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Abstract
This article analyses changes in the distributions of working-age individuals’ earnings and total income in New Zealand over the period 1998–2004. We find that there have been broad gains in income across the distribution, suggesting the spoils of growth have been shared widely. Mean and median earnings increased 15 and 23 per cent respectively, while mean and median income increased 12–13 per cent. Inequality, as measured by the Gini coefficient, was more stable: earnings inequality fell 4 per cent, while income inequality was unchanged. The main drivers of the changes were employment and real wage growth. We estimate that roughly one-half of the growth in average incomes was due to employment growth, and one-quarter each to demographic changes and wage growth. The relative employment and wage contributions varied across the income distribution; employment growth dominated gains at the lower end of the distribution, while wage gains dominated changes at the higher end.

1. Introduction
The dramatic increases in income inequality in New Zealand during the late 1980s and early 1990s have been widely documented (for example, Chatterjee 2004; Chatterjee and Podder 2003; Dixon 1996, 1998; Hyslop and Maré 2001, 2005; O’Dea 2000; Podder and Chatterjee 2002). This was a period of both significant economic and social policy reform and stagnant economic growth. In contrast, since the early 1990s New Zealand has experienced two extended periods of economic growth, from 1993 until 1997 and then from 1998 until the present, interrupted by a relatively brief and shallow recession during 1997–98. The literature on changes in inequality during the 1990s has generally found relatively modest changes during the first of these growth periods (for example, Hyslop and Maré 2001, 2005; Podder and Chatterjee 2002).

The current research focuses on how the benefits of growth, as measured by income, have been distributed across the population over the period 1998–2004. In contrast to the 1980s and 1990s during which there were substantial policy changes in New Zealand, the period since 1998 may be roughly characterised as comparatively stable in terms of the domestic policy environment, and as a period of resilient economic growth in the face of external economic shocks. For example, the period included international events such as the September 11 terrorist attacks, together with more direct potential economic shocks such as the 1998 Asian Crisis, and a large devaluation of the New Zealand dollar followed by a revaluation
against other currencies (for example, the trade-weighted exchange rate index fell from 69 at the start of 1997 to a low of 47 in late 2000, before rising to 69 again in late 2004). As well as updating the literature on distributional changes in New Zealand, the article provides a more specific analysis of the distributional impacts during this period of extended employment and economic growth.

We use data from the New Zealand Household Labour Force Survey and its annual Income Supplement, and concentrate primarily on changes in the distributions of gross pre-tax income and employment-related earnings of working-age individuals (aged 15–64).2 Our methodology involves three analyses. First, we describe the trends in real (inflation-adjusted) earnings and income levels, and relative inequality over the period. We also provide kernel density estimates of the distributions of individuals’ earnings and income in 1998 and 2004. Second, based on the findings from these descriptive trends, we turn our attention to the factors contributing to the observed changes in the individual income distributions over the period. Given the sustained growth over the period, employment and real wage growth are the major contributors to the changes. Thus, we rank-order individuals by their income, and describe the relative change in income at each percentile of the distribution between 1998 and 2004. We then estimate the contributions of earnings, and then employment, hours and wages, to the relative changes in income across the distribution. Our third analysis adopts a method developed by Juhn, Murphy and Pierce (1993) to decompose changes in individual incomes into observable socio-demographic and human capital, employment, wage (returns), and unobserved effects at various points of the respective income distributions.

The patterns of increasing earnings and incomes described in these analyses indicate there has been widespread gains across the distribution. The attribution of the changes to employment and wage effects across the distribution indicates that the gains at the lower end of the distribution were primarily driven by employment growth, while the gains in the higher reaches of the distribution were largely the result of wage growth.

2. Background and Data Description

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 primarily interested in the distributional changes may wish to skip the data description.

![Figure 1 New Zealand Business Cycle Trends, 1991–2004](image-url)
2.1 Background

Figure 1 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 per cent in 1991 to 6 per cent in 1995–96, while per capita real annual GDP growth was between 2 and 6 per cent over the 1993–1997 period. Second, economic activity contracted during 1997–98: unemployment increased from 6 per cent to 7.5 per cent in 1998, and per capita annual GDP growth was negative for five quarters during 1997 and 1998. Finally, from late 1998 to 2004 the economy expanded continuously: unemployment fell steadily to around 3.5 per cent by the end of 2004, and per capita annual GDP growth was always positive and averaged 2–3 per cent 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 years 1998 and 2004. We choose 1998 in preference to 1997 as the initial year for the analysis both because 1998 corresponds more closely to the bottom of the most recent business cycle allowing an analysis of trough-to-peak changes, and also because 1998 is the end point for much of the earlier literature on income distribution changes during the 1980s and 1990s. The strong economic upswing, together with the absence of major policy shocks over the 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.

