The Effects of Changes in Family Composition and Employment Patterns on the Distribution of Income in Australia: 1982 to 1997-1998

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Abstract

We examine income and expenditure distributions over the last two decades using Australian Bureau of Statistics unit record data, presenting both nonparametric kernel density estimates and summary measures of the distributions. Standard errors of summary measures are also reported to facilitate assessments of the statistical significance of inferred distributional changes. The results show that there was a significant increase in private income inequality over the 1980s and 1990s, with most of the increase occurring by the early 1990s. However, the increase in dispersion for disposable income was modest, implying taxes and transfers acted to mitigate the increases in inequality emanating from changes in private income. Using a semiparametric procedure developed by DiNardo, Fortin and Lemieux (1996), we examine the effects on the distribution of private income of changes in the family type composition of the population and changes in the distribution across families of employment, educational attainment and number and ages of dependent children. We find that half of the increase in private income inequality is explained by changes in these characteristics. Changes in the distribution of work across families – for example, an increase in both two-earner families and no-earner families – were the single most important source of the increase in private income inequality, with such changes on their own accounting for half the increase in inequality. Changes in the family type composition of the population also acted, to a lesser extent, to increase inequality. Changes in demographic characteristics (the age, education and country of birth composition of the population) acted to reduce income inequality, while changes in the distribution of the number and ages of dependent children across families had no effect on income inequality.

Contents

1. Introduction and motivation 5

1.1 Recent trends in labour market, family and other demographic characteristics in Australia 6

1.2 Plan of the paper 10

2. Recent findings on inequality in Australia 11

3. Data 14

3.1 The data sources 15

3.2 The target population 17

3.3 Outliers 18

3.4 The unit of observation 18

3.5 The income measure 19

3.6 Household income and expenditure 21

4. Trends in income inequality in Australia 23

4.1 Trends in the aggregate distribution: Income unit annual income 26

4.2 Weekly income 34

4.3 'Equivalent' income 38

4.4 Household income and expenditure 40

4.5 Trends in private and disposable income of income unit types 49

4.6 Summary 54

5. Decomposing distributional changes 55

5.1 The DFL method 56

5.2 Implementation 58

5.3 Decomposition results 62

6. Concluding comments 66

References 69

Appendix: Alternative decomposition results 71

1. Introduction and motivation

A number of researchers have studied changes in the distribution of income, and components of income (such as wages and salaries), over the last two decades. The findings of this research may be summarized as follows. Inequality in the distribution of labour market earnings has grown significantly over the period, particularly in the last part of the eighties, but continuing through the nineties. Market income, largely reflecting what is happening with wages, has also become much more dispersed. Government intervention has, however, served to constrain the increases in income inequality. Inequality in the distribution of gross income, which comprises market income plus transfer payments, has increased only mildly, while the increase in inequality in disposable income, which additionally takes into account the effects of income taxes, has been even more muted.

The findings have suggested that the increases in inequality primarily derive from a greater rate of growth of incomes at the top end of the distribution than at both the middle and lower end of the spectrum. The evidence on expenditure inequality is somewhat different, with lower levels of inequality than for the income distribution, but the trend increase in inequality is nonetheless evident for the expenditure distribution. The research has also found that, despite significant changes in the composition of the household and family units in recent decades, the above trends are true of both individual incomes and household or family incomes (although the increases at the individual level are more marked than at the family or household level).

What is responsible for these changes? In particular, what is the source of the increases in market income inequality? There are several key possibilities: First, the widening disparity at the family level may to a large extent derive from increased dispersion in market incomes, particularly in wages. Second, the composition of families has changed, and it may be that a consequence of these compositional changes is increased inequality in incomes across families. Third, a number of changes have taken place in the labour market in recent decades, including increases in female participation, falls in male participation, delays in (full-time) labour market entry (as students prolong their studies), and possibly increases in both jobless families and two-earner families. These changes in the labour market are likely to have had significant effects on the distribution of income across families. Other possible sources of changes to the income distribution include changes in demographic characteristics such as the age, educational attainment and place of birth composition of the population.

The first objective of this project is to confirm the developments in the distribution of income in Australia over the past 20 years noted above. An important contribution of our analysis in this regard is to bring together results from the ABS income and expenditure surveys and provide estimates of the statistical significance of distributional changes, via the reporting of standard errors on all distributional measures and their changes. The second objective is to explore potential sources of the changes that have occurred. In particular, we first consider the role of government intervention via transfer payments and income

taxation by comparing movements in private income with changes in the distributions of gross income (after transfers and before income taxes) and disposable income (after transfers and income taxes). We then examine the effects on the distribution of private income of such factors as labour force status, family structure and other demographic and economic variables. This kind of analysis has not previously been attempted using Australian data, and the project therefore provides important new insights into the causes of trends in the distribution of income in Australia. These insights have wide-ranging policy relevance, including the evaluation of the effects on income inequality of policy in relation to income taxation, social security support and unemployment, and family and labour market policies more generally.

Consistent with previous research, we find that market income inequality grew substantially between 1982 and 1997-8, but that transfer payments and income taxes have exerted a strong equalising force over the period, thereby substantially reducing the extent of growth in disposable income inequality that might otherwise have occurred. Decomposition of the changes in the distribution of private income suggests that approximately half the growth in inequality between 1982 and 1997-8 derived from changes in the distribution of labour force outcomes, family types and other demographic and economic variables. Changes in labour force outcomes were a particularly important source of the increase in income inequality, with changes in the composition of family types in the population also acting to marginally increase dispersion. Other changes in the characteristics of the Australian population, including increases in educational attainment and changes in the age structure, have, by contrast, worked to decrease income inequality over the period.

1.1 Recent trends in labour market, family and other demographic characteristics in Australia

In this section we briefly review a number of trends in Australian society over the last two decades that are potentially important for their implications for the income distribution. These include trends in wage or earnings inequality, trends in family (or income unit[1]) composition, trends in the work patterns within and between families, as well as trends in demographic characteristics such as the age, educational attainment and country of birth composition of the population.

Trends in earnings and wage rates

Table 1.1, reported by Borland, Gregory and Sheehan (2001), shows trends in the distribution of full time earnings of Australians at different points of the earnings distribution between 1975 and 1999. The trends are described by earnings ratios at different points of the distribution. Thus P10/50 refers to the earnings

[1] An income unit generally comprises either a single person or a couple living together (whether married or not), together with any dependent children. The term 'income unit' derives from the assumption that income obtained by each member of the unit is pooled to finance the consumption of all members.

of a person at the tenth percentile relative to the earnings of a person at the fiftieth percentile. The table suggests that there has been substantial widening of earnings differentials, with the earnings of higher paid persons increasing at a faster rate right through the distribution. For both males and females, earnings for workers with below-median earnings have decreased relative to workers at the median point of the distribution, though the difference is more pronounced for males than for females. Similarly, in the top half of the distribution, the earnings of high-earning men and women have increased relative to those of men and women at median earnings.

Table 1.1 Earnings dispersion – Weekly earnings of full-time employees in main job, Australia 1975 to 1999

	P10/50	*P25/50*	*P75/50*	*P90/50*	*P90/10*
Males					
1975	0.683	0.834	1.266	1.654	2.422
1980	0.625	0.816	1.316	1.714	2.742
1985	0.619	0.803	1.313	1.621	2.619
1990	0.593	0.777	1.309	1.616	2.725
1995	0.594	0.765	1.360	1.750	2.946
1999	0.590	0.760	1.401	1.878	3.183
Females					
1975	0.633	0.834	1.192	1.440	2.275
1980	0.604	0.802	1.225	1.538	2.546
1985	0.599	0.811	1.240	NA	NA
1990	0.604	0.804	1.281	1.604	2.656
1995	0.631	0.797	1.289	1.598	2.532
1999	0.620	0.793	1.323	1.661	2.679

Note: from Borland, Gregory and Sheehan (2001) Table 1.1, p5

Trends in family composition

The top panel of Table 1.2 shows the proportion of households of each type in each of five years over the period 1976 to 2001.[2] The table shows a steady growth in the proportion of lone person households and a concomitant fall in the proportion of households comprising families. The data indicate that since 1991 the proportion of people living in group households has stabilised at around 4.5 per cent.

The lower panel of the table shows, among households comprising families, the proportion with no dependents and the proportion with dependents. It shows there have been important changes in the composition of families between 1976 and 1996. In particular, there has been steady growth in the proportion of families without dependents, rising from 45 per cent in 1976 to nearly 50 per cent in 1996.

[2] In 1976 and 1981, group households were not distinguished from other families.

Most of the growth has been in families comprising couples only, with growth in this family type partially offset by a decline in the proportion of families comprising couples plus non-dependents. The decline in the proportion of families with dependents is the net outcome of a very large decline in two parent families, from 48.4 to 40.6 per cent of all families, and a partially offsetting increase in one-parent families, from 6.5 to 9.9 per cent of all families.

Table 1.2 Household and family types, Australia 1976 to 2001 (%)

	1976	*1981*	*1986*	*1991*	*1996*	*2001*
Household type						
One person	15.7	18.0	18.5	19.6	23.1	25.2
Group			4.1	4.5	4.4	4.5
Family	84.3	82.0	77.3	75.7	72.5	70.3
Family type						
Families without dependents	45.0	44.7	47.4	46.8	49.5	
Couple only	28.0	28.7	30.3	31.4	34.1	
Couple plus non-dependents	11.1	10.0	10.9	9.5	9.0	
Other	5.9	6.0	6.2	5.9	6.4	
Families with dependents	54.9	55.2	52.6	53.2	50.5	
One parent	6.5	8.6	7.8	8.8	9.9	
Two parents	48.4	46.6	44.8	44.4	40.6	

Source: ABS (2001a)

In summary, there have been important changes in the structure of household types. Couples with dependents now constitute less than a third of all households[3] and no longer represent the predominant family type, which is now couples without dependents.

Trends in the labour force and in work patterns of families

Table 1.3 presents employment-population ratios among males and females over the last two decades. The proportion of males in employment has fallen from 74 per cent in 1981 to 67 per cent in 2001, while over the same period female employment has risen from 41 per cent to 52 per cent of the female population.

[3] Specifically, 70.3 per cent of households comprise families, and 40.6 per cent of families comprise couples with dependents, implying 28.5 per cent of all households are couples with dependents.

Table 1.3 Employment-population ratios of persons aged 15 years and over, Australia 1981 to 2001 (November)

	1981	*1986*	*1991*	*1996*	*2001*
Males	73.6	69.5	66.8	67.2	67.2
Females	41.3	44.5	46.9	49.4	51.6
Persons	57.2	56.8	56.7	58.1	59.3

Source: ABS (2001b)

Associated with these changes in the labour force behaviour of males and females have been important changes in the relationship between families and work. Table 1.4 reports trends in the numbers of adults working in families with dependent children over the last ten years. There has been growth in families in which there are two workers and a decrease in families in which there are no workers or just one worker.

Table 1.4 Families and work, Australia 1991 to 2001

Household type	*1991*	*1996*	*2000*
Couple families with children under 15 and			
Two adults working	51.8	54.5	56.3
One adult working	40.1	37.6	36.2
No adult working	8.1	7.9	7.5
One parent families with			
One adult working	43.2	42.7	47.3
No adult working	56.8	57.3	52.7

Source: ABS (2001c)

Not evident in Table 1.4, because of the limited time-frame and exclusion of households without dependents, is the finding by several commentators of an emerging polarisation of families into the 'work rich' and the 'work poor', meaning there has been growth in both the number of families with both adults in work and the number of families with no adults in work (see Dawkins, Gregg and Scutella (2001) and Burbidge and Sheehan (2001)).

Another important trend in family work patterns has been the increase in average hours of work of some families. Wooden (2001a) and Wooden and Loundes (2001) find that the proportion of the employed workforce working 45 or more hours per week increased from around 20 per cent in 1975 to 28 per cent in 1995, and has remained stable at around this level since.

Trends in demographic characteristics

Table 1.5, using data drawn from the unit record files of the ABS income surveys, shows that other significant changes in the Australian population in recent decades include increases in the average age and educational attainment of the population. Also notable is the large increase in proportion of the

population in the 45-54 years age group, and the lesser increase in the 35-44 years group, reflecting the effects of the ageing of the 'baby boom' cohort.

Table 1.5 Characteristics of persons aged 15-64 years – ABS Income Surveys

	1982	*1986*	*1990*	*1994-5*	*1997-8*
Educational attainment (%):					
Bachelor's degree or higher	5.6	6.7	8.5	10.6	12.1
Other post-school qualification	30.4	28.9	31.8	28.3	29.0
No post-school qualifications	64.0	59.3	54.4	56.8	54.3
Foreign-born (%)	25.4	25.6	25.9	25.5	26.8
Age (%):					
15-24 years	22.7	22.0	20.7	19.0	18.0
25-34 years	21.5	21.4	21.2	20.3	19.7
35-44 years	17.4	18.8	19.7	19.7	19.8
45-54 years	13.5	12.9	13.9	16.0	16.8
55-64 years	12.3	11.9	11.0	10.8	11.0
65 or more years	12.5	12.9	13.5	14.2	14.7
Mean age (years)	40.7	40.8	41.3	42.2	42.8

The likely impacts on the income distribution of many of the above trends are ambiguous. Indeed, their implications for income inequality will very much depend on their interaction with the income unit composition of the population. For example, the increase in educational attainment may be inequality-increasing if it has been accompanied by an increase in income units with two degree-holders and no increase in income units with one degree-holder. Similarly, the increase in earnings inequality may lead to an increase in income inequality, but it need not do so (as indeed Burtless (1999) finds for the US). Examination of the effects of the above trends on income inequality is therefore a valuable exercise.

1.2 Plan of the paper

In the next section we review recent findings about trends in Australian income inequality. In Section 3 we describe the data sources used and the main limitations of the data. Section 3 also contains discussion of the alternative approaches to the study of income inequality and justification for the approach taken in this paper.

Section 4 explores recent trends in the income distribution utilising unit record data from ABS income surveys spanning the period 1981-2 to 1997-8, and examines the impact of government policy in the form of the provision of transfer payments and levying of income taxation. In particular, the impact of the tax and transfer system on changes to the income distribution is achieved by comparing the changes for

disposable income with those for gross (before taxes) income and those for private (before taxes and transfers) income. We report results for the distributions of private, gross and disposable income using graphical representations of the income distributions as well as a variety of statistical measures. We also examine trends in the income distribution separately for each of four income unit types: single persons, couples with no dependents, sole parents and couples with dependent children.

Based on the results obtained in Section 4, our focus in Section 5 turns to identification of the sources of changes in the distribution of private (or market) income. Specifically, we decompose changes in the distribution of private income into those attributable to changes in the income unit composition, the distribution of labour force status and the distribution of demographic characteristics. This is undertaken by adapting a semiparametric method for decomposing distributional changes developed by DiNardo, Fortin and Lemieux (DFL) (1996). Section 6 concludes.

2. Recent findings on income inequality in Australia

Much of the recent literature on income inequality in Australia has also extended investigation to developments in expenditure/consumption inequality. Arguments in support of using consumption expenditure rather than income as a proxy for well-being are based on: i) the fact that expenditure is less subject to short term fluctuations, i.e. most households are capable of borrowing/saving to smooth out movements in transitory income over time; and ii) that utility is typically defined over consumption rather than income and that resources consumed over a given period are not necessarily equal to received income. Furthermore, income data is sometimes considered unreliable for use in welfare-based distributional comparisons because of apparent income concealment for the purpose of tax evasion etc. Nevertheless income data is much easier to gather and policy analysts are interested in the distribution of both income and total household expenditure.

Barrett et. al. (2000) consider both income and expenditure inequality in Australia using the Household Expenditure Surveys (HES) between 1975-76 and 1993-94, focusing on single-family households headed by individuals aged 15-59 years. They examine inequality in three measures: private income (gross income minus government transfers and benefits), net income (more usually known as disposable income and equal to private income plus government transfers, minus income taxes) and consumption expenditure. They find much less inequality in the distribution of net income than private income, and less inequality again in the distribution of consumption. Increases in inequality over the sample period were evident for all three measures, but the increase was greatest for private income and least for consumption. They therefore conclude that government transfers and taxes helped mitigate the rise in private income inequality, and consumption smoothing by households further acted to reduce growth in expenditure inequality. Barrett et. al. (2000) also show that real incomes rose at the top of the income distribution, remained stable in the middle and fell at the bottom, with real income losses particularly concentrated between the 10^{th} and 25^{th} percentile, suggesting a possible growing incidence of working

poor. Meanwhile, the very bottom of the distribution showed rising real consumption levels over the data period, implying growing dissaving.

Blacklow and Ray (2000) extend Barrett et. al. (2000) to include multiple family households consisting of unrelated young adults and others. In their analysis, they also include durables expenditure and examine the impact of changing equivalence scale specifications on inequality magnitudes and on their movements over time. Overall, Blacklow and Ray (2000) agree that income inequality increased over the period, although they find that expenditure inequality either fell or retained a comparatively flat trajectory. Results are, however, shown to be quite sensitive to the equivalence scale used. Decomposition analysis undertaken by Blacklow and Ray (2000) found that the picture of rising income inequality and decreasing expenditure inequality holds across most household types – old-age pensioners and single parent families excepted. Furthermore, increases in within-group inequality are found to dominate increases in differences in incomes between groups as the source of the overall growth in inequality.

Also using the HES, Harding and Greenwell (2001) extend the period of study by including data from the 1998-99 survey. Consistent with Barrett et. al. (2000) and Blacklow and Ray (2000), they report that income inequality rose through the 1980s and 1990s, while expenditure inequality remained stable. They furthermore find, most notably through the latter half of the nineties, very marked increases in incomes at the top end of the distribution, marked increases in incomes at the middle, stable incomes at the 10th percentile of the income distribution, and falling incomes at the 5th percentile. The authors also use the ABS income surveys (IDS), which do not entirely support the results obtained using the HES, showing that income inequality remained unchanged from 1994-5 to 1997-8. The HES and IDS are, however, consistent in that both indicate a rise in income inequality over the 1980s and early-to-mid 1990s. Both surveys suggest that the relative income shares of both the middle and bottom segments of the income distribution have fallen, while the income share of the top 10 per cent has increased.

Interestingly, Harding and Greenwell (2001) find a large change occurred in the 15 years to 1998-99 in the expenditure-income ratio of the bottom decile. The authors' analysis suggests that there has been a significant shift in the composition of the bottom decile, with retired households and working poor without dependents households moving in, and income support-recipient families with dependents moving out. The study notes a possibility that these new entrant groups may have greater accessibility to credit/savings, and as such are more able to smooth income over time, which could help explain the dramatic shift in the spending/income ratio.[4]

Using the IDS for 1986, 1990 and 1996-7, Pappas (2001) finds that market income became less equal across families, with income units in the top half of the income distribution receiving significantly larger proportional increases in market income between 1985-6 and 1995-6. As with previous researchers, he

[4] In the bottom decile, reported spending is 2.3 times reported income. There are strong doubts about the validity of the income data, with suggestions that there may be considerable under-reporting of income (see Johnson and Scutella, 2002).

concludes that the tax/transfer system has offset the growth in income inequality and appears to be targeting those families most in need. Pappas (2001) then decomposes the changes in inequality in an attempt to cast light on the factors driving the increase. He finds a significant increase in the contribution of wages and a decrease in the contribution of investment to market income inequality over time. This trend was particularly pronounced in single and couple (without dependents) income units. Further decomposition showed that these changes were influenced by education, and that wage inequality was decreasingly correlated with age and sex over the period.

Borland and Kennedy (1998) focus on earnings inequality, reporting evidence of growing inequality in Australia over the 1980s and 1990s using the IDS between 1982 and 1994-5. Decomposition of the sources of changes in overall earnings inequality suggests that the growth in earnings inequality stemmed largely from increases in within-group inequality rather than between-group inequality (where groups are defined by socio-economic characteristics). A specific finding of their analysis is that the increase in earnings inequality between 1982 and 1994-5 for a sample composed of individuals aged 15-64 years was substantially lower than that for a sample of individuals aged 25-59 years. They conclude that the differing trends suggest significant changes in the age composition of the workforce due to an increase in school retention rates. Additionally, their research highlights differences in income inequality trends within workforce groups, finding increases in earnings inequality among employees in the private sector, but not among public sector employees, and that inequality growth was largely confined to particular industries.

The trend in income inequality in Australia in recent decades is therefore reasonably well established. Economists broadly agree that income inequality rose through the 1980s and up until the mid 1990s, with some evidence (e.g. Harding and Greenwell (2001)) suggesting that the trend has continued since then. The path of expenditure inequality has been found to contrast to some degree with that of income inequality, though findings have conflicted somewhat. Overall, however, reports have agreed that income inequality has generally risen at a faster rate than consumption inequality. Indeed, the studies to date concur that current expenditure inequality fell between 1984 and 1993-94. These findings appear to suggest that government tax and transfers as well as consumption smoothing have helped to mitigate the impact of rising income inequality.

Other elements highlighted by the various findings on inequality include:

- Within-group inequality dominates differences in incomes between groups as the source of income inequality and growth in income inequality (where groups are defined by socio-economic characteristics); and
- Incomes at the top end of the distribution have grown at a significantly greater rate than at both the middle and lower end of the spectrum.

Disparities in results between studies are largely explained by methodological decisions. For example, Barrett et. al. (2000) exclude observations in the top and bottom 3 per cent of the income/expenditure

distribution, plus all households with a head younger than 25 or older than 59 years of age; and Blacklow and Ray (2001) use different equivalence scales and rank households rather than individuals, claiming it cannot be assumed that '…resources are equally shared within the household'. Additionally, results are somewhat sensitive to the data source examined, with Harding and Greenwell (2001) finding that the ABS Income Distribution Surveys and Surveys of Income and Housing Costs (IDS) on the one hand, and the Household Expenditure Surveys (HES) on the other hand, offer somewhat contrasting pictures of trends in income inequality over time.

