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Income Inequality and Gender in New Zealand, 1998-2003

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ABSTRACT

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A number of authors have documented an increase in earnings or income inequality in New Zealand during the late 1980s and early 1990s, a period of major economic reform, however no study has evaluated changes in inequality during the post-reform era. This paper applies a recently-developed method for decomposing changes in inequality to New Zealand income and earnings data and extends it to analyse changes in inequality between men and women. Across the total working-age population, income inequality rose among both males and females between 1998 and 2003. In both cases, the majority of this was unexplained by changes in the observed determinants of income, however shifts in the distribution of education and the associated returns were responsible for part of the increase. Among the subset of workers, earnings inequality increased significantly for both genders. Although changes in the returns to measured characteristics contributed to the rise in inequality, this was partially offset by changes in the distribution of these characteristics. Between-gender inequality fell with respect to both samples. In contrast to within-gender inequality, this was largely explained by changes in the returns to the observed characteristics. Overall, there is evidence that the male and female income distributions are converging, although both are becoming more dispersed.

JEL Classification: J3

Keywords: income inequality, gender, labour force structure

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1. Introduction

The decade from the mid-1980s to the mid-1990s was a period of enormous economic upheaval in New Zealand, which was transformed from a highly protected economy to one of the most deregulated in the world. A number of studies have documented an increase in earnings inequality or income inequality over this same time period, however none have investigated the changes in inequality since the major reforms concluded. While inequality growth may have subsided in recent years, it is equally possible that it has remained high, affected by continuing adjustment of the labour market to the economic reforms. Important long-term trends in the attainment of university qualifications and the age and ethnic composition of the population have also been present during this time and it is unclear what effect these have had on inequality. Finally, despite considerable interest in the labour market outcomes of women, it remains unknown whether the observed convergence of male and female labour force participation rates has translated into a closing of the gender pay gap in recent years.

The objective of this study is to provide an indication of which labour market factors are important determinants of these ongoing changes in the national income distribution. It represents the first study of changes in earnings inequality in New Zealand since 1997. In addition, this paper is the first to use individual-level data from the New Zealand Income Survey to examine the extent of inequality. Yun's "unified" decomposition method will be used, allowing not only estimates of how much each income determinant has contributed to the change in inequality between 1998 and 2003 but also whether it was due to a change in the composition of the workforce or a change in coefficients over the period.

The next section reviews previous empirical research on income and earnings inequality in New Zealand, before Section 3 outlines the method that will be used to analyse changes in inequality in this paper. After a discussion of the dataset that is used, Section 5 presents the results of estimating cross-sectional earnings and income equations for 1998 and 2003 and the conclusions that can be drawn regarding the source of changes in inequality between these years. Section 6 summarises the results of the paper and suggests some directions for future work to take.

2. Past Research

A number of studies have attempted to determine the causes of changes in income inequality in New Zealand prior to 1998.[1] Hyslop and Maré (2001) used Household Economic Survey data for 1983-1998. They found that over this period, household gross income inequality, as measured by the Gini coefficient, interquartile range and 90-50 percentile ratio, increased, although the 50-10 percentile ratio indicated a slight decrease in inequality. Podder and Chatterjee (2002) also found an increase in household inequality over this period using the Gini coefficient. Much of the increase in inequality appeared to be concentrated between 1987/88 and 1990/91. Bakker and Creedy (1999) suggested that this is due to a downturn in the business cycle during this period.

Hyslop and Maré found that changes in household structure (particularly the declining proportion of two-parent families), attributes and employment outcomes each contributed to the observed increase in inequality, while changes in returns were found to reduce the level of inequality. Collectively, these factors accounted for about half of the observed increase, depending on the measure of inequality used. For example, of the total change in the standard deviation of log income between 1983 and 1998, 7% was explained by changes in household types, 62% by changes in observed attributes, -2% by changes in employment outcomes, -21% by changes in returns to the attributes, with 54% unexplained.

Martin (1998) used census data to analyse changes in the income distribution among families between 1976 and 1996. Inequality, as measured by the Gini coefficient, rose between 1976 and 1981, fell between 1981 and 1986, before increasing sharply over the following decade. This result was found to hold for both all families and families where at least one partner worked, as well as for males at the individual level.

After disaggregating all families into a large number of sub-groups based on age, sex (for sole-parent families), ethnicity, family type and size, Martin found that changes in between-group inequality accounted for almost all of the total change in inequality between 1981 and 1991, but only about half of the increase between 1991 and 1996. Among those employed, he found that shifts in the structure or composition of the labour force accounted for just under 40% of the increase in income inequality between 1986 and 1996. Another 20% was due to a

[1] O'Dea (2000) provided an exhaustive summary of previous studies of the changes in New Zealand's income distribution over time.

widening of income differentials by occupation, education, industry and age. The remaining 40% was unexplained.