There are some potentially important caveats to acknowledge for the analysis. In particular, our income measures exclude family support and other tax credits that are becoming increasingly important components of the New Zealand family welfare system, although the period of analysis predates the introduction of the recent Working for Families package of changes. Also, except for a simple estimate of post-tax income, our measures of income are essentially pre-tax gross income.

2.2 Data Description

The data we analyse come from the New Zealand Household Labour Force Survey (HLFS) and its Income Supplement (HLFS-IS). The HLFS is a quarterly survey of about 15000 households and 30000 individuals aged 15 and over that collects information on labour force status, hours worked, and demographic characteristics of individuals and households, but it does not collect any wage or income information. However, since 1997 the June quarter HLFS has included an annual income supplement (also known as the New Zealand Income Survey) to collect information on income from a variety of sources.

The HLFS-IS collects information on wage and salary earnings 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. Each income source was converted to a weekly basis and presented as such in the HLFS-IS data extract provided by Statistics New Zealand, except for investment income that was excluded for confidentiality reasons. In addition to this information on sources of ‘weekly’ income, the HLFS-IS also asks a categorical-response question on individuals’ total income over the last year. Although annual income would be preferred to weekly income for distributional analysis, we concentrate on the weekly measure because of its continuous nature, and it 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, together with a comparison of the weekly and annual income measures. Based on this...
comparison, we believe that the weekly income measure provides a reasonable proxy for annual income. This is in line with Boëheim and Jenkins (2000) who also conclude that current and annual income measures provide very similar estimates of the income distribution in the United Kingdom. For comparability with other studies that focus on annual income, we use ‘annualised’ weekly earnings and income measures, calculated by multiplying the weekly variables by 52.14. Also, nominal incomes are adjusted for inflation using the Consumer Price Index (CPI), and expressed in September quarter 2004 dollar values.

Table 1 presents sample means of various socio-demographic, employment and income

| Table 1 | HLFS-IS Working-Age Individuals’ Characteristics, 1997–2004* |
|----------------|-------------------------------------------------|----------------|----------------|----------------|
| Sample year | All years | 1998 | 2004 | 1998–2004 change (per cent) |
| Number of working-age adults | 18568 | 23277 | 23047 | |
| 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 full-time | 0.53 | 0.51 | 0.55 | 7.5 |
| Work part-time | 0.18 | 0.17 | 0.18 | 0.2 |
| Average weekly hours workedb | 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 | $27972 | $26628 | $29778 | 11.8 |
| Average earnings | $25689 | $24017 | $27788 | 15.7 |
| Average benefit income | $1817 | $1956 | $1650 | –15.7 |
| Average NZ Superannuation | $165 | $249 | $90 | –63.8 |
| Average miscellaneous income | $301 | $406 | $250 | –38.4 |

Notes: (a) 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. Full-time versus part-time work is determined by whether weekly hours worked are greater or less than 30 hours. (b) Average weekly hours is calculated among those individuals working.
characteristics of the HLFS-IS data over the period 1997–2004 for working-age individuals. The sample means are based on the full samples, including both proxy responses in either the HLFS main survey or the HLFS-IS and imputed income values in the HLFS-IS. The first column 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 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. Substantial fractions of responses have either imputed incomes (about 15 per cent each year) and/or are completed by proxy (an additional 13 per cent on average). Individuals with proxy and/or imputed responses are somewhat more likely to be reported as male, working full-time, having no qualifications, and having lower earnings and income; however, other characteristics and their 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.

The main observed changes in the demographic characteristics of working-age individuals between 1998 and 2004 involved ethnicity and qualifications. There were large relative increases in the fraction of working-age individuals with Pacific Island (21 per cent) and ‘Other’ ethnicity (50 per cent) (that is, non-Maori, Pakeha and Pacific Island), matched by a 6 per cent decline in the fraction reporting Pakeha ethnicity.³ There was also a large increase in the fraction of individuals with university-level qualifications (36 per cent), and a large decrease in the fraction with no formal educational qualifications (15 per cent).

