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Pay Inequality between Men and Women in New Zealand

by
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Abstract

This study examines changes in the gender earnings gap in New Zealand between 1984 and 1998 – a period in which the gender gap in average earnings was declining. It describes in detail the changing dimensions of gender pay inequality, using unit record data from the HES and the HLFS Income Supplement. Wage regressions are estimated for men and women. Standard decomposition techniques are used to estimate the contribution of male–female differences in education and past paid work experience (our two proxy measures of skill level), and differences in job type, to the log wage gap. An attempt is made to estimate the contribution of the long-term changes in male–female skill levels and job distributions to the reduction in the gender pay gap. The effects of motherhood and part-time employment on women's earnings are also explored.

The results suggest that the contraction of the gender earnings gap was due to a combination of convergence in measured skill levels and job distributions; and reductions in 'residual' or unexplained pay inequality. Male–female disparities in measured skill levels and job type continued to be important sources of the gender pay inequality that remained at the end of the 1990s.

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Access to the official data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the confidentiality provisions of the Statistics Act 1975. The results presented in the paper are the work of the author, not Statistics New Zealand.

CONTENTS

EXECUTIVE SUMMARY

The size of the gender pay gap is commonly viewed as an indicator of the progress made by women towards achieving equity with men in the labour market. This study examines the nature and sources of change in the gender earnings gap in New Zealand between 1984 and 1998, a period in which the relative earnings of females were rising.

Objectives and study design

The research objectives were to:

1. Describe the dimensions of the gender earnings gap, and the way it has changed over time.
2. Estimate how much of the gender earnings gap in the late 1990s can be attributed to male–female differences in skill-related characteristics – particularly education and experience – and to job characteristics.
3. Identify factors that contributed to the reduction of the gender earnings gap over the last 10-15 years, and estimate their impacts.
4. Investigate the effects of motherhood and part-time employment on women's earnings in the late 1990s, as a means to better understand the underlying causes of the gender pay gap.

The population of study is male and female waged and salaried employees aged between 20 and 59 years. The approach taken was to use data from the Household Economic Survey (HES) to analyse the changes in the gender pay gap between 1984 and 1998; and data from the 1997 and 1998 HLFS Income Supplement (IS) to supplement and extend analysis of the gap as at the late 1990s.

Overseas studies of the male–female wage differential have drawn attention to the importance of gender differences in continuity of past employment. This is the first New Zealand study to estimate the work experience distributions of men and women, and to incorporate imputed experience measures into an analysis of the sources of the gender pay gap.

The study uses descriptive statistics initially to explore the dimensions of the gender earnings gap. Regression models of the determinants of hourly earnings are estimated. Standard decomposition techniques are used to estimate the portions of the male-female earnings gap that are statistically attributable to male–female differences in personal or job attributes.

Section 1 provides a brief summary of previous empirical research on the gender earnings gap. Section 2 gives an overview of the theoretical context for the study and the methods used. It includes a discussion of the interpretative issues that are associated with research on this topic. Section 2 also describes the data sources.

The changing dimensions of the gender earnings gap

Between 1984 and 1998 there was a significant narrowing of the gender earnings gap. Using the latest available figures, and focusing on the population of 20-59 year olds, we estimate that the female-to-male ratio of geometric mean hourly earnings rose from 79 percent in 1984 to around 86 percent in 1999 – an increase of approximately 7 percentage points. The female-to-male ratio of full-time weekly earnings rose from around 74 percent in 1984 to 81 percent in 1999, also an increase of 7 percentage points.

Both part-time employed and full-time employed women experienced increases in their relative earnings during the 1980s and 1990s. The percentage point rises in the female–male pay ratios for these two groups were fairly similar in size. This evidence does not support concerns that part-time employed women, *as a group*, were being 'left behind' by trends that raised the relative earnings of full-time women.

The size of the gender gap increases with level of earnings, so that it is larger among higher-paid men and women than among lower-paid men and women. In the 1998 Income Supplement, for example, earnings at the 10th percentile of the female hourly earnings distribution were 90 percent of earnings at the 10th percentile of the male hourly earnings distribution. The ratio was 84 percent at the mid-point of the distribution, and 79 percent at the 90th percentile. The decline in the gender earnings gap between 1984 and 1998 was sufficiently widely-based to cause increases in the female-to-male ratio at almost all levels of earnings. However, women with relatively high earnings did not gain as much, relative to males, as did women elsewhere in the earnings distribution.

To understand why, one needs to consider changes in the male earnings distribution as well as the female. Both the male and the female earnings distributions became more dispersed during the late 1980s and 1990s, but the changes in the male wage structure were more strongly skewed by level of earnings. Lower-paid male workers experienced reductions in their real hourly earnings, while higher-paid male workers experienced sizeable increases. Consequently, higher-paid males maintained a larger earnings 'lead' over females.

Changes in the gender earnings gap by age group; birth cohort; educational level; ethnic group; marital status; parental status; and occupational and industrial group were examined. The narrowing of the gap was larger among younger employees than among older workers. However, the gender earnings gap declined in size, to a greater or lesser degree, within all broadly-defined population sub-groups and labour market sectors.

Education and experience effects on the gender earnings gap

Differences between male and female employees in average levels of educational attainment became much less pronounced during the 1980s and 1990s. At lower levels of educational attainment, male–female parity was essentially achieved. The gender gap in the percentage of workers with post-school qualifications narrowed substantially. At the end of the 1990s a significant gap still remained, however.

Two external sources of information were used in the development of imputed experience variables in this study: Population Census employment rate data, and data on women's work histories drawn from the New Zealand Women: Fertility, Employment and Education Survey 1995. Using the census data, estimates of the distribution of years of past work experience by gender and five-year age group were generated. The results indicate that the male–female gap in average years of paid past work experience continued to be quite large in the 1990s. In 1996, men aged 20-59 had accumulated 18.4 years of prior full-time paid work experience on average. Women aged 20-59 had accumulated 11.2 years on average, a difference of 7.2 years. NZW:FEE Survey data yielded a similar estimate of the average experience level of New Zealand women in 1995, 12.2 years.

Three methods were used to impute measures of individuals' actual experience levels in the HES and IS samples. A potential work experience variable was derived for all men and women, in the standard way. Two further measures of the past work experience of the women in the HES and IS samples were imputed using methods suggested by Zabalza and Arrufat (1985) and Filer (1993). The imputed experience variables have mean values and age-group distributions that approximate – in a rough manner – what we believe to be the actual mean and age-group distributions of experience among New Zealand women.

A regression analysis of the determinants of the gender pay differential was undertaken using the HES samples of employees in 1989-91, 1993-95, and 1996-98, and the IS samples of employees in 1997-98. Wage equations were estimated for men and women using data from the pooled HES and IS samples. In order to explore the implications of different assumptions about the true size of the experience gap between men and women, a series of wage equations were estimated, incorporating alternative imputed measures of women's experience.

Decomposition of the components of the pay gap demonstrated that the choice of an experience measure has a major impact on the portion that can be statistically attributed to male–female differences in average skill levels. Comparing across models using different imputed experience variables for women, experience alone was able to account for 15–50 percent of the total gender gap in average hourly earnings. Gender differences in educational attainment also contributed to the pay gap, but that contribution was smaller, and declined in importance as male–female educational differences narrowed. Our estimates suggest that the female shortfall in qualifications could statistically explain about 15 percent of the gap in the late 1980s, and 0-10 percent of the gap in the late 1990s.

If we consider the combined impact of experience and education, the estimates indicate that the portion of the total male-female wage differential that was attributable to male–female differences in these two proxies for skill lay between 30 and 60 percent, as at late 1990s. This suggests that gender differences in average levels of measured skills (education and work experience) continue to be large enough to account for a large chunk of the contemporary gender gap in hourly earnings – between one-third and three-fifths.

Decomposition of the sources of *change* in the male–female wage gap indicated that about 14-15 percent of the total reduction between 1989-91 and 1996-98 was due to the rising relative educational level of women. Because experience is not measured directly, and we did not succeed in generating good historical estimates, it is difficult to identify the extent to which the male–female differential in employees' past work experience narrowed during this period. We therefore explored the range of wage effects that were implied by alternative assumptions about the underlying trends in male and female relative experience levels. Those estimates suggested that the experience shifts could have been responsible for zero to 40 percent of the total reduction of the gender pay gap during the 1990s. Assuming a one-year narrowing of the gender experience gap, the wage effects flowing from this would account for around 10-20 percent of the total narrowing of the gender pay differential.

Job characteristics and the gender earnings gap

The male and female employment distributions became more similar to each other during the 1980s and 1990s, reducing the level of gender 'segregation' in the labour market. Nevertheless, large differences remained in the types of jobs typically undertaken by men and women at the end of the 1990s. Cross-sectional decompositions of the gender hourly earnings

gap in 1997-98 indicated that male–female differences in occupational and industrial distribution could account for around 20 to 40 percent of the total gender wage gap, when industries and occupations were defined at the most detailed, three-digit level.

HES data were used to estimate the effects of changes in the male–female distribution of employment by industry, and the effects of changes in the structure of relative wages across industries. It appears that changes in the structure of employment during the late 1980s and early 1990s did help to compress the male–female gap in average hourly earnings. The decomposition estimates suggest that shifts in relative industry employment shares were responsible for about 20 percent of the total reduction of the gap, and shifts in the inter-industry wage structure were responsible for about 12 percent of the reduction, during the decade from the mid-1980s to the mid-1990s. However, we did not fully explore the sensitivity of these estimates to variations in data and method.

Family responsibilities and women's hourly earnings

The effects of family responsibilities on the average hourly earnings of female employees were explored using data from the 1997 and 1998 Income Supplement samples. The analysis compared mothers with childless women, and full-time with part-time employees. It addressed the question of whether the observed wage differentials between these groups flow from the direct effects of motherhood or part-time employment, or alternatively are due to compositional differences in other measured attributes, such as age and education. The population of study in this part of the analysis was restricted to women aged 20-39 years, because the IS and HES samples do not record women's full childbearing histories, and parental-child relationships can only be identified if the children are still living in the household.

To explore the effect of motherhood on earnings, a series of wage regressions incorporating indicators of whether a woman had children aged under 18 years, and controls for other personal and skill-related characteristics, were estimated. The results suggested that mothers do indeed earn relatively less than childless women who are similar in their demographic characteristics and educational level. In the most basic models that include controls for age, education, ethnicity and marital status, the estimated hourly earnings 'penalty' (or negative wage differential) for having one dependent child is around –7 percent, and the predicted differential for two or more dependent children is around –10 percent. These estimates should be regarded as preliminary estimates of the effects of children on New Zealand women's hourly earnings, however, because the data and methods on which they are based have some significant limitations.

The reductions in the relative earnings of female employees that are implied by the child wage penalties estimated in this study could potentially account for about one-third of the total wage gap between men and women aged 20-39 years. Thus, child wage effects are materially and statistically significant, but they do not appear to be large enough to serve as the primary explanation for gender wage inequality.

Estimates of the wage effects of motherhood varied by partnership status. Sole mothers in waged employment were predicted to experience substantially larger wage penalties than were partnered women (about 1.5 times larger), after differences in basic demographic characteristics were controlled for. Without further research aided by better data, we cannot tell whether the wage gaps between sole and partnered mothers were mainly due to

unmeasured differences between the two groups, to differences in their treatment in the labour market, or to other causes.

A human capital explanation of the wage gap between mothers and childless women would suggest that time out of the workforce restricts the ability of mothers to maintain or upgrade the types of skills that are rewarded in the labour market. Hence, the lower average hourly earnings of mothers are a reflection of lower average skills. Using the imputed experience variables, we attempted to explore the contribution of differences in prior work experience to the wage gap between mothers and childless women. Incorporating imputed experience into the wage models substantially reduced the size of the coefficients that were estimated for children, and rendered them insignificant in some models. This evidence is consistent with the view that the adverse effects of children on women's earnings operate partly through discontinuity of employment and reduced years of labour market experience. It lends some support for a human capital explanation of the 'family gap' in earnings, but does not rule out other possible explanations.

Mothers are more likely to work on a part-time basis than are women without dependent children. This prompts the question of whether working part-time is a 'cause' of lower wages for mothers – that is, whether the decision to work part-time reduces their hourly earnings relative to what they would have received had they worked full-time. A series of wage regressions were estimated to explore the wage effects of working part-time, for younger women, using alternative sets of controls for in-sample variations in age, education, experience, and parental status. The part-time coefficients estimated in these regressions were reduced in size by the inclusion of the demographic control variables, and tended to become statistically insignificant. These results suggest that the observed part-time/full-time wage gap among women aged under 40 is mainly due to demographic and skill differences between the two groups.

Concluding comments and implications

The analysis of the dimensions of change in the gender earnings gap provided some useful new insights. For instance, the gender pay gap is larger – and has been decreasing more slowly – among more highly paid employees than among the lower paid. This suggests that policies to redress gender pay inequality should not focus solely or primarily on the situation of low-paid workers – a more broadly-based approach would seem more appropriate. Another insight is that the narrowing of the gender pay gap during the late 1980s and 1990s was aided by slow growth in the real earnings of male workers. Understanding the factors that influence average male earnings may be as important as understanding the factors that influence average female earnings, for interpreting the overall trends and for achieving gender gap reductions.

A gender pay differential representing about 14 percent of average male earnings remained in place at the end of the 1990s. We estimated that between 40 and 80 percent of that gender wage differential could be explained in a straight-forward manner, with reference to the wage effects of male–female differences in four variables: education, past work experience, and occupation and industry of employment. Although a large portion of the contemporary male–female gap in average hourly earnings can be attributed to these differences in measured skills and job characteristics, that should not be taken to imply that the 'explained' portion of the gender pay gap is fair, efficient, or justified. The processes whereby men and women come to have different levels of educational qualifications and different labour force participation

patterns, and enter different jobs, may have discriminatory or gender-biased elements. What is important about the finding is that it suggests there is still considerable potential for further reductions in gender pay inequality, if these measured skill and employment pattern disparities are further reduced.

The analysis of the sources of change in the gender earnings gap indicated that both inequality due to male–female differences in measured characteristics, and 'residual' or 'unexplained' inequality, declined in size during the 1980s and 1990s. There is no single consensus interpretation of what the 'residual' component of the gender pay gap represents. Its reduction in size could be due to declining gender discrimination in the labour market, or to reductions in unmeasured skill differences between men and women.

It seems likely that the existing male–female differences in measured skills and job characteristics will continue to narrow somewhat further in future, due to the continuing impact of recent increases in the relative educational attainment of women, and the long-run tendency for men's and women's paid work patterns to become gradually more similar. These trends should help to bring about some additional narrowing of the aggregate gender earnings gap. There is no *guarantee* that further declines in the aggregate gender pay gap will occur, because the wage structure is influenced by shifts in the relative demand for different skills, as well as by shifts in supply. If the New Zealand labour market were to experience very rapid growth in the relative demand for experienced workers, workers with university qualifications, or any other 'skills' that men hold in greater amounts than women, this would tend to raise average male earnings and would tend to expand the gender pay gap. Based on current trends, a reversal of the long-run trend towards reduced gender inequality seems unlikely, however.

The study was not designed to evaluate specific gender equity policies, and therefore it does not lead directly to conclusions about the appropriateness or relative merits of policies that might influence the gender earnings gap. At a general level, the results are consistent with the view that individuals' past employment patterns influence their current wages, and therefore policies that make the paid work patterns of men and women more similar would be likely to have an impact. Those policies might include, for example, the promotion of part-time working options for both men and women within all occupations and firms, the promotion of parental leave arrangements, or the promotion of parental leave sharing between mothers and fathers; and policies that make childcare services accessible to working parents.

1. INTRODUCTION

The size of the gender pay gap is commonly viewed as an indicator of the progress made by women towards achieving equity with men in the labour market. This study examines changes in the gender earnings gap in New Zealand between 1984 and 1998, a period in which the ratio of female to male average hourly earnings rose from around 79 percent to 84 percent.

1.1 Why does gender pay inequality matter?

Differences in the rate of pay received by men and women are important both from the perspective of labour market efficiency and from the perspective of fairness or equity. An efficient allocation of resources in the labour market requires that equally productive workers should receive equal pay. If they do not, this may lead to distortions in the time and effort that different workers allocate to paid work, or to the acquisition of skills. A less than optimal distribution of paid work among men and women may mean that the welfare of both men and women is not as high as it could be if paid work was more efficiently allocated.

Differences in the rate of pay received by men and women may be perceived as unfair, particularly if they do not appear to be justified by differences in productivity. The Equal Pay Act (1972), which made it illegal to pay different rates to men and women who are doing the same work, was motivated by the view that direct discrimination in pay rates is unfair.[1] The principle of fairness can be extended to comparisons of pay outcomes where men and women are performing different types of work but their work has similar or identical skill requirements. If there are persistent earnings differentials between men and women that cannot be attributed to differences in individual skills, job amenities or job requirements, one can question whether the processes through which men and women were selected into jobs and assigned pay rates were genuinely fair and equitable ones.

The gender gap in earnings also has implications for the demands that are placed on the welfare state. Growing numbers of women in New Zealand are providing financially for their families in the absence of a male partner. Growing numbers of women in New Zealand are reaching the age of retirement. The fact that women earn less than men on average could increase requirements for state income assistance beyond those of a society with a more equal earnings distribution (Colgate, 1999, p. 6).

1.2 Changes in the employment patterns of men and women 1984-98

The 14-year period from 1984 to 1998 was a period of quite major shifts in the employment patterns of men and women in New Zealand. These changes represent the background context to this study. They are relevant insofar as they influenced the size of the gender pay gap.

The employment rate of mature males (those aged 20-59 years) fell from around 92 percent in 1986 to around 81 percent in 1992, before rising again to 85 percent in 1996.[2] Large numbers

[1] The Equal Pay Act led to the elimination of separate rates for men and women in collective employment contracts. During the five-year implementation period following the passage of the Act, the female-to-male ratio of average ordinary time hourly earnings rose from 72 percent to 78 percent (Hyman, 1994, p.84).

[2] These figures are from the Household Labour Force Survey. Population census data suggest that the full-time employment rate of mature males (aged 20-59 years) fell from 87.2 percent in 1986 to 73.4 percent in 1996, an even larger decline.

of men became unemployed or moved out of the labour force during the recession of the late 1980s and early 1990s. Job growth during the subsequent economic recovery raised the employment rate of mature males but did not restore it to pre-recessionary levels. Waged and salaried employment became relatively less important for mature males during the 1980s and 1990s, while self-employment became relatively more important. Part-time employment became more common. The industrial composition of male employment shifted away from manufacturing, transport and communications, towards a higher share of service sector industries.

While men's employment rate declined, the employment rate of women rose slowly but undramatically over the period, from around 64 percent in 1984 to 68 percent in 1996.[3] The composition of women's employment also shifted away from manufacturing towards the service industries. Both the male and the female workforces became better qualified on average as increasing numbers of school leavers acquired post-school qualifications, but the educational levels of working women rose more rapidly than those of working males. This caused the gender gap in educational qualifications to fall.

By the end of the period, women accounted for around 48 percent of all waged and salaried employees and 40 percent of those working full-time.[4] The gaps between employed men and women in mean educational levels, mean ages, and occupational distribution had all narrowed – trends that might be expected to lead to a narrowing of the gender gap in earnings. On the other hand, the period between 1984 and 1998 was also one of substantial growth in the dispersion of earnings in New Zealand. The 90-10 log earnings differential for full-time weekly earnings increased by around 16.5 log points, or 17.9 percent, between 1984 and 1997 (Dixon, 1998, p.78). Because increased wage inequality tends to lower the relative earnings of groups of workers with below-average labour market skills, and women typically have fewer formal labour market skills than men, rising earnings inequality might have been expected to widen the gender earnings gap.

In practice, the effects of rising wage inequality were offset by other factors. The gender gap in hourly earnings, which had shrunk by around 6 percentage points in the years following the implementation of the Equal Pay Act 1972 (Hyman, 1994, p.88), declined further during the 1980s and 1990s. This study explores the reasons for that decline.

1.3 Research objectives

The research objectives were to:

1. Describe the dimensions of the gender earnings gap, and the way it has changed over time.
2. Estimate how much of the gender earnings gap in the late 1990s can be attributed to male-female differences in skill-related characteristics – particularly education and experience – and to job characteristics.
3. Identify factors that contributed to the reduction of the gender earnings gap over the last 10-15 years, and estimate their impacts.

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[3] Again, these figures are from the Household Labour Force Survey and refer to the employment rate of 20-59 year olds. Census data show that the full-time employment rate of females in this broad age group remained steady at 44.1 percent in both 1986 and 1996, while the part-time employment rate rose from 18.0 percent in 1986 to 21.1 percent in 1996.

[4] June 1998 HLFS. These figures are for wage and salary earners aged 20-59 years.

4. Investigate the effects of motherhood and part-time employment on women's earnings in the late 1990s, as a means to better understand the underlying causes of the gender pay gap.

The approach taken was to use data from the Household Economic Survey (HES) to investigate the changes in the gender pay gap between 1984 and 1998, and data from the HLFS Income Supplement (IS) to supplement and extend the analysis of the gap as at the late 1990s. The annual HES is the only household survey in New Zealand that provides repeated measures of individual earnings over a lengthy period of time. The Income Supplement is a new but substantially larger survey, which provides more accurate measures of earnings and greater scope for disaggregated analysis.

With one or two exceptions, previous New Zealand researchers working on gender pay issues did not have access to micro-level data. The use of unit record data in this study meant that it was possible to analyse the dimensions and changing structure of the gender earnings gap in a more detailed manner (objective 1). The use of data from two different statistical surveys was also expected to strengthen the research by showing the sensitivity of results to differences in measures or differences in sample characteristics.

In its analysis of factors contributing to the gender earnings gap as at the end of the 1990s (objective 2), the study focuses in particular on the role of male–female differences in educational level, years of prior work experience, and industry and occupation of employment. Using standard cross-sectional methods of 'decomposing' the gender gap, the study estimates the portion of the total gap remaining at the end of the 1990s that was attributable (statistically) to male-female differences in skill-related attributes and job characteristics.

HES data for the years 1984 to 1998 are used to investigate the causes of the convergence in the gender earnings gap (objective 3). The study considers three main sources of change: increases in the educational levels and work experience levels of working women, relative to those of males; changes in the industrial structure of employment; and changes in the industrial wage structure. Recent cohorts of working women have acquired higher levels of education and accumulated greater work experience over their lifetimes than did earlier cohorts. This study attempts to identify the size of those educational and work experience changes, and to estimate their effects upon the total size of the gender earnings gap.

Due to the differences in types of jobs undertaken by men and women, shifts in the industrial and occupational structure are likely to have differing effects on male and female mean earnings. The impacts of changes in labour demand and other structural changes in the New Zealand economy during the 1980s and 1990s on the economy-wide gender pay differential are explored in this study. The analysis looks for labour demand shifts that operated through changes in the composition of employment by gender, or through changes in industrial wage premia. The basic question is whether those changes were 'gender-biased', leading (for example) to reductions in the relative earnings of male-dominated jobs, or to increases in the proportion of women employed in higher paid sectors.

Because women are more likely than men to take time away from work, reduce their working hours, or change their occupation in order to care for children, parenthood and parenting patterns are likely to have a substantial impact on the gender gap in earnings. This study explores the impact of children on women's earnings as at the late 1990s, using data from the

1997 and 1998 HLFS Income Supplements (objective 4). Due to data limitations, it does not attempt to investigate the contribution of change*s* in family structure or family responsibilities to the contraction of the gender pay gap during the 1980s and 1990s. However, the analysis of the wage effects of children as at the end of the 1990s is intended to be a first step in identifying whether women's family responsibilities are likely to be a major, or a minor, underlying cause of contemporary gender pay inequality.

1.4 Study population

The population of study is male and female waged and salaried employees aged between 20 and 59 years. Teenagers were excluded from the study population for two main reasons. Firstly, one of the methods used to impute prior work experience values for women required the use of information from another survey, which was available for 20-59 year olds only. Secondly, teenagers are much less likely than 20-59 year olds to be in stable, long-term employment situations. Between the mid-1980s and the late 1990s the full-time employment rate of teenagers was halved, as increasing numbers of teenagers stayed on at school or took up post-school education and training options. Excluding teenagers excludes the population group whose changes in employment patterns were most extreme over the study period.

Throughout most of the study, part-time and full-time employees are analysed together (pooled) rather than treated as separate populations. This approach was adopted because the pay gap between 20-59 year old part-time and full-time employees is relatively small in New Zealand. Female part-time employees, who comprised about four-fifths of all part-time employees in the IS and HES samples of 20-59 year olds, earned around 92-95 percent of the average hourly earnings of female full-timers in the late 1990s.[5] Although there are statistically significant differences between part-time and full-time employees in both mean characteristics and earnings, the differences are not large enough in substantive terms to justify treating part-time and full-time employment as separate sectors of the labour market. However, the effects of part-time employment on women's earnings are considered briefly in Section 7.

The structure of the report is as follows. Section 2 provides a brief summary of previous research on the gender pay gap. Section 3 gives an overview of the theoretical context and methods, and describes the data used in the study. Section 4 provides a descriptive analysis of the gender pay gap. It documents the changes that took place over the last fifteen years in the level and dimensions of the male–female earnings differential.

Section 5 begins the analysis of the determinants of men's and women's earnings. It explores the effects of differences in education and past work experience. Section 6 considers the effects of differing industrial and occupational distributions. In Section 7, the focus shifts to women aged 20-39, and the effects of motherhood and part-time employment on the predicted average hourly earnings of this sub-population. Section 8 concludes.

[5] The part-time /full-time gap was a little larger for males. The average hourly earnings of male part-time employees were around 90 percent of the average hourly earnings of male full-timers.

2. PREVIOUS RESEARCH ON THE GENDER PAY GAP

The findings of recent empirical research on the gender earnings gap are briefly summarised in this section.

2.1 New Zealand

Hyman (1994) and Cook and Briggs (1997) give time-series information on the changes in the raw gender earnings differential, using measures drawn from the firm-based Quarterly Employment Survey. Dixon (1998) also provides information on the trends in the gender earnings gap, but uses the Household Economic Survey as her source. Both surveys provide evidence of a contraction of the gender gap between the mid-1980s and the mid-1990s. The timing and exact size of the contraction differs between the two data sources, however.[6]

Two previous authors have undertaken regression analyses designed to identify and quantify the sources of the gender earnings differential. Sutton (1984) analysed the gender earnings gap using a sample of 751 public servants who were employed in the executive/clerical occupational class in 1984. She found a female-to-male ratio of 0.75 in annual salaries. Approximately one-third of the gap could be attributed to gender differences in qualifications, and one-third to differences in years of service in the public service. The remainder was unexplained.

Kirkwood and Wigbout (1998) used a standardisation method to estimate the effects of male-female differences in five key characteristics (occupation, hours worked, age, highest qualification and ethnicity) on the gender gap in weekly full-time earnings. They used data on men and women in full-time employment who were surveyed in the June 1997 HLFS Income Supplement. Approximately one-third of the male-female gap in full-time weekly earnings was found to be attributable to the five variables considered.

2.2 Other countries

Size of the gender earnings gap and its components

The size of the gender gap varies considerably across countries. Joshi and Paci (1998) and Blau and Kahn (1995) give comparative data on the gender pay gap in a range of OECD countries as at the mid-1990s. The Scandinavian countries, Australia and New Zealand had female/male hourly earnings ratios in the range of 80-90 percent. Other countries, including Germany, Switzerland and the United States, had lower female/male pay ratios, falling in the range of 65-75 percent.

Virtually all OECD countries experienced reductions in their aggregate gender earnings gaps between the 1970s and the 1990s. Harkness (1996) reports that in the UK, the ratio of female to male average hourly earnings rose from around 0.65 at the start of the 1980s to 0.71 in 1993. Among full-time employees, the gender ratio in hourly earnings rose from about 0.66 in 1980 to 0.77 in 1993 (ibid., p.4). In the United States, the female-male hourly earnings ratio rose from around 0.65 in 1980 to 0.77 in 1993 (Joshi and Paci, 1998, p.16-17). In Australia,

[6] The QES indicates that the increase of the female-male hourly earnings ratio 'stalled' in the early 1990s at around 0.82. However, the rise in the gender earnings ratio in this time series resumed in 1998, and by February 1999 it had increased to 0.84. In contrast the HES indicates that the narrowing of the gender gap continued until around 1994. The gap then stabilised until 1998, the last year in which this survey was collected.

the initial gap was smaller and the change slower. A female-to-male hourly earnings ratio of around 0.85 for full-time employees in the early 1980s had risen to about 0.88 by 1998 (Borland, 1999; Whitehouse, 1999, p.4).

Much of the empirical research in this field has attempted to determine how much of the gender earnings gap can be attributed to differences in the productive attributes of men and women, and how much remains unexplained after those productivity differences are accounted for. 'Productive attributes' are measured using proxy variables such as educational attainment, years of work experience, or time spent undertaking job-related training. The Blinder-Oaxaca decomposition method, which compares male and female earnings and productive characteristics at their means, has frequently been used to estimate the relative importance of gender differences in productive characteristics, and the contribution of those differences to longer-term reductions in the gender earnings gap.

Typically, researchers using these methods have reported that they are able to attribute about one-third of the total male-female wage differential to differences in productivity-related attributes, such as education and past work experience. If information on job characteristics is also included, up to two-thirds of the gap is 'explained' in these studies. For example, Blau and Kahn (1997) analysed the pay gap between full-time employed men and women in the US in 1979 and 1988, using samples drawn from the Panel Study of Income Dynamics. They found that women's lower levels of human capital accounted for roughly one-third of the gap in both 1979 and 1988. When industry, occupation and union status were added to the regressions, the explained portion rose to around 50–60 percent (p.16). Joshi and Paci (1998) report decomposition results for a British sample of men and women who were aged 33 in 1991. Around one-quarter of the total wage gap was attributable to male-female differences in human capital characteristics. When a detailed set of information on job characteristics was also incorporated, the portion of the gap attributable to differences in mean characteristics rose to 56 percent (p.133).

In most studies of this type, residual or 'unexplained' pay differentials between men and women (i.e. the differences not attributable to characteristics) are found to be quite substantial in size, even in the 1990s. For example, Joshi and Paci (1998, p.132) estimated an unexplained hourly earnings differential of around 15 percent of men's average earnings in the UK in 1991. In Australia, Spilsbury and Kidd (1996), using a basic wage equation with human capital variables, estimated an unexplained hourly earnings gap representing about 9 percent of male average earnings in 1990.

Researchers have almost universally found that reductions in male-female differences in measured productivity-related characteristics, particularly education and years of work experience, contributed to the reductions in gender earnings differentials that were recorded during the 1980s and 1990s. Frequently, changes in the wage returns to characteristics – which are characterised as 'unexplained' in the Blinder-Oaxaca decomposition – are found to be quantitatively important as well, in terms of their impact on the reduction of the pay gap. Estimates of the relative contribution of each vary considerable across studies. At one end of the spectrum, Wellington (1993, p.19) estimates that almost half of the reduction in the gender earnings gap in the US between 1976 and 1985 was due to a convergence in male and female average levels of education, experience, training and tenure. At the other end of the spectrum, Spilsbury and Kidd (1996) are able to attribute only 12–16 percent of the total reduction in the gender gap in Australia between 1973 and 1990 to the changes in mean

characteristics using a Blinder-Oaxaca decomposition (p.216). The remainder (84–88 percent) is attributed to reductions in gender differences in the 'returns' to characteristics.

A recent strand of the literature has focused on the effects of motherhood on women's relative earnings and the gender pay gap. It is fairly well documented that in countries such as the United States and the United Kingdom, mothers tend to earn lower hourly wages than do childless women. Waldfogel (1998b) studied the earnings of two birth cohorts of young women in the US and in the UK, observed in their early twenties and their early thirties. She found that mothers had lower hourly earnings than non-mothers in part because of their reduced work experience, and in part because of a loss of continuity of employment with pre-childbirth employers. She speculates that the benefits of women remaining with the same employer after childbirth include the maintenance of seniority; the preservation of good job matches; and the preservation of firm-specific and job-specific skills (1998b, p.534). Joshi and Paci (1998) also studied the earnings of the same two cohorts of young women in the UK. They concluded that the relative earnings of mothers were reduced partly by their reduced work experience, and partly by their movement into part-time jobs, which tend to be lower paid than full-time jobs in the UK labour market.