3. Data

As the preceding discussion suggests, the study of trends in income distributions requires decisions on a large number of data-related issues. These include the most appropriate choice of the target population, the sample to be examined, the unit of observation (for example, person, income unit, family or household) and the definition of income to be used. In addition, the researcher must be mindful of the availability of explanatory variables, the extent of their comparability over time, and the degree of confidence in the individual records. The decisions required include the following:

- Whether to examine income or expenditure. Related to this is the choice of data source, with the income surveys containing information about income, and expenditure surveys containing information about both income and expenditure (but often attenuated);
- The definition of income (or expenditure) to be applied. Several different definitions of income are possible: gross, private or disposable income, actual or equivalent income (and if equivalent, the equivalence scale to use), before or after housing costs, etc.;
- The 'observational unit' for the analysis (individual, income unit, family, household);
- The criteria for selection into the sample (i.e. who we examine, who we exclude);
- The distributional measures to be examined (e.g. Gini coefficient, Theil coefficient, coefficient of variation, percentile log differences, whole densities etc);
- The sub-groups of the population to be examined (e.g. examine separately groups defined by gender, age, family type, etc.);
- For decomposition analysis, the characteristics on which we condition as sources of distributional change (i.e. we can isolate the effect of changes to many separate sources); and
- The decomposition method to be used. There are a number of alternative decomposition methods available.

3.1 The data sources

Several data sources are available for Australia that are potentially suited to the study of income or expenditure inequality. Two sources commonly used by researchers for such studies are the ABS income surveys and expenditure surveys (which we refer to as the IDS and the HES, respectively). The ABS has made available 'confidentialised' unit record files for seven of the nine IDS, spanning the period 1981-82 to 1997-8, and all five of the HES, spanning the period 1975-6 to 1998-9.[5] Unfortunately, for both series of surveys there have been significant changes over time in survey methodology, in the questions asked and in the variables recorded for respondents in the surveys, creating substantial problems for comparability of the surveys over time. For the most part, however, these problems are not insurmountable, although they do impose significant constraints on the decomposition analysis that is feasible in Section 5.

The HES contain information about both income (at the household level, and also at the person level for the surveys after 1984) and expenditure (at the household level), while the IDS contain information only about income (at the person and income unit level, with the ability to also infer family and household income). The IDS therefore appear preferable to the HES if we are to examine income, since we can identify income for a wider range of units (person, income unit, family unit and household unit) than is possible with the HES (person and household only). However, the IDS are only the best option if we are to focus on income; the HES need to be used if we are to study expenditure inequality. It follows that, in deciding on the data source to be used, the relative merits of income-based versus expenditure-based studies of inequality need to be considered.

The fundamental motivation for the study of income or expenditure distributions is interest in the distribution of *consumption*, in turn motivated by the view that an individual's level of consumption is an important contributor to the individual's welfare. A focus on income is justified on the grounds that, at least in the long run, an individual's income places an upper bound on consumption possibilities. The qualifier *in the long run* is, however, an important one, since the ability for individuals to intertemporally smooth consumption implies income over a limited timeframe may provide a poor measure of the consumption possibilities of the individual. For example, it has been argued that an increase in weekly income inequality over time may not translate into an increase in consumption inequality, but rather reflect an increase in variability of weekly income for each individual. That is, it may reflect an increase in transitory income inequality, with there being no increase in permanent income inequality. This has in part motivated the study of expenditure inequality, on the basis that expenditure is likely to have a closer relationship to consumption than income (for example, Barrett et. al. (2000)).

[5] Unit record files for surveys conducted in 1999-2000 and 2001-2002 are scheduled for public release towards the end of 2003.

However, expenditure-based measures do suffer from failings that income-based measures do not. In particular, increases in income inequality may not translate to increases in expenditure inequality for reasons that are unrelated to greater inequality in transitory (as opposed to permanent) income. The argument is that low income persons may borrow more/save less if income falls, and high income persons may save more if income rises, for example to facilitate earlier retirement, higher consumption in retirement or increased bequests. These effects on lifetime consumption inequality (including consumption of leisure) are not captured by expenditure-based measures, yet seem relevant to the social welfare implications from which stems our interest in income inequality. Thus, the potential for consumption and income in a given period to differ, which gives rise to criticism of income measures, in fact also causes expenditure based measures to be inadequate.[6]

It therefore doesn't follow, on the criteria of correspondence to (lifetime) consumption, that expenditure-based measures of inequality are necessarily better than income-based ones. Indeed, the best compromise would seem to be to use income measured over a reasonable long time frame. For example, changes in the extent of transitory income fluctuations are likely to be relatively unimportant for annual income. Expenditure-based measures, it should be noted, do retain some appeal, however, because of the apparent unreliability of income information in most data sources. Non-reporting of income is a major problem for all income surveys, and even among those reporting income, individuals may misreport income for reasons such as concerns for privacy and perceptions that reported income information may be used by government authorities to determine tax obligations and welfare entitlements (Johnson and Scutella, 2002).

Notwithstanding this concern, in this study we primarily focus on income-based measures, and analysis has been conducted on all seven IDS. The ABS describe the seven surveys by a reporting year, but information gathered is for a recent financial year as well as for current information at the time the survey was undertaken. The 1982 survey was undertaken over a two-month period in the fourth quarter of the year and gathered current information for 1982 and annual information for the 1981-2 financial year. The 1986 and 1990 surveys were also undertaken over two months in the fourth quarter in 1986 and 1990, respectively, and gathered current information for 1986 and 1990 and annual information for 1985-6 and 1989-90. The 1994-5 survey was undertaken over the whole of the financial year, and gathered current information for 1994-5, but annual information for 1993-4. Similarly the 1995-6, 1996-7 and 1997-8 surveys were undertaken for the whole of a financial year and gathered current information for 1995-6, 1996-7 and 1997-8 respectively, and annual information for 1994-5, 1995-6 and 1996-7.[7]

[6] Of course, an increase in dispersion in wage rates may induce contemporaneous labour supply responses which attenuate increases in both income and expenditure inequality, but this is a failure of *both* measures to account for changes in work effort (i.e. leisure consumption).

[7] Harding and Greenwell (2001) argue that only the 1990, 1994-5, 1995-6 and 1997-8 surveys are usable (the 1982 and 1996-7 surveys appear "unreliable", and the 1986 survey does not report imputed weekly income tax payable). Harding and Greenwell (2001) also reweight observations in the 1990 survey. Not having access to the reweighting

Although our primary focus is on the IDS, in the interests of providing as complete and accurate a picture of distributional trends in the 1980s and 1990s as possible, we also examine income and expenditure using the HES. The ABS conducted expenditure surveys in 1975-6, 1984, 1988, 1993-4 and 1998-9, for each survey collecting information on *household weekly* income and expenditure. The last three surveys also contain information on personal weekly income, but for none of the surveys do the unit record files contain information on *annual* income or expenditure. We are therefore restricted to weekly measures of income and expenditure using the HES.

3.2 The target population

The target population comprises all persons over the age of 15. Most studies of income or expenditure distributions in Australia have, however, found it necessary or desirable to impose various restrictions on the sample examined. Studies have variously excluded those whose income unit, family or household:

- contains a self employed person;
- contains only one person and that person is under 21 years of age;
- has no income/expenditure, negative income/expenditure, and/or income/expenditure outside some range defined by either dollar amount thresholds (for example, Hyslop and Mare (2001) censor at $2400 and $268,000 in their study of actual (as opposed to per-member equivalent) household income in New Zealand[8]) or percentile rank in the income/expenditure distributions (for example, Barrett et. al. (2000) exclude observations outside the 3-97 percentile range);
- is not headed by a person in a specified age range (for example, this range is 25-59 years in Barrett et. al. (2000)); and
- is not a household that comprises only one family (Barrett et. al. (2000)).

In this study, we exclude only those for whom income/expenditure information is missing and those with income/expenditure outside a specified percentile range.[9]

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scheme used by Harding and Greenwell, we adopt the ABS population weights for all surveys, while we have decided to persist with all the surveys despite the reservations expressed by Harding and Greenwell (2001).

[8] Hyslop and Mare (2001) present an analysis of changes in the distribution of gross household income in New Zealand over the period 1983 to 1998, decomposing trends in inequality into effects of changes in pension rates, household socio-demographic attributes and employment outcomes. They find that changes in household structure (particularly the declining proportion of two-parent families), attributes, and employment outcomes each contribute to the observed increase in inequality, while the changes in returns are estimated to reduce the level of inequality. Collectively these factors account for about fifty per cent of the observed increase, depending on the measure of inequality used. The results confirm other research findings that the changes primarily occurred during the late 1980s.

[9] However, sensitivity tests (not reported) have in fact been conducted with alternative sample exclusions.

3.3 Outliers

Decisions on sample restrictions *based on reported income or expenditure* are part of a more general decision process regarding what to do with observations with extreme values for income/expenditure, or that are missing income/expenditure information altogether. The problem is largely confined to the study of income, with missing or extreme values of expenditure relatively uncommon. Those with missing income are generally dropped in all studies, but the treatment of those with very low or very high reported incomes varies a great deal across studies. Extreme observations are likely to reflect measurement error, and it is generally desirable to minimise the effects of measurement error on inequality estimates. One option is to recode very low incomes to some arbitrary level so as not to drop observations, motivated by evidence that individuals reporting non-credible low incomes do indeed have very low incomes (although not as low as reported). This approach averts the information loss associated with dropping observations outside a pre-specified income range, but involves 'making up' results to some extent. A better compromise would seem to be to drop observations with incomes outside a pre-specified percentile range. We then examine the middle x per cent of the income distribution, and therefore know how to interpret the results. While not informing us about the entire distribution, this approach does not suffer from the problem of 'making up' any of the results, nor the problem of changing the distribution under study across different samples (e.g. time periods) that may occur with the 'dollar thresholds' approach. That is, excluding observations on the basis that income is below some lower threshold or above some upper threshold may result in variation across samples in the proportion of observations that are excluded. For example, in some years, we may be examining 95 per cent of the distribution, and in other years, 90 per cent of the distribution.

Consistent with the above reasoning, in this paper individuals with income unit income outside the 3-97 percentile range are excluded from the analysis. We should note, therefore, that the true extent of income inequality will most likely be understated in this study.[10]

3.4 The unit of observation

An issue concerns the appropriate 'observational unit' and the appropriate associated income variable. There is no consensus in the literature on this issue. Studies have variously employed as the observational unit the individual, the income unit, the family or the household, and as the income variable the disposable, gross or private income of the individual, income unit, family or household. The choice of observational unit determines the population for which the distribution of income is examined. For example, taking the household as the observational unit means the distribution of income across households is being examined (although if each household is weighted according to the number of

[10] The 3-97 percentile sample restriction is applied to *total* income only, so that the same sample is examined for all the analysis. For example, when looking at private income, sample restrictions are still on the basis of total income. The 3-97 percentile restriction is also adopted when examining expenditure distributions to provide comparable distributional measures.

members of the household, then the observational unit is in fact the individual). The choice of income variable does not need to match the observational unit, in the sense that it is valid to examine the income for a larger unit than is the unit of observation. For example, it is common to examine the income of the income unit to which an individual belongs. This is in fact the approach taken in this paper: we treat the individual as the observational unit and examine the income of the income unit of that individual.[11] Consequently, we examine the distribution of income over the population of individuals aged over 15 years. This approach accords equal weight to each individual in the population over the age of 15 years, while ascribing to the individual the total income to which that individual is likely to have (at least partial) access.[12] This overcomes the problem of finding a large number of individuals have no income, which would occur if personal income was the income variable, while it still gives equal weight to each person in the population over the age of 15 years. The reason for not including individuals aged under 15 years is because our primary interest is in the population who could potentially work or take other actions to influence the income unit income distribution (such as choosing who to live with).

3.5 The income measure

Annual or weekly income

Descriptive statistics are presented for both annual and weekly real income.[13] As discussed earlier, annual income is probably preferable to weekly income, in order to reduce the impact of changes in the extent and distribution of transitory fluctuations in income. However, an issue that arises for the decomposition analysis in Section 5 is that it is more difficult to decompose changes in annual income measures, because most characteristics of interest (for their effects on the income distribution) are only known for the current week. This includes labour force status, employment status, hours worked and income unit type. It is possible to use current week attributes as conditioning variables for annual income, but it is not clear how to interpret results based on annual income and current week attributes. Consequently, all decomposition analysis is done for weekly income. However, descriptive statistics are nonetheless produced for annual income to aid interpretation of the results for weekly income. In particular, changes to transitory income fluctuations will be revealed by changes in the disparity between annual and weekly estimates, which we can factor into the interpretation of weekly estimates.

[11] As mentioned earlier, an income unit comprises either a single person or couple together with any dependent children. A dependent child is defined to be a person under the age of 15 years or a person under the age of 21 years who lives with the parent(s), does not have any (resident) children and is a full-time student. Note that in the surveys from 1994-5, the maximum age of a dependent child was 24 years, but prior to 1994-5, the maximum age was 20 years. In order to be consistent, therefore, dependent children aged 21-24 years are treated as separate (single person) income units in the surveys from 1994-5.

[12] Therefore, the *person* weights supplied by the ABS are used in all the analysis.

[13] To focus on changes in *real* income, all incomes are adjusted to values at June quarter, 2002 prices using the ABS Consumer Price Index.

'Equivalising'

An issue arising from the choice of *income unit* income as the income variable is that of whether adjustments should be made for the number (and ages) of persons dependent on that income (i.e. comprising the income unit). That is, it needs to be decided whether to use what is termed in the literature an 'equivalence scale', and if so, what scale to use. A common rule of thumb scale is to divide income unit income by the square root of the number of members of the income unit, the motivation being there are economies of scale in family or income unit production. Another equivalence scale is calculated by dividing income by one plus 0.6 for each person over the age of 15 years and 0.3 for every person under 15 years. Ultimately, the choice of equivalence scale is arbitrary, and the problem arises that the choice of scale is likely to alter inferences on changes to the distribution of income. In this study, it was decided to not use any equivalence scale, and instead allow changes in the income unit composition over time be an explanatory factor in decomposing sources of change in the income distribution. This approach is to some extent consistent with the approach of Hyslop and Mare (2001) (although their study is of household gross income, with no adjustments for household size and, more importantly, no weighting by household size, so that each household, rather than each individual, receives equal weight). However, although the primary focus is on actual income unit income, a limited number of results are presented, as a sensitivity test, using the equivalence scale in which income is divided by the square root of the number of members of the income unit.[14]

The income variable

To ascertain the relative roles of income taxes, transfer payments and changes to market income in producing changes in the distribution of income, we report results for three different income concepts: disposable (after taxes and transfers), gross (before taxes and after transfers) and private (before taxes and transfers) income.

Several issues associated with the construction of the income variables warrant mention. First, the income unit income information has been derived from person record information, with the income unit income assumed equal to the sum of the incomes of the individuals who comprise that income unit. This approach has been taken for two reasons. First, the 1982 survey does not report income unit income, and to be consistent across surveys the same approach should be adopted for each survey. Second, income unit income is missing for a significant number of individuals. It is unclear why this is the case, but it may be related to changes in income unit composition over time. This implies that the income variable used in this study is 'the income received in the relevant period by the income unit to which the individual *currently* belongs, irrespective of whether the individual belonged to the income unit in the period over which income is being measured.' This is particularly important to be aware of when interpreting results

[14] Income inequality estimates were also obtained using several alternative equivalence scales, with no significant differences in inferred changes over the sample period.

for annual income, since some individuals will not have been in the current income unit in the previous financial year.

Second, the 1982 survey does not allow for negative business income, investment income or other income. To ensure consistency across all surveys, business, investment and other income that is negative has been set equal to zero in all the surveys. This provides a further reason (in addition to the restriction to those with incomes in the 3-97 percentile range) why actual income inequality will be greater than measured.

Third, a problem for calculating disposable income is that the 1982 survey does not report imputed income tax payable for either annual or weekly income, while the 1986 survey does not report imputed weekly income tax payable. We have imputed annual and weekly income tax for the 1982 survey based on estimated net income and the income tax rates, deductions and rebates in place in the relevant period (1981-2 for annual income, 1982-3 for weekly income).[15]

3.6 Household income and expenditure

Although our primary focus is on income inequality using the IDS, sensitivity analysis is also undertaken using the HES. The approach for the IDS of adopting the individual as the unit of observation, and the income of the income unit to which the individual belongs is not possible for the HES, which report income and expenditure at the household level (and income at the individual level after 1984). We could potentially construct income units from the person-level information available for the surveys after 1984, and hence income unit income, but we would not be able to identify income-unit expenditure (because it is not recorded at the person level). Consequently, although we retain the individual as the unit of observation, the income/expenditure variable examined is for the *household* to which the individual belongs.[16] As mentioned in Section 3.1, the HES restricts us to *weekly* income and expenditure.

In employing the HES we have two primary objectives. The first is to explore the income distribution estimates derived from the HES and in particular how they compare with those obtained from the IDS. To this end, we examine household weekly income using the IDS (prior to the HES analysis). As for the income-unit analysis, we examine household private, gross and disposable income over the respective sample periods.[17]

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[15] No attempt has been made to impute weekly income tax in 1986, since the primary focus is on the changes in the income distribution over the entire sample period (1982 to 1997-8).

[16] The 1976 and 1984 CURFs report data items at the household level only, but contain information on the number of members of the household aged 15 years and over. We create pseudo person-level datasets by replicating each household record for each household member aged 15 year and over. That is, if a household has *n* members over the age of 15 years, the pseudo person-level dataset will have *n* observations for that household. ABS household weights are used for these two surveys.

[17] However, for the HES we are unable to estimate disposable income in 1975-6, since the unit record file does not contain information on income taxes paid by the household, and income tax paid cannot be inferred without knowing the personal income of each member of the household.

The second objective is to examine the expenditure distribution, and how changes over the sample period compare with changes in the income distribution. A significant issue that arises for this part of the analysis is deciding what expenditure items to include. All HES unit record files have separate data items for expenditure on: current housing costs; fuel and power; food; alcohol; tobacco; clothing and footwear; household equipment and operation; medical care and health expenses; transport; recreation; and miscellaneous goods and services. In all years except 1976, the unit record files also have separate items for mortgage principal repayments on the dwelling, other capital housing costs, superannuation contributions and life insurance premiums, and income tax payments. In 1976 all these latter items are grouped into one data item. Thus, given the need to be consistent across all surveys, the possibilities for the expenditure concept adopted are:

- include all expenditure items (including income tax);
- include all goods and services expenditure items (i.e. exclude items for mortgage repayments, other capital housing costs, superannuation and life insurance and income tax); or
- include only a subset of the goods and services expenditure items.

The first of the approaches is not particularly useful, since it includes some forms of investment/saving (mortgage principal repayments, other capital housing costs, superannuation contributions) but not others (saving, share purchases, etc.). Thus, it doesn't correspond to any useful notion of expenditure or income. The second approach excludes saving and investment and therefore has appeal as a measure of expenditure. We therefore present results for this expenditure concept, which roughly corresponds to the disposable income concept.

However, the primary motivation for examining expenditure distributions is their likely correspondence to *consumption* distributions, and it is in fact the case that much current expenditure does not relate to current consumption. For example, a car purchased in one week will potentially provide consumption 'services' for a number of years. This divergence does not just apply to goods - current expenditure on services can also not correspond to current consumption (e.g. insurance policies, memberships).[18] Barrett et. al. (2000) address this issue by attempting to restrict attention to non-durable consumption expenditure. They therefore examine only a limited part of the expenditure distribution; indeed, because of the limited number of categories into which expenditure items are classified in the HES, they exclude much non-durable consumption expenditure, and include some durable consumption expenditure. Despite these issues, we also adopt the approach of Barrett et. al. (2000) and examine a narrow class of expenditures designed to focus only on those that facilitate current consumption. The expenditure items included are fuel and power, food, alcohol and tobacco, clothing and footwear, health, personal care and recreation. Current housing costs are excluded because they include actual rent payments, but not imputed

[18] Even with very good expenditure data detailing the exact nature of each expenditure item, this is still a significant problem, because we cannot include the consumption services deriving from expenditure made prior to the survey reference period.

rent payments for owner-occupiers. Other items excluded because they contain substantial durable consumption components are household equipment and operation, transport and communication (includes expenditure on and sales of motor vehicles) and miscellaneous goods and services. As with the second approach, we also exclude mortgage principal repayments, other capital housing costs, superannuation contributions and life insurance premiums.

Despite its advantages, the problems with this narrow approach are nonetheless numerous and include the inability to include all current consumption expenditure items and exclude all durable consumption expenditure items, and the fact that an important source of inequality in consumption is likely to derive from inequality in consumption of durables – one could argue that houses, cars, boats, dishwashers, and so on, are likely to differ more in value across individuals than is the value of food, clothing and the like.

4. Trends in income inequality in Australia

Examination of the income distribution is undertaken using both kernel density estimates of log income and statistical measures of central tendency and dispersion of the income distribution. Kernel density estimation techniques permit examination of the entire income distribution, and are particularly useful for providing an overview of the distribution and the nature of changes over time. They essentially permit us to draw a histogram of the income distribution. This provides a useful visual representation of the distribution of income and how it has changed over the sample period.

Formally, the weighted kernel density estimate $\hat{f}_h$ of a univariate density f based on a random sample $y_1,...,y_n$ with weights $\theta_1,...,\theta_n,\ \sum_i \theta_i = 1,$ is:

$$\hat{f}_h(y) = \sum_{i=1}^{n} \frac{\theta_i}{h} K\left(\frac{y - y_i}{h}\right) \tag{4.1}$$

where h is the bandwidth and $K(.)$ is the kernel function, and which together regulate the relationship between the distance of y_i from y and the weight given to observation i in the estimation of the density at y. The kernel function chosen is not critical, but it should be positive, integrate to unity, be symmetric around zero and decreasing in the absolute value of its argument. We adopt an Epanechnikov kernel:

$$K(x) = \begin{cases} \frac{3}{4}\left(1 - \left(\frac{1}{5}\right)x^2\right)\Big/\sqrt{5} & \text{if } |x| < \sqrt{5} \\ 0 & \text{otherwise} \end{cases} \tag{4.2}$$

More critical is the choice of bandwidth, with smaller bandwidths resulting in less bias but more variance than larger bandwidths. A rule of thumb bandwidth (due to Silverman (1986) is given by:

$$h = 0.9 \min\left(\sigma_y, IQR/1.34\right) n^{-1/5} \tag{4.3}$$

where σ_y is the estimated standard deviation of the density and IQR is the inter-quartile range. For the data used in this paper, this results in bandwidths between 0.05 and 0.15. Bandwidths chosen are based on this rule, but are held constant across survey years, at 0.08 for all annual income distributions, at 0.075 for all weekly income unit income distributions, and at 0.06 for all other distributions. This ensures a consistent trade-off between bias and variance across the densities under comparison.

