Change in the distribution of income of the working-age population, 1976–1996

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Census data are used to analyse changes in the distribution of income among the working-age population (15 to 59 years) between 1976 and 1996. The income distribution of the population is shown at three levels of aggregation: the whole population, the labour force and the employed. Income has become more equally distributed with respect to the whole population, due to women's employment and income. But, with respect to the labour force and the employed, income inequalities have grown. Changes in the structure of employment appear to account for a small part of the change, but unemployment does not appear to have had a significant effect. For the most part, the observed increase in income inequality is not captured by the variables presently used in labour market research.

1 Introduction

THIS PAPER EMPLOYS CENSUS DATA to look at change in the distribution of income among individuals of working age (15 to 59 years). It complements published research based on the *Household Economic Survey* (HES). Both the HES and the Census of Population and Dwellings (the Census) have their advantages and disadvantages. The Census has the advantage of full coverage of the population, longer time coverage and greater flexibility for disaggregating into population sub-groups.

The 1990s saw the publication of research on trends in the income and earnings distribution in New Zealand during the 1980s and 1990s (for example, Easton, 1996; Podder and Chatterjee, 1998; Dixon, 1996a, 1998; Martin, 2000; Hyslop and Maré, 2000). These analyses focus on either the incomes of households and families or the earnings of individuals. Statistics New Zealand's *New Zealand Now: Incomes* booklet (1999) provided a useful overview by combining evidence from the Census and the *Household Economic Survey* in respect of both households and individuals. O'Dea (2000) has synthesised all the principal writings to examine and comment on the evidence concerning change in household income distribution, and on earnings as the principal force changing household incomes.

It has been found that income inequality has increased in New Zealand in the 1980s and 1990s. This is true regardless of the recipient unit (households, families, individuals) or definition of income used (O'Dea, 2000). Among households, the degree of inequality of equivalised disposable income increased by 6.3 percentage points between 1981/82 and 1995/96 (Statistics New Zealand, 1999). Among males aged 15 to 59 years, inequality of gross income increased by 7.8 percentage

points between 1981 and 1996 (Martin, 1999). There was, by contrast, relatively little change in the income distribution of men and women combined. There is a change of only 2 percentage points of the Gini index between 1982 and 1996 for all individuals aged 15 years and over (Statistics New Zealand, 1999). Inequality of weekly earnings of male and female full-time workers grew by 4.5 percentage points of the Gini index in the period 1984 to 1997. For men by themselves, the figure is 6.1 percentage points (Dixon, 1998). However, there has been relatively little change in inequality of hourly earnings (Dixon, 1996b, 1998).

Inequality of household income and individual earnings has increased over the same time period in a range of countries within the Organisation for Economic Cooperation and Development (OECD), with the English-speaking countries, especially the United States and the United Kingdom, experiencing the greatest increases (see for example, Gottschalk and Smeeding, 1997; Atkinson, Rainwater and Smeeding, 1995; Gardiner, 1993; Hills, 1996; the collection of papers in *Oxford Review of Economic Policy* 12:1, 1996; Borland, 1999; Freeman and Katz, 1994; OECD, 1996). The changes have generated a considerable amount of published research, particularly from the United States. There is a plethora of factors contributing to increased income inequality that can be discussed and analysed. In addition, the range of factors to consider depends firstly on whether one is discussing households or individuals. Factors changing the distribution of earnings and income appear to be common to all the OECD countries affected. The extensive research carried out in the United States thus has some application to other countries (Borland, 2000). However, the situation of each individual country is different. Dixon's research suggests that in New Zealand, change in the premium for such attributes as experience and qualifications may have been a minor factor contributing to increased earnings inequality. Change in the composition of the labour force in terms of experience and qualifications does not appear to be a contributory factor. Rather than change *between* workers grouped by such attributes as age and education being found to be important, by far the largest component of the increase is *within* groups with similar observed characteristics (Dixon, 1998). Increased income volatility may be one reason for the apparent increase in income inequality. Longitudinal data have not been available in New Zealand to research this aspect of income and earnings distribution (O'Dea, 2000).

Statistics New Zealand (1999) measured change in income inequality between 1982 and 1996 of individuals aged 15 years and over, using census data, and discussed the social, economic and demographic background to the change. Dixon, using HES data, discussed reasons for increased earnings inequality, but only discussed the employed (Dixon, 1996a, 1996b, 1998). This study bridges the gap between these two pieces of research. It employs incomes data from the Census rather than earnings data from the HES, and the analysis progressively

disaggregates the working-age population by the three major labour force statuses, starting with all persons (the not actively engaged, the unemployed and the employed), then turning to the labour force (the unemployed plus the employed) and finishing with the employed by themselves. The movement of women into paid employment, the growth of unemployment in the 1980s, the contribution of disparities by age, ethnicity, gender, education, hours of work, occupation and industry, and shifts in the structure of employment as factors in change in the distribution of income, are discussed. This study shows that, with respect to the whole working-age population, the narrowing gender-income gap has outweighed increasing income inequality along other dimensions. When the not actively engaged are excluded, decreasing gender-income differences do not outweigh increases in other income inequalities. In the labour force, the increase in unemployment in the 1980s appears to have had negligible influence on income distribution, and among the employed, change in the structure of employment appears to account for a minor part of increased earnings inequality. The major part of the increase in inequality among the employed and unemployed is not, however, accounted for by the attributes covered in this analysis.

2 Data

The data were drawn from the five censuses between 1976 to 1996. There were 10 variables available for analysis. The variables (with number of categories in brackets) were as follows: age (9), ethnicity (4), gender (2), labour force status (3), employment status (2), hours of work (2), occupation (4), industry (5), education (4) and income (13–24).

Some of the variables changed their form over time. First, in the 1976 Census, income was defined as market income only, while in later censuses income has included social welfare benefits. The 1976 incomes data were adjusted to achieve a degree of consistency with the 1981–1996 data. Secondly, the number of income categories changed over time, starting at 18 in 1976, peaking at 24 in 1981, and then declining to 13 in 1991 (rising again to 14 in 1996). It should be noted that this variation in number of income categories affects the measurement of income inequality. The variables 'hours of work' and 'ethnicity' changed between the 1981 and 1986 censuses. The definition of part-time work was changed from 20 hours to 30 hours, and the definition of ethnicity changed from biological descent to self-affiliation.

There are also anomalies in the data that need to be noted. The education variable was only available in respect of the 1981, 1986 and 1991 censuses. It was also obtained in a separate cross-tabulation that excluded labour force status, employment status, hours of work, occupation and industry. While this variable has been included in Tables 12 and 13, it is not strictly comparable with the other variables. This fact has been referred to in table notes. The 1996 data for the employed is also not consistent with the earlier data for this group. It excludes

employment status, and it is also split into two datasets, one including occupation, and one including industry.