Waldfogel (1998b, pp 519-20) attempted to estimate the portion of the total hourly earnings gap between men and women in the US and UK that could be attributed to the differing effects of marital status and parental status on men's and women's earnings. She found that nearly half (45 percent) of the gender gap at age 30 in the US is due to the direct effects of marital status and children. In the UK, nearly half (48 percent) of the gender gap at age 32 is due to the direct effects of marital status and children. These estimates include the wage premiums that are associated with marriage and children for men, as well as the wage penalties that are associated with marriage and children for women. Because the variables included in Waldfogel's wage equations are limited to education, years of experience, marital status and number of children, her approach maximises the estimated size of the marital status and child effects.[7]

Another recent development in the literature is the use of alternative decomposition methods to study the evolution of the gender earnings gap at different positions of the wage distribution. This development was motivated by the view that considering the whole of the male and female earnings distributions, not just the means, yields greater insights into the determinants of the gender pay gap. Blackaby et al (1997), which examines shifts in the gender pay gap in the UK between 1973 and 1991, is an example of this approach. The authors use a method suggested by Juhn, Murphy and Pierce (1993) to decompose the changes in the earnings distributions of men and women into the three components: the effects of changes in measured attributes, the effects of changes in attribute prices, and the effects of changes in residuals. They analyse the contribution of these three sources of change to the overall changes in the male-female earnings gap, evaluated at the mean of the distribution and at the 10^{th} and 90^{th} percentiles. Blackaby et al find that the earnings gap for full-time employees closed more at the lower end (the tenth percentile of the distribution) than at the upper end (the ninetieth). They argue that at the 90^{th} percentile of male and female earnings, changes in the prices were the driving force in the contraction of the gender pay gap during the 1970s, the decade in which Equal Pay regulations were implemented in the UK

[7] Reductions in work experience may be an indirect effect of motherhood, and this is not included in Waldfogel's estimate. On the other hand, fuller wage functions containing more information about other dimensions of productivity such as ability, training, tenure, or would probably have led to lower estimates of the contribution 'family effects' make to the total gender earnings gap.

(p.266). During the 1980s, in contrast, convergence in the relative characteristics of men and women was quantitatively the most important factor. At the 10th percentile, changes in the 'prices' associated with measured characteristics were the most important factor contributing to change throughout the entire study period.

Alternative estimation methods

Gender pay studies using alternative methods to estimate the determinants of individual earnings have reported much smaller unexplained pay differentials between men and women. For example, Kim and Polachek (1994) and Choudhury (1993) use panel data estimation methods, in an attempt to redress the unobserved heterogeneity and endogenity biases that they believe distort estimates obtained from conventional cross-sectional wage regressions. Both authors use relatively small samples of American employees drawn from the Panel Study of Income Dynamics. Both authors conclude that once unobservable individual heterogeneity is removed, the portion of the male-female wage gap that is unexplained (ie not attributable to mean productivity differences) is substantially smaller than indicated by the cross-sectional studies using the conventional methods.

Korenman and Neumark (1992), Neumark and Korenman (1994), and Waldfogel (1998) have used panel data estimation methods to re-examine the effects of children on mothers' earnings, while seeking to control for the effects of any unobserved differences between mothers and non-mothers. Results from this recent work are somewhat mixed. Korenman and Neumark (1992) find that the wage penalty experienced by women with children is much smaller than the penalty suggested by cross-sectional estimation methods. Neumark and Korenman (1994) – using different data and methods – and Waldfogel (1998) find little evidence of heterogeneity bias in the estimated wage effects of children.

Korenman and Neumark (1992) and Neumark and Korenman (1994) provide reasonably persuasive evidence that experience, tenure, education and marital status may be endogenous variables in women's wage functions – that is, they embody the effects of wages on individuals' past choices. An implication is that including these variables in wage functions may cause bias in the estimation of all parameters. A few other authors have tested for the presence of endogeneity biases in specific variables such as experience. In general, however, analyses of the gender earnings gap have ignored rather than grappled with the implications of possible endogeneity biases in the key earnings equations.

Implications of rising earnings inequality

Some OECD countries experienced quite marked growth in wage inequality during the 1980s. Juhn, Murphy and Pierce (1993) drew attention to the fact that wage differentials between two groups of workers that differ in their mean earnings, such as men and women, are influenced by the amount of wage dispersion that is present in the labour market as a whole. In an era of rising dispersion, the gap between average male and average female earnings could expand purely because of the fact that the total earnings distribution had spread out.

Blau and Kahn (1997) looked at the relationship between rising wage inequality in the United States and the contraction of the gender pay gap between 1979 and 1988. They analysed samples of full-time employees drawn from the Panel Study of Income Dynamics. Over the study period, the female-male pay ratio for sample members rose from 62.2 to 72.4 percent, reflecting a 9.9 percent fall in men's real average hourly earnings and a 4.9 rise in women's real hourly earnings (p.12). Blau and Kahn argue that changes in the wage structure over the

study period were unfavourable to low-wage workers in general. Had earnings inequality not increased, the contraction in the gender gap would probably have been larger. They estimate that rising wage inequality 'reclaimed' about one-third to two-fifths of women's potential gains in relative wages.[8] They also investigate the influence of shifts in the composition of supply and demand on changes in the gender pay gap. Their analysis indicates that demand changes favoured women over men at low-skill and middle-skill levels, but men over women at high-skill levels (p.31). The growth in the supply of women was also considerably larger than that of men at high-skill levels. Despite the less favourable demand and supply shifts affecting high-skilled women, the reduction in the gender gap at the upper end of the earnings distribution was not much less than the reductions recorded at the middle and lower end of the earnings distribution. Blau and Kahn attribute this result to the fact that there were substantial improvements in the human capital characteristics and occupational distribution of high-skilled women (p.32).

[8] Suen (1997) criticises the method used by Blau and Kahn to decompose wage residuals between 'the effects of unobserved prices' and 'the gender gap effect', arguing that the decomposition is conceptually invalid. If one accepts Suen's view, the claim that one-third to two-fifths of the potential reduction in the gender earnings gap was 'reclaimed' by rising wage inequality is also invalidated.

3. THEORY, METHODS AND DESCRIPTION OF THE DATA

3.1 Theoretical background

This study examines gender wage differentials using an approach that was inspired by the human capital theory of earnings. A basic assumption of human capital theory is that wages represent an economic return on the knowledge and skills that enable a worker to perform his or her job. Variations in wage rates are a consequence of variations in the productivity of individual workers, which in turn is shaped by workers' human capital endowments and skills. Human capital can be acquired in various ways, including formal education, structured training courses provided by employers, and on-the-job learning.

According to this broad theoretical approach, equity and efficiency within the labour market would require that equally productive workers receive equal pay, irrespective of gender, age or race (Joshi and Paci, 1998, p.3). However, empirical evidence that women and men are not paid identically does not necessarily imply that there is any inefficiency or inequity in the labour market. It may be the case that women and men are not identical in terms of the productive endowments that they bring to the labour market, or that the jobs they work in are not equally desirable in terms of their non-wage characteristics. Economic theory recognises several additional reasons why the observed relationship between the productivity of workers, and their relative wages, may not be a simple and direct one.[9]

Multiple regression models of earnings are widely used in labour economics to measure the influence of human capital characteristics on wages, and are one of the main tools used in empirical studies of the gender wage gap. A basic objective of these studies is to estimate how much of the female shortfall in pay is due to women's lower average levels of labour market skills. This is accomplished by taking a sample of male and female employees, estimating wage equations separately for men and women, and using the coefficients thus estimated in a decomposition of mean effects (see below, Section 3.2). In the simplest versions of this work, the portion of the wage gap that is found to be attributable to differences between men and women in productivity-related attributes is treated as non-discriminatory. The residual or remaining part of the wage gap is regarded as the difference in wages that is partly or wholly due to wage discrimination. Theoretical and methodological issues that have arisen in the implementation of this method are discussed in the following sections.

The specification of human capital wage equations

Direct measures of workers' productive capacities – which include many dimensions of ability, knowledge and skills – are not usually available in large survey datasets. Consequently, level of education and years of work experience or age are frequently used as proxy measures.

Formal educational qualifications are hypothesised to raise workers' productivity because their acquisition has led to the development of employment-related skills, whether generic (eg problem-solving ability) or specific (eg welding). Alternatively, qualifications may simply act as a signal to employers of underlying differences between individual workers in learning

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[9] For example, the demand for or the supply of specific skills – held in different amounts by men and women – may be in a state of change, and relative wages take time to adjust fully. Another complicating factor is that workers' skills and potential productivity are imperfectly measured.

ability. Length of employment experience is expected to be associated with productivity both because of learning-by-doing effects, and because workers with greater years of work experience are likely to have undertaken more formal training. If a measure of prior work experience is not available, age may be included as a proxy indictor of individuals' experience because it is highly correlated with *potential* years of experience. In addition, age may be directly associated with productivity if ageing leads to greater maturity, and greater maturity leads to better performance at work.

While education and past work experience are the most important proxy indicators of an individuals' probable productive capacity, measures of ethnic identity, country of birth, and region of residence are also included in many studies. The rationale is that these variables are likely to be correlated with variations across individuals in other dimensions of productive capacity that are not directly observed or measured – such as educational quality or fluency in English. Including ethnic identity or country of birth in the wage regression is an indirect way of controlling for the effects of those unobserved qualities on wages.

In this study, level of educational qualifications and years of work experience are treated as the core indicators of productive capacity. Education is measured directly in the HES and the IS. Measures of work experience are imputed in this study. No other measures of ability, experience, or training are available in the HES or IS. Age is available, but it is not entered directly into most of the models of earnings that are estimated here because it plays a large role in the estimation of the imputed values of experience. Information on ethnic identity, and in the case of the IS, country of birth, is also utilised.

Interpretation of the 'explained' and residual components of the gender wage gap

Most researchers acknowledge that the acquisition of human capital by men and women may be distorted by inequitable or discriminatory processes that operate *outside* the labour market, in families, schools or the wider community. Even if the pricing of men's and women's labour *within* the labour market is considered to fair, that does not necessarily imply that the pay differentials that result are fair when viewed from a broader social perspective.

Once the wage effects of male–female differences in skills are accounted for, the remaining portion of the gender pay gap is typically characterised as the 'residual', 'parameter' or 'unexplained' gap. In the standard decomposition method, this portion represents differences in the wage returns that men and women are estimated to receive in the labour market for their measured skills and productivity-related attributes. In early work on the gender pay gap, it was customary to suggest that the residual gap was the product of discrimination. This view was challenged, however, and has been replaced by agreement that there are several possible causes of residual pay inequality.

Firstly, residual wage inequality may reflect unmeasured male–female differences in the quality of the attributes that are included in the wage equations. Education is usually measured in terms of highest qualification attained, for example, but the field of the qualification also has a major influence on individuals' work opportunities and earnings. Degrees obtained from different institutions may also vary in quality, leading to differences in wages. Gender differences in these qualitative dimensions of education could be the true basis of the male–female differences estimated wage returns to education.

Unmeasured skills are a second possible source of residual gender pay inequality. Workers with equal endowments of measured human capital are not necessarily equally productive.

They may differ in their firm-specific or job-specific skills, for example, or in difficult-to-measure personal attributes such as career commitment. The omission of unmeasured but relevant skills from empirical wage models could distort estimates of male and female average returns to skills, causing them to appear to be gender-biased.

Thirdly, there may be differences in the non-wage attributes of the jobs that men and women undertake, such as the quality of the working conditions or the convenience of the hours. If those non-wage attributes vary by gender in a systematic manner, then part of the unexplained gender wage gap could be due to compensating wage differentials.

Finally, the residual portion of the gender wage gap will also pick up the effects of any discriminatory processes in the labour market that lead to unequal wage outcomes for women and men. This includes the effects of direct wage discrimination against women, and the effects of any barriers that impede women's access to higher-paid jobs.

The use of information about job characteristics

In most industrialised labour markets, men and women tend to carry out different kinds of jobs, and the jobs undertaken by women tend to be lower paid on average. This is relevant to studies of the gender wage gap, because there are both theoretical and empirical grounds for suggesting that job characteristics can influence an individual's wages independently of his or her own productive characteristics.[10] It raises the issue of how systematic differences in the distribution of men and women across jobs should be treated in an analysis of the gender pay gap.

Researchers vary in their treatment of this issue. Most researchers estimate both 'pure' human capital wage functions, and extended wage functions that include job variables such as industry and occupation of employment, size of employer, and whether the employer provided training. The inclusion of job variables enables researchers to account for (statistically) for a much larger portion of the total gender pay gap. However, it further complicates the interpretation of the 'explained' and residual components. It is difficult to argue that the differing distribution of men and women across jobs is exogenous to the labour market and is purely the outcome of individual choices, based on past human capital investments. It seems more likely that some gender barriers exist within the labour market, which contribute to the different job distributions. This means that any male–female wage differentials that are associated with job characteristics cannot readily be interpreted as fair, efficient or non-discriminatory.

The approach taken in this study

In broad terms, this study follows the standard approach of the economic literature on gender pay inequality. It begins by estimating a series of human capital-inspired models of wages, and applies the decomposition techniques first developed by Oaxaxa (1975) and Blinder (1973) to apportion the log wage gap between men and women into the component due to differences in characteristics and the residual. Initially, it focuses on the role of personal attributes like education and past work experience. Later, information on industry and occupation of employment is also incorporated.

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[10] Theories about the linkages between job characteristics and wage variation are discussed in Section 6.2.

One criticism of this standard method of investigating the gender wage gap is that the set of factors considered as potential causes of gender pay inequality is too limited in scope, and too focused on individual attributes. The size of the gender pay gap is also influenced by firm-level, societal and institutional factors. Recent studies have considered the effects of inter-establishment wage differentials (Barth and Mastekaasa, 1996; Groshen, 1991); collective bargaining agreements; minimum wage regulations (Blau and Kahn, 1997); and parental leave regulations (Ruhm, 1996).

This criticism has some validity. Unfortunately, there are significant data availability problems, which make it difficult to investigate firm-level and institutional influences on the gender pay gap in New Zealand at this time. The micro-level datasets currently available for research are derived from household surveys, and access to firm-based statistical data is quite limited.

In defence of individually-focused studies of gender pay inequality, it can be noted that the best studies of this type have been successful in accounting for a significant portion of observed gender wage gaps. For example, Joshi and Paci (1998) were able to explain up to two-thirds of the total gender wage differential found in a UK sample using detailed information on individual characteristics, job attributes and family circumstances.

3.2 Methods for decomposing the male-female wage gap

Cross-sectional decompositions of the gender gap in mean wages

Oaxaca (1975) and Blinder (1973) introduced an approach for estimating wage discrimination which has been much used in the literature on gender pay disparities. Let $\overline{\ln w_m}$ and $\overline{\ln w_f}$ be the means of the natural logs of male and female wages, where the *m* and *f* subscripts denote male and female employees respectively. Log wage regression equations are estimated separately for males and females. Because regression lines pass through the means of the variables, the log wage gap between men and women is equivalent to:

$$\overline{\ln w_m} - \overline{\ln w_f} = \beta_m \overline{X}_m - \beta_f \overline{X}_f \qquad (1)$$

where $\overline{X}_m$ and $\overline{X}_f$ are vectors containing the means of the explanatory variables for males and females, and β_m and β_f are the vectors of estimated coefficients from the male and female wage regressions. Given this result, the log wage differential can be decomposed in various ways. Oaxaca proposed the following forms:

$$\overline{\ln w_m} - \overline{\ln w_f} = (\overline{\mathrm{X}}_m - \overline{\mathrm{X}}_f)\beta_m + (\beta_m - \beta_f)\overline{\mathrm{X}}_f \qquad (2a)$$

and

$$\overline{\ln w_m} - \overline{\ln w_f} = (\overline{\mathrm{X}}_m - \overline{\mathrm{X}}_f)\beta_f + (\beta_m - \beta_f)\overline{\mathrm{X}}_m \qquad (2b)$$

The first term on the right-hand side of these equations represents the part of the log wage differential that is due to male–female differences in mean characteristics. Given that the characteristics included in $\overline{X}$ are education, experience, and other proxies for skill, this term

can be interpreted as measuring the effects of the gender gap in productive capacity upon the gender gap in earnings.

The second term in the equations represents the effect of male–female differences in the estimated coefficients or log wage 'returns' to characteristics. As noted, there are several interpretations of these differences in returns. They may partially reflect unmeasured gender differences in the quality of the attributes that are included in the equation; or other measurement errors in variables; or gender differences in skills that are unmeasured in surveys, and therefore omitted from the regression. They may also reflect male–female differences in preferences for non-wage job characteristics, or differences in the wage rates that men and women receive for a given level of skills. *If* in the absence of discrimination males and females would receive identical returns to the same characteristics, *and* gender differences in wages were due only to differences in the specific characteristics that are included in the model, *then* the second term could be interpreted as that part of the log wage differential that is due to discrimination. Because the interpretation of the second term in the decompositions is problematic, we focus mainly on the first term in the analysis undertaken in this study.

There are two possible weighting schemes in the Oaxaca decomposition. The first weighting scheme (2.a) uses the male wage structure to value (assign a price to) the attributes of men and women. Intuitively, this assumes that the male wage rates are unaffected by discrimination, and would prevail in the absence of discrimination against women. The converse is true of the second weighting scheme. (2.a) is more commonly reported in the gender inequality literature than (2.b).

Neumark (1988) has suggested a more general weighting method:

$$\overline{\ln w_m} - \overline{\ln w_f} = (\overline{X}_m - \overline{X}_f)\beta + [(\beta_m - \beta)\overline{X}_m - (\beta_f - \beta)\overline{X}_f] \qquad (3)$$

where β is estimated from a pooled regression of males and females. This version is intuitively appealing if one believes that both the male and the female wage structures are influenced by the unequal treatment of the sexes in the labour market. The (employment-weighted) average of the two is taken to be a reasonable representation of the wage rates that would prevail if men and women were treated equally in the labour market.

Unfortunately, the choice of weighting scheme can lead to quite large variations in the empirical results obtained. This is one of the weaknesses of the decomposition methodology.

In this study we present and compare results from decompositions using two of the three alternative weighting schemes – following equations 2.a and 3. The first version, which weights the gap in productive attributes with the coefficients from the male regression, is used because it is the weighting method most commonly reported in previous literature on the gender pay gap. The second version, which uses the coefficients from a pooled regression as weights, is used because it does not require such strong assumptions about the alternative wage structure that would prevail in a labour market free from gender inequities. While it would have been possible to obtain and report decomposition results using all three weighting schemes, this option was rejected as too time consuming.

Time series decompositions of the gender gap in wages

There are a number of alternative ways to decompose *changes* in the gender earnings gap between two periods. Drawing on equation (1), the change in the gender earnings gap between two periods, time 1 and time 2, can be written:

$$(\overline{\ln w_{m2}} - \overline{\ln w_{f2}}) - (\overline{\ln w_{m1}} - \overline{\ln w_{f1}}) = (\beta_{m2}\overline{\mathrm{X}}_{m2} - \beta_{f2}\overline{\mathrm{X}}_{f2}) - (\beta_{m1}\overline{\mathrm{X}}_{m1} - \beta_{f1}\overline{\mathrm{X}}_{f1}) \qquad (4)$$

Adding and subtracting $\beta_{m1}\overline{X}_{m2}$ and $\beta_{f1}\overline{X}_{f2}$ from the right-hand side of equation (4), and rearranging the terms, it is possible to derive the following decomposition:

$$\begin{aligned}(\overline{\ln w_{m2}} - \overline{\ln w_{f2}}) - (\overline{\ln w_{m1}} - \overline{\ln w_{f1}}) = {} & \beta_{m1}(\overline{\mathrm{X}}_{m2} - \overline{\mathrm{X}}_{m1}) - \beta_{f1}(\overline{\mathrm{X}}_{f2} - \overline{\mathrm{X}}_{f1}) \\ & + \overline{\mathrm{X}}_{m2}(\beta_{m2} - \beta_{m1}) - \overline{\mathrm{X}}_{f2}(\beta_{f2} - \beta_{f1})\end{aligned} \qquad (5)$$

The first two right-hand side terms in (5) capture the effects of changes in the means of the explanatory variables, weighted by the starting period coefficients for men and women respectively. The 3rd and 4th terms capture the effects of changes in the coefficients, weighted by the male and female mean levels of characteristics in the second period.

The first two right-hand side terms of Equation (5) are used in this study to estimate the effects on the gender pay gap of changes in the relative male–female gap in measured characteristics. The 3rd and 4th terms of this decomposition are not generally reported in this study, because of the difficulty of interpreting what they measure.

Equation (5) is just one of four alternative ways of calculating the effects of changes in the relative skills of men and women. The first two terms of the equation could be weighted by the beginning or the end-year coefficients; and in each period, by either the male or female coefficients. The choice between these alternative weighting systems is essentially an arbitrary one, yet the choice of weights can have a significant impact on the results that are obtained. To keep the size of the analysis manageable, we selected a single approach and did not test the sensitivity of the results to variations in weighting scheme in a systematic way. The decomposition described above, in which male and female mean characteristics are weighted in each case by their own starting-period coefficients, is intuitively appealing. However, the results obtained using this particular approach should be regarded as preliminary estimates, which could be modified in future by more detailed studies which explored alternative weighting methods in a more systematic way.

3.3 Data Sources

Household Economic Survey

The Household Economic Survey is a Statistics New Zealand survey of people living in private households. Income data, including details of all wage and salary income that was earned during the preceding 12 months, are collected from each adult in each surveyed household through personal interviews. The HES collects data from around 7000 people each year, of whom about 3,000 hold wage or salary jobs at the time of their interview. The response rate to the HES is 80-81 percent of sampled households.

The collection of data for each annual HES survey is spread over a twelve-month period from 1 April to 31 March the following year. For brevity, the annual datasets are referred to in this study by the year in which data collection ended. For example, '1998' denotes the data collected between 1 April 1997 and 31 March 1998.

This study utilises HES data for the years from 1984 through to 1998. The HES was collected annually between those dates (but will not be collected again until 2000/01). Due to changes in coding procedures, the information on family relationships that was collected in the years 1984 to 1986 is not comparable with the data collected in subsequent years. This means that consistent measures of parental status cannot be created spanning the periods 1984-86 *and* 1987-1998. Other important data limitations are that: (i) the highest qualification variable is not available in 1987; and (ii) in 1988, industry of employment was coded in a way that is not comparable with the coding schemes used in other years. Because of these data limitations, much of the multivariate analysis undertaken in this study is limited to the decade from 1989 to 1998, the years for which a consistent set of explanatory variables is available.

Household Labour Force Survey Income Supplement

A supplementary survey on incomes was collected by Statistics New Zealand for the first time in June 1997, as an attachment to the quarterly Household Labour Force Survey. The Income Supplement is now an annual survey.

The Household Labour Force Survey has a response rate of approximately 90 percent of sampled households. Each quarter, around 28,000 individuals provide responses (possibly by proxy, that is through another household member). In the 1997 and 1998 June quarters around 9,500 wage and salary earners also provided responses to the Income Supplement. Statistics New Zealand then imputed responses for the remaining individuals who were surveyed in the HLFS, but could not be personally contacted for the Income Supplement or refused to participate.[11] Just over 2,000 responses were imputed in 1997 and around 1400 in 1998.

The imputed responses, which made up 17.5 percent of all wage earner responses in 1997 and 12.7 percent in 1998, were included in the datasets that are analysed in this study. Response rates to this survey are demographically biased – for example, the response rate is lower among younger adults.[12] This means that the inclusion of the imputed records is likely to improve the representativeness of the sample. Estimates of mean hourly and weekly earnings are slightly higher (between 0 and 1 percent higher) if the imputed records are excluded. However, the exclusion of the imputed records does not significantly affect estimates of the size of the gender gap in hourly or weekly earnings.

3.4 Definitions of variables

This study focuses on two key measures of earnings: usual regular weekly earnings, and usual regular hourly earnings, obtained from all currently-held jobs. Overtime payments are included, but irregular payments such as bonuses and commissions are excluded. These

[11] Records are imputed by drawing information from a randomly-selected record of a respondent who matched the missing respondent in terms of his or her primary demographic and job characteristics, including age group, labour force status, full-time/part-time status, highest qualification, ethnic group and whether a resident of the Auckland region.

[12] Unpublished analyses by Statistics New Zealand staff have examined the differences between respondents and non-respondents in demographic profile.

measures of earnings were selected because they were available in both survey data sources. Their use enables more consistent comparison of the data drawn from the two surveys.

The implications of choosing these particular measures of earnings for this detailed study of the gender pay gap are examined in Appendix 1. The exclusion of irregular earnings (bonuses and commissions) does seem to affect the estimated size of the gender earnings gap, in recent years at least. This reflects the fact that men on average have higher irregular earnings than women. Excluding irregular earnings raises the ratio of female to male hourly earnings in the HES by around 1 percent in 1998. Switching between other alternative definitions of earnings (for example, between usual and actual earnings, or between 'main job' and 'total' earnings) does not materially affect the estimated size of the gender gap.

The nominal earnings and income data recorded in HES and IS were converted to constant March 1998 dollars, using a quarterly CPI series. The particular CPI series used for this purpose excludes the estimated effects of the implementation of GST, a general goods and services tax, during the 1980s.[13] This series matches the official CPI series from March 1990 onwards.

Definitions of other variables used in the analysis are set out in Appendix 1.

3.5 Samples used in the study

Two slightly different samples of employees were used in this study.

The *full waged* samples from the HES and the IS include all wage or salary earners with complete and valid information on usual weekly and hourly earnings, and usual hours worked. The full waged samples are used in Section 4, which provides a descriptive overview of developments in the gender earnings gap. A small number of wage earner records were dropped in the formation of the 'full' waged samples because of incomplete earnings or hours information, or very low or very high values of earnings or hours. In addition, the 1997 Income Supplement sample of usual earners was enlarged to make it more comparable with the 1998 sample. Details of these sample adjustments are given in Appendix 2.

Slightly smaller *analytic* samples were used in the remainder of the study. The analytic samples exclude wage earner records with missing information on qualifications, ethnicity, or occupation. Those variables are used to predict years of work experience, as well as acting as explanatory variables in the wage regressions. Details of the adjustments made to get from the 'full' to the 'analytic' samples are set out in Appendix 2.

To smooth measurement error that is present when sample sizes are small, the samples for two or three adjacent years are pooled in the regression and decomposition analyses undertaken in this study. The pooling arrangements are described at each stage of the analysis.

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[13] The CPI (excluding GST effects) series was calculated by the Reserve Bank of New Zealand. Roger (1995) outlines the methods used to calculate it. The introduction of GST was accompanied by a simultaneous reduction in direct income taxes, intended to offset the impact of higher indirect taxes on the real value of employees' after-tax earnings. If one is using gross earnings data to examine the trends over time in employees' real incomes from wage and salaried employment, it is more consistent to inflation-adjust the data using the GST-exclusive CPI series than using the official CPI.

Unweighted sample sizes

Table 3.1 provides information on the unweighted sizes of the full waged and the analytic samples. Between 1984 and 1990, the records of around 1900 wage-earning males and 1500 wage-earning females are available from each annual HES survey. From 1991 to 1998 sample sizes were smaller, and records for around 1450 male and 1300 female employees are available in each year.

Table 3.1 Unweighted total sample sizes

		HES Ann avge 1984-90	HES Ann avge 1991-98	Inc Supp 1997	Inc Supp 1998
Total samples					
Males	Full-time employee	1819	1373	5294	5085
	Part-time employee	53	79	597	463
	All employees	1872	1451	5891	5548
	Other status	642	701	3366	3568
	Total sample	2515	2153	9257	9116
Females	Full-time employee	965	888	3610	3539
	Part-time employee	509	441	2140	1994
	All employees	1474	1329	5750	5533
	Other status	1198	1034	4538	4732
	Total sample	2672	2363	10288	10265
		1989-91	HES 1993-95	1996-98	IS 1997-98
		(Numbers given are for the pooled samples)			
Analytic samples of employees					
Males	Full-time	4397	4536	3859	10309
	Part-time	146	277	236	1053
	Total	4543	4813	4095	11362
Females	Full-time	2510	3001	2525	7112
	Part-time	1280	1429	1319	4123
	Total	3790	4430	3844	11235

The Income Supplement samples are much larger. In each of 1997 and 1998, records are available for around 5,500 male employees and a similar number of female employees (including the imputed records).

The unweighted sample sizes of key demographic sub-groups are summarised in Table 3.2.

3.6 Sampling errors

In this study, all estimates were made using sampling weights supplied by Statistics New Zealand. Sampling weights are required to adjust the estimates for the fact that different individuals in the survey population, and the achieved sample, have different probabilities of selection.

Table 3.2: Unweighted sample sizes for demographic sub-groups

	HES				IS	
	1984-86 (pooled)		1996-98 (pooled)		1997-98 (pooled)	
	Males	Females	Males	Females	Males	Females
Highest qualification						
None	2048	1756	810	773	2580	2409
School	1240	1200	1135	1378	2300	2940
Vocational	1793	1011	1358	1061	5076	4582
Bachelor degree	515	255	555	476	971	963
Post-graduate degree	135	58	242	157	482	363
Ethnic group						
Pakeha	4973	3784	3405	3226	9068	9076
Mäori	419	282	354	330	1256	1167
Pacific Island peoples	187	122	151	132	618	585
Other	153	96	221	174	493	454
Marital status						
Married or living as married	4070	2934	3041	2689	8039	7566
Never married	1318	892	843	738	2761	2433
Separated, widowed, divorced	344	458	247	435	639	1284
	HES				IS	
	1987-88 (pooled)		1997-98 (pooled)		1997-98 (pooled)	
	Males	Females	Males	Females	Males	Females
Parental status						
Joint parent	2003	1287	1164	895	4692	3719
Sole parent	52	176	27	198	207	966

Sampling errors were estimated using information supplied by Statistics New Zealand on the design of the HES and IS samples (specifically, the clustering of respondents within primary sampling units and strata), and the survey data estimations procedures that are available within STATA Version 6. In the HES and IS, as in many other surveys, individuals are not sampled independently but rather are sampled in clusters – primary sampling units and strata. Because of the sampling design, observations in the same cluster are not independent of each other. The variances on the estimates are generally larger than would be the case if the samples were not clustered.

Table 3.3: Estimated sampling errors on estimates of geometric mean earnings, HES

	1984			1990			1998		
	Estimate	Sampling error		Estimate	Sampling error		Estimate	Sampling error	
	$	$	%	$	$	%	$	$	%
Hourly earnings, all employees									
Males	15.15	0.31	2.1	15.98	0.46	2.9	15.28	0.49	3.2
Females	12.02	0.25	2.0	13.17	0.37	2.8	13.33	0.34	2.6
Hourly earnings, full-time employees									
Males	15.17	0.31	2.1	16.01	0.46	2.9	15.37	0.47	3.1
Females	12.34	0.27	2.2	13.37	0.37	2.8	13.45	0.38	2.8
Weekly earnings, full-time employees									
Males	652.97	13.20	2.0	702.15	20.74	3.0	715.21	23.37	3.3
Females	481.09	11.41	2.4	528.53	16.29	3.1	549.75	17.22	3.1

Tables 3.3 to 3.5 give estimated sampling errors for a selection of estimates of geometric mean earnings. The selection is based on the range of estimates that are reported in the descriptive overview of trends in the gender earnings gap (Section 4).

The figures in Table 3.3, for example, relate to the HES samples for 1984, 1990 and 1998, and show that estimates of the mean hourly and weekly earnings of male and female employees in any given year have 95 percent confidence intervals of about 2-3 percent on either side of the estimate. The errors estimated for the 1998 estimates are larger than those

on the 1984 estimates because the sizes of the HES samples were progressively reduced over time.

Table 3.4: Estimated sampling errors on estimates of geometric mean earnings, IS

	1997			1998		
	Estimate	Sampling error		Estimate	Sampling error	
	$	$	%	$	$	%
Hourly earnings, all employees						
Males	15.02	0.23	1.5	15.45	0.28	1.8
Females	12.69	0.16	1.2	12.98	0.18	1.4
Hourly earnings, full-time employees						
Males	15.12	0.24	1.6	15.63	0.26	1.7
Females	12.93	0.19	1.5	13.49	0.23	1.7
Weekly earnings, full-time employees						
Males	674.95	10.59	1.6	687.65	11.54	1.7
Females	530.07	8.22	1.6	541.49	9.83	1.8

The sampling errors associated with mean earnings estimates calculated using 1997 and 1998 Income Supplement data are summarised in Table 3.4. These IS estimates generally have 95 percent confidence intervals of around 1.5 to 1.8 percent on either side of the estimate. The annual IS samples are much larger than the HES samples, which leads to more accurate estimates.