For the statistical measures presented, the mean and median are employed as measures of central tendency, while the Gini coefficient, Theil coefficient, coefficient of variation and percentile log differences are used to describe the extent of dispersion or inequality in the distribution of income. Percentile log differences provide information about the extent of inequality at different locations in the distribution. For example, the difference in the log of the income at the 90th percentile from the log of median income, denoted P90/50, provides information about the extent of dispersion in the upper tail of the distribution.[19]

The Gini coefficient is the ratio to the mean income of half the average over all pairs of the absolute deviations in incomes between individuals (see Deaton (1997) for details):

$$\gamma = \frac{1}{\mu N\left(N-1\right)} \sum_{i>j} \sum_{j} \left| x_i - x_j \right| \qquad (4.4)$$

where μ is the mean income, N is the number of persons and x_i is the income of person i. The Gini coefficient is bounded between zero (perfect equality) and one (perfect inequality), and can be represented graphically as twice the area between the Lorenz curve and the 45 degree line.

The Theil coefficient is given by (see Deaton (1997)):

$$I_T = \frac{1}{N} \sum_{i=1}^{N} \frac{x_i}{\mu} \ln\left(\frac{x_i}{\mu}\right) \qquad (4.5)$$

where variables are as defined for the Gini coefficient.[20] Like the Gini coefficient, higher values of the Theil coefficient imply higher levels of inequality. The upper bound of the Theil coefficient is $\ln(N)$,

[19] Note, however, that percentile log differences are not defined for private income in some cases because of the presence of persons with zero income unit private income. For example, the P50/10 percentile log difference is not defined when more than 10 per cent of individuals have no income.

[20] The formulas for the Gini and Theil coefficients actually employed differ from those presented because of the need to incorporate ABS sample weights, and because a computationally more convenient formula for estimating the Gini coefficient is available. The formula employed for the Gini is:

$$\gamma = \left(\frac{N+1}{N-1}\right) - \left(\frac{2}{N(N-1)\mu}\right) \sum_{i} w_i x_i \rho_i$$

where w_i is the sample weight assigned to individual i, $\sum_i w_i = N$, and ρ_i is individual i's rank in the distribution of incomes (ordered from highest to lowest). When sample weights are used, an individual's rank is given by:

which suggests it is sensitive to the sample size. However, in practice this is not the case, since it is generally less than 1, and the sample size only impacts on the Theil coefficient when one person receives all income. The coefficient of variation is the ratio of the standard deviation to the mean. It is bounded from below at zero, where there is perfect equality, but has no upper bound.

Standard errors derived from bootstrap samples are reported for all distributional measures in this section, including for changes in the measures over the sample period. This provides information on the precision of the estimates and the statistical significance of changes in inequality estimates.[21]

In the first part of this section we present results for the income distribution of all persons. We start with a focus on private, gross and disposable *annual* income using the ABS income surveys. Differences between private and gross income distributions reflect the effects of government transfers received by the income unit (pensions, benefits and allowances). Differences between gross and disposable income distributions reflect the effects of income taxation paid by the income unit. Means and medians of each distribution are shown first. Densities for three years, 1981-2, 1989-90 and 1996-7, for private, gross and disposable income are presented to indicate trends, while to compare distributions across all survey years we use summary measures. The robustness of the results to alternative income measures are then assessed using the income surveys by examining densities and summary measures for weekly income, 'equivalised' annual income and household weekly income. The weekly income unit income results are also important because the decomposition analysis in Section 5 is conducted on weekly income unit income. The expenditure surveys are then used to examine changes in household income inequality and household expenditure inequality between 1975-6 and 1998-9.

The second part of this section examines trends in the distribution of income within and between income unit types. Specifically, we identify four types of income units – single persons with no dependent

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$$\rho_i = \sum_{j=1}^{i-1} w_j + \tfrac{1}{2}\left(1 + w_i\right)$$

For the Theil coefficient, the formula used is:

$$I_T = \frac{1}{N}\sum_{i=1}^{N} w_i \frac{x_i}{\mu} \ln\left(\frac{x_i}{\mu}\right)$$

[21] 1000 bootstrap samples are taken to estimate the standard errors. Following Biewen (2002), the standard error of any statistic M is computed from the bootstrap distribution as:

$$SE_M = \sqrt{\left(\frac{1}{B-1}\right)\sum_{i=1}^{B}\left[\hat{M}^i - \left(\left(\frac{1}{B}\right)\sum_{i=1}^{B}\hat{M}^i\right)\right]^2}$$

where B is the number of bootstrap iterations and $\hat{M}^i$ is the value of M in the ith bootstrap sample.

children, couples with no dependent children, single persons with dependent children and couples with dependent children – and measure trends in inequality between the groups and within the groups.[22]

4.1 Trends in the aggregate distribution: Income unit annual income

Mean and median income

Table 4.1 shows trends in real 'unequivalised' (actual) income unit annual income for seven years from 1981-2 to 1996-7. The table presents mean and median private, gross and disposable income at June quarter 2002 prices.

Table 4.1 Mean and median income unit annual income 1981-2 to 1996-7
IDS, June 2002 prices

	1981-2	1985-6	1989-90	1993-4	1994-5	1995-6	1996-7	81-2 to 96-7
Mean								
Private	37729	38500	40684	38279	38984	38131	39221	1492
	(175.7)	(244.2)	(200.0)	(304.8)	(310.4)	(300.7)	(332.7)	(380.0)
Gross	41503	42595	44462	42672	43460	42780	44046	2543
	(160.2)	(218.7)	(178.7)	(288.8)	(294.4)	(272.8)	(291.0)	(328.6)
Disposable	33808	34475	35608	34851	35337	34899	35738	1930
	(112.8)	(167.8)	(124.6)	(198.5)	(200.9)	(191.5)	(206.2)	(240.4)
Median								
Private	36273	36200	37332	34189	34156	33677	34314	-1958
	(236.1)	(295.4)	(260.1)	(515.3)	(327.3)	(511.8)	(266.8)	(345.3)
Gross	37816	37850	38800	37202	36737	36353	37042	-774
	(218.4)	(279.9)	(222.2)	(421.9)	(377.4)	(341.0)	(390.9)	(453.2)
Disposable	31667	31194	32285	31539	31220	31027	31864	198
	(149.4)	(276.5)	(193.9)	(337.1)	(301.9)	(280.6)	(319.2)	(357.9)
Mean transfers	3774	4094	3778	4393	4476	4649	4825	1052
	(35.8)	(50.8)	(34.8)	(63.5)	(62.6)	(61.5)	(68.7)	(77.3)
Mean Taxes	7695	8120	8854	7821	8123	7881	8308	613
	(47.8)	(86.7)	(59.3)	(85.1)	(88.8)	(79.9)	(93.0)	(102.7)

Note: Standard errors (in parentheses) are derived from 1000 bootstrap samples. The mean transfer is defined as the mean of transfer payments *received*, not the *net* transfer payments of the income unit.

A number of trends can be identified from the table:

- Mean private, gross and disposable incomes all rose significantly over the period. The growth was not sustained in a consistent fashion across the sample period, however. For most of the

[22] In the decomposition analysis in Section 5, 6 groups of income units are distinguished., with singles separated according to gender. The restriction to four groups for this part of the analysis is to render interpretation of the roles of changes between and within income unit types more straightforward.

measures there was strong growth between 1981-2 and 1989-90, followed by declines to 1993-4 and then growth again thereafter. The percentage growth over the full sample period was greater for gross and disposable incomes (at approximately 6 per cent) than for private income (4 per cent).

- Median private income falls significantly over the period (by 5.4 per cent), while the changes in median gross and disposable incomes (-2 and 0.6 per cent, respectively) are not statistically significant.
- Median income is always lower than mean income, indicating a positively skewed distribution. This gap widens between 1981-2 and 1996-7 for all three income measures, but the widening is greatest for private income and least for disposable income.
- Transfers have become more important over time, evidenced by growth in the mean level of transfers of 28 per cent, from $3,774 to $4,825.
- Mean income taxes also increased over the period, but at 8 per cent, the proportionate growth is less than one third the growth in transfer payments received. Mean transfers received consequently rise from 49 per cent of mean taxes paid in 1981-2 to 58 per cent of mean taxes in 1996-7.

The divergence between the mean and the median for all three measures of income suggests increasing inequality. This is particularly so for private income, and least so for disposable income, suggesting that the effect of taxes and transfers has been to mitigate the increase in inequality due to increased inequality in private income. This is reinforced by the fact that the growth in mean transfers received is 28 per cent, and the growth in mean income taxes paid is 8 per cent, compared with growth in mean private income of 4 per cent.

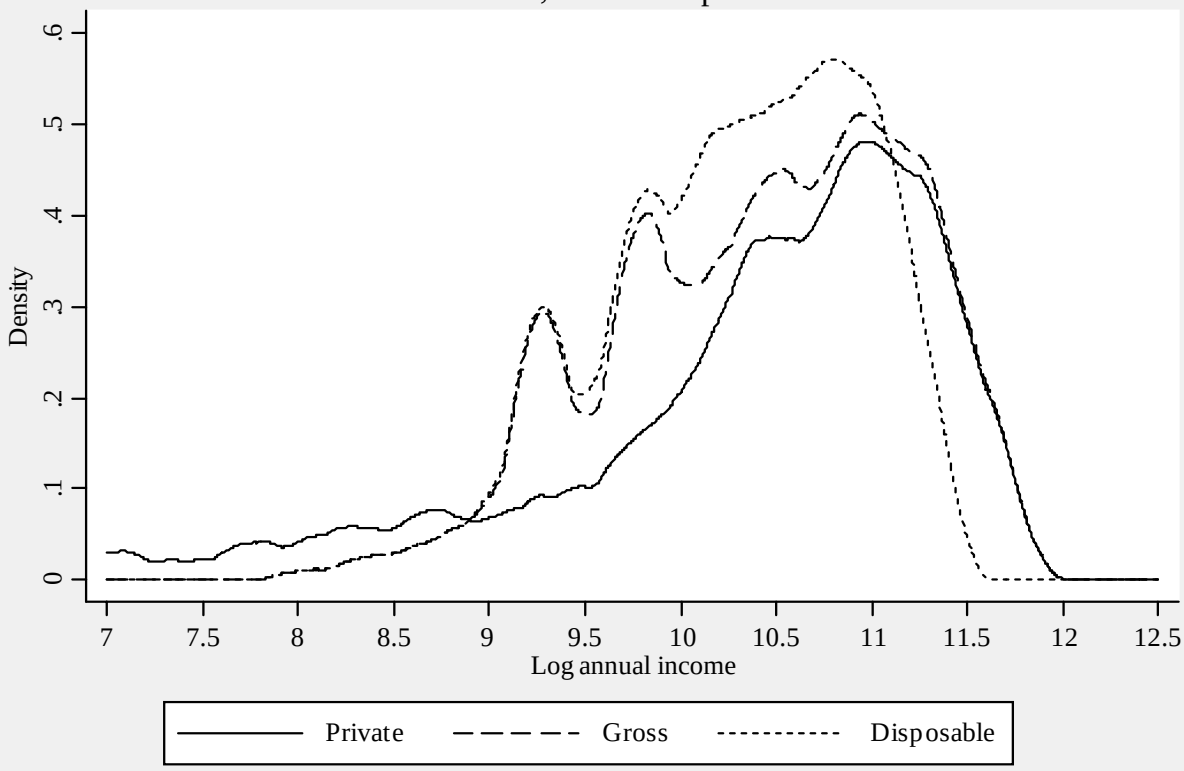
Kernel density estimates

Figure 4.1 presents kernel density estimates for log private, gross and disposable income in 1996-7 to provide a visual representation of the distribution of income and the effects of the transfer and tax system. The density curve presented for private income, although estimated over the entire population, does not provide a complete picture of the income distribution. This is because of a large ‘spike’ at zero, which cannot be displayed in a graph of the distribution of *log* income. Consequently, the proportion of the population with no income unit private income is also reported to provide an indication of the magnitude of the spike at zero.

The effects of transfer payments receipt are represented by the move from the private income density curve to the gross income density curve. As expected, transfer payments do not affect the top end of the income distribution, but increase the density at middle to lower incomes, in the process decreasing the density at very low or zero incomes. In contrast to the density curve for private income, the density curve

for gross income has two pronounced spikes at middle to low income levels – at approximately $10,000 and $16,000 – roughly corresponding to the level of income support payments for single persons and couples respectively.

Figure 4.1 Distribution of log annual income unit income in 1996-7
IDS, June 2002 prices



Proportion with no private income: 10.7%

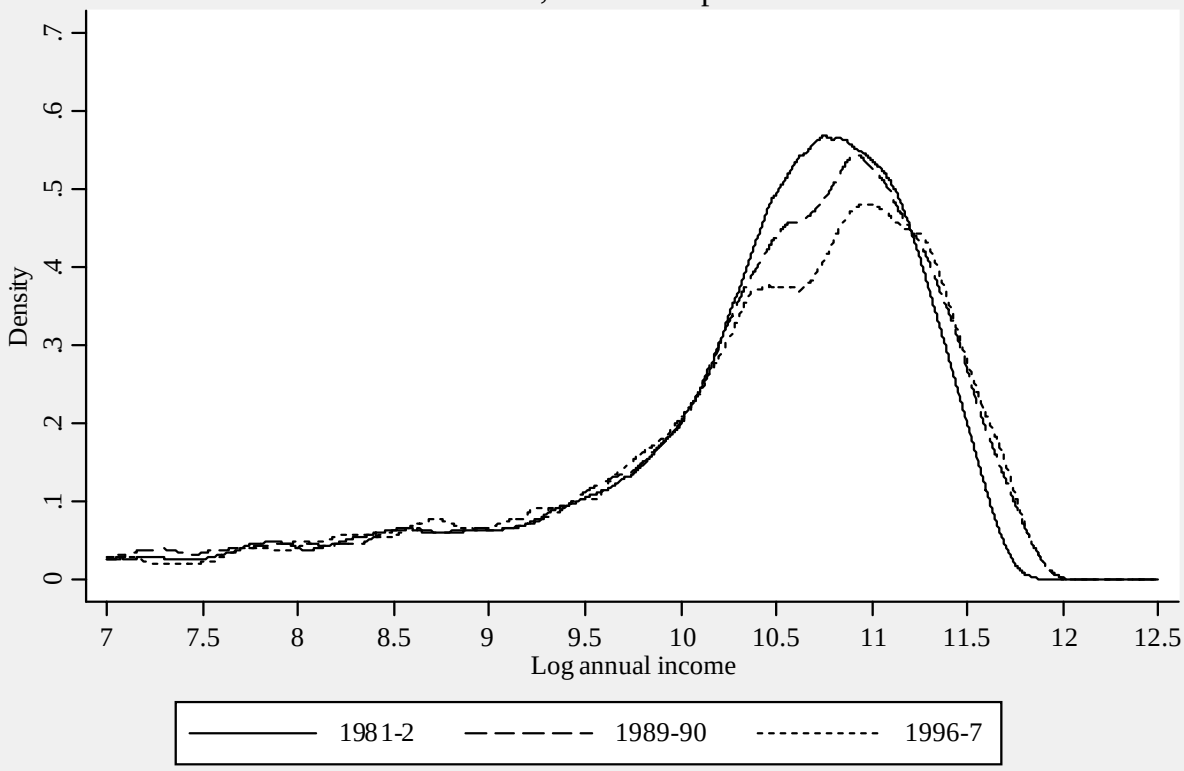
The effects of income taxes are represented by the move from the gross income density curve to the disposable income density curve. These effects are largely on the density at middle to upper income levels, with taxes decreasing the density at very high income levels (greater than $65,000) and increasing the density at middle income levels ($16,000-$65,000).

Figures 4.2, 4.3 and 4.4 provide a picture of changes to the income distribution over time, presenting the kernel density estimates of the distributions of private, gross and disposable annual income respectively, for the 1982, 1990 and 1997-8 surveys.

Figure 4.2 shows the distribution of the log of annual *private* income at June 2002 prices for 1981-2, 1989-90 and 1996-7. In 1981-2 there is a modal peak at a log income of about 10.75, corresponding to $46,630 per year. By 1989-90 the density at the modal peak had fallen and the peak had shifted to the right. This trend continued between 1989-90 and 1996-7, such that in 1996-7 the modal peak was at about $60,000. The density at the modal peak declined from about 0.58 in 1981-2 to about 0.47 in 1996-7, which is consistent with an increase in dispersion in the income distribution over the period. There has also been an increase in numbers of people with income at high levels, which was particularly

pronounced between 1981-2 and 1989-90. This is reflected in the right tail of the density curve in 1989-90 extending above and to the right of the upper tail in 1981-2. There is likewise a similar, less pronounced pattern for 1996-7 compared with 1989-90.

Figure 4.2 Distribution of log annual income unit private income
IDS, June 2002 prices



Proportion with no private income: 1981-2: 8.7% 1989-90: 6.2% 1996-7: 10.7%

As mentioned above, the density curve for private income cannot display the proportion of individuals in income units with zero private income, and so this information is displayed separately in Figure 4.2. It shows that, between 1981-2 and 1996-7, the proportion of individuals with no private income increased from 8.7 to 10.7 per cent.[23] The figure implies two effects on the distribution of private income between 1981-2 and 1996-7: an increase in inequality brought about by higher income people receiving even higher incomes, shown by the 1996-7 curve being to the right of the 1981-2 curve; and an increase in inequality arising from an increase in the size of the spike at zero private income.

Figure 4.3 shows the distribution of the log of annual *gross* income at June 2002 prices for 1981-2, 1989-90 and 1996-7. There are now three peaks. The modal income for 1981-2 is at $\log(10.8)$ or \$49,020 per year. There is a secondary peak at about $\log(9.8)$ or \$18,033 per year. This is around the level of social

[23] Figure 4.2 also shows that the proportion of income units with no private income in 1989-90 was 6.2 per cent, possibly attributable to business cycle conditions. Economic conditions peaked and unemployment was in a trough in 1989-90. Thus, the proportion of income units with no private income fell to a low, even though the longer-term trend may have been upward.

security payments for couples dependent on government benefits and pensions. The third peak at $\log(9.2)$ is at a gross income of around $9,900 per year, or about the income of a single income support recipient. As with private income, going from 1981-2 to 1989-90 and then to 1996-7, the modal peak shifts to the right and the proportion of people at the peak falls. On the high income side (to the right of the modal point) the 1989-90 curve is to the right of the 1981-2 curve and the 1996-7 curve is to the right of the 1989-90 curve. To the left of the modal point the curves seem to be coincident and do not indicate a clear change in inequality in this part of the distribution.

Figure 4.3 Distribution of log annual income unit gross income
IDS, June 2002 prices

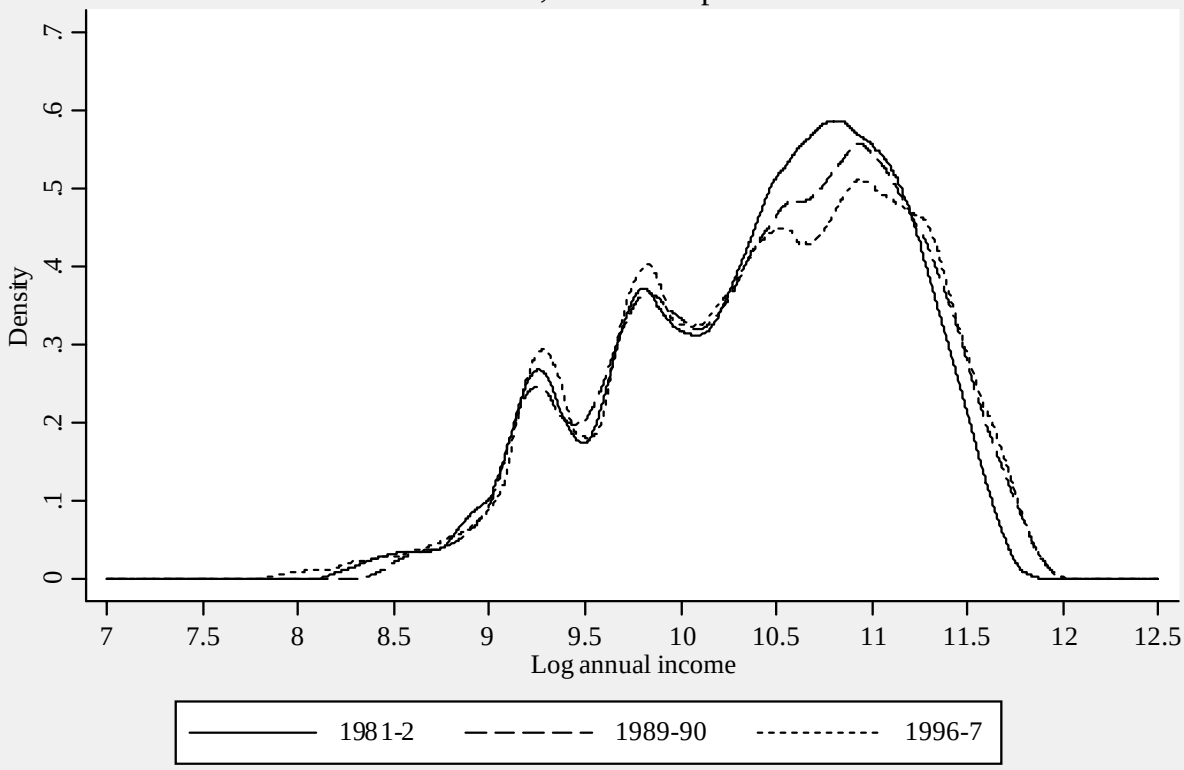
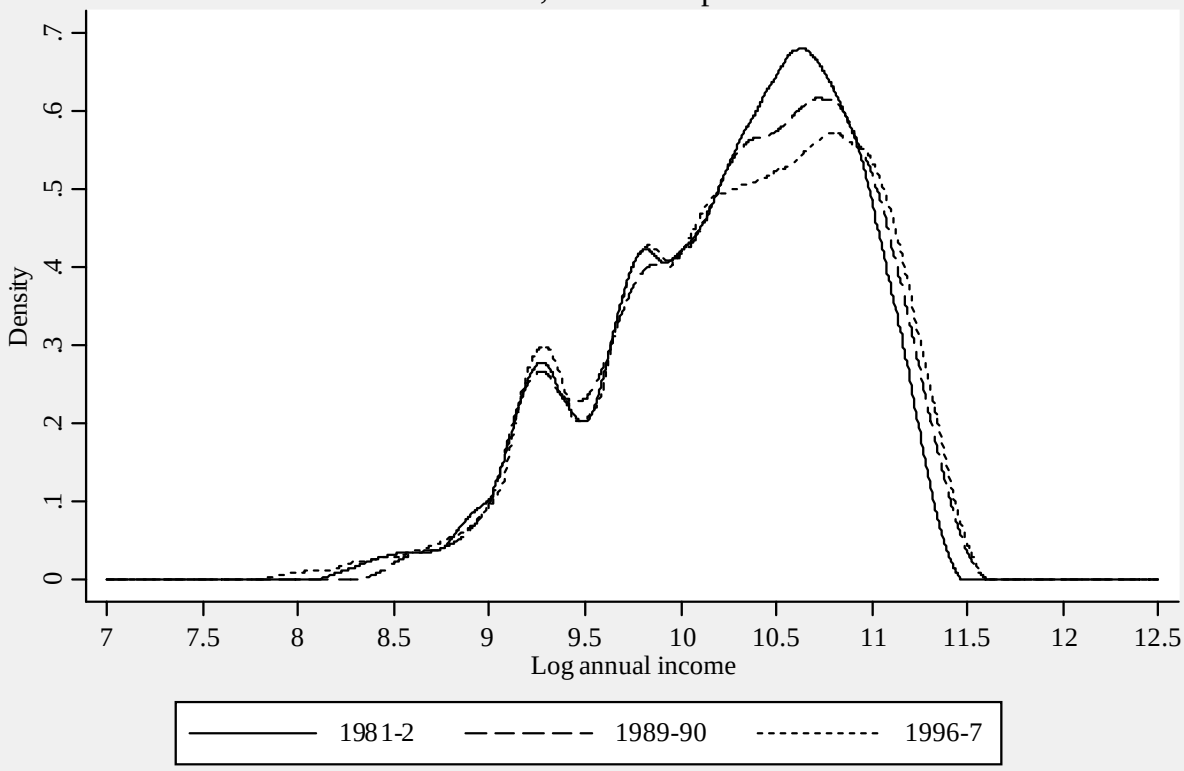


Figure 4.4 shows the distribution of the log of annual *disposable* income at June 2002 prices for 1981-2, 1989-90 and 1996-7. The three peaks identified in the gross income distribution remain, but the effect of income taxation is to reduce the width of the peaks. The modal peak has been shifted to the left in comparison with gross income. In 1981-2 it is at a log income of 10.6 or $40,135 per year. The second and third peaks remain at their values for gross income (since at this level of income personal income taxation is likely to be trivial and gross and disposable income will be very close). As for gross incomes, these peaks roughly correspond with the level of income support payments for single and couple income units.