In a more recent paper, Martin (2002) focused on changes in income inequality among the working-age population, using census data again. Although he found that income became *more* equally distributed between 1976 and 1996 with respect to the entire population, due principally to employment and income growth among women, income inequality increased with respect to the labour force and the employed. Martin found that changes in the structure of employment accounted for a small part of this change, while unemployment did not have a significant effect. He concluded that the observed increase in income inequality is largely not captured by the standard variables used in labour market research.

Dixon (1998) applied the approach of Juhn *et al*. (1993) to Household Economic Survey data for the period 1984-1997. Using a number of measures of inequality, she found that the increases in weekly earnings dispersion over the period were substantially larger than the increases in hourly earnings dispersion. Hence, she concluded that at least part of the increased inequality could be attributed to changes in the distribution of hours worked, which cannot be controlled for using the census. Between 1984 and 1997, the standard deviation of the logarithm of weekly earnings increased by 0.129 for men and 0.099 for women. Of this, changes in observed characteristics accounted for 9% for men and 27% for women. Changes in the returns to these characteristics accounted for 19% for men and 0% for women, with the remainder unexplained.

Finally, Maani (1999) investigated income returns to educational qualifications using census data. She found that returns to tertiary qualifications increased between 1981 and 1991. Between 1991 and 1996, the income premium for having a bachelor degree stabilised for men and fell slightly for women. Nevertheless, the returns to all educational levels were significantly higher in 1996 than in 1981. Despite this, neither Dixon nor Hyslop and Maré found educational qualifications to be a major component of the increase in inequality, relative to other factors.

3. Method

One standard approach to studying the determinants of changes in inequality is based on the tradition of Blinder (1973) and Oaxaca (1973), who were interested in explaining wage

differentials in terms of differences in individual characteristics and differences in the coefficients of the wage-generating function. Juhn *et al*. (1993) provided a method for applying the so-called Blinder-Oaxaca decomposition to changes in income inequality between two points in time. This procedure allows the overall change in inequality to be decomposed into the part due to changes in the measured and unmeasured characteristics of the population and the part due to changes in the returns to these characteristics.

More recently, Fields (2003) proposed an alternative methodology that decomposes changes in income inequality over time into the portion explained by each determinant of income. In this approach, so-called relative factor inequality weights are calculated for each explanatory variable, measuring the proportion of the variation in income that is explained by the variable in a given year.[2] The contribution of this variable to the overall change in inequality is then given by the change over time in the product of the factor weight and the chosen measure of inequality.

Yun (2002) noted that Fields' method does not decompose the changes in wage inequality in terms of characteristics, coefficients and residuals effects. On the other hand, the approach of Juhn *et al*. is able to explain changes in wage inequality in terms of these three effects but does not identify the separate contribution of each variable. Yun therefore suggested the following method that "unifies" these two approaches, if the variance of the logarithm of incomes is accepted as the measure of inequality.[3]

First, consider two regression equations generating income in logarithmic form, $\mathbf{y}_t = \ln \mathbf{Y}_t$, in two periods, 0 and 1:

$$\mathbf{y}_t = \hat{\beta}_{0t} + \sum_{k=1}^{K-1} \hat{\beta}_{kt} \mathbf{x}_{kt} + \mathbf{e}_t, t = 0,1. \qquad (1)$$

Defining $\mathbf{y}^* = \hat{\beta}_{01} + \sum_{k=1}^{K-1} \hat{\beta}_{k1} \mathbf{x}_{k0} + \mathbf{e}_0$, Yun proposed using the following decomposition of the change in the variance of log income:

[2] Specifically, the weight for each explanatory variable is found by calculating the covariance of income and the product of the estimated coefficient for the given variable multiplied by the variable itself and then dividing this by the variance of income.

[3] See Gang and Yun (2002) for a convenient explanation of this method. A major drawback of using the variance of log income as the measure of inequality is that it is not Lorenz consistent. Hence, it is possible for an economy's Lorenz curve to move further from the line of perfect equality yet have this inequality measure fall.

$$\sigma^2_{\mathbf{y}_1} - \sigma^2_{\mathbf{y}_0} = \sum_{k=1}^{K-1}(\hat{\beta}_{k1}\sigma_{\mathbf{x}_{k1},\mathbf{y}_1} - \hat{\beta}_{k1}\sigma_{\mathbf{x}_{k0},\mathbf{y}^*}) + \sum_{k=1}^{K-1}(\hat{\beta}_{k1}\sigma_{\mathbf{x}_{k0},\mathbf{y}^*} - \hat{\beta}_{k0}\sigma_{\mathbf{x}_{k0},\mathbf{y}_0}) + (\sigma^2_{\mathbf{e}_1} - \sigma^2_{\mathbf{e}_0}). \quad (2)$$

The first, second and third terms on the right hand side of this equation can be thought of as representing the characteristics effect, coefficients effect and residuals effect, respectively, and the first two of these are expressed as the sum of separate effects due to each determinant of income.