The sampling errors on estimates of the mean earnings of population sub-groups tend to be larger, and in some cases much larger, as shown in Table 3.5. For example, the estimated 95 percent confidence interval around an estimate of the average hourly earnings of male part-time employees, obtained using the 1984-86 HES samples (pooled), was 12.3 percent on each side of the estimate. Generally, very large sampling errors like this one are a consequence of small underlying sample sizes, although the dispersion of the dependent variable (in this case, the earnings of part-time males) can also play a role.

In this study, knowing whether particular male–female differences in mean earnings, or the *changes* in those male–female differentials over time, are statistically significant is often more important than knowing the size of the error on the point estimate for any one group. The statistical significance of the difference between two means can be tested in STATA using the 'svylc' software. 'Svylc' produces mean and standard error estimates for linear combinations of previously-estimated parameters. The significance of the differences between the male and female means shown in Tables 3.3 to 3.5 was tested in this manner. Almost without exception, those estimated point-in-time male-female earnings differentials were large enough to exceed the significance test threshold, indicating that they were unlikely to be random differences.

As a general rule of thumb, the male–female 'difference' estimates do not change enough from one year to the next for the changes to lie outside the bounds of sampling error. Considered over a 10-14 year period, however, a high proportion of the *long-term* movements in the male–female differentials that are reported in this research paper *are* large enough to be considered statistically significant. For example, HES estimates of male and female average hourly earnings in 1984 and 1998 (given in Table 3.3) show a decline in the gender differential from $3.13 in 1984 to $1.95 in 1998. This reduction is larger than the 95 percent confidence intervals on either side of each 'difference' estimate, indicating a statistically significant long-term reduction in the gender pay gap.

That said, there are some population sub-groups for whom the long-term changes in the male–female differential in average hourly earnings were relatively small, and cannot be considered statistically significant. An example is 20-24 year olds. Where appropriate, we comment on the statistical significance of key results presented later in the report.

Table 3.5: Estimated sampling errors on estimates of sub-group earnings, HES and IS

		HES 1984-86			HES 1996-98			IS 1997-98		
		Estimate	Sampling error		Estimate	Sampling error		Estimate	Sampling error	
		$	$	%	$	$	%	$	$	%
Males	All	14.73	0.17	1.2	14.99	0.29	1.9	15.23	0.23	1.5
	Full-time	14.72	0.17	1.2	15.08	0.29	1.9	15.37	0.23	1.5
	Part-time	15.19	1.86	12.3	13.62	1.38	10.2	13.90	0.69	5.0
Females	All	11.57	0.14	1.2	12.88	0.21	1.7	12.83	0.15	1.1
	Full-time	11.87	0.16	1.3	13.10	0.23	1.8	13.21	0.19	1.4
	Part-time	11.06	0.26	2.4	12.48	0.38	3.0	12.19	0.22	1.8
Males	20-24	11.55	0.24	2.1	10.87	0.38	3.5	11.40	0.27	2.3
	25-34	14.74	0.25	1.7	14.06	0.37	2.6	14.68	0.30	2.0
	35-44	16.28	0.36	2.2	16.43	0.50	3.0	16.82	0.43	2.6
	45-54	15.94	0.41	2.6	16.71	0.69	4.1	17.11	0.50	2.9
	55-59	15.21	0.58	3.8	15.70	1.05	6.7	15.77	0.69	4.4
Females	20-24	10.83	0.24	2.2	10.65	0.33	3.1	10.99	0.25	2.3
	25-34	11.86	0.27	2.3	13.21	0.30	2.3	13.26	0.26	1.9
	35-44	11.66	0.28	2.4	13.35	0.39	2.9	13.25	0.27	2.0
	45-54	11.81	0.36	3.0	13.44	0.50	3.7	13.00	0.28	2.1
	55-59	11.46	0.56	4.9	12.12	0.78	6.4	12.89	0.50	3.9
Males	No qualifcations	13.04	0.25	1.9	12.16	0.40	3.3	12.37	0.24	1.9
	School qualifications	14.43	0.33	2.3	14.25	0.40	2.8	14.00	0.34	2.4
	Vocational qualfications	15.50	0.27	1.7	15.32	0.39	2.5	15.80	0.26	1.7
	Bachelors degree	18.94	0.68	3.6	18.51	0.97	5.3	19.71	0.79	4.0
	Post-graduate degree	22.13	1.46	6.6	22.42	1.42	6.3	22.03	1.24	5.6
Females	No qualifcations	10.29	0.17	1.7	10.57	0.33	3.2	10.54	0.19	1.8
	School qualifications	11.45	0.25	2.2	12.27	0.29	2.3	12.26	0.21	1.7
	Vocational qualfications	13.16	0.32	2.5	14.02	0.45	3.2	13.37	0.24	1.8
	Bachelors degree	15.02	0.78	5.2	15.34	0.69	4.5	15.86	0.54	3.4
	Post-graduate degree	16.80	1.71	10.2	18.62	1.23	6.6	18.47	1.19	6.4
Males	Pakeha	15.01	0.19	1.3	15.36	0.32	2.1	15.71	0.25	1.6
	Mäori	13.14	0.58	4.4	13.06	0.60	4.6	13.18	0.38	2.9
	Pacific Island peoples	12.49	0.61	4.9	12.80	0.74	5.8	11.88	0.35	3.0
	Other	13.48	0.87	6.4	14.16	0.93	6.6	14.93	1.18	7.9
Females	Pakeha	11.72	0.15	1.3	13.22	0.24	1.8	13.11	0.16	1.2
	Mäori	10.57	0.58	5.5	11.18	0.56	5.0	11.37	0.33	2.9
	Pacific Island peoples	10.02	0.37	3.7	10.99	0.63	5.7	11.00	0.47	4.3
	Other	10.84	0.90	8.3	11.48	0.83	7.2	12.63	0.84	6.7
Males	Partnered	15.55	0.21	1.4	15.83	0.34	2.2	16.40	0.30	1.8
	Never married	12.40	0.26	2.1	12.32	0.37	3.0	12.69	0.27	2.1
	Separated, widowed, div	14.99	0.61	4.1	14.77	1.23	8.4	14.87	0.62	4.2
Females	Partnered	11.57	0.18	1.5	13.21	0.26	2.0	13.11	0.18	1.4
	Never married	11.44	0.28	2.5	11.65	0.38	3.3	12.04	0.26	2.2
	Separated, widowed, div	11.80	0.38	3.2	12.96	0.52	4.0	12.73	0.39	3.0
Males	Joint parent	n.a.	n.a.	n.a.	16.23	0.46	2.8	16.60	0.37	2.2
	Sole parent	n.a.	n.a.	n.a.	15.24	1.80	11.8	14.62	0.98	6.7
	No dependent children	n.a.	n.a.	n.a.	14.07	0.33	2.3	14.39	0.23	1.6
Females	Joint parent	n.a.	n.a.	n.a.	13.19	0.32	2.5	12.98	0.23	1.8
	Sole parent	n.a.	n.a.	n.a.	11.84	0.61	5.1	11.72	0.42	3.6
	No dependent children	n.a.	n.a.	n.a.	12.82	0.29	2.2	12.89	0.18	1.4

3.7 Comparison of the two data sources

The HES and IS samples of mature men and women used in this study are profiled and compared in Table 3.6. For comparative purposes, the figures shown here are drawn from the 1996/97 and 1997/98 HES samples and the June 1997 IS sample. The IS sample overlaps with the first quarter of the 1997/98 HES sample in time.

It is clear that there are some quite significant differences between the two survey samples in terms of economic activity patterns and demographic characteristics. Rates of participation in

waged or salaried employment are noticeably higher in the HES than the IS, particularly for males. Sixty-nine percent of males in the 1997/98 HES were currently employed in waged or salaried jobs – almost 6 percentage points lower than the employment rate of 63.0 percent recorded in the IS in June 1997.

Male employees in the IS sample were more likely to be working part-time hours than were male employees in the HES. The average usual weekly hours reported by employed men in the HES were also well above those reported by men in the IS. Although this is partly due to the lower rate of part-time employment recorded in the HES, there is also a significant difference in the mean hours reported by full-time employees. On average, full-time employees in the HES worked 2–3 hours per week longer than did full-time employees in the IS.

For women, the between-survey differences in economic activity patterns were smaller. The female waged employment rate in the 1997 IS was only two percent lower than the employment rate recorded in the 1997/98 HES. The full-time part-time mix was reasonably similar across the two surveys, and there was little difference in average hours worked per week.

There are also some significant differences in the demographic composition of the two survey's samples of employees. Post-school qualifications below degree level are recorded at much higher levels in the IS than is the case in the HES. In 1997, 44 percent of male employees in the IS were classified as having post-school qualifications below degree level, compared with only 31 percent of males in the 1998 HES. The between-survey gap in the percentage of female employees with post-school qualifications below degree level was similar. Employees in the HES were much more likely to be classified as having school qualifications only.[14] There are also differences in the incidence of degree qualifications. HES sample members were more likely to have bachelor or post-graduate degrees.

The age profiles of the samples from the two surveys show that the IS samples are younger. The proportion of sample members aged between 20 and 29 was about 4-5 percent higher in the IS sample than in the HES. The mean age of the total sample was around 1 year lower in the IS than in the HES. The ethnic profiles of the two survey samples were reasonably similar. Employees in the IS sample were a little less likely to be joint parents of dependent children than were those in the HES. Consistent with this, the mean number of dependent children per sample member was somewhat lower in the IS. A higher proportion of the HES employees worked in management and professional occupations than did the IS employees.

[14] Possibly this difference is due to the fact that in the HES, demographic data is supplied for the whole household by one household member, who may not be aware of all the post-school qualifications held by the others. Differences in the questions used in the two surveys may also be playing a role.

Table 3.6: Comparison of HES and IS weighted samples of employees

		Males			Females		
		HES, 1997	HES, 1998	IS, 1997	HES, 1997	HES, 1998	IS, 1997
Wage and salary employmt rates	Full-time	63.5	64.9	56.6	36.6	37.7	36.0
	Part-time	3.8	4.0	6.3	20.3	21.3	20.7
	Total	67.3	68.9	63.0	57.0	59.0	56.7
Full-time status	Full-time	94.3	94.1	89.9	64.3	63.9	63.5
	Part-time	5.7	5.9	10.1	35.7	36.1	36.5
Mean wkly hrs	All employees	46.2	45.5	42.5	32.9	32.4	32.2
	Full-time employees	48.1	47.4	45.3	42.4	41.6	41.6
Age	20-29	26.0	24.3	30.1	25.0	24.4	29.1
	30-39	30.7	32.4	30.7	29.9	28.9	28.6
	40-49	26.3	25.5	24.0	30.2	27.2	26.7
	50-59	17.1	17.9	15.3	14.8	19.5	15.6
	Mean age	37.9	38.1	36.8	37.9	38.6	37.3
Highest qualification	None	20.1	20.4	20.5	21.9	20.8	19.0
	School	26.9	27.0	20.9	36.2	34.1	27.3
	Vocational	33.1	31.2	44.1	26.4	27.3	41.3
	Bachelor degree	13.7	14.5	9.7	11.9	12.6	9.1
	Post-graduate degree	5.4	6.1	4.6	2.8	4.8	3.3
Ethnicity	Pakeha	82.4	82.3	81.3	82.1	85.7	83.0
	Mäori	7.6	9.8	9.5	9.4	8.0	8.3
	PI	3.7	3.4	4.7	3.3	3.2	4.5
	Other	6.3	4.5	4.5	5.2	3.1	4.2
Parental status	Joint parent	43.0	42.7	39.3	36.2	34.3	33.5
	Sole parent	0.6	1.5	1.5	8.2	6.7	6.9
	No dependent chn	56.5	55.8	59.2	55.5	59.0	59.6
Avge no. depend chn		0.93	0.91	0.82	0.86	0.80	0.76
Occupation	Management	18.4	18.7	14.5	11.1	10.8	7.4
	Professional	14.8	14.4	12.5	19.0	20.4	18.1
	Technical, assoc prof	11.6	12.0	12.7	9.9	10.0	13.5
	Clerical	4.6	4.4	6.0	23.8	24.6	27.4
	Sales and Service	7.8	9.1	9.9	21.3	21.6	18.7
	Agricultural	6.5	5.1	5.6	2.8	1.9	2.5
	Trade	15.5	15.8	15.1	1.9	0.8	1.4
	Operators & assemblers	14.0	13.4	14.7	3.9	5.6	4.1
	Elementary	6.8	7.1	8.8	6.4	4.3	6.7

What are the main reasons for these between-survey differences in the economic and demographic profile of the population of employees? One explanation lies in the fact that the IS achieves a higher overall response rate than the HES – capturing around 90 percent, rather than 80 percent of sampled households. The households that are surveyed in the IS but not the HES include a higher proportion of younger workers (see Table 3.7), who tend to be harder to contact in statistical surveys.

Table 3.7: Comparison of the total HES and IS samples

		Males			Females		
		HES, 1997	HES, 1998	IS, 1997	HES, 1997	HES, 1998	IS, 1997
Age	20-29	24.8	22.4	27.0	24.1	25.0	27.2
	30-39	32.4	34.3	31.6	35.4	33.5	32.7
	40-49	25.6	25.4	25.4	25.6	24.7	24.5
	50-59	17.2	17.8	16.0	14.9	16.8	15.6
	Mean age	38.5	38.8	38.0	38.0	38.3	37.8
Highest qualification	None	23.7	21.8	22.9	27.8	25.5	25.3
	School	26.7	27.1	21.2	35.0	33.1	27.8
	Vocational	30.3	30.4	42.5	23.5	24.1	36.4
	Bachelor degree	13.4	14.4	9.3	10.1	12.5	7.6
	Post-graduate degree	4.9	5.5	4.0	2.3	4.0	2.8

A second explanation is that the two surveys differ in their classification of employment as either 'waged employment' or ' self-employment'. A wage and salary earner is defined in the HES questionnaire as 'working for wages or salary, or on a piecework basis, or on commission and receiving a wage'. There has been a practice within the survey of assigning self-employed people who are working in limited liability companies to the wage or salary earner group, regardless of the nature of their role in the business. In the IS, employment status is self-reported and the respondents' own self-classification is rarely challenged. The outcome is that employed workers – and particularly men – are more likely to be classified in the IS as self-employed than they are in the HES. In the June 1997 Income Supplement, 19.3 percent of men were classified as a full-time self-employed worker in their main job, compared with 16.4 percent of men in the 1997/98 HES. This 3 percentage-point difference in self-employment rates could account for about half of the 6 percentage-point between-survey difference in men's waged-employment rates.

Timing of collection factors may also be contributing to the between-survey differences in sample composition. Data collection for the Income Supplement is concentrated in the June quarter. Some types of seasonally-varying employment are low in this quarter.

On the basis of the comparison of sample mean characteristics, it might be expected that mean earnings would be higher in the HES than in the IS, especially for males. This is in fact the case. Summary measures of average earnings in the two surveys are shown in Table 3.8. Geometric means are reported, as they are less sensitive to year-to-year fluctuations in the upper tail of the earnings distribution than are arithmetic means. Male full-time weekly earnings were 5.6 percent higher in the 1997/98 HES than the 1997 IS. Female full-time weekly earnings were 3.6 percent higher. Among females, the difference between surveys in mean weekly earnings is carried through into a similar difference in hourly earnings. Among males, the HES and IS estimates of mean hourly earnings are closer to each other. This reflects the fact that males in the HES work significantly longer hours on average than males in the IS. The inter-survey difference in earnings is reduced when weekly earnings are divided by hours.

Table 3.8: Comparison of mean earnings levels in the HES and IS

	Males			Females		
	HES 1997/98	IS 1997		HES 1997/98	IS 1997	
	($ March 1998)		% differ	($ March 1998)		% differ
Hourly earnings, all employees	15.28	15.02	1.73	13.33	12.69	4.83
Hourly earnings, full-time employees	15.37	15.12	1.64	13.45	12.93	3.82
Weekly earnings, full-time employees	715.21	674.95	5.63	549.75	530.07	3.58

Note: The estimates in this table are geometric means

On balance, the IS is likely to provide a more accurate and representative picture of the characteristics and earnings of New Zealand employees than the HES. There are several reasons for rating the quality of the IS data above that of the HES data. These include the larger sample size, the higher response rate of households, and the fact that the questionnaire used to capture information on employees' current earnings and hours worked was specifically designed for this purpose.

Given these considerations, it seems reasonable to attach a greater weight to results drawn from the IS than to results drawn from the HES when these surveys give conflicting or inconsistent information. Extensive use is made of the HES in this study, however, because it is the only data source available for analysis of the earnings distribution prior to 1997.

4. THE CHANGING DIMENSIONS OF THE GENDER EARNINGS GAP

4.1 Changes in the aggregate gender earnings gap

Between 1984 and 1998 there was a significant increase in the average earnings of women relative to those of men. All measures of earnings show reductions in the gender earnings gap. Although the year-to-year changes were small, the long-run changes are large enough to lie outside the bounds of sampling error.

Estimates of the actual levels of male and female real average earnings, and rates of real earnings growth over the study period, are shown in Table 4.1. Alternative measures of the ratio of female to male earnings are displayed in Table 4.2. Results from the 1999 HLFS Income Supplement, which became available only after this research project was well advanced, are used selectively in this section in order to provide a clearer picture of the trends emerging from this data source.

Table 4.1: Changes in the real earnings of male and female employees

	HES				IS		
	1984	1990	1998	% Chge 1984-98	1997	1999	% Chge 1997-9
	($ March 98)				($ March 98)		
Hourly earnings, all employees							
Males	15.15	15.98	15.28	0.9	15.02	15.58	3.7
Females	12.02	13.17	13.33	11.0	12.69	13.40	5.6
Hourly earnings, full-time employees							
Males	15.17	16.01	15.37	1.3	15.12	15.88	5.0
Females	12.34	13.37	13.45	8.9	12.93	14.11	9.1
Weekly earnings, full-time employees							
Males	652.97	702.15	715.21	9.5	674.95	698.60	3.5
Females	481.09	528.53	549.75	14.3	530.07	566.27	6.8

Note: All estimates of average earnings in this table are geometric means.

The HES estimates in Table 4.1 indicate that there was very little growth in the real hourly earnings of male employees between 1984 and 1998. The average real hourly earnings of males aged 20-59 (shown in the first row of Table 4.1) were only 1 percent higher in 1998 than in 1984. Over the same period, the average hourly earnings of female employees increased by 11 percent. The full-time weekly earnings measures (given in the second row) also show faster growth in the real earnings of females than males, although the gender difference is smaller in this case. A basic message that can be taken from these results is that the long-term contraction of the gender earnings differential was partly due to limited growth in the real earnings of *men*.

Income Supplement estimates of real earnings growth between June 1997 and June 1999 are shown in the right-hand side of Table 4.1. The annual rate of earnings growth was faster in this period, for both sexes. The increases in women's average earnings continued to outpace those of men. However, the male-female differences in growth rates were not so marked as those recorded in the earlier period by the HES.

The long-term changes in the economy-wide female-to-male earnings ratio are summarised in Table 4.2. There are several ways of measuring 'average' earnings. Table 4.2 gives a comprehensive set of estimates, showing how the gender earnings ratio is affected by the choice of a measure of the centre of the distribution (arithmetic mean, geometric mean or

median); the choice of an earnings measure (hourly, or full-time weekly); and the population of earners that is considered (full-time or all earners). The first entry in the table, for example, shows the ratio of female-to-male hourly earnings for all employees in 1984 when 'average' is measured by an arithmetic mean.

Table 4.2: Summary of alternative measures of the gender earnings gap

	HES			IS	
	1984	1990	1998	1997	1999
	Ratio of female to male				
Hourly earnings, all employees					
Arithmetic means	0.79	0.82	0.84	0.83	0.84
Geometric means	0.79	0.82	0.87	0.84	0.86
Medians	0.79	0.83	0.87	0.83	0.87
Hourly earnings, full-time employees					
Arithmetic means	0.79	0.81	0.84	0.83	0.86
Geometric means	0.81	0.84	0.87	0.86	0.89
Medians	0.82	0.86	0.90	0.87	0.91
Weekly earnings, full-time employees					
Arithmetic means	0.73	0.73	0.74	0.76	0.79
Geometric means	0.74	0.75	0.77	0.79	0.81
Medians	0.74	0.77	0.79	0.81	0.83
Hours, full-time employees					
Arithmetic means	0.90	0.90	0.88	0.92	0.91

Alternative measures of the centre of the earnings distribution give slightly different results, particularly in the later years of the study period. By the end of the period, gender ratios based on arithmetic means were generally one or two percentage points lower than those based on geometric means; and gender ratios based on medians were typically one or two percentage point higher again. Geometric means will be used as the standard measure of the centre of the earnings distribution in this paper.[15] Geometric means tend to fluctuate less across successive small samples than do medians, and they are less sensitive to changes in the dispersion of the upper tail of earnings than are arithmetic means. In addition the geometric mean for a given distribution typically lies between the arithmetic mean and median of that distribution, and hence it provides a 'central' estimate of earnings.

Focusing on the gender ratios that were calculated using geometric means, the results in Table 4.2 indicate that the female-to-male ratio of hourly earnings, for all employees, rose from 0.79 in 1984 to 0.86 in 1999. The female-to-male ratio of the hourly earnings of *full-time* employees rose from 0.81 in 1984 to 0.89 in 1999. The IS estimates of the gender ratio in June 1997 were lower than the HES estimates of the gender ratio in the year ended March 1998 (which is the last point in the HES series). However, there was an upward trend in the IS estimates, causing the estimated gender ratio in June 1999 to be reasonably close to the comparable HES figure for 1997/98. Using the HES samples to test the statistical significance of these changes, our tests indicated that the long-term movements in the male–female differences in means were large enough to be statistically significant.

The gender gap in weekly full-time earnings is larger than the gender gap in hourly earnings, and it remained so throughout the study period. In 1984, the average weekly earnings of full-time female employees were 74 percent of the weekly earnings of male employees. This ratio had risen to approximately 81 percent in June 1999. The gender gap in weekly earnings is

[15] The geometric mean is the antilog of the mean of the log distribution. Converting earnings to their log values before taking the mean causes the distribution of earnings to become more symmetrical and less skewed to the right. Hence geometric means tend to be lower than arithmetic means.

partly caused by a significant difference between men and women in average hours of work. In 1984, full-time employed women worked for 10 percent fewer hours on average than full-time employed men. In the late 1990s the gender gap in the average working hours of full-time employees was only one or two percentage points smaller than in 1984, and therefore still very significant.

Taking the HES estimates for 1984, and the IS estimates for 1999, as 'end point' estimates, the total increase in the hourly gender earnings ratio was 7 percentage points. The total increase in the full-time weekly earnings ratio was also 7 percentage points.

Figure 4.1: The gender ratio in hourly earnings, HES and IS

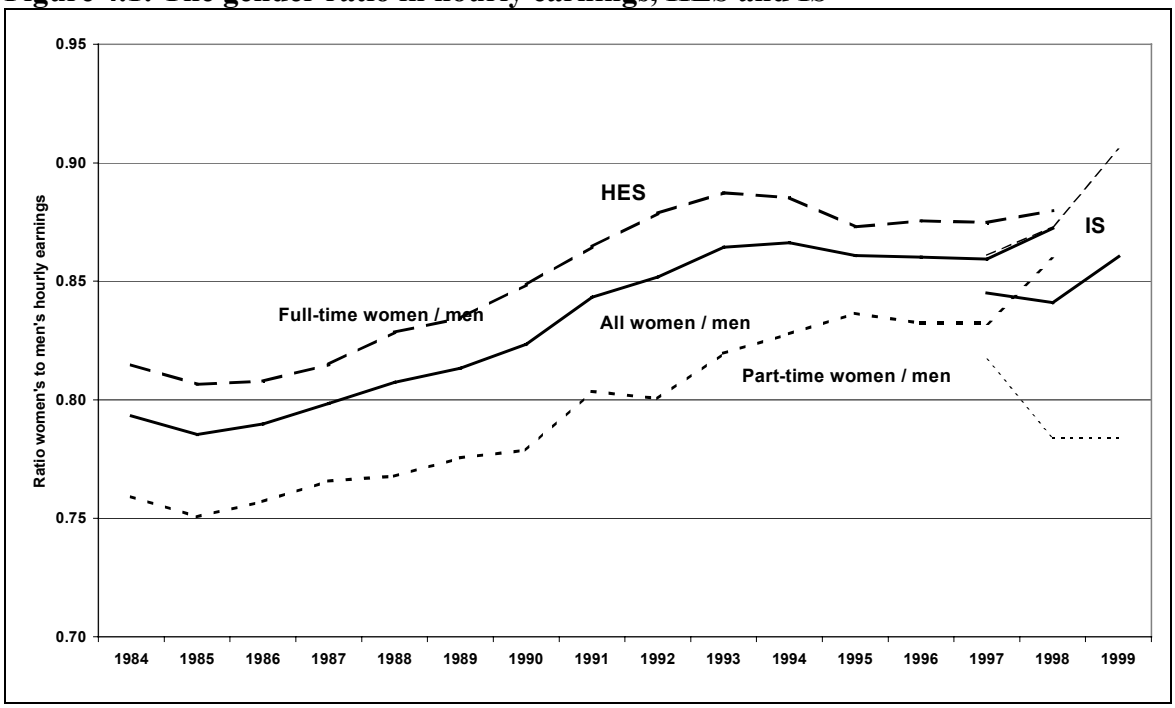
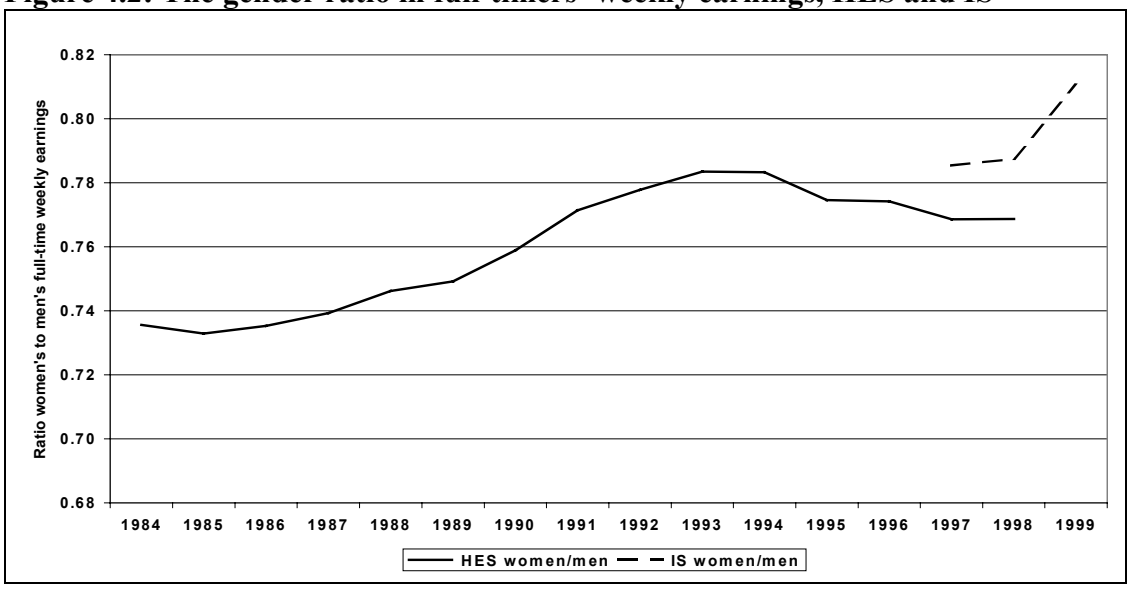


Figure 4.2: The gender ratio in full-timers' weekly earnings, HES and IS



Figures 4.1 and 4.2 illustrate the long-term trends in the gender earnings gap. The bold lines in Figure 4.1 represent the female-to-male ratio of geometric mean hourly earnings, as

measured by the HES (1984–98) and the IS (1997–99). The broken lines show the ratio of full-time employed female earnings to the earnings of all men, and the ratio of part-time employed female earnings to the earnings of all males.[16] The full-time female-to-male ratios are consistently higher than the all female-to-male ratios, while the part-time female-to-male ratios are consistently lower.

All of the HES trend lines show growth in female-to-male earnings ratios between 1984 and 1994, and a period of stabilisation after 1994. The IS trend lines show growth in the gender ratios for all women and full-time employed women between 1997 and 1999, but a decline in the ratio for part-time employed women. There is a significant discrepancy between the two surveys in estimates of the relative earnings of part-time employed women. This discrepancy is discussed in Section 4.2.

Figure 4.2 displays the ratio of female to male weekly full-time earnings. The HES trend line increases until around 1993 but subsequently *declines* by a couple of percentage points. The IS trend line, in contrast, starts at a higher level and was increasing between 1997 and 1999.

Figures 4.1 and 4.2 raise the question of why the contraction in the gender earnings gap as measured by the HES tapered off after 1994, while the IS shows continued improvement. The answer seems to lie in differences between the two surveys in patterns of change at the upper end of the earnings distribution. During the last three years of the HES series, real earnings growth rates were quite strongly correlated with level of earnings, and the increases recorded for men at the 85th percentile and above exceeded the growth rates experienced by higher-paid women. Female-to-male pay ratios declined at the upper end of the earnings distribution, while continuing to rise over the lower and middle range. This pattern is particularly strong in the weekly earnings data. It is weaker in the hourly earnings data, because the impact of rapid increases in the real earnings of highly-paid men was attenuated by increases in the relative hours of work reported by this group of men. These patterns of change are not apparent in the IS earnings distributions between 1997 and 1999. Thus, improvements in the gender earnings ratio in the IS samples were not reduced by disproportionately rapid increases in the relative earnings of higher paid men.

More detailed information on the long-term changes in the relative earnings of full-time and part-time employees is given in Table 4.3. Observations for three adjacent years of HES data (1984-86 and 1996-98) were pooled in the calculation of these figures in order to smooth the variations in estimates that arise when sample sizes are relatively small. The 1997 and 1998 IS samples were also pooled, for the same reason. The average earnings of each group are displayed in the upper half of Table 4.3, and the ratios of the earnings of the various groups are displayed in the lower half.

[16] With the exception of the start and end points, the points in each of the HES series have been smoothed by the calculation of three-year moving averages, so that the trends are easier to visualise. The IS points are *not* smoothed.

Table 4.3: Gender earnings ratios for part-time and full-time employees

	HES 1984-86	HES 1996-98	IS 1997-98	Implied change HES-HES	Implied change HES-IS
Geometric mean hourly earnings ($ March 1998)					
All males	14.73	15.23	15.23	3.4	3.4
Full-time	14.72	15.08	15.37	2.4	4.4
Part-time	15.19	13.62	13.90	-10.3	-8.5
All females	11.57	12.83	12.83	11.0	11.0
Full-time	11.87	13.10	13.21	10.4	11.3
Part-time	11.06	12.48	12.19	12.8	10.2
Ratios					
Part-time males / FT males	1.03	0.90	0.90	-0.13	-0.13
Part-time females / FT females	0.93	0.95	0.92	0.02	-0.01
Part-time females / all males	0.75	0.82	0.80	0.07	0.05
Full-time females / all males	0.81	0.86	0.87	0.05	0.06
FT females / FT males	0.81	0.87	0.86	0.06	0.05

Note: Sample sizes are given in Table 3.1

Both part-time employed men and part-time employed women earn substantially less on average than do their full-time employed counterparts. For part-time employed males, the 'pay penalty' appears to be a recent phenomenon, which emerged following a substantial decline in the average earnings of this group between the mid-1980s and the late 1990s. While full-time employed males experienced a small amount of real earnings growth, the average hourly earnings of part-time employed men declined by about 10 percent in real terms. Because the HES sample of part-time male employees is quite small, however, there some risk that the results for this group are distorted by sampling or other errors.[17]

In contrast, the gap in earnings between part-time employed and full-time employed women did not show a clear trend over the study period. The ratio lay between 92 percent and 95 percent, and was higher in the HES sample in the late 1990s than in the IS sample. The long-term increases in the real average hourly earnings of part-time and full-time employed women were fairly similar (10-12 percent).

Although the gender earnings gap faced by part-time employed women is larger than that faced by full-timers, both groups experienced long-term improvements in their relative earnings. The ratio of part-time employed women's hourly earnings to those of all employed men increased from 75 percent in 1984-86 to about 81 percent in the late 1990s. The full-time female-to-all-male ratio rose from 81 percent in 1984-86 to approximately 86 percent in 1997-98. Using the HES samples to test the statistical significance of these changes, we found that the long-term movements can be considered statistically significant.

