

# Income Growth and Earnings Variations in New Zealand, 1998—2004

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# Abstract

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This work provides an update of changes in the income distribution over the period from 1998-2004, using data from the Household Labour Force Survey's annual Income Supplement (HLFS-IS). We focus on changes in working-age individuals' earnings and total income distribution and, to allow for resource sharing within households, their equivalised household total income distribution over the period. Our analysis shows that there have been broad gains in income across the distribution, suggesting the spoils of growth have been shared widely across the income distribution. Mean and median individual earnings increased 15 percent and 23 percent respectively, while mean and median individual income both increased 12-13 percent and equivalised household income by 11 percent. Inequality, as measured by the Gini coefficient, was more stable: individual earnings inequality fell 4 percent; individual income inequality was unchanged, while equivalised household income inequality increased 2-3 percent. The main contributors to the observed changes appear to be employment and real wage growth. We estimate that roughly one-half of the growth in average individual incomes is due to employment growth, and one-quarter each to demographic changes and wage growth. We also find that the relative employment and wage contributions have varied across the distribution: income gains at the lower end of the income distributions have been largely driven by employment, while changes at the higher end have been driven by wage gains.

**JEL CLASSIFICATION** I32 – Measurement and Analysis of Poverty

**KEYWORDS** Income; earnings; employment; wages; inequality

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# Income Growth and Earnings Variations in New Zealand, 1998—2004

## 1 Introduction

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The dramatic increases in income inequality in New Zealand during the late 1980s and early 1990s have been widely documented.<sup>1</sup> This was a period of both significant economic and social policy reform and stagnant economic growth. The broad economic trends since the early 1990s can be characterised as consisting of two periods of strong economic growth, the first from 1993 until 1997 and the second from 1999 until the present, interrupted by a relatively brief and shallow recession during 1997-98. The body of literature on changes in inequality during the 1990s has generally found relatively modest changes during the first of these growth periods.<sup>2</sup>

The period since 1998 has seen no substantial policy or external shocks, and can be characterised roughly as one of “pure” economic growth. The current research focuses on this period and has two objectives: first, to provide an update of income distributional changes during this period; and second, to understand how the benefits of growth, as measured by income, over the period have been distributed across the population. Our analysis uses data from the Household Labour Force Survey’s annual Income Supplement (HLFS-IS) over the period from 1997-2004. We treat working-age individuals (aged 15-64) as the unit of observation, and focus on changes in the distributions of their employment related earnings, their gross pre-tax income, and their “equivalised” total household earnings and income between 1998 and 2004.<sup>3</sup>

We begin by describing trends in real (inflation-adjusted) earnings and income levels, and relative inequality over the period. There were widespread increases in earnings and income across the distribution, and comparatively little change in inequality. For example, mean and median individual earnings increased 15 percent and 23 percent respectively between 1998 and 2004, mean and median individual income each increased 12-13 percent; while mean and median equivalised household earnings for working-age individuals increased 15-16 percent, and mean and median equivalised household income

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<sup>1</sup> For example, see Dixon (1996, 1998), O’Dea (2000), Chatterjee (2004), Chatterjee and Podder (2003), Podder and Chatterjee (2002), and Hyslop and Maré (2001, 2005).

<sup>2</sup> See Hyslop and Maré (2001, 2005), Podder and Chatterjee (2002).

<sup>3</sup> Largely for measurement reasons, most income distributional research focuses on cash income, either gross (pre-tax) or disposable (post-tax and transfer) income. Crawford and Johnston (2004) provide an analysis of the impacts of non-cash Government expenditures on changes in New Zealand’s household income distribution between 1987 and 1998.

increased 11-13 percent. Individual and equivalised-earnings inequality, as measured by the Gini coefficient, fell about 4 percent over this period, while individual income inequality was unchanged, and equivalised-income inequality rose 2 percent. Simple kernel density descriptions of the distributions of individuals' earnings and income in 1998 and 2004 show no visibly dramatic changes have occurred across the distributions.

Based on these descriptive findings we next turn our attention to the factors contributing to the observed changes over time in the individual (and equivalised) income distributions. Perhaps unsurprisingly, given the sustained period of growth over the period, employment and real wage growth are major contributors to the changes. First, we rank-order individuals by their individual (or equivalised) income, and describe the relative change in income at each percentile of the distribution between 1998 and 2004. We then describe the contributions of earnings, and then employment, hours and wages, to the relative changes in income across the distribution. This provides a more nuanced description of relative changes across the distribution than provided by the trends in the summary statistics, and shows that there have been particularly strong increases in income, of up to 20 percent, in the low-mid range of the distribution. These gains are largely due to strong increases in employment among individuals with income in this region and, to a lesser degree, increased hours of work and wages. Further up the distribution, the relative increases in income are generally smaller (on the order of 6-9 percent), and are dominated by wage increases, arguably because individuals in this range are at or close to full employment.

Second, we adopt a method developed by Juhn, Murphy and Pierce (1993) to decompose changes in individual and equivalised household incomes into observable socio-demographic and human capital, employment, wage (returns), and unobserved effects at various points of the respective income distributions. The results from this analysis are largely consistent with those described previously. About one-half of the increase in mean individual incomes are attributed to the increase in employment, and 20-25 percent due to demographic and wage changes. The relative contribution of employment to increases in income peaked at 90 percent at the 25<sup>th</sup> percentile of the distribution, and was only 10-20 percent at the 75<sup>th</sup> and 90<sup>th</sup> percentiles. In contrast, we find the contributions of (wage) returns increase steadily across the income, from 10-15 percent at the 10<sup>th</sup> and 25<sup>th</sup> percentiles to over 60 percent at the 90<sup>th</sup> percentile. Although somewhat similar patterns of employment and wage contributions to the changes in equivalised household incomes of working-age individuals across the distribution, both the differences in relative income change and the relative contributions to the change at different points of the distribution appear to be moderated when we take account of access to shared resources within households.

The patterns of increasing earnings and incomes described in the analysis indicate there has been wide spread gains across the distribution. The attribution of the changes to employment and wage effects across the distribution indicate that the gains to individuals at the lower ends of their respective distributions have been primarily driven by employment growth, while the gains in the higher reaches of the distributions are largely the result of wage growth.

## 2 Background and Data Description

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Before describing the income distribution trends and changes, in this section we first briefly outline the broad economic and labour market trends over the period since 1991, and then discuss the salient features of the data to be used in the analysis. Readers who are primarily interested in the distributional changes may wish to skip the discussion of the data in section 2.2.

### 2.1 Background

Figure A1 describes the pattern of the business cycle over the period since 1991, as measured by the unemployment rate and GDP per capita growth. A vertical line at 1997 marks the beginning of our observed sample period. This period can be split into three sub-periods. First, the early to mid 1990s (and before our sample period) was a period of substantial growth: the unemployment rate declined steadily from over 10.5 percent in 1991 to 6 percent in 1995-96, while per capita real annual GDP growth was between 2-6 percent over the 1993-97 period. Second, this was followed by a contraction in economic activity during 1997-98, and corresponding to the early part of our sample period: unemployment increased from 6 percent to 7.5 percent in 1998, and per capita annual GDP growth was negative for 5 quarters during 1997 and 1998. Finally, late 1998-2004 the economy expanded continuously: the unemployment rate fell steadily to around 3.5 percent by the end of 2004, and per capita annual GDP growth was always positive and averaged 2-3 percent over the period.

In our analysis below, we first describe the annual trends in various income distribution summary statistics over the full period 1997—2004, and then concentrate on the changes that occurred between the 1998 and 2004 years. We choose 1998 in preference to 1997 as the initial year for the analysis largely because 1998 is the end of period for much of the earlier literature on income distribution changes during the 1980s and 1990s. Note, also, that the bottom of the most recent business cycle occurred in 1998, so that our analysis may be viewed as a trough-to-peak analysis of distributional changes over this period.

Both the strong economic upswing and the absence of major policy change or economic shocks over the data period, suggests that distributional changes will flow through labour market outcomes. Largely for these reasons, our analysis focuses on working-age individuals, defined as those aged 15-64, as the unit of observation. The primary outcome of interest is individual total income. However, recognising that individuals tend to both share resources and also have obligations to dependents within their family unit, we also consider a measure of the “equivalised” household income associated with working-age individuals that takes account of both of these factors.<sup>4</sup> In particular, we adopt the so-called Luxembourg Income Scale (0.5), LIS(0.5), that divides total household income by the square root of the (total) number of persons in the household, and assign this value to each working-age individual in the household. Our analysis of equivalised income changes also incorporates more household-level information than the analysis of individual (non-equivalised) income changes.

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<sup>4</sup> Although the “family” is preferred to the “household” as the relevant unit, we adopt the household because it is more simply defined. To the extent that unrelated individuals share the same household (e.g. flatmates), this will tend to overstate the resources available to, and/or obligations of, individuals. Conversely, if individuals receive support from families outside their household (e.g. students flatting away from home), this will tend to understate the resources available to, and/or obligations of, individuals. See e.g. Jenkins (1991) and Jenkins and Cowell (1994) for discussions of alternative equivalence scales.

There are some, potentially important, caveats to acknowledge for the analysis. First, our measures of income exclude family support and other tax credits that are becoming increasingly important components of the family welfare system, although the period of analysis predates the introduction of the recent Working for Families package of changes. Second, and related, except for a very simple estimate of post-tax income, our measures of income are essentially pre-tax gross income. Thus, in the context of equivalised incomes, it is important to recognise that the adjustment is in terms of gross and not disposable household income.

## 2.2 Data Description

The data we primarily use for the analysis in this paper comes from the Household Labour Force Survey and its Income Supplement (HLFS-IS). The HLFS is a quarterly survey that began in 1986 to collect information on labour force status, hours worked, and demographic characteristics of individuals and households, but does not collect any wage or income information. However, since 1997 the Income Supplement (also known as the New Zealand Income Survey, NZIS) has been included as an annual supplement to the June quarter HLFS, to collect information on income from a variety of sources. The HLFS sample frame uses an eight-quarter panel, and samples approximately 15,000 households and 30,000 individuals aged 15 and over each quarter.

The HLFS-IS collects information of wages and salaries earned in a reference period (typically the week prior to the survey), self employment income over the last year (recorded as a categorical response), welfare benefit and other transfer income (in the two-weeks prior to the survey), and income from other sources such as investments and private pensions etc.<sup>5</sup> Each of these income sources are converted to a weekly basis and presented as such in the HLFS-IS data extract provided by Statistics New Zealand. In addition to this information on sources of “weekly” income, the Income Supplement also asks a categorical-response question on individuals’ total income over the last year.

Although an annual income measure would be preferred to weekly income for distributional analysis, because it will smooth out very short run intra-year fluctuations, we concentrate on the weekly measures. This is largely because the weekly earnings and income measures, as continuously measured variables, can be more accurately adjusted for inflation and thus provide more useful comparison across years. The appendix provides some more details on the alternative earnings and income measures we use.

In order to provide a sense of the concordance between the continuous weekly income measure and the categorical annual total income, and hence the robustness and reliability of the weekly measure as a proxy for income distributional analysis, we compare the distributions of the two measures. For this purpose, we first “annualise” the weekly total income by multiplying it by 52.14, and then compare the implied categorical distribution of this measure to that of the total annual income variable. We graph these two distributions in Figure A2. The most striking difference between the distributions is that a much larger fraction of individuals report zero weekly income (15.8 percent) than zero annual income (about 7.5 percent), while a larger fraction report \$1-\$5,000 annual income (9 percent) than weekly income corresponding to this band (4.5 percent). These differences are broadly consistent with the view that some workers who have low annual income only

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<sup>5</sup> Statistics New Zealand considers the investment income to be potentially sensitive and has not included it in the data extract available for this analysis.



work part-year and thus have zero income in some weeks.<sup>6</sup> However, except for the differences in these income categories, the two distributions are reasonably comparable. Furthermore, the simple correlation coefficient between individuals' weekly and annual income reports is 0.81 for all years.

We believe these results are encouraging for the view that the weekly income measure available in the HLFS-IS is a reasonable proxy for individuals annual income, bearing in mind there is some discrepancy in the fractions reporting zero versus very low positive incomes.<sup>7</sup> Thus, our subsequent analysis is based on the weekly report measures of earnings and income. For ease of comparison with other studies that focus on annual income, we use "annualised" weekly earnings and income measures (as above, calculated by multiplying the weekly variables by 52.14): note, this simply changes the scale and does not affect any relativities. Also, nominal incomes are adjusted for inflation using the CPI, and expressed in September-Quarter 2004 dollar-values.

In Table 1 and Table 2 we present the sample means of a variety of socio-demographic, employment and income characteristics of the HLFS-IS data over the period 1997-2004. Table 1 summarises the individual-level information of working-age individuals, and Table 2 summarises the household-level and equivalised-income information of working-age individuals.<sup>8</sup> The first column in each panel summarises the characteristics across all years, the next two columns summarise the characteristics of the 1998 and 2004 samples, and the final column presents the relative (percentage) changes in the means between 1998 and 2004.

The second and third rows in Table 1 show the fractions of individuals with imputed income responses for the HLFS-IS, and with imputed income responses and/or proxy responses to the HLFS or HLFS-IS questionnaires. As is apparent, substantial fractions of responses have either imputed incomes (about 15 percent each year) and/or are completed by proxy (an additional 13 percent on average). Individuals with proxy and/or imputed responses are somewhat more likely to be reported as being male, working fulltime, and (slightly) more likely to have no qualifications; however, their characteristics and relative earnings and income changes are otherwise broadly similar to other respondents. For this reason we include both proxy and imputed respondents in our analytical samples.

Focussing on the average characteristics of working-age individuals presented in Table 1, the main observed changes in the demographic characteristics between 1998 and 2004 involved ethnicity and qualifications. There were large relative increases in the fraction of working-age individuals with Pacific Island (21 percent) and "Other" ethnicity (50 percent) (i.e. non-Maori, Pakeha and Pacific Island), matched by a 6 percent decline in the fraction reporting Pakeha ethnicity.<sup>9</sup> There was also a large increase in the fraction of individuals

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<sup>6</sup> Note that, of the roughly 4 percent net difference in the difference between the fractions reporting zero or \$1-\$5,000 annual income versus weekly income, 2 percent does not report annual income while the remaining is associated with differences between the fractions in the other income categories.