A fuller description of the data has been appended at the end of this article.

3 Analytical methodology

To analyse change in income inequality over time, the Mean Logarithmic Deviation (MLD) inequality index is decomposed into components. A methodology for decomposing the MLD has been described by Mookherjee and Shorrocks (1982) and Jenkins (1995). The decomposition equation for the MLD is as follows:

$$I = \underbrace{\sum_g v_g I_g}_{\text{within sub-groups}} + \underbrace{\sum_g v_g \ln\left(\frac{1}{\lambda_g}\right)}_{\text{between sub-groups}} \quad (1)$$

Where g = sub-group

v_g = proportion of population in sub-group g

I_g = income inequality within sub-group g

$\lambda_g = \frac{y_g}{Y}$ = mean income of sub-group g relative to population mean income.

The census datafiles were organised into three datasets: the entire working-age population, the labour force and the employed. The working-age population dataset was disaggregated into 216 sub-groups by the variables age, gender, ethnicity and labour force status. The labour force dataset was disaggregated into 144 sub-groups by the variables age, gender, ethnicity and labour force status. For the years 1976 to 1991, the employed dataset was disaggregated into 5,760 sub-groups by the variables age, gender, ethnicity, full-time/part-time status, occupation, industry and employment status. For the year 1996, the employed dataset was disaggregated into 576 sub-groups, including the first four of the above 1976–91 variables plus occupation, but omitting industry and employment status. There were two additional datasets that were employed to obtain the index values for industry and education in Tables 12 and 13, but which played no part in the decomposition results graphed in Figure 2. The first of these datasets had 720 sub-groups, and included the first four of the 1976–91 variables plus industry, but omitted occupation and employment status. The second supplementary dataset was education and income cross-tabulated with age, ethnicity and gender, and had 288 sub-groups.

The between-group term of the index shows the relative contribution to aggregate income inequality of the variables by which the population is disaggregated into sub-groups. The more variables that are included, the higher the proportion of income inequality attributable to between-group variation will

be. Conversely, the population may be disaggregated by subsets of variables, or even by one variable at a time, in order to see influence of single variables on income inequality (Grubb and Wilson, 1989, 1992).

However, a decomposition analysis is not suited for investigating the interactions or independent effects of variables (Grubb and Wilson, 1992). A disaggregation of the data by one variable does not control the effects of other variables. In order to determine the independent effect of variables, it is necessary to include all variables in the analysis and introduce a method of control. Grubb and Wilson's method of computing the 'marginal' value of variables has been adopted here as a measure of their independent effects (Grubb and Wilson, 1992). The technique is to compute aggregate inequality with all variables, and then to re-compute inequality with the variable of interest omitted. The difference between the two between-group indices is the marginal value of the omitted variable.

Equation (1) is a decomposition of the index at one point in time. Change in the MLD income inequality index between censuses is first decomposed into four terms, as follows:

$$\Delta I = \Delta\sum_g v_g I_g + \Delta\sum_g v_g \ln\left(\frac{1}{\lambda_g}\right) \tag{2}$$

$$= \sum_g v_g^t \Delta I_g + \sum_g I_g^{t+5}\Delta v_g + \sum_g \ln\left(\frac{1}{\lambda_g}\right)^{t+5}\Delta v_g + \sum_g v_g^t \Delta \ln\left(\frac{1}{\lambda_g}\right)$$

$$= \sum_g v_g^t \Delta I_g + \sum_g I_g^{t+5}\Delta v_g - \sum_g \ln\left(\lambda_g\right)^{t+5}\Delta v_g - \sum_g v_g^t \Delta \ln\left(\lambda_g\right)$$

The four terms are respectively: (i) change in within-group inequality; (ii) effect of change in sub-group relative sizes on the within-group component; (iii) effect of change in sub-group relative sizes on the between-group component; (iv) change in relative incomes of sub-groups.

This paper follows earlier analyses (Mookherjee and Shorrocks, 1982; Jenkins, 1995) in making two modifications to the above equation. The changes were to take the mean values of each intercensal period for v_g, I_g, and λ_g instead of endpoint values, and to substitute absolute mean income into term (iv) in place of relative mean income. Substituting absolute mean income involved further changes to the third and fourth terms. These two modifications do not appear to make a difference to results (Mookherjee and Shorrocks, 1982). The form of the decomposition employed in this analysis is, therefore:

$$\Delta I = \sum_g \bar{v}_g \Delta I_g + \sum_g \bar{I}\Delta v_g + \sum_g \left[\bar{\lambda}_g - \overline{\ln\left(\lambda_g\right)}\right]\Delta v_g + \sum_g \left(\bar{\theta}_g - \bar{v}_g\right)\ln\left(y_g\right) \tag{3}$$

where θ_g is subgroup g's share of total income.

TABLE 1: Indices of income inequality among the working-age population, 1976–1996

Index	*1976*	*1981*	*1986*	*1991*	*1996*
Variance of the Logarithm	2.8592	1.8027	1.3886	1.2752	1.3268
Coefficient of Variation	1.1097	1.0695	0.8546	0.6560	1.1468
Gini Coefficient	0.5142	0.4914	0.4424	0.4663	0.5038
Theil Coefficient	0.5397	0.4591	0.3564	0.3888	0.4780
Mean Logarithmic Deviation	0.8572	0.3903	0.3283	0.3119	0.3578

Source: Census database

Change was analysed for each intercensal period in turn, the weighting of the four terms of the decomposition thus changing in each period. When change over the whole period 1976 to 1996 is referred to, it means the sum of four discrete decompositions, rather than one decomposition for a 20-year period. Thus, a graph of decomposition of change over the whole period 1976 to 1996 was created by summing the four intercensal periods, then adding them to the index as at 1976. It should be noted that the graph in question combines terms (ii) and (iii) as the overall effect of shifts in sub-group relative sizes, in order to simplify results for the reader. Term (ii) was found in data analysis to be a very small component of change in respect of the whole working-age population and the labour force, but in respect of the employed, it assumed a larger role. This point is discussed later.[1]

4 The working-age population

The aggregation of all working-age men and women incorporates the employed, the unemployed and the various categories of 'not actively engaged': students, early retired, domestic duties and others. The trend in the distribution of income in this grouping of the population has, since the 1950s, been towards more equality (Martin, 1999). The trend up to 1996 is represented in Table 1 by five indices. The reason for measuring inequality with five indices is that indices differ in their response to the data. The Gini Coefficient for example, is most sensitive in the middle of the income range, while the Mean Logarithmic Deviation is most sensitive to change at the top end of the income range. Trends over time may thus be misrepresented if we rely on one index only (see for example, Karoly, 1992). All five indices in Table 1 show that inequality continued to decrease up to the late 1980s/early 1990s, followed by a slight trend to more inequality between the 1991 and 1996 censuses. According to the Gini index, inequality decreased by only

[1] See footnote 3.