4.2 Dimensions of the gender earnings gap

Changes in average earnings can disguise large variations in the experience of earners located at different points of the earnings distribution, in different population groups, or in different sectors of the labour market. This section considers the broad question of whether improvements in the female-to-male earnings ratio were widely spread across the labour market, or concentrated within particular groups or sectors.

[17] We were unable to find a demographic explanation for the apparent fall in the relative earnings of part-time males.

The gender gap by level of earnings

The figures shown in Table 4.4 summarise the total real earnings growth that was experienced by men and women located at different levels of the earnings distribution between 1984-86 and the late 1990s. There are two columns of figures. The first shows the increases in real hourly earnings recorded by the HES between 1984-86 and 1996-98, for employees at the 90th, 50th and 10th percentile boundaries of the male and female earnings distributions.[18] The second column shows the (implied) real earnings growth recorded between 1984-86 and 1997-98 if one uses the IS as the data source for 1997-98.

Table 4.4: Long-term growth of real hourly earnings by position in the gender-specific earnings distribution

	HES 1984-86 to HES 1996-98	HES 1984-86 to IS 1997-98
	Percentage increase in real hourly earnings	
Males		
90th percentile	10.6	11.7
50th percentile	0.9	1.9
10th percentile	-4.5	-1.7
Females		
90th percentile	15.9	15.2
50th percentile	10.7	9.1
10th percentile	5.5	8.3

For both genders, and particularly for men, earnings growth was positively related to position in the earnings distribution. Higher-paid workers experienced faster real earnings growth than workers with relatively low hourly earnings. For example, the earnings of males at the 90th percentile of the earnings distribution increased by around 11 percent, while males at the 10th percentile experienced a real earnings decline of 2-4 percentage points. While total long-term earnings growth was greater for women than men at all levels of earnings, the dispersion of growth rates among women was also fairly pronounced. Real earnings at the 90th percentile of the female distribution increased by around 10 percent more than at the 10th percentile.

Difference in rates of earnings growth across the wage distribution resulted in greater improvements in the gender earnings ratio at some points of the distribution than at others. Table 4.5 and Figures 4.3-4.4 illustrate the changes in the size of gender earnings gap at different points of the distribution. The first entry in Table 4.5, for example, gives the ratio of the hourly earnings of the 90th percentile woman to the hourly earnings of the 90th percentile man in the HES in 1984. The points graphed in the Figures are similarly calculated. Figure 4.3 plots the female-to-male hourly earnings ratio by percentile, using data for 1984-86 (HES), 1996-98 (HES), and 1997-98 (IS). Figure 4.4 plots the female-to-male ratio in the weekly earnings of full-time employees, using the same years and samples.

[18] In a ranking of earners from lowest to highest, the 90th percentile boundary is the point that separates the lowest 90 percent of earnings from the highest 10 percent. Hence, it is near the top of the earnings distribution. The 10th percentile is similarly defined and is the near the bottom of the earnings distribution. The 50th percentile is the median.

Table 4.5: Gender pay ratios by position in the earnings distribution

		HES		IS	
	1984	1990	1998	1997	1998
Hourly earnings, all employees					
90th percentile	0.77	0.77	0.79	0.78	0.79
50th percentile	0.79	0.83	0.87	0.83	0.84
10th percentile	0.85	0.89	0.94	0.93	0.90
Weekly earnings, full-time employees					
90th percentile	0.71	0.70	0.70	0.73	0.75
50th percentile	0.74	0.79	0.79	0.81	0.81
10th percentile	0.79	0.81	0.85	0.82	0.83

Figure 4.3: The gender gap in hourly earnings by level of earnings

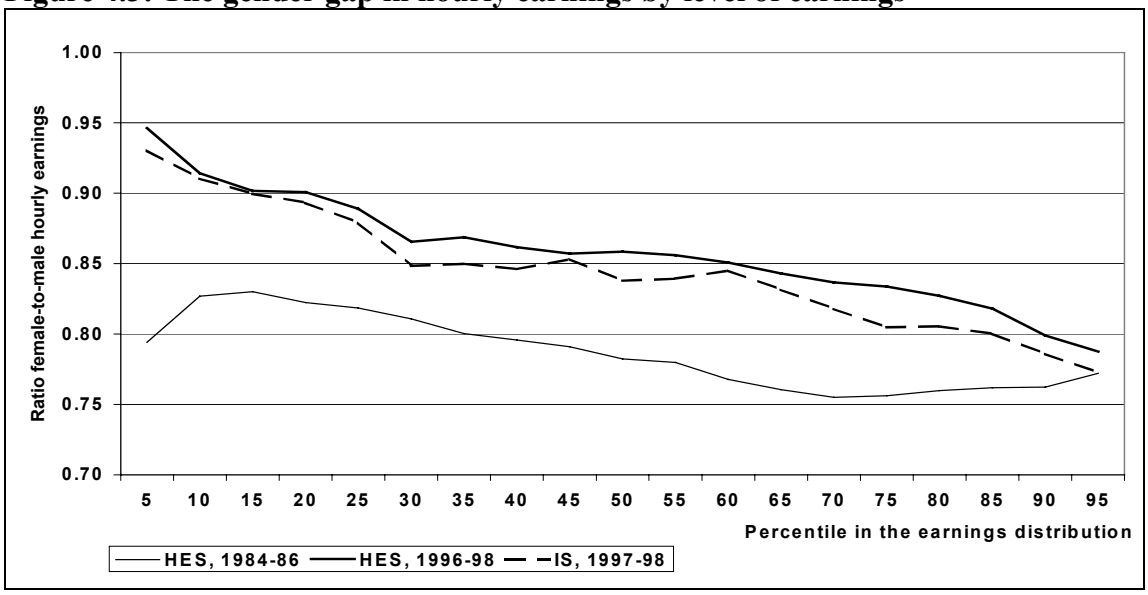
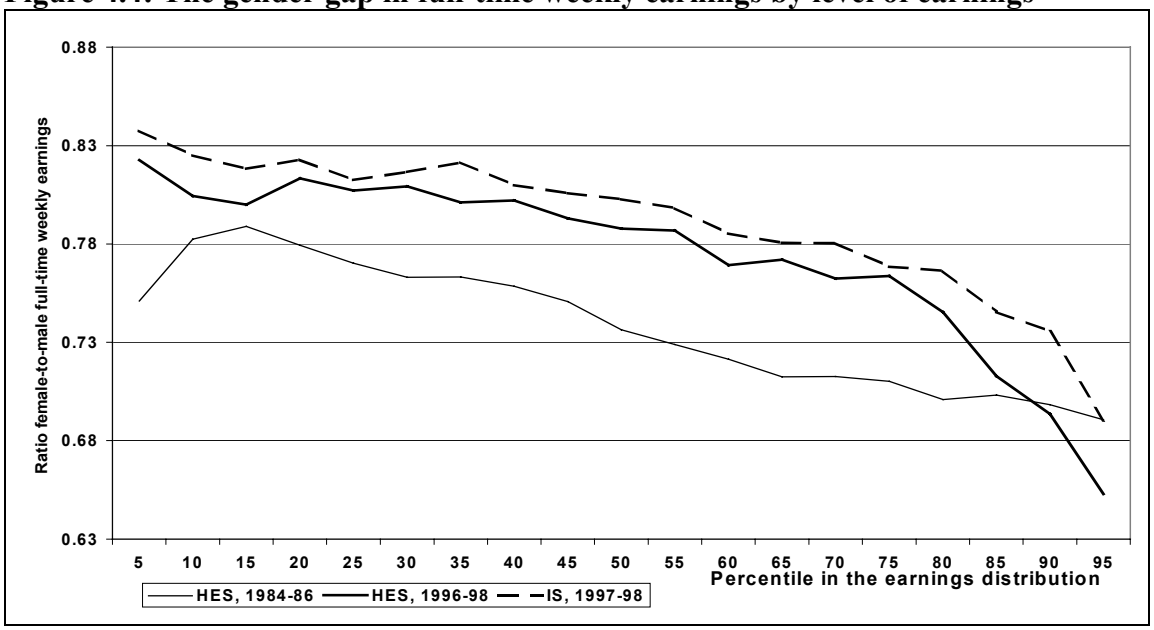


Figure 4.4: The gender gap in full-time weekly earnings by level of earnings



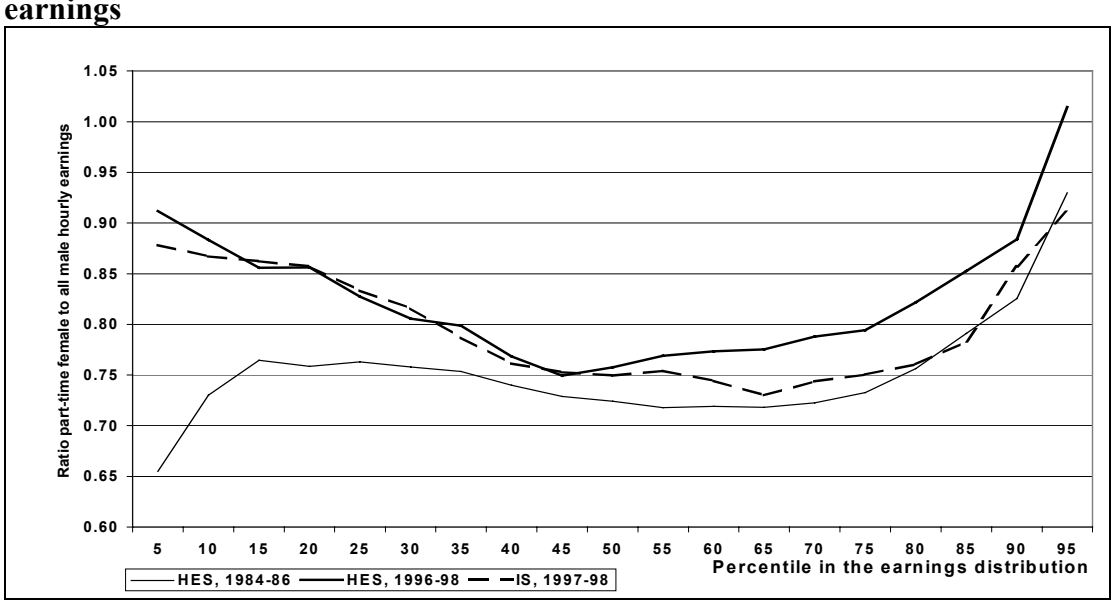
The size of the gender gap is positively related to level of earnings – as shown by the downward slope of the gender-ratio lines in Figures 4.3 and 4.4. In 1984, for example, female hourly earnings at the 10th percentile were 0.85 percent of male hourly earnings at the 10th

percentile. The ratio was 0.79 at the mid-point of the distribution and 0.77 at the 90th percentile.

The decline in the gender earnings gap between 1984 and 1998 was sufficiently widespread to cause increases in the female-to-male ratio at almost all levels of earnings (as shown by the upward shift of the lines plotted on the graphs). The improvement in the hourly gender earnings ratio (Table 4.5 and Figure 4.3) was largest at the lowest end of the distribution, and smallest at the very highest levels of the earnings distribution. This is consistent with the fact that the male–female differences in long-term hourly earnings growth rates shown in Table 4.5 are larger at the 10th percentile (where there is a gap of roughly 10 percent between women and men), than at the 90th (where the gap is about 4-5 percent). The *weekly* gender earnings ratio for full-timers (Figure 4.4) shows a somewhat different pattern of change. The upward shift in the gender ratio was more evenly spread over the lower and middle ranges of the distribution. However, there was little movement in the gender ratio at the highest level of weekly earnings.

The earnings gap between part-time and full-time employees can be analysed in a similar manner. Figure 4.5 shows the ratio of *part-time* female hourly earnings to the hourly earnings of *all* males, once again plotted by percentile and using data for 1984-86 (HES), 1996-98 (HES), and 1997-98 (IS). Three points can be made on the basis of this graph. Firstly, the part-time female-to-male earnings ratio is lowest at the median of the distribution. Hence, median-based earnings ratios will tend to reveal larger gaps between part-time employees and full-time employees than will mean-based ratios, which incorporate information from all parts of the distribution. Secondly, there was an improvement in the relative earnings of the lowest-paid part-time women between 1984 and 1998. Presumably this was due to the decline in the real wages of lower-paid men. Thirdly, the HES samples of part-time women in the late 1990s contain a higher proportion of high-paid employees than do the IS samples. This is visible on the graph as the vertical gap between the lines plotted for the HES 1996-98 and the IS 1997-98. The fact that the HES surveys a higher proportion of higher-paid part-time employees than does the HES is driving the divergence between the HES and IS gender-earnings ratio trendlines plotted in Figure 4.1.

Figure 4.5: The gap between part-time female and male hourly earnings, by level of earnings



To summarise this section, women with relatively high earnings did not gain as much, relative to males, as did women in the lower and middle reaches of the earnings distribution. Although higher-paid women experienced faster long-term growth in their real earnings than did lower-paid women, the bias in growth rates by initial level of pay was even more pronounced among males. The real earnings of lower-paid men declined, and those of men at the centre of the earnings distribution increased relatively little during the late 1980s and 1990s. In contrast, higher-paid men benefited from some appreciable real earnings increases. The net result of these trends was that the male–female earnings gap contracted less among high earners than it did among low earners.

The gender gap by demographic and job characteristics

The rise in the relative earnings of women between 1984 and 1998 was a fairly widespread phenomenon. Table 4.6, which shows the changes in the female-to-male hourly earnings ratio for a range of broadly-defined demographic and labour market groups, illustrates this. The first two columns give figures from the HES for 1984-86 and 1996-98, and the last column gives results obtained from the IS.

Table 4.6: Gender hourly earnings ratios by demographic and labour force group

	HES		IS
	1984-86	1996-98	1997-98
	Ratio female to male mean hourly earnings		
Age group			
20-24	0.94	0.98	0.96
25-34	0.80	0.94	0.90
35-44	0.72	0.81	0.79
45-54	0.74	0.80	0.76
55-59	0.75	0.77	0.82
Highest qualification			
No qualifications	0.79	0.87	0.85
School qualifications	0.79	0.86	0.88
Vocational qualifications	0.85	0.92	0.85
Degree	0.78	0.82	0.81
Ethnic group			
Pakeha	0.78	0.86	0.83
Mäori	0.80	0.86	0.86
Pacific Island peoples	0.80	0.86	0.93
Other	0.80	0.81	0.85
Broad occupational group			
Managerial, professional, technical	0.77	0.84	0.81
Clerical, service, sales	0.74	0.89	0.88
Manual / blue collar	0.72	0.83	0.76
Broad industrial group			
Primary industries	0.73		0.87
Manufacturing	0.73		0.80
Utilities & construction	0.83		0.95
Services	0.78		0.83

Note: Sample sizes are given in Table 3.2.

The gender gap in earnings is smallest among young people, and increases in size with increasing age. Improvements in the female-to-male earnings ratio were apparent across all age groups between 1984 and 1998. However, the increases were largest among the younger age groups. For example, the ratio among 25-34 year olds in the HES rose by 14 percentage points between 1984-86 and 1996-98, reaching 0.94. In contrast, the ratio for 55-59 year olds increased by only 2 percentage points, to 0.77. These age-group differences raise the question of how much of the total gender gap reduction was a birth cohort effect, reflecting changes in the attributes of the younger cohorts of men and women who entered the labour market in more recent times, and how much was due to 'period' factors which affected all age groups

simultaneously. Shifts in educational attainment patterns would tend to lead to cohort-based effects, because most people acquire their main qualifications before entering the labour market and do not subsequently upgrade. A shift in societal attitudes towards working women is an example of a 'period' factor, which is likely to affect all age groups simultaneously.

Figure 4.6: Cohort-based shifts in the female–male hourly earnings ratio

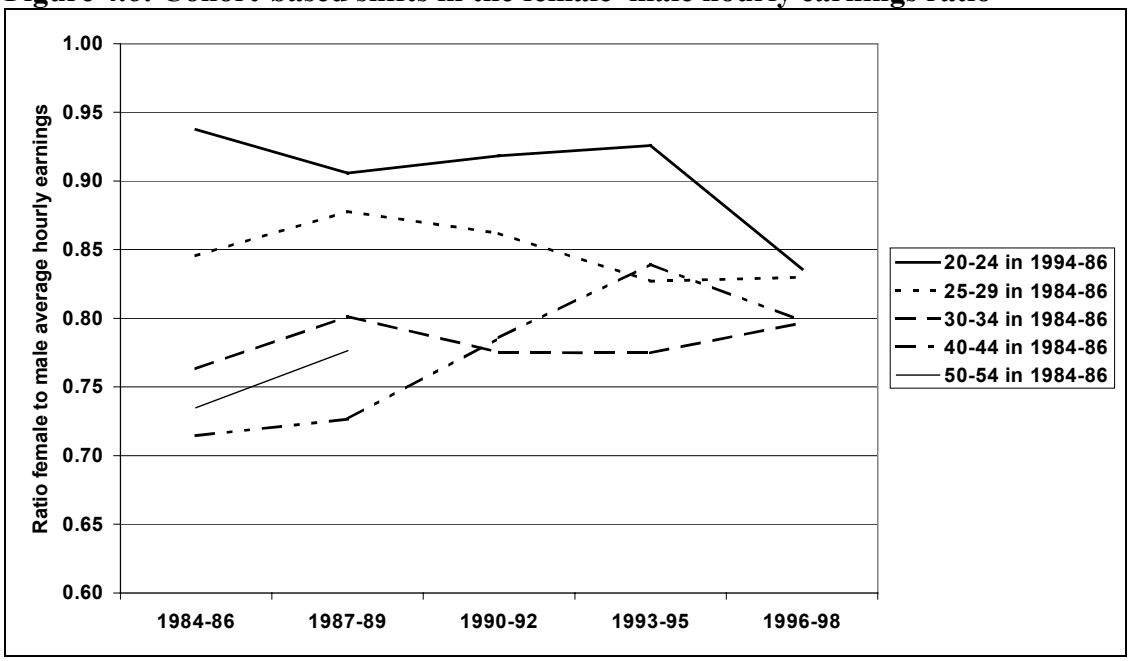
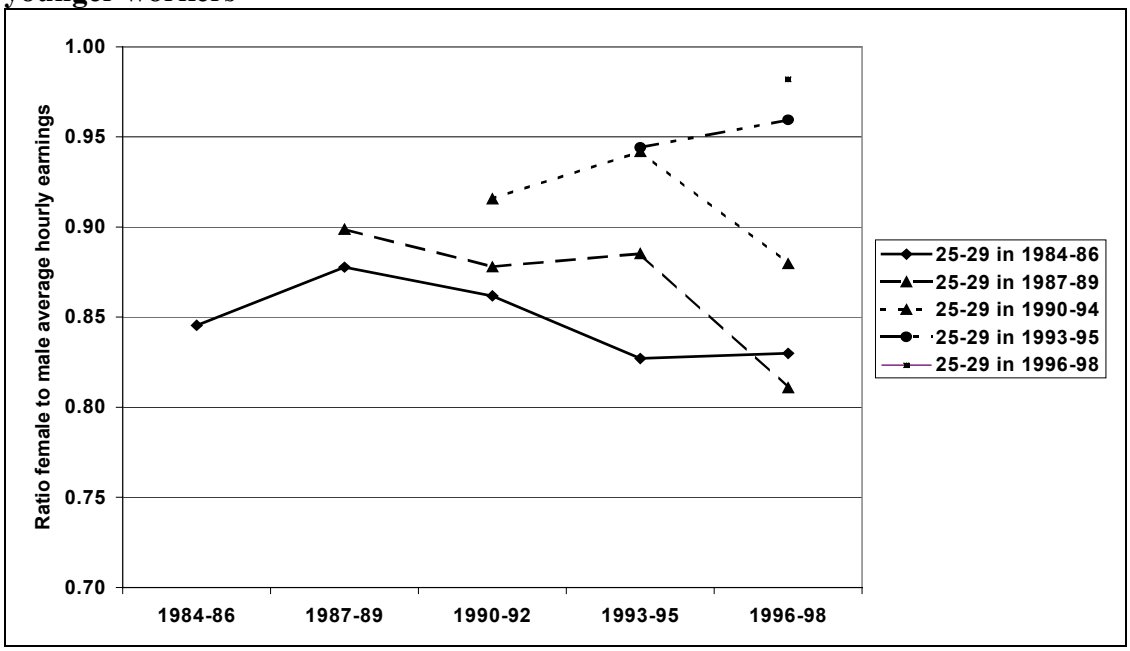


Figure 4.6 explores this question by tracking movements over time in the relative wages of men and women belonging to specific birth cohorts. It focuses on cohorts who were participating in the labour market in 1984-86. Each line plotted in Figure 4.6 shows the female-to-male ratio of average hourly earnings within a specific birth cohort, as measured in successive HES surveys. For example, the lowest line plotted in Figure 4.6 shows the gender pay ratio for employees who were aged 20-24 years in 1984-86, 23-27 years in 1987-89, 26-30 years in 1990-92, 29-33 years in 1993-95, and 32-36 years in 1996-98. The gender earnings ratio within other birth cohorts, who were older when they were first observed in 1984-86, is plotted in a similar manner.[19]

There is evidence of increases in the female-to-male ratio within all of the older cohorts of men and women, suggesting that 'period' effects were operating. It appears that the aggregate reduction in the gender pay gap was not simply the product of improvements in the relative earnings of women within younger birth cohorts. That does not mean, however, that none of the change was cohort based. Figure 4.7, which plots the relative earnings of successive cohorts of younger men and women when they were aged 25-29, 28-32, 31-35 and 34-38, shows the gender pay gap gradually falling in size over successive cohorts. Later cohorts tended to start at a higher point on the graph, and to experience smaller declines in the female-to-male pay ratio as members aged. These patterns could be driven by cohort *or* period effects on male and female relative earnings. Distinguishing the period from the birth-cohort effects would require more complex statistical methods, and we do not attempt the task here.

[19] The HES does not track or re-interview individuals. The cohort earnings trajectories presented here are based on survey estimates of the average earnings of groups of people who shared a common set of birth dates.

Figure 4.7: Cohort-based shifts in the female-to-male hourly earnings ratio among younger workers



Estimates of gender pay differentials by level of qualification and ethnic group (Table 4.6) indicate that all major educational and ethnic groups experienced reductions in the gender earnings gap, over the long term at least. The reductions were larger for unqualified and school qualified workers than for workers with post-school qualifications. This is consistent with the evidence discussed earlier of a negative relationship between level of earnings and the rate of improvement in the gender gap. There are no clear differences in trend by ethnic group.[20]

The lower part of Table 4.6 gives estimates of the gender hourly earnings gap for broadly-defined occupational and industrial groups. These results suggest that the reductions in the gap were relatively larger for workers employed in clerical, sales and service occupations than for workers in manual or managerial, professional and technical occupations. Moreover, the reductions were relatively larger for workers employed in the primary industries (agriculture, forestry and fishing, and mining), and in the utilities and construction industries, than elsewhere. However, a key point to draw from Table 4.6 is that the increases in the female-male earnings ratio were widely spread across the labour market. Many (although not all) of the increases in the gender earnings ratio recorded among population sub-groups were large enough to be statistically significant.

The gender gap by family circumstances

Historically, the average earnings of married women and women with children have tended to be lower than the average earnings of single and childless women. Historically, married men have tended to earn more than unmarried men. The data in Tables 4.7 and 4.8 provide some recent New Zealand estimates of the relationship between marital status, parental status and earnings among men and women.

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[20] The HES and IS give inconsistent signals about the relative sizes of the gender earnings gap among Pacific Islands peoples and members of 'other' ethnic groups. This inconsistency may be due to the fact that the samples of Pacific Island and other minority ethnic groups in each survey are small, and are not entirely representative of the wider population.

Table 4.7: Gender hourly earnings ratios by marital status

	HES		IS
	1984-86	1996-98	1997-98
Geometric mean hourly earnings ($ March 1998)			
Males			
Married or living as married	15.55	15.83	16.40
Never married	12.41	12.32	12.69
Separated, widowed, divorced	14.99	14.77	14.87
Females			
Married or living as married	11.57	13.21	13.11
Never married	11.44	11.65	12.04
Separated, widowed, divorced	11.80	12.96	12.73
Ratios			
Partnered females / partnered males	0.74	0.83	0.80
Never married females / never married males	0.92	0.95	0.95
Separated, widowed or divorced females / males	0.79	0.88	0.86
Partnered males / never married males	1.25	1.29	1.29
Partnered females / never married females	1.01	1.13	1.09
Partnered males / separated, widowed or divorced males	1.04	1.07	1.10
Partnered females / separated, widowed or divorced fema	0.98	1.02	1.03

Note: Sample sizes are given in Table 3.2.

The figures in Table 4.7 show there is a gender gap in earnings for employees in all marital status groups: married or living as married (which we refer to as 'partnered'); never married[21]; and separated, divorced or widowed (which we refer to as 'previously married'. The female-to-male hourly earnings ratio is lowest for the partnered group (around 0.80–0.83 in the late 1990s), and highest for the never married group (at 0.95). Between the mid-1980s and the late 1990s, there were increases in the female-to-male earnings ratio across all marital status groups.

Table 4.7 also contains some interesting information on the wage differentials by marital status that exist among men and women. In the late 1990s, the average hourly earnings of partnered men were around 25 percent higher than those of never married males, and around 7-10 percent higher than those of separated, divorced or widowed males. The partnered-to-never married differential for males appears to have remained fairly stable since the mid-1980s, while the partnered-to-separated differential become larger over time.

The pattern of wage differentials by marital status is quite different among women. In the mid-1980s, the average hourly earnings of partnered women were fairly similar in level to those of never married or previously married women. By the late 1990s, however, increases in the relative earnings of partnered women had led to the emergence of a *positive* wage gap between the partnered and other two marital status groups. Married/partnered women's hourly earnings were a few percentage points above those of the previously-married group, and about 10 percentage points above those of never-married women.

These results are presented in order to demonstrate that the historical relationships have undergone considerable change. It is no longer valid to assume that married women, as a group, earn less than unmarried women. However, the true effects of marriage on earnings cannot be validly deduced from simple average earnings ratios like those presented here. The members of the different marital status groups are likely to differ form each other in terms of other attributes that influence earnings, such as educational level or health status. This means that the 'raw' wage gap that exist between partnered and unpartnered men and women could

[21] The 'never married' group includes people who may have cohabited in the past but were not legally married.

be a product of differential selection into partnership and marriage, the effects of marriage on earnings, or some combination of the two.

Trends in the relative earnings of employees with and without dependent children are summarised in Table 4.8. 'Mothers' and 'fathers' are defined as adults who are the parent of at least one dependent child who is currently living with them.[22] A dependent child is a child aged 0-17 years. Parents whose children are older or have left home are classified as non-parents in the figures tabulated here. 'Partnered parents' are parents who are currently living with a spouse or de facto partner. Sole parents are those who do not have a co-residing partner. The parental status data are not available in a consistent form before 1987. Hence, the figures in Table 4.8 are for the HES years 1987-88 and 1997-98, and the IS years 1997-98.

Table 4.8: Gender hourly earnings ratios by parental status

	HES		IS
	1987-88	1997-98	1997-98
Geometric mean hourly earnings ($ March 1998)			
Males			
All	15.23	14.99	15.23
All fathers	16.04	16.12	16.51
Partnered fathers	16.06	16.16	16.60
Sole fathers	15.23	14.62	14.62
No dependent children	14.46	14.15	14.39
Females			
All	12.28	13.07	12.83
All mothers	11.94	13.17	12.75
Partnered mothers	11.88	13.43	12.98
Sole mothers	12.38	12.01	11.72
No dependent children	12.57	12.99	12.89
Ratios			
All mothers / all males	0.78	0.88	0.84
Non-mothers / all males	0.82	0.87	0.85
Partnered mothers / all males	0.78	0.90	0.85
Sole mothers / all males	0.81	0.80	0.77
Partnered mothers / partnered fathers	0.74	0.83	0.78
All mothers / all fathers	0.74	0.82	0.77
Females w'out dep chn / males w' out dep	0.87	0.92	0.90
Mothers/women without dependent chn	0.95	1.01	0.99
Fathers / men without dependent chn	1.11	1.14	1.15

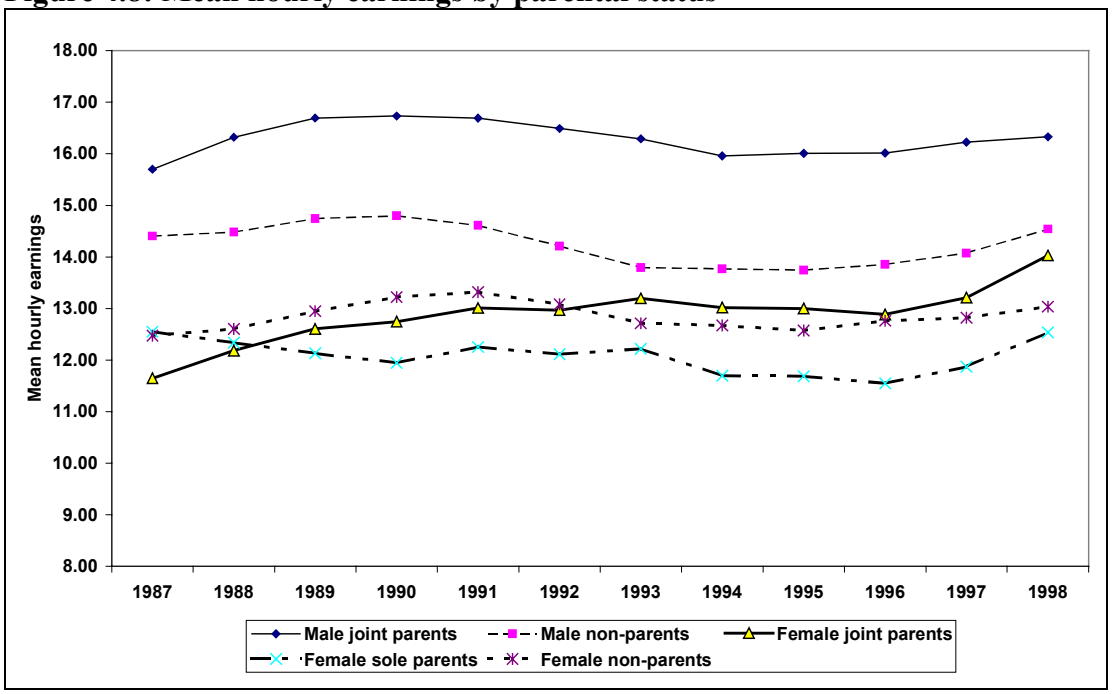
Note: Sample sizes are given in Table 3.2.

In 1987-88, the average hourly earnings of all mothers and partnered mothers were a little lower than the earnings of women without dependent children. Consequently, the gender earnings gap, measured relative to the earnings of *all* males, faced by mothers was a little larger than the gender gap faced by childless women. Over the decade to 1997-98, there were two main changes. Firstly, there was a reduction in the relative earnings of sole mothers, causing the sole mother/all male earnings ratio to decline. Secondly, the earnings gap between partnered mothers and women without dependent children was eliminated. By the late 1990s, partnered mothers' average earnings were similar to, and possibly a little higher

[22] The HES and IS record information on the children who are currently living in the household. They do not provide a complete record of all the children ever born to the adults in the survey. Defining parents as the set of people who have *any* children present, regardless of the children's ages, would lead to a less consistent classification of parents. Some people's older children will have left home, while other people's older children will still be living at home and will be countable in the survey records.

than, those of the non-mother group. The gender earnings gap narrowed for both partnered mothers and childless women. Figure 4.8 illustrates the trends in the real earnings of each parental status group using the HES data.

Figure 4.8: Mean hourly earnings by parental status



Fathers earned considerably more than men without dependent children throughout the decade. In 1987-88, for example, fathers' mean earnings were 11 percent above the mean earnings of childless men, and in 1996-98, they were around 15 percent higher. Partnered fathers earned substantially higher average hourly earnings than did sole fathers.[23]

The men and women in each parental status group are likely to differ from each other in a variety of ways that influence the 'raw' wage differentials illustrated in Figure 4.7. The independent effect of parental status on women's average hourly earnings is considered again in Section 7.

4.3 Summary

Between 1984 and 1998 there was a significant narrowing of the gender earnings gap. Using the latest available figures, and focusing on the population of 20-59 year olds, we estimate that the female-to-male ratio of geometric mean hourly earnings rose from 79 percent in 1984 to around 86 percent in 1999 – an increase of approximately 7 percentage points. The female-to-male ratio of full-time weekly earnings rose from around 74 percent in 1984 to 81 percent in June 1999, also an increase of 7 percentage points.