As with the previous figures, going from 1981-2 to 1989-90 and then to 1996-7, the modal peak shifts to the right and the number of people at the peak falls. On the high income side (to the right of the modal

point) the 1989-90 curve is to the right of the 1981-2 curve and the 1996-7 curve is to the right of the 1989-90 curve. However, left of the modal point the curves cross at a number of points and no clear pattern emerges. In summary, the shapes of the distributions do not indicate a clear increase in inequality.

Figure 4.4 Distribution of log annual income unit disposable income
IDS, June 2002 prices



Summary inequality indexes

The graphs shown above are useful ways of depicting trends in a small number of distributions but are cumbersome when we wish to compare many distributions, and do not permit us to quantify distributional changes. For these purposes, we use a number of summary indexes. To illustrate their use we first consider a single year, 1996-7.

Table 4.2 reports the mean and median income unit annual income as well as six summary measures of inequality in the distribution. The first three are overall inequality measures, comprising the Gini index, the Theil coefficient and the coefficient of variation. The last three measures provide information about the location of inequality in the income distribution, where location is defined in terms of an individual's rank in the income distribution. They compare the incomes of income units at the ninetieth and fiftieth percentiles (P90/50), at the fiftieth and tenth percentiles (P50/10) and at the seventy-fifth and twenty-fifth percentiles (P75/25). For example, the P90/50 statistic measures the difference in the log of income at the ninetieth percentile and the log of income at the fiftieth percentile. A value of one for this index indicates that income at the ninetieth percentile is 100 per cent higher than income at the fiftieth percentile, when

evaluated at the midpoint of the two incomes. These three indexes provide information about the extent of inequality at different points in the income distribution, namely upper end (P90/50), the lower end (P50/10) and the middle (P72/25) of the distribution. In all cases, higher values correspond to greater inequality.

Table 4.2 Distribution of income unit annual income in 1996-7
IDS, June 2002 prices

	Private	Gross	Disposable	Effect of transfers	Effect of taxes
Mean	39221	44046	35738	4825	-8308
	(332.7)	(291.0)	(206.2)	(65.2)	(93.7)
Median	34314	37042	31864	2728	-5178
	(266.8)	(390.9)	(319.2)	(304.2)	(186.8)
Gini coef.	0.475	0.374	0.330	-0.101	-0.044
	(0.0031)	(0.0021)	(0.0018)	(0.0018)	(0.0004)
Theil coef.	0.457	0.223	0.172	-0.235	-0.050
	(0.0069)	(0.0023)	(0.0019)	(0.0053)	(0.0006)
Coef. of variation	0.846	0.673	0.585	-0.173	-0.088
	(0.0064)	(0.0041)	(0.0035)	(0.0031)	(0.0011)
P90/50	0.925	0.857	0.731	-0.068	-0.126
	(0.0086)	(0.0104)	(0.0097)	(0.0083)	(0.0057)
P50/10	–	1.231	1.091	–	-0.141
		(0.0110)	(0.0103)		(0.0057)
P75/25	2.052	1.209	1.020	-0.843	-0.189
	(0.0663)	(0.0118)	(0.0115)	(0.0594)	(0.0050)

Note: Standard errors (in parentheses) are derived from 1000 bootstrap samples.

The table shows all summary measures of inequality are reduced by both government transfers and personal income tax. With the provision of government pensions, benefits and allowances, the Gini index falls from 0.475 to 0.374. When income is taxed the Gini falls further to 0.330.

Transfers received have a bigger impact on decreasing inequality than do taxes paid, but taxes have a bigger impact on decreasing inequality (in terms of income unit income) among the top half of the population. Transfers have most of their impact on the bottom half of income recipients, reflecting the targeting of transfers on those with limited privately sourced income. This is not evident from the P50/10 difference, which is not defined because greater than 10 per cent of the population aged 15-64 years are in income units with no private income. However, it can be inferred from the combined evidence of a larger impact on the P90/50 ratio for taxes accompanied by a larger impact on overall inequality for transfers.

Table 4.3 presents summary indexes for all three measures of income for all seven survey years. The three measures of overall inequality – the Gini, Theil and coefficient of variation – all provide a consistent story about changes in inequality over the sample period. Focusing on the Gini as the representative measure of inequality, the Gini index for private income increased steadily through the eighties and early nineties but slowly in the latter part of the nineties. The Gini for gross income also increased until the mid-nineties and remained flat over the last four years. For disposable income, the Gini increased over the first four years but was also virtually constant thereafter. Over the full sample period, the increase in the

Gini was greatest for private income (0.048) and least for disposable income (0.025), but for all income measures the increase was statistically significant at the 0.01 level.

Table 4.3 Income unit annual income inequality 1981-2 to 1996-7
IDS, June 2002 prices

	1981-2	1985-6	1989-90	1993-4	1994-5	1995-6	1996-7	81-2 to 96-7
Gini coef.								
Private income	0.427 (0.0020)	0.447 (0.0026)	0.440 (0.0019)	0.470 (0.0032)	0.473 (0.0030)	0.471 (0.0031)	0.475 (0.0031)	0.048 (0.0036)
Gross income	0.346 (0.0012)	0.358 (0.0018)	0.360 (0.0012)	0.374 (0.0021)	0.379 (0.0021)	0.370 (0.0019)	0.374 (0.0021)	0.029 (0.0023)
Disposable income	0.306 (0.0012)	0.325 (0.0016)	0.316 (0.0011)	0.332 (0.0020)	0.337 (0.0018)	0.327 (0.0018)	0.330 (0.0018)	0.025 (0.0022)
Theil coef.								
Private income	0.367 (0.0037)	0.398 (0.0052)	0.372 (0.0035)	0.448 (0.0071)	0.446 (0.0063)	0.446 (0.0066)	0.457 (0.0069)	0.090 (0.0076)
Gross income	0.190 (0.0014)	0.205 (0.0021)	0.206 (0.0014)	0.225 (0.0025)	0.229 (0.0025)	0.217 (0.0023)	0.223 (0.0023)	0.032 (0.0027)
Disposable income	0.148 (0.0010)	0.167 (0.0016)	0.157 (0.0011)	0.177 (0.0021)	0.180 (0.0020)	0.168 (0.0017)	0.172 (0.0019)	0.024 (0.0022)
Coef. of variation								
Private income	0.753 (0.0037)	0.794 (0.0054)	0.782 (0.0036)	0.833 (0.0061)	0.844 (0.0058)	0.839 (0.0062)	0.846 (0.0064)	0.093 (0.0073)
Gross income	0.615 (0.0025)	0.644 (0.0040)	0.649 (0.0027)	0.670 (0.0042)	0.683 (0.0043)	0.667 (0.0038)	0.673 (0.0041)	0.058 (0.0048)
Disposable income	0.538 (0.0020)	0.576 (0.0029)	0.559 (0.0022)	0.586 (0.0036)	0.598 (0.0034)	0.581 (0.0033)	0.585 (0.0035)	0.047 (0.0041)
P90/50								
Private income	0.755 (0.0072)	0.787 (0.0091)	0.831 (0.0070)	0.883 (0.0150)	0.919 (0.0101)	0.910 (0.0145)	0.925 (0.0086)	0.170 (0.0108)
Gross income	0.729 (0.0059)	0.756 (0.0083)	0.798 (0.0059)	0.811 (0.0119)	0.856 (0.0110)	0.839 (0.0091)	0.857 (0.0104)	0.127 (0.0125)
Disposable income	0.636 (0.0049)	0.703 (0.0088)	0.692 (0.0063)	0.712 (0.0104)	0.749 (0.0106)	0.732 (0.0087)	0.731 (0.0097)	0.095 (0.0112)
P50/10								
Private income	5.349 (0.2430)	5.464 (0.1787)	4.348 (0.1054)	10.216 (0.7788)	7.937 (0.6389)	–	–	–
Gross income	1.246 (0.0075)	1.245 (0.0113)	1.201 (0.0114)	1.263 (0.0106)	1.225 (0.0110)	1.199 (0.0145)	1.231 (0.0110)	-0.015 (0.0136)
Disposable income	1.069 (0.0073)	1.083 (0.0101)	1.037 (0.0083)	1.099 (0.0103)	1.073 (0.0108)	1.055 (0.0112)	1.091 (0.0103)	0.022 (0.0126)
P75/25								
Private income	1.548 (0.0269)	1.829 (0.0399)	1.539 (0.0254)	2.161 (0.0740)	1.996 (0.0531)	1.980 (0.0605)	2.052 (0.0663)	0.503 (0.0740)
Gross income	1.100 (0.0079)	1.151 (0.0117)	1.137 (0.0079)	1.203 (0.0116)	1.212 (0.0108)	1.174 (0.0112)	1.209 (0.0118)	0.108 (0.0139)
Disposable income	0.922 (0.0074)	0.969 (0.0077)	0.954 (0.0070)	1.010 (0.0086)	1.023 (0.0078)	0.993 (0.0090)	1.020 (0.0115)	0.098 (0.0137)

Note: Standard errors (in parentheses) are derived from 1000 bootstrap samples.

The P90/50 index provides a measure of inequality in the upper part of the distribution. For private income, aside from a slight dip between 1994-5 and 1995-6, it increased steadily over the sample period. The P90/50 indices for gross and disposable income follow a similar pattern, but, as with the overall inequality measures, the increase over the full period is greatest for private income (0.170), next highest for gross income (0.127) and lowest for disposable income (0.095). All of these changes are statistically significant at the 0.01 level.

The P50/10 index provides information on the lower part of the distribution, but is of limited value for the analysis of private income because more than ten per cent of income units had no private income in the last two survey years, such that the P50/10 index is not defined in these two years. The P50/10 index for both gross income and disposable income oscillated over time, but was fairly constant through the period. For neither income measure was the change in the P50/10 ratio significantly different from zero at the 0.05 level. The similarity between the pattern for gross and disposable income is perhaps to be expected, given the limited role of income taxation with respect to the bottom half of incomes.

The P75/25 index measures the trend in inequality for the middle part of the distribution. The index for private income rose to 1993-4 with a downward deviation in 1989-90, and then remained fairly constant. The extent of change between 1989-90 and 1993-4 was particularly dramatic, with the income at the 75th percentile rising from 154 per cent higher than the income at the 25th percentile to 216 per cent higher. The trend between 1981-2 and 1996-7 for gross and disposable income was similar, but much less dramatic, with the P75/25 difference increasing by 0.108 for gross income and 0.098 for disposable income over the full period.

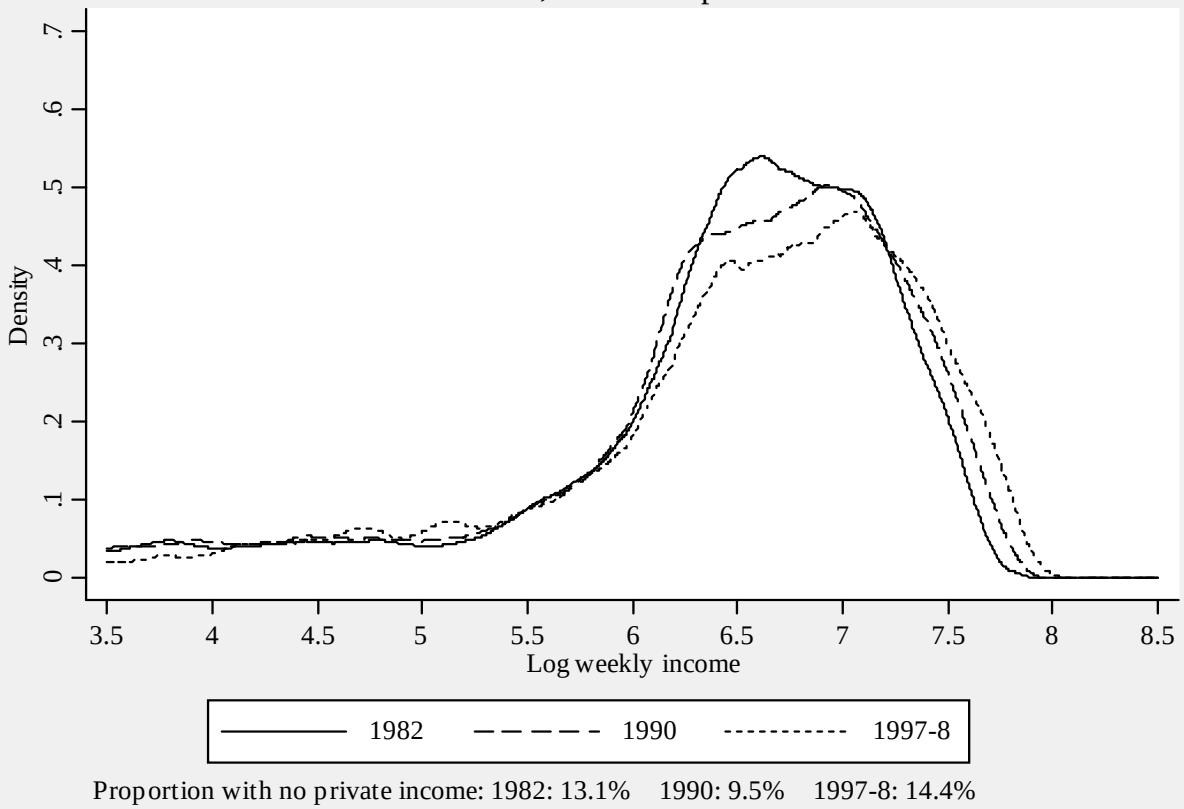
In summary, over the full period, the increase in overall inequality is significant for private, gross and disposable income. Importantly, however, there is not a significant increase in bottom-half dispersion of gross or disposable income.[24]

4.2 Weekly income

In this section we explore the sensitivity of results to the income period examined by examining *weekly* income, which is particularly important for the interpretation of the decomposition results obtained in Section 5. Figures 4.5 and 4.6 present density curves for weekly private and disposable income in 1982, 1990 and 1997-8, while Table 4.4 reports means and Gini indexes for private, gross and disposable weekly income.

[24] Although, the P50/10 is not defined for private income, a significant increase in the proportion with no private income suggests bottom-half dispersion of private income may have increased (see Figure 4.2).

Figure 4.5 Distribution of log weekly income unit private income
IDS, June 2002 prices



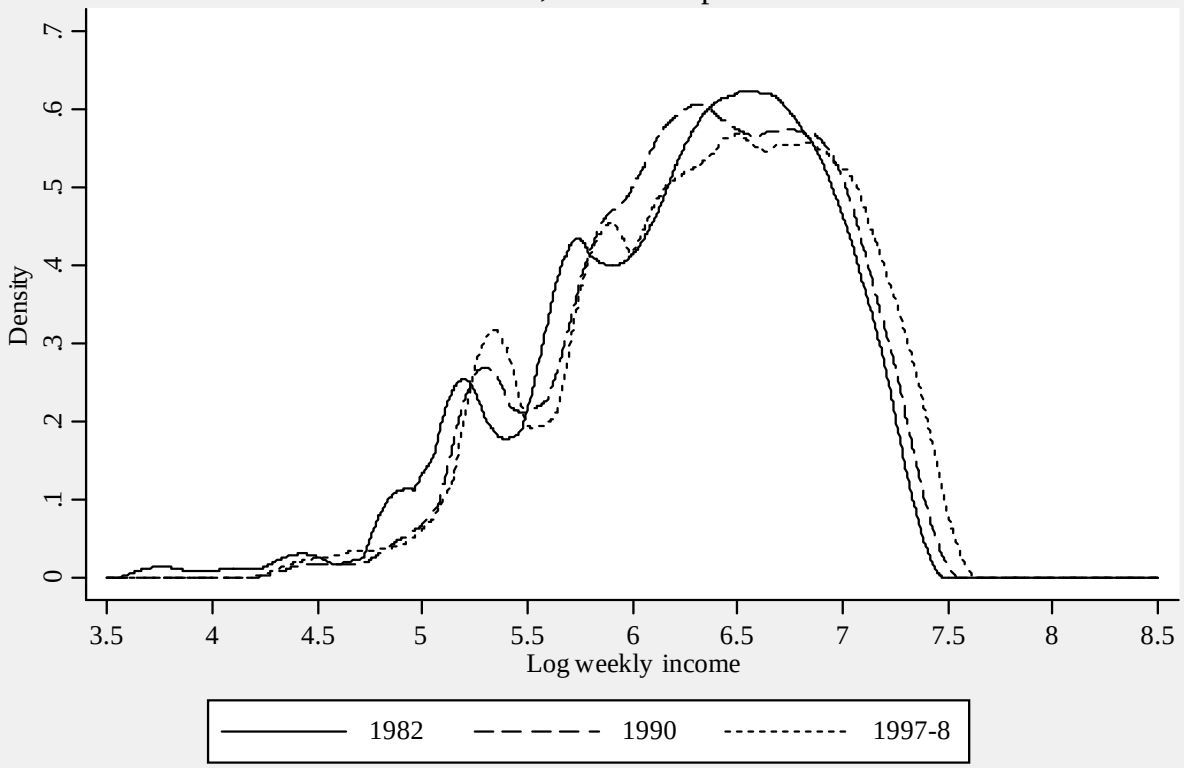
Proportion with no private income: 1982: 13.1% 1990: 9.5% 1997-8: 14.4%

Figure 4.5 shows the same pattern as for Figure 4.2, with the modal peak for private income in 1982 falling in 1990 and falling further in 1997-8. As for Figure 4.2, the distribution flattens out, with a longer tail at the high end and an increased proportion of income units with zero private income.[25] As might be expected, the proportion with no income unit private income is higher than is the case for the annual timeframe.

The distribution shown by Figure 4.6 is likewise similar to Figure 4.4, although a move of the *whole* curve to the right is apparent, as opposed to increases in incomes only at the top end of the distribution. This suggests taxes and transfers have been more important for weekly income than was apparent for annual income in counteracting the increased inequality of private incomes.

[25] As with annual income, the per cent of units with zero private income is at its lowest in 1989-90. We attribute this result to business cycle conditions.

Figure 4.6 Distribution of log weekly income unit disposable income
IDS, June 2002 prices



The picture generated by the above density curves is confirmed by the results in Table 4.4, which compares means, Gini indexes and the P90/50 and P50/10 differences for private, gross and disposable weekly income in all survey years. The table shows:

- Mean private, gross and disposable incomes all increased significantly over the 15 year period, but growth in mean gross and disposable incomes (13 per cent) exceeded that of mean private income (10 per cent).
- Inequality increased for all three income measures, with the increase in dispersion greatest for private income and least for disposable income. For example, the increase in the Gini coefficient was 0.036 for private income, 0.011 for gross income and 0.007 for disposable income, all of which are statistically significant increases at the 0.01 level.
- Inequality increased between 1982 and 1997-8 in the top half of the distribution, as measured by the increase in the P90/50 difference, for private, gross and disposable income. As with overall inequality, the extent of increase in top-half dispersion was greatest for private income and least for disposable income.

- Bottom-half dispersion, as measured by the P50/10 difference, significantly decreased between 1982 and 1997-8 for both gross income (by 0.080) and disposable income (by 0.043). Thus, all the increase in gross and disposable income inequality occurred in the top half of the distribution.