The employment rate increased from 68 per cent to 73 per cent between 1998 and 2004 and was due almost entirely to an increase in the full-time employment rate from 51 per cent to 55 per cent.⁴ Conditional on employment, average hours worked were roughly constant (at 37 hours per week) over the period. Despite the

increase in employment, the fraction of individuals receiving (any) income remained constant at 84 per cent; the fraction receiving welfare benefits fell from 16 to 13 per cent. There was also a drop in receipt of New Zealand Superannuation (NZS) payments, largely due to the age of eligibility increasing from 63 in 1997 to 65 by 2001 (the small incidence of NZS among working-age individuals in 2004 may be due to either errors in the reported age in the HLFS and/or under-age qualifying spouse payments). The fraction reporting other miscellaneous income, which we calculate as a residual, fell from 8 to 6 per cent over the period.

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

In summary, between 1998 and 2004 there have been significant increases in earnings and total income, and a decrease in benefit income. Associated with these changes was a substantial increase in employment, particularly full-time employment. The main demographic changes were increases in the fraction of Pacific Island and ‘Other’ ethnicities, and increasing levels of educational qualifications.

3. Trends and Changes in Income Distributions

We now turn to a graphical description of changes in the distribution of individual incomes over the period. This section provides two alternative descriptions of the changes over the period. First, we describe the relative trends in alternative summary statistics characterising the level and dispersion of individual incomes over the 1997–2004 period. Second, we present a more detailed comparison of the
3.1 Trends in Summary Statistics

Figure 2 describes trends in alternative individual earnings and incomes measures over the sample period. All trends are based on unconditional earnings and incomes—that is, including zero and negative values. In order to emphasise the relative change between our focus years (1998 and 2004), we index all series to a value of 100 in 1998. First, Figure 2a shows the trends in the mean and median individual earnings, together with the commonly used 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 per cent between 1998 and 2004 (as seen in Table 1). By comparison, median earnings fell about 2 per cent in 1998 and then increased steadily, and somewhat more strongly than mean earnings, over the remainder of the period, resulting in a 23 per cent increase between 1998 and 2004. As a result of the stronger increase in median earnings, the median to mean earnings ratio increased from 80 per cent in 1998 to 85 per cent in 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 per cent over the period.

Figure 2b shows the corresponding trends in the mean, median and Gini coefficients of individuals’ total gross (that is, pre-tax) income. These trends are similar to those observed for earnings, although the trends in mean and median income were very similar, and increased less than for earnings: mean and median incomes increased 12–13 per cent versus 16 and 23 per cent respectively for earnings. This largely reflects the mitigating effect of the loss of benefit income associated with the increase in employment and earnings. Also, 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.

Figures 2c to 2e describe further the trends in individuals’ income. Figure 2c shows the trends in the mean, median and Gini coefficient of individuals’ estimated post-tax income, derived simply by applying the income tax schedule to their reported annualised total income. This assumes individuals’ reported weekly income accrues continuously over the full year, and ignores family and other tax credits. The trends are broadly similar to those in Figure 2b. The lower increase in mean compared to median post-tax income between 1998 and 2004 (about 10 versus 13 per cent) is partly due to the introduction of the 39 per cent marginal tax rate for incomes over $60000 in 2000: all else equal, the introduction of the 39 per cent 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 per cent) in the Gini coefficient over the period.

Figure 2d describes the trends in alternative percentiles (25th, 75th and 90th, together with the median) of individuals’ annualised gross income. (We exclude the 10th percentile from this analysis as it is always zero.) This figure shows no clear pattern of relative gains across the income distribution. For example, the relative gain in median incomes was larger than the other three percentiles, but only dominated gains at the 75th percentile after 2000. Also, while gains at the median were stronger than at the 75th and 90th percentiles, the net gain over the period at the 25th and 90th percentiles was about the same. (To some extent these findings depend on the particular points in the distribution considered and will be revised somewhat with more detailed analysis in subsequent sections, so they should be interpreted with some care.)