Improvements in the gender earnings ratio for both part-time employed and full-time employed women were recorded between the mid 1980s and the late 1990s. The ratio of the

[23] Because the number of sole fathers in the HES samples is very small, the HES estimates for the earnings of sole fathers may not be very reliable. However the sample of sole fathers in the 1997-98 IS *was* large enough to provide a credible estimate.

hourly earnings of part-time females to those of all males rose from 75 percent in 1984-86 to around 81 percent in the late 1990s. The full-time female to all-male ratio rose from 81 percent to about 86 percent over this period. Concerns that part-time employed women, *as a group*, were being 'left behind' by the social and economic trends that raised the relative earnings of full-time women, are not well supported by this evidence.

The size of the gender gap increases with level of earnings, so that it is larger among higher-paid men and women than among lower-paid men and women. In the 1998 Income Supplement, for example, hourly earnings at the 10^{th} percentile of the female distribution were 90 percent of hourly earnings at the 10^{th} percentile of the male distribution. The ratio was 84 percent at the mid-point of the distribution, and 79 percent at the 90^{th} percentile. The decline in the gender earnings gap between 1984 and 1998 was sufficiently widely-based to cause increases in the female-to-male ratio at almost all levels of earnings. However, women with relatively high hourly earnings did not gain as much, relative to males, as did women elsewhere in the earnings distribution.

To understand why, one needs to consider changes in the male earnings structure as well as the female. Both the male and the female earnings distributions became more dispersed during the late 1980s and 1990s, but the changes in the male wage structure were more strongly skewed by level of earnings. Lower-paid male workers experienced reductions in their real hourly earnings, while higher-paid male workers experienced sizeable increases. Consequently, higher-paid males maintained a larger earnings 'lead' over females.

The long-term changes in the gender earnings gap by age group; birth cohort; educational level; ethnic group; marital status; parental status; and occupational and industrial group were examined. The narrowing of the gap was larger among younger employees than among older workers. However, over the long run, the gender earnings gap declined in size – to a greater or lesser degree – within all broadly-defined demographic groups and labour market sectors. We did not identify groups of women who experienced *no* long-term improvement in their relative earnings.

5. EDUCATION AND EXPERIENCE EFFECTS ON THE GENDER EARNINGS GAP

5.1 Introduction

This section analyses the effects of male–female differences in skill-related attributes on the gender pay gap. A basic objective is to estimate how much of the female shortfall in average hourly earnings may be due to women's lower levels of skill endowments.

The section begins by describing the key changes that took place in the employment patterns of men and women (Section 5.2.1). Section 5.2.2 outlines the demographic and skill profiles of male and female employees, and their typical job characteristics, comparing the mid 1980s with the late 1990s.

The remainder of Section 5 focuses primarily on the wage effects of education and prior work experience. The methods used to impute measures of prior work experience in this study are outlined in Section 5.2.3. In section 5.3, we use wage regressions and decomposition methods to estimate the contribution made by male-female education and work experience differences to the gender earnings gap. The sensitivity of these results to variations in the measure of women's experience is explored. Section 5.4 uses a decomposition-of-change procedure to estimate the contribution of the changes in relative education and experience levels to the reduction in the gender pay gap between the late 1980s and the late 1990s.

5.2 Overview of changes in the characteristics of male and female employees

5.2.1. Employment rate trends

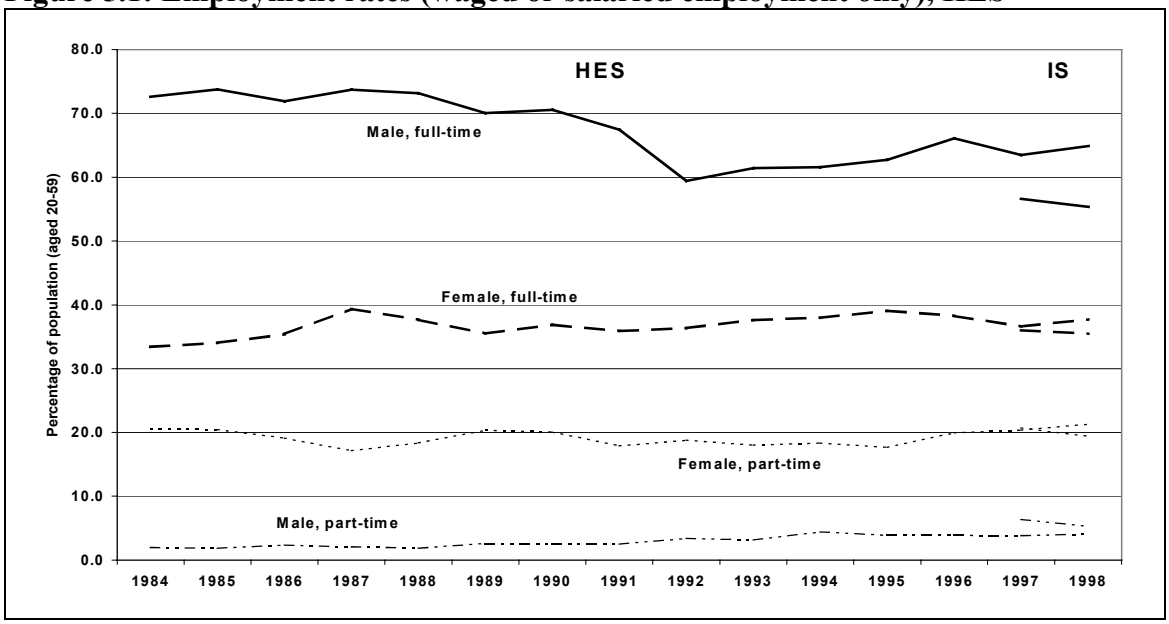
During the 14 years from 1984 to 1998, there were quite marked shifts in the participation patterns of New Zealand men and women. Male and female rates of employment in full-time and part-time waged and salaried employment are plotted in Figure 5.1.[24] The extended lines give estimates from the HES for the years 1984 through to 1998. The short lines plotted on the right-hand side of the gap show the comparable IS estimates for the June 1997 and June 1998 quarters. All waged-employment rates are calculated for the 20-59 year age group.

The full-time employment rate of men changed most over the study period. It slumped from 72.6 percent in 1984 to a low of 59.4 percent during the recession of 1989-92. Despite a post-recession recovery, the male full-time waged employment rate at the end of the 1990s was at least 8 percent lower than in 1984. Movement into self-employment accounted for some of the reduction, as did movement out of the labour force. Over the same period, the rate of part-time employment among males increased gradually, doubling from around 2 to 4 percent.

The shifts in women's waged and salaried employment rates were less dramatic. Women's participation in full-time employment rose by about 4 percentage points, from 33.4 percent in 1984 to 37.7 percent in 1998. The female part-time employment rate was relatively stable, hovering at around 20 percent.

[24] These employment rates are calculated as the ratio of the number of waged or salaried employees to the number of persons in the total population.

Figure 5.1: Employment rates (waged or salaried employment only), HES



The two survey's estimates of women's employment rates are quite similar. They are rather different for males, however. The IS figures show a higher rate of male part-time employment (2-3 percent higher than the HES estimates for the late 1990s). The IS figures indicate a much lower rate of male full-time employment – about 7-8 percent below the rate measured by the HES. The reasons why the HES captures a higher level of waged employment among males than the IS are not known. In Section 3, two hypotheses were suggested. Firstly, differences in the way the two surveys identify and define 'waged' employment mean that some jobs are classified as 'wage employment' in the HES but as 'self employment' in the IS. Secondly, the IS achieves a higher household response rate than the HES, and the people who are surveyed in the IS but not the HES may have lower employment rates.

More detailed analysis of the changes in employment rates between the mid-1980s and the late 1990s indicates that the decline in male waged employment was spread fairly evenly across most age groups. The 20-24 and 55-59 year age groups recorded larger than average employment reductions, however. Men without any formal educational qualifications suffered a larger reduction in their employment rate during the recession of 1989-92 than did other educational groups. They also experienced the largest increase following the recession. The *variation* in male wage and salary employment rates by level of education in 1998 was not obviously any greater than in 1984.[25]

Among women, the 50-54 and 55-59 year age groups recorded larger than average employment rates increases. The only age group for which the employment rate fell was 35-39 year olds. There were gradual increases in the wage and salary employment rates of women in at all levels of qualifications, with the exception of degree holders.

These shifts in aggregate employment patterns are likely to have led to changes in both the measured and the unmeasured characteristics of wage and salary earners. Shifts in the

[25] But there is evidence from HLFS time series data of a long-term increase in the dispersion of the *total* employment rates of prime-aged males by level of education. It is possible that growth in self-employment among more highly educated males helped to raise the employment rates of well educated men, relative to the less educated.

distribution of key measured characteristics, such as age and education, are examined below in Section 5.2.2.

Wages can only be observed for those women and men who are in paid employment. If there are systematic unobserved differences between the people who are in waged employment and the others, then confining the analysis of earnings to current employees may lead to biased estimates of the impact of factors that determine individual earnings.

Many studies in the gender earnings gap literature attempt to 'correct' their earnings function estimates for women (although not those for men) using the procedure suggested by Heckman (1979). The first step of this procedure is to estimate a probit model of the probability of being observed in waged employment, using all of the women in the sample. This generates a 'selection-correction variable' for each woman. In the second step, the estimated selection parameter is included as a right-hand-side variable in the wage equation for the wage-earning women. The coefficient on this term could have either a positive or a negative sign, depending on whether the unmeasured characteristics of the wage-earning women, compared with those of the non-participants, lead to higher or lower wages.

This approach has been criticised for its lack of robustness (Blau and Kahn, 1997, p. 9). Estimating the participation selection factor correctly requires the use of information about characteristics that accurately 'predict' participation, but do not simultaneously determine wages (Hamermesh, 1999, p.18). Such variables are often difficult to find.

In this study, the potential role of unobserved sample selection factors in the determination of earnings was explored using the 'Heckman' procedure in STATA. In that procedure, a selection (participation) equation and a wage equation are simultaneously estimated, and a likelihood ratio test of whether the errors of the two equations are independent of each other is carried out. A more detailed account of this analysis is given in Appendix 3. The models that were estimated for women did not give rise to statistically significant selection parameters. Some of the models estimated for men did identify statistically significant selection differences. However the sign and size of the selection parameter estimated was quite unstable across the different specifications that were tested.

Heckman-type selection correction factors are *not* included in the wage regressions that are estimated in the main body of this report. We believe it is not possible to obtain robust estimates of the appropriate selection correction factors, given the information available in the HES and IS samples.

5.2.2 Changes in the average characteristics of male and female employees

Between 1984 and 1998, the demographic, educational, and skill profiles of male and females employees underwent change. There were reductions in male–female differentials along a number of dimensions that might be expected to influence the size of the economy-wide gender earnings differential.

Table 5.1: Profiles of the employee samples, HES 1984, 1990 and 1998

	Males			Females			*Male - female*		
	1984	**1990**	**1998**	**1984**	**1990**	**1998**	***1984***	***1990***	***1998***
Mean log earnings									
Hourly	2.72	2.77	2.73	2.49	2.58	2.59	*0.23*	*0.19*	*0.14*
Weekly, full-time	6.48	6.55	6.57	6.18	6.27	6.31	*0.31*	*0.28*	*0.26*
Age									
20-24	18.2	13.1	11.0	20.7	14.8	11.8	*-2.5*	*-1.7*	*-0.9*
25-34	32.8	34.4	29.7	29.0	31.1	26.5	*3.8*	*3.2*	*3.2*
35-44	24.6	27.5	30.0	26.6	31.4	29.2	*-2.0*	*-3.8*	*0.8*
45-54	16.8	18.6	21.7	18.8	18.3	25.7	*-2.0*	*0.2*	*-4.0*
55+	7.6	6.4	7.6	4.9	4.4	6.7	*2.7*	*2.1*	*0.9*
Mean age	35.9	36.6	38.1	35.5	36.3	38.6	*0.4*	*0.3*	*-0.5*
Highest qualification									
No qualifications	35.6	24.4	20.4	41.7	26.1	20.8	*-6.1*	*-1.8*	*-0.4*
School	21.3	30.1	27.0	25.7	35.6	34.1	*-4.5*	*-5.5*	*-7.2*
Vocational	30.0	31.3	31.2	24.7	28.9	27.3	*5.3*	*2.5*	*3.9*
Bachelor	10.6	9.1	14.5	6.2	6.7	12.6	*4.4*	*2.5*	*1.8*
Post-graduate	2.6	4.5	6.1	1.5	2.0	4.8	*1.1*	*2.5*	*1.3*
Ethnic group									
Pakeha	87.0	83.8	82.3	90.1	87.1	85.7	*-3.1*	*-3.3*	*-3.4*
Mäori	7.5	8.2	9.8	6.3	7.3	8.0	*1.2*	*1.0*	*1.8*
PI	2.7	4.9	3.4	1.8	3.3	3.2	*0.9*	*1.6*	*0.2*
Other	2.8	3.1	4.5	1.8	2.3	3.1	*1.0*	*0.8*	*1.4*
Marital status									
Married (incl de facto)	71.0	67.1	75.1	68.9	64.8	72.8	*2.0*	*2.3*	*2.3*
Sep,widowed, div	5.6	7.5	5.6	10.3	12.5	10.3	*-4.7*	*-5.1*	*-4.6*
Never married	23.4	25.4	19.3	20.7	22.7	17.0	*2.7*	*2.7*	*2.3*
Parental status									
Joint parent	n.a.	48.1	42.7	n.a.	42.9	34.3	*n.a.*	*5.2*	*8.4*
Sole parent	n.a.	0.5	1.5	n.a.	4.8	6.7	*n.a.*	*-4.3*	*-5.2*
No dep chn	n.a.	51.4	55.8	n.a.	52.3	59.0	*n.a.*	*-0.9*	*-3.3*
Avge no. depend chn	n.a.	0.95	0.91	n.a.	0.90	0.80	*n.a.*	*0.0*	*0.1*
FT /PT status									
Full-time	97.4	96.5	94.1	62.0	64.8	63.9	*35.4*	*31.7*	*30.2*
Part-time	2.6	3.5	5.9	38.0	35.2	36.1	*-35.4*	*-31.7*	*-30.2*
Mean hours									
All	42.8	43.6	45.5	30.3	31.8	32.4	*12.6*	*11.8*	*13.1*
Full-time	43.6	44.5	47.4	39.3	40.0	41.5	*4.3*	*4.5*	*5.9*
Part-time	14.3	16.9	14.6	15.6	16.6	16.3	*-1.3*	*0.3*	*-1.8*
N	***1951***	***1604***	***1382***	***1446***	***1358***	***1307***			

n.a.= not available.

The HES and IS datasets contain direct measures of age, qualifications, ethnic group, marital status, the relationships between the respondent and other household members, and hours of work. Indicators of parental status and information on the number and ages of respondents' children can be derived using the information that is collected on other household members and their inter-relationships.

The average characteristics of male and female employees are summarised and compared in Tables 5.1 and 5.2. Table 5.1 contains information for the HES samples in 1984, 1990 and 1998, and Table 5.2 contains information for the 1998 IS sample.

Table 5.2: Profiles of the employee samples, IS 1998

	Males	Females	*Male-Fem*
Mean log earnings			
Hourly	2.74	2.56	*0.17*
Weekly, full-time	6.53	6.29	*0.24*
Age			
20-24	14.4	14.1	*0.4*
25-34	31.0	26.9	*4.2*
35-44	28.0	28.5	*-0.5*
45-54	19.7	24.3	*-4.6*
55+	6.8	6.3	*0.5*
Mean age	36.9	37.8	*-0.9*
Highest qualification			
No qualifications	18.9	18.6	*0.3*
School	20.8	26.5	*-5.7*
Vocational	45.2	40.7	*4.5*
Bachelor	9.8	10.4	*-0.6*
Post-graduate	4.8	3.5	*1.3*
Ethnic group			
Pakeha	81.5	82.2	*-0.7*
Mäori	9.6	8.6	*1.0*
PI	4.1	4.6	*-0.5*
Other	4.8	4.6	*0.2*
Marital status			
Married (incl de facto)	67.4	68.6	*-1.2*
Sep,widowed, div	5.4	9.9	*-4.4*
Never married	27.2	21.5	*5.7*
Parental status			
Joint parent	39.2	33.2	*6.1*
Sole parent	2.1	7.1	*-5.0*
No dep chn	58.6	59.7	*-1.1*
Avge no. depend chn	0.82	0.76	*0.1*
FT /PT status			
Full-time	91.3	64.7	*26.6*
Part-time	8.7	35.3	*-26.6*
Mean hours			
All	42.2	32.3	*10.0*
Full-time	44.7	41.0	*3.7*
Part-time	16.5	16.3	*0.2*
N	***5548***	***5533***	

Expressed in logs, the gender gap in hourly earnings in the HES was 0.23 log points in 1984 and 0.14 in 1998. The gender gap in hourly earnings was 0.17 in the IS sample in 1998. The gender gap in the log weekly earnings of full-time employees was 0.31 in the HES in 1984, 0.26 in the HES in 1998, and 0.24 in the IS in 1998.

In 1984 the average age of male employees was slightly higher than the average age of female employees, but by 1998 this difference had been reversed, so that females were slightly older in both surveys. The faster ageing of the female population was partly due to the fact that employment rates increased more rapidly among women aged in their 50s than among younger women. This was not true of men – older men's employment rates declined.

The gender gap in educational attainment became much less pronounced over the 14-year period. This reflects the fact that the level of qualifications typically attained by younger women increased more rapidly than the attainment level of younger men. In 1984, the proportion of female employees who lacked any formal qualifications was around 6 percent higher than the comparable proportion of male employees. By 1998 this particular gender

differential had essentially disappeared. In 1984, 43 percent of male employees held a post-school qualification, 11 percent higher than the equivalent proportion of females. By 1998, the gender gap in the share of post-school qualifications had declined to 5 percent in the IS and 7 percent in the HES. Despite the convergence in educational levels, school-level qualifications continued to be more prevalent among female employees, and post-school qualifications more prevalent among males, in the late 1990s.

There were some minor gender differences in the ethnic composition of the HES samples (although this was not true of the IS samples). Female employees in the HES were more likely than males to be Päkeha, and less likely to be members of other ethnic groups. As Päheka tend to have higher earnings than non-Päkeha, this difference in ethnic composition would tend to reduce the size of the aggregate gender earnings gap at a given point in time. However, the gender difference in ethnic composition remained fairly stable in the HES between 1984 and 1998.

Female employees were more likely than male employees to be separated, divorced or widowed, and less likely to be in the 'never married' group. However, these gender differences in marital status patterns did not change materially between 1984 and 1998.

Joint parenthood became less prevalent among both male and the female employees, while sole parenthood became more common. In 1990, 43 percent of women in the HES were joint parents of one or more dependent children; this proportion fell to 34 percent in 1998.[26] Over the same period, the rate of sole parenthood rose from around 5 to around 7 percent. The rates of joint parenthood and sole parenthood recorded by the IS in 1998 were similar. The average number of dependent children in the care of 20-59 year old women in the HES employee samples declined from 0.90 in 1990 to 0.80 in 1998.

The decline in the incidence of dependent children was partly caused by a small decline in the total fertility rate for all women from 1990 onwards[27], and partly caused by the increase in the relative employment rates of older women, whose children are less likely to be dependent. The decline suggests that impact of childcare responsibilities on women's employment patterns and earnings is likely to have diminished in importance between the late 1980s and the late 1990s. On the other hand, the increase in the prevalence of sole parenthood could potentially have had effects operating in the opposite direction. It has been suggested that sole mothers find it more difficult than partnered parents to balance the requirements of work and children, and that the arrangements they make to reconcile those commitments lead to lower average hourly earnings.

There was also some convergence in the characteristics of the jobs undertaken by men and women between 1984 and 1998. Most significantly, the gap between men and women in the relative share of part-time employment narrowed, due to an expansion of part-time employment among men. In 1984 less than three percent of male employees aged 20-59 worked part-time; by 1998, this had increased to around six percent (in the HES sample) or nearly nine percent (in the IS sample). The part-time share of female waged employment was much higher (around 35 percent) and appears to have declined a little over this period.

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[26] Figures for 1984 are not available because family relationships were not recorded in a consistent manner in the HES before 1987.

[27] Fertility statistics compiled by Statistics New Zealand for the total usually-resident population indicate that the total fertility rate was increasing between 1984 and 1990, and declining between 1990 and 1998.

While increasing numbers of men were working part-time, the average weekly hours of both men and women who were workers in full-time jobs were growing longer between 1984 and 1998. The HES samples show an increase of nearly 4 hours in the average working week of full-time men between 1984 and 1998. The IS estimate of men's average full-time hours in 1998 is rather lower, however. That estimate suggests that the average weekly hours of full-time men may have increased by only around one hour. Women's full-time working hours also seem to have lengthened between 1984 and 1998. Although there are discrepancies between the two surveys' estimates of average full-time weekly hours as at the late 1990s, it is clear that a substantial gender gap (of several hours) persisted.

The industrial and occupational employment distributions of men and women also moved closer to each other between 1984 and 1998. The similarity of the distribution of the two groups across the sectors in the economy can be summarised by an index number.[28] Table 5.3 gives index numbers summarising the dissimilarity of men's and women's distribution across two-digit industrial groups, and two-digit occupational groups, in selected years. The higher the index number, the more dissimilar are the employment distributions of the two genders, and the greater the number of people who would need to change jobs in order to make the male and female distributions identical. The index numbers in Table 5.3 are declining over time, indicating that the 'segregation' of the genders into different industries and occupations was becoming less pronounced between 1984 and 1998.

Table 5.3: Changes in the industrial and occupational dissimilarity of male and female employment

Index of dissimilarity*	Data source and years		
	HES, 1984-85	**HES, 1995-96**	**IS, 1997-98**
Industry - 2 digit NZSIC 1968	0.389	0.345	0.333
	HES, 1984-85	**HES, 1990-91**	
Occupation - 2-digit NZSCO 1968	0.619	0.596	
	HES, 1992-93	**HES, 1997-98**	**IS, 1997-98**
Occupation - 2-digit NZSCO 1990	0.456	0.435	0.433

** The Duncan and Duncan (1955) Index was calculated*

5.2.3 Trends in experience levels and the imputation of experience values

No information on prior employment histories is gathered in the HES or the IS. Because of the potential importance of work experience in the determination of earnings, estimates of the experience levels of the employees in the HES and IS samples were imputed in this study.

Profiling New Zealanders' actual experience levels

The first step was to assemble information on the actual work experience profiles of employees in New Zealand – in order to provide benchmarks for carrying out the imputations and assessing their accuracy. Two sources were used: employment rate data from successive Population Censuses, and data on women's work histories that were collected in the New Zealand Women: Fertility, Employment and Education Survey 1995.[29]

[28] The index of dissimilarity used here is the one usually attributed to Duncan and Duncan (1955).

[29] More information on New Zealander's actual experience levels is given in the first section of Appendix 4.

The Population Census has measured New Zealanders' employment rates repeatedly over many decades. By tracking the average employment rates of successive birth cohorts from census to census, it is possible to build up 'quasi-cohort' estimates of the average number of years of work experience that men and women are likely to have undertaken earlier in their lives. Until 1981, the census employment measures only counted workers who were employed for 20 or more hours a week only, excluding those working 1–19 hours. This means that only *full-time* work experience estimates, where full-time is defined as 20 or more hours per week, can be derived consistently for all cohorts,.

Census-derived estimates of the full-time work experience profiles of men and women in 1986, 1991 and 1996 are shown in Table 5.4. The beginning-year and end-year experience profiles are also graphed in Figure 5.2.

Table 5.4: Census estimates of male and female average years of full-time work experience

	Males			*Females*			*Difference (M-F)*		
Age group	***1986***	***1991***	***1996***	***1986***	***1991***	***1996***	***1986***	***1991***	***1996***
20-24	4.5	3.9	2.9	3.6	3.3	2.4	*0.9*	*0.6*	*0.5*
25-29	9.2	8.4	7.4	6.5	6.4	5.9	*2.6*	*2.1*	*1.4*
30-34	14.1	13.4	12.3	8.6	8.8	8.7	*5.5*	*4.6*	*3.6*
35-39	19.4	18.4	17.3	10.7	11.0	11.0	*8.7*	*7.4*	*6.3*
40-44	24.7	23.9	22.5	12.9	13.6	13.7	*11.9*	*10.3*	*8.7*
45-49	29.7	29.1	28.0	14.5	15.9	16.6	*15.2*	*13.3*	*11.3*
50-54	34.7	34.0	33.2	15.9	17.2	18.8	*18.8*	*16.8*	*14.4*
55-59	39.3	38.7	37.7	16.4	18.0	19.5	*22.9*	*20.7*	*18.2*
Mean experience, all ages*	**19.3**	**18.8**	**18.4**	**10.1**	**10.7**	**11.2**	***9.1***	***8.1***	***7.2***
Mean ages*	**36.8**	**37.1**	**37.8**	**36.7**	**37.0**	**37.6**	***0.1***	***0.1***	***0.1***

** These are weighted means, obtained by using age group population frequencies as weights*

Source: New Zealand Population Censuses, 1945 to 1996

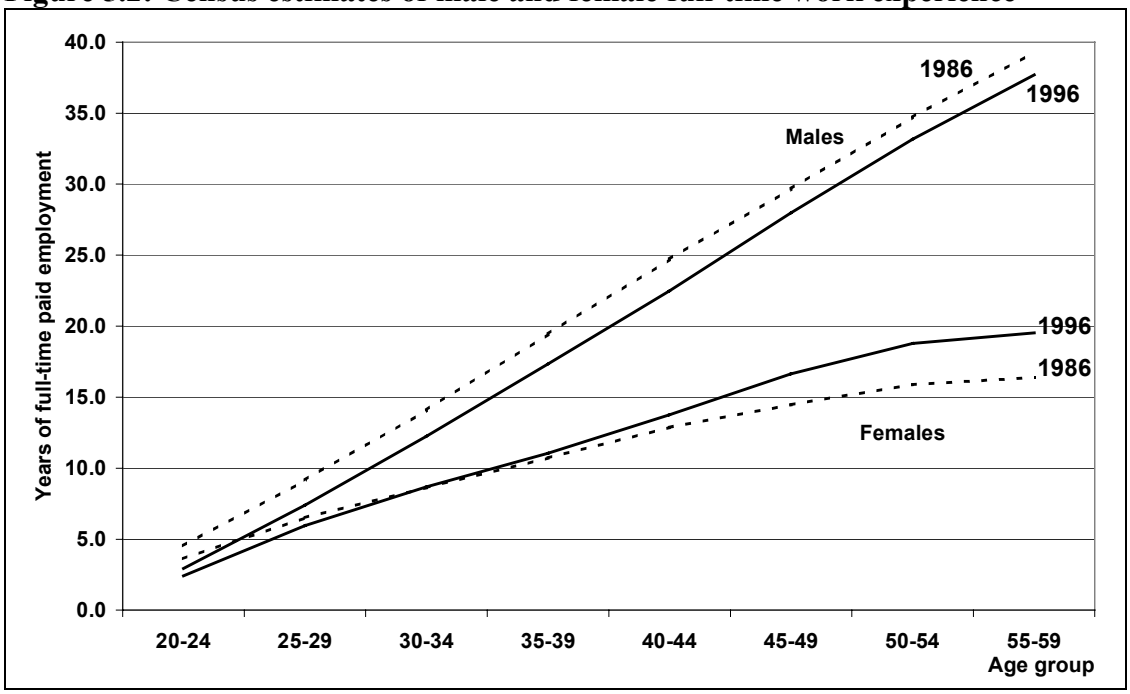
Notes: Figures are estimated from the employment rates of 5-year synthetic birth cohorts

Full-time work experience is defined as time spent employed in jobs of 20 or more hours per week

Very substantial gender differences are apparent. In 1986, a typical 55-59 year old man was likely to have worked full-time for nearly 40 years during his past working life. A typical woman of the same age group was likely to have accumulated only 16.4 years of full-time experience – a difference of nearly 23 years. Weighted mean experience levels, averaged across all age groups (from 20-24 to 54-59) are shown at the bottom of Table 5.4. In 1986 men had 19.3 years of full-time experience on average, 9.1 years more than the mean of 10.1 among women.

The Census figures for men show a decline in average full-time experience levels of men in all age groups between 1986 and 1996. Individual age-group means typically declined by 1-2 years. The decline in the weighted mean for the total population (from 19.3 to 18.4) was smaller, reflecting the fact that the ageing of the population partially offset the effects of the decline in experience levels at any specific age. The mean age of both the male and the female populations rose by about one year, as shown in the bottom row of Table 5.4.

Figure 5.2: Census estimates of male and female full-time work experience



The average experience levels of women who were aged in their twenties declined over the decade, by a year or so. Among older women, however, levels of prior work experience increased substantially over the decade. This was most notably so among women aged between 45 and 59. The 50-54 year age group, for example, gained nearly 3 years of full-time work experience. The average experience level of the total population of women increased by 1.1 years. As for males, this increase was aided by the ageing of the population.[30]

The gender gap in experience levels is shown in the right-hand columns of Table 5.4. The gender differential was reduced across all age groups in the decade to 1996. Despite this convergence, the gender differences for adults aged 30 or above remained large in both relative and absolute terms. In 1996, a 55-59 year-old man was likely to have worked full-time for twice as many years of his life as an average 55-59 year-old woman. The mean gender differential for the total population was 7.2 years, a reduction of approximately two years from the mean of 9.1 in 1986.

The New Zealand Women: Fertility, Employment and Education Survey 1995, which we will refer to here as the 'Fertility Survey' for brevity, collected detailed employment histories from a nationally-representative sample of about 3,000 women aged 20-59. Estimates of women's cumulative years of employment experience were derived from the employment history data. The mean experience levels of the women in the sample are summarised in Table 5.5.

[30] Data from the New Zealand Women: Fertility, Employment and Education Survey 1995 on women's employment histories also provide evidence that younger women's average years of work experience have declined, while experience levels have risen among women aged 40 and over. See Appendix 4.

Table 5.5: Fertility Survey estimates of women's average years of work experience

	All women		*Women in W&S empt*	
Age group	***All jobs***	***FT jobs****	***All jobs***	***FT jobs****
20-24	2.7	2.4	3.7	3.2
25-29	6.4	6.0	7.5	7.1
30-34	9.5	8.9	11.4	10.5
35-39	12.5	11.5	14.2	12.8
40-44	15.8	14.5	17.9	16.3
45-49	19.6	17.8	21.8	20.1
50-54	22.1	20.4	25.8	23.8
55-59	23.9	21.7	30.5	27.2
All ages	**13.3**	**12.2**	**15.5**	**14.2**

** Counts experience in jobs of 20 or more hours per week*

Source: New Zealand Women: Fertility, Employment and Education Survey, University of Waikato, 1995

The average woman in the Fertility Survey sample had 13.3 cumulative years of work experience, of which 12.2 were full-time (defined here as employment for 20 or more hours a week). Women who were employed in waged or salaried jobs at the time of the survey (54 percent of the total sample) had higher levels of experience on average – around two years more than all women. The age-specific and overall full-time experience levels of *all* women in the Fertility Survey (shown in the second column of Table 5.5) are fairly close in level to the Population Census estimates for all women in 1996 (shown in the sixth column of Table 5.4). This similarity is reassuring, suggesting that both sources are providing reasonable approximations of women's actual work experience levels.

As another 'reality check', the New Zealand figures can be compared with overseas measures of the actual distribution of work experience among men and women. Lathe and Giles (1995) report information on the work experience patterns of Canadians in 1993. Their data were gathered in the Survey of Labour and Income Dynamics, a representative national longitudinal survey. The statistics reported by Lathe and Giles show very large male–female gaps in years of work experience. Among all Canadian adults aged 15 to 69 years, the mean number of years of full-time, full-year work experience was 17.1 years for males and 10.1 years for females (ibid, p. 16), a gap of 7 years. As one would expect, the size of the gender experience differential was strongly correlated with age. Men aged under 45 reported around 1.5 times the experience that women aged under 45 reported. Men aged over 45 reported approximately twice the experience years of women aged over 45. Compared with these Canadian estimates, the experience estimates assembled for New Zealanders do not seem too implausible.

Imputation of experience values in the HES and IS samples

A strategy commonly adopted by researchers when information on actual work experience is not available is to estimate individuals' potential experience, by taking each individual's current age and subtracting their age when they entered the labour force for the first time. 'Potential experience' is a relatively poor measure of the actual experience of women, because few women are employed continuously during their working-age years. Potential experience is likely to significantly overstate actual experience for women (Filer, 1993, p.520). Potential experience is a rather better approximation of men's actual experience, however, because men are less likely than women to have extended spells away from paid employment.