<sup>7</sup> Böheim and Jenkins (2000) also conclude that current and annual income measures provide very similar estimates of the income distribution in the UK.

<sup>8</sup> The summary statistics in these tables are based on the full samples, and include both proxy responses in either the HLFS main survey or the HLFS-IS and also imputed income values in the HLFS-IS. In total, about 21 percent of working age individuals' questionnaires involve either proxy and/or imputed responses. Although the summary statistics are somewhat affected by the decision to include proxy and imputed responses (e.g. the non-proxy/impute subsample is more predominantly female, and has higher earnings and income), the relative changes over the period and comparable.

<sup>9</sup> Individuals can self-identify with up to three ethnicities. The classification of ethnicity used here is based on Statistics New Zealand's prioritised definition of ethnicity: a mutually exclusive ethnicity is assigned to each individual as Maori if any of their self-

with University level qualifications (36 percent), and a large decrease in the fraction with no formal educational qualifications (15 percent).

The next characteristics presented in Table 1 are the full- and part-time employment rates, and average hours worked conditional on being employment.<sup>10</sup> The total employment rate increased from 68 percent to 73 percent between 1998 and 2004, and this increase was almost entirely due to a 7.5 percent increase in the fulltime employment rate from 51 percent to 55 percent. Conditional on employment, average hours worked (about 37 hours per week) is almost unchanged over this period.

The final set of characteristics we report in Table 1 are fractions of the samples that received income from various sources, and the unconditional (i.e. including zeros) mean incomes (expressed in constant 2004 dollar values). Despite the increase in employment between 1998 and 2004, the fraction of individuals receiving (any) income has remained constant at 84 percent. The fraction of individuals with employment earnings increased 7 percent from 68 to 73 percent, which is broadly consistent with the employment rates reported earlier.<sup>11</sup> There has also been a 16 percent drop in the fraction receiving welfare benefits from 16 to 13 percent. There has also been a large relative drop in receipt of New Zealand Superannuation (NZS) payments, largely due to the increasing age of eligibility over the period, from 63 in 1997 to 65 by 2001.<sup>12</sup> Finally, other miscellaneous income is reported by about 7 percent of the sample, and the fraction has fallen 23 percent over the sample period.<sup>13</sup>

Turning to the income changes, average annualised total income increased about 12 percent between 1998 and 2004. Average annualised earnings increased of 16 percent: a simple comparison of this increase with the 7 percent increase in employment and no change in average hours worked described above, suggests that average hourly wages increased 8-9 percent. Also mirroring the increases in employment and earnings, the average level of benefit income to working age individuals fell by 16 percent over the period and, as expected, the average NZS income also fell.

Table 2 contains household-level and equivalised income summary statistics associated with working-age individuals. First, we describe some of the basic characteristics of the households containing working-age individuals. We have divided households into six types, defined according to the presence or absence of children (defined here as aged under 15), by the number of adults in the household (single versus multiple adults) and, for households without children, by whether the household is predominantly working-aged or retirement-aged.<sup>14</sup> According to this division, one-half of working-age individuals live in “multiple-adult,

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reports are Maori; if not, they are classified as Pacific Island if they report Pacific Island as any ethnicity; if not, as “Other”, if they report any ethnicity other than European/Pakeha; and finally, as Pakeha if their only reported ethnic affiliation is Pakeha.

<sup>10</sup> The appendix contains a description of how we measure hours worked. Fulltime and part-time work are defined, respectively, as working at least or less than 30 hours per week.

<sup>11</sup> Note, there are some inconsistencies between our measures of earnings and employment from the surveys, due to a combination of possibly different reference periods for earnings in the HLFS-IS and employment in the HLFS and reporting or measurement errors in the survey responses. For example, a small fraction of those employed do not report earnings; likewise a small fraction of those with earnings report no employment.

<sup>12</sup> The small incidence of NZS among working-age individuals in 2004 may be due to either errors in the age reported in the HLFS and/or under-age qualifying spouse payments.

<sup>13</sup> We calculate miscellaneous income as a residual amount and have not explored the reasons for its fall.

<sup>14</sup> The categorisation is similar to that adopted by Hyslop and Maré (2001, 2005). In particular, we class single adult households as “retirement” aged if the individual is 65 or over. We classify multiple adult households as “retirement” aged if all adults are 65 or over; or if at least 1 adult is at least 65, all adults are 50 or over, and at least half of total household income is source from New Zealand Superannuation. The categorisation of households between working-aged and retired is reasonably robust to alternative definitions.

no children” households, nearly 40 percent live in “multiple-adult with children”, 8-9 percent live alone, 3-4 percent live in “single-adult with children” (i.e. sole parent) households, and 1 percent live in households defined as predominantly “retired”. Over the period the household structure of the samples appears to have been reasonably stable, although the fraction of working-age individuals living alone has increased 9 percent, and the fraction in sole parent households has decreased 10 percent. These changes may be partly due to the 4 percent drop in the average number of children in households; otherwise the average household size and age-composition has also been stable.

Second, we consider the equivalised household incomes of working-age individuals. Almost all (98 percent) working-age individuals have non-zero equivalised incomes (i.e. are in households with income), in contrast to 84 percent of working-age individuals with non-zero income. The fraction of working-age individuals in households with employment earnings increased nearly 4 percent from 86 to 89 percent: comparing this to the 7 percent increase in employment of individuals shown in Table 1, suggests that about one-half of the increase in employment occurred across households and half within households. The fraction of individuals in households with benefit income fell 16 percent from 26 to 22 percent. Finally, although the levels of equivalised incomes shown in Table 2 differ from individuals’ unequivalised incomes, the relative changes over the sample period are comparable.

In summary, there have been significant increases in earnings and total income, and a decrease in benefit income, as measured at both the individual and household levels, between 1998 and 2004. Associated with these changes was a substantial increase in employment, particularly fulltime employment. The main demographic changes were increases in the fraction of Pacific Island and “Other” Ethnicities, increasing levels of educational qualifications, and also some changes in household structure.

### 3 Recent Trends in Incomes

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In light of the descriptive statistics presented in the previous section, we now turn to a graphical description of the relative trends in alternative summary statistics of the level and dispersion of individual and household incomes. We focus first on the income trends of working-age individuals’ annualised earnings and total incomes, and then consider trends in household level earnings and incomes. For each of the graphical descriptions, we show the trend over the 8 years of the HLFS-IS data 1997-2004 and, in order to emphasise the relative change between our focus years (1998 and 2004), we normalise all series to an index value of 100 in 1998.

#### 3.1 Working-age Individuals’ Earnings and Income

Figure 1 describes various trends in individual earnings and incomes over the sample period. All trends are based on unconditional earnings and incomes – i.e. including zero and negative values. First, Figure 1a shows the trends in the mean and median individual earnings, together with the Gini coefficient as a summary measure of inequality. This figure shows mean individual earnings were flat between 1997 and 1998 and then increased steadily until 2004, increasing 16 percent between 1998 and 2004 (as seen in Table 1). By comparison, median earnings fell about 2 percent in 1998 and then increased steadily, and somewhat more strongly than mean earnings, over the remainder of the period, resulting in a 23 percent increase between 1998 and 2004. In contrast to

the steady cumulative increases in the level of earnings described by the mean and median, earnings dispersion as measured by the Gini coefficient fell by 4-5 percent over the period. The relative trends in the mean, median and Gini coefficient of individuals' earnings, in combination with the patterns of characteristics' changes observed in Table 1, are suggestive of the increase in employment causing a relatively larger increase in earnings in the low to middle range of the distribution, than higher up. We return to this issue more formally later in the analysis.

Figure 1b shows the corresponding trends in the mean, median and Gini coefficients of individuals total (gross, i.e. pre-tax) income. Although these trends are similar to those observed for earnings in Figure 1a, two points are worth noting. First, the trends in mean and median income were very similar, and increased less than for earnings: mean incomes increased 12 percent versus 16 percent for earnings, while median income increased 13 percent versus 23 percent for earnings. This largely reflects the mitigating effect of the loss of benefit income associated with the increase in employment and earnings. Second, in contrast to the small but steady drop in the Gini coefficient on earnings, the Gini coefficient on individual income shows almost no change over the sample period.

Figure 1c-e describe further the trends in individuals' income. Figure 1c shows the trends in the mean, median and Gini coefficient on individuals' post-tax income, using a crude estimate of post-tax income derived simply by applying the income tax schedule to individuals' reported annualised total income.<sup>15</sup> The trends here are broadly similar to those in b. The lower increase in mean compared to median post-tax income between 1998 and 2004 (about 10 versus 13 percent) is partly due to the introduction of the 39 percent higher marginal tax rate for incomes over \$60,000 in 2000 – e.g. all else equal, the introduction of the 39% marginal tax rate explains about one-third of the difference between the mean and median growth over this period. This effect also contributes to the slight fall (-2 percent) in the Gini coefficient over the period.

Figure 1d describes the trends in alternative percentiles (25<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup>, together with the median) of individuals' annualised (gross) income.<sup>16</sup> In contrast to expectations, based partly on the trends in the mean and median shown in Figure 1b, this figure does not show a clear picture of differential relative gains across the income distribution. For example, the relative gain in median incomes was larger than the other 3 percentiles, but only dominated gains at the 75<sup>th</sup> percentile after 2000. Also, while gains at the median were stronger than at the 75<sup>th</sup> and 90<sup>th</sup> percentiles, the net gain over the period at the 90<sup>th</sup> percentile was the same as at the 25<sup>th</sup> percentile.<sup>17</sup>

Finally, Figure 1e describes the trends in mean incomes for each of the four (prioritised) ethnic groups, Maori, Pacific Island, Pakeha, and "Other" ethnicities. This figure shows some quite large year-to-year variations in average incomes for some of the groups, particularly the Maori and Pacific Island groups. However, the net increases between 1998 and 2004 for the Pakeha, Maori and Pacific Island ethnic groups are quite similar (around 12-14 percent), while the average incomes of the "Other" group appears to be lagging since 2002 and increased about 8 percent between 1998 and 2004.

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<sup>15</sup> That is, we assume that individuals reported weekly income accrues continuously over the full year, and we ignore family and other tax credits.

<sup>16</sup> Note, the 10<sup>th</sup> percentile is always 0, so has not been included in this analysis.

<sup>17</sup> These findings depend to some extent on the particular points in the distribution considered, and will be revised somewhat with more detailed analysis in subsequent sections, so should be interpreted with some care.

## 3.2 Working-age Individuals' Equivalised Incomes

We now turn our focus to trends in individuals' equivalised household earnings and incomes. Figure 2 describe trends in equivalised earnings and income measures, following an analogous pattern to Figure 1 for individuals. For this analysis, we aggregate the earnings and incomes of all (i.e. not just working-age) individuals in the household. We begin by describing the mean, median and Gini coefficient trends for equivalised earnings, presented in Figure 2a. As was the case for individual earnings, there was a small drop (-2 to -3 percent) in mean and median equivalised earnings in 1998. Between 1998 and 2004, both the mean and median increased steadily and, in contrast to individual earnings, very closely together, resulting in 15-16 percent increases over the period. Finally, and similarly to individual earnings, the Gini coefficient fell slowly but steadily by 4 percent between 1998 and 2004.

Figure 2b presents the corresponding trends in equivalised household gross incomes. Mean and median incomes increased by 11 and 13 percent respectively between 1998 and 2004, while the Gini coefficient also increased slightly (2-3 percent). Similar, although slightly muted, trends are evident for equivalised household post-tax income shown in Figure 2c: median post-tax income increased 11 percent, mean income increased 9 percent, and the Gini coefficient was unchanged between 1998 and 2004.

We compare trends in the 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup> (median), 75<sup>th</sup> and 90<sup>th</sup> percentiles of equivalised household (gross) incomes in Figure 2d. Again, this shows the income growth was non-monotonic across the distribution, and appears to have been slightly stronger in the middle of the distribution than in the tails. In particular, the growth at the 10<sup>th</sup> percentile point was relatively slow, 3 percent between 1998 and 2004 compared to 13 percent median growth.

Finally, Figure 2e describes the trends in mean equivalised household incomes for the different ethnic groups of the working-age population. The trends are very similar to those for individual incomes in Figure 1e, except for Pacific Islanders: in contrast to mean individual incomes which showed the smallest increase among the ethnic groups of 8 percent, Pacific Islanders' mean equivalised household incomes increase more between 1998 and 2004 (15 percent) than that of other ethnicities.

In summary, the trends in earnings and income levels and dispersion changes suggest generally steady increases in incomes with comparatively little change in the dispersion. This is broadly true of both individual and equivalised household earnings and incomes. The main exception to this summary is that individual earnings appear to have increased significantly more in the low-middle range of the distribution. We suspect that this may be closely correlated with how increases in employment have been distributed across individuals and households.

## 4 Changes in the Distributions

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In this section we concentrate on describing more fully the 1998 and 2004 distributions of working-age individuals' earnings and total income, and their equivalised household incomes, and the changes in these distributions. We do this by constructing kernel

density estimates of the distributions in order to provide a visual appreciation of the changes across the full range of earnings and incomes.<sup>18</sup>

For the analysis presented here we excluded zero earning and incomes, but included negative self-employment earnings and incomes so, in contrast to the descriptions provided thus far, this analysis is correctly viewed as conditional (on non-zero incomes).<sup>19</sup> This has little impact on individuals' equivalised household incomes since, as seen in Table 2, 98 percent of working-age individuals live in households with non-zero income in each year. However, only 84 percent of individuals have non-zero total income in either year; furthermore, only 68 percent and 73 percent of individuals have non-zero earnings in 1998 and 2004 respectively. Thus, any observed changes in the earnings distribution, in particular, between 1998 and 2004 may be due either to the increased employment in 2004 being non-random across the earnings distribution, or to earnings distributional changes conditional on employment. Also, each distribution has been estimated on a logarithmic scale, and we have left- and right-censored the income variable so as to restrict the income range displayed while still representing accurately the degree of (non-zero) mass in each tail.<sup>20</sup>

We begin by describing the distributions of individuals' conditional earnings in 1998 and 2004, and the changes between these years. Figure 3a shows the kernel density estimates of the distribution of earnings in 1998 (dotted line) and in 2004 (solid line), and the change between 1998 and 2004 (dashed line), calculated simply as the vertical distance between the 1998 and 2004 lines. From this figure it seems there were only comparatively small changes in the overall earnings distribution. There was a predominant, though modest, increase in earnings reflected by the rightwards shift in the distribution between 1998 and 2004, and perhaps more clearly in the tendency for negative changes in the distribution at low earnings levels and positive changes at higher earnings. For example, mean conditional earnings increased by about 7.5 percent, and median earnings increased by about 4 percent over this period. (Note that these increases are lower than the unconditional increases described in Figure 1a, because of the increase in employment over this period.)