TABLE 2: Income inequality among the working-age population: between-group inequality by sex, age, ethnicity and labour force status, 1976–1996

Variable	*1976*	*1981*	*1986*	*1991*	*1996*
Labour Force Status	0.3258	0.2499	0.1366	0.1342	0.1177
Age	0.0707	0.0773	0.0674	0.0942	0.1163
Gender	0.1493	0.0979	0.0582	0.0373	0.0428
Ethnicity	0.0058	0.0058	0.0050	0.0114	0.0167
Between-groups (all variables)	0.4931	0.3610	0.2277	0.2303	0.2357
Within-groups (all variables)	0.2274	0.2287	0.2173	0.2070	0.2284
Total	0.7205	0.5897	0.4450	0.4373	0.4641

Source: Census database

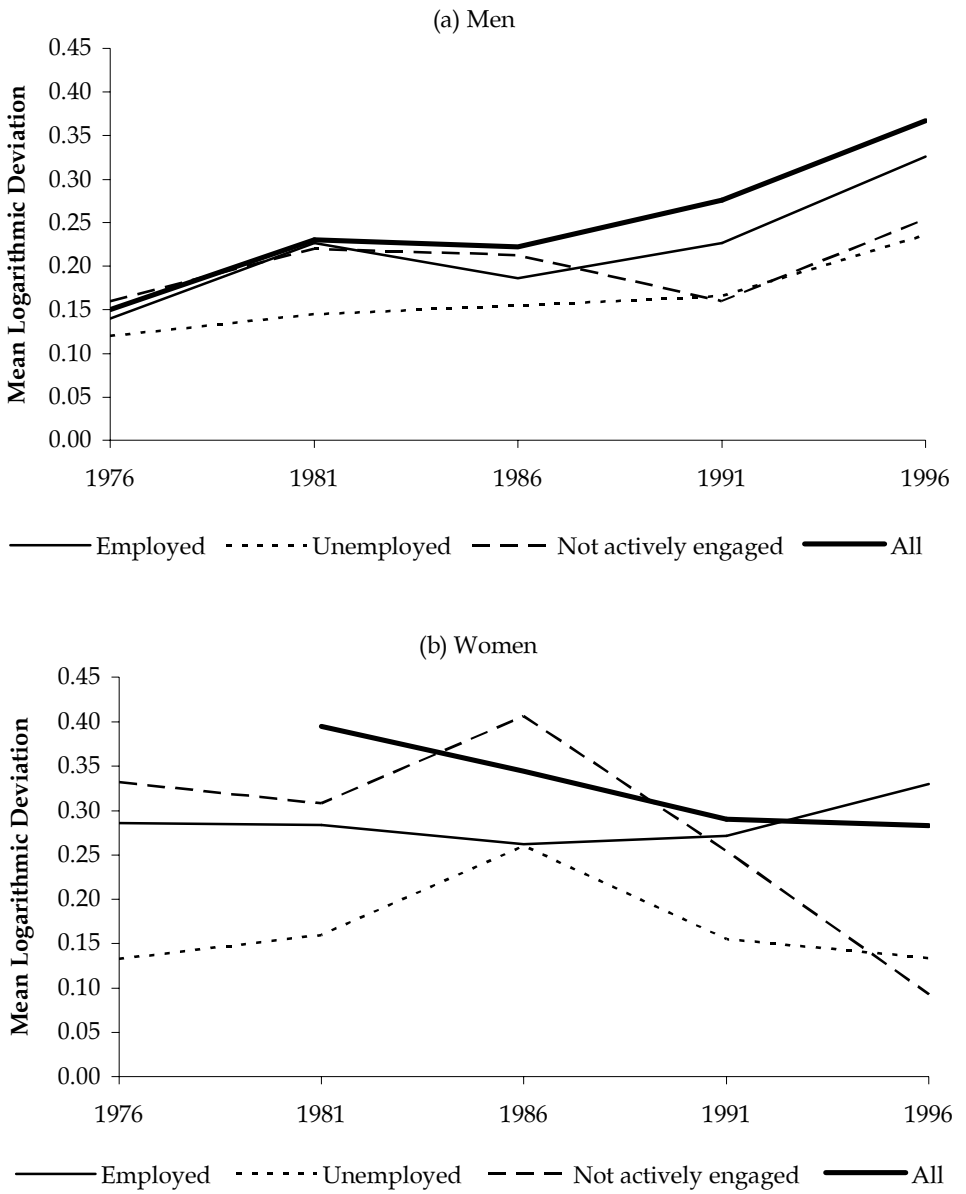
1 percentage point between 1976 and 1996. However, the decline in inequality recorded by the MLD index, employed for analysis in this paper because of its decomposition properties, is large (see Figure 2a (i)). This is because of strong changes in the nil income and lower income categories.

A decomposition of the MLD index into components indicates that the decline in inequality is associated with the four variables (age, ethnicity, gender, labour force status), in other words the 'between-group' component (Table 2). Within-group inequality remained roughly constant in absolute terms. Grouping the working-age population by one variable at a time suggests that reduction of inequalities between labour force statuses and between the two sexes were forces reducing overall inequality. Age and ethnic inequalities were, on the other hand, increasing.

Because of the different labour force status distributions of men and women, the two sexes have quite different trends in income inequality (Figure 1). Among men, income inequality began to increase in the late 1970s. There was a reduction in income inequality among all men about the time of the 1986 Census due to a reduction of inequalities among employed men (Figure 1a), as well as a reduction of income differentials between the employed and those receiving social welfare benefits (Martin, 1997a, 1997b, 1999). After 1986, income inequality began to increase again among all men, regardless of labour force status, with the exception of men not in the labour force between 1986 and 1991.

Income inequality among women has been steadily decreasing from at least the 1960s until the present day (Martin, 1999; see also Figure 1). This has been driven by a movement of women into paid employment. As can be seen from Figure 1b, among women not in the labour force, and also among unemployed

FIGURE 1: Income inequality among men and women by labour force status, 1976–1996



Women's income inequality in 1976 could not be measured by the Mean Logarithmic Deviation due to this index's sensitivity to high proportions of nil income recipients. Other indices (the Gini Coefficient, the Coefficient of Variation, and the Theil Coefficient) show that inequality in 1976 was higher than in 1981 (Martin, 1999).