Three different methods were used to impute experience variables for the employees in the HES and IS samples:

- A potential work experience variable was imputed for all men and women. This was calculated in the standard way, as age – estimated years of schooling – 5.
- Women's full-time actual experience was estimated using a method suggested by Zabalza and Arrufat (1985). In-sample predictions of past work experience were obtained using information on women's cross-sectional participation patterns.
- Women's full-time actual experience was estimated using a method suggested by Filer (1993). Individual values of experience were predicted using the coefficients from an out-of-sample experience regression.

The imputation methods are described in more detail in Appendix 4. Briefly, the Zabalza and Arrufat method begins with the estimation of a probit model describing the tendency of the individuals in the sample to be employed. The coefficients obtained from this probit equation are used to predict the probability of employment for each individual backwards through time, back to the year when they finished their full-time education. In making the backward predictions, any variables in the employment specification that change through time in a predictable way (such as age, and number and ages of children) are backdated. A prediction of each individuals' cumulative years of work experience is then obtained by summing their predicted probabilities of being employed across all past years, from the year of their entry into the labour force to the year of the survey.

The basic approach of the Filer method is to: (i) find a supplementary data source that *does* contain a direct measure of work experience; (ii) regress that actual experience measure on an appropriate set of independent variables within the supplementary sample; (iii) use the coefficients thus obtained to predict experience in the context of the primary sample. The Fertility Survey sample was used as the external data source for the implementation of this method.

The imputed experience values obtained using these three methods are summarised in Table 5.6. The figures in Table 5.6 show the mean years of experience of the men and women in the 'analytic' samples of wage earnings.[31] The samples for adjacent years are pooled, reflecting the way the data are analysed in later sections of the report.

Table 5.6: Summary of the imputed values of work experience

	Males			Females			*Male - female*		
	1989-91	1993-95	1996-98	1989-91	1993-95	1996-98	*1989-91*	*1993-95*	*1996-98*
HES									
Potential experience	19.0	19.3	20.1	19.5	19.5	20.5	*-0.4*	*-0.3*	*-0.3*
Filer (high)				13.3	13.5	14.2	*5.8*	*5.8*	*5.9*
Zabalza-Arrufat (low)				11.3	11.7	12.5	*7.8*	*7.6*	*7.7*
IS			**1997-98**			**1997-98**			**1997-98**
Potential experience			18.7			19.6			*-0.8*
Filer (high)						14.1			*4.7*
Zabalza-Arrufat (low)			.			11.3			*7.4*

Based on the imputations, the mean potential experience level of male employees in the HES was 19.0 years in 1989-91, rising to 20.1 years in 1996-98. Males in the 1997-98 IS had a slightly lower average experience level of 18.8 years. The potential experience values for

[31] The imputation of experience values was limited to the 1988-98 HES samples and the IS samples. Information on educational qualifications and parental circumstances was used in the implementation of the Zabalza and Arrufat and Filer imputation methods, and those variables are not available in full for the HES years 1984 though to 1987.

women are slightly higher than those for men, reflecting the fact that historically, women tended to undertake fewer years of full-time education before joining the labour force.

The means of the Filer experience values for female employees lie in the range of 13.2 to 14.2. These estimated means are quite similar to the Fertility Survey estimate of the average full-time experience of working women in 1994, which was 14.2 years (see Table 5.5). The means of the Zabalza and Arrufat experience values for women lie in the range of 11.3 to 12.5 years. These results are quite similar to the estimate of women's average work experience in 1996 that was derived from census data, which was 11.2 years (see Table 5.4). Hence, the Zabalza and Arrufat and the Filer imputations provide reasonably plausible 'low' and 'high' estimates of working women's actual experience levels during the mid 1990s.[32]

All three estimates of women's experience levels are used in the analysis that follows. The difference between them is useful in showing the sensitivity of the wage analysis results to differences in assumptions about working women's actual experience (and the relative size of the experience gap between women and men). Note that the male-female gap in mean years of prior work experience is *negative* if one uses the potential experience measure for both genders; 5-6 years if one uses the Filer estimates for women, and about 7.5 years if one uses the Zabalza and Arrufat estimates for women.

The procedures used in this study to impute work experience measures have some significant limitations. One limitation is that neither the Zabalza and Arrufat nor the Filer imputation methods take full account of any long-term changes that may have occurred in the employment propensities of women. In applying the Zabalza and Arrufat method, we used probabilities of participation that reflected women's labour supply behaviour in 1988-89 in the case of the HES, and in 1997-98 in the case of the IS. However, women's labour supply behaviour has changed structurally over time, in ways that are probably not fully captured by the personal and family characteristic variables that are included in the imputation models. Over the post-war period, the participation and employment propensities of women aged 25 and over have undergone long-term increases, while those of women aged under 25 have tended to decline. The use of fixed estimates of employment propensities, estimated as at the late 1980s or the late 1990s, will tend to overestimate the work experience that has been accumulated by the older women in the sample, and to underestimate the experience of younger women. However, estimates of the *mean* experience levels of all women in the sample may not be too badly distorted. In practice, the experience variables that were imputed in this study have mean values that are reasonably close to the means of the Fertility Survey and Census measures of women's actual experience.

A more serious problem with the use of fixed estimates of women's employment propensities in the imputation procedure is that any *changes* that occurred in women's average experience levels over the study period – from the late 1980s to the late 1990s – are likely to be underestimated. Note that the imputed experience measures (summarised in Table 5.6) fail to reflect the rising experience trend for women, and the falling experience trend for men, that are apparent in the Population Census results (Table 5.4).

Ideally, birth-cohort effects on women's employment propensities should be taken into account when women's past employment histories are predicted backwards in time, in order

[32] A more detailed comparison of the imputed values with available information on actual experience levels is given in Appendix 4.

to address this problem.[33] The Fertility Survey is currently the best source of New Zealand data on women's working life histories, and it could potentially be used to estimate birth-cohort effects on women's changing employment propensities during the post-war decades. Because the author's access to this data source was quite limited and indirect in nature, the option of using Fertility Survey data for this purpose was not pursued in the current study.

A second issue concerning the imputations is that we lack good external time-series information on the experience levels of *employees*, which could be used to 'benchmark' or evaluate the accuracy of the imputations.[34] Experience trends among employees may differ from the trends in the total population. Changes in the employment patterns of men and women during the 1980s and 1990s could potentially have led to compositional effects that either slowed down or speeded up the contraction of the gender experience gap among employees, relative to the trend in the total population.

HES data indicate that the male rate of participation in waged or salaried employment fell from about 73 percent in 1989 to around 69 percent in 1998. If men with relatively low levels of experience were more likely to become unemployed or move out of the labour force, then the fall in the male employment rate could have raised average experience levels among male employees, slowing down the contraction of the gender experience gap. On the other hand, the movement of older men with extensive prior work experience from waged to self-employment could have operated to reduce the average experience levels of male employees, hastening the contraction of the gender experience gap.

The female rate of participation in waged or salaried employment rose by around 2 percentage points between 1989 and 1998. Because the largest participation increases came from women aged in their fifties, it is hard to judge whether the net impact of this compositional change would have been to raise or lower the average experience level of female employees.

On balance, there is not enough evidence to deduce the actual trend in the male–female experience gap among employees during the late 1980s and 1990s. We simply have to acknowledge at this point that the imputed estimates of experience do not necessarily give correct signals with respect to trends through time. In Section 5.4, we explore the implications of different assumptions about the actual trends in male–female experience levels.

A final issue concerning the imputations is that no adjustment has been made for discrepancies between men's actual employment rates and their potential employment rates. In reality, men's actual full-time experience values are likely to be somewhat below their potential experience values, taking into account unemployment, part-time employment spells, and spells out of the workforce. A comparison of the experience imputations for men (Table 5.6) with the Census-derived estimates of men's actual experience levels (Table 5.4) suggests that the effects of this simplification are unlikely to be too serious, however.

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[33] Zabalza and Arrufat (1985), using data for the UK, adjusted their back-cast employment projections using year-by-year estimates of women's participation probabilities – obtained using data from a separate survey of women's working life histories.

[34] Census employment data for the years prior to 1981 were not tabulated in a manner than would permit the calculation of age and sex-specific employment rates for *employees*, and therefore we can't derive life-time work experience estimates for employees using Census data.

5.3 Education and experience effects on the gender earnings gap

5.3.1 The earnings equations

We begin by estimating a series of log hourly earnings equations for all male and female employees, incorporating alternative imputed measures of experience. We then use the Blinder-Oaxaca decomposition method to provide an initial set of estimates of the contribution that male–female differences in education and experience are making to the total gender gap in average hourly earnings.

Separate wage equations for males and females were estimated for the following pooled samples: HES 1989-91; HES 1993-95; HES 1996-98; and IS 1997-98. The wage regressions took the form:

$$\ln w_i = \alpha + \beta X_i + \delta Q_j + \varepsilon_i \qquad (6)$$

where ln w_i is an individuals' log real hourly earnings (measured in March 1998 dollars); X_i is a vector of variables describing the characteristics of the individual; and Q_j is a vector of indicator variables for each quarter in the case of the HES regressions, and a single dummy variable for the year 1997 in the case of the IS regressions. The explanatory variables (X_i) are highest qualification; experience; ethnic identity; and in the IS equations, country of birth. The quarter dummy variables (Q_j) were included in order to control for the effects of any time-related shifts in earnings levels (within each pooled sample) that were not already eliminated through the conversion of nominal values to real.

In this study, level of educational qualifications and years of work experience are treated as the core indicators of productive capacity. No other measures of ability, experience, or training are available in the HES or IS. Age is available, but it is not entered directly into most of the models of earnings that are estimated here because it plays a large role in the estimation of imputed values of experience.

The education variable is a dummy variable indicating the individual's highest qualification, classified into the following groups: no formal qualifications; school qualifications; vocational qualifications (a group that includes all post-school qualifications below degree level); bachelors degrees; and post-graduate degrees. 'No formal qualifications' is the omitted category.

Experience is entered as a quartic function (β_1 experience + β_2 experience^2 + β_3 experience^3 + β_4 experience^4) because this specification allows the relationship between experience and earnings to be modelled in a more flexible manner than does the traditional quadratric specification. In practice, the wage equations estimated using the quartic specification for experience did in fact have slightly higher measures of 'fit' than similar equations in which experience was specified in quadratic form.

A single wage equation was estimated for males, using the potential experience variable. Three separate regressions were estimated for each sample of women, using each of the three alternative measures of women's experience (potential; Filer; Zabalza and Arrufat).

Ethnic identity is entered into the wage regressions via three dummy variables that identify individuals who are Mäori, Pacific Islanders, or a member of any other non-Pakeha ethnic

group. In the IS equations, dummies for 'born in Asia' and 'born in the Pacific' are also included. These are intended to capture any wage differentials that are associated with attributes such as English-language difficulties or foreign schooling.

Estimates obtained from these regressions are presented in Tables 5.7 to 5.10.[35]

The reduction in the gender earnings gap was smaller over this shorter time period than over the 14-year period from 1984 to 1998, which was the focus of Section 4. The gender gap in log hourly earnings for the HES samples was 0.19 log points in 1989-91, falling to 0.14 log points in 1993-95, and rising slightly to 0.153 in 1996-98. The gender gap in log hourly earnings in the 1997-98 IS sample was 0.17 log points.

5.3.2 Results

The R^2 scores for each equation (Tables 5.7 to 5.10) indicate that the HES equations explain around 20 percent of the total variation in male hourly earnings, and 15-17 percent of the variation in female hourly earnings. The IS equations explain around 23 percent of the variation in male wages and 16 percent of the female wage variation.

Table 5.7: HES wage regressions for 1989-91

	Means			*Parameter estimates*							
				Males		Females (1)		Females (2)		Females (3)	
	Males	Females	*M-F*	Coeffic	*SE*	Coeffic	*SE*	Coeffic	*SE*	Coeffic	*SE*
Potential experience	19.044	19.457	*-0.413*	0.059 *	*0.011*	0.079 *	*0.011*				
Potential exp^2 / 100	4.762	4.922	*-0.160*	-0.236 *	*0.109*	-0.554 *	*0.105*				
Potential exp^3 / 10000	1.382	1.426	*-0.044*	0.400	*0.389*	1.601 *	*0.363*				
Potential exp^4 / 1000000	0.440	0.449	*-0.010*	-0.259	*0.454*	-1.615 *	*0.416*				
Filer experience		13.258	*5.786*					0.055 *	*0.019*		
Filer exp^2/100		2.248	*2.514*					-0.359	*0.255*		
Filer exp^3/10000		0.438	*0.944*					0.986	*1.292*		
Filer exp^4/1000000		0.093	*0.346*					-0.947	*2.170*		
Z&A experience		11.276	*7.768*							0.078 *	*0.017*
Z&A exp^2/100		1.733	*3.029*							-0.614 *	*0.250*
Z&A exp^3/10000		0.318	*1.064*							1.999	*1.378*
Z&A exp^4/1000000		0.065	*0.375*							-2.278	*2.490*
School qualifications	0.282	0.355	*-0.073*	0.152 *	*0.020*	0.186 *	*0.019*	0.182 *	*0.018*	0.182 *	*0.019*
Vocational quals	0.335	0.282	*0.053*	0.271 *	*0.020*	0.339 *	*0.020*	0.318 *	*0.019*	0.331 *	*0.019*
Bachelor degree	0.096	0.066	*0.030*	0.549 *	*0.026*	0.506 *	*0.033*	0.477 *	*0.032*	0.490 *	*0.032*
Postgraduate degree	0.040	0.021	*0.019*	0.652 *	*0.037*	0.645 *	*0.035*	0.597 *	*0.035*	0.624 *	*0.034*
Maori	0.071	0.065	*0.006*	-0.028	*0.023*	-0.031	*0.023*	-0.026	*0.023*	-0.020	*0.023*
Pacific Islander	0.039	0.036	*0.003*	-0.082 *	*0.023*	-0.084 *	*0.028*	-0.093 *	*0.027*	-0.085 *	*0.027*
Other ethnicity	0.036	0.028	*0.008*	-0.108 *	*0.040*	-0.029	*0.028*	0.004	*0.028*	-0.019	*0.027*
Log wage	2.758	2.563	*0.195*								
Adj R^2				0.203		0.168		0.165		0.171	
F				47.4		32.0		32.1		32.6	
N				4543		3790		3790		3790	

* Denotes significant at the 5 percent error level

Note: An intercept and 11 quarterly dummy variables were also included.

[35] The equations were estimated in STATA using the 'svyreg' procedure, which uses survey design information in the estimation of variances. See Section 3.5 for an explanation.

Table 5.8: HES wage regressions for 1993-95

	Means			*Parameter estimates*							
				Males		Females (1)		Females (2)		Females (3)	
	Males	Females	*M-F*	Coeffic	*SE*	Coeffic	*SE*	Coeffic	*SE*	Coeffic	*SE*
Potential experience	19.252	19.516	*-0.264*	0.073 *	*0.012*	0.106 *	*0.011*				
Potential exp^2 / 100	4.808	5.009	*-0.201*	-0.328 *	*0.109*	-0.745 *	*0.102*				
Potential exp^3 / 10000	1.384	1.471	*-0.088*	0.682	*0.378*	2.144 *	*0.355*				
Potential exp^4 / 1000000	0.435	0.468	*-0.033*	-0.568	*0.437*	-2.135 *	*0.407*				
Filer experience		13.475	*5.777*					0.092 *	*0.019*		
Filer exp^2/100		2.338	*2.471*					-0.694 *	*0.254*		
Filer exp^3/10000		0.465	*0.918*					2.214	*1.285*		
Filer exp^4/1000000		0.101	*0.334*					-2.498	*2.166*		
Z&A experience		11.677	*7.576*							0.122 *	*0.018*
Z&A exp^2/100		1.868	*2.940*							-1.144 *	*0.267*
Z&A exp^3/10000		0.353	*1.030*							4.559 *	*1.466*
Z&A exp^4/1000000		0.074	*0.361*							-6.519 *	*2.646*
School qualifications	0.277	0.361	*-0.084*	0.175 *	*0.021*	0.169 *	*0.020*	0.162 *	*0.019*	0.164 *	*0.019*
Vocational quals	0.344	0.261	*0.083*	0.248 *	*0.020*	0.280 *	*0.022*	0.244 *	*0.021*	0.265 *	*0.022*
Bachelor degree	0.115	0.099	*0.015*	0.521 *	*0.027*	0.474 *	*0.029*	0.436 *	*0.028*	0.458 *	*0.029*
Postgraduate degree	0.042	0.036	*0.006*	0.695 *	*0.037*	0.582 *	*0.044*	0.531 *	*0.044*	0.556 *	*0.043*
Maori	0.078	0.087	*-0.008*	-0.043 *	*0.020*	-0.061 *	*0.023*	-0.043	*0.023*	-0.034	*0.023*
Pacific Islander	0.037	0.034	*0.003*	-0.184 *	*0.033*	-0.068 *	*0.025*	-0.077 *	*0.024*	-0.068 *	*0.024*
Other ethnicity	0.039	0.035	*0.004*	-0.152 *	*0.041*	-0.080 *	*0.038*	-0.049	*0.038*	-0.072	*0.038*
Log wage	2.691	2.547	*0.144*								
Adj R^2				0.209		0.149		0.143		0.153	
F				45.6		26.5		25.0		26.1	
N				4813		4430		4430		4430	

* Denotes significant at the 5 percent error level

Note: An intercept and 11 quarterly dummy variables were also included.

Table 5.9: HES wage regressions for 1996-98

	Means			*Parameter estimates*							
				Males		Females (1)		Females (2)		Females (3)	
	Males	Females	*M-F*	Coeffic	*SE*	Coeffic	*SE*	Coeffic	*SE*	Coeffic	*SE*
Potential experience	20.115	20.464	*-0.349*	0.062 *	0.012	0.091 *	0.011				
Potential exp^2 / 100	5.191	5.401	*-0.210*	-0.223	0.112	-0.575 *	0.106				
Potential exp^3 / 10000	1.529	1.613	*-0.084*	0.329	0.398	1.512 *	0.383				
Potential exp^4 / 1000000	0.489	0.519	*-0.030*	-0.169	0.468	-1.429 *	0.454				
Filer experience		14.203	*5.912*					0.090 *	0.021		
Filer exp^2/100		2.547	*2.644*					-0.588 *	0.280		
Filer exp^3/10000		0.517	*1.012*					1.679	1.422		
Filer exp^4/1000000		0.113	*0.375*					-1.911	2.400		
Z&A experience		12.453	*7.661*							0.137 *	0.018
Z&A exp^2/100		2.090	*3.101*							-1.278 *	0.278
Z&A exp^3/10000		0.408	*1.121*							5.116 *	1.574
Z&A exp^4/1000000		0.087	*0.402*							-7.544 *	2.917
School qualifications	0.278	0.360	*-0.081*	0.213 *	0.021	0.168 *	0.022	0.169 *	0.021	0.173 *	0.020
Vocational quals	0.327	0.274	*0.052*	0.263 *	0.020	0.303 *	0.025	0.282 *	0.023	0.305 *	0.022
Bachelor degree	0.134	0.118	*0.015*	0.496 *	0.028	0.443 *	0.030	0.417 *	0.028	0.441 *	0.028
Postgraduate degree	0.057	0.039	*0.018*	0.646 *	0.037	0.609 *	0.037	0.565 *	0.036	0.601 *	0.036
Maori	0.085	0.084	*0.001*	-0.061 *	0.022	-0.113 *	0.027	-0.096 *	0.027	-0.090 *	0.027
Pacific Islander	0.036	0.033	*0.003*	-0.080 *	0.026	-0.087 *	0.026	-0.100 *	0.026	-0.083 *	0.026
Other ethnicity	0.051	0.044	*0.007*	-0.142 *	0.031	-0.159 *	0.034	-0.123 *	0.034	-0.155 *	0.034
Log wage	2.708	2.556	*0.153*								
Adj R^2				0.200		0.160		0.159		0.166	
F				38.3		35.4		40.0		40.5	
N				4095		3844		3844		3844	

* Denotes significant at the 5 percent error level

Note: An intercept and 11 quarterly dummy variables were also included.

Table 5.10: IS wage regressions for 1997-98

	Means			*Parameter estimates*							
				Males		Females (1)		Females (2)		Females (3)	
	Males	Females	*M-F*	Coeffic	*SE*	Coeffic	*SE*	Coeffic	*SE*	Coeffic	*SE*
Potential experience	18.747	19.595	*-0.848*	0.062 *	*0.008*	0.076 *	*0.008*				
Potential exp^2 / 100	4.686	5.082	*-0.396*	-0.224 *	*0.077*	-0.470 *	*0.071*				
Potential exp^3 / 10000	1.356	1.500	*-0.144*	0.337	*0.270*	1.220 *	*0.247*				
Potential exp^4 / 1000000	0.428	0.478	*-0.049*	-0.194	*0.316*	-1.129 *	*0.288*				
Filer experience		14.094	*4.654*					0.047 *	*0.011*		
Filer exp^2/100		2.533	*2.153*					-0.046	*0.147*		
Filer exp^3/10000		0.518	*0.838*					-1.023	*0.730*		
Filer exp^4/1000000		0.115	*0.314*					2.768 *	*1.214*		
Z&A experience		11.312	*7.435*							0.086 *	*0.011*
Z&A exp^2/100		1.831	*2.855*							-0.667 *	*0.157*
Z&A exp^3/10000		0.353	*1.003*							1.988 *	*0.863*
Z&A exp^4/1000000		0.075	*0.353*							-1.914	*1.549*
School qualifications	0.209	0.269	*-0.060*	0.186 *	*0.015*	0.171 *	*0.013*	0.167 *	*0.012*	0.161 *	*0.012*
Vocational quals	0.448	0.411	*0.037*	0.267 *	*0.013*	0.261 *	*0.014*	0.238 *	*0.013*	0.238 *	*0.014*
Bachelor degree	0.098	0.097	*0.001*	0.542 *	*0.022*	0.485 *	*0.021*	0.467 *	*0.020*	0.445 *	*0.020*
Postgraduate degree	0.047	0.034	*0.013*	0.624 *	*0.029*	0.616 *	*0.035*	0.574 *	*0.033*	0.577 *	*0.034*
Maori	0.095	0.084	*0.011*	-0.074 *	*0.014*	-0.084 *	*0.015*	-0.068 *	*0.015*	-0.058 *	*0.015*
Pacific Islander	0.044	0.045	*-0.002*	-0.134 *	*0.025*	-0.074	*0.038*	-0.096 *	*0.038*	-0.070	*0.038*
Other ethnicity	0.047	0.044	*0.003*	-0.059	*0.036*	-0.028	*0.033*	0.006	*0.032*	0.014	*0.034*
Born in Pacific Islands	0.035	0.036	*-0.001*	-0.056	*0.029*	-0.046	*0.041*	-0.038	*0.040*	-0.047	*0.041*
Born in Asia	0.019	0.020	*-0.001*	-0.154 *	*0.052*	-0.151 *	*0.050*	-0.150 *	*0.050*	-0.158 *	*0.049*
Log wage	2.724	2.552	*0.171*								
Adj R^2				0.231		0.160		0.168		0.163	
F				165.6		91.3		100.8		94.7	
N				11,362		11,235		11,235		11,235	

* Denotes significant at the 5 percent error level

Note: An intercept and a dummy variable for June 1997 were also included.

Differences in means

We begin by discussing the male–female gaps in mean characteristics. These are shown in the first three columns of each table. The difference between male and female workers in years of potential experience was around –0.5 years on average. When the Filer estimates of women's experience were used, the male–female experience gap was approximately 5.8 years in each of the HES samples, and 4.7 years in the IS sample. When the Zabalza and Arrufat estimates of women's experience were substituted, the gender gap in experience was about 7.8 years in the HES samples and 7.4 years in the IS samples. As noted previously, the gender experience gap, as measured by these three alternative sets of experience imputations, is stable over time. That is more likely to be a consequence of shortcomings in the imputation methods than a reflection of the true trends in the gender experience gap.

The sample means for education show a higher level of school-level qualifications among women than men, and a lower level of post-school qualifications. Women gained bachelor degrees more rapidly than men over the decade, however, causing the gender differential in the proportion of degree holders to decline.

The gender differences in the proportions of ethnic minorities and people born overseas were relatively small. In most of the samples, women were a little less likely than men to be in the non-Päkeha groups, suggesting that the ethnic distributions may have given women a small advantage in relative earnings.

Parameters

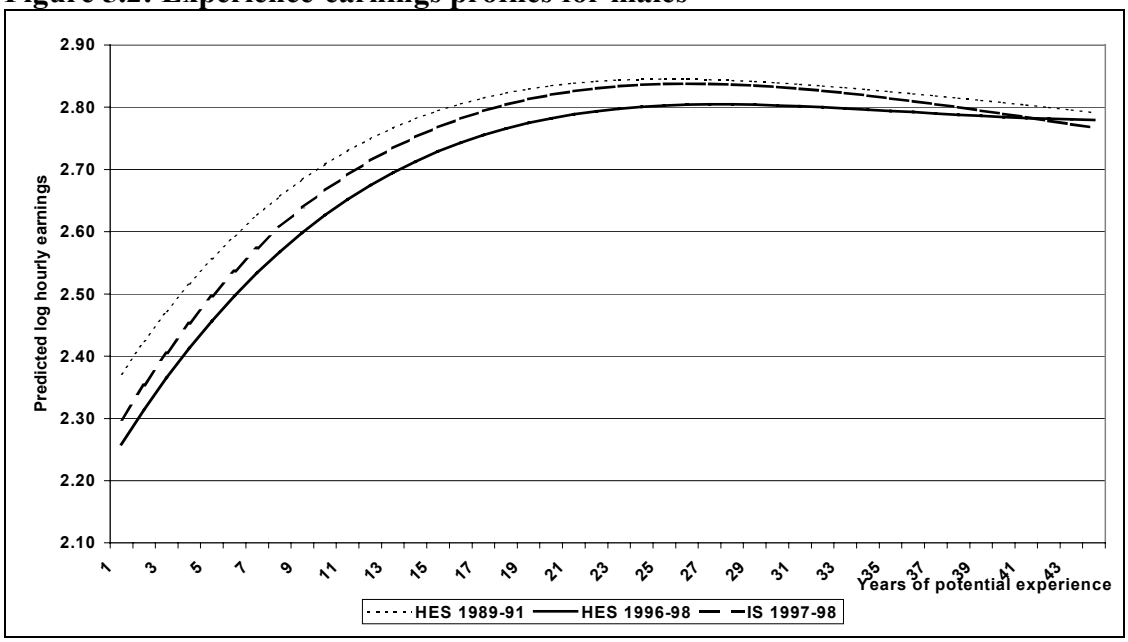
The coefficients that are shown in the right-hand columns of Tables 5.7 to 5.10 can be interpreted as estimates of the average wage premium (or deficit) that is paid for each

attribute. For example, the entry for 'school qualifications' in the 4th column of Table 5.7 indicates that in 1989-91, the predicted earnings of male employees with school qualifications were 0.152 log points, or about 16.4 percent, above those of male employees who lacked any educational qualifications (controlling for differences in experience and ethnicity between these two groups).

Estimates of male and female returns to experience differ across the alternative measures of experience. To make the interpretation of these coefficients easier, we present graphs of the experience-earnings profiles that are implied by the regression coefficients. The lines plotted on these graphs represent the predicted log hourly earnings of men and women with different levels of experience.[36] The slope of the line represents the predicted increase in log earnings that is associated with each additional year of experience (controlling for the effects of education, ethnic status, and country of birth).

Figures 5.2 and 5.3 plot experience-earnings profiles estimated using the potential years of experience measure. For males, the predicted earnings function rises gradually with age and flattens out at about 25 years of experience (corresponding to an average age of about 42). The relative earnings of younger men, who have fewer years of potential experience, appear to have shifted downwards a little since 1989-91, as shown by the downward shift of the left end of the plotted lines. For females, the predicted earnings function increases more steeply at the lowest levels of potential experience, but it reaches a flatter and lower peak that that of males. The female earnings function appears to have two peaks in fact – the first at about 15 years, and the second at about 38 years. The average ages of the women at these experience levels are 32 and 54 years respectively. However, the twin peaks pattern was not so pronounced in 1996-98 as in 1989-91. It may be disappearing over time as women's participation in employment becomes more continuous over their lifetimes.

Figure 5.2: Experience-earnings profiles for males



[36] The other components of earnings were evaluated at their mean levels in the construction of these graphs.