Given the similarity of the earnings distributions in 1998 and 2004, a simple way to compare them formally is using a Kolmogorov-Smirnoff (KS) test of the equality of two distributions.<sup>21</sup> Perhaps unsurprisingly, given that the mean and median increased over the period, the null hypothesis that the two distributions are equal is easily rejected here.<sup>22</sup> A more useful statistical comparison may be obtained by first adjusting one distribution so that the two distributions have the same mean (or median). For this purpose we have

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<sup>18</sup> See Silverman (1986) for a detailed account of kernel density estimation, and Hyslop and Maré (2001, 2005), and Dixon and Maré (2004) for recent applications in the context of income distribution changes in New Zealand. We adopted a constant bandwidth of 0.05 across all the density estimates presented, which is somewhat lower than the so-called "optimal" bandwidth which varies between 0.07 and 0.09: the narrower bandwidth allows for more localised variations in the distribution to be identified without trading off too much smoothness in the estimates.

<sup>19</sup> The effect of including zero incomes would be relatively transparent: first, there would be a "spike" in the income distribution at zero, corresponding to the fraction ( $p_0$ , say) of individuals with zero income; second, the remaining non-zero distribution would be scaled down by a factor of  $(1-p_0)$ . In our view, the main consideration associated with the decision to include/exclude zeros relates to the ability to compare two distributions over time when the fraction of zeros changes: in our context this seems to be an issue only for earnings.

<sup>20</sup> Earnings and incomes were left and right censored at  $\log(\text{income})=7$  (approximately \$1,100) and  $\log(\text{income})=12$  (\$163,000) respectively. The effect of censoring shows up on the figures as localised mass points at each end of the income ranges. In a logarithmic context, censoring also provides a convenient way to handle negative incomes.

<sup>21</sup> For example, see Conover (1999). The KS test is quite powerful for detecting differences around the middle of the distribution and due to clustering in the data, but not very powerful against differences in the tails of the distribution.

<sup>22</sup> The p-value=0.000 for this test. Perhaps more meaningful is that the maximum difference between the cumulative earnings distributions in 1998 and 2004 is 4.4 percent.

adjusted the 1998 earnings data, by the difference in means and standard deviations between the two years, so that the distribution of the adjusted data has the same mean and standard deviation of the 2004 distribution.<sup>23</sup> The KS test still easily rejects the hypothesis of equal distributions (p-value=0.000) and, although the maximum difference between the cumulative distributions is 3.4 percent, this adjustment doesn't noticeably improve the match between the 1998 and 2004 distributions.

Figure 3b present analogous kernel density estimates for the distributions of individuals' total income in 1998 and 2004. There is a more noticeable shift in the income distribution than in the conditional earnings distribution, reflected by the 9-9.5 percent increases in the mean and median. Again, there is a (visually) modest drop in density in the lower income range, and an increase in upper income range. A large fraction of the drop in mass around the \$10,000-13,000 range can be attributed to the effect of the increasing age of eligibility for New Zealand Superannuation (NZS) over the period: 63 and 64 year-olds were eligible for NZS in 1998, but were ineligible by 2004. We will see in the next section that the drop in density in this region translates into a strong impact on the growth of incomes between the 20<sup>th</sup> and 30<sup>th</sup> percentiles of the income distribution. The KS-tests again reject the equality of the 1998 and 2004, and the 1998-adjusted and 2004, distributions (p-values=0.000); however, the adjustment again does lower the maximum difference in the cumulative distributions from 6.2 percent to 2.6 percent.

Figure 3c present the estimated distributions of working-age individuals' equivalised household total income in 1998 and 2004. The changes in this distribution over time appear much clearer than those for individual earnings and income. There was a steady rightward shift in the distribution over most of the income range: the density fell over the equivalised income range \$10,000-\$30,000, and increased over the \$30,000+ range. The KS-test for the equality of the 1998-adjusted and 2004-actual distributions again rejects this hypothesis (p-value=0.000), but the adjustment lowers the maximum difference between the cumulative distributions from 7.6 percent to 2.6 percent.

Our summary of the changes in the income distributions is that there have been comparatively steady increases in earnings and incomes for both individuals and households, and little evidence of any dramatic localised changes in the distributions. This conclusion is largely in line with the summary statistics presented in Tables 1 and 2 and the trend figures discussed in the previous section, and in sharp contrast to the dramatic distributional changes observed during the 1980s and 1990s in New Zealand (e.g. see Hyslop and Maré, 2001, 2005). This suggests focusing on changes in summary statistics of the distribution may provide an adequate account of the changes. This view is also supported by analysis of gross unequivalised household income not presented here.<sup>24</sup>

<sup>23</sup> Jenkins and Van Kerm (2004) present a formal discussion of this decomposition method. Specifically, we have constructed  $\hat{y}_{t98} = s_{04}(y_{t98} - \bar{y}_{98})/s_{98} + \bar{y}_{04}$ , where  $\bar{y}_t$  and  $s_t$  are the mean and standard deviation of earnings in year-t, and  $y_{98}$  is individual-i's earnings in 1998. Similar results are obtained based on analogous adjustments using just the mean, and just the median.

<sup>24</sup> In fact, KS tests do not reject the hypothesis that the mean and standard deviation adjusted household income distributions in 1998 and 2004 are equal.

## 5 Decomposition Analyses of Changes

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In this section we consider more formally the issue of decomposing changes in alternative summary measures of individual and household income distributions between 1998 and 2004. We focus on the contributions of direct labour market effects (i.e. the increase in employment, together with changes in hours worked and wages) and changes in related demographic factors over the period. In particular, we first present simple analyses of the contributions of earnings, employment, hours and wage changes across the distribution of individuals' income; and then we present analyses that decompose the relative change in income at various points of the distribution into components attributable to observable demographic, employment, and household structure change, components attributable to changes in the economic "returns" to these factors, and components attributable to unobserved factors.

### 5.1 Changes across the Income Distribution

We begin by describing income changes broadly across the income distribution, and then consider the contributions of, first, changes in employment earnings, and then employment, hours worked and wages to these changes. For this exercise, we focus on working age individuals, and stratify the sample according to each individual's rank in the total income distribution in 1998 and 2004. More specifically, each individual was assigned to one of 102 "strata" corresponding to negative income, zero income, and the 100 percentiles of the distribution of positive income for each year. Our analyses then consider within-strata income, earnings, employment, and conditional hours worked and hourly wage, averages and changes in these averages between 1998 and 2004.

First, Figure 4a shows the average income across the percentile-strata in each of 1998 and 2004, together with the fraction of income from earnings in each year.<sup>25</sup> The fraction of income from earnings has a U-shape across the distribution in both years. In 1998, the fraction drops sharply from around 90 percent in the lowest percentile to below 20 percent at the 18<sup>th</sup> percentile, and then rises to about 60 percent at the 30<sup>th</sup> percentile, 80 percent at the 45<sup>th</sup> percentile, and (almost) 100 percent by the 75<sup>th</sup> percentile. A similar pattern is observed in 2004, although the earnings fraction does not fall below 40 percent, and is consistently higher across the distribution than in 1998. The much lower earnings fraction in 1998 between the 15<sup>th</sup> and 20<sup>th</sup> percentiles is largely associated with NZ Superannuation income available to 63 and 64 year-olds in that year (see the appendix Figure A3).

In Figure 4b we next describe the percentage increase in income at each percentile of the distribution between 1998 and 2004, and also the increase in earnings relative to 1998 income levels. The solid line shows particularly strong relative income gains on the order of 20 percent around the 3<sup>rd</sup> decile (i.e. between the 20<sup>th</sup>-30<sup>th</sup> percentiles) of the distribution, and lower gains elsewhere.<sup>26</sup> The earnings increases (relative to income),

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<sup>25</sup> Note, the earnings fractions have been smoothed across neighbouring percentiles in order to reduce some of the noise associated with the relatively small percentile samples. Similar smoothing has been applied in subsequent graphs in this section. Also, the average income across the percentiles for each year corresponds, approximately, to the inverse cumulative distribution function of individual incomes. A more detailed set of figures, that also includes the fractions of individual income derived from working-age Benefits and from NZ Superannuation, is presented in the appendix Figure A3.

<sup>26</sup> Note, as alluded to earlier, this is somewhat at odds with the patterns in Figure 1d that shows comparable gains, on the order of 10 percent, at different points of the distribution. The differences are due partly to the earlier choice of percentile points, and partly the



represented by the dashed line, show large increases in the low-mid range of the income distribution. Thus, Figure 4a and Figure 4b show both that incomes increased across all percentiles in the distribution (broadly consistent with results shown earlier), and emphasise the strong contribution of employment earnings to the increases between the 10<sup>th</sup> and 70<sup>th</sup> percentile of the distribution over the period.

We next pick up on the latter point by showing, in Figure 5, the changes in the factors that contribute to earnings (i.e. being employed, hours worked and hourly wages). First Figure 5a shows the average employment rate, and hours worked and hourly wage (both conditional on being employed) in 1998 for individuals in each percentile-group of the income distribution. This figure shows a steady increase in each of these measures from low to higher percentiles of the distribution. The employment rate and hours worked gradients are steeper at low-mid range percentiles, while the wage gradient is steeper towards the top end of the distribution. Note that, the employment rate does not distinguish between full-time and part-time, so that an increase in average hours worked may reflect either a greater fraction of full-time versus part-time workers (at 'standard' hours) or an increase in hours worked conditional on full- or part-time employment status.

Second, Figure 5b describes the changes between 1998 and 2004 in each of these factors across the distribution. This graph shows that individual employment increases were concentrated between the 10<sup>th</sup> and 55<sup>th</sup> percentiles of the distribution (largely because there is essentially full-employment by this point). The relative changes in hours and wages are less clear. However, broadly speaking, there appear to have been some positive relative increases in hours worked in the low-mid range (10<sup>th</sup>-60<sup>th</sup> percentiles) of the distribution; and, although relative wage increases are observed over most of the distribution, they appear to be somewhat stronger in the top half of the distribution.

We have repeated this set of analyses based on working-age individuals' equivalised household incomes. The fractions associated with each of the income components are based on the respective equivalised household income from that source. For this analysis, the employment rate whether the household had any employment earnings; average hours worked are calculated, for households with employment, as the average across all working-age individuals in the household (including zeros for those not working); and average wages are based on the average wage across all working-age individuals who were working in the household.

The results based on equivalised incomes are presented in the appendix figures: Figure A4, Figure A5, and Figure A6, and are broadly in line with those described here for individual-level outcomes. Due to the recognition of income sharing within households that underlies the equivalisation, differences in the relative equivalised income and earnings changes are less pronounced across the distribution. The same basic conclusion that employment increases were confined to the lower half of the distribution remains (again, arguably because, based on the definition of employment adopted, there is full employment above the median of the distribution). However, hours of work (conditional on household employment), which is perhaps a more useful measure of "employment" in this context, have been increasing across most of the equivalised income distribution, while relative wage changes are also somewhat more broadly spread than across the individual income distribution.

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earlier figure was based on the unconditional distribution (i.e. including zero and negative incomes), so that the percentiles differ from those here. In addition, the current figures are based on within-percentile group averages rather than percentile points, so not strictly comparable.

## 5.2 Contributions to Changes in Incomes

We now turn to a decomposition analysis that formalises the descriptive effects described in the previous section. The approach that we adopt was developed by Juhn, Murphy, and Pierce (1993) (JMP), and focuses on changes in the individual and equivalised household income distributions and the relative contributions of demographic, employment and, for household-level incomes, household structure changes versus the contributions of changes in the income “returns” to (or prices of) these factors and unobserved effects, to changes in summary measures of the distribution. We first briefly outline and motivate the method here.

Consider the following regression for individual or household log(income) in year ( $y_{it}$ ):

$$(3) \quad y_{it} = X_{it}'\beta_t + u_{it},^{27}$$

where  $X_{it}$  is a vector of observed demographic and employment characteristics,<sup>28</sup>  $\beta_t$  is a vector of coefficients representing the “returns” to these characteristics,<sup>29</sup> and  $u_{it}$  is a residual that captures both unobserved factors and their associated returns. Also, denote the year- $t$  residual distribution  $F_t(\cdot|X_{it})$  – i.e.  $u_{it} = F_t^{-1}(\theta_{it}|X_{it})$ , where  $\theta_{it}$  is  $i$ 's (quantile) rank in that distribution.

Let  $Y_t(X_t, \beta_t, u_t)$  denote a summary measure of interest from the income distribution that depends on  $X_t$ ,  $\beta_t$ , and  $u_t$ . (For our analysis,  $Y_t(\cdot)$  is either the mean or the 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup> (median), 75<sup>th</sup>, or 90<sup>th</sup> percentile of the year- $t$  income distribution.) The objective of the analysis is to decompose the change in this measure between 1998 and 2004,  $\Delta Y_t = Y_{04} - Y_{98}$ , sequentially into components attributed to changes in the observed characteristics  $\Delta X_t$ , changes in the returns  $\Delta \beta_t$ , and changes in the distribution of the unobserved factors  $\Delta F_t(\cdot|X_{it})$ .<sup>30</sup> In particular, treating 1998 as the “base” period, we first allow the distribution of the observable characteristics to change from 1998 to 2004, but hold both the returns and the distribution of unobserved effects constant at their 1998 values:

$$(4a) \quad y_{it}^X = X_{it}'\beta_{98} + F_{98}^{-1}(\theta_{it} | X_{it}).^{31}$$

<sup>27</sup> Note that, because the regressions use log(incomes), individuals and households with zero or negative incomes are excluded from this analysis. The respective fractions of positive incomes are roughly constant in 1998 and 2004. In particular, the fraction of working-age individuals with positive income is 84 percent in each year, and the fraction with positive equivalised household income is 98 percent.