Finally, Figure 2e describes the trends in mean incomes for each of the four 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 per
Figure 2  Working-Age Individuals’ Income and Inequality Trends, 1997–2004

(a) Annualised Earnings

Index (1998 = 100)

- Median (1998 = $19120)
- Mean (1998 = $24020)
- Gini (1998 = 0.58)∗

Gini (1998 = 0.58)∗

Mean (1998 = $24020)

Median (1998 = $19120)

1997 1998 1999 2000 2001 2002 2003 2004

(b) Annualised Total Income

Index (1998 = 100)

- Median (1998 = $21980)
- Mean (1998 = $26630)
- Gini (1998 = 0.50)

1997 1998 1999 2000 2001 2002 2003 2004

(c) Annualised Post-Tax Income

Index (1998 = 100)

- Median (1998 = $17940)
- Mean (1998 = $20880)
- Gini (1998 = 0.48)

1997 1998 1999 2000 2001 2002 2003 2004

(d) Total Income Percentiles

Index (1998 = 100)

- 25th (1998 = $8300)
- 50th (1998 = $21980)
- 75th (1998 = $37810)
- 90th (1998 = $55110)

1997 1998 1999 2000 2001 2002 2003 2004

(e) Average Income by Ethnicity

Index (1998 = 100)

- Pakeha (1998 = $28610)
- Maori (1998 = $20520)
- Pacific (1998 = $18760)
- Other (1998 = $18710)

1997 1998 1999 2000 2001 2002 2003 2004

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cent), while the average incomes of the ‘Other’ group appear to be lagging since 2002 and increased about 8 per cent between 1998 and 2004.

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 earnings and incomes. These patterns suggest that the increase in employment over the period led to 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.

3.2 Distributional Changes

We now concentrate on describing more fully the 1998 and 2004 distributions of working-age individuals’ earnings and total income, 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. For this analysis we exclude zero earnings and incomes, but include negative self-employment earnings and incomes and so, in contrast to the descriptions presented above, this analysis is conditional (on non-zero incomes). This has little impact on individuals’ incomes since 84 per cent of individuals have non-zero total income in either year. However, the fraction of individuals with non-zero earnings increased from 68 per cent in 1998 to 73 per cent in 2004. Thus, any observed changes in the earnings distribution 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. In addition, each distribution has been estimated on a logarithmic scale, and we have censored log(income) below 7 (about $1100) and above 12 (about $163000) so as to restrict the income range displayed while still representing accurately the degree of (non-zero) mass in each tail (left censoring also provides a convenient way to handle negative incomes in a logarithmic context). The effect of censoring shows up on the figures as mass points at each end of the income ranges.

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 and in 2004, and the change between 1998 and 2004, 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 rightward 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 levels. For example, mean conditional earnings increased by about 7.5 per cent and median earnings increased by about 4 per cent over this period. (Note that these increases are lower than the unconditional increases described in Table 1 because of the increase in employment over the period.)

Given the similarity of the earnings distributions in 1998 and 2004, a simple way to compare them formally is by using a Kolmogorov-Smirnoff (KS) test of the equality of two distributions (see Conover 1999). Given that the mean and median increased over the period, it is unsurprising that the null hypothesis that the two distributions are equal is easily rejected (p-value = 0.000), and the maximum difference between the cumulative earnings distributions in 1998 and 2004 is 4.4 per cent. A more useful statistical comparison may be obtained by first adjusting the two distributions to have the same mean (or median) and, possibly, standard deviation. For this purpose we adjust 1998 earnings to have the same mean and standard deviation as the 2004 distribution; see Jenkins and Van Kerm (2004) for a discussion of this decomposition method. Specifically, for each individual’s earnings in 1998, 1998, we constructed 1998 = 1998 (1998) / 1998 + 1998, where 1998 and 1998 are the mean and standard deviation of earnings in year t, and then compared the distribution of 1998 with the 2004 distribution. To the extent that the hypothesis that these
distributions are equal is accepted, this implies the distributional changes are adequately summarised by the change in mean and standard deviation over the period. The KS test again easily rejects this hypothesis (p-value = 0.000) and, although the maximum difference between the cumulative distributions is now 3.4 per cent, this adjustment does not noticeably improve the match between the 1998 and 2004 distributions. Similar results are obtained based on analogous mean or median adjustments.