Table 4.4 Distribution of income unit weekly income 1982 to 1997-8
IDS, June 2002 prices

	1982	1986	1990	1994-5	1995-6	1996-7	1997-8	Change 1982 to 1997-8
Mean								
Private	668.69 (3.300)	675.83 (4.482)	711.16 (3.516)	706.37 (5.929)	691.83 (5.366)	703.70 (5.476)	736.02 (6.209)	67.33 (6.864)
Gross	740.27 (2.901)	754.59 (4.043)	790.88 (3.191)	803.62 (5.264)	787.06 (5.232)	804.45 (4.938)	838.18 (5.218)	97.91 (6.075)
Disposable	607.16 (2.070)	–	643.55 (2.262)	657.62 (3.627)	646.27 (3.414)	660.22 (3.410)	685.71 (3.753)	78.55 (4.396)
Gini								
Private	0.445 (0.0020)	0.450 (0.0027)	0.449 (0.0020)	0.470 (0.0032)	0.479 (0.0031)	0.477 (0.0031)	0.481 (0.0032)	0.036 (0.0038)
Gross	0.356 (0.0013)	0.350 (0.0016)	0.352 (0.0012)	0.357 (0.0019)	0.366 (0.0018)	0.359 (0.0017)	0.367 (0.0019)	0.011 (0.0023)
Disposable	0.316 (0.0011)	0.000 (0.0000)	0.306 (0.0011)	0.315 (0.0018)	0.322 (0.0017)	0.314 (0.0016)	0.323 (0.0017)	0.007 (0.0020)
P90/50								
Private	0.789 (0.0073)	0.818 (0.0088)	0.857 (0.0079)	0.905 (0.0099)	0.951 (0.0132)	0.926 (0.0150)	0.944 (0.0134)	0.156 (0.0151)
Gross	0.768 (0.0062)	0.795 (0.0090)	0.830 (0.0072)	0.820 (0.0110)	0.863 (0.0112)	0.848 (0.0092)	0.860 (0.0099)	0.092 (0.0120)
Disposable	0.678 (0.0053)	0.000 (0.0000)	0.703 (0.0057)	0.727 (0.0085)	0.746 (0.0110)	0.733 (0.0089)	0.734 (0.0090)	0.056 (0.0106)
P50/10								
Private	–	–	6.207 (0.1693)	–	–	–	–	–
Gross	1.260 (0.0070)	1.158 (0.0165)	1.081 (0.0097)	1.139 (0.0128)	1.126 (0.0135)	1.116 (0.0119)	1.180 (0.0136)	-0.080 (0.0152)
Disposable	1.096 (0.0066)	0.000 (0.0000)	0.944 (0.0097)	0.988 (0.0122)	0.995 (0.0125)	0.972 (0.0125)	1.053 (0.0120)	-0.043 (0.0140)

Note: Standard errors (in parentheses) are derived from 1000 bootstrap samples.

Note that these weekly estimates correspond to the period 1982 to 1997-8, whereas the annual income estimates correspond to the period 1981-2 to 1996-7. Furthermore, there have been changes in the sampling method of the surveys over the period which are likely to have impacted on estimates. In the surveys up until 1990, weekly income was constructed from a sample gathered over a two-month period, whereas in the surveys since it has been based on a year-long survey period. Given that the estimates also refer to income measured over different time frames, we should therefore not be surprised to find differences between the estimates for weekly and annual income. However, most of the above findings are consistent with those for annual income reported earlier, there being two main differences. The first is that the increases in the Gini coefficient are smaller for weekly income than for annual income, implying

inequality in weekly income has grown less than inequality in annual income. Interestingly, this is at odds with the explanation offered by Barrett et. al. (2000) for apparent lower growth in expenditure inequality than income inequality, that increases in income inequality may in part have derived from increases in transitory income fluctuations. Such a change should probably have led to a greater increase in weekly income inequality than in annual income inequality. The second main difference to the annual income results is that there was found to be no significant change in the P50/10 ratio between 1981-2 and 1996-7 for annual income, whereas we find a significant decrease in this ratio for weekly income between 1982 and 1997-8.

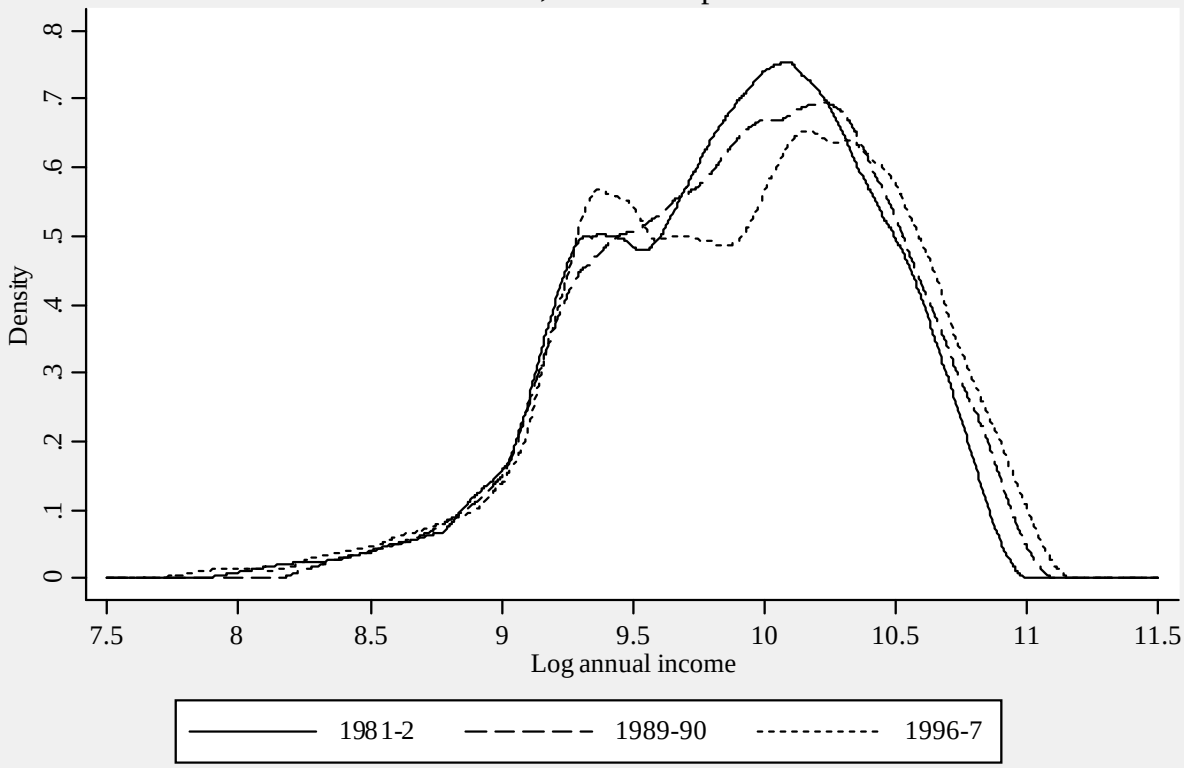
Despite these differences, the broad trends of increasing overall inequality are essentially the same for weekly income as for annual income. In undertaking further decompositions in Section 5, we report results for weekly income only, since most of the information available on individual or income unit characteristics applies only to the current week. The consistency of the inequality results with those for annual income is therefore important for the greater confidence it permits us in the validity of inferences based on the decomposition of changes in weekly income inequality.

4.3 'Equivalent' income

Figure 4.7 reports distributions of equivalent annual disposable income, defined as income unit annual income divided by the square root of the number of members of the income unit. The same general trends over the period 1981-2 to 1996-7 described above for annual disposable income are noted for this distribution. However the effect of equivalising is to eliminate one of the peaks – in Figure 4.7 there are just two peaks, a modal peak and a second peak corresponding to the 'equivalent' value of social security pensions and benefits.

Table 4.5 reports summary measures for all seven years for private, gross and as disposable income when income is equivalised. Again, we see the same general results as found for 'unequivalised' income. For mean equivalent private incomes there is a rise until 1989-90, then a plateau through to 1996-7. The trend is similar for equivalent gross income, with a faster rise in the period to 1989-90, followed by a slight rise in the period to 1996-7. Mean equivalent disposable income also rises more steeply in the first two periods, but continues to rise thereafter, although at a reduced rate.

Figure 4.7 Distribution of log annual equivalent disposable income
IDS, June 2002 prices



Inequality measures for equivalent income likewise exhibit similar patterns over the sample period to those for actual income unit income. Inequality in private equivalent income increases most, and inequality in disposable equivalent income increases least. Furthermore, total changes between 1981-2 and 1996-7 in Gini coefficients are almost identical to those for actual income, while P90/50 changes are only slightly smaller. The consistent results here therefore suggest that findings are not likely to be sensitive to the equivalence scale adopted.[26]

[26] Estimates have in fact been produced employing several alternative equivalence scales. Changes in inequality are remarkably similar to those for actual income irrespective of the equivalence scale used, despite significant changes in the income unit type composition of the population over the sample period.

Table 4.5 Distribution of equivalent annual income 1981-2 to 1996-7
IDS, June 2002 prices

	1981-2	1985-6	1989-90	1993-4	1994-5	1995-6	1996-7	Change 1981-2 to 1996-7
Mean								
Private	24240	24860	26066	25117	25569	25111	25865	1625
	(112.4)	(153.4)	(120.4)	(202.7)	(206.6)	(199.3)	(216.0)	(239.8)
Gross	26942	27771	28748	28195	28710	28382	29205	2263
	(95.9)	(138.3)	(111.1)	(172.7)	(165.0)	(163.4)	(179.9)	(207.8)
Disposable	22021	22583	23128	23089	23414	23229	23754	1733
	(68.6)	(97.8)	(74.5)	(119.7)	(120.1)	(112.7)	(125.7)	(149.2)
Gini								
Private	0.412	0.432	0.422	0.455	0.457	0.453	0.461	0.049
	(0.0020)	(0.0027)	(0.0019)	(0.0032)	(0.0031)	(0.0031)	(0.0032)	(0.0037)
Gross	0.315	0.328	0.328	0.347	0.348	0.338	0.347	0.032
	(0.0011)	(0.0016)	(0.0011)	(0.0019)	(0.0018)	(0.0018)	(0.0019)	(0.0022)
Disposable	0.270	0.292	0.279	0.301	0.302	0.291	0.298	0.028
	(0.0010)	(0.0014)	(0.0010)	(0.0018)	(0.0017)	(0.0016)	(0.0017)	(0.0019)
P90/50								
Private	0.724	0.742	0.760	0.775	0.815	0.802	0.828	0.104
	(0.0060)	(0.0100)	(0.0063)	(0.0117)	(0.0124)	(0.0116)	(0.0142)	(0.0154)
Gross	0.693	0.709	0.736	0.737	0.782	0.757	0.766	0.073
	(0.0064)	(0.0090)	(0.0069)	(0.0104)	(0.0117)	(0.0102)	(0.0124)	(0.0134)
Disposable	0.603	0.662	0.632	0.636	0.677	0.655	0.656	0.053
	(0.0055)	(0.0075)	(0.0046)	(0.0090)	(0.0099)	(0.0102)	(0.0094)	(0.0110)
P50/10								
Private	5.041	5.194	4.145	–	7.934	–	–	–
	(0.1968)	(0.1872)	(0.0855)		(0.5799)			
Gross	0.916	0.920	0.925	0.990	0.943	0.902	0.933	0.017
	(0.0060)	(0.0083)	(0.0066)	(0.0121)	(0.0121)	(0.0109)	(0.0127)	(0.0140)
Disposable	0.743	0.748	0.750	0.826	0.784	0.744	0.771	0.028
	(0.0053)	(0.0074)	(0.0057)	(0.0114)	(0.0104)	(0.0106)	(0.0103)	(0.0121)

Note: Standard errors (in parentheses) are derived from 1000 bootstrap samples.

4.4 Household income and expenditure

In this section, we move from the income unit to the household as the unit over which income (or expenditure) is measured. To aid interpretation of the results from the expenditure surveys, we first present estimates for household income inequality using the income surveys. The focus in this section is on *weekly* measures, because no annual measures are available for expenditure (and for income for some of the expenditure surveys).

Income surveys

Figure 4.8 presents density curves of log weekly household private income in 1982, 1990 and 1997-8, while Figure 4.9 presents density curves for log weekly household disposable income in each of the same years. Given the potential for greater diversity in household types and sizes than in income unit types and sizes, unsurprisingly, curves are in general broader and flatter than is the case for income unit income, reflecting greater inequality in household income than in income unit income.

Figure 4.8 Distribution of log weekly household private income
IDS, June 2002 prices

Proportion with no private income: 1982: 8.4% 1990: 5.8% 1997-8: 10.0%

Although changes are qualitatively similar to those for income unit income, they appear to be slightly less pronounced for household income. In particular, there is not the same extent of decrease in density at the modal peak. Nonetheless, a decrease in density at middle income levels and an increase in density at high income levels is evident for both private and (to a lesser extent) disposable income, as well as there being an increase in the proportion with no private income.

Figure 4.9 Distribution of log weekly household disposable income
IDS, June 2002 prices

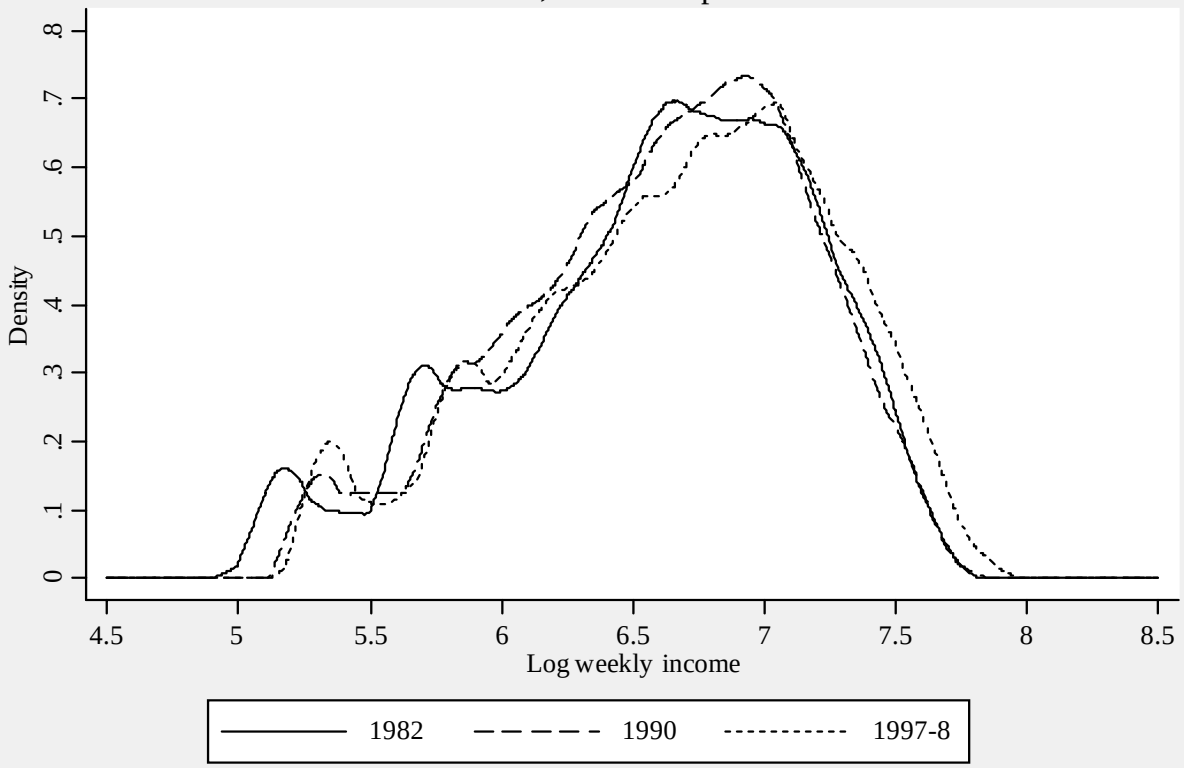


Table 4.6 presents summary distributional measures for household weekly income in each of the seven income surveys. Comparing with the estimates for income unit weekly income contained in Table 4.4, we see that mean incomes are higher for household income than for income unit income (since households can comprise multiple income units, but income units cannot comprise multiple households). Significantly, in contrast to the indications from Figures 4.8 and 4.9, dispersion in household incomes is actually slightly less than dispersion in income unit incomes. This probably reflects multiple income unit households tending to comprise income units with lower incomes.

In terms of changes over the sample period, similar trends in income levels and dispersion are evident, with two main differences. First is that growth in the means (of private, gross and disposable income) is more muted for household income. The second difference is there is slightly less pronounced growth in dispersion in the top half of the income distribution. Both of these differences possibly reflect a greater decline in average household size than has occurred in average income unit size over the period.

Table 4.6 Distribution of household weekly income 1982 to 1997-8
IDS, June 2002 prices

	1982	1986	1990	1994-5	1995-6	1996-7	1997-8	Change 1982 to 1997-8
Mean								
Private	930.42	924.04	936.65	940.35	917.09	957.45	989.50	59.08
	(4.070)	(5.259)	(4.153)	(7.006)	(6.517)	(7.288)	(7.818)	(8.680)
Gross	1028.81	1026.19	1038.41	1063.16	1039.02	1087.89	1120.56	91.74
	(3.851)	(4.888)	(3.751)	(6.396)	(6.077)	(6.319)	(7.024)	(7.750)
Disposable	844.21	–	846.29	870.20	854.05	892.40	917.14	72.93
	(2.738)		(2.697)	(4.495)	(4.332)	(4.524)	(4.963)	(5.865)
Gini								
Private	0.398	0.398	0.403	0.424	0.428	0.429	0.437	0.038
	(0.0018)	(0.0026)	(0.0019)	(0.0029)	(0.0029)	(0.0030)	(0.0029)	(0.0036)
Gross	0.326	0.319	0.320	0.330	0.332	0.331	0.337	0.011
	(0.0012)	(0.0015)	(0.0011)	(0.0018)	(0.0019)	(0.0019)	(0.0019)	(0.0022)
Disposable	0.295	–	0.283	0.295	0.296	0.294	0.300	0.005
	(0.0011)		(0.0011)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0020)
P90/50								
Private	0.745	0.704	0.736	0.784	0.798	0.792	0.831	0.085
	(0.0057)	(0.0085)	(0.0060)	(0.0128)	(0.0131)	(0.0124)	(0.0116)	(0.0129)
Gross	0.705	0.676	0.692	0.711	0.717	0.729	0.753	0.048
	(0.0058)	(0.0085)	(0.0052)	(0.0084)	(0.0100)	(0.0090)	(0.0101)	(0.0115)
Disposable	0.630	–	0.610	0.630	0.631	0.649	0.654	0.024
	(0.0047)		(0.0050)	(0.0083)	(0.0089)	(0.0081)	(0.0074)	(0.0088)
P50/10								
Private	4.562	3.850	3.757	5.897	5.900	5.975	–	–
	(0.1152)	(0.1242)	(0.0791)	(0.3341)	(0.2904)	(0.3744)		
Gross	1.141	1.068	1.015	1.074	1.059	1.061	1.079	-0.062
	(0.0071)	(0.0087)	(0.0073)	(0.0085)	(0.0074)	(0.0081)	(0.0096)	(0.0116)
Disposable	0.971	–	0.848	0.902	0.902	0.893	0.919	-0.052
	(0.0060)		(0.0052)	(0.0078)	(0.0095)	(0.0070)	(0.0078)	(0.0101)

Note: Standard errors (in parentheses) are derived from 1000 bootstrap samples.

Expenditure Surveys

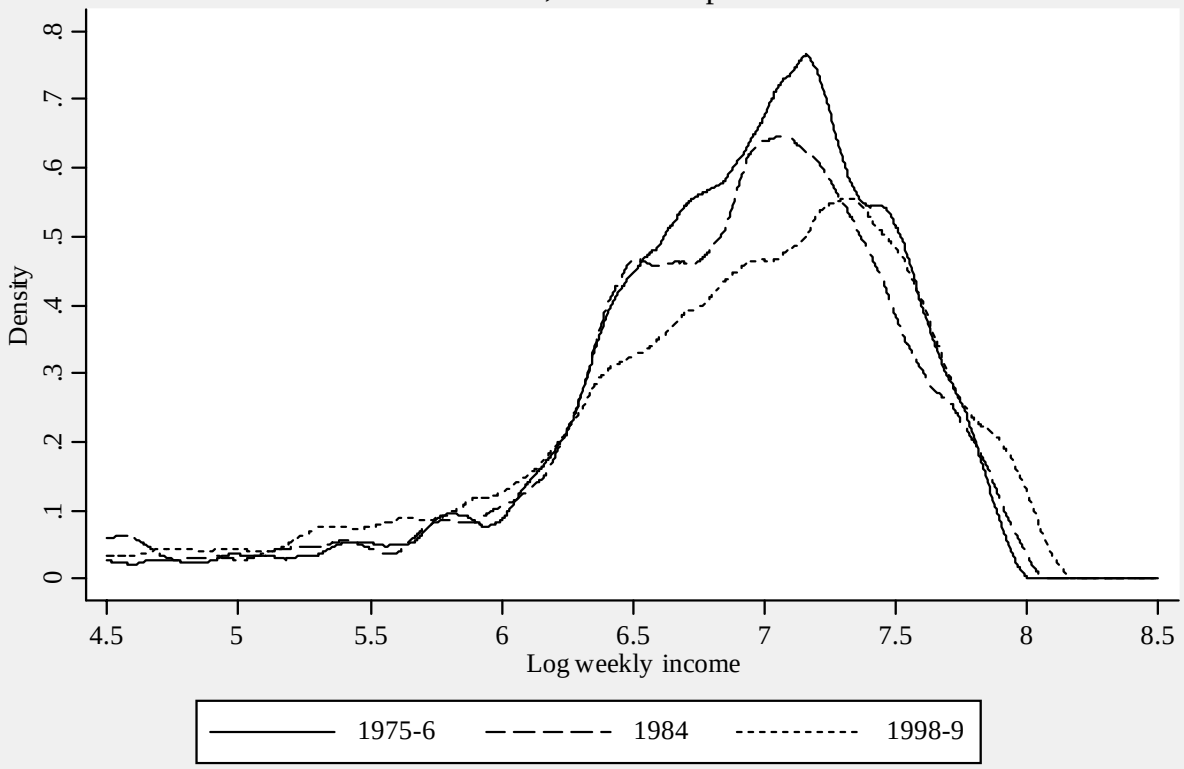
In drawing comparisons between the income surveys and the expenditure surveys we encounter the problem that we are unable to exactly match the HES to the IDS sample period. The closest approximation is to examine 1984 and 1998-9 estimates, compared with 1982 and 1997-8 estimates for the IDS. However, we also report estimates for 1975-6 (where available) in order to maximise the time-span examined.