<sup>28</sup> For the individual income analysis, the demographic variables are a quadratic in age, dummy variables for gender, marital status, highest qualification (No qualifications, School, Post-school, and University), and ethnicity (Maori, Pacific Island, Asian, and Other); the employment variables are dummy variables for part-time and full-time work. For the equivalised household income analysis of working-age individuals, the demographic variables are a quadratic in the average age of working-age adults in the household, the number of persons in the household and the fraction who are working-age, the fractions of working-age adults who are female, married, with alternative highest qualification (No qualifications, School, Post-school, and University), and ethnicity (Maori, Pacific Island, Asian, and Other); the employment variables are the fractions of working-age adults working part-time and full-time; and we also include dummy variables for each of the household-types described in Table 2.

<sup>29</sup> We are using “returns” here somewhat loosely. For example, changes in the  $\beta$  coefficients over time may reflect either changes in the pure wage returns to the observable covariates and/or other income factors such as changes in hours worked, benefit income effects, etc.

<sup>30</sup> Note that, if the sequential order of the analysis changes, the results will vary according to reassignment of the interactions between the observable characteristics, price and unobservable factor changes.

<sup>31</sup> Note that  $y_{i98}^X = y_{i98}$ , while  $y_{i04}^X$  is obtained by using the 2004 observables,  $X_{i04}$ , and rank in the 2004 residual distribution,  $\theta_{i04}$ , but applying the 1998 coefficients and residual distribution.

Changes in  $Y_t$  based on regression (4a),  $\Delta Y_t^X = (Y_{04}^X - Y_{98}^X)$ , are attributed to changes in characteristics  $\Delta X_{it}$ .

Similarly, we next allow both characteristics and their returns to vary, but hold the distribution of unobserved factors constant at its 1998 values:

$$(4b) \quad y_{it}^{X\beta} = X_{it}'\beta_t + F_{98}^{-1}(\theta_{it} | X_{it}).$$

Changes in  $Y_t$  based on regression (4b),  $\Delta Y_t^{X\beta} = (Y_{04}^{X\beta} - Y_{98}^{X\beta})$ , are attributed to changes in the characteristics  $\Delta X_{it}$ , and the coefficients  $\Delta\beta_t$ ; while the marginal change from (4b) relative to (4a), i.e.  $\Delta Y_t^\beta = (Y_{04}^{X\beta} - Y_{98}^{X\beta}) - (Y_{04}^X - Y_{98}^X)$ , are attributed to changes in coefficients.

Finally, we allow the distribution of the observables, their coefficients, and the unobserved factors to change, via unrestricted regressions for each year, which is simply equation (3) above. Any residual changes from (3) relative to (4b), i.e.  $\Delta Y_t^u = (Y_{04} - Y_{98}) - (Y_{04}^{X\beta} - Y_{98}^{X\beta})$ , are attributed to changes in the distribution of  $u_{it}$ .

Our results from this analysis are presented in Table 3. Panel A of this table presents the results based on individual incomes, and panel B contains the results for the equivalised household income analysis. For both analyses we consider the following distributional summary statistics: the mean income, and the 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup> (median), 75<sup>th</sup> and 90<sup>th</sup> percentiles of the distribution.<sup>32</sup> We focus first on the individual income decompositions in Table 3, panel A. The first row presents the decomposition of changes in mean log(income), which increased 10 percent between 1998 and 2004. About three-quarters of this increase is attributed to changing characteristics, about one-quarter is due to changing coefficients, and there is almost no unobserved effect. We also separate the changing (observable) characteristic effects into socio-demographic and employment effects. About one-third of the characteristics' effect is due to changing demographics and the remaining two-thirds to increasing employment. Thus, employment accounts for about one-half of the increase in individual mean incomes, while demographic changes and "returns" to the observable characteristics each account for about one-quarter of the increase.

Perhaps more interesting is the pattern of contributions across the distributions as measured by the contributions at different percentiles and presented in the next five rows of the panel. In this discussion we concentrate on the relative contributions of employment and coefficient changes. First, consistent with the discussion in the previous section, the increase in log(income) was stronger in the low-to-mid income range than higher in the distribution: for example, incomes increased about 15 percent and 10 percent at the 25<sup>th</sup> percentile and the median, compared to 5-6 percent at the 75<sup>th</sup> and 90<sup>th</sup> percentiles of the distribution. Second, the relative employment contributions to these increases display a distinctive "inverted-U" shape across the distribution: employment changes account for 26, 90, 56, 16 and 9 percent at the 10<sup>th</sup>, 25<sup>th</sup>, median (50<sup>th</sup>), 75<sup>th</sup>, and 90<sup>th</sup> percentiles of the distribution respectively. In contrast, there is a reasonably steady increase in the relative contributions of changing returns, from 10-15 percent at the 10<sup>th</sup> and 25<sup>th</sup> percentiles, to 27 percent at the median, and 51 and 64 percent at the 75<sup>th</sup> and 90<sup>th</sup> percentiles of the distribution. Also, interestingly, changes in demographic

<sup>32</sup> Note that, although most of our discussion of the results will be in terms of percentage effects, the actual changes are log(income) changes which only approximate percentage changes – e.g. a log(income) change of 0.1 corresponds to a 10.5 percent change in income.

characteristics contribute more at the 10<sup>th</sup>, 75<sup>th</sup> and 90<sup>th</sup> percentiles (about 40-50 percent), than at the 25<sup>th</sup> and median. These patterns are broadly consistent with the notion that income increases were concentrated in employment effects at low-to-middle of the distribution, perhaps due to the changing composition of the workforce associated with the increase in employment, and in wage effects at the upper end of the distribution.

Table 4 contains descriptions of the sample average demographic and employment variables used in the regressions calculated at each of the five percentile points of the income distributions in 1998 and 2004 at which we describe changes here.<sup>33</sup> First, this provides a “point in time” summary of the relative characteristics of individuals at alternative points in the distribution, and confirms commonly expected patterns. For example, the average employment rate rises moving from lower to higher points in the distribution; similarly, qualification levels, and the fractions of males and Pakeha, are higher at higher points of the distribution. Second, and of more interest for the discussion here, comparisons between 1998 and 2004 reveal the relative changes over time at different points of the distribution, and confirm some of the patterns suggested in our discussion above. For example, focusing on employment, the employment rates at the 10<sup>th</sup> percentile of the distribution were almost unchanged between 1998 and 2004; while fulltime employment increased strongly at both the 25<sup>th</sup> and 50<sup>th</sup> (median) percentiles (8 and 10 percentage points respectively, and due partly to a drop in part-time rates); these changes were also stronger than at the 75<sup>th</sup> percentile and the 90<sup>th</sup> percentile (in fact, reported fulltime employment actually dropped at the 90<sup>th</sup> percentile).

We turn now to the decompositions of working-age individuals’ equivalised household income changes across the distribution, presented in panel B of Table 3. Again, these results are broadly similar, with the same caveats as in the previous section, to those discussed for individual-level incomes. First, average equivalised incomes increased about 10 percent, and employment contributed roughly one-half, and returns and demographic (including household structure) changes each contributed about one-quarter, of the increase. Second, equivalised income increases ranged between 3.1-12.2 percent across the five percentile points of the distribution, was highest at the 10<sup>th</sup> and 25<sup>th</sup> percentiles and lowest at the median. Third, the relative employment contributions are generally greatest in the low-middle range of the distribution and tapers off in the higher range: e.g. employment contributes around 70 and 50 percent at the 10<sup>th</sup> and 25<sup>th</sup> percentiles respectively, and about one-half and one-quarter at the 75<sup>th</sup> and 90<sup>th</sup> percentiles. Again, the contribution of changing “returns” increases monotonically across the distribution. In fact, the contributions are negative (20-25 percent) at the 10<sup>th</sup> percentiles, and rise steadily to about 50 percent and 60 percent at the 75<sup>th</sup> and 90<sup>th</sup> percentiles of the distribution. Finally, Table 5 shows the averages of the equivalised-level characteristics calculated around each of the 5 percentile points of the distribution: with similar patterns apparent to those for individuals shown in Table 4.

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<sup>33</sup> That is, we ranked individuals in each year according to their income, and then calculated the sample means of subsamples within +/- 1 percent of each of the five percentile points – e.g. the 10<sup>th</sup> percentile statistics were calculated as the averages of individuals whose incomes were between the 9<sup>th</sup> and 11<sup>th</sup> percentiles, etc.

## 6 Concluding Discussion

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The period since 1998 has seen strong economic and employment growth in New Zealand. Our analysis in this paper shows that this growth has resulted in broad gains in income to working-age individuals, measured at both the individual-level and also allowing for resource sharing within households, suggesting the spoils of growth have been shared widely across the income distribution. For example, mean incomes of working-age individuals grew 12 percent in real terms between 1998 and 2004, and income growth was generally stronger in the low-mid range of the distribution than at higher levels. Furthermore, individual earnings growth was even stronger, with the mean earnings growing 16 percent.

We have also provided an analysis of the relative contributions of changing socio-demographic characteristics and employment, and of economic returns to these factors (loosely speaking “wage” effects), to the observed changes in incomes at different points in the distribution. The principal results of interest here are that the income gains in the low-mid range of the distribution are primarily due to increasing employment, while the income gains observed higher in the distribution are more strongly due to increasing returns to demographic and employment characteristics. These findings are suggestive of employment gains at the lower end versus wage gains at the higher end of the distribution, however there are several caveats associated with such a simple interpretation. First, associated with the employment gains that have been concentrated in the low-mid range of the individual income distribution, there are possible non-random employment composition effects that may bias downwards measured wage growth, and thus understate the true wage gains for comparable individuals in this range. Second, the net income gain for those who moved into employment and out-of a benefit state will be far less than their earnings growth because of their lost benefit income.

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## Appendix: Data Issues

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### Measuring Earnings and Income

All incomes are derived from the HLFS-IS data. Our main earnings measure, Annualised Earnings, includes wages and salaries, self-employment income and earnings-related ACC income. Our main income measure, Annualised Total Income, includes earnings and other transfer and private pension income. (Note that, although collected by the HLFS-IS, investment income is considered potentially too sensitive and has not been included in the HLFS-IS extracts made available to us.) Each of these measures are reported in the HLFS-IS data extract on a weekly basis, and we have annualised them by multiplying by 52.14.

The HLFS-IS also collects categorical information from individuals on their total income over the last year. Statistics New Zealand assigns a weighted-average mid-point value for each categorical range. For comparative sample statistics we have used these values as the Annual Income Bracket measure.

All earnings and income measures have been inflation- adjusted using the CPI and are reported in September 2004 dollar values.

### Measuring Hours Worked

There are four alternative measures of (total) hours worked available to us: actual and usual total hours worked from each of the HLFS and HLFS-IS questionnaires. Ideally, for consistency with the earnings data being collected, we would use the actual hours measure from the HLFS-IS. However, the HLFS-IS only collects hours information for wage and salary earnings' jobs – in particular, this information is not collected for self-employment. In contrast, the main HLFS survey does collect hours worked for all those who reported they were employed (including self-employed). In addition, it is apparent that, at least for a small number of individuals, the recorded hours from the HLFS-IS are on an annual rather than weekly basis; whereas this doesn't appear to occur for the HLFS sourced hours.

For these reasons, we have used actual hours worked from the HLFS as our primary source of hours worked for all individuals. A secondary issue is that some individuals report non-zero earnings but zero actual hours worked. This could occur validly for at least two reasons: first, for an individual on annual (or other paid) leave; and second, for those who are not working but receiving ACC income, which we include as earnings for the distributional analysis in this paper. To handle this issue, we use the HLFS measure of usual hours worked if the individual has non-zero earnings but zero actual hours worked.

**Table 1 – HLFS-IS Sample Working-age Individuals' Characteristics, 1997—2004**

	Sample Year			1998-2004 Change (%)
	All Years	1998	2004	
No. Working Age Adults	185,868	23,277	23,047	
Fraction: IS Imputed	0.15	0.14	0.15	
IS Imputed or IS/HLFS Proxy	0.28	0.27	0.29	
Average Age	37.6	37.2	38.0	2.3
Fraction:				
Female	0.51	0.51	0.51	0.3
Married	0.62	0.62	0.61	-0.8
Maori	0.11	0.11	0.11	0.6
Pacific Island	0.05	0.05	0.06	20.7
Pakeha	0.76	0.78	0.74	-5.8
Other ethnicity	0.08	0.07	0.10	49.7
University Qualifications	0.12	0.11	0.15	36.4
Other Post-school Qualifications	0.36	0.36	0.36	-1.4
School Qualifications	0.28	0.28	0.28	1.8
No Qualifications	0.24	0.25	0.21	-14.7
Work Fulltime	0.53	0.51	0.55	7.5
Work Part-time	0.18	0.17	0.18	0.2
Average weekly hours worked <sup>(a)</sup>	36.9	36.9	37.0	0.2
Fraction:				
Reported Income	0.84	0.84	0.84	0.4
Reported Earnings	0.70	0.68	0.73	6.9
Reported Benefits	0.15	0.16	0.13	-15.8
Reported NZ Superannuation	0.02	0.02	0.01	-56.9
Reported Miscellaneous Income	0.07	0.08	0.06	-22.7
Average Total Income	\$27,972	\$26,628	\$29,778	11.8
Average Earnings	\$25,689	\$24,017	\$27,788	15.7
Average Benefit Income	\$1,817	\$1,956	\$1,650	-15.7
Average NZ Superannuation	\$165	\$249	\$90	-63.8
Average Misc. Income	\$301	\$406	\$250	-38.4

Notes: All earnings and incomes are reported in constant 2004 dollar-values, adjusted using the CPI. Ethnicity refers to Statistics New Zealand's "prioritised" ethnicity. Qualifications refer to highest recorded qualification. Fulltime versus Part-time work is determined by whether weekly hours worked are greater or less than 30 hours.

<sup>(a)</sup> Average weekly hours is calculated among those individuals working.