While Yun's method is suitable for evaluating the contribution of each determinant of changes in inequality *within* genders, it is unable to explain changes in inequality *between* genders. However, it is possible to divide the total level of income inequality in any period into within-gender inequality and between-gender inequality:

$$\sigma^2_{\mathbf{y}_t} = \sigma^2_{\mathbf{y}_t,W} + \sigma^2_{\mathbf{y}_t,B}. \quad (3)$$

Within-gender inequality can be expressed as follows, where p is the proportion of males in the sample:

$$\sigma^2_{\mathbf{y}_t,W} = p\sigma^2_{\mathbf{y}_{Mt}} + (1-p)\sigma^2_{\mathbf{y}_{Ft}}. \quad (4)$$

Consequently, the change in between-gender inequality between periods 0 and 1 can be found if p is time invariant:

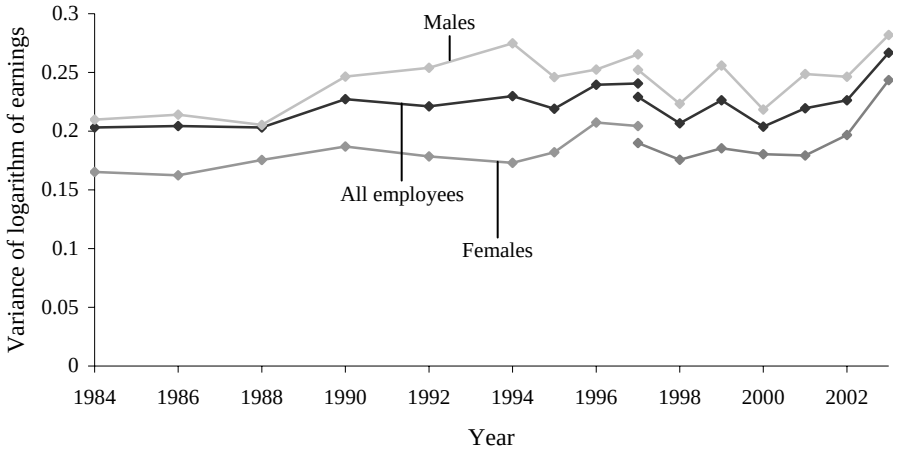
$$\Delta\sigma^2_{\mathbf{y}_t,B} = \Delta\sigma^2_{\mathbf{y}_t} - p\Delta\sigma^2_{\mathbf{y}_{Mt}} - (1-p)\Delta\sigma^2_{\mathbf{y}_{Ft}}. \quad (5)$$

Since each of the three terms on the right hand side of Equation 5 can be decomposed as in Equation 2, the change in between-gender inequality may also be expressed as the sum of a characteristics effect, coefficients effect and a residuals effect. These measure the contribution of each source of inequality to the change in the average income difference between men and women.

4. Data

This paper uses individual-level data drawn from the Household Labour Force Survey and the New Zealand Income Survey. The Household Labour Force Survey is a quarterly survey that provides a range of statistics on the employed, the unemployed and those not in the labour force, who collectively comprise the working-age population. The target population for the survey is the civilian non-institutionalised usually resident New Zealand population aged 15 and over. Each quarter, a representative sample of approximately 15,000 households and

Figure 1
Variance of the logarithm of hourly earnings in New Zealand, 1984-2003



Notes: The 1984-1997 series refers to Household Economic Survey data and was taken from Table 2 of Dixon (1998), with values for additional years supplied by the author.
The 1997-2003 series was taken from the New Zealand Income Survey.

30,000 individuals is surveyed.

Household questionnaires and individual questionnaires for all working-age household members collect information on labour force status, hours worked and educational status, along with basic demographic information, but no wage or income information. Since 1997, however, the June quarter Household Labour Force Survey has included a supplemental questionnaire known as the New Zealand Income Survey, which collects information on pre-tax income from self-employment, wages and salaries, government transfers and other sources.

As an indication of changes in the dispersion of earnings in New Zealand, Figure 1 plots the variance of the natural logarithm of hourly earnings among those with wage and salary income for each year of the Income Survey. Separate series for males and females are also presented. For comparison, corresponding values from the Household Economic Survey for 1984 to 1997 are included, as taken from Dixon (1998).[4] Surprisingly, inequality rose at approximately the same rate between 1997 to 2003 as during the earlier reform period. The dispersion of earnings among men was consistently greater than that among women.

[4] The Income Survey series is not strictly comparable with the Household Economic Survey series as the latter has a much smaller sample size. In addition, Dixon documented evidence that the Household Economic Survey features a considerably higher fraction of employees working long weekly hours than the Income Survey.