Income

The distributions of (log) weekly household private income among individuals aged 15 years and over in 1975-6, 1984 and 1998-9, derived from the HES, are shown in Figure 4.10. These provide evidence that the patterns of decreasing density at middle incomes, increasing density at high income levels (particularly after 1984) and increased numbers with no income, have been sustained over the longer period 1975-6 to 1998-9. The HES also indicate that between 1984 and 1998-9 there was some increase

in the proportion of individuals with low household private incomes (in the range $180 to $400 per week). This is also evident in the results for household income using the IDS (although to a lesser degree), and may to some extent derive from growth in single person households among young persons (who would previously have been separate income units within the parents' household).

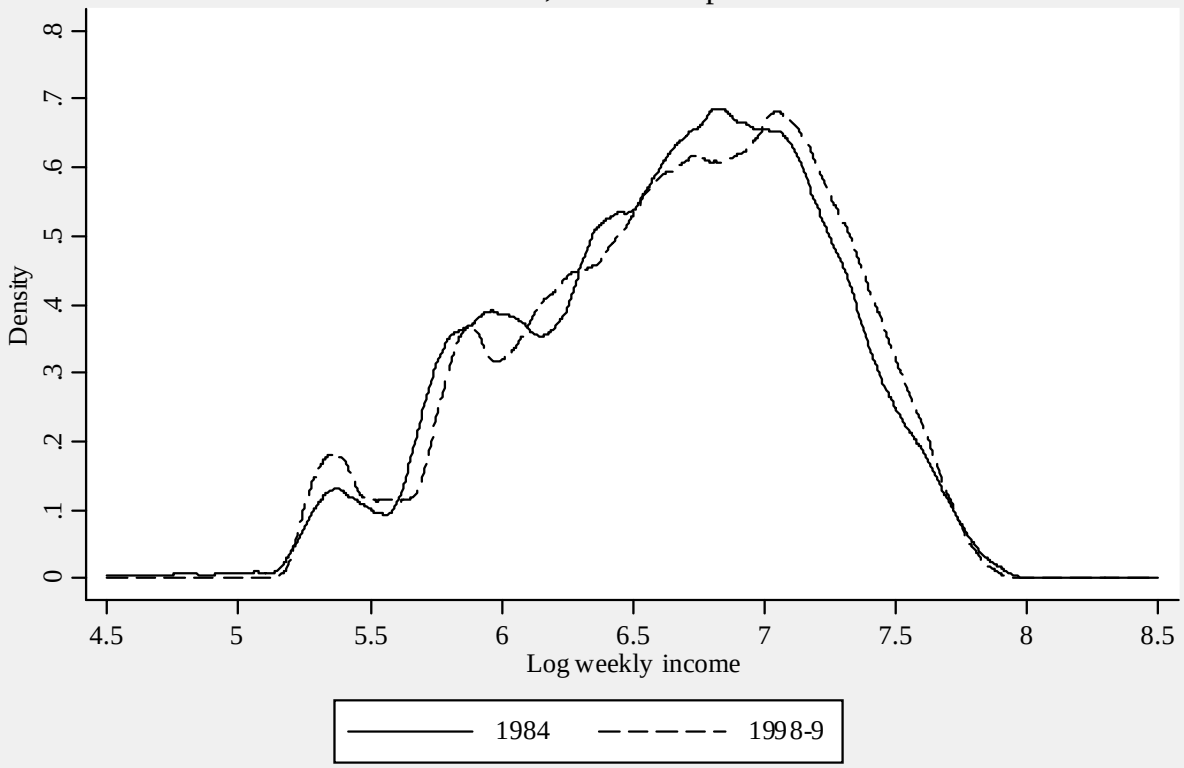
Figure 4.10 Distribution of log weekly household private income
HES, June 2002 prices



Proportion with no private income: 1975-6: 2.4% 1984: 6.3% 1998-9: 9.2%

Figure 4.11 presents density curves for disposable income in 1984 and 1998-9 using the HES. The density curve is not presented for 1975-6 because we are unable to infer disposable income from the information provided in the unit record file for this survey. Consistent with earlier findings, changes are significantly more muted than for private income.

Figure 4.11 Distribution of log weekly household disposable income
HES, June 2002 prices



The mean, Gini coefficient and P90/50 and P50/10 differences for private gross and disposable household income are reported in Table 4.7 for each of the five expenditure surveys. The HES show mean household income tending to decline up until 1993-94, and then increasing between 1993-4 and 1998-99. The Gini coefficient increases over most of the period for both private and gross income. Between 1984 and 1998-9 it increases by 0.043 for private income and 0.025 for gross income, and between 1975-6 and 1998-9 it increases by 0.111 and 0.053 for private and gross income respectively. We are unable to determine the change in the Gini for disposable income between 1975-6 and 1998-8, but it does not change (significantly, at the 0.05 level) between 1984 and 1993-94.

Compared with the IDS household weekly income estimates, the HES indicate lower growth in mean incomes, similar growth in private income inequality, and lower growth in both gross and disposable income inequality. Indeed, we find no evidence of an increase in disposable income inequality, although this is in fact broadly consistent with the IDS, for which we find only a small increase in disposable income inequality.

Table 4.7 Distribution of household weekly income 1975-6 to 1998-9
HES, June 2002 prices

	1975-6	1984	1988	1993-4	1998-9	Change 75-98	Change 84-98
Mean							
Private	1050.69	943.52	942.04	863.32	980.20	-70.47	36.68
	(7.026)	(7.773)	(5.306)	(6.759)	(7.546)	(10.589)	(10.043)
Gross	1118.98	1055.60	1037.64	993.80	1120.57	1.59	64.97
	(6.466)	(7.398)	(4.528)	(5.129)	(6.551)	(9.460)	(9.388)
Disposable	–	878.02	836.21	819.10	910.28	–	32.26
		(5.363)	(4.001)	(3.786)	(4.391)		(8.610)
Gini							
Private	0.330	0.398	0.379	0.441	0.441	0.111	0.043
	(0.0030)	(0.0037)	(0.0024)	(0.0028)	(0.0030)	(0.0042)	(0.0049)
Gross	0.284	0.312	0.303	0.329	0.338	0.053	0.025
	(0.0021)	(0.0022)	(0.0015)	(0.0016)	(0.0018)	(0.0029)	(0.0027)
Disposable	–	0.300	0.295	0.291	0.299	–	-0.001
		(0.0021)	(0.0017)	(0.0015)	(0.0017)		(0.0026)
P90/50							
Private	0.614	0.707	0.689	0.798	0.813	0.199	0.106
	(0.0091)	(0.0143)	(0.0080)	(0.0121)	(0.0105)	(0.0151)	(0.0160)
Gross	0.605	0.645	0.642	0.708	0.745	0.140	0.100
	(0.0083)	(0.0112)	(0.0068)	(0.0092)	(0.0077)	(0.0118)	(0.0126)
Disposable	–	0.639	0.627	0.620	0.656	–	0.017
		(0.0109)	(0.0064)	(0.0068)	(0.0067)		(0.0123)
P50/10							
Private	1.723	3.671	3.461	5.784	5.989	4.266	2.318
	(0.1009)	(0.1359)	(0.0791)	(0.0694)	(0.3615)	(0.3636)	(0.4087)
Gross	0.949	1.018	1.001	1.004	1.061	0.111	0.043
	(0.0182)	(0.0123)	(0.0114)	(0.0067)	(0.0081)	(0.0187)	(0.0140)
Disposable	–	0.884	0.867	0.847	0.889	–	0.005
		(0.0108)	(0.0086)	(0.0061)	(0.0067)		(0.0157)

Note: Standard errors (in parentheses) are derived from 1000 bootstrap samples.

Expenditure

Of the three income measures examined – private, gross and disposable - expenditure corresponds most closely to disposable income. The relatively small changes in disposable income inequality suggest that changes to expenditure inequality will be similarly limited. We examine distributions for two expenditure 'concepts', the first of which includes expenditure on all items except income tax, superannuation, mortgage principal repayments on dwelling and other capital housing costs. The second expenditure concept attempts to restrict to expenditure on non-durable consumption goods. This excludes from the first group expenditure on 'transport', 'current housing costs', 'household equipment and operation' and 'miscellaneous goods and services'. These groups of expenditure will in part comprise non-durable consumption, but the expenditure categories used in the unit record files make it necessary to either completely include or exclude these groups. Similarly, some of the expenditure categories not excluded (fuel and power, food, alcohol, tobacco, clothing and footwear, medical care and health, recreation) will comprise items other than non-durable consumption goods. The decision on which groups to exclude was made on the basis of the likely predominate type of expenditure (durable or non-durable) of each group –

that is, the excluded expenditure groups are likely to be primarily comprised of durable consumption expenditure.

Density curves for each of the expenditure types (all goods and services, and non-durable consumption goods) in 1975-6, 1984 and 1998-9 are presented in Figures 4.12 and 4.13 respectively. Both indicate relatively little change in the distribution of household expenditure has occurred between 1975-6 and 1998-9, although there is some evidence of decreasing density at middle expenditure levels and increasing density in the tails of the distribution (at high and low expenditure levels), more so for expenditure on all goods and services than for non-durable consumption expenditure.

Figure 4.12 Distribution of log weekly household expenditure on goods and services
HES, June 2002 prices

Figure 4.13 Log weekly household expenditure on non-durable consumption goods
HES, June 2002 prices

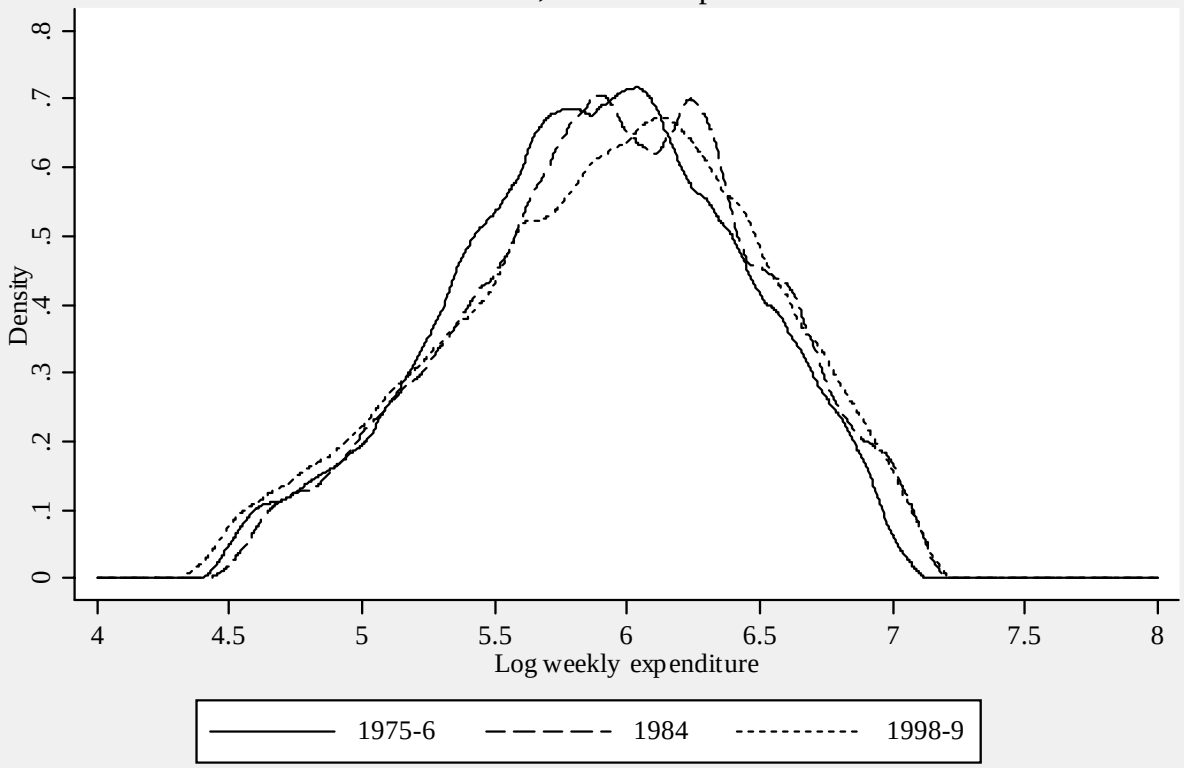


Table 4.8 presents summary measures of the two expenditure distributions for each of the five HES. The Gini index shows a small, but statistically significant, increase in inequality in expenditure on all goods and services. All of the increase occurred between 1993-4 and 1998-9 (with a decrease in fact evident between 1984 and 1988).

A similar (statistically significant) increase in overall inequality is apparent for non-durable consumption expenditure. An important contrast, however, is that the increase is concentrated among the top half of persons (ordered by household expenditure) for all goods expenditure, whereas it is concentrated in the bottom half for non-durable goods expenditure.

Interestingly, mean non-durable goods expenditure does not change between 1984 and 1998-99, whereas the mean of expenditure more generally does increase, implying increased income has tended to be expended on durables. This suggests the non-durables expenditure approach may not fully reveal increased consumption inequality, since it may be that additional income of high-income persons is largely spent on durables, and the reductions in income of low-income persons similarly mostly impact on durables expenditure. It also bears emphasising again that it is not surprising changes in household expenditure inequality have been somewhat small, since both the IDS and HES indicate there has been only a small increase in inequality of disposable incomes, and the disposable income of a household is likely to be closely related to its expenditure.

Table 4.8 Distribution of household weekly expenditure 1975-6 to 1998-9
HES, June 2002 prices

	1975-6	1984	1988	1993-4	1998-9	Change 75-98	Change 84-98
				All goods and services			
Mean	837.18	836.43	827.42	819.58	880.65	43.47	44.22
	(5.150)	(4.997)	(3.470)	(3.861)	(4.562)	(6.520)	(6.100)
Gini coef.	0.283	0.284	0.274	0.279	0.295	0.012	0.011
	(0.0021)	(0.0019)	(0.0014)	(0.0015)	(0.0017)	(0.0029)	(0.0026)
P90/50	0.652	0.639	0.594	0.637	0.680	0.028	0.041
	(0.0084)	(0.0107)	(0.0061)	(0.0077)	(0.0081)	(0.0120)	(0.0131)
P50/10	0.767	0.809	0.813	0.797	0.831	0.064	0.022
	(0.0161)	(0.0094)	(0.0092)	(0.0085)	(0.0115)	(0.0223)	(0.0164)
				Non-durable consumption goods and services			
Mean	407.72	438.96	420.40	421.71	437.68	29.97	-1.28
	(2.418)	(2.963)	(1.724)	(2.026)	(2.437)	(3.485)	(4.099)
Gini coef.	0.288	0.295	0.280	0.292	0.307	0.019	0.012
	(0.0021)	(0.0021)	(0.0015)	(0.0016)	(0.0019)	(0.0027)	(0.0026)
P90/50	0.695	0.691	0.641	0.670	0.702	0.007	0.011
	(0.0097)	(0.0105)	(0.0079)	(0.0110)	(0.0092)	(0.0129)	(0.0145)
P50/10	0.744	0.793	0.771	0.830	0.883	0.139	0.090
	(0.0109)	(0.0152)	(0.0086)	(0.0108)	(0.0096)	(0.0136)	(0.0182)

Note: Standard errors (in parentheses) are derived from 1000 bootstrap samples.

4.5 Trends in private and disposable income of income unit types

In this section we trace the fortunes of each of four income unit types using the income surveys, considering changes in both inequality between the income unit types and inequality within each type. The first part of this section examines between-group inequality by comparing mean incomes. We present the trends in mean private and disposable annual income unit income separately for singles, couples, singles with dependent children and couples with dependent children. The second part examines within-group inequality using the Gini index, again for both private and disposable income.

Between-group inequality

Table 4.9 shows the mean real annual private income of the four income unit types. There are enduring large differences between them. However, note that in this table, we take no account of income unit size or composition. That is, income is not equivalised. Couples with dependents earn the highest average private income, followed by couples with no dependents, singles, and finally singles with dependents.

The table shows increases in real private incomes for all groups over the 15-year period. The (dollar) increases were greatest for couples with dependents, and smallest for single persons with dependents. As a proportion of initial income, gains made were similar for three of the groups, at approximately 6.5 to 7 per cent, the exception being single persons with dependents, for whom the increase of 4 per cent was not

statistically significant. Despite some volatility between successive survey years, the increases were fairly evenly spread over the period, except for single persons without dependents, for whom most improvement occurred from the mid-nineties. Given that increases in mean private income were greatest for the income unit types with the highest mean incomes (couples) and least for the income unit type with lowest mean income (single parents), the evidence presented in Table 4.9 suggests that changes between income unit groups have acted to increase private income inequality.

Table 4.9 Mean income unit annual private income by income unit type 1981-2 to 1996-7
IDS, June 2002 prices

	Singles, no dependents	Couples, no dependents	Singles with dependents	Couples with dependents
1981-2	20367	39647	16058	51764
	(224.3)	(373.2)	(643.3)	(236.9)
1985-6	20604	40086	16349	53264
	(298.6)	(488.8)	(960.5)	(357.5)
1989-90	20892	42308	16917	56253
	(240.7)	(377.9)	(643.7)	(291.8)
1993-4	20505	42056	15814	53098
	(385.2)	(609.2)	(846.3)	(488.1)
1994-5	20362	42720	18615	54982
	(363.9)	(591.1)	(1037.8)	(521.4)
1995-6	21279	41072	14768	54034
	(361.4)	(564.6)	(903.7)	(476.7)
1996-7	21681	42474	16749	55074
	(387.3)	(611.3)	(879.3)	(543.2)
Change, 1981-2 to 1996-7	1314	2827	691	3310
	(454.1)	(702.4)	(1028.7)	(574.9)
Percentage change	6.45	7.13	4.30	6.39

Note: Standard errors in parentheses.

Table 4.10 shows trends in mean disposable income for the income unit groups. All income unit types made (statistically significant) real gains in income on average. The largest gains occurred in couples with dependents followed by singles with dependents, couples and singles. Singles with dependents made the largest *proportionate* gains, followed by couples with dependents, singles and, finally, couples.

Given initial income levels of the income unit types, the relative decline in income of single persons has acted to increase between-group inequality in disposable incomes, but the relative gains in income of sole parents have acted to decrease between-group inequality. This is because singles are the poorest income unit type, and singles with dependents are the second-poorest income unit type. This suggests the net impact of these changes on inequality is ambiguous. However, singles with dependents make up a very small proportion of the population, while singles are one of the largest groups in terms of size. This

suggests the changes in mean incomes of each income unit type – changes in between-group inequality – have acted to increase aggregate disposable income inequality.[27]

Table 4.10 Mean income unit annual disposable income by income unit type
1982 to 1997-8
IDS, June 2002 prices

	Singles, no dependents	Couples, no dependents	Singles with dependents	Couples with dependents
1981-2	19522	37110	21237	43597
	(127.3)	(203.6)	(367.3)	(156.0)
1985-6	19879	37409	22061	44692
	(192.9)	(297.1)	(621.0)	(242.5)
1989-90	19768	38359	21690	46316
	(142.3)	(223.9)	(367.5)	(184.9)
1993-4	19831	38849	23215	45720
	(227.2)	(367.6)	(509.7)	(295.2)
1994-5	19843	39244	24990	47091
	(212.4)	(365.3)	(616.5)	(306.3)
1995-6	20540	38393	22913	46509
	(212.1)	(342.6)	(520.3)	(291.1)
1996-7	20747	39316	23829	47530
	(235.3)	(354.4)	(485.7)	(319.2)
Change 1981-2 to 1996-7	1226	2205	2592	3933
	(263.5)	(435.7)	(624.5)	(352.3)
Percentage change	6.28	5.94	12.20	9.02
Effect of transfers & taxes on change	-88	-622	1901	623
	(197.6)	(321.3)	(549.3)	(271.2)

Note: Standard errors in parentheses. The 'transfers and taxes effect' is the difference between the change in mean disposable income and the change in mean private income.

Comparing Tables 4.9 and 4.10 shows the effects of income taxes and transfers on the mean income of each income unit type. Their effect is to considerably reduce the income of couples with dependents, moderately reduce the income of couples and singles without dependents and to increase significantly the income of singles with dependents. For example, in 1996-7 (at June quarter 2002 prices), transfers and taxes act to:

- *decrease* the mean income of couples with dependents by $7,544;
- *decrease* the mean income of couples without dependents by $3,158;
- *decrease* the mean income of single persons without dependents by $934; and

[27] Changes in between-group inequality are also a function of changes in the proportion of the population in each income unit type. We have not examined this source of increased income inequality. Among the changes in income unit type composition that have occurred (see Section 1.1), one suspects, in particular, that the increase in the proportion of the population in sole parent income units is likely to have caused increased between-group inequality.

- *increase* the mean income of sole parents by $7,080.

Government intervention, through transfer payments and personal income tax, has moderated the gains of singles and couples with no dependents, and improved the gains of singles and couples with dependents. This is indicated in the last row of Table 4.10, which shows the difference between the effects of transfers and taxes in 1996-7 and their effects in 1981-2 (with the effect in a given year equal to the difference between disposable and private income). Taxes and transfers (and changes in them) have served to decrease the change in mean disposable annual income by $88 for single persons and by $622 for couples without dependents. That is, if average net taxes and transfers received/paid per year had remained unchanged over the sample period, single persons would have averaged $88 more in disposable income in 1996-7, and couples without dependents would have averaged $622 more. By contrast, transfers and taxes have acted to increase the change in mean disposable income by $623 for couples with dependents, and by $1901 for sole parents.

The changes in the mean income of each income unit type induced by transfers and taxes superficially translate to ambiguous effects on between-group inequality. Couples with dependents have the highest mean income, and transfers and taxes have acted to increase mean disposable income of this group. On the other hand, single persons with dependent children have a low mean income, and this group has had the largest increase in mean disposable income due to transfers and taxes. However, couples with dependent children are a much larger group and we would expect the effects of taxes and transfers on this group to dominate their effects on sole parents. This implies taxes and transfers have acted to *increase* between-group inequality. It should be noted, however, that since the changes in taxes and transfers appear to have benefited persons with dependent children, they may have reduced between-group inequality in *equivalent* income, since income units with dependent children generally contain more people than those without dependent children.