TABLE 3: Marginal effects of variables on income inequality in working-age population, 1976–1996

Variable	*1976*	*1981*	*1986*	*1991*	*1996*
Labour Force Status	0.2719	0.1852	0.0988	0.0871	0.0683
Age	0.1084	0.0760	0.0633	0.0746	0.0871
Gender	0.0691	0.0363	0.0363	0.0214	0.0264
Ethnicity	0.0097	0.0037	0.0038	0.0048	0.0053
Sum of marginals	0.4591	0.3012	0.2022	0.1879	0.1871

Source: Census database

women, the degree of income inequality was increasing up to 1986, and has since then been decreasing. Income inequality among employed women by contrast, roughly follows the pattern among men.

Marginal values of labour force status and gender are a further indicator of the significance of these attributes to income distribution in the working-age population. A large disparity between marginal and total index values indicates that the attribute or variable is interacting with other attributes and is, by itself, a weak influence on income inequality. A comparison of the marginal values of labour force status, age and ethnicity in Table 3 with the index values in Table 2 suggests that the strength of these variables as determinants was declining over time. A comparison of the marginal and total index values of gender in the 1986–96 and 1976–81 periods suggests that, by contrast, gender's influence was becoming more independent of other attributes over time, even while gender differences in income were lessening.

TABLE 4: Working-age population: marginal effects of variables expressed as a percentage of the MLD inequality index, 1976–1996

Variable	*1976*	*1981*	*1986*	*1991*	*1996*
Age	15.0	12.9	14.2	17.1	18.8
Labour Force Status	37.7	31.4	22.4	19.9	14.7
Gender	9.6	6.2	6.5	4.9	5.7
Ethnicity	1.3	0.6	0.8	1.1	1.2
Sum of marginals	63.7	51.1	44.1	42.9	40.3
Between-groups	68.4	61.2	51.2	52.7	50.8
Within-groups	31.6	38.8	48.8	47.3	49.2
Total	100.0	100.0	100.0	100.0	100.0

Source: Census database

Reductions in labour force status and gender differentials thus capture most of the decrease in income inequality over time. Reduction in these observed inequalities outweighed increases in inequality along other dimensions. The reduction in observed between-group inequalities had the effect of increasing the importance of the within-group component to overall inequality. Expressing index components as a percentage of the total index (Table 4) shows that differences between age, labour force status, gender and ethnic groups accounted for two-thirds of the variance of incomes in 1976. This proportion declined over time; by 1996 the proportion had diminished to half.

Decomposition of the index at one point in time can split the change into between-group and within-group components, and show the influence of individual attributes. Decomposition of intercensal change in the index provides further detail on the forces decreasing inequality, breaking down the between-group component into effects of shifts in group-relative sizes, and effects of change in group-relative incomes.

TABLE 5: A: Mean incomes of men and women by labour force status as a percentage of mean income of whole working-age population, 1976–1996; B: Distribution of men and women by labour force status 1976–1996

Labour force status	*Gender*	*1976*	*1981*	*1986*	*1991*	*1996*	*1976–96*
A: Incomes by labour force status and gender as percentage of mean income of working-age population							
Employed	Men	168.6	157.2	147.1	154.5	151.1	–17.5
	Women	85.4	86.0	87.3	96.8	91.0	+5.6
Unemployed	Men	50.3	37.0	41.4	47.6	40.7	–9.7
	Women	28.7	25.8	30.1	39.8	33.6	+4.9
Not Actively Engaged	Men	30.9	21.8	32.6	38.2	42.5	+11.6
	Women	13.5	18.0	29.1	36.3	33.4	+19.9
All	All	100.0	100.0	100.0	100.0	100.0	–
B: Distribution by labour force status and gender							
Employed	Men	44.2	43.7	42.6	36.4	40.3	–3.9
	Women	24.9	27.3	29.8	28.4	34.8	+9.9
Unemployed	Men	0.8	1.8	2.3	4.3	3.0	+2.2
	Women	0.6	1.4	3.0	3.5	3.0	+2.4
Not Actively Engaged	Men	5.6	4.9	5.3	9.0	6.1	+0.5
	Women	23.9	20.8	16.9	18.3	12.7	–11.2
All	All	100.0	100.0	100.0	100.0	100.0	–

Source: Published censuses

Table 5 summarises changes in mean incomes and group-relative sizes of the working-age population by gender and labour force status over the 1976–1996 period. Prominent are the rise in the relative value of the incomes of women not in the labour force, and the decline in relative value of the incomes of employed men (Panel A). The increasing value of the incomes of women not in paid employment at the time of the Census indicates that the proportion of women of that labour force status who had had some earnings in the preceding 12 months was rising. The percentage of women outside the labour force fell from 48 percent in 1976 to only 25 percent as at 1996 (Panel B).

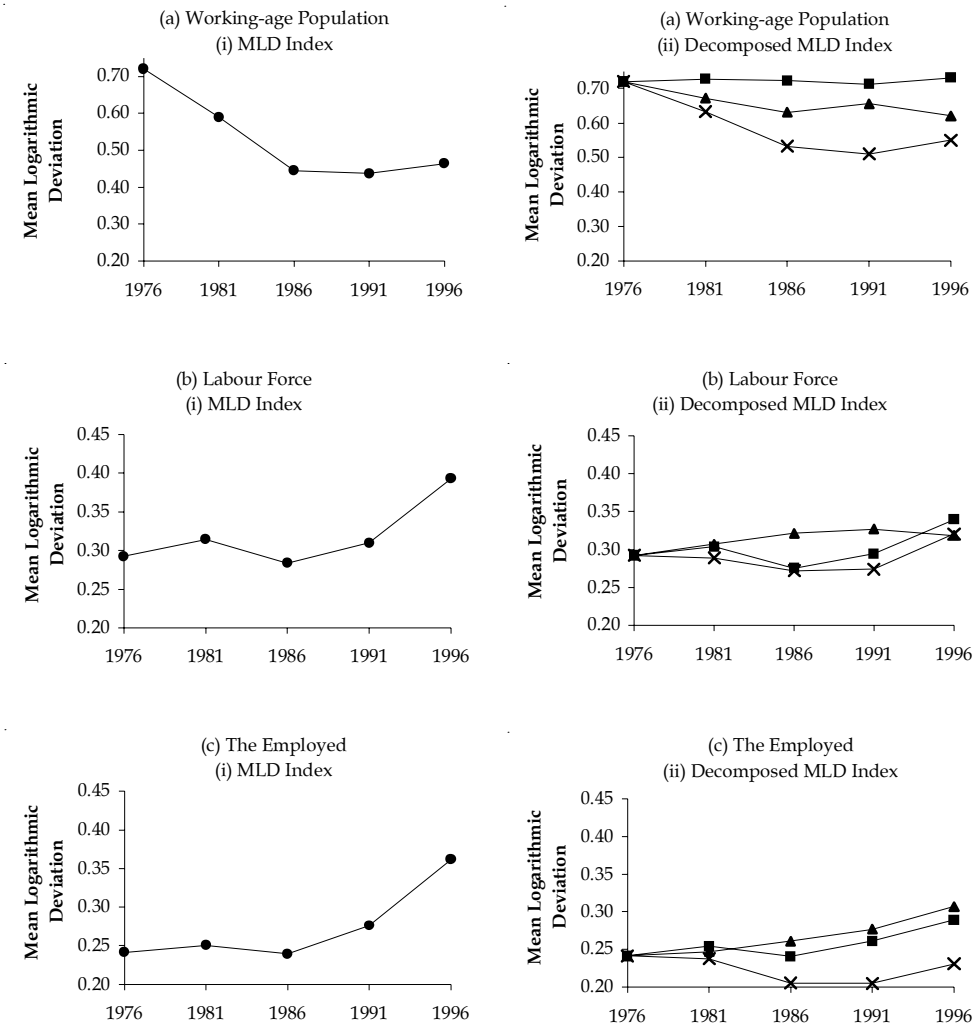
Decomposition of intercensal change in income inequality is graphed for the working-age population in Figure 2a (ii). In the 1976–86 period, shifts in relative size of sub-groups and changes in income relativities were both contributing to a decrease in income inequality, with the income changes being the stronger of the two effects. The effect of the movement of women into the employed category appears, in the 1986–91 period, to have been submerged by other effects. At this time, both unemployment, which had first appeared in the late 1970s, and withdrawal from the labour force, increased markedly (Table 5), outweighing the inflow of women into paid employment and apparently helping to increase income inequality. It can be seen in Figure 2a (i) that the net effect was a continued decrease in income inequality, but at a slower rate of change.