However, although male inequality in particular is highly volatile from year to year, it appears that the gap in inequality between the genders reached a maximum in the early 1990s and has been closing since. The inequality series for all employees in Figure 1 reflects the fact that women comprised a steadily increasing fraction of the workforce between 1984 and 2003.

For the analysis in this paper, data are drawn from the June 1998 and June 2003 Household Labour Force Surveys and Income Surveys for all individuals aged 25 to 59.[5] The final sample has 34,765 observations.[6] All summary statistics for the sample and the regression results in the next section are adjusted using the survey weights created by Statistics New Zealand to increase the representativeness of the samples given the realities of non-random survey response.

Table 1 presents summary statistics for some of the key demographic characteristics used in the analysis, as well as the earnings and income variables.[7] The first two columns describe the characteristics of the full sample in 1998 and 2003, respectively. On average, New Zealanders had an actual weekly income of approximately $525 in 1998, which rose to $590 in 2003, after adjusting for inflation. Over this period, there were also increases in the average age of individuals in the sample, the proportion with a post-school qualification and the proportion of non-Europeans.[8]

The analysis also focuses on the subset of wage and salary earners in the total sample. The final two columns of Table 1 pertain to the 20,694 such individuals and exclude the self-employed, the unemployed and those not in the labour force. Compared to the full sample, these workers tend to be slightly younger and more educated and have higher incomes. Nonetheless, the wage and salary earner sample experienced similar demographic changes to the full sample between 1998 and 2003. The average usual hourly wage rose from around $16.30 to $17.60 over the sample period, after adjusting for inflation.

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[5] The 1997 data were avoided due to concerns about their quality, given that this was the first year of the Income Survey.

[6] In the analysis of the following section, a total of 3843 observations are dropped from the full sample because of zero values for income, while 7 observations are excluded from the wage and salary earner sample due to zero wages.

[7] The Appendix provides a full list of the variables that were obtained.

[8] Table 1 uses Statistics New Zealand's hierarchical method of classifying ethnic groups, however a full set of mixed major ethnic group variables is included in the regressions in the next section.

Table 1
Sample characteristics for 1998 and 2003

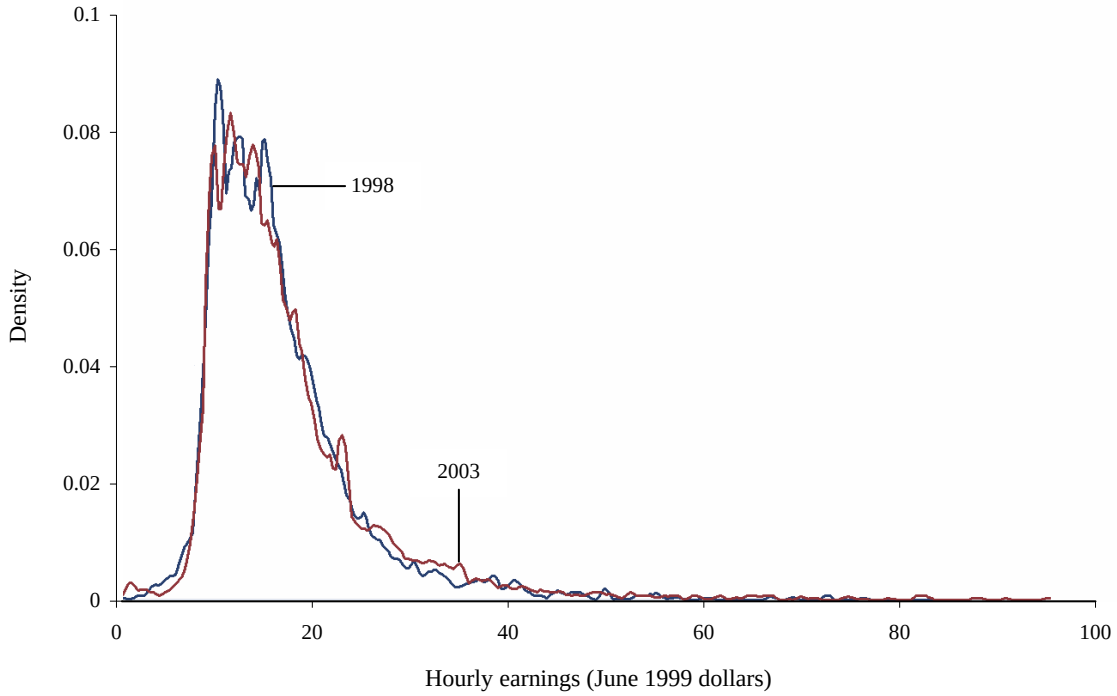
Variable	Full sample		Wage and salary earners	
	1998	2003	1998	2003
Age	40.51	41.39	39.84	40.90
	(9.57)	(9.61)	(9.38)	(9.52)
Female	0.51	0.51	0.49	0.50
	(0.50)	(0.50)	(0.50)	(0.50)
No qualification	0.24	0.19	0.20	0.16
	(0.43)	(0.39)	(0.40)	(0.37)
School qualification	0.22	0.22	0.22	0.21
	(0.45)	(0.45)	(0.45)	(0.45)
Post-school qualification	0.54	0.59	0.59	0.62
	(0.63)	(0.66)	(0.65)	(0.67)
European	0.80	0.75	0.83	0.77
	(0.40)	(0.43)	(0.38)	(0.42)
Māori	0.09	0.10	0.09	0.10
	(0.30)	(0.31)	(0.28)	(0.31)
Pacific Islander	0.04	0.05	0.04	0.05
	(0.20)	(0.22)	(0.20)	(0.22)
Asian	0.04	0.05	0.03	0.04
	(0.19)	(0.22)	(0.16)	(0.20)
New Zealand born	0.79	0.77	0.80	0.79
	(0.41)	(0.42)	(0.40)	(0.41)
Wage or salary earner	0.57	0.62	1.00	1.00
	(0.50)	(0.49)	(0.00)	(0.00)
Usual hourly wage	16.26	17.58	16.26	17.58
	(8.48)	(13.00)	(8.49)	(13.00)
Actual weekly income	525.41	590.25	643.19	683.24
	(562.84)	(613.70)	(421.81)	(491.81)
Observations	17,235	17,530	9739	10,955