Figure 3 presents 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 per cent increases in the mean and median. Again, there is a (visually) modest drop in density in the lower income range, and an increase in the upper income range. A significant fraction of the fall in density around the $10000–$13000 range appears to be due to the effect of the increasing age of
eligibility for NZS over the period: 63- and 64-year-olds were eligible for NZS in 1998, but they were ineligible by 2004. For example, the drop in the fraction receiving NZS accounts for one-third of the (3.2 per cent) fall in the density in this range. In addition, full-time and part-time employment rates of individuals aged 63–64 years increased 20.5 and 7.7 percentage points respectively (compared with 12.3 and 2.4 percentage points for those aged 61–62 years)—Hurnard (2005) also discusses the substantial impact of the rising age of eligibility on labour force participation rates of age-affected workers. 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 20th and 30th percentiles of the income distribution. The KS tests again reject the equality of the 1998 and 2004, and the mean and standard deviation adjusted, distributions (p-values = 0.000); however, the adjustment again does lower the maximum difference in the cumulative distributions from 6.2 per cent to 2.6 per cent.

Our summary of the changes in the income distributions is that there have been comparatively steady increases in individuals’ earnings and incomes. Although the formal KS tests reject the equality of the distributions, with the exception of the $10000–$13000 range, there are few dramatic localised changes in the distributions over the period. This conclusion is largely in line with the summary statistics presented in Table 1 and the trends shown in Figure 2, and in sharp contrast to the dramatic distributional changes observed during the 1980s and 1990s in New Zealand. For example, the kernel density estimates in Hyslop and Maré (2001, 2005) show a large hollowing out of the middle of the distribution and widening tails between the early 1980s and late 1990s. This suggests that focusing on changes in summary statistics of the distribution may provide an adequate account of the changes.8

4. Decomposition Analyses of Changes

We now consider more formally decomposing changes in alternative summary measures of individual income distributions between 1998 and 2004. We focus on the contributions of direct labour market effects (that is, 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. We then consider analyses that decompose the relative change in income at various points of the distribution into components attributable to observable demographic, employment and household structure changes, components attributable to changes in the economic ‘returns’ to these factors, and components attributable to unobserved factors.

4.1 Changes across the Income Distribution

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

Figure 4a shows the average income across the percentile-strata in each of 1998 and 2004, together with the fraction of (non-investment) income from earnings in each year.9 The fraction of income from earnings has a V-shape across the distribution in both years. In 1998, the fraction drops sharply from around 90 per cent in the lowest percentile to below 20 per cent at the 18th percentile, and then rises to about 60 per cent at the 30th percentile, 80 per cent at the 45th percentile, and (almost) 100 per cent by the 75th percentile. A similar pattern is observed in 2004, although the earnings fraction barely falls below 40 per cent, and is consistently higher across the distribution than in

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1998. The much lower earnings fraction in 1998 between the 15th and 20th percentiles is largely associated with NZS income available to 63- and 64-year-olds in that year.

Figure 4b next describes the increases in income and earnings at each percentile of the distribution between 1998 and 2004, both expressed relative to 1998 income levels. The thin line shows strong relative income gains in the order of 20 per cent around the 3rd decile of the distribution, and lower gains elsewhere. As noted earlier, this is somewhat at odds with the patterns in Figure 2d that shows similar gains (in the order of 10 per cent) at different points of the distribution. The differences are due partly to the particular choice of percentile points, and partly because Figure 2d was based on the unconditional distribution (that

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Figure 4 Contributions to Individuals’ Income Levels and Changes, 1998–2004

(a) Income Levels and Earnings Contributions

(b) Income and Earnings Changes Relative to 1998 Income

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is, including zero and negative incomes), so that the percentile points differ. In addition, the current figures are based on within-percentile group averages rather than percentile points, so they are not strictly comparable.

The relative earnings increases, represented by the thick line, are especially large in the low to middle range of the income distribution. Thus, Figures 4a and 4b show that incomes increased across all percentiles in the distribution, and emphasise the strong contribution of employment earnings to the increases between the 10th and 70th percentiles of the distribution over the period.

We pick up on the latter point by showing, in Figure 5, the changes in the factors that contribute to earnings (that is, being employed, hours worked and hourly wages). Figure 5a shows the employment rate, and average 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

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

(a) Averages, 1998

(b) Changes, 1998–2004

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distribution. The employment rate and hours worked gradients are steeper at low-to-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 constant hours or an increase in hours worked conditional on full-time or part-time employment status.