In the 1991–96 intercensal period, changes in the distribution of men and women by labour force status returned to being a force for income equalisation, apparently because of the reversal of the trend in unemployment. (Unemployment peaked in 1992, and by 1996 had returned to a level roughly equivalent to 1986.) But the impact of these movements was outweighed by an increase in observed and unobserved income inequalities.

5 The labour force

When the not actively engaged are excluded from analysis, a completely different trend appears. The trend becomes one of increasing income inequality from 1976 to 1996, but, with a reduction of inequality in between the 1981 and 1986 censuses (Figure 2b (i)). This increase is a reversal of the trend that had been seen up to the mid-1970s; between 1951 and 1976, income inequality of the labour force, when measured by the Gini index, declined by 3.8 percentage points (Martin, 1999). But between 1976 and 1996, the Gini index increased by 10.7 percentage points (Table 6).

FIGURE 2: Change in income inequality in the working-age population 1976–1996, decomposed into three components: working-age population by three levels of aggregation



Key:
- ● Income inequality in the aggregate
- ■ Change in inequality within-groups
- ▲ Change in relative size of sub-groups
- × Change in sub-group relative mean incomes

TABLE 6: Indices of income inequality among the labour force, 1976–1996

Index	*1976*	*1981*	*1986*	*1991*	*1996*
Variance of the Logarithm	0.9546	0.8341	0.7883	0.7862	1.0036
Coefficient of Variation	0.7983	0.8953	0.7454	0.8087	1.0785
Gini Coefficient	0.3604	0.3821	0.3704	0.3982	0.4672
Theil Coefficient	0.2471	0.2837	0.2486	0.2821	0.4113
Mean Logarithmic Deviation	0.3193	0.2968	0.2652	0.2928	0.3859

Source: Census database

The exclusion of the not actively engaged has the effect of drastically decreasing the degree of cross-sectional inequality (compare Figures 2a (i) and 2b (i)). This general decrease is reflected in the reduction of inequalities by age, gender and labour force status. In the whole working-age population, there was a greater degree of inequality between labour force statuses than there was between age, gender or ethnic groups. But, in the labour force, income disparities between labour force statuses are less apparent (Table 7).

The four attributes in Table 7 account for only about a third of cross-sectional inequality among the labour force, far less than these same attributes do among the whole working-age population (Table 2). Although part of the increase in inequality can be attributed to three of the four observed inequalities, age, ethnic and labour force status inequalities (according to the MLD decomposition) only account for about a third of the increase in the period 1986 to 1996. The relative lack of influence of these variables is reflected in marginal index values, which were either declining in relative terms (ethnicity and labour force status) or stable (age) (Table 8).

TABLE 7: Income inequality among the labour force: between-group inequality by sex, age, ethnicity and labour force status, 1976–1996

Variable	*1976*	*1981*	*1986*	*1991*	*1996*
Age	0.0389	0.0458	0.0425	0.0519	0.0865
Labour Force Status	0.0103	0.0254	0.0329	0.0405	0.0359
Gender	0.0500	0.0409	0.0343	0.0249	0.0312
Ethnicity	0.0035	0.0042	0.0044	0.0064	0.0100
Between-groups (all variables)	0.0965	0.1053	0.1012	0.1074	0.1425
Within-groups (all variables)	0.1961	0.2090	0.1827	0.2025	0.2505
Total	0.2926	0.3143	0.2839	0.3099	0.3930

Source: Census database

TABLE 8: Marginal effects of variables on income inequality in the labour force, 1976–1996

Variables	*1976*	*1981*	*1986*	*1991*	*1996*
Age	0.0331	0.0366	0.0349	0.0397	0.0713
Gender	0.0461	0.0375	0.0304	0.0239	0.0278
Labour Force Status	0.0090	0.0194	0.0233	0.0269	0.0212
Ethnicity	0.0036	0.0026	0.0026	0.0031	0.0045
Sum of marginals	0.0917	0.0963	0.0912	0.0936	0.1248

Source: Census database

A separation of change over time into the three components (relative sizes of sub-groups, sub-group mean incomes, within-group inequality) shows that between 1976 and 1991, changes in the composition of the labour force (essentially the outflow from employment to unemployment) had the effect of increasing income inequality (Figure 2b (ii)). The observed income inequalities were, on the other hand, decreasing. Between 1991 and 1996, the role of the two components reversed. Observed income inequalities increased sharply, while the movements from unemployed to employed status helped to equalise the distribution of income.

But most (62 percent) of the increase in labour force income inequality between 1986 and 1996, was, according to the MLD index, attributable to an increase in inequality *within* each of the 144 sub-groups that the labour force had been divided into (Table 9).