Figure 5.3: Experience-earnings profiles for females, using potential experience

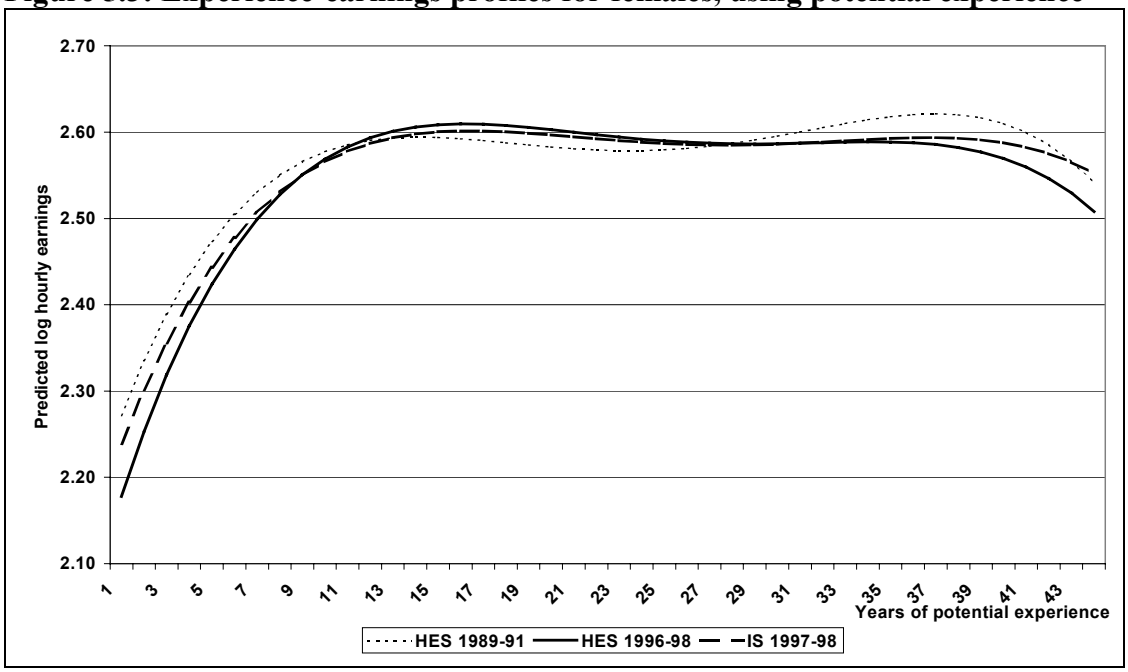


Figure 5.4: Experience-earnings profiles for females, using Filer experience

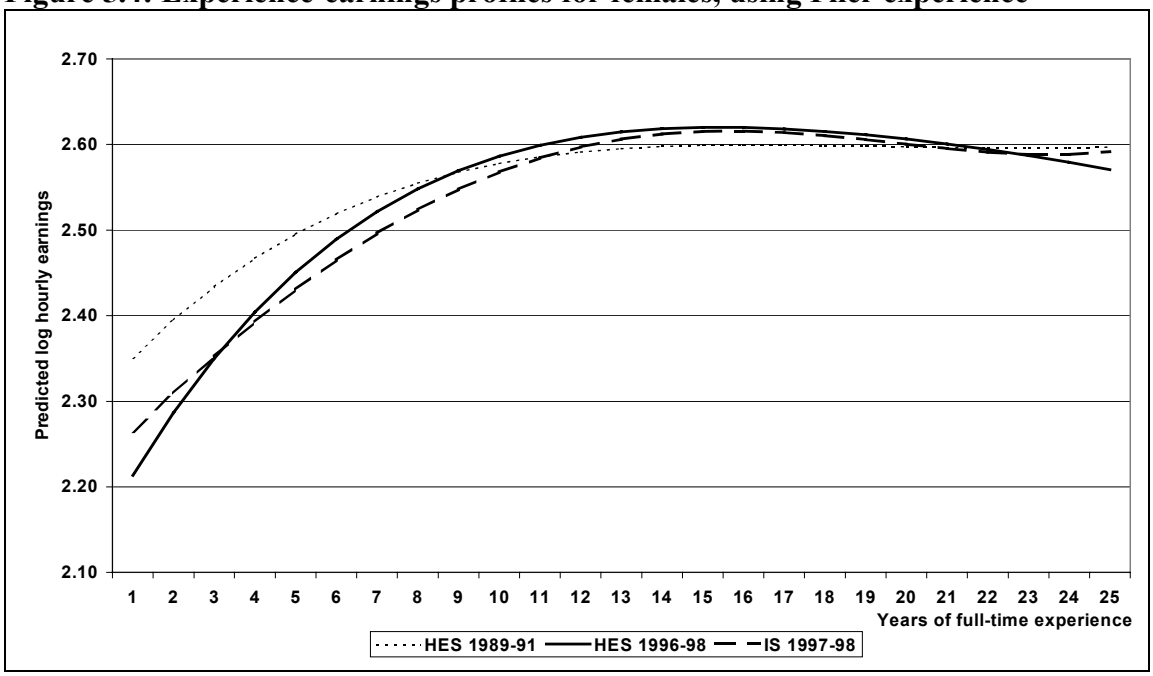
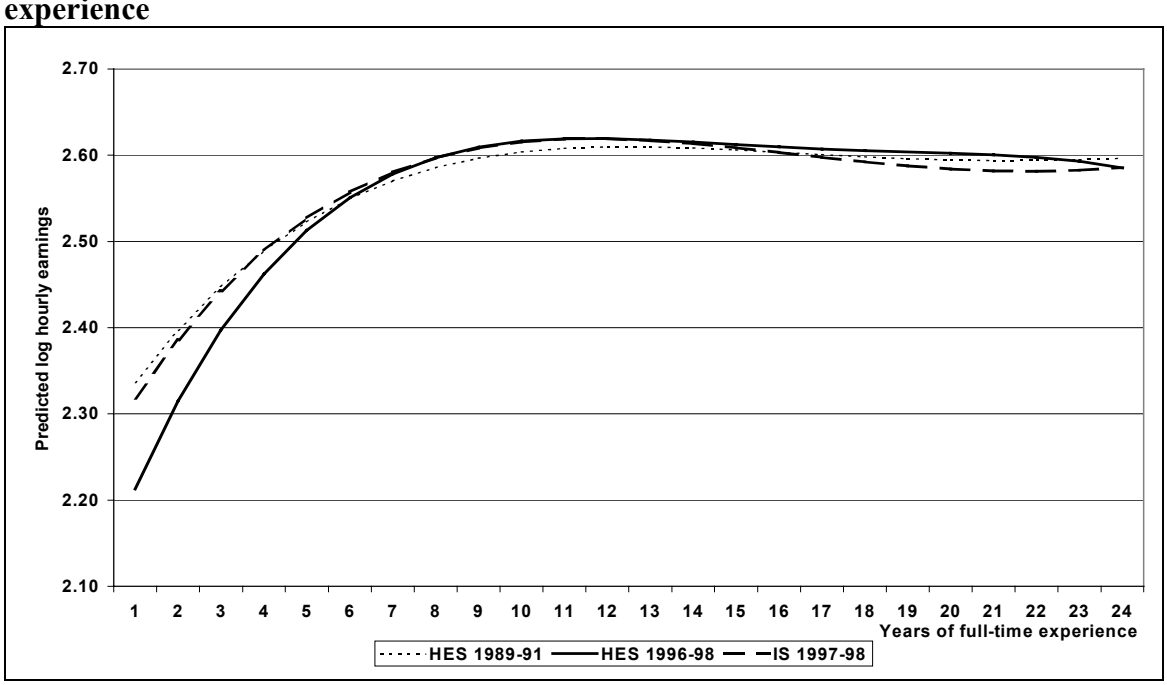
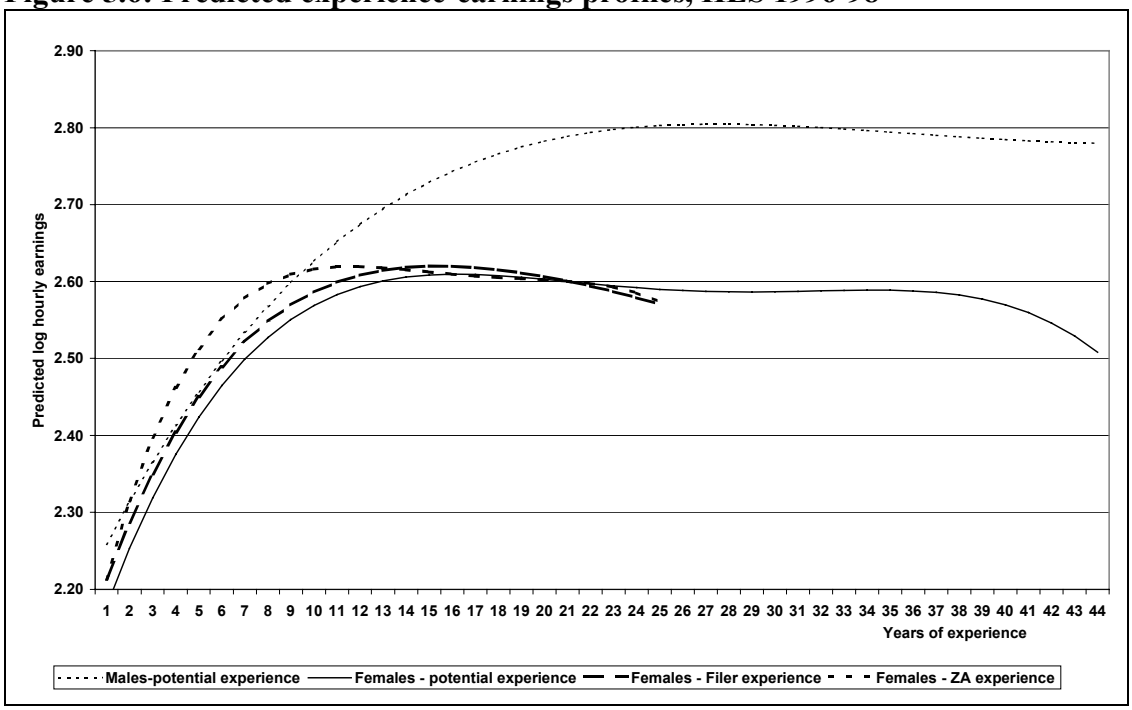


Figure 5.5: Experience-earnings profiles for females, using Zabalza and Arrufat experience



Figures 5.4 and 5.5 plot the predicted earnings of women with various levels of experience using the Filer and the Zabalza and Arrufat experience measures. Here, the shape of the 'returns to experience' function is more similar to that of men, with a more clearly defined single peak. Comparison of the lines plotted for 1989-91 and 1996-98 suggests that the relative earnings of young women (represented by the left-hand end of the lines) have fallen, causing the slope of the experience-earnings function to become steeper.

Figure 5.6: Predicted experience-earnings profiles, HES 1996-98



The alternative measures of experience are plotted together in Figure 5.6, using the estimates for men and women in the 1996-98 HES sample. This graph illustrates the influence that

alternative measures of experience have on estimates of the wage returns to experience, particularly over the 1-10 years range of experience. The Zabalza and Arrufat imputations credit women in the sample with the lowest number of years of experience, on average. As a consequence, the return estimated per year of experience for women with 1-10 years of experience is higher than that of the alternative two measures. The potential experience measure, in contrast, which assigns the highest values of experience to women over the first decade or two of their working life, yields the lowest estimates of the wage 'return' per year of experience.

Statistical tests carried out for each of the different pooled samples and specifications indicate that the differences between the male and the female coefficients for experience were statistically significant.

Educational qualifications are strongly and significantly related to hourly earnings for both males and females. In 1989-91, for example, the males in the HES sample who held a post-graduate degree had average predicted hourly earnings that were 0.652 log points, or 92 percent, above those of men with no formal qualifications at all. For women in 1989-91, the predicted earnings premium for a post-graduate degree (relative to no qualifications) was about 90 percent in the first model (using the potential experience variable), about 82 percent in the second model (using the Filer experience variable), and about 86 percent in the third model (using the Zabalza and Arrufat experience variable).

Although there are differences in the male and female coefficients for school qualifications, the direction of the differences is not consistent across the different samples and specifications. At the higher end of the educational spectrum, however, the estimated returns to bachelor and post-graduate degrees are consistently higher for males than for females, across all years and samples. In the IS in 1997-98, for example, the earnings premium associated with a bachelors degree was 0.542 log points, or about 72 percent, for males. It ranged from 56 percent to 62 percent across the three different specifications for females.

The effects of vocational qualifications on male and female earnings present a slightly more complicated picture. In the HES regressions, the estimated wage premium for vocational qualifications is consistently higher in the *female* regressions than in the male. In the IS regressions, in contrast, the returns to vocational qualifications do not differ significantly by gender. As noted earlier, the IS records a much larger number of post-school qualifications below degree level than does the HES. Within this larger 'pool' of certificate and diploma qualifications, the average returns estimated for each gender appear to be more equal.

These gender differences in estimated wage returns to vocational and bachelor degree qualifications have more than one possible interpretation. They could be due to differences in the quality or mix of qualifications that are held by men and women, within each broad grouping. Trades qualifications are more prevalent among men, and teaching and nursing diplomas are more prevalent among women, and this difference in type could help to explain the higher return to vocational qualifications that was estimated for women in the HES regressions. Differences in subject type could also help to explain the higher wage premium for bachelor degrees that was estimated for males, given that men are more likely to hold degrees in engineering, law and business, and less likely to hold arts degrees. Alternatively, the male–female coefficient differences could be a consequence of unequal treatment of men and women in the labour market.

Considering all educational qualifications as a group, statistical tests carried out for each of the different samples and specifications indicated that the male and female returns to educational qualifications were significantly different from each other. Not all of the test scores were *substantially* above the significance thresholds, however. Differences in returns to vocational qualifications and bachelor degrees made the largest contributions to the significant F-scores in the HES sample tests, while in the IS sample tests, differences in returns to bachelor degrees were the main factor raising the F-scores.

Drawing together these findings on educational coefficients, some general points can be made. Firstly, there is a suggestion in the results that male workers gain higher wage returns from university qualifications than do females. This is consistent with the notion of unequal treatment of men and women in the labour market, but it could also be due simply to gender differences in type of degree held, with males holding a higher proportion of degrees in subjects that are highly rewarded in the labour market. There is no clear evidence that men and women are differentially rewarded for lower levels of qualifications. Secondly, estimates of the returns to educational qualifications are influenced by the choice of a measure of experience. Comparisons across the female wage equations demonstrate this point. In the second and third models, which incorporate more 'realistic' measures of women's actual work experience, a greater portion of the variation in earnings across women is attributed to experience, and the coefficients on educational qualifications are smaller. A basic message one can take from this is that measuring experience correctly does matter for inferences about educational returns.

The ethnic coefficients in Tables 5.7 to 5.10 provide estimates of the independent effect of ethnicity on earnings, controlling for ethnic differences in experience and education. These coefficients indicate that Mäori, Pacific Island peoples, and people of other ethnic minority groups, tend to earn less than Pakeha in all samples and specifications. The coefficients for Mäori in the HES in 1989-91 were quite small and are not statistically significant. By 1996-98, however, a statistically significant wage penalty for 'Mäori' was identifiable. The coefficients for Pacific Island peoples and people of 'other' ethnic groups are relatively larger than those for Mäori, and they are statistically significant in all HES samples. Statistically significant wage penalties for Mäori and Pacific Island peoples were also estimated in the IS regressions.

In the IS regressions, two additional indicator variables were added to distinguish the effects of overseas birth from the effects of ethnicity. Those variables identify people who were born in the Pacific Islands and those who were born in Asia. The full effects of ethnicity and country of birth for foreign-born Asians and Pacific Islanders are now obtained by summing the ethnicity and overseas-birth coefficients.[37] The coefficients obtained, shown in Table 5.10, reveal relatively larger wage penalties for Pacific Islanders who were born in the Pacific (who represent 3.5 percent of the sample), and Asian-born immigrants (who make up 2 percent of the sample). For example, the mean earnings of Pacific-born males are estimated to be 17 percent lower than the mean earnings of Päkeha (after adjusting for educational and experience differences). The mean earnings of Asian-born men are estimated to be around 19 percent lower than those of Päkeha men, and 9 percent lower than those of Asian men who were not born in Asia. Not all of the ethnic and immigrant wage effects estimated in Table 5.10 are statistically significant, and given the small sample sizes they are likely to be imprecisely estimated.

[37] This is not strictly accurate for foreign-born Asians, as the 'other' ethnicity group includes some non-Asian people.

These ethnic differences in earnings are of little consequence for explanations of gender earnings inequality, however, because the male–female differences in ethnic returns tend to be very small. Statistical tests comparing the male with the female ethnic and country-of-birth coefficients (as a group) failed to show statistically significant differences in any of the samples or specifications.

5.3.3 Decomposition of the sources of the gender earnings gap

The Oaxaca-Blinder method of decomposing the male–female log earnings gap between the portion due to gender differences in measured attributes, and differences in returns to those attributes, was described in Section 3. In this study decompositions were undertaken using two different weighting schemes. Results of the first set of decompositions, shown in Table 5.11, weight the gap in productive attributes with the coefficients from the male wage regression. The second set of decomposition results, shown in Table 5.12, weight the gap in characteristics with 'average' coefficients. These are obtained from a pooled regression incorporating both males and females.

Both tables provide estimates of the log hourly earnings differential (expressed in log points) that is attributable to gender differences in experience; qualifications; and the ethnic/immigrant mix, in each sample and year. We focus firstly on Table 5.11. It can be seen that the choice of an experience measure has a large impact on the portion of the gender earnings gap that is attributed to male–female differences in these two proxies for skill. When women's experience is measured using the potential experience variable, experience makes a negligible contribution (reflecting the fact that the mean value of potential experience for women is close to the mean value for men). If women's experience is measured using the Filer imputed values (Model 2), the decompositions attribute around 0.03 to 0.05 log points of the total gender earnings gap (or about 15-25 percent) to the gender gap in experience. Using the Zabalza and Arrufat values of experience for women (Model 3), the decompositions show that the experience gap accounts for between 0.07 and 0.09 log points of the gap (or about 35-45 percent).[38]

The log earnings gap that is attributable to gender differences in qualifications was around 0.03 log points in 1989-91, falling to around 0.015 in the 1996-98 HES and just 0.007 log points in the 1997-98 IS. These estimates indicate that gender differences in mean levels of educational qualifications were making a positive contribution to the total gender earnings gap, but the size of that contribution was relatively minor, and declined in importance as the gender gap in educational attainment became smaller. The log earnings gap that is attributable to the ethnic and immigrant mix is very small and has a negative rather than a positive sign – which is probably due to the fact that slightly fewer female than male employees belonged to these ethnic minority groups.

[38] These estimated experience effects are only very marginally influenced by the decision to model earnings as a quartic function of experience, rather than a quadratric function.

Table 5.11: Summary of human capital decompositions – Part A

	HES			IS
	1989-91	1993-95	1996-98	1997-98
Total log hourly earnings gap	0.195	0.144	0.153	0.171
	M-F gap in characteristics weighted by male returns			
Individual components				
Gap due to experience - potential	-0.002	0.006	0.003	-0.003
Gap due to experience - Filer	0.037	0.047	0.046	0.027
Gap due to experience - Zabalza & Arrufat	0.074	0.085	0.084	0.090
Gap due to qualifications*	0.032	0.018	0.015	0.007
Gap due to ethnic/immigrant mix*	-0.001	-0.001	-0.001	-0.001
Summary of the portion of the earnings gap due to differences in characteristics				
Model using potential experience for both genders				
Total gap in characteristics (Xm-Xf)*bm	0.029	0.023	0.017	0.004
Parameter gap (bm-bf)*Xf	0.166	0.121	0.136	0.167
Percent attributed to gap in characteristics	14.9	16.0	11.1	2.3
Model using Filer experience for women				
Total gap in characteristics (Xm-Xf)*bm	0.068	0.065	0.061	0.034
Parameter gap (bm-bf)*Xm	0.127	0.079	0.092	0.137
Percent attributed to gap in characteristics	34.9	44.8	39.6	19.7
Model using Zabalza and Arrufat experience for women				
Total gap in characteristics (Xm-Xf)*bm	0.105	0.102	0.098	0.097
Parameter gap (bm-bf)*Xm	0.090	0.042	0.054	0.074
Percent attributed to gap in characteristics	53.7	71.1	64.4	56.5

* The effects of the male-female gaps in qualifications and ethnic/immigrant composition are the same across the three experience specifications. This is because the male-female differences in educational levels and ethnic/immigrant composition do not change, and they are weighted by an unchanging set of coefficients, derived from the male wage regression.

Table 5.12: Summary of human capital decompositions – Part B

	HES			IS
	1989-91	1993-95	1996-98	1997-98
Total log hourly earnings gap	0.195	0.144	0.153	0.171
	M-F gap in characteristics weighted by average returns			
Model using potential experience for both genders				
Gap due to experience	0.000	0.006	0.005	0.000
Gap due to qualifications	0.034	0.020	0.019	0.009
Gap due to ethnic/immigrant mix	-0.001	0.000	-0.001	-0.001
Total gap in characteristics $(X_m-X_f)*b_{m+f}$	0.034	0.026	0.022	0.008
Parameter gap $(b_m-b_f)*X_{m+f}$	0.161	0.118	0.130	0.163
Percent attributed to gap in characteristics	17.4	18.0	14.6	4.9
Model using Filer experience for women				
Gap due to experience	0.046	0.049	0.049	0.038
Gap due to qualifications	0.033	0.018	0.017	0.008
Gap due to ethnic/immigrant mix	-0.001	-0.001	-0.001	0.000
Total gap in characteristics $(X_m-X_f)*b_{m+f}$	0.078	0.066	0.065	0.045
Parameter gap $(b_m-b_f)*X_{m+f}$	0.117	0.078	0.088	0.126
Percent attributed to gap in characteristics	40.0	46.0	42.6	26.4
Model using Zabalza and Arrufat experience for women				
Gap due to experience	0.073	0.074	0.074	0.080
Gap due to qualifications	0.033	0.019	0.018	0.008
Gap due to ethnic/immigrant mix	-0.001	-0.001	-0.001	0.000
Total gap in characteristics $(X_m-X_f)*b_{m+f}$	0.105	0.092	0.091	0.087
Parameter gap $(b_m-b_f)*X_{m+f}$	0.090	0.052	0.062	0.084
Percent attributed to gap in characteristics	54.0	64.1	59.3	50.8

The results given in the middle and lower sections of Table 5.11 show how much of the total log wage gap is due to gender differences in experience, education and ethnicity, considered together. Using the potential experience specifications, this ranges from almost zero to 16 percent of the total wage gap. Using the Filer and the Zabalza and Arufat experience specifications, it ranges from a low of 20 percent to a high of 71 percent.

The decomposition results set out in table 5.12 employ the alternative weighting system, using the average returns of male and female employees to weight each characteristic. In these results, the portion of the log earnings gap that is attributed to male–female differences in the proxies for skill is generally higher. If we use the Filer and the Zabalza and Arrufat experience imputations, it ranges from a low of 26 percent to a high of 64 percent. The main points that emerge from the first set of results still hold true.

The decompositions can be given the following overall interpretation. While we do not know the actual experience levels of the employees in these samples, we do know that potential experience is a poor measure of actual experience for women. Based on the evidence provided by the Population Census and the Fertility Survey, the actual mean value of employed women's full-time work experience in the mid 1990s was likely to be in the range of 11-15 years. The wage regressions and decompositions that incorporate the Zabalza and Arrufat and the Filer experience imputations for women allow us to estimate the contribution of gender differences in productive attributes under two different assumptions about the true level of women's experience.

The low (Zabalza and Arrufat) estimate, which yields the largest male-female gap in experience levels, indicates that between half and two-thirds (50–65 percent) of the total male-female gap in hourly earnings is attributable to differences in average levels of measured skills. The high (Filer) estimate suggests that about one-third to two-thirds (25–45 percent) can be attributed to this source.

These estimates have some limitations. Firstly, the 'highest qualification' and 'years of work experience' variables are quite crude proxy measures of skill and do not capture the full range of productivity-related attributes that vary across individuals and influence earnings. If additional information on skills were available, the 'explained' portion of the total gender gap would probably change. Secondly, it is likely that men's actual full-time experience levels are somewhat below those given by the potential experience measure used here. If an adjustment was made for the lower level of actual male experience, the 'explained' portion of the total gender gap would be a little smaller than suggested here, although probably not materially so. Thirdly, the decompositions focus on male and female differences measured at the *means* of each sample. The relative importance of the various components of the gender earnings gap may vary at different positions in the earnings distribution.

In this analysis, the range of estimated effects is quite large – 30 to 65 percent. It is worth comparing this with the range of results obtained in overseas studies.

Blau and Kahn (1997) analysed changes in gender pay differentials among *full-time* employees in the United States between 1979 and 1988, using data from the Panel Study of Income Dynamics. They estimated that full-time women's lower levels of education and experience explained roughly one-third of the pay gap that existed in 1988. In their study, the male–female gap in average years of experience was 4.6 years, which is smaller than the

average male–female experience gap estimated here for all New Zealand employees (part-time included).

Wellington (1993) incorporated several specific measures of work history, along with measures of education and tenure, in her analysis of the relative earnings of male and female employees in the US in 1976 and 1985. Work history variables alone were found to account about 45 percent of the male–female log wage gap in 1985.[39]

Joshi and Paci (1998) also used detailed information on individuals' work histories in their study of the gender pay gap observed in a UK sample of men and women who were aged 33 in 1991. In their results, only around one-quarter of the log wage gap between men and women is attributable to differences in education and experience levels. The age of the sample may help to explain the lesser importance of skills in this study, as educational and experience differentials between young men and women are likely to be smaller than those found in samples of men and women that encompass all age groups.

Few overseas studies have been able to attribute more than half of the pay gap between men and women to differences in measured proxies for skill. This suggests that the 'high' estimates obtained for NZ (up to 65 percent) may be too high. It is hard to draw strong conclusions on this matter, though. The number of overseas studies that have utilised good information on employees' past work histories is relatively small, and differences between countries in wage distributions and labour force participation patterns mean there may be legitimate reasons why the New Zealand results may differ from those reported elsewhere.

5.4 The effects of changes in mean levels of education and experience

In this section we use an alternative, time series decomposition method, to estimate the contribution made by reductions in the size of male–female education and experience differentials to the total reduction of the gender earnings gap during the late 1980s and 1990s.

The task is complicated by the fact that the actual size of the contraction in the work experience gap between male and female employees is not known. The census-based experience estimates for the total population suggest there was a two-year reduction in the gender experience gap between 1986 and 1996. However, the reduction in the experience gap between male and female *employees* between 1989-91 and 1996-98 may not have been so large. For this reason, we develop several estimates based on the following scenarios: (i) no change in the male–female experience gap; (ii) a reduction of one year, due to an increase on women's relative experience; (iii) a reduction of one year, due to a reduction in men's relative experience; (iv) a reduction of two years, due to an increase in women's relative experience; and (v) a reduction of two years, driven by both falling male and rising female relative experience levels. In each scenario, the ageing of the population leads to a one-year absolute increase in both the male and the female experience means. The gender-specific shifts in relative experience levels that are modelled here either enhance or slow down the increases that stem from population ageing.

The period between 1989-91 and 1996-98 was approximately seven years. The log hourly earnings gap decreased by 0.042 log points over this seven-year period.

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[39] This result was calculated by the author using the information that Wellington (1993) presents in Tables A and B in the appendix.

The total contribution of changes in men's and women's mean characteristics to the total reduction in the log gender wage gap between 1989-91 and 1996-98 is calculated (drawing on equation (5) in Section 3.2) as:

$$\beta_{m1}(\overline{X}_{m2} - \overline{X}_{m1}) - \beta_{f1}(\overline{X}_{f2} - \overline{X}_{f1}) \qquad (7)$$

β_{m1} and β_{f1} are vectors of coefficients that are obtained from log wage regressions estimated for males and females separately using the starting period samples, and the following explanatory variables: experience, education, and ethnic identity, and quarter. $\overline{X}_{m1}$ and $\overline{X}_{f1}$ are vectors containing the mean characteristics of males and females in the starting period samples; and $\overline{X}_{m2}$ and $\overline{X}_{f2}$ are vectors containing the mean characteristics of males and females in the end period samples. The effect of a *specific* variable, such as experience, is obtained by simply inserting the means and coefficients of that variable into equation (7).

In the estimates that follow, the coefficients used in each calculation (β_{m1} and β_{f1}) were estimated using the actual 1989-91 sample data and a complete set of explanatory variables. The mean values of the education and ethnic variables are also those found in the actual sample data in each period. To explore the implications of different assumptions about the size of the long-term shifts in male and female relative experience levels, we take the imputed experience variables in 1989-91 to get our starting-period mean values, and arbitrarily vary the experience means for 1996-98. The experience values used in the estimates are shown in Table 5.13.

Table 5.13: Assumed mean values of experience

	1989-91	1996-98
Males - potential experience		
Observed sample values	19.0	20.0
Assuming 1 year reduction in relative experience	19.0	19.0
Females - Filer or 'high' experience estimates		
Assuming no contraction in the gender experience gap	13.3	14.3
Assuming 1 year rise in relative experience	13.3	15.3
Assuming 2 year rise in relative experience	13.3	16.3
Females - Zabalza and Arrufat or 'low' experience estimates		
Assuming no contraction in the gender experience gap	11.3	12.3
Assuming 1 year rise in relative experience	11.3	13.3
Assuming 2 year rise in relative experience	11.3	14.3

Results of the analysis are summarised in Table 5.14. Note that because we are analysing changes in the male–female log wage differential, a negative sign in the table indicates that the factor worked to *decrease* the differential and a positive sign indicates that the factor worked to *increase* the differential.

The estimates of the effect coming from education indicate that 14-15 percent of the total reduction in the gap is attributable to the narrowing of the male–female gap in educational levels. Estimates of the experience effect range from zero to about 40 percent of the total log wage gap reduction – depending on the measure of women's experience used, and the assumptions made about the size of the shifts in men's and women's relative experience levels. If we assume that the experience gap narrowed by one year (scenarios II and III), the

contribution of this factor to the total contraction of the gender pay gap is estimated to be 7-21 percent. The contribution of experience is largest (about 40 percent) in the final scenario, which assumes simultaneous movements in the experience levels of both men and women.

Table 5.14: Estimates of the wage effects of changes in mean education and experience endowments, 1989-91 to 1996-98

	Measure of experience for women			
	Filer (high)		Z & A (low)	
	Log points	%	Log points	%
Total change in M-F log hourly earnings differential	-0.042		-0.042	
Scenario I - no contraction in the M-F experience gap				
Experience	0.003	6.2	0.001	1.3
Education	-0.006	-13.8	-0.007	-15.4
Total	-0.005	-11.1	-0.007	-17.1
Scenario II - contraction due to a 1 year relative increase in the female experience mean				
Experience	-0.003	-6.9	-0.007	-15.8
Education	-0.006	-13.8	-0.007	-15.4
Total	-0.010	-24.1	-0.014	-34.1
Scenario III - contraction due to a 1 year relative decline in the male experience mean				
Experience	-0.009	-21.0	-0.007	-16.1
Education	-0.007	-15.4	-0.006	-13.8
Total	-0.017	-39.4	-0.014	-33.3
Scenario IV - contraction due to a 2 year relative increase in the female experience mean				
Experience	-0.007	-16.9	-0.012	-28.8
Education	-0.006	-13.8	-0.007	-15.4
Total	-0.014	-34.2	-0.020	-47.1
Scenario V - contraction due to declining male, increasing female experience (movements of 1 year in each case)				
Experience	-0.017	-41.2	-0.016	-38.0
Education	-0.006	-13.8	-0.007	-15.4
Total	-0.025	-58.5	-0.024	-56.4

The results presented in Table 5.14 should be regarded as illustrative only. They are not based on real numbers, and they do not encompass the full range of results that could be obtained by varying details of the method. For example, variations in the specification of the wage equation, and the use of end-period rather than starting-period coefficients as weights, would lead to somewhat different estimates of the impact of changes in educational and experience levels to some degree. The key message to be taken from Table 5.14 is that plausibly-sized shifts in the male–female experience gap *could* have been the underlying source of a sizeable portion of the total contraction in the gender wage gap. Changes in the distribution of experience have the potential to 'explain' (in a statistical sense) quite large shifts in the relative wages of men and women.

It is interesting to compare these results with those obtained in some of the overseas studies in which women's experience levels is measured directly, rather than imputed. Wellington (1993), using data for the United States and quite detailed measures of prior work experience, found that the increases in women's relative experience levels could account for more than half of the total reduction in the hourly earnings differential between 1976 and 1985. Blau and Kahn (1997) estimated that improvements in the relative education and experience levels of employed women in the United States, taken together, were large enough to account for nearly half of the convergence of the male-female pay gap between 1979 and 1988.

Under all the scenarios modelled here, a substantial portion of the total reduction of the gap was *not* due to education or experience. There are several possible explanations for the decline in the residual or unexplained portion of the gender earnings gap. There may have been an upgrading of women's unmeasured labour market skills relative to those of men. Because women improved their relative level of measured characteristics, it is plausible that they also improved their relative level of unmeasured characteristics. Changes in the wage structure may have reduced differences in the returns earned by men and women for their skills. To the extent that wages are influenced by job characteristics as well as by personal skills, changes in the distribution of men and women across jobs may have contributed to the decline in the residual wage gap. There may also have been a decline in pay discrimination against women. As women have increased their commitment to paid work and their other job skills, it is possible that the rationale for discrimination against them has also tended to diminish (Blau and Kahn, 1997, p.31).

5.5 Summary

This section explored the effects of male–female differences in skill-related attributes on the gender pay gap. A basic objective was to estimate how much of the female shortfall in average hourly earnings could be due to women's lower levels of skill endowments.

The chapter began by profiling the main changes that took place in composition of male and female waged and salaried employment from 1984 through to 1998. Over this period there were some quite marked shifts in the employment rates and employment patterns of males, and to a lesser extent females. Along with other demographic and socio-economic changes, the employment rate shifts helped to modify the composition of the male and female employee populations.

Differences between male and female employees in mean levels of educational attainment became much less pronounced during the 1980s and 1990s. In 1984, the proportion of female employees who lacked any formal qualifications was around 6 percent higher than the comparable proportion of male employees. By 1998 this particular gender difference had essentially disappeared. In 1984, 43 percent of male employees held a post-school qualification, 11 percent higher than the equivalent proportion of females. By 1998, the gender gap in the share of post-school qualifications had declined to 5 percent in the IS and 7 percent in the HES. Other significant changes in the composition of male and female employees included a sizeable decline in the proportion who were the joint parents of dependent children; a smaller increase in proportion who were sole parents; and a significant increase in the proportion of male who were working part-time hours.

Overseas studies of the male–female wage differential have drawn attention to the importance of gender differences in continuity of past employment. This is the first New Zealand study to estimate the work experience distributions of men and women, and to incorporate imputed experience measures into an analysis of the sources of the gender pay gap.

Two external sources of information on experience were used in the development of the imputed experience variables: employment rate data from successive Population Censuses, and data on women's work histories recorded in the New Zealand Women: Fertility, Employment and Education Survey 1995. Using the census data, estimates of the distribution of years of past work experience by gender and five-year age group were generated. The results indicate that the male–female gap in average years of paid past work experience

continued to be quite large in the 1990s. In 1996, men aged 20-59 had accumulated 18.4 years of prior full-time paid work experience on average. Women aged 20-59 had accumulated 11.2 years on average, a difference of 7.2 years. NZW:FEE Survey data yielded a similar estimate of the average experience level of New Zealand women in 1995, 12.2 years.

Three methods were used to impute measures of individuals' actual experience levels in the HES and IS samples. A potential work experience variable was derived for all men and women, in the standard way. Two further measures of the past work experience of the women in the HES and IS samples were imputed using methods suggested by Zabalza and Arrufat (1985) and Filer (1993). The imputed experience variables have mean values and age-group distributions that approximate – in a rough manner – what we believe to be the actual mean and age-group distributions of experience among New Zealand women.

A regression analysis of the determinants of the gender pay differential was undertaken utilising the HES samples of employees in 1989-91, 1993-95, and 1996-98, and the IS samples of employees in 1997-98. Wage equations were estimated for men and women using data from the pooled HES and IS samples. In order to explore the implications of different assumptions about the true size of the experience gap between men and women, a series of wage equations were estimated, incorporating alternative imputed measures of women's experience.