Figure 5b describes the changes between 1998 and 2004 in each of these factors across the distribution. This figure shows that individual employment increases were concentrated between the 10th and 55th percentiles of the distribution (largely because there is essentially full-employment by this point). Although the patterns in changes in hours and wages are less clear, broadly speaking there appears to have been some positive relative increases in hours worked in the low to middle range (10th–60th percentiles) of the distribution, and somewhat stronger relative wage increases in the top half of the distribution.

### 4.2 Contributions to Changes in Incomes

We now turn to a decomposition analysis that formalises the descriptive effects described in the previous section. The approach adopted was developed by Juhn, Murphy and Pierce (1993) (JMP), and focuses on changes in the individual income distribution and the relative contributions of demographic and employment 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 ($y_{it}$):

$$y_{it} = X_{it}'\beta_i + u_{it}$$

where $X_{it}$ is a vector of observed demographic and employment characteristics; $\beta_i$ is a vector of coefficients representing the ‘returns’ to these characteristics ($\beta_i$ reflects both pure wage returns to the covariates as well as other income factors such as hours worked and benefit income effects); and $u_{it}$ is a residual that captures both unobserved factors and their associated returns. Also, denote the year-t residual distribution $F_t(.)|X_{it}$—that is, $u_{it} = F^{-1}_t(\theta_{it}|X_{it})$, where $\theta_{it}$ is $i$'s (quantile) rank in that distribution. The demographic variables include a quadratic in age, and dummy variables for gender, marital status, highest qualification (No qualifications, School, Post-school and University), and ethnicity (Maori, Pacific Island, Asian and Other); while employment is characterised by dummy variables for part-time and full-time work.

Let $Y(X, \beta, u)$ denote a summary measure of interest from the income distribution that depends on $X$, $\beta$, and $u$. For our analysis, $Y(.)$ is either the mean or the 10th, 25th, 50th (median), 75th or 90th percentile of the year-t income distribution. The objective of the analysis is to decompose the change in this measure between 1998 and 2004, $\Delta Y_t = Y_{2004} - Y_{1998}$, 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 $\Delta F_t(.)|X_{it}$.

Treating 1998 as the ‘base’ period, we first allow the distribution of the observable characteristics to change from 1998 to 2004, holding both the returns to and the distribution of unobserved effects constant at their 1998 values:

$$y_{it}^X = X_{it}'\beta_{it98} + F^{-1}_{04}(\theta_{it}|X_{it})$$

(4a)

Note that $y_{1998}^X = y_{2004}^X$, while $y_{1998}^X$ is obtained by using the 2004 observables, $X_{2004}$, and rank in the 2004 residual distribution, $\theta_{2004}$, but applying the 1998 coefficients and residual distribution. Changes in $Y_t$ based on regression (4a), $\Delta Y_t^X = (Y_{2004}^X - Y_{1998}^X)$, are attributed to changes in characteristics $\Delta X_{it}$. Similarly, allowing both characteristics and their returns to vary, and holding the distribution of unobserved factors constant at its 1998 values:

$$y_{it}^{X\beta} = X_{it}'\beta_{it} + F^{-1}_{04}(\theta_{it}|X_{it})$$

(4b)

The marginal change from (4b) relative to (4a), $\Delta Y_t^\beta = (Y_{2004}^{X\beta} - Y_{1998}^{X\beta}) - (Y_{2004}^X - Y_{1998}^X)$, is attributed to changes in coefficients. Finally, allowing the

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distribution of the observables, their coefficients, and the unobserved factors to change, is simply the unrestricted regression in equation (3) above. Any residual changes from (3) relative to (4b), $\Delta Y_t^u = (Y_{04} - Y_{08}) - (Y_{04}^{0b} - Y_{08}^{0b})$, are attributed to changes in the distribution of $u_t^c$.