Within-group inequality

Table 4.11 reports values of the Gini index for private income for individuals in each of the income unit groups, while Table 4.12 reports values for disposable income. Table 4.11 indicates that the greatest private income inequality within groups is among single parents, followed by singles, couples and couples with dependents. The high level of inequality among singles with dependents to a significant extent reflects the large proportion of this group with no private income. As measured by the Gini coefficient, inequality within groups increased significantly for all income unit types except sole parents, among whom there was in fact a decrease in with-in group inequality (although the decrease was not significant). The greatest increase was among couples with dependents, which at 0.064, was approximately double that of singles and couples with no dependents.

Table 4.11 Within-group inequality in annual private income
Gini indexes by income unit type 1981-2 to 1996-7
IDS, June 2002 prices

	Singles, no dependents	Couples, no dependents	Singles with dependents	Couples with dependents
1981-2	0.502 (0.0041)	0.447 (0.0039)	0.633 (0.0119)	0.267 (0.0022)
1985-6	0.517 (0.0053)	0.470 (0.0051)	0.656 (0.0153)	0.286 (0.0035)
1989-90	0.508 (0.0042)	0.452 (0.0036)	0.610 (0.0111)	0.288 (0.0024)
1993-4	0.541 (0.0064)	0.460 (0.0058)	0.606 (0.0160)	0.325 (0.0042)
1994-5	0.536 (0.0065)	0.461 (0.0059)	0.613 (0.0158)	0.329 (0.0041)
1995-6	0.524 (0.0059)	0.472 (0.0057)	0.665 (0.0151)	0.318 (0.0043)
1996-7	0.536 (0.0066)	0.471 (0.0058)	0.609 (0.0149)	0.331 (0.0044)
Change, 1981-2 to 1996-7	0.035 (0.0078)	0.024 (0.0071)	-0.024 (0.0187)	0.064 (0.0051)

Note: Standard errors (in parentheses) are derived from 1000 bootstrap samples.

Table 4.12 reports estimates of inequality for disposable annual income. In comparison with the results for private income, Table 4.12 shows the marked reduction of inequality when the effect of transfer payments and income taxation are taken into account. Inequality among income unit types is remarkably similar when disposable income is the measure, showing the importance of the effects of transfers and taxes on the income distribution.

Although the Gini values are erratic from year to year, overall they indicate small (but statistically significant) increases in inequality for all income unit types except sole parents. Interestingly, the increase in the Gini coefficient is somewhat similar for all three of the income unit types to experience an increase in inequality, ranging from a low to 0.021 for couples with dependents to a high of 0.028 for couples without dependents. The contrast between the results for private income and disposable income again emphasises the important role played by transfers and taxes. This is particularly true for couples with dependents, among whom inequality would have increased by three times as much but for the impact of transfers and taxes. Notable, however, is that taxes and transfers have had no significant impact on the change in inequality among couples without dependents, nor sole parents.

Table 4.12 Within-group inequality in annual disposable income
Gini indexes by income unit type 1981-2 to 1996-7
IDS, June 2002 prices

	Singles, no dependents	Couples, no dependents	Singles with dependents	Couples with dependents
1981-2	0.307 (0.0019)	0.276 (0.0017)	0.288 (0.0055)	0.201 (0.0014)
1985-6	0.330 (0.0031)	0.297 (0.0021)	0.320 (0.0092)	0.224 (0.0021)
1989-90	0.305 (0.0022)	0.287 (0.0016)	0.289 (0.0058)	0.214 (0.0016)
1993-4	0.340 (0.0038)	0.304 (0.0031)	0.269 (0.0083)	0.224 (0.0026)
1994-5	0.332 (0.0037)	0.307 (0.0030)	0.281 (0.0082)	0.230 (0.0025)
1995-6	0.322 (0.0034)	0.302 (0.0027)	0.269 (0.0083)	0.218 (0.0023)
1996-7	0.332 (0.0037)	0.304 (0.0028)	0.260 (0.0080)	0.222 (0.0025)
Change, 1981-2 to 1996-7	0.026 (0.0042)	0.028 (0.0031)	-0.029 (0.0099)	0.021 (0.0029)
Effect of transfers & taxes on change	-0.009 (0.0061)	0.004 (0.0050)	-0.004 (0.0168)	-0.043 (0.0031)

Note: Standard errors (in parentheses) are derived from 1000 bootstrap samples.

4.6 Summary

In this section we have described trends in income inequality over the period 1981-2 to 1996-7 using seven income surveys and trends in both income and expenditure inequality over the period 1975-6 to 1998-9 using five household expenditure surveys. Despite the limitations of the surveys, we believe they provide a reasonable picture of developments in the income and expenditure distribution. We note that many of the limitations are more important to estimates of the *level* of inequality at a point in time than they are to estimates of *changes* in inequality over time. Specifically, to the extent that the limitations apply to all of the income surveys or all of the expenditure surveys, measures of change are not likely to be significantly compromised by the limitations, and it is *change* in inequality that is the focus of this paper.

The section has indicated that at the level of disposable income, there was a modest increase in inequality over the eighties and nineties, with most of the increase occurring by the early nineties. Similarly, modest increases in expenditure inequality are evident over recent decades. Analysis of trends in income inequality by income unit type confirms the aggregate findings. Dispersion has increased most for private income, with smaller increases for gross income and little increase for disposable income. At the same time, the real mean income unit incomes of all persons, and of each income unit type, increased over the sample period.

Decomposition of the relative roles played by market income, government transfers and income taxation in the changes in the disposable income distribution has shown that there were large increases in inequality at the level of private income, but this was mitigated by the provision of government transfers and by income taxation. The increased income inequality at the private level appears to derive from both greater increases in incomes of income units with high incomes, and falls in income at the low end of the spectrum. In the next section, we aim to uncover the sources of the increased dispersion at the private income level.

5. Decomposing distributional changes

In Section 4, it was found that private income inequality has increased significantly over the sample period, but the impact of this on disposable income inequality has been mitigated to a significant extent by the tax and transfer system. We now focus on what has driven the changes in the distribution of private income.

The primary interest for the decomposition analysis is in the effect on the income distribution of changes in socio-economic and demographic characteristics, in particular examining the roles played by changes in the income unit structure, including the number and ages of dependent children, and changes in the distribution of employment across income units. The effects of other factors are also explored. The specific variables constructed to some extent depend on the data available, and are discussed further below.

There are several decomposition approaches that could potentially be adopted for our purpose. These include parametric methods such as those due to Juhn, Murphy and Pierce (JMP), (1993) and semi-parametric methods, such as the conditional density estimation approach developed by DiNardo, Fortin and Lemieux (DFL), (1996).

Parametric methods typically assume a formal relationship between a variable of interest and its components. For instance JMP utilise a wage equation:

$$w_{it} = X_{it}\beta_i + \varepsilon_{it} \,. \tag{5.1}$$

Change in the distribution of wages w, is determined by change in observable characteristics X, change in the return to those characteristics β, and changes to unobservables which are subsumed into the error term, ε. JMP assume a functional form for 5.1 which imposes constraints on the way change may be distributed between X, β and the error term.

By contrast, semiparametric approaches, such as the DFL method, do not require assumptions on the functional form of the relationship between characteristics and the outcome of interest. In this paper we therefore adopt the DFL approach, since it provides the most flexibility of the available approaches, allowing us to examine the effects of changes in any characteristic on any distributional measure, while requiring few assumptions about the relationship between characteristics and income.

5.1 The DFL method

The intuition for the DFL approach is that a density (of any distribution, including income) may be viewed as a weighted average of densities conditional on characteristics, where the weight assigned to each conditional density is proportionate to the share of the population with that set of characteristics. Distributional changes over time can then be viewed as the outcome of two distinct forces: changes in the group weights brought about by changes to the 'characteristics composition' of the population; and changes in the conditional densities (i.e. the incomes accruing to members of each group).

Formally, the DFL approach views each observation i as a vector $\left(y_i, x_i, t_i\right)$ consisting of an income y, a vector of characteristics x and a date t, that belongs to a joint distribution $F\left(y, x, t\right)$ of incomes, characteristics and dates. The density of incomes at one point in time $f_t\left(y\right)$ can then be written as the integral of the density of incomes conditional on a set of individual characteristics and on a date t_p, over the distribution of individual characteristics $F\left(x \mid t_x\right)$ at date t_x:

$$\begin{aligned} f_t\left(y\right) &= \int_{x \in \Omega_x} f\left(y \mid x, t_p = t\right) dF\left(x \mid t_x = t\right) \\ &\equiv f\left(y; t_p = t, t_x = t\right) \end{aligned} \tag{5.2}$$

where Ω_x is the domain of definition of the individual characteristics.

The notation in the second line of equation (5.2) allows us to express equations for counterfactual densities, with t_p denoting the date from which the incomes associated with each set of characteristics are drawn (i.e. the characteristics 'prices'), and t_x denoting the date from which the distribution of characteristics is drawn. For example, while $f\left(y; t_p = 97, t_x = 97\right)$ represents the actual density of incomes in 1997-8, $f\left(y; t_p = 97, t_x = 82\right)$ represents the density that would have resulted in 1997-8 had the distribution of characteristics remained as it was in 1982. This hypothetical density is identified as follows:

$$\begin{aligned} f\left(y; t_p = 97, t_x = 82\right) &= \int f\left(y \mid x, t_p = 97\right) dF\left(x \mid t_x = 82\right) \\ &= \int f\left(y \mid x, t_p = 97\right) \psi_x\left(x\right) dF\left(x \mid t_x = 97\right) \end{aligned} \tag{5.3}$$

where ψ_x is a 'reweighting' function:

$$\psi_x\left(x\right) \equiv \frac{dF\left(x \mid t_x = 82\right)}{dF\left(x \mid t_x = 97\right)} \tag{5.4}$$

The counterfactual density is identical to the 1997-8 density except for the function $\psi_x(x)$, so that once an estimate of this function, $\hat{\psi}_x(x)$, is obtained, the counterfactual density can be estimated by weighted kernel methods as:

$$\hat{f}\left(y; t_p = 97, t_x = 82\right) = \sum_{i=1}^{n_{97}} \frac{\theta_i}{h} \hat{\psi}_x(x_i) K\left(\frac{y - y_i}{h}\right) \tag{5.5}$$

where n_{97} is the 1997-8 sample size and the summation is over observations in the 1997-8 sample.

Essentially, each observation in the 1997-8 sample is reweighted so as to give the same distribution of individual characteristics as in the 1982 sample. Applying Bayes' rule to the ratio $\frac{dF(x \mid t_x = 82)}{dF(x \mid t_x = 97)}$ gives the following equation for the reweighting function:

$$\psi_x(x) = \frac{\Pr(t_x = 97)}{\Pr(t_x = 82)} \cdot \frac{\Pr(t_x = 82 \mid x)}{\Pr(t_x = 97 \mid x)} \tag{5.6}$$

Since the weights θ_i sum to one for each date we can set $\Pr(t_x = 97) = \Pr(t_x = 82)$ and ignore these unconditional probabilities. The probability of being in period t given characteristics x $\left(\Pr(t_x = t \mid x)\right)$ can be estimated non-parametrically, by identifying the proportion of individuals with each characteristic combination at each date, or by a discrete choice model like the logit. We take the latter approach, since implementation is straightforward and the equivalent of the non-parametric model can be achieved by specifying a full set of dummy variables indicating each possible value of x:

$$\Pr(t_x = t \mid x) = \Lambda\left(H(x)\beta\right) \tag{5.7}$$

where Λ is the cumulative logistic distribution and $H(x)$ is a vector of covariates that is a function of x.

The weights resulting from estimation of this model are normalised to sum to one and can then be used to estimate the counterfactual density as per equation (5.5) or indeed any summary measure of the counterfactual distribution, such as the mean or Gini coefficient.

Using the logit equation estimates, the 1997-8 observations have therefore been reweighted to produce a counterfactual earnings distribution: that which would have prevailed in 1997-8 if the characteristic composition, *as measured by the included variables*, had remained as it was in 1982, and the 'prices' of the characteristics had remained at their 1997-8 levels. By comparing the counterfactual density with the actual densities we can get a visual representation of the effects of changes in characteristics versus changes to the incomes associated with each set of characteristics. For example, comparison of the above counterfactual density with the actual 1997-8 density shows the effect of changes to characteristics

between 1982 and 1997-8, if both 1982 and 1997-8 individuals were to face 1997-8 'prices'. Alternatively, the effects of characteristics changes can be evaluated at 1982 'prices' by estimating the density that would have prevailed in 1982 if the distribution of characteristics was the same as in 1997-8.

The approach can also be adapted to isolating the effects of changes to particular characteristics by selectively excluding variables from the logit equation used to reweight the samples. For example, the effects of changes to labour force status may be identified by comparing the results when labour force status is included in the reweighting process with the results obtained when it is excluded. This does require additional assumptions, however, since if the excluded variables are correlated with included variables, the distribution of these variables in the reweighted sample will be altered from their actual distribution, and so we will also pick up this effect in the counterfactual density.[28]

5.2 Implementation

In order to ascertain the role of changes to characteristics in changes to the income distribution we need to construct variables capturing characteristics. The information available in all seven of the IDS permit us to potentially construct variables based on:

- Income unit type (single or couple, number and ages of dependent children);
- Years of age;
- Highest educational attainment (bachelor's degree or higher, other post-school qualification, no post-school qualifications);
- Labour force status (employed full-time, employed part-time, unemployed, not in the labour force);
- Whether self-employed, an employer or an employee;
- Region of birth (including whether foreign-born);
- State of residence;
- Current usual hours worked per week (although this is categorical information, with the categories varying over surveys);
- Income by source (welfare payments, wages/salary, own business, dividends/rent, superannuation, other);
- Income tax paid (annual and weekly, imputed); and

[28] A disadvantage of the DFL method compared with the parametric JMP method is that it is unable to distinguish changes in the returns to characteristics from changes in unobservables. The ability of the JMP approach to generate coefficient estimates that parameterise the effects of a characteristic on the outcome variable is also useful in some contexts.

- Industry, occupation and sector of employment.

An issue that arises in determining the appropriate approach to defining variables to reflect characteristics is that it is the distribution of *income unit* income that is under study. This implies that it is not appropriate to define variables simply in terms of the personal characteristics of the individual; rather, the characteristics of the income unit to which the person belongs should be used. The reason why it is not appropriate to use individual-specific characteristics is that if we hold a set of personal characteristics constant, this will have implications for the income unit income of persons for whom we are not holding characteristics constant. For example, if we accord less weight in 1997-8 to those married females who are working (so as to hold this characteristic of the population constant at the 1982 level), we necessarily should give less weight to males who are married to those females, since the income unit income of these males in part derives from the earnings of the females.

It is not, however, entirely clear how variables for income unit characteristics should be defined. One possibility is to adopt the approach of Hyslop and Mare (2001), who employ variables such as 'the proportion of household adults in employment'. We take a slightly different approach, and define many income unit characteristics in terms of the characteristics of the reference person and the characteristics of the partner of the reference person. For example, variables capturing the educational attainment of both the reference person and the partner of the reference person are used.[29]

The variables created fall into four broad groups of types of income unit characteristics that we attempt to capture:

1. Income unit type.

Dummy variables for each of 6 income unit types are employed: single male, single female, couple with no dependents, single male with dependent children, single female with dependent children, couple with dependent children.

2. Number, and mean age, of dependent children:

Dummy variables are created for each combination of:

$$\left.\begin{array}{l}0\\1\\2\\3\text{ or more}\end{array}\right\}\text{ dependent children, with a mean age of }\left\{\begin{array}{l}\text{less than 5 years}\\5\text{ to }9\text{ years}\\10\text{ to }14\text{ years}\\15\text{ or more years}\end{array}\right.$$

(13 dummy variables).

3. Labour force status:

Dummy variables are created for: employed full-time, employed part-time, unemployed and not in the

[29] Note that the partner is always female in all surveys, and the reference person is only female if the income unit is a single woman (with or without dependent children).

labour force. For couples, separate dummies are employed for each possible combination of labour force status of the reference person and the partner of the reference person (16 dummy variables).

4. Demographic characteristics, the variables for which comprise:

- Age: 6 dummy variables for the age in years of the reference person in the income unit: 15-24, 25-34, 35-44, 45-54, 55-64, 65+;
- Country of birth dummy variables: Foreign-born, Australian-born. For couples, separate dummy variables are employed for each possible combination (4 dummy variables); and
- Educational attainment dummy variables: Degree, other post-school qualification, no post-school qualifications. For couples, separate dummies are employed for each possible combination (9 dummy variables).[30]

In estimating a binary choice model to derive the reweighting function, we employ a large number of interaction terms in order to allow as much flexibility as possible in the changes in the distribution of characteristics in the population. For example, the effects of an increase in the polarisation of work across income units may not be fully identified without interactions between income unit type and labour force status variables, particularly if there is little change in labour force status in the aggregate. As such, the dependent children, labour force status, country of birth and highest educational attainment dummies are all fully interacted with the 6 income unit type dummies.

Identification of the separate effects of changes in each of the four groups of characteristics is achieved by sequential elimination from the logit equations of the variables for each group of characteristics. Specifically, the effects of labour force status are identified by comparing results when all variables are included with results when the labour force status variables are excluded. The effects of changes in the distribution of the number and ages of dependent children are then isolated by additionally eliminating the variables for these characteristics from the logit equation. Likewise, the effects of changes in demographic characteristics are identified by then eliminating these variables, and, finally, the effects of income unit compositional changes are derived from the logit equation containing only the income unit type variables.

To illustrate, consider decomposition of changes in some moment *M* of the income distribution (e.g. the mean) between the base year and end year. If:

- M_B is the actual value of the moment in the base year;
- M_E is the value in the end year;

[30] A significant omission for demographic characteristics is a variable for *gender*. This is because the variables used for income unit types differentiate between males and females, such that this characteristic is accounted for by the income unit type variables rather than the variables for demographic characteristics.

- M_A is the value in the end year when all observable characteristics are held at base year levels;
- M_{A-L} is the value in the end year when all observable characteristics except labour force status are held at base year levels;
- M_{A-L-C} is the value in the end year when all observable characteristics except labour force status and (number and ages of) dependent children are held at base years levels (i.e. when only demographic and income unit type characteristics are held at base year levels); and
- M_I is the value in the end year when only the distribution of income unit types is held at the base year distribution;

then we have the following:

- Total change: $M_E - M_B$
- Effect of changes in the distribution of all characteristics: $M_E - M_A$
- Effect of changes in the distribution of labour force status:

$$\left(M_E - M_A\right) - \left(M_E - M_{A-L}\right) = M_{A-L} - M_A$$

- Effect of changes in the distribution of number and ages of dependent children:

$$\left(M_E - M_{A-L}\right) - \left(M_E - M_{A-L-C}\right) = M_{A-L-C} - M_{A-L}$$

- Effect of changes in the distribution of demographic characteristics:

$$\left(M_E - M_{A-L-C}\right) - \left(M_E - M_I\right) = M_I - M_{A-L-C}$$

- Effect of changes in the distribution of income unit types: $M_E - M_I$

The change in the moment *M* that is not explained by changes to observable characteristics $\left(M_A - M_B\right)$ is that due to changes in the distributions of income among each combination of characteristics; that is, it is a 'within-group' effect. This may be interpreted as the effects of changes in the 'prices' of observable characteristics, reflecting changes in the distributions of wages and other private income, but it will in fact also reflect the effects of changes in unobservable characteristics.

Results are potentially sensitive to the order in which variables are removed from the logit equation because of potential correlations between variables measuring different characteristics. For example, an increase in educational attainment may be associated with an increase in labour force participation. If we eliminate variables capturing labour force status first, some of the change in the income distribution attributed to changes in educational attainment may in fact reflect the effects of labour force status changes (although note that in this case it might be argued that the change in labour force status is caused by the educational attainment change, in which case it is correct to attribute all of the effect to educational

attainment, both directly and via its impact on labour force status). In general, we should expect effects to be greater the later a characteristic is eliminated from the logit equation. Consequently, as a sensitivity test, the appendix reports results when the variables for demographic characteristics are eliminated first, followed by the variables for numbers and ages of dependent children and the labour force status variables.[31]

The potential for correlations between variables to confound the effects of individual characteristics also means that in this paper we do not attempt to isolate the effects of specific changes, such as the increase in sole parent households and the increase in the incidence of part-time work among females. The semi-parametric approach used is not suited to answering such questions, since the problem of correlations between characteristics becomes critical for individual variables. For example, the increase in sole parent households is perfectly correlated with the decrease in other household types. While the DFL approach can provide useful information about the net effects of changes in the household type composition of the population, it cannot quantify the specific role played by the increase in sole parent households. Rather, a parametric regression approach, perhaps along the lines of Juhn, Murphy and Pierce (1996), is required to isolate the effects of changes in specific characteristics such as these.

5.3 Decomposition results

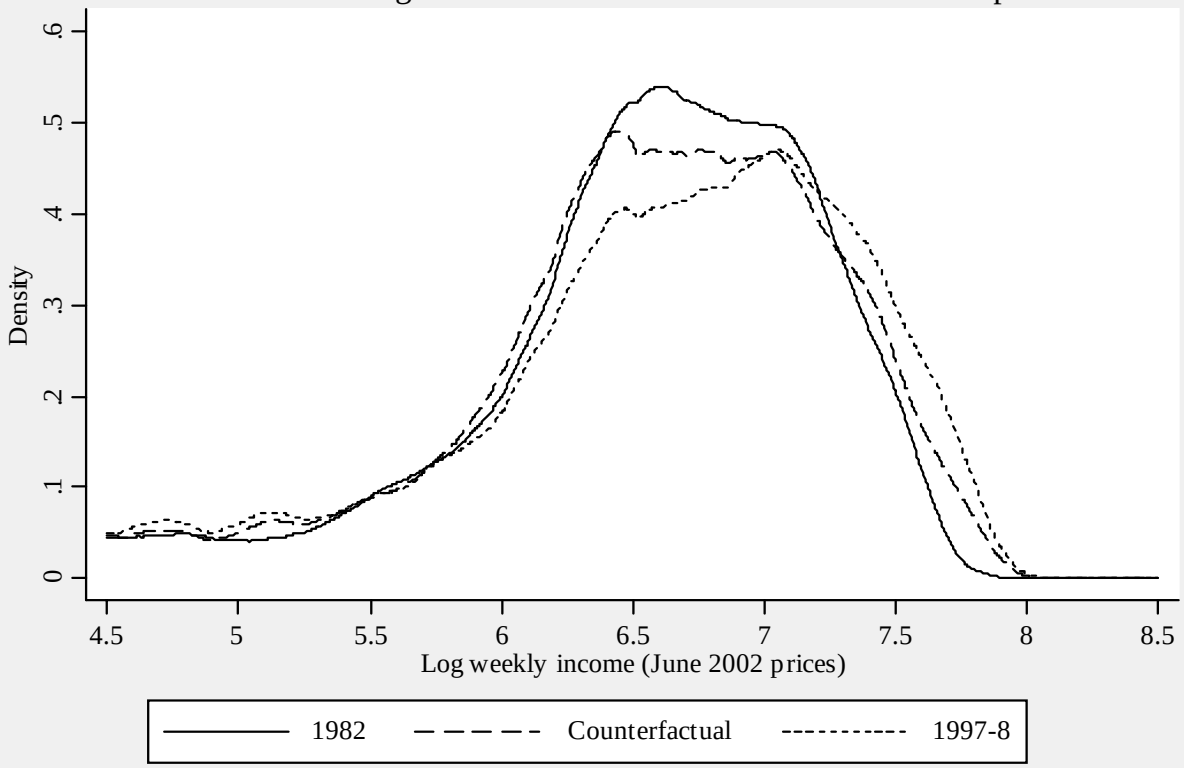
Although there are numerous decompositions possible, we focus only on changes over the entire sample period 1982 to 1997-8 and on the effects of the above four groups of characteristics. The results of the decomposition analysis are presented in Figures 5.1 and 5.2 and Table 5.1.