Notes: Summary statistics are weighted by the Household Labour Force Survey sampling weights.
Standard deviations are shown in parentheses.
Wages and incomes are in constant (June 1999) dollar values, adjusted using the Consumer Price Index.

Figure 2 depicts kernel density estimates for the distribution of usual hourly earnings among wage and salary earners in 1998 and 2003. Overall, the earnings distribution was slightly more positively skewed in 2003 than in 1998. There was a reduction in the mass around the median wage rate but little change in the lower tail of the distribution, which is consistent with rising mean hourly earnings.[9]

[9] The three peaks of the distributions in Figure 2 reflect the large number of workers with nominal wage rates of $10, $12 and $15. These peaks have shifted to the left as inflation has eroded their value.

Figure 2
Kernel estimates of the distribution of earnings in 1998 and 2003



Notes: The Epanechnikov kernel is used and the bandwidth chosen is the one that would minimise the mean integrated square error if the data were Gaussian and a Gaussian kernel was used.
For presentational purposes, the domain is restricted to be less than $100.

5. Results

Changes in inequality across the full sample will initially be considered. This sample is composed of employees, the self-employed, the unemployed and those not in the labour force. The dependent variable used is real weekly income and the explanatory variables consist of age and its square, eight dummy variables for educational attainment, nine dummy variables for ethnic group, eleven dummy variables for region and a dummy variable for New Zealand born.

The results of estimating income equations separately for each gender and for 1998 and 2003 using feasible generalised least squares are presented in Table 2. All explanatory variables have the expected impacts, with most regressors, except the dummy variables for region and New Zealand born, found to be significant at the 1% level. The effect of age on income is found to be stronger for men than for women, possibly reflecting the fact that age is a better proxy for actual labour market experience among men. The returns to having a bachelor degree were lower for women than for men in both years, however the gap narrowed

Table 2
Results of estimating income equations for 1998 and 2003

Regressor	Males		Females	
	1998	2003	1998	2003
Age	0.086 * (0.008)	0.083 * (0.009)	0.035 * (0.011)	0.040 * (0.010)
Age squared	-0.001 * (0.000)	-0.001 * (0.000)	0.000 * (0.000)	0.000 * (0.000)
Attained school certificate	0.211 * (0.036)	0.167 * (0.037)	0.111 * (0.035)	0.163 * (0.036)
Attained sixth form certificate	0.252 * (0.040)	0.303 * (0.042)	0.086 (0.055)	0.182 * (0.054)
Attained higher school certificate	0.301 * (0.067)	0.257 * (0.060)	0.388 * (0.067)	0.316 * (0.071)
Attained other school qualification	0.072 (0.069)	0.015 (0.061)	0.163 * (0.051)	0.077 (0.061)
Attained vocation or trade qualification	0.311 * (0.022)	0.335 * (0.027)	0.244 * (0.027)	0.299 * (0.027)
Attained bachelor or higher degree	0.628 * (0.031)	0.634 * (0.035)	0.552 * (0.046)	0.618 * (0.037)
Other post-school qualification	0.337 * (0.044)	0.260 * (0.043)	0.194 * (0.045)	0.213 * (0.048)
Unspecified qualification	0.227 (0.109)	0.098 (0.160)	0.559 (0.143)	0.243 (0.137)
New Zealand born	0.026 (0.026)	-0.002 (0.029)	-0.011 (0.031)	0.043 (0.033)
R^2	0.152	0.134	0.077	0.079
Sample size	7675	7833	7497	7915

Notes: A full set of dummy variables for 9 ethnic groups and 11 regions was also added to each regression, although the estimated coefficients are omitted.
Generalised least squares estimation was used with the Household Labour Force Survey sampling weights.
Standard errors are shown in parentheses; * denotes significance at the 1% level.

substantially over the intervening period.