**Table 2 – HLFS-IS Sample Working-age Individuals' Household Characteristics, 1997-2004**

	Sample Year			1998-2004
	All Years	1998	2004	Change (%)
No. Working Age Adults	185,868	23,277	23,047	
Fraction in Households with:				
Single adult, no kids	0.08	0.08	0.09	9.2
Single adult with kids	0.03	0.04	0.03	-9.9
Multiple adults, no kids	0.49	0.49	0.50	1.1
Multiple adults with kids	0.38	0.38	0.38	-1.8
Single adult, retired	0	0	0	
Multiple adults, retired	0.01	0.01	0.01	-20.8
Average No. in Household:				
All Persons	3.25	3.27	3.24	-1.0
Children, aged 0-14	0.78	0.80	0.77	-4.1
Working Age, aged 15-64	2.42	2.42	2.42	-0.1
Retired, aged 65+	0.05	0.05	0.05	2.8
Fraction in Households with:				
Income	0.98	0.98	0.98	0.0
Earnings	0.88	0.86	0.89	3.7
Benefits	0.25	0.26	0.22	-16.3
NZ Superannuation	0.05	0.06	0.05	-24.6
Miscellaneous Income	0.14	0.15	0.12	-21.3
Average Equivalised Total Income	\$37,715	\$35,970	\$40,087	11.4
Average Equivalised Earnings	\$34,695	\$32,560	\$37,453	15.0
Average Equivalised Benefit Income	\$2,044	\$2,193	\$1,809	-17.5
Average Equivalised NZ Super	\$491	\$587	\$417	-29.0
Average Equivalised Misc. Income	\$485	\$630	\$407	-35.4

Notes: All "equivalised" earnings and incomes are reported in constant 2004 dollar-values, adjusted using the CPI, and have been adjusted for the number of people in the household (N) using the LIS (0.5) equivalisation that divides the household income measure by  $N^{1/2}$ .

**Table 3 – JMP Decomposition of Changes in Income Summary Statistics**

	1998-2004 Change	Observed Endowments			Observed Coefficients	Unobserved Effects
		Total	Demographics	Employment		
A. Working-age Individuals' Total Income						
Mean	0.098	74.4%	21.9%	52.5%	25.9%	-0.3%
10 <sup>th</sup>	0.060	66.6%	40.6%	26.0%	15.8%	17.6%
25 <sup>th</sup>	0.153	93.6%	3.2%	90.4%	12.3%	-6.0%
Median	0.098	77.0%	21.2%	55.8%	27.0%	-4.0%
75 <sup>th</sup>	0.052	69.3%	52.9%	16.4%	51.2%	-20.5%
90 <sup>th</sup>	0.062	57.0%	48.2%	8.8%	64.1%	-21.1%
B. Working-age Individuals' Equivalised Total Household Income						
Mean	0.098	72.4%	21.4%	51.0%	27.9%	-0.3%
10 <sup>th</sup>	0.112	81.3%	8.8%	72.5%	23.6%	-4.9%
25 <sup>th</sup>	0.122	73.7%	22.0%	51.6%	32.8%	-6.5%
Median	0.031	179.5%	50.9%	128.7%	-71.1%	-8.5%
75 <sup>th</sup>	0.087	56.0%	28.5%	27.5%	48.8%	-4.8%
90 <sup>th</sup>	0.075	40.4%	13.6%	26.7%	56.7%	2.9%

Notes: For the individual income analysis, the demographic variables are a quadratic in age, dummy variables for gender, marital status, highest qualification (No qualifications, School, Post-school, and University), and ethnicity (Maori, Pacific Island, Asian, and Other); the employment variables are dummy variables for part-time and full-time work.

For the equivalised household income analysis of working-age individuals, the demographic variables are a quadratic in the average age of working-age adults in the household, the number of persons in the household and the fraction who are working-age, the fractions of working-age adults who are female, married, with alternative highest qualification (No qualifications, School, Post-school, and University), and ethnicity (Maori, Pacific Island, Asian, and Other); the employment variables are the fractions of working-age adults working part-time and full-time; and we also include dummy variables for each of the household-types described in Table 2.

**Table 4 – Characteristics of Working-age Individuals**

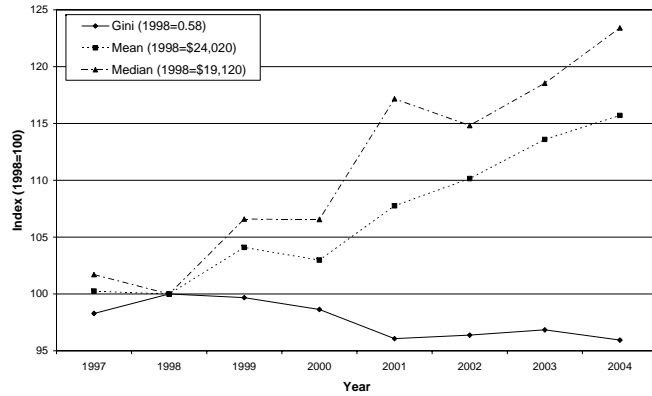
	Percentile of the Total Income Distribution				
	10 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	90 <sup>th</sup>
A: 1998					
Sample Size	406	405	424	379	260
Total Income	\$8,258	\$14,054	\$26,913	\$41,301	\$59,289
Fulltime Work	0.08	0.22	0.74	0.90	0.98
Part-time Work	0.35	0.44	0.15	0.06	0.02
Age	33.8	40.5	36.1	38.4	41.2
Fraction Female	0.55	0.65	0.51	0.35	0.24
No Qualifications	0.30	0.32	0.24	0.17	0.12
School Qualifications	0.34	0.24	0.26	0.22	0.13
Post School Qualifications	0.31	0.38	0.43	0.49	0.42
University Qualifications	0.05	0.06	0.06	0.11	0.33
Maori	0.14	0.13	0.09	0.14	0.06
Pacific	0.07	0.07	0.04	0.03	0.02
Other	0.08	0.07	0.05	0.03	0.04
Pakeha	0.71	0.73	0.81	0.80	0.87
B: 2004					
Sample Size	361	438	574	487	315
Total Income	\$8,903	\$16,728	\$29,845	\$44,662	\$63,525
Fulltime Work	0.07	0.30	0.84	0.94	0.95
Part-time Work	0.32	0.39	0.12	0.05	0.04
Age	37.8	38.8	39.6	40.5	43.5
Fraction Female	0.58	0.69	0.51	0.36	0.25
No Qualifications	0.32	0.30	0.23	0.12	0.08
School Qualifications	0.31	0.28	0.28	0.22	0.13
Post School Qualifications	0.28	0.34	0.38	0.47	0.43
University Qualifications	0.08	0.08	0.11	0.19	0.34
Maori	0.15	0.17	0.10	0.09	0.06
Pacific	0.11	0.07	0.07	0.04	0.02
Other	0.08	0.06	0.06	0.08	0.04
Pakeha	0.66	0.70	0.76	0.79	0.88

**Table 5 – Characteristics of Equivalised Households**

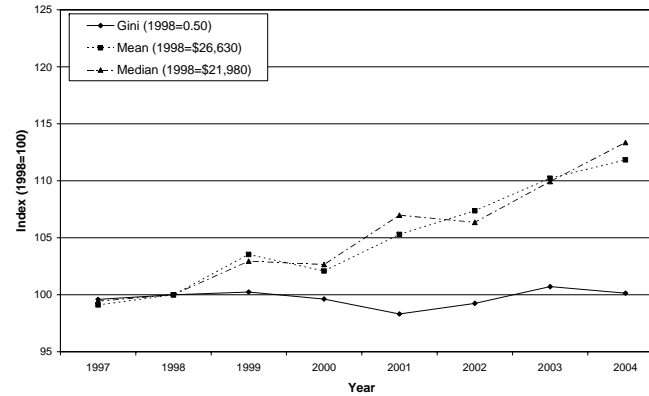
	Percentile of the Total Income Distribution				
	10 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	90 <sup>th</sup>
A: 1998					
Sample Size	469	426	427	386	382
Average Equivalised HH Income	\$13,521	\$20,138	\$33,303	\$49,696	\$67,179
Household size	3.24	3.52	3.28	3.11	2.77
Fraction Working-age	0.67	0.72	0.79	0.90	0.94
Average Working-age Age	35.5	36.6	36.6	36.4	38.3
Fraction Working-age: Working Fulltime	0.13	0.34	0.61	0.74	0.84
Working Part-time	0.20	0.25	0.22	0.16	0.10
Female	0.63	0.52	0.48	0.46	0.46
Married	0.48	0.64	0.63	0.65	0.66
No Qualifications	0.38	0.28	0.24	0.19	0.16
School Qualifications	0.30	0.29	0.27	0.27	0.18
Post-school Qualifications	0.28	0.38	0.40	0.43	0.47
University Qualifications	0.04	0.05	0.08	0.12	0.18
Maori	0.19	0.14	0.09	0.06	0.09
Pakeha	0.67	0.74	0.81	0.89	0.85
Pacific	0.06	0.06	0.04	0.01	0.02
Other Ethnicity	0.08	0.06	0.06	0.04	0.04
Household type: Single Adult	0.12	0.08	0.11	0.04	0.05
Single Adult with kids	0.22	0.03	0.01	0.00	0.00
Multiple adults	0.26	0.36	0.39	0.68	0.82
Multiple adults with kids	0.38	0.52	0.49	0.27	0.13
B: 2004					
Sample Size	443	389	410	349	361
Average Equivalised HH Income	\$14,461	\$23,005	\$37,426	\$54,001	\$73,421
Household size	3.20	3.53	3.04	2.92	2.94
Fraction Working-age	0.68	0.72	0.85	0.90	0.92
Average Working-age Age	39.2	36.3	38.3	37.2	40.0
Fraction Working-age: Working Fulltime	0.18	0.47	0.66	0.78	0.83
Working Part-time	0.25	0.27	0.19	0.15	0.12
Female	0.61	0.53	0.48	0.46	0.50
Married	0.50	0.56	0.63	0.64	0.68
No Qualifications	0.37	0.25	0.22	0.18	0.09
School Qualifications	0.22	0.36	0.25	0.27	0.25
Post-school Qualifications	0.31	0.30	0.42	0.38	0.40
University Qualifications	0.09	0.09	0.12	0.16	0.26
Maori	0.19	0.16	0.15	0.08	0.09
Pakeha	0.64	0.70	0.71	0.86	0.83
Pacific	0.07	0.04	0.05	0.01	0.01
Other Ethnicity	0.09	0.10	0.09	0.06	0.08
Household type: Single Adult	0.13	0.06	0.11	0.05	0.04
Single Adult with kids	0.15	0.03	0.01	0.00	0.00
Multiple adults	0.24	0.39	0.52	0.71	0.76
Multiple adults with kids	0.43	0.52	0.37	0.24	0.20