The results from this analysis are presented in Table 2. The first row presents the decomposition of changes in mean log(income), which increased 0.10 (about 10 per cent) between 1998 and 2004. About three-quarters of this increase is attributed to changing characteristics, one-quarter to changing coefficients, and there is almost no unobserved effect. We also split the effects of (observable) characteristics into socio-demographic and employment factors: roughly one-third of these effects 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 middle income range than higher in the distribution: for example, log(income) increased about 0.15 and 0.10 at the 25th percentile and the median, compared to 0.05 and 0.06 at the 75th and 90th 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 per cent at the 10th, 25th, median (50th), 75th and 90th percentiles of the distribution respectively. In contrast, there is a reasonably steady increase in the relative contributions of changing returns, from about 10–15 per cent at the 10th and 25th percentiles, to 27 per cent at the median, and 51 and 64 per cent at the 75th and 90th percentiles of the distribution. Also, interestingly, changes in demographic characteristics contribute more at the 10th, 75th and 90th percentiles (about 40–50 per cent) than at the 25th percentile and median. These patterns are broadly consistent with the notion that income increases were concentrated in employment effects at the low to middle range 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 3 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. First, this provides a ‘point in time’ summary of the relative characteristics of individuals at alternative points in

| Table 2 | JMP Decomposition of Changes in Income Summary Statistics |
|-----------------------------|-----------------------------|---------------- -------------|
| 1998–2004 change | Observed endowments (per cent) | Observed coefficients (per cent) | Unobserved effects (per cent) |
| Mean | 0.098 | 74.4 | 21.9 | 52.5 | 25.9 | –0.3 |
| 10th | 0.060 | 66.6 | 40.6 | 26.0 | 15.8 | 17.6 |
| 25th | 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 |
| 75th | 0.052 | 69.3 | 52.9 | 16.4 | 51.2 | –20.5 |
| 90th | 0.062 | 57.0 | 48.2 | 8.8 | 64.1 | –21.1 |

Note: 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.
the distribution, and confirms commonly expected patterns—for example, the employment rate, 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, the employment rates at the 10th percentile of the distribution were almost unchanged between 1998 and 2004, while full-time employment increased strongly at both the 25th and 50th (median) percentiles (8 and 10 percentage points respectively, due partly to a drop in part-time rates); these changes were also stronger than at the 75th percentile and the 90th percentile (in

| Table 3 Characteristics of Working-Age Individuals |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                  | 10th            | 25th            | 50th            | 75th            | 90th            |
| 1998             |                 |                 |                 |                 |                 |
| Sample size      | 406             | 405             | 424             | 379             | 260             |
| Total income ($) | 8258            | 14054           | 26913           | 41301           | 59289           |
| Full-time work   | 0.08            | 0.22            | 0.74            | 0.90            | 0.98            |
| Part-time work   | 0.35            | 0.44            | 0.15            | 0.06            | 0.02            |
| Age              | 33.8            | 40.5            | 36.1            | 38.4            | 41.2            |
| Fraction female  | 0.55            | 0.65            | 0.51            | 0.35            | 0.24            |
| No qualifications| 0.30            | 0.32            | 0.24            | 0.17            | 0.12            |
| School qualifications | 0.34  | 0.24            | 0.26            | 0.22            | 0.13            |
| Post-school qualifications | 0.31  | 0.38            | 0.43            | 0.49            | 0.42            |
| University qualifications | 0.05  | 0.06            | 0.06            | 0.11            | 0.33            |
| Maori            | 0.14            | 0.13            | 0.09            | 0.14            | 0.06            |
| Pacific          | 0.07            | 0.07            | 0.04            | 0.03            | 0.02            |
| Other            | 0.08            | 0.07            | 0.05            | 0.03            | 0.04            |
| Pakeha           | 0.71            | 0.73            | 0.81            | 0.80            | 0.87            |
| 2004             |                 |                 |                 |                 |                 |
| Sample size      | 361             | 438             | 574             | 487             | 315             |
| Total income ($) | 8903            | 16728           | 29845           | 44662           | 63525           |
| Full-time 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            |

**Notes:** The summary statistics are calculated as follows. We first ranked individuals in each year according to their income, and then calculated the sample means of sub-samples within +/- 1 per cent of each of the five percentile points—for example, the 10th percentile statistics were calculated as the averages of individuals whose incomes were between the 9th and 11th percentiles.
fact, reported full-time employment actually dropped at the 90th percentile).