TABLE 9: Marginal effects of variables expressed as a percentage of the MLD inequality index, 1976–1996

Variable	*1976*	*1981*	*1986*	*1991*	*1996*
Age	11.3	11.7	12.3	12.8	18.1
Gender	15.8	11.9	10.7	7.7	7.1
Labour Force Status	3.1	6.2	8.2	8.7	5.4
Ethnicity	1.2	0.9	0.9	1.0	1.1
Sum of marginals	31.4	30.6	32.1	30.2	31.8
Between-groups (all variables)	33.0	33.5	35.6	34.7	36.3
Within-groups (all variables)	67.0	66.5	64.4	65.3	63.7
Total	100.0	100.0	100.0	100.0	100.0

Source: Census database

TABLE 10: Indices of income inequality among the employed, 1976–1996

Index	*1976*	*1981*	*1986*	*1991*	*1996*
Variance of the Logarithm	0.7459	0.8086	0.7517	0.7551	0.9465
Coefficient of Variation	0.7983	0.8838	0.7430	0.7862	1.0466
Gini Coefficient	0.3595	0.3729	0.3625	0.3858	0.4522
Theil Coefficient	0.2461	0.2714	0.2380	0.2661	0.3873
Mean Logarithmic Deviation	0.2757	0.2939	0.2618	0.2838	0.3756

Source: Census database

The low index values for labour force status and the large role of within-group inequality suggest that unemployment (the principal change associated with the labour force status variable) had relatively little effect on income inequality. This is, at first glance, surprising in view of the growth of unemployment in the 1980s and early 1990s. Unemployment grew from 25,000 in number in 1976, to 60,000 by 1981, then to 107,000 in 1991. The peak unemployment period was 1987 to 1992; since then unemployment has receded. In the 1996 Census, the number of unemployed was down to 134,000.

It has been hypothesised that the reason for the apparent lack of influence of unemployment on the distribution of income was because unemployment was fairly equally distributed across all occupations and income levels (O'Dea, 2000). This would have had the effect of increasing income disparities above the median income, while also decreasing the gap between the median and zero income. The two effects would largely cancel each other out, thus explaining why the net effect was small.

6 The employed

Exclusion of the unemployed reduces the cross-sectional degree of inequality still further but not by much (compare Figures 2b (i) and 2c (i)). As measured by the Gini Coefficient, income inequality increased by 9 percentage points between 1986 and 1996 (Table 10). The increase is slightly less than when the unemployed are included.

The increase in income disparities was manifested between workers grouped by age, ethnicity, hours of work, occupation, industry and education (Table 11). But, in spite of the extensive disaggregation of the data – the employed were subdivided into 5,760 groups in respect of the years 1976, 1981, 1986 and 1991, and subdivided into 576 groups in respect of the year 1996 – the seven variables (six in the case of 1996) accounted for only half of income inequality at all five years. In the period 1976 to 1991, none of the growth in income inequality can be associated with these variables – the increase was attributable to the 'within-group' component (Table 11). However, in the period 1986–1991 period, the seven variables did account for one-quarter (27 percent) of the inequality increase. In

TABLE 11: Income inequality among the employed: between-group inequality by eight variables, 1976–1996

Variables	*1976*	*1981*	*1986*	*1991*	*1996*
Age	0.0348	0.0358	0.0318	0.0377	0.0725
Hours	0.0160[1]	0.0144[1]	0.0345	0.0420	0.0647
Occupation	0.0234	0.0231	0.0244	0.0291	0.0387
Gender	0.0523	0.0457	0.0339	0.0266	0.0312
Industry	0.0057	0.0097	0.0048	0.0095	0.0169[2]
Employment Status	0.0204[1]	0.0206[1]	0.0070	0.0063	NA
Ethnicity	0.0029	0.0027	0.0030	0.0033	0.0057
Education[2]	NS	0.0132	0.0209	0.0233	NA
Between-groups[2]	0.1168	0.1157	0.1072	0.1169	0.1662
Within-groups[2]	0.1312	0.1458	0.1344	0.1596	0.1953
Total	0.2480	0.2615	0.2416	0.2765	0.3615

Note: 1 Hours of work and employment status 1976 and 1981 not consistent with later dates.

2 Values of industry 1996 and education 1981–91 obtained from separate dataset from the other variables in this table. Hence 'Sum of Marginals' and 'Between/Within-groups' rows exclude education 1976–91 and exclude education and industry 1996.

NA Not applicable NS Not suitable

Source: Census database

the period 1991–1996, six variables accounted for 58 percent of the increase (Tables 11 and 13).[2]

The sum of marginal effects of variables was increasing relative to total effects from 1976 to 1991 (Table 13). This indicates that, up to 1991, the influence of the standard worker attributes (that is, those in Tables 11, 12 and 13) on income inequality was strengthening, and there was less interaction between attributes being manifested. The trend is, however, less clear at the level of individual variables, because some had declining marginal values, some had no clear trend and the marginal values of others did not consistently increase. Thus, the marginal value of industry declined between 1986 and 1991 while that of occupation showed no clear trend. Age appears to have become more independent of other factors between 1976 and 1986, but then exhibited no change from 1986 to 1991, even though age inequalities without control of other factors continued to increase. The marginal value of education increased between 1986 and 1991 after having decreased between 1981 and 1986. That of gender increased from 1981 to 1991. The marginal value of hours of work was unchanged from 1986

[2] Dixon, using microdata on earnings rather than income, and a different methodology, finds that slightly over 70 percent of the increase (71 percent in the case of males, 73 percent in the case of females) over the period 1984–97 is attributable to unobserved or within-group factors (Dixon, 1998).

TABLE 12: Marginal effects of eight variables on income inequality in the employed, 1976–1996

Variables	*1976*	*1981*	*1986*	*1991*	*1996*
Age	0.0222	0.0239	0.0226	0.0260	0.0500
Hours	0.0052[1]	0.0180[1]	0.0224	0.0271	0.0342
Occupation	0.0101	0.0139	0.0153	0.0201	0.0227
Sex	0.0266	0.0190	0.0163	0.0154	0.0176
Industry	0.0042	0.0033	0.0049	0.0088	0.0114[2]
Employment Status	0.0026[1]	0.0087[1]	0.0046	0.0055	NA
Ethnicity	0.0014	0.0015	0.0037	0.0039	0.0025
Education[2]	NS	0.0085	0.0112	0.0153	NA
Sum of Marginals[2]	0.0723	0.0883	0.0898	0.1068	0.1270

Note: 1 Hours of work and employment status 1976 and 1981 not consistent with later dates.

2 Values of industry 1996 and education 1981–91 obtained from separate dataset from the other variables in this table. Hence 'Sum of Marginals' row excludes education 1976–91 and excludes education and industry 1996.

NA Not applicable NS Not suitable

Source: Census database

to 1991. Index values for these variables for the year 1996 are included in the tables 11, 12 and 13, but are not strictly comparable with the earlier years because they were derived from a dataset containing six variables only.