**Figure 1 – Working-age Individuals Income and Inequality Trends, 1997–2004**

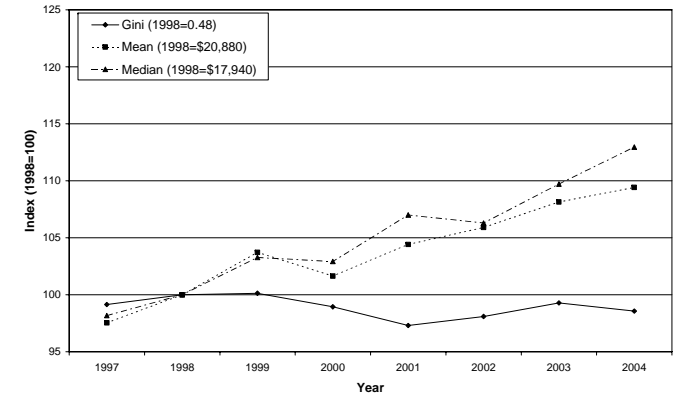
(a) Annualised Earnings



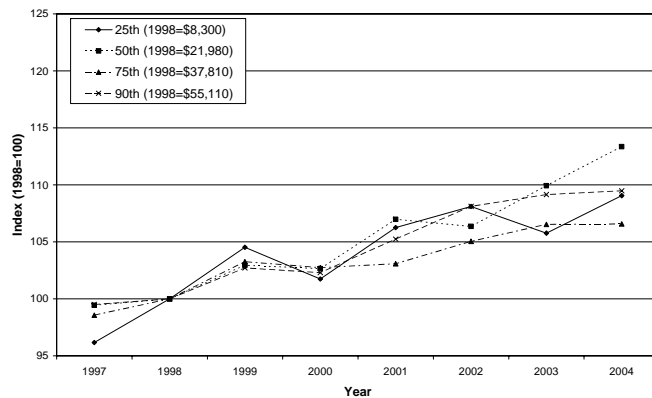
(b) Annualised Total Income



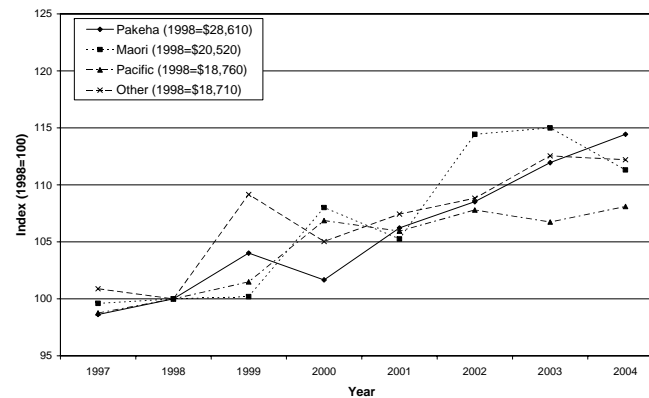
(c) Annualised Post-tax Income



(d) Total Income Percentiles

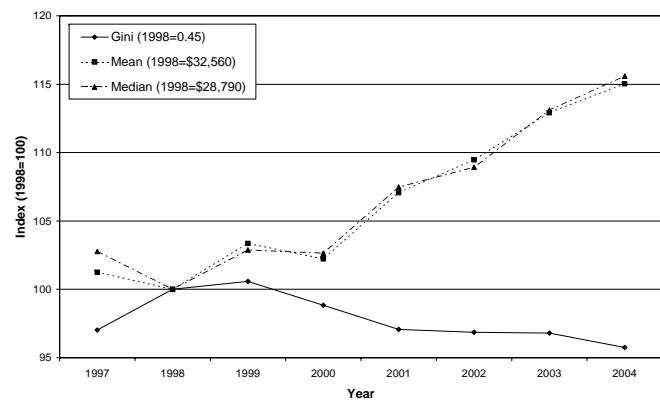


(e) Average Income by Ethnicity

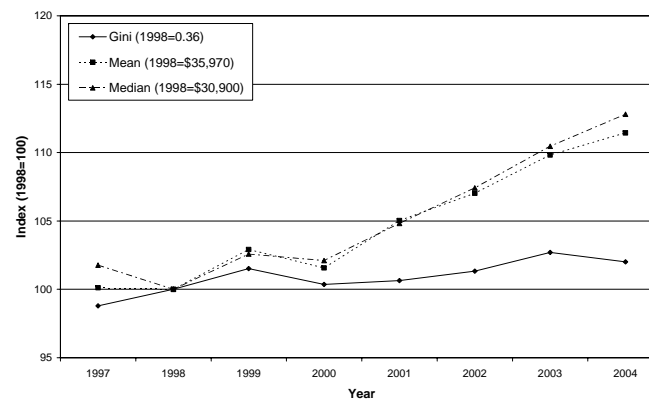


**Figure 2 – Working-age Individuals Equivalised Household Income and Inequality Trends, 1997–2004**

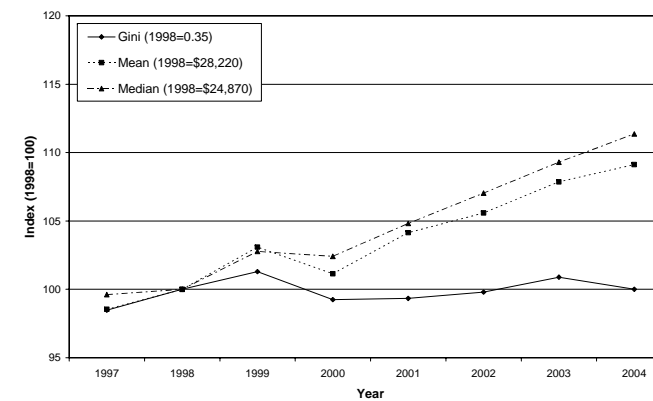
(a) Annualised Earnings



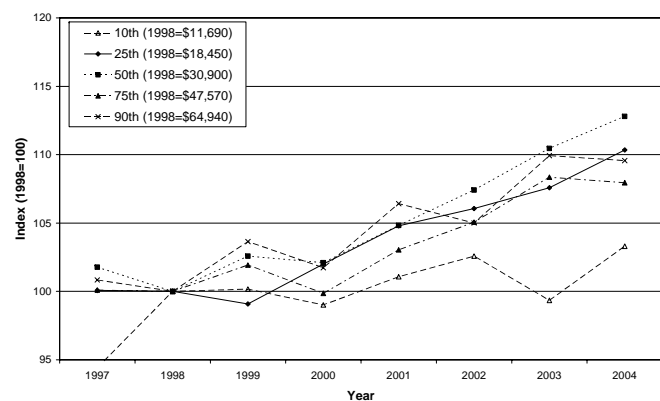
(b) Annualised Total Income



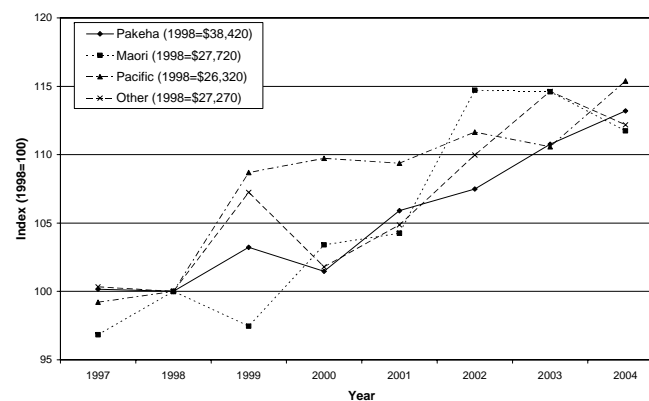
(c) Annualised Post-tax Income



(d) Total Income Percentiles

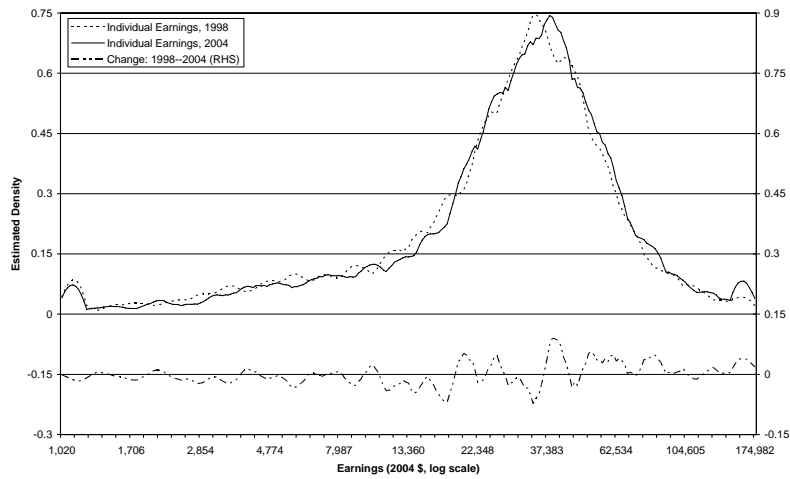


(e) Average Income by Ethnicity

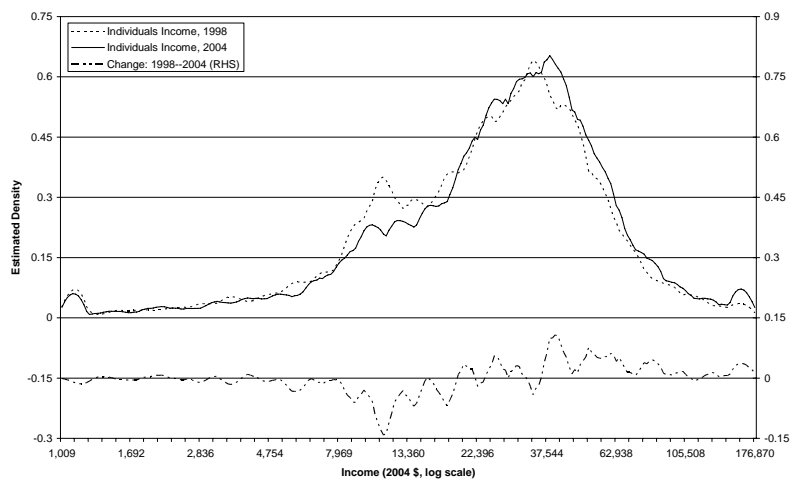


**Figure 3 – Working-age Individuals' Earnings and Income Distributions, 1998 and 2004**

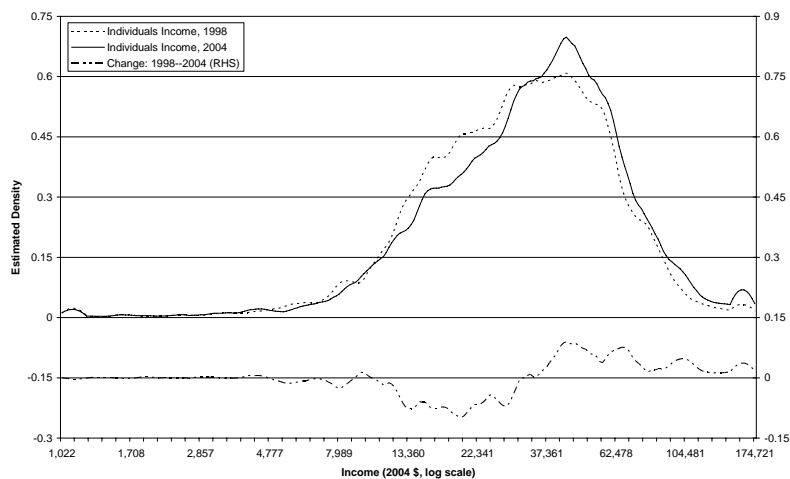
**(a) Annualised Weekly Earnings Distribution**



**(b) Annualised Weekly Income Distribution**

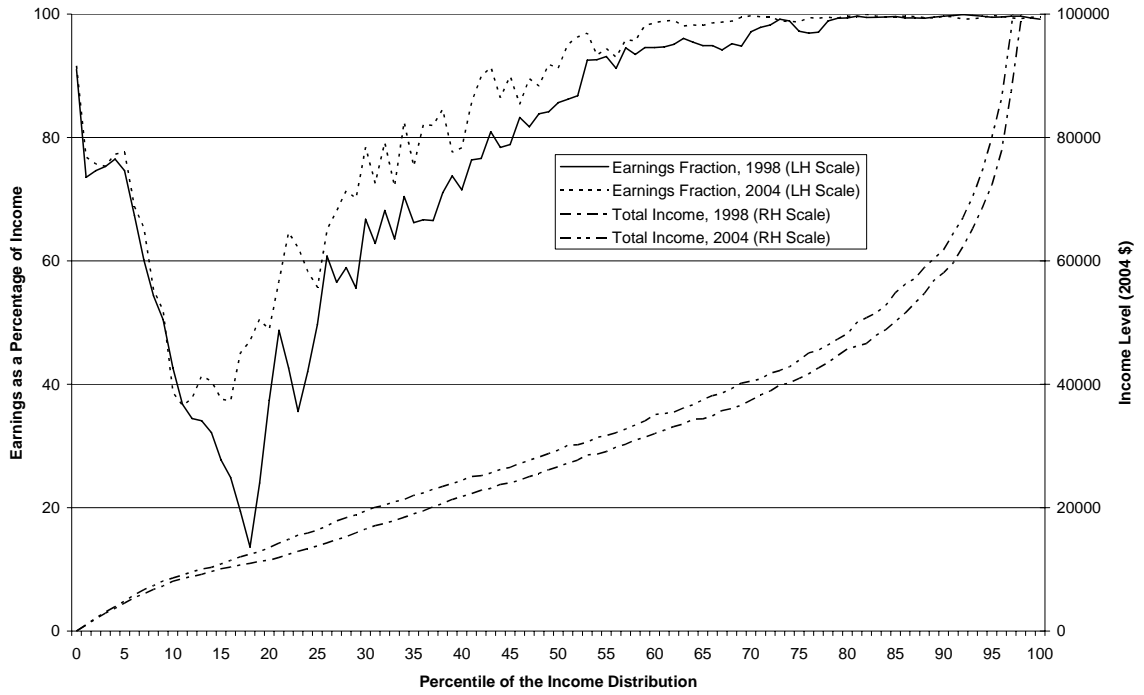


**(c) Equivalised Household Annualised Weekly Income Distribution**

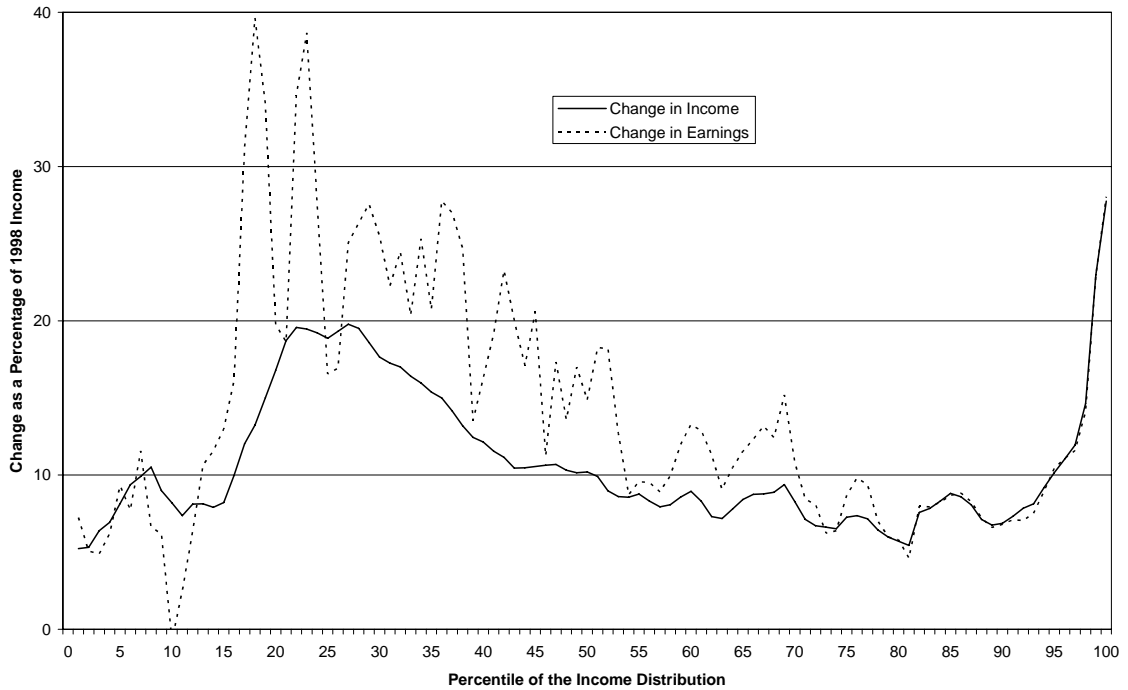


**Figure 4 – Contributions to Individual Income Levels and Changes, 1998–2004**

**(a) Income Levels, and Earnings Contributions**



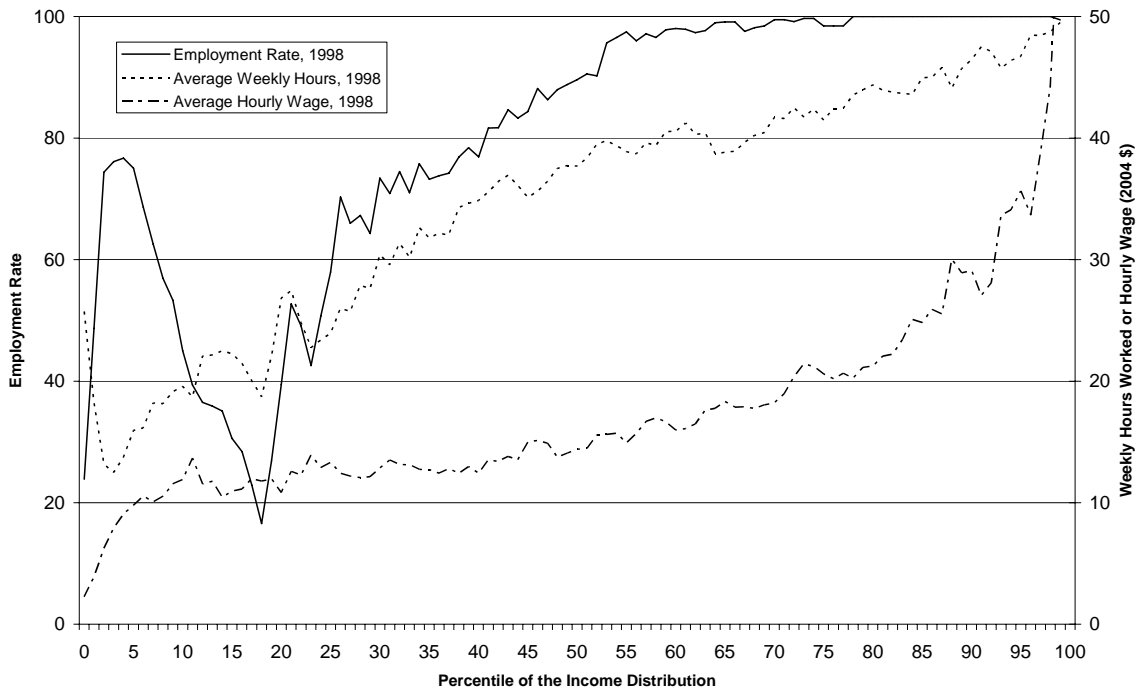
**(b) Income and Earnings Changes Relative to 1998 Income**