Between 1998 and 2003, inequality, as measured by the variance of log income, increased from 0.515 to 0.596 for men and from 0.628 to 0.669 for women. Using Yun's procedure, these changes were decomposed into a characteristics effect and a coefficients effect for each independent variable, as documented in the first four columns of Table 3. For both genders, most of the overall change in inequality is due to unexplained factors, with neither changes in the demographic characteristics of the sample nor changes in returns having much effect. Shifts in the returns to ethnicity decreased inequality among men slightly, however changes in the ethnic composition partially offset this. For women, the increase in the proportion with a bachelor degree was a significant contributor to increased inequality, as was the increase in the returns to higher education.

Table 3
Decomposition of changes in income inequality between 1998 and 2003

Variable	Males		Females		Between genders	
	$\Delta\mathbf{x}$ effect	$\Delta\hat{\beta}$ effect	$\Delta\mathbf{x}$ effect	$\Delta\hat{\beta}$ effect	$\Delta\mathbf{x}$ effect	$\Delta\hat{\beta}$ effect
Total	0.0012	-0.0000	0.0022	0.0022	-0.0047	-0.0065
Gender	–	–	–	–	-0.0019	-0.0085
Age and age squared	0.0002	-0.0006	-0.0003	0.0003	-0.0003	0.0004
New Zealand born	0.0000	-0.0002	0.0001	0.0000	0.0001	0.0001
Education dummy vector	-0.0001	0.0025	0.0023	0.0066	-0.0021	0.0008
Ethnicity dummy vector	0.0020	-0.0029	0.0006	0.0001	-0.0003	0.0007
Regional dummy vector	-0.0009	0.0012	-0.0005	-0.0049	-0.0002	0.0000
Residuals	0.0797		0.0368		0.0009	

Note: $\Delta\mathbf{x}$ effect denotes the characteristics effect; $\Delta\hat{\beta}$ effect denotes the coefficients effect.
The gender effects represent the effects of the gender regressor in the income equation for all individuals.

In contrast to income inequality within each gender group, between-gender inequality, as defined in Equation 5, decreased from 0.061 to 0.050.[10] The final two columns of Table 3 present the results of decomposing this change into characteristics and coefficients effects. Together, these explain more than the total fall in inequality between genders. This is largely attributable to changes in unmeasured gender-specific effects and a decline in the male income premium. Changes in the returns to having a degree or trade qualification also contributed to the reduction in income inequality between men and women.

One problem with using total income as the dependent variable in the inequality decomposition is that it reflects variation in the number of hours worked by individuals. It is possible that the results observed in Table 3 are simply due to changes in the hours worked each week by different groups of the population. However, by focusing on the subset of wage and salary earners, rather than the entire working-age population, it is possible to control for this by using an hourly wage measure, rather than weekly income. An additional advantage of this is that extra control variables may be introduced to the analysis.

Table 4 reports the results of estimating earnings equations, where the real usual hourly wage is used as the dependent variable. In addition to the regressors used in Table 2, a dummy variable for full-time workers is included, along with eight dummy variables for major occupational group and eighteen dummy variables for major industrial group.

[10] The average proportion of males over the two years was used as the value for *p* in Equation 4.