Between-group changes can be further broken down into effects of shifts in the structure (composition) of the employed, and effects of observed income changes. Shifts in the composition of the labour force essentially accounted for the observed part of the increase in the period 1986–1991. In the period 1991–1996, the observed part of the inequality increase was roughly equally apportioned between increase in observed income disparities and compositional change.[3]

Three broad types of compositional change can be identified from the Census. First, the occupational structure has changed. Table 14, taken from the Census database used for the statistical analysis of this paper, shows the occupational distribution of the employed from 1976 to 1996. It shows that there has been a decline in waged manual employment, particularly between 1981 and 1991.

[3] The increase in income inequality over the period 1986–91, in the depiction in Figure 2, breaks down as 44 percent because of compositional changes (terms iii and ii combined), and 56 percent because of within-group changes (term i). The increase in income inequality over the period 1991–96 breaks down as: observed income changes, 30.7 percent; compositional changes, 35.6 percent; within-group changes, 33.7 percent. Because the decomposition of change between 1991 and 1996 was based on six variables, and the decomposition of change between 1986 and 1991 (and the other earlier periods) was based on seven variables, the two sets of results cannot really be compared.

TABLE 13: Marginal effects of variables expressed as a percentage of the MLD inequality index, 1976–1996

Variable	*1976*	*1981*	*1986*	*1991*	*1996*
Age	9.2	9.5	9.4	9.4	13.8
Hours	2.1[1]	7.2[1]	9.4	9.8	9.5
Occupation	4.2	5.6	6.4	7.3	6.3
Industry	1.7	1.3	2.0	3.2	3.1[2]
Gender	11.0	7.6	6.8	5.6	4.9
Employment Status	1.1[1]	3.5[1]	1.9	2.0	NA
Ethnicity	0.6	0.6	0.9	1.4	0.7
Education[2]	NS	3.4	4.7	5.5	NA
Sum of Marginals[2]	29.9	35.3	36.8	38.7	38.3
Between-groups[2]	47.1	44.2	44.4	42.2	46.0
Within-groups[2]	52.9	55.8	55.6	57.8	54.0
Total	100.0	100.0	100.0	100.0	100.0

Note: 1 Hours of work and employment status 1976 and 1981 not consistent with later dates.

2 Values of industry 1996 and education 1981–91 obtained from separate dataset from the other variables in this table. Hence 'Sum of Marginals' and 'Between/Within-groups' rows exclude education 1976–91 and exclude education and industry 1996.

NA Not applicable NS Not suitable

Source: Census database

According to the published census, this change mostly affected men (Statistics New Zealand, Census, 1976–96). Up to 1981, about 50 percent of male employment was in jobs of a manual nature. The percentage of men engaged in this type of employment fell by seven points between 1981 and 1986, then fell another six points between 1986 and 1991. Between 1991 and 1996, the percentage of men in manual waged employment has been stable at about 35 percent. The percentage of the female labour force engaged in manual employment declined similarly in the 1980s, falling by 14 percentage points between 1981 and 1991.

However, the Census shows that the growth areas of male and female employment have been different. For men, the compensatory growth has been in self-employment in manual and non-manual occupations, the percentage in this type of employment rising by nine points between 1981 and 1991. For women, the compensatory growth has been as an employee in the clerical and professional occupations.

Secondly, the female labour force has grown. The growth was especially strong between 1981 and 1986 (by 30 percent between these two years; the male labour force grew by only 5 percent).

Thirdly, there have been changes in relative size of economic sectors, or major industry groupings. There has been a decline in employment in manufacturing

TABLE 14: Percent distribution of the labour force by major occupational group, 1976–1996

Occupational major group	*1976*	*1981*	*1986*	*1991*	*1996*
Professions	18.4	18.8	20.5	24.1	24.8
Clerical occupations	36.1	37.5	38.2	38.9	40.6
Agricultural, fishing etc occupations	10.1	10.6	10.4	9.4	9.2
Manual occupations	36.2	33.4	31.1	25.1	25.4
Total	100.0	100.0	100.0	100.0	100.0

Source: Census database

industries, and in agriculture. Table 15 shows that manufacturing (which here includes electricity, gas and water utilities as well as construction) accounted for a third of employment in 1976, but by 1996 had fallen to a little over a fifth of all employment. By contrast, the wholesale, retail, finance, insurance, social and community services industries grew from a little under half (46.6 percent) of employment in 1976, to nearly a third (62.1 percent) in 1996.

TABLE 15: Distribution of the employed by industrial sector, 1976–1996

Sector	*1976*	*1981*	*1986*	*1991*	*1996*
Wholesale, retail	18.3	17.7	19.7	20.9	26.4
Finance, insurance etc	6.4	7.0	8.3	11.8	12.8
Social, community services	21.9	25.3	24.1	26.9	22.9
Manufacturing	33.9	30.6	29.6	24.2	22.1
Agriculture	18.7	18.7	17.7	15.8	15.7
Total	100.0	100.0	100.0	100.0	100.0

Source: Census database

7 Discussion and summary

Among the whole working-age population, income became more equally distributed in the 1970s and the 1980s. As measured by the Gini index, the degree of income inequality was 4.7 percentage points lower in 1991 than it had been in 1976. There was an increase in income inequality between 1991 and 1996, but, as at 1996, the degree of income inequality was still lower than it had been in 1976.[4] This long-term equalisation of income may be basically attributed to changes in

[4] About 1 percentage point lower than 1976 (Table 1).

the economic position of women. Measurement of income inequality among all adults of working age clearly shows that the distribution of income has been equalised over time by both the rise of women's incomes and by increased participation of women in the labour force.

Labour force income inequality has been rising since the 1970s. As measured by the Gini index, income inequality increased by 10.7 percentage points between 1976 and 1996. This is because, when those not in the labour force are excluded, the equalisation of men's and women's incomes has been outweighed by increased income inequality in other respects, and from unemployment. Unemployment growth, and increases in observed income inequalities (by age, ethnicity and labour force status) had only a minor effect upon the distribution of income. These standard variables did not capture the growth in income inequality in the labour force in the 1980s and early 1990s.

Income inequality among the employed increased by almost the same magnitude as it did in the labour force (that is, with the unemployed included). By 1996, the degree of income inequality among the employed, as measured by the Gini index, was 9.3 percentage points above the 1976 level. Change in the structure of employment appears to account for part of the increase in income inequality, accounting for 44 percent in the period 1986–1991, according to index decomposition (or 30 percent, according to how index components are grouped). Up to 1991, observed income inequalities in the aggregate were equalising rather than disequalising, therefore they do not help account for the increase in income inequality. It appears that because a variety of worker attributes are aggregated, the equalisation of income by gender outweighed the disequalisation that can be observed occurring along other dimensions. In the period 1986 to 1991, 57 percent of the increase in income inequality (or again, depending on how index components are grouped, about 70 percent), came from increases in income inequality *within* the 5,760 groupings that the employed had been subdivided into.