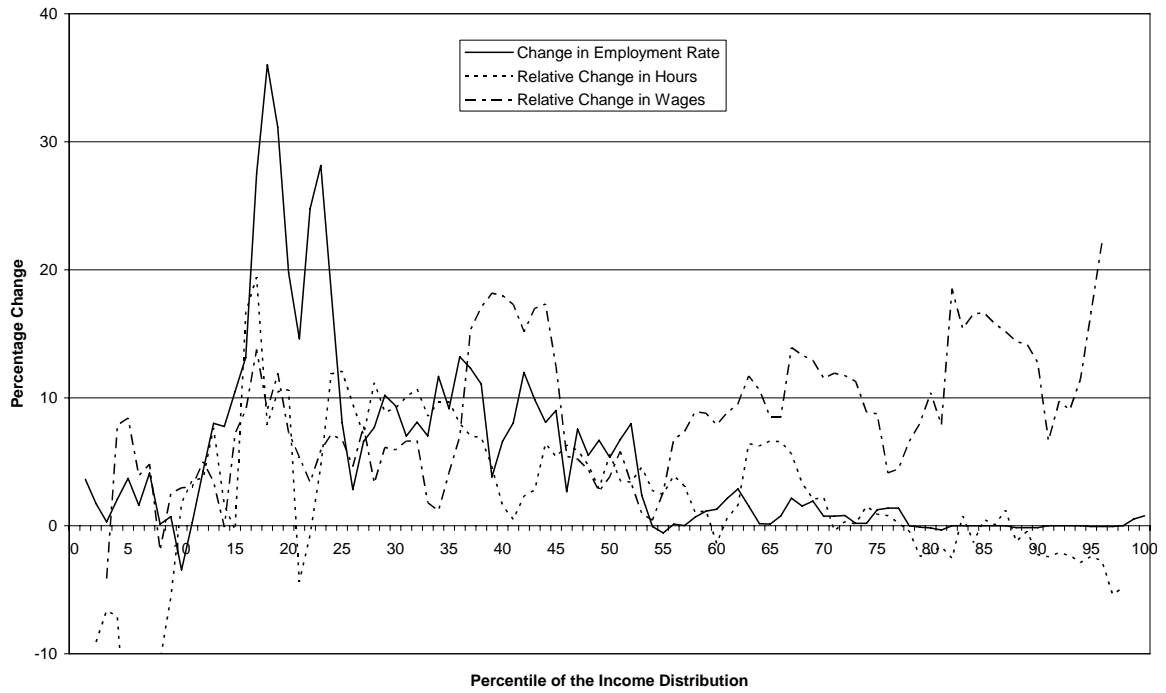


**Figure 5 – Working-age Individuals’ Employment, Hours Worked, and Wages**

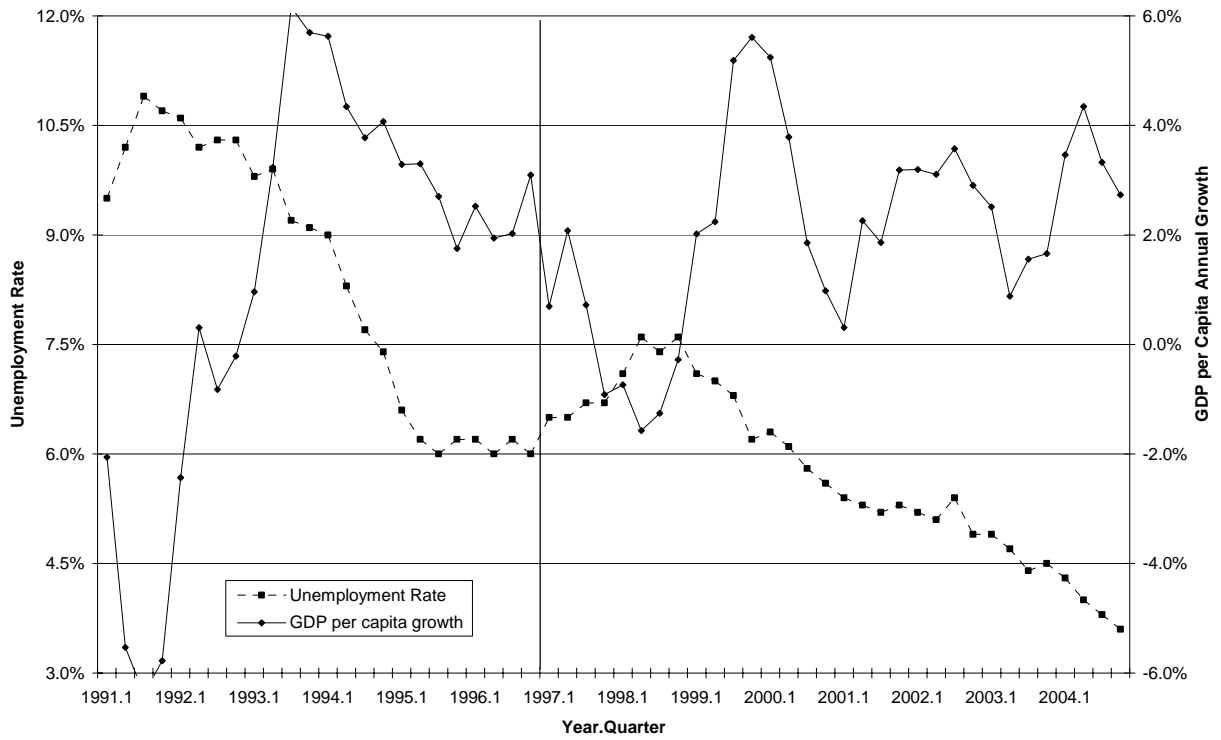
**(a) Averages, 1998**



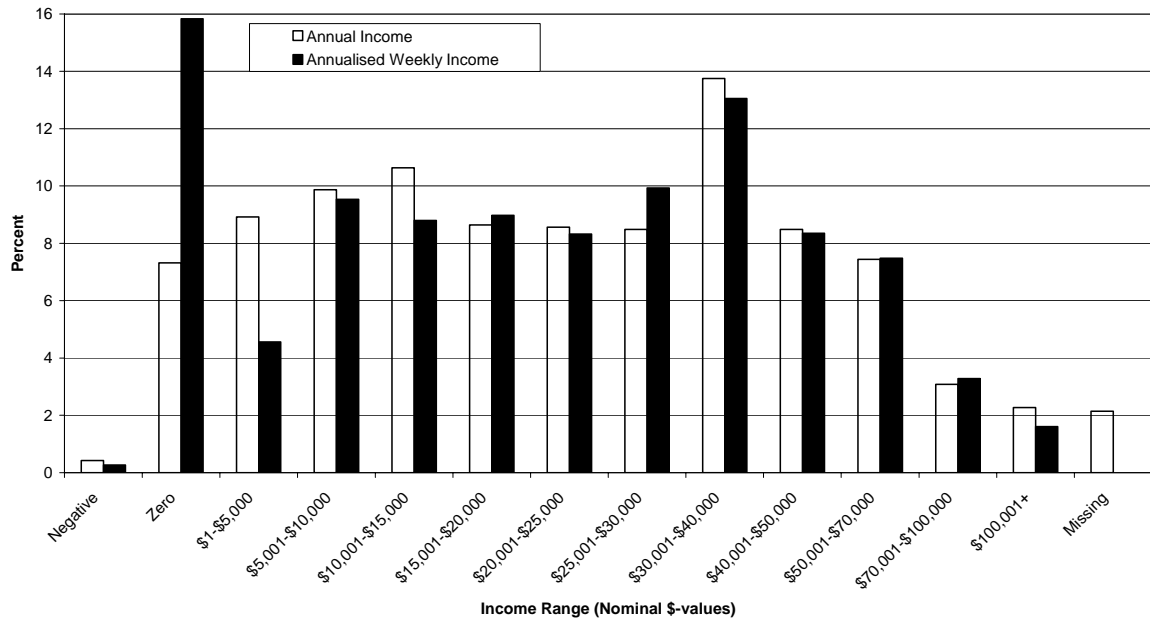
**(b) Changes, 1998—2004**



**Figure A1 – New Zealand Business Cycle Trends, 1991–2004**

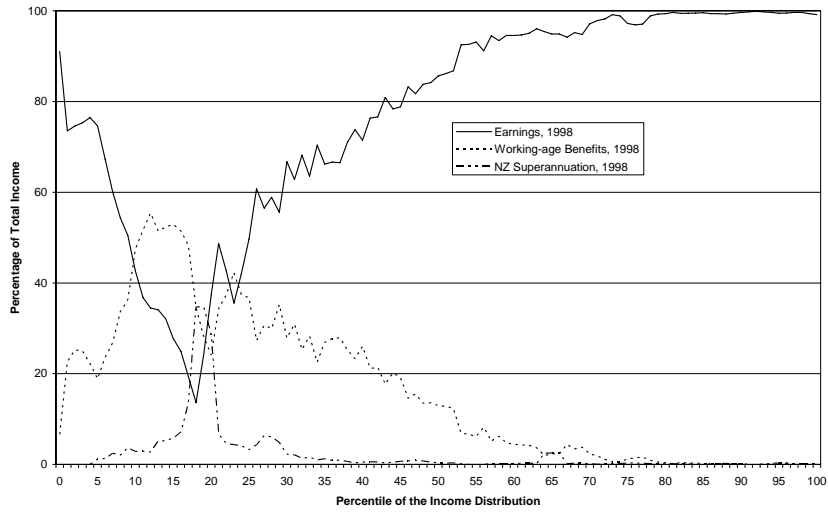


**Figure A2 – HLFS Annual and Annualised Weekly Income Distributions, 1997–2004**

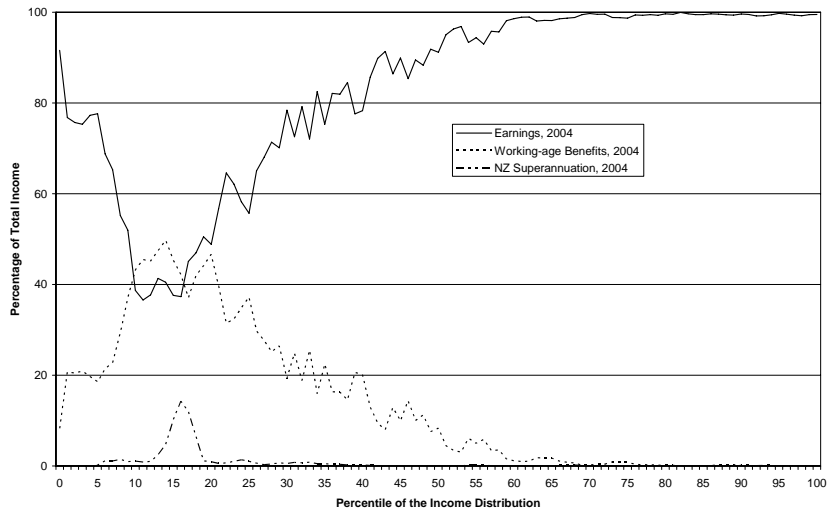


**Figure A3 – Contributions to Working-age Individuals' Total Income**

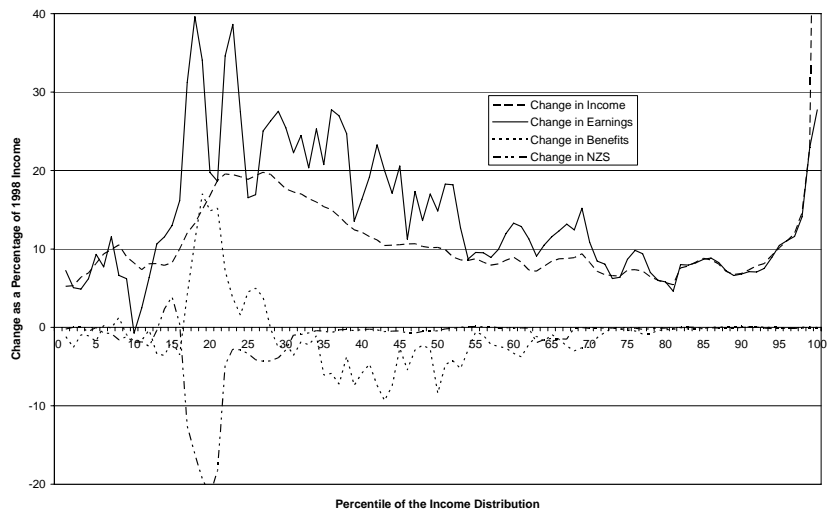
**(a) Earnings, Benefits and NZ Superannuation in 1998**