5. Conclusion

This analysis shows that the period of strong economic and employment growth in New Zealand since 1998 has resulted in broad gains in income to working-age individuals, suggesting the spoils of growth have been shared widely across the income distribution. Mean incomes grew 12 per cent in real terms between 1998 and 2004, and mean earnings growth (16 per cent) was even stronger. The gains have been particularly strong in the low to middle range of the distribution, with income rising by up to 20 per cent in this range, while in other areas of the distribution the gains were typically closer to 10 per cent.

We have also analysed the relative contributions of changing socio-demographic characteristics and employment, and of economic returns to these factors, 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 to middle 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 suggest that employment dominated gains in the low to middle range of the distribution, while wages dominated gains at the higher end. However, there are several caveats associated with such a simple interpretation. First, associated with the employment gains that have been concentrated in the low to middle range of the individual income distribution, there are possible non-random employment composition effects that may bias downwards measured wage growth, and thus underestimate 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. Despite this, the results presented here suggest that the benefits of growth over this period have more than ‘trickled’ down to the low to middle range of the distribution.

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Appendix 1: Data Issues

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 Accident Compensation Corporation (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 is 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 midpoint value for each categorical range. For comparative sample statistics we have used these values as the annual income bracket measure. Finally, all earnings and incomes have been inflation adjusted using the CPI and are reported in September quarter 2004 dollar values.

Figure A1 provides a sense of the concordance between the continuous weekly income and the categorical annual total income measures. In this figure we have pooled the nominal data from all eight sample years, and compare the implied categorical distribution of the annualised weekly income measure to that of the categorical total annual income variable. There are striking differences between the fractions of individuals reporting zero weekly income (15.8 per cent) and zero annual income (7.5 per cent), and fractions reporting $1–$5000 annual income (9 per cent) and weekly income corresponding to this band (4.5 per cent). These differences are broadly consistent
with the view that some workers with low annual income are part-year workers and thus have zero income in some weeks. 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.

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 earning jobs—in particular, this information is not collected for self-employment. In contrast, the main HLFS survey collects 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 does not 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 in at least two situations: first, for an individual on annual (or other paid) leave; and second, for those who are not working but receive ACC income, which we include as earnings for the distributional analysis in this article. 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.

Endnotes

1. This assessment requires some qualification. For example, potentially important policy changes included the Employment Relations Act (2000) that increased workers’ employment and bargaining position, and substantial increases in minimum wages, particularly for young workers (see Hyslop and Stillman 2006). In addition, some policy changes made earlier, such as an increase in the age of eligibility for New Zealand Superannuation, were also ‘realised’ during the period.

2. 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. To allow for resource sharing within households, we have also considered working-age individuals’ ‘equivalised’ total household earnings and income: the results from this exercise are discussed in Hyslop and Yahanpath (2005), and are qualitatively similar to those of the un-equivalised analysis presented here.

3. HLFS respondents 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 which sequentially classifies individuals as Maori if any of their self-reports are Maori, as Pacific Island if any report is Pacific Island, as ‘Other’ if they report any ethnicity other than Pakeha (European) and, finally, as Pakeha if their only reported ethnicity is Pakeha.

4. The Appendix contains a description of how we measure hours worked. Full-time work is defined as working at least 30 hours per week, and part-time work as less than 30 hours per week. Although the fraction with employment earnings also increased from 68 per cent to 73 per cent, our measures of earnings and employment are not entirely consistent, 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. A small fraction of employed individuals report no earnings; similarly, a small fraction of those with earnings report no employment.

5. The Gini is sensitive to changes in the middle of the distribution and less so to changes in the tails. Also, the Gini is equally responsive to equivalent transfers up and down the distribution, so does not satisfy the principle of diminishing transfers (for example, Mehran 1976).

6. See Silverman (1986) for a detailed account of kernel density estimation, and see 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 lower than the so-called ‘optimal’ bandwidth range of 0.07–0.09: the narrower bandwidth allows for more localised variations in the distribution to be identified, while trading off some smoothness in the estimates.

7. 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 \( p_0 \) of individuals with zero income; second, the remaining non-zero distribution would be scaled down by a factor of \( (1 - p_0) \). The main issue associated with the decision to exclude zeros relates to the ability to compare two distributions over time when the fraction of zeros changes, and this only affects earnings.

8. This view is also supported by an analysis of both equivalised household income and gross unequivalised household income (see Hyslop and Yahanpath 2005). 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.

9. 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.

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