Change between the 1991 and 1996 censuses was analysed, on the basis of disaggregating the employed into 576 groups, and the results indicate that the proportion of change in income inequality that was unobserved now only accounted for about a third of the total. The two thirds of the increase that was observable was roughly equally split between increase in income inequalities attributable to the six worker attributes (31 percent) and change in the structure of employment (36 percent).

Results for the period 1976 to 1991 in this census-based research suggest that standard variables presently used in labour market research do not adequately capture causes of the increased inequality in the distribution of earnings and income of the employed. This confirms results based on microdata obtained by other researchers (Dixon, 1996a, 1996b, 1998; Borland, 2000). Somewhat different results were obtained for the period 1991 to 1996, but the significance of these results remains unclear, given inconsistencies in the data series.

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Appendix: Data description

This study employs computerised datasets belonging to the Population Studies Centre at the University of Waikato in respect of the censuses from 1976 to 1996. It also employs datasets of the employed only, kindly supplied to the author by Statistics New Zealand in respect of the censuses from 1976 to 1996.

There were three types of datasets:

(a) Individuals by age, gender, ethnicity and labour force status.
(b) Employed individuals by age, gender, ethnicity, full-time/part-time status, occupation and industry. (See following notes concerning industry in 1996.)
(c) Employed individuals by age, gender, ethnicity and education.

The variables are defined as follows:

Age: Nine, five-year age groups from age 15 to 59 years.

Ethnicity: Respondents were divided on a priority basis into the four Level 1 ethnic affiliations of the *New Zealand Standard Classification of Ethnicity* (Department of Statistics, 1993). However, the definition of ethnic affiliation has changed over time. In the 1976 and 1981 censuses, ethnicity was defined in terms of biological descent. From the 1986 census, respondents were requested to indicate which ethnic group(s) they identified with. These changes in definition do not make intercensal comparisons of ethnic data invalid, but do need to be borne in mind in analysis (Pool, 1991).

Gender: Men, women.

Labour force status: Employed, unemployed and not actively engaged.

Employment status: The three original categories were: wage and salary workers, self employed, and other employed. The latter were insignificant in the datasets of 1986 to 1996, but it was found that there were significant numbers of 'other employed' in 1976 and 1981. This group was, therefore, retained and merged with wage and salary workers. The categories were therefore: waged and salaried, self employed.

Employment status was not obtained for 1996. See discussion below.

Hours of work: Full-time and part-time. See discussion below.

Occupation: The standard classification of occupations was collapsed into four categories:[5] agricultural and fishing occupations; manual occupations (trades, plant and machine operators and labourers); professionals (professional and technical occupations, managers and administrators, etc); clerks (clerks, sales workers, service workers).

[5] The New Zealand Standard Classification of Occupations was changed in 1990, one of the changes being that the number of categories was expanded from seven (excluding 'not adequately defined') to nine. The four broad categories employed here are consistent across all five censuses.

Industry: The nine official major industrial groups have been collapsed into five. These are: wholesale and retail trade, restaurants and hotels; finance, real estate, insurance and business services; social, community and personal services; manufacturing (manufacturing, electricity, gas and water, construction); a remaining group named 'agriculture' (agriculture, forestry etc, mining and quarrying, and transport storage and communication).

Education: Four groups: bachelor's and postgraduate degrees, other tertiary qualifications, secondary school qualifications, and no qualifications. The income x education data were provided in a separate cross-tabulation with age, sex and ethnicity for the years 1976, 1981, 1986 and 1991. The 1976 data were discarded because the census question related to attendance, not to qualifications gained.

Income: In the 1976 census, the incomes data obtained was market income only. From the 1981 census onwards, income from all sources was included. In respect of the whole working-age population, it was necessary to attempt to make the income data comparable. This problem was addressed by imputing an amount equivalent to unemployment benefit to not actively engaged men, and to not actively engaged women aged 15 to 24 years, with an abatement for market income. Family benefit for two children was imputed to not actively engaged women aged 25 to 59 years. Details as to how and why this was done are in Martin (1999). Unemployment benefit was not imputed to the unemployed in 1976, because it was found that income levels of the unemployed in 1976 were about the same as they were in later censuses.

Employment status and hours of work were originally received as one variable, with the following categories: wage and salary worker, full time; wage and salary worker, part time; self-employed, full time; self-employed, part time; other employed, full time; other employed, part-time. Hours of work and employment status were separated into two variables.

The 'other employed' category was found in the 1976 and 1981 datasets to be mostly women. The datasets contained 64,000 and 80,000 women of 'other employed' status in 1976 and 1981 respectively. The principal categories of the 'other employed' were women who did some part-time work (classified at the time as not being in the labour force), and those assisting in family businesses, who were classified as being in the labour force. Those women assisting in family businesses numbered between 4,000 and 5,000 in 1976 and about 3,000 in 1981. In the 1976 and 1981 censuses, persons employed less than 20 hours a week were classified as not being in the labour force, although the industry and occupation of their part-time employment was recorded. From the 1986 Census, part-timers were treated as being in the labour force, but the definition of part time was changed to those who worked less than 30 hours a week. Thus, the part-time category in the 1976 and 1981 datasets is not consistent with the part-time

category in the later datasets (see values of 'employment status' and 'hours' in Tables 12 and 13).

There are some further inconsistencies in the data. The 1996 datafile was obtained in the form of three datasets.[6] None of the three are consistent with the 1976–91 data. One of the datasets contained the variables age, ethnicity, gender, hours of work and occupation, while another contained the variables age, ethnicity, gender, hours of work and industry. Thus, income, age, ethnicity, gender and hours of work are not cross-tabulated with industry and occupation simultaneously. The variable employment status was not obtained. The third dataset was in respect of education, the details of which are given above.

Income computations were based on all income intervals/categories, from the nil category to the top open-ended category. A midpoint to the top income interval was estimated from Pareto's formula for the upper tail (Martin, 1999). There has been considerable change over time in the number of income intervals or categories. The numbers of income intervals by census were: 1976 (18), 1981 (24), 1986 (16), 1991 (13), 1996 (14). It has been shown that income inequality indices computed from midpoints of income intervals over-estimate the actual degree of inequality (Martin, 1999). Also, the less income intervals there are, the greater will be the inaccuracy of income statistics (Martin, 1999). The effects of the number of income intervals on statistical results, therefore, need to be borne in mind.

[6] These data were obtained at very short notice for a purpose other than this research.