Table 4
Results of estimating earnings equations for 1998 and 2003

Regressor	Males		Females	
	1998	2003	1998	2003
Age	0.052 *	0.051 *	0.007	0.032 *
	(0.006)	(0.007)	(0.005)	(0.007)
Age squared	-0.001 *	-0.001 *	0.000	0.000 *
	(0.000)	(0.000)	(0.000)	(0.000)
Full-time	0.162 *	0.207 *	0.034 *	0.067 *
	(0.035)	(0.036)	(0.013)	(0.016)
Attained school certificate	0.076 *	0.073 *	0.048	0.096 *
	(0.024)	(0.023)	(0.019)	(0.020)
Attained sixth form certificate	0.122 *	0.113 *	0.103 *	0.076
	(0.031)	(0.029)	(0.023)	(0.033)
Attained higher school certificate	0.108	0.153 *	0.121 *	0.077
	(0.060)	(0.050)	(0.045)	(0.050)
Attained other school qualification	0.017	0.106 *	0.052	0.011
	(0.043)	(0.040)	(0.033)	(0.073)
Attained vocation or trade qualification	0.146 *	0.165 *	0.101 *	0.127 *
	(0.016)	(0.018)	(0.016)	(0.019)
Attained bachelor or higher degree	0.313 *	0.339 *	0.254 *	0.269 *
	(0.029)	(0.028)	(0.025)	(0.031)
Other post-school qualification	0.212 *	0.091 *	0.098 *	0.111 *
	(0.029)	(0.034)	(0.025)	(0.036)
Unspecified qualification	0.045	-0.146	-0.081	0.112
	(0.101)	(0.149)	(0.167)	(0.064)
New Zealand born	0.002	-0.036	-0.019	-0.001
	(0.019)	(0.023)	(0.017)	(0.024)
R^2	0.309	0.285	0.340	0.249
Sample size	4877	5364	4849	5576

Notes: A full set of dummy variables for 9 ethnic groups, 8 occupational groups, 18 industrial groups and 11 regions was also added to each regression, although the estimated coefficients are omitted.
Generalised least squares estimation was used with the Household Labour Force Survey sampling weights.
Standard errors are shown in parentheses; * denotes significance at the 1% level.

Not surprisingly, this model fits the data much better than that estimated in Table 2. The exclusion of the unemployed and those not in the labour force results in a substantial fall in the returns to age for men, although this is still higher than that for women. The full-time dummy variable is found to have a significant positive effect in all cases, although it is much larger for men. The returns to higher education are lower than for the full sample, although the premium for a bachelor degree is still lower for women than for men. Furthermore, the returns to education are generally higher in 2003 than in 1998, suggesting a reversal of the

Table 5
Decomposition of changes in earnings inequality between 1998 and 2003

Variable	Males		Females		Between genders	
	$\Delta\mathbf{x}$ effect	$\Delta\hat{\beta}$ effect	$\Delta\mathbf{x}$ effect	$\Delta\hat{\beta}$ effect	$\Delta\mathbf{x}$ effect	$\Delta\hat{\beta}$ effect
Total	-0.0083	0.0245	-0.0056	0.0121	0.0001	-0.0027
Gender	–	–	–	–	-0.0002	-0.0034
Age and age squared	-0.0020	0.0016	0.0013	-0.0002	0.0004	0.0006
Full-time	-0.0011	0.0025	-0.0002	0.0016	0.0001	-0.0003
New Zealand born	-0.0001	0.0003	0.0000	-0.0001	0.0000	0.0000
Education dummy vector	-0.0013	0.0045	-0.0003	0.0020	-0.0004	0.0001
Ethnicity dummy vector	-0.0005	0.0025	0.0001	0.0012	-0.0001	-0.0002
Occupation dummy vector	-0.0045	0.0108	-0.0070	0.0062	0.0005	0.0005
Industry dummy vector	0.0009	0.0018	0.0012	0.0005	0.0000	-0.0001
Regional dummy vector	0.0001	0.0010	-0.0007	0.0013	0.0000	0.0000
Residuals	0.0570		0.0774		-0.0011	

Note: $\Delta\mathbf{x}$ effect denotes the characteristics effect; $\Delta\hat{\beta}$ effect denotes the coefficients effect.
The gender effects represent the effects of the gender regressor in the earnings equation for all workers.

trend identified by Maani (1999) during the first half of the 1990s.[11]

The variance of log wages increased from 0.184 to 0.258 among men and from 0.155 to 0.239 among women over the sample period. Evidence from Figure 1 suggests that the large magnitude of this increase in earnings inequality may be partly due to the choice of years, especially for men.

Table 5 decomposes the change in earnings inequality into characteristics and coefficients effects for each explanatory variable. For men, changes in the returns to the measured characteristics of the workforce accounted for 33% of the overall rise in inequality, while changes in the distribution of these characteristics resulted in an 11% *reduction* in inequality. The remaining 78% is attributed to a fall in the variance of the residuals of the earnings equation, that is, the unexplained component of earnings. These results contrast with those of Martin (1998), who claimed that the increase in male inequality between 1986 and 1996 was largely due to changes in the composition of the population. However, they are similar to those of Dixon (1998), who found that the change in characteristics explained less than half as much of the increase in inequality between 1984 and 1997 as the change in returns, with over 70% of the variation remaining unexplained.

Among women, the coefficients effect also yielded higher inequality, however over 90% of

[11] Maani focused on the employed, which includes the self-employed as well as wage and salary earners, and she used annual income instead of hourly earnings.

the observed increase was unexplained by the regressors used. As with men, the shift towards high-skilled occupations had a particularly large offsetting effect on the rise in inequality, while the corresponding change in returns had a large contributing effect. Dixon reported that between 1984 and 1997 changes in attributes accounted for over a quarter of female earnings inequality growth, although changes in returns were unimportant. This suggests that, while earnings inequality among women has continued to grow in recent years, there has been a change in the source of this change.