Figure 5.1 displays the actual density curves for weekly private income unit income in 1982 and 1997-8 along with the counterfactual density curve derived by reweighting observations in the 1997-8 sample to have the same distribution of observed characteristics (as measured by the included variables discussed above) as in 1982. Figure 5.2 displays the same information, but with the counterfactual density curve constructed by reweighting the 1982 sample to have the same distribution of characteristics as in 1997-8. The effects of changes in characteristics are given by the move from the counterfactual density curve to the 1997-8 density curve in Figure 5.1, and by the move from the 1982 density curve to the counterfactual density curve in Figure 5.2. The residual change between 1982 and 1997-8 can be interpreted as the change in the distribution of incomes associated with each set of characteristics, or more simply as changes in the 'price' of each bundle of characteristics. Any differences between Figures 5.1 and 5.2 in

[31] Reassuringly, results are in fact very similar for the two sequences of elimination from the logit equations. We test the sensitivity of results to all other possible sequences of elimination, and for all sequences obtain similar results (which are therefore not reported). Note that it is not possible to completely eliminate income unit type variables before the variables for the other characteristics because of the nature of the variables constructed for these other characteristics. For example, the labour force status variables for couples are not defined for single persons. As a consequence, both sequences of elimination from the logit equations have income unit type variables as the last remaining set of variables.

the implied effects of changes in characteristics are the outcome of evaluating at different ‘prices’ (1997-8 prices in the former, 1982 prices in the latter).

Figure 5.1 Distribution of log weekly income unit private income
Effects of changes in characteristics - Evaluated at 1997-8 'prices'

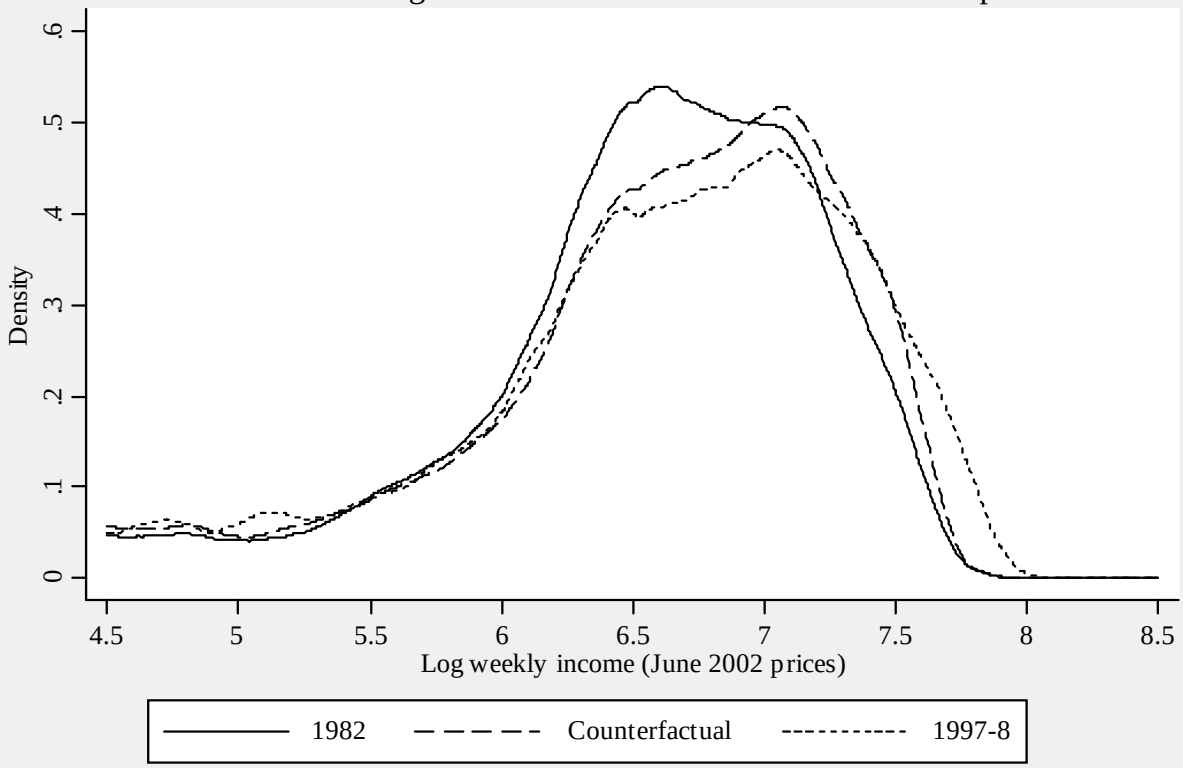


Proportion with no private income: 1982 - 13.1%; CF - 13.7%; 1997-8 - 14.4%

Both figures show that changes in the distribution of observed characteristics have acted to decrease the proportion of the population with income unit private income at middle levels and increase both the proportion of the population with high private income and the proportion with no private income. As a rough approximation, about half the decrease in the density at middle income levels and increase in the density at high income levels and at zero income between 1982 and 1997-8 is explained by changes to observed characteristics. This suggests that approximately half the growth in private income inequality over the sample period is due to changes to the distribution of income unit types, labour force status and demographic characteristics.

Also evident is that the peak of the counterfactual distribution is at approximately the same income level as the 1982 distribution in Figure 5.1, and at approximately the same income as the 1997-8 distribution in Figure 5.2. This implies the rightward shift between 1982 and 1997-8 of the peak of the income distribution derives primarily from changes in the distribution of characteristics.

Figure 5.2 Distribution of log weekly income unit private income
Effects of changes in characteristics - Evaluated at 1982 'prices'



Proportion with no private income: 1982 - 13.1%; CF - 13.8%; 1997-8 - 14.4%

Table 5.1 permits us to quantify the distributional effects of changes to characteristics. It shows the actual change in selected distributional measures between 1982 and 1997-8, along with the effects of changes in observed characteristics. As well as presenting the total effects of changes in characteristics, Table 5.1 presents the separate effects of changes in each of three groups of characteristics. As mentioned, the separate identification of the effects of each group is achieved by sequentially eliminating from the logit equation the variables capturing each group of characteristics.[32] Results are presented evaluated at both 1997-8 prices (reweighting the 1997-8 sample) and 1982 prices (reweighting the 1982 sample).

Consistent with the impression generated by the density curves in Figures 5.1 and 5.2, approximately half the increase in inequality, as measured by the Gini coefficient, Theil coefficient and coefficient of variation, is accounted for by changes in characteristics. For example, whether evaluated at 1982 or 1997-8 prices, the increase in the Gini coefficient associated with changes to characteristics is approximately 0.02, compared with a total increase of 0.036. Likewise consistent with the densities is that characteristics explain approximately half the increase in the mean private income, and acted to increase the median income by over double the actual increase in the median. Evaluated at 1997-8 prices, the increase in the mean due to characteristics was $37, compared with a total increase of $67, while the increase in the median was $17, compared with an actual increase of $5.

[32] See the appendix for effects derived from an alternative sequence of elimination.

Table 5.1 Change in the income distribution 1982 to 1997-8 – Income unit weekly private income IDS, June 2002 prices

	Actual Change	Effect of changes in the distribution of									
		All characteristics		Labour force status		Dependent children		Demographic characteristics		Income unit types	
		1997-8 prices	1982 prices	1997-8 prices	1982 prices	1997-8 prices	1982 prices	1997-8 prices	1982 prices	1997-8 prices	1982 prices
Mean	67.33	37.22	27.33	-9.70	-8.70	2.63	3.43	62.00	48.57	-17.7	-15.98
	(6.864)	(6.217)	(5.888)	(3.817)	(3.211)	(1.164)	(1.068)	(4.147)	(4.002)	(3.204)	(2.752)
Median	5.48	17.20	11.41	-27.52	-20.54	2.29	2.28	65.36	50.20	-22.93	-20.54
	(9.818)	(3.370)	(7.797)	(5.657)	(4.636)	(2.018)	(1.714)	(6.597)	(5.172)	(5.283)	(3.718)
Gini	0.036	0.021	0.019	0.022	0.017	0.000	-0.001	-0.010	-0.007	0.008	0.010
	(0.0038)	(0.0033)	(0.0035)	(0.0025)	(0.0022)	(0.0006)	(0.0005)	(0.0021)	(0.0022)	(0.0013)	(0.0015)
Theil	0.069	0.040	0.035	0.043	0.030	0.000	-0.001	-0.020	-0.012	0.016	0.018
	(0.0090)	(0.0066)	(0.0066)	(0.0054)	(0.0044)	(0.0012)	(0.0008)	(0.0042)	(0.0042)	(0.0026)	(0.0027)
CV	0.072	0.035	0.032	0.039	0.029	0.001	-0.001	-0.022	-0.015	0.017	0.019
	(0.0073)	(0.0065)	(0.0067)	(0.0049)	(0.0042)	(0.0013)	(0.0009)	(0.0041)	(0.0043)	(0.0028)	(0.0029)
P90/50	0.156	0.053	0.064	0.059	0.046	-0.002	-0.002	-0.031	-0.004	0.027	0.023
	(0.0151)	(0.0129)	(0.0108)	(0.0088)	(0.0069)	(0.0037)	(0.0030)	(0.0107)	(0.0080)	(0.0072)	(0.0045)
P75/25	0.436	0.448	0.484	0.473	0.339	0.002	-0.038	-0.208	-0.108	0.180	0.292
	(0.0992)	(0.0776)	(0.0838)	(0.0623)	(0.0667)	(0.0162)	(0.0176)	(0.0530)	(0.0694)	(0.0375)	(0.0388)
Zero	0.014	0.008	0.007	0.016	0.010	0.000	-0.001	-0.012	-0.007	0.004	0.006
	(0.0043)	(0.0030)	(0.0029)	(0.0029)	(0.0023)	(0.0007)	(0.0005)	(0.0019)	(0.0015)	(0.0010)	(0.0011)

Note: Effects evaluated at 1997 'prices' are derived from the counterfactual income distribution that is obtained by reweighting observations in the 1997 sample to produce the same distribution of characteristics in the reweighted sample as in the 1982 sample. Effects evaluated at 1982 'prices' are derived from a reweighting of the 1982 sample. 'Zero' is the proportion of the population with no income unit private income. The sequence of elimination from the logit equations to estimate the effects of specific groups of characteristics is: labour force status, dependent children, demographic characteristics. Standard errors (in parentheses) are derived from 1000 bootstrap samples.

Interestingly, only about one third of the increase in the P90/50 difference is explained by changes to characteristics. Although the role of wage changes are not explicitly explored in this paper, a possible explanation, consistent with the findings of Borland (1998), is that an important contributor to the increase in income dispersion in the top half of the distribution has been strong growth in wages at the top end of the wage distribution.

Identification of the separate effects of changes to the distribution of income unit types, number and ages of dependent children, labour force status and demographic characteristics reveals that, for the most part, it is changes in the distribution of labour force status that have been responsible for characteristics-induced increases in income inequality. For example, evaluated at 1997-8 prices, the Gini coefficient increases by 0.022 due to labour force status changes (and by 0.017 evaluated at 1982 prices). This implies that changes to the distribution of work in the population have been an important source of growth in private income inequality between 1982 and 1997-8. This would include the effects of the growth in both the number of workless households and dual-earner households that has been documented by Dawkins, Gregg and Scutella (2002). These changes have also had a negative effect on the average

level of real private incomes, with labour force status changes decreasing the mean weekly income by $9.70 and the median weekly income by $27.52.

Changes to the income unit composition of the population have also acted to both increase income inequality and decrease the average real level of private incomes, reflecting the relative growth in single person and sole parent income units. Evaluated at 1997-8 prices, the Gini coefficient increased by 0.008 (0.010 at 1982 prices) and the mean decreased by $17.70 ($15.98 at 1982 prices). Changes to demographic characteristics (age, education and country of birth), by contrast, have acted to decrease income inequality and substantially increase average real private incomes. The Gini coefficient decreased by 0.010 (0.007 evaluated at 1982 prices) due to demographic changes, which also act to increase the mean by $62 and the median by $65 (at 1997-8 prices, with increases approximately $15 smaller when evaluated at 1982 prices). The mean and median income increases most likely reflect the increase in educational attainment, and to a lesser extent the increase in the average age in the population, between 1982 and 1997-8.

Changes across income units in the distribution of the number of dependent children of each average age level have had minimal impact on the income unit private income distribution. The trend towards smaller families has been associated with slight increases in mean and median incomes, but has had no (statistically significant) effect on income inequality.

In summary, although changes to the income unit type composition and distribution of work among income units have acted to decrease income unit incomes, these effects have been significantly outweighed by the effects of changes to the education and age structure of the population. The income unit type and labour force changes have, however, also acted to significantly increase inequality in income unit income, and although changes in the age, education and country of birth composition of the population have to some extent offset this, the net effect of changes to characteristics is to substantially increase inequality. In aggregate, changes in the characteristics that we have examined appear to account for a little over half the increase in income inequality. The remainder of the increase is explained by changes in wage rates and the income from other sources (businesses, investments, etc.) associated with each ‘bundle’ of characteristics, and possibly also changes in other population characteristics not considered in this paper.

6. Concluding comments

The results reported in Section 4 confirm the findings of other recent studies of trends in inequality in Australia. At an aggregate level, inequality of private income increased, particularly during the eighties and less so during the nineties. The effects of the increases at the private level on disposable income inequality, were, however, significantly offset by transfer payments and income taxation. As a consequence, the increase in inequality of disposable income was much more muted than it might have been.

Among income unit types, the story is mixed. Average real disposable incomes of all main groups increased, but while the greatest increases were for one of the poorest groups, single persons with dependents, the smallest increases were for the second poorest group, single persons without dependents. Overall, between-group inequality appears to have increased. As was the case for the aggregate income distribution, increases at the private level were moderated by government action, with the increases in disposable income inequality much smaller. Within-group changes at the disposable income level were erratic, with increases for some groups and decreases for others, and overall not much change over the period. Again, the changes in disposable income were the outcome of greater change at the private level moderated by government action through taxes and transfers.

The important new findings of the paper concern the decomposition of changes in the distribution of private incomes at the aggregate level. Here we find:

- About half the increase in income inequality is explained by changes to observable characteristics, comprising changes in income unit composition, changes in the distribution of the number and ages of dependent children across income units, changes in demographic factors and changes in the distribution of employment (labour force status) across income units;
- Changes in labour force status alone have acted to increase inequality by the full amount attributed to all characteristics examined;
- Changes to the income unit composition of the population have also increased income inequality (by a smaller amount), while changes in the distribution of the observed demographic characteristics have reduced inequality (of a similar magnitude to the effect of changes to the income unit composition); and
- Much of the increase in inequality not attributable to characteristics – that due to changes in the 'prices' of characteristics – may reflect changes in wage rates. For example, it is consistent with our decomposition analysis that there has been a relative increase in wage rates at the top end of the wage distribution.[33]

How do we interpret these findings? The decomposition approach adopted does not involve the imposition of any assumptions, nor does it deliver any information on the causal relationships between incomes and characteristics, or the reasons for changes over time in the characteristics composition of the population and the relationships between incomes and characteristics. For example, although the DFL approach identifies the important role of changes in the distribution of work in increasing income inequality, it provides no explanation for this change. In particular, the relative roles of supply and demand factors, and the specific nature of these factors, are not identified by the decomposition method.

[33] However, note that we do not explicitly identify the role played by changes in wage rates. Thus, for example, we cannot exclude the possibility that changes in wage rates have acted to increase income inequality by more than is implied by our analysis, but are offset by some other unobserved effect that acts to decrease income inequality.

Rather, the value of the decomposition is that it informs us that the changes in labour force participation have been very important for their effects on the income distribution. Therefore, from an income inequality perspective, the distribution of labour market activity is an important issue for policy and for further research.

Although the possibilities for further work are numerous, several avenues of research stand out as particularly worthy of inquiry. First is more detailed study of the effects of changes in specific economic and social characteristics of the Australian population. For example, this might include examination of the effects of increased female labour force participation, the rise in the number of workless income units and the growth in single parent income units. The DFL method is not so readily adapted to such analysis, however, suggesting an alternative approach may be preferable.

Second, it would be informative to identify the effect of changes to the distribution of wages, as well as changes to the distribution of income from other private sources, on changes to the private income distribution. This is complicated by the fact that, in the same manner as income, wage changes can derive from changes to characteristics and from changes to the wages attached to each bundle of characteristics. It may therefore also be necessary to adopt an alternative perspective to the DFL approach in order to identify the role of wage changes. For example, it may be appropriate to attempt to decompose distributional changes into those due to changes in the wage distribution, those due to changes in the distribution of other income and those due to changes in the relationship between wages and other income. It is not clear how this would be implemented. One possibility, however, is to adopt the approach of Burtless (1999), who investigates the effects of growing wage disparities and changing family composition on the extent of dispersion of the US family income distribution. The approach involves first normalising mean incomes and earnings to be the same in base- and end-years, and then examining the extent of dispersion in the income distribution in the end-year holding constant the extent of earnings dispersion at the base-year level. This approach does, however, only identify the effect of changes in earnings inequality on the extent of income *dispersion*, and not the effects on the income distribution more generally.[34]

Third, the use of alternative data sources permitting us to examine different time frames, and perhaps decompose distributional changes using other characteristics, would be an important addition.

[34] Burtless finds that, while US income inequality rose sharply after 1979, the direct contribution of increased earnings inequality was surprisingly modest. Even if male and female earnings inequality remained unchanged at 1979 levels, about two-thirds of the observed increase in overall US inequality would still have occurred. Other factors contributing to higher overall inequality include the growing correlation between husband and wife earned incomes and the increased percentage of Americans who live in single adult families. These families have much more unequal incomes than couple families.

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Appendix: Alternative decomposition results

Table A1 Change in the income distribution 1982 to 1997-8 – Income unit current weekly private income – Alternative Decomposition

	Actual Change	Effect of changes in the distribution of									
		All characteristics		Labour force status		Dependent children		Demographic characteristics		Income unit types	
		1997-8 prices	1982 prices	1997-8 prices	1982 prices	1997-8 prices	1982 prices	1997-8 prices	1982 prices	1997-8 prices	1982 prices
Mean	67.33	37.22	27.33	8.21	3.64	4.71	3.10	42.01	36.57	-17.7	-15.98
	(6.864)	(6.217)	(5.888)	(4.675)	(4.019)	(1.110)	(0.871)	(2.821)	(2.977)	(3.204)	(2.752)
Median	5.48	17.20	11.41	0.00	-11.41	0.00	2.28	40.13	41.07	-22.93	-20.54
	(9.818)	(3.370)	(7.797)	(6.351)	(5.087)	(1.929)	(1.632)	(5.747)	(4.529)	(5.283)	(3.718)
Gini	0.036	0.021	0.019	0.013	0.014	0.002	-0.001	-0.002	-0.004	0.008	0.010
	(0.0038)	(0.0033)	(0.0035)	(0.0027)	(0.0029)	(0.0005)	(0.0004)	(0.0011)	(0.0013)	(0.0013)	(0.0015)
Theil	0.069	0.040	0.035	0.025	0.024	0.003	-0.002	-0.004	-0.006	0.016	0.018
	(0.0090)	(0.0066)	(0.0066)	(0.0055)	(0.0056)	(0.0009)	(0.0008)	(0.0020)	(0.0024)	(0.0026)	(0.0027)
CV	0.072	0.035	0.032	0.020	0.023	0.003	-0.002	-0.006	-0.009	0.017	0.019
	(0.0073)	(0.0065)	(0.0067)	(0.0052)	(0.0055)	(0.0010)	(0.0009)	(0.0023)	(0.0026)	(0.0028)	(0.0029)
P90/50	0.156	0.053	0.064	0.024	0.046	0.011	-0.002	-0.009	-0.004	0.027	0.023
	(0.0151)	(0.0129)	(0.0108)	(0.0092)	(0.0077)	(0.0039)	(0.0029)	(0.0100)	(0.0078)	(0.0072)	(0.0045)
P75/25	0.436	0.448	0.484	0.256	0.245	0.023	-0.018	-0.011	-0.035	0.180	0.292
	(0.0992)	(0.0776)	(0.0838)	(0.0688)	(0.0738)	(0.0141)	(0.0170)	(0.0295)	(0.0342)	(0.0375)	(0.0388)
Zero	0.014	0.008	0.007	0.006	0.004	0.001	-0.001	-0.003	-0.002	0.004	0.006
	(0.0043)	(0.0030)	(0.0029)	(0.0026)	(0.0025)	(0.0005)	(0.0005)	(0.0012)	(0.0012)	(0.0010)	(0.0011)

Notes: The sequence of elimination from the logit equations to estimate the effects of specific groups of characteristics is: demographic characteristics, dependent children, labour force status. Standard errors (in parentheses) are derived from 1000 bootstrap samples.

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