**(b) Earnings, Benefits and NZ Superannuation in 2004**

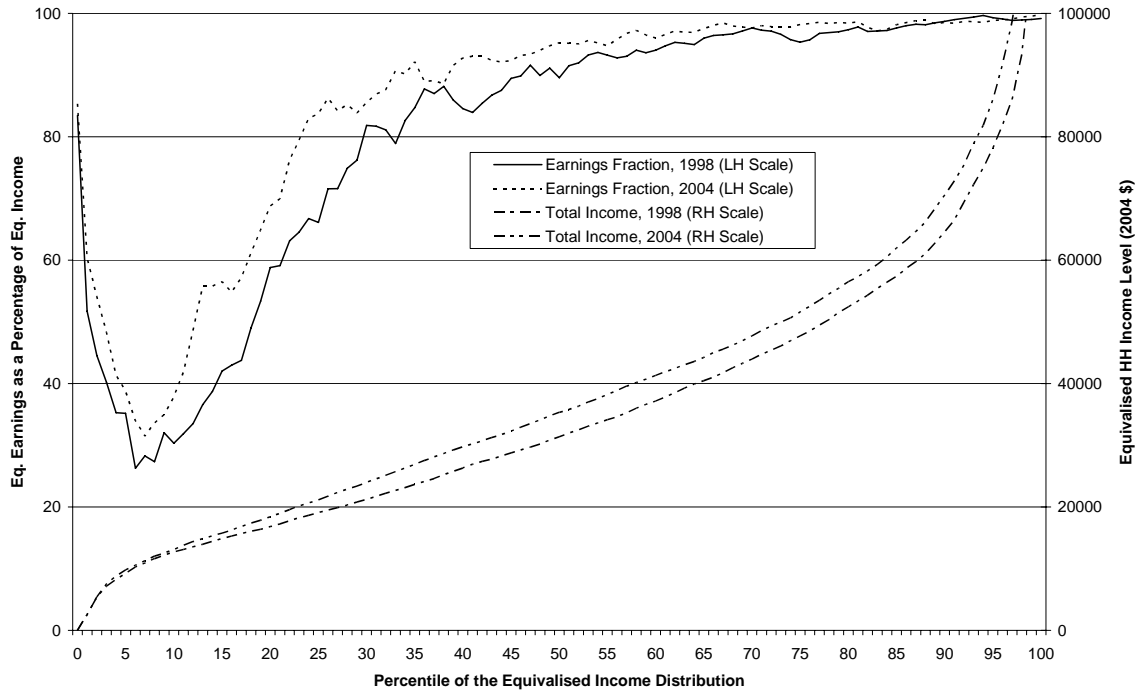


**(c) Changes Relative to 1998 Income**

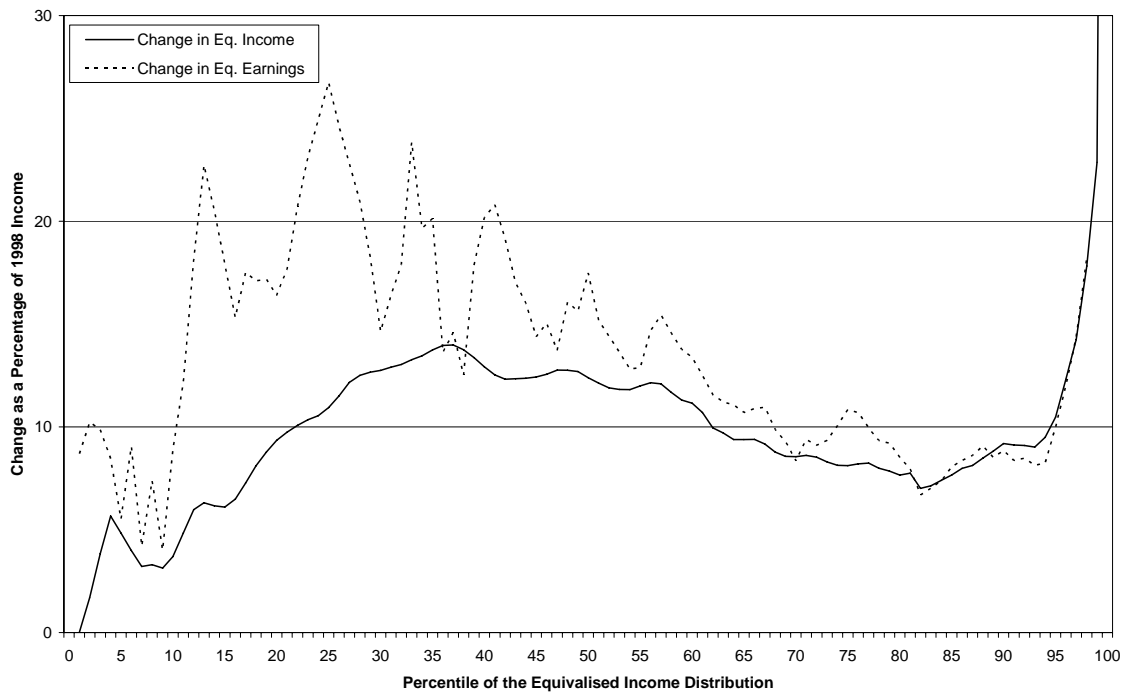


**Figure A4 – Contributions to Working-age Individuals' Equivalised Household Income Levels and Changes, 1998–2004**

**(a) Equivalised Income Levels, and Equivalised Earnings Contributions**

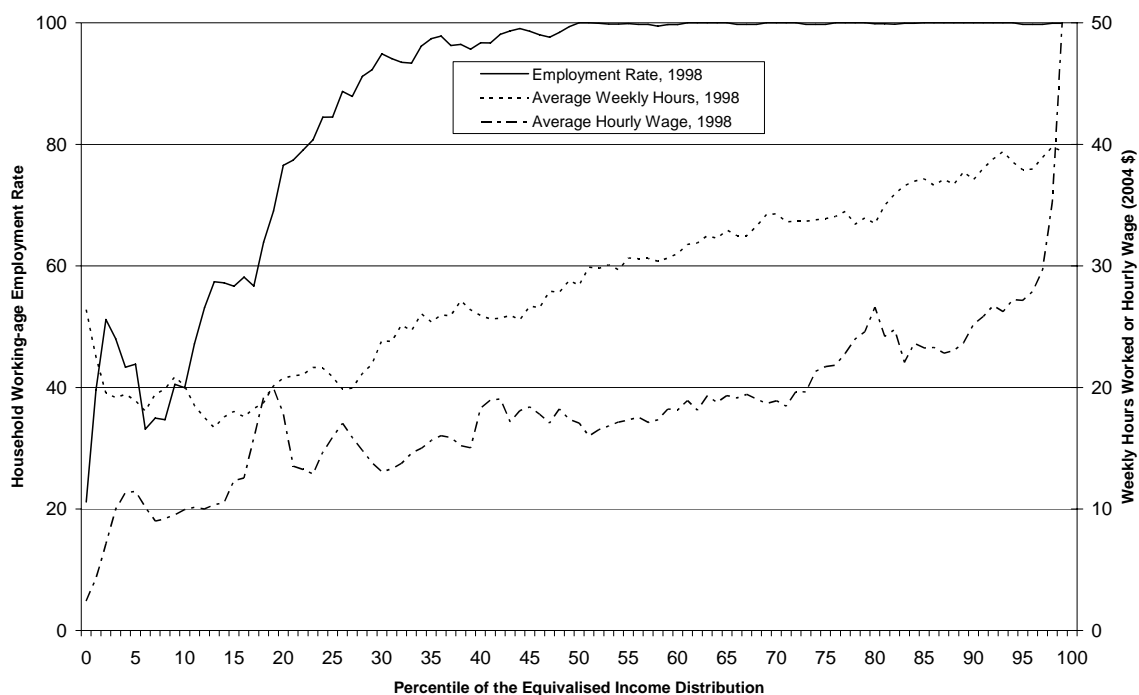


**(b) Income and Earnings Changes Relative to 1998 Equivalised Income**

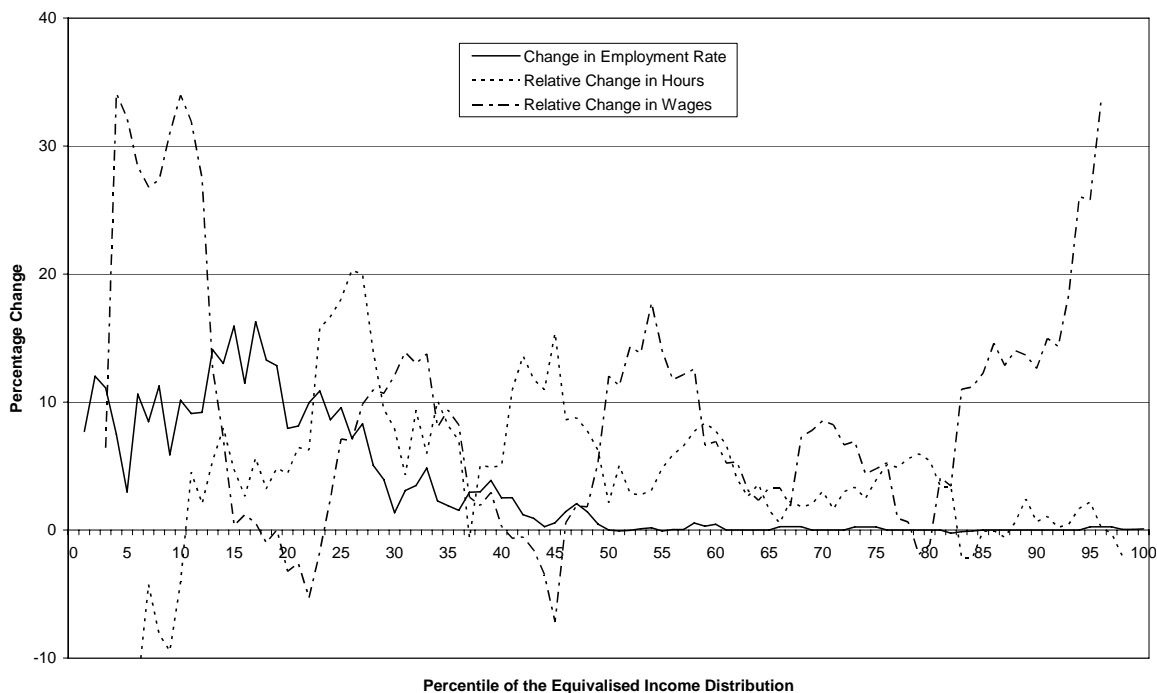


**Figure A5 – Household Working-age Employment, Hours Worked, and Hourly Wages**

**(a) Averages, 1998**

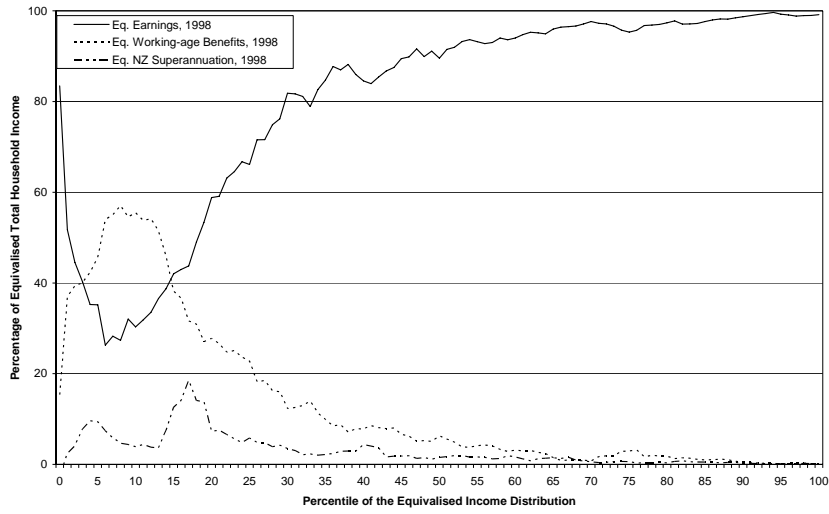


**(b) Changes, 1998—2004**

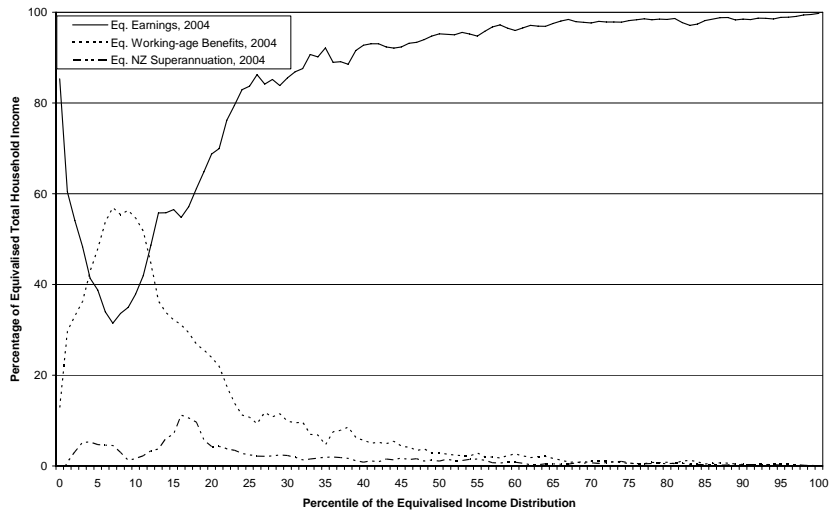


**Figure A6 – Contributions to Individuals' Equivalised Household Income**

**(a) Equivalised Earnings, Benefits and NZ Superannuation in 1998**



**(b) Equivalised Earnings, Benefits and NZ Superannuation in 2004**



**(c) Changes Relative to 1998 Equivalised Income**