The measured level of between-gender earnings inequality fell from 0.010 to 0.006 between 1998 and 2003. As with the full sample, estimated changes in returns, particularly a decrease in the male earnings premium, explained most of the reduced inequality between men and women. The overall conclusion is that the female earnings distribution is moving closer to the male distribution and that both are becoming more dispersed.

6. Conclusion

While a number of studies have analysed changes in income or earnings inequality in New Zealand during the period of economic liberalisation from the mid-1980s to the mid-1990s, no paper has previously investigated what has happened to inequality since this period, despite the continuation of important long-term demographic trends and ongoing adjustment to the structural reforms. Furthermore, to date, no study has analysed the extent of inequality using data from the New Zealand Income Survey. This paper has used individual-level observations from this survey to evaluate the change in both income and earnings inequality between 1998 and 2003, for both men and women. A straightforward method recently proposed by Yun (2002) was then used to decompose the total change in inequality into the portion explained by changes in the measured characteristics of the population, the portion explained by changes in the returns to these characteristics and the portion that is unexplained by these attributes. This method has the advantage over previous methods, such as those of Juhn *et al*. (1993) and Fields (2003), of providing estimates of the contributions of the change in composition and the change in returns for *each* explanatory variable. A simple way to extend Yun's approach to provide estimates of the contributions to changes in inequality between groups, such as gender, was also provided.

With respect to the entire working-age population, income inequality, as measured by the

variance of log income, was found to have increased by 16% among men between 1998 and 2003 and by 7% among women. In both cases, this was mostly due to unobserved changes rather than shifts in demographic characteristics or returns. Nonetheless, changes in the educational composition of the female population and the returns to post-school qualifications were important contributors to the change in income inequality among women. There was a significant reduction in between-gender inequality between 1998 and 2003. In addition to changes in the education-income profile, a fall in the male income premium was a major determinant of this.

To control for the possible effect of changes in hours worked, the decomposition was repeated using hourly earnings and focusing only on the group of wage and salary earners. Among males, inequality was found to have risen by 40% over the sample period, while among females, inequality rose by 54%. Although the magnitude of this change was partly due to the choice of time periods, this finding suggests that between 1998 and 2003 New Zealand continued a trend of increasing earnings inequality during the late 1980s and early 1990s. Once again, the observed decrease in inequality is largely explained by variables that are omitted from the earnings equations for both men and women. However, here this masks sizeable shifts in measured characteristics, which increased inequality among both genders, and returns, which reduced inequality. Changes in the occupational structure contributed significantly to both effects. Finally, between-gender earnings inequality fell significantly between 1998 and 2003. This result was largely explained by changes in characteristics, while changes in returns tended to *increase* between-gender inequality slightly.

This paper has uncovered evidence that although there has been an overall increase in inequality among both male and female workers, the average gap in income or earnings between genders has shrunk. Future work should examine the effects of these changes on households by focusing on the earnings of matched married and cohabitating couples. Such an approach would be possible with the Income Survey data and would allow one to determine whether changes in marriage and fertility rates are responsible for the increase in inequality among women. In addition, controls for marital and child status may allow the model to better capture the effect of labour market experience among women. In the long term, use of matched employer-employee administrative data may prove a superior means of studying earnings inequality, as these will not only allow the researcher to account for both

unobserved individual-specific heterogeneity and unobserved firm-specific heterogeneity but will also largely avoid the problem of measurement error in self-reported earnings.

Appendix: Categories for the demographic variables

Educational attainment: No qualification; school certificate; sixth form certificate; higher school certificate; other school qualification; vocation or trade qualification; bachelor or higher degree; other post-school qualification; unspecified qualification.

Ethnic group: Only European/Pakeha; only Māori; only Asian; only other; Māori/Pacific; Māori/non-Pacific; Pacific/non-Māori; non-Pacific/non-Māori; none.

Industry: Agriculture, forestry and fishing; mining; manufacturing; electricity, gas and water supply; construction; wholesale trade; retail trade; accommodation, cafes and restaurants; transport and storage; communication services; finance and insurance; property and business services; government administration and defence; education; health and community services; cultural and recreational services; personal and other services.

Occupation: Legislators, administrators and managers; professionals; technicians and associate professionals; clerks; service and sales workers; agricultural and fishery workers; trades workers; plant and machine operators; elementary occupations.

Region: Northland; Auckland; Waikato; Bay of Plenty; Gisborne/Hawke's Bay; Taranaki; Manawatu-Wanganui; Wellington; Nelson/Tasman/Marlborough/West Coast; Canterbury; Otago; Southland.

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