The coefficients estimated for education and experience in those wage regressions can be interpreted as measures of the average wage 'returns' obtained by individual employees for their skills. A comparison of the male and female coefficients for education provided some evidence in support of the notion that male workers gain higher earnings from university qualifications than do female workers. This is consistent with the idea of unequal treatment of men and women in the labour market, but the alternative possibility that it is solely due to differences in the mix or quality of qualifications held by men and women at university level cannot be ruled out.

Decomposition of the components of the pay gap demonstrated that the choice of an experience measure has a major impact on the portion that can be statistically attributed to male–female differences in average skill levels. Comparing across models using different imputed experience variables for women, experience alone was able to account for 15–50 percent of the total gender gap in average hourly earnings. Gender differences in educational attainment also contributed to the pay gap, but that contribution was smaller, and declined in importance as male–female educational attainment differences narrowed. Our estimates suggest that the female shortfall in qualifications could explain about 15 percent of the gap in the late 1980s, and 0-10 percent of the gap in the late 1990s.

If we consider the combined impact of experience and education, the estimates suggest that the portion of the total male-female wage differential that was attributable to male–female differences in these two proxies for skill lay between 30 and 60 percent, as at late 1990s. This implies that gender differences in average levels of measured skills (education and work experience) continue to be large enough to account for a large chunk of the contemporary gender gap in hourly earnings – between one-third and three-fifths.

Decomposition of the sources of *change* in the male–female wage gap indicated that about 14-15 percent of the total reduction between 1989-91 and 1996-98 was due to the rising relative educational level of women. Because experience is not measured directly, and we did

not succeed in generating good historical estimates, it is difficult to identify the extent to which the male–female differential in employees' past work experience narrowed during this period. We therefore explored the range of wage effects that were implied by alternative assumptions about the underlying trends in male and female relative experience levels. Those estimates suggested that the experience shifts could have been responsible for zero to 40 percent of the total reduction of the gender pay gap during the 1990s. Assuming a one-year narrowing of the gender experience gap, the wage effects flowing from this would account for around 10-20 percent of the total narrowing of the gender pay differential.

6. JOB CHARACTERISTICS AND THE GENDER EARNINGS GAP

6.1 Introduction

Because men and women tend to carry out different types of jobs, wage variations that are associated with job characteristics rather than personal skills have the potential to influence the size of the gender earnings gap. This section of the paper considers the effects of industrial and occupational job characteristics on the gender pay gap.

In New Zealand, as in other industrialised labour markets, male employees are more likely than females to work in agriculture, other primary sector industries, manufacturing, and construction. The distributions of male and female employees across industries and occupations in 1984-86 and 1994-96 are summarised in Tables 6.1 and 6.2. Women who are working in waged or salaried jobs are far more likely than men to be employed in the retail trade and the social and community services industries. Occupationally, women are more highly represented in professional and technical, clerical, and sales and service occupations, while men are far more numerous in management jobs and in trades, production and labouring jobs.

During the 1980s and 1990s, there were some substantial changes in the occupational and industrial profiles of male and female employment. For both men and women, the share of employment located in primary sector industries, in many areas of manufacturing, and in the utilities, declined. A growing share of total employment was located in service industries. Social and community services, business services, financial services, and building services recorded particularly large increases in their relative employment shares. Managerial, professional and technical, and personal service occupations grew relatively rapidly between the mid-1980s and mid-1990s, while clerical occupations and some blue-collar occupations contracted in relative or even in absolute terms.

As demonstrated in Section 5.1, the occupational and the industrial profiles of male and female employment became more similar between the mid-1980s and the late 1990s. Occupational and industrial 'segregation' by gender declined. One might expect the convergence of the male and female employment distributions to help reduce the size of the aggregate gender earnings gap. However, occupational and industry-specific wage differentials were also changing during the 1980s and 1990s, and the net impact of both sets of changes in job-related wage differentials on the gender pay gap is difficult to infer without empirical investigation.

We begin by discussing the theoretical grounds for extending a basic human capital model of earnings to include information on job characteristics (Section 6.2). There are two main parts to the empirical work. Initially, we focus on the gender earnings gap as at 1997-98, and estimate how much of the gender earnings gap that is not explained by differences in measured personal characteristics can be attributed to differences in occupation and industry of employment. Both HES and Income Supplement samples are used in this point-in-time analysis.

Table 6.1: Changes in the industrial and occupational distribution of employees, HES

	1984-86 distribn		1994-96 distribtn		Changes	
	Males	Females	Males	Females	Males	Females
	%	%	%	%	%	%
Major industry group						
Agriculture, forestry, fishing	7.5	4.3	7.4	3.3	*-0.1*	*-1.0*
Mining	0.8	0.1	0.9	0.1	*0.1*	*0.0*
Manufacturing	28.2	17.2	25.1	12.4	*-3.1*	*-4.8*
Utilities	2.9	0.6	1.7	0.4	*-1.2*	*-0.2*
Construction	7.3	1.6	7.9	1.4	*0.6*	*-0.1*
Trade, restaurants, hotels	12.4	20.7	14.9	19.0	*2.5*	*-1.7*
Transport, communication	11.9	5.4	9.5	5.0	*-2.4*	*-0.4*
Financial & business services	5.9	9.2	9.7	13.2	*3.8*	*4.1*
Community, social, personal services	22.9	40.6	21.8	44.3	*-1.0*	*3.7*
Broad occupational groups*						
Professional, technical	17.9	22.7	25.5	28.7	*7.6*	*6.1*
Managerial	6.0	1.0	18.2	10.8	*12.2*	*9.7*
Clerical	8.2	33.5	4.9	25.1	*-3.3*	*-8.4*
Sales, service	16.3	26.8	8.3	21.5	*-8.0*	*-5.3*
Agricultural	6.7	3.9	5.8	2.3	*-0.9*	*-1.6*
Trades, production, labouring	44.9	12.0	36.9	11.5	*-8.0*	*-0.5*

* Several major occupational groups were combined to faciliate comparison of the 1984-86 and 1994-96 data, which were coded to different occupational classifications.

Table 6.2: Changes in the industrial distribution of employees, HES

	1984-86 distribn		1994-96 distribtn		Changes	
	Males	Females	Males	Females	Males	Females
Two-digit industry group	%	%	%	%	%	%
Agriculture	5.4	4.0	5.9	3.0	*0.6*	*-1.1*
Hunting, forestry, fishing	2.2	0.3	1.5	0.4	*-0.6*	*0.0*
Mining	0.8	0.1	0.9	0.1	*0.1*	*0.0*
Food, beverages and tobacco	6.8	3.7	5.7	3.1	*-1.1*	*-0.7*
Textiles, clothing and leather	2.1	5.1	2.0	3.3	*-0.2*	*-1.8*
Wood, wood products, furniture	2.1	0.6	3.5	0.6	*1.4*	*0.0*
Paper, printing, publishing	3.7	2.4	3.1	2.2	*-0.5*	*-0.2*
Chemicals, plastics	2.6	1.5	2.0	1.2	*-0.6*	*-0.3*
Non-metallic mineral prodts	1.0	0.3	0.7	0.2	*-0.3*	*-0.2*
Metal industries	1.1	0.3	1.9	0.3	*0.7*	*0.0*
Fabricated metal products	8.0	2.7	5.4	1.1	*-2.6*	*-1.6*
Other manufacturing	0.8	0.7	1.2	0.6	*0.4*	*-0.1*
Electricity, gas, steam, water	2.9	0.6	1.8	0.4	*-1.2*	*-0.2*
Building	2.7	0.5	2.7	0.5	*-0.1*	*-0.1*
Other construction	1.8	0.4	0.8	0.1	*-1.0*	*-0.2*
Building services	2.7	0.7	4.5	0.8	*1.8*	*0.2*
Wholesale trade	5.2	2.7	4.1	2.7	*-1.1*	*0.0*
Retail trade	6.3	12.6	8.7	11.4	*2.4*	*-1.3*
Restaurants, hotels	0.9	5.4	2.2	5.0	*1.3*	*-0.3*
Transport	9.0	2.5	6.9	3.0	*-2.1*	*0.5*
Communication	2.9	2.9	2.7	2.1	*-0.2*	*-0.8*
Financial services	1.9	3.1	2.2	4.4	*0.3*	*1.3*
Insurance	1.1	1.1	0.9	1.1	*-0.2*	*0.0*
Business services	2.9	5.0	6.8	7.8	*3.9*	*2.8*
Public administration	10.0	5.9	6.9	6.5	*-3.1*	*0.6*
Sanitory services	0.2	1.2	0.4	0.7	*0.1*	*-0.5*
Social and community services	8.1	27.9	9.6	31.7	*1.5*	*3.8*
Recreational & cultural services	1.3	2.6	2.2	2.0	*0.9*	*-0.6*
Personal & household services	3.3	3.2	3.0	3.8	*-0.3*	*0.6*

In the second part of the empirical work, HES data are used to estimate the effects of changes in the male–female distribution of employment by industry, and changes in the structure of relative wages across industries, during the period 1984-96 to 1994-96. Because the coding

of occupation changed during the middle of this period, and the old and new codes cannot be reconciled, occupational data are not used in this analysis.

6.2 Why job characteristics matter

In most industrialised societies, there are large differences in the typical characteristics of the jobs held by men and women. The jobs held by men and women are distributed differently across industries and occupations, and differ in characteristics such as requirements for physical effort, safety and health risks, supervisory responsibilities, hours of work and time schedules. These differences are relevant because numerous studies have documented the existence of variations in earnings by job type that cannot be readily attributed to variations in the skills or productivity of the workers undertaking the jobs (for example, Dickens and Katz, 1987; Kreuger and Summers, 1988). In addition, studies of the gender earnings gap have found that gender differences in job attributes can explain part of the male–female wage differential.

Supply and demand imbalances are one reason why wage differentials that are linked to job characteristics may arise. Changes in the demand for different products or services, changes in technologies of production, and changes in regulatory and trade barriers, lead to changes in the demand for different types of labour. In the short-run, before full adjustments have been made, supply and demand disequilibria can lead to positive or negative wage differentials arising between jobs, firms or industries. Some firms pay higher wages to attract a specific skill that is in short supply, or allow wage rates to fall in real terms because there is an excess supply of labour.

Some job-related wage differentials persist for long periods of time, and are not easily attributable to supply or demand disequilibria. Explanations for persistent variations in wages linked to job characteristics can be categorised into three broad groups: a) compensating wage differential theories; b) efficiency wage theories; and c) union bargaining theories. The theory of compensating differentials suggests that non-monetary differences in job attributes, such the quality of the working conditions or the convenience of the hours, will lead to compensating wage premiums or deficits. If jobs differ in the attractiveness of their non-monetary characteristics, then differences in wages are likely to arise in order to compensate the workers who undertake the less desirable jobs. There are several variants of efficiency wage theory. All variants give reasons why some firms may benefit from paying higher wages than other firms. For example, the ‘turnover’ model suggests that high wages are used to reduce turnover. Wages will tend to be high in jobs, firms or industries in which the costs of turnover and training are high (Fields and Wolff, 1995, p.107). The ‘selection’ model predicts high wages in jobs in which it is difficult for employers to directly evaluate the quality of workers’ skills or the quality of their outputs. Union bargaining theories suggest that wage differentials will arise in firms or industries where workers have bargaining power. Union bargaining theories predict a correlation between excess profits at the firm or industry level and higher-than-average wages, because excess profits give employers greater potential to pay higher wages.

Given that men and women differ greatly in their distribution across occupations and industries, the distribution of job-related wage differentials will also vary by gender. A more difficult question to address is whether the male–female differences in employment distributions are mainly a consequence of gender differences in pre-labour market skills or preferences; a consequence of constraints operating outside the labour market that influence

women's job choices; or a consequence of constraints that women face within the labour market (Altonji and Blank, 1999, p.3220). There are well-documented differences in the type, level and subject areas of the educational qualifications that are acquired by young men and women. These differences in qualifications probably play some role in causing occupational sorting and sorting across firms in the labour market. It is possible that women have stronger preferences than men for some types of jobs, and those differences in preferences lead to voluntary sorting across jobs. Another possibility is that gender differences in family commitments lead to differences in job choices (Joshi and Paci, 1998, p.25). Due to their greater commitment to the care of children, women may be less mobile than men, prefer shorter travel-to-work distances, or have more restrictive hours-of-work requirements. These mobility and hours-of-work constraints may limit the range of alternative job offers that women can consider relative to men, and lead them to accept jobs that are less well remunerated (ibid, p.25). The under-representation of women in some jobs and occupations may also be partly due to demand-side barriers to the entry of women into male-dominated occupations.

6.3 The effects of gender differences in job type in 1997-98

The effects of male–female differences in job type are explored using IS data for 1997-98 and HES data for 1997-98. The 1996 HES sample was dropped from this part of the analysis because of a change in industry coding in the survey between 1996 and 1997 (coding to the ANZISC classification replaced coding to NZSIC). Apart from the exclusion of the 1996 records, the samples of wage earners are the same as those used in the previous regressions, reported in Section 5.

Log wage equations were estimated separately for each sample and gender. The equations took the following form:

$$\ln w_i = \alpha + \beta_k X_{ik} + \phi_j Z_{ij} + \gamma_m J_{im} + \delta_n Q_{in} + \varepsilon_i \qquad (8)$$

The dependent variable is log hourly earnings. X_{ik} is a vector of the skill-related personal characteristics of each individual, containing information on education, imputed actual experience (which is entered as a quartic function), ethnicity, and, in the case of the IS regressions, overseas birth. Z_{ij} is a vector of industry dummies that assigns each individual to an industry. J_{im} is a vector of occupational dummies that assigns each person to an occupational group. Q_{in} is a vector of quarterly dummies in the case of the HES regressions, and a single dummy for the year 1997 in the case of the IS regressions. These variables are included to control the effects of any time-related variations in earnings not already eliminated by the conversion of nominal wage rates to real values. ε_i is a stochastic error term.

The total effect of male–female disparities in industrial employment shares on the total log wage gap is calculated as:

$$\sum_J (\overline{Z}_{jm} - \overline{Z}_{jf})\alpha_{jm} \qquad (9)$$

or

$$\sum_{J} (\overline{Z}_{jm} - \overline{Z}_{jf})\alpha_{jm+f} \qquad (10)$$

where $\overline{Z}_{jm}$ represents the proportion of the male sample that is employed in industry j, $\overline{Z}_{jf}$ the proportion of the female sample that is employed in industry j, α_{jm} is the coefficient estimated in the male wage equation for the j^{th} industry, and α_{jm+f} is the 'average' coefficient for the j^{th} industry, estimated in a pooled regression incorporating both sexes. Equation (9) weights the differences between the male and female industry shares with the 'returns' that males receive for working in each industry (as estimated in the male wage equation). Equation (10) weights the gender differences in industry shares with the *average* returns that employees of both sexes obtain from employment in each industry. The total effects of male–female differences in occupational employment shares are estimated in the same way, using the occupational means and coefficients.

Workers who did not report an industry were retained in the sample, and a dummy variable for 'industry not specified' was included to capture their mean earnings. Industries and occupations with fewer than 10 male or female members in the sample were merged with an adjoining industry. Following the re-grouping, there were 33 industries and 19 occupations available for use in the HES decomposition. Two sets of decompositions were carried out using the IS samples. The first decomposition, at two-digit level, used information for 27 industries and 21 occupations. A second decomposition at three-digit level used information on 77 industries and 62 occupations. In each regression equation, the dummies for the largest industry and occupation were omitted.[40]

The HES samples sizes were 2711 males and 2579 females, and the adjusted R^2 values for the male and female wage equations were 0.33 and 0.28 respectively. The IS sample sizes were 11,361 males and 11,234 females. In the regressions using 2-digit occupation and industry dummy variables, R^2 values of 0.33 and 0.28 were obtained in the male and female wage regressions. Not surprisingly, the use of the 3-digit occupation and industry variables increased the amount of variation 'explained' by the regressors, raising the R^2 values to 0.35 for males and 0.31 for females.

Results of the decompositions are summarised in Table 6.3. The four columns of the table show the range of results obtained when the measure of women's work experience, and the weighting scheme, were varied. The three sub-sections of the table give the results obtained from the HES; those obtained from the IS when industries and occupations were defined at two-digit level; and those obtained from the IS when industries and occupations were defined at three-digit level.

Using the two-digit variables to capture male and female industrial and occupational shares, 15 to 30 percent of the total gap in hourly earnings between males and females is attributed in the decompositions to differences in distribution across industries. This is a reflection of the fact that female workers tend to be more concentrated in low-paying industries than male workers, all other things being equal. Occupational differences are less important in these two-digit decompositions. Less than 10 percent of the male-female wage gap is attributed to gender differences in occupational distribution, indicating that the allocation of men and

[40] The choice of which industry or occupation to omit does not influence the results presented in this section, because only total industry and occupational effects are reported.

women between high-paying and low-paying occupations was on average not so very different at this level of occupational aggregation.

Table 6.3: Contribution of industrial and occupational employment distributions to the gender earnings gap in the late 1990s

	Male coef. weighting		Average coef. weighting	
	Filer exp.	ZA exp.	Filer exp.	ZA exp.
HES 1997-98: Two-digit industry and occupational groups				
Total male-female log wage gap	0.136	0.136	0.136	0.136
Estimated wage gaps due to male-female differences in attributes				
Due to experience	0.034	0.064	0.031	0.052
Due to education	0.014	0.014	0.015	0.015
Due to ethnic composition	-0.002	-0.002	-0.002	-0.002
Due to industrial composition	0.019	0.019	0.041	0.038
Due to occupational composition	0.013	0.013	0.010	0.006
Total	**0.078**	**0.108**	**0.095**	**0.109**
Percent attributed to industry	14.1	14.1	30.2	28.2
Percent attributed to occupation	9.7	9.7	7.0	4.4
Percent attributed to all characteristics	57.2	79.2	69.8	80.2
IS 1997-98: Two-digit industry and occupational groups				
Total male-female log wage gap	0.171	0.171	0.171	0.171
Wage gaps due to male-female gap in attributes				
Due to experience	0.022	0.070	0.029	0.063
Due to education	0.006	0.006	0.006	0.006
Due to ethnic composition	0.000	0.000	0.000	0.000
Due to industrial composition	0.034	0.034	0.042	0.039
Due to occupational composition	-0.015	-0.015	0.008	0.001
Total	**0.046**	**0.095**	**0.084**	**0.108**
Percent attributed to industry	19.8	19.8	24.3	22.6
Percent attributed to occupation	-8.8	-8.8	4.8	0.4
Percent attributed to all characteristics	27.0	55.5	49.0	63.3
IS 1997-98: Three-digit industry and occupational groups				
Total male-female log wage gap	0.171	0.171	0.171	0.171
Wage gaps due to male-female gap in attributes				
Due to experience	0.022	0.071	0.027	0.061
Due to education	0.006	0.006	0.005	0.005
Due to ethnic composition	0.000	0.000	0.000	0.000
Due to industrial composition	0.020	0.020	0.031	0.028
Due to occupational composition	0.011	0.011	0.039	0.029
Total	**0.058**	**0.107**	**0.102**	**0.124**
Percent attributed to industry	11.5	11.5	18.2	16.5
Percent attributed to occupation	6.4	6.4	23.0	17.1
Percent attributed to all characteristics	34.0	62.3	59.8	72.2

When industries and occupations are defined at the more detailed three-digit level, the proportion of the gender wage gap that is attributed to industrial distribution falls, while the portion attributed to occupational distribution rises. Taken together, the industrial and occupational distributions can explain around 20 to 40 percent of the gender gap in hourly earnings in the most detailed decompositions.

The bottom line of each sub-section of Table 6.3 shows the estimated 'total effect' of the male–female differences in measured characteristics in these models, in percentage terms. These figures can be compared with the results of the earlier decompositions reported in

Section 5.3, which used information on personal characteristics only. Now, the wage variation explained in terms of gender differences in (personal or job) attributes ranges from about one-third to four-fifths of the total male-female pay gap. Compared with the earlier decompositions, the portion that is attributed to differences in characteristics rises by 15 to 25 percent in the case of HES sample, and by 0 to 30 percent in the case of the IS sample.

These results are reasonably similar to those obtained in overseas studies using similar methods and datasets. For example, in an Australian study, Spilsbury and Kidd (1996) found the portion of the gender earnings gap that could be statistically explained in terms of differing industrial and occupational distributions was about 16 percent in one sample of employees (using 1973 data) and about 25 percent in another sample (using 1990 data). In a US study, Fields and Wolff (1995) report estimates suggesting that 15–19 percent of the overall gender earnings gap in 1988 could be explained by differences in the distribution of male and female workers across industries.

Joshi and Paci (1998) draw on a particularly detailed set of information about job characteristics in their analysis of the pay gap within a sample of men and women in the UK who were aged 33 in 1991. They included measures of the size of the worker's employer; whether the employer is located in the private or public sector; whether the employer ever provided training; the flexibility of working hours; travel-to-work time; and the availability of non-wage benefits, as well as information on industry and occupation. Taken together, these detailed measures of job characteristics raised the portion of the gender earnings gap attributable to male-female attribute differences from 28 percent to 60 percent.

In a different but related study, Macpherson and Hirsh (1995) explored the role of job characteristics in accounting for the fact that occupations numerically dominated by women tend to have lower average earnings than occupations numerically dominated by men. Like Joshi and Paci, they utilised information about attributes of jobs not usually measured in household surveys, such as general educational requirements, specific vocational training requirements, the amount of on-the-job training undertaken, the physical demands of the job, and the nature of the environmental conditions. They concluded that the detailed measures of job requirements and job amenities have considerable explanatory power, and account for a substantial portion of the otherwise unexplained pay gap between male-dominated and female-dominated occupations.

These studies suggest that the manner in which job characteristics are measured is important in estimating their contribution to the gender wage gap. Industry and occupational identifiers represent relatively crude indicators of the features of jobs that are associated with pay differentials. It is fairly likely that more of the male–female gap in New Zealand could be explained with reference to differences in job characteristics if better data on job characteristics were available.

Although occupational and industrial wage effects are treated as part of the 'explained' portion of the gender earnings gap in this analysis, this should not be taken to imply that they are necessarily either efficient or equitable. Although the uneven distribution of men and women across jobs is likely to be partly an outcome of gender differences in job preferences and skills, it is also likely to be shaped by a variety of social and institutional constraints. Those constraints include pre-labour market socialisation processes, educational systems that foster gender differences in outcomes, and the differing constraints that home responsibilities place on men's and women's paid work choices.

6.4 Effects of changes in industry distributions and industry wage premia

The objective of this section is to estimate the effects of changes in industry employment shares, and changes in the structure of relative wages across industries, on the reduction of the gender earnings gap. The analysis uses HES data, and focuses on the period between 1984-86 and 1994-96.

As noted previously, the 1997 and 1998 HES samples cannot be used in time-series analyses of industry wage effects because a change in the method of coding industry was implemented in 1997. In order to lengthen the period of analysis, we use the 1984-86 samples as the starting point, rather than 1989-91. Unfortunately, the imputation of women's actual work experience did not cover the years 1984-86 (because of other data limitations), and therefore we are forced to use *potential* experience measures for both men and women in this part of the analysis. Because the coding of occupation changed during the middle of the period (NZSOC 1990 replaced NZSOC 1968 in 1992), and the old and new codes are not reconcilable, no use is made of occupational data.

Log wage regressions were estimated separately for each gender and each period. These wage equations took the form:

$$\ln w_i = \alpha + \beta_k X_{ik} + \phi_j Z_{ij} + \delta_n Q_{in} + \varepsilon_i \qquad (11)$$

where the notation is the same as for equation (8). Note that the intercept was omitted and every industry dummy was included. The usual procedure of omitting one industry dummy was not followed here, because we wanted the assessment of industry effects to be comprehensive in scope. When the intercept is excluded and a full set of industry dummies is included, the mean wage component normally captured by the intercept is distributed across the industry coefficients.

The effect of changes in the male industry employment shares on average male earnings is calculated as:

$$\sum_J (\overline{Z}_{j2m} - \overline{Z}_{j1m})(\alpha^*_{j1m}) \qquad (12)$$

where $\overline{Z}_{j2m}$ is the proportion of the period 2 (1994-96) male sample that is employed in industry j, $\overline{Z}_{j1m}$ is the proportion of the period 1 (1984-86) male sample that is employed in industry j, and α^*_{j1m} is the standardised coefficient estimated for period 1 males in industry j. Industry coefficients were standardised by subtracting the employment-weighted mean coefficient for *all* industries. The latter was estimated as the intercept in a second, separate regression in which the industry dummies were dropped and an intercept was reintroduced.

The first term in equation (12) represents the change in the relative employment share of each industry. The effect of that change is weighted by the starting-period relative wage differential estimated for that industry.

The effects of changes in the industry employment shares of females are calculated in the same manner. The *net* effect of the male and female industry employment changes on the gender earnings gap is obtained by simply subtracting the female from the male effect:

$$\sum_J (\overline{Z}_{j2m} - \overline{Z}_{j1m})(\alpha^*_{j1m}) - \sum_J (\overline{Z}_{j2f} - \overline{Z}_{j1f})(\alpha^*_{j1f}) \quad (13)$$

The effect of changes in the male industry wage differentials on male average earnings is calculated as:

$$\sum_J (\alpha^*_{j2_m} - \alpha^*_{j1m}) \quad (14)$$

where α^*_{j2m} is the standardised industry coefficient for males in industry *j* in period 2, and α^*_{j1m} is the standardised industry coefficient for males in industry *j* in period 1. The impact of changes in female industry wage differentials on female average earnings is calculated in the same manner, and the net gender wage gap effect is calculated by taking the difference between the two.

The samples used in this part of the analysis included all wage earners with valid information for the personal skill explanatory variables. Individuals who did not report an industry were retained in the sample, and a dummy variable for 'industry not specified' was included to capture their mean earnings. Industries containing fewer than 10 male or female sample members were merged with an adjoining industry. Following this re-grouping, twenty-nine industries were available for use in the analysis. The sample sizes for 1984-86 were 5731 males and 4280 females. For 1994-96, the samples sizes were 4170 males and 3833 females.

Ideally, industry wage differentials would be estimated with a more comprehensive set of controls for productivity-related worker characteristics than used here. For example, Field and Wolff (1995) incorporate controls for education, experience, region, race, marital status, and major occupational group when estimating industry-specific wage differentials. Along with educational variables, occupational dummies are likely to pick up variations in the skill levels of the workforce in each industry. Because occupation could not be included in this analysis, there is a risk that the changes in wages captured by the industry wage differentials are partly driven by shifts in the occupational mix of the workforce in each industry.

Results

Summary results from the decomposition of the industry changes are given in Table 6.4. The male–female log hourly earnings differential was 0.24 in 1984-86 and 0.15 in 1994-96, a reduction of 0.09 log points over the decade. The numbers in the first column summarise the estimated effects of changes in the distribution of male and female employment across industries. These are calculated holding the industry wage differentials constant at their initial, 1984-86, levels. The figures in the second column summarise the estimated effects of the changes in the industry wage differentials. These are calculated holding employment in each industry constant at its initial, 1984-86, level.[41] Note that because we are analysing changes in the male-female differential $(\overline{\ln w_m} - \overline{\ln w_f})$, a negative sign in the table indicates

[41] Given this weighting scheme, the employment share and industry wage differential effects cannot be summed to get a total industry effect.

that the factor worked to *decrease* the differential and a positive sign indicates that the factor worked to *increase* the differential.

Table 6.4: Contribution of industrial employment and wage changes to the reduction in the gender earnings gap, HES 1984-86 to 1994-96

	Change in empt shares	Change in industry wage premia
Estimated using potential experience for both males and females		
Primary sector, utilities	-0.005	0.002
Manufacturing	-0.004	-0.004
Construction	-0.001	-0.005
Services	-0.010	-0.004
All industries	**-0.021**	**-0.011**
Total reduction in the gender gap	*-0.089*	

Shifts in the employment distribution of men and women are estimated to have contributed 0.021 log points to the total reduction in the gender gap in hourly earnings, which is about twenty percent of the total reduction. Grouping industries by sector, it appears that employment share shifts in all sectors (primary industries and utilities; manufacturing; construction; and services) contributed to the reduction in the gender gap.

In this decomposition, changes in the structure of relative wage differentials across industries also made a small contribution to the reduction of the gender pay gap, of –0.01 log points, or about 12 percent of the total. Unfortunately, decompositions of the effects of changes in industry wage differentials are highly sensitive to variations in the specification of the wage equations, which influence the allocation of the wage changes between the industry coefficients, the coefficients for personal characteristics, and the intercepts. In this analysis we have removed all of the trend change in average male and female wages, through the standardisation of the industry coefficients. This means that only the effects of changes in *relative* industry wage differentials are counted in the decomposition results.

A more detailed analysis of the specific industries that made the largest contributions to the reduction in the gender earnings gap is summarised in Table 6.5. Although the industries that are high paying for males also tend to be high paying for females, the correlation in male and female industry rankings is far from perfect. Reflecting this, we identify the industries whose employment shifts or relative wage changes had relatively large effects on average male and female earnings separately, was well as the industries whose employment or relative wage changes had large *net* effects. The upper half of Table 6.5 presents information on effects operating through changes in employment shares, and the lower half presents information on effects flowing from relative price changes. The industries with the largest estimated effects, ranked in absolute size, are listed in each sub-section of the table.

Focusing on the first sub-section of the table, the results suggest that employment reductions in public administration, transport, and the food, beverages and tobacco industries, operated to reduce average male earnings. These were relatively highly-paid industries at the start of the period. The rising employment share of agriculture, a low-paying industry, also helped to reduce average male wages. Working in the opposite direction, the growth of employment in the business services industry acted to raise average male earnings.

Table 6.5: Industries with relatively large impacts on the gender earnings gap

Industry	Rel wage 1984-86	Direction of employment change	Direction of wage effect
Effects on male earnings via male employment share changes			
1 Business services	Above average	Increased share	Increase
2 Public administration	Above average	Reduced share	Decrease
3 Transport	Above average	Reduced share	Decrease
4 Food, beverages and tobacco	Above average	Reduced share	Decrease
5 Agriculture	Below average	Increased share	Decrease
Effects via female earnings via female employment share changes			
1 Business services	Above average	Increased share	Increase
2 Agriculture	Below average	Reduced share	Increase
3 Social and community services	Above average	Increased share	Increase
4 Financial services	Above average	Increased share	Increase
5 Textiles, clothing and leather	Below average	Reduced share	Increase
Net effects (male-female)			
1 Public administration	Above average	Reduced male, increased female	Reduced M/F gap
2 Agriculture	Below average	Increased male, decreased female	Reduced M/F gap
3 Transport	Above average	Reduced male, increased female	Reduced M/F gap
4 Social and community services	Above average	Female empt share growing faster than ma	Reduced M/F gap
5 Business services	Above average	Male empt share growing faster than fema	Increased M/F gap
6 Textiles, clothing and leather	Below average	Female empt share declining faster than m	Reduced M/F gap
7 Food, beverages and tobacco	Above average	Female empt share declining faster than m	Reduced M/F gap
8 Retail trade	Below average	Male empt share rising faster than female	Reduced M/F gap
9 Personal & household services	Below average	Reduced male, increased female	Increased M/F gap
10 Financial services	Above average	Female empt share growing faster than ma	Reduced M/F gap

	Direction of change	Effect on the gender earnings gap
Effects via male industry premia changes		
1 Public administration	Increased relative wage	Increase
2 Agriculture	Increased relative wage	Increase
3 Wholesale trade	Increased relative wage	Increase
4 Communication	Increased relative wage	Increase
5 Social and community services	Reduced relative wage	Decrease
Effects via female industry premia changes		
1 Agriculture	Increased relative wage	Decrease
2 Business services	Increased relative wage	Decrease
3 Public administration	Increased relative wage	Decrease
4 Personal & household services	Increased relative wage	Decrease
5 Wholesale trade	Increased relative wage	Decrease
Net effects (male-female)		
1 Business services	Increase in female industry differential faster than male	Reduced M/F gap
2 Retail trade	Reduction in male industry differential faster than female	Reduced M/F gap
3 Utilities	Reduction in female industry differential faster than male	Increased M/F gap
4 Personal & household services	Increase in female industry differential faster than male	Reduced M/F gap
5 Food, beverages and tobacco	Reduction in male industry differential faster than female	Reduced M/F gap
6 Restaurants and hotels	Reduction in female industry differential faster than male	Increased M/F gap
7 Building services	Male differential declined, female increased	Reduced M/F gap
8 Public administration	Increase in male industry differential faster than female	Increased M/F gap
9 Agriculture	Increase in female industry differential faster than male	Reduced M/F gap
10 Social and community services	Reduction in male industry differential faster than female	Reduced M/F gap

The ‘top five’ industries for women, ranked in terms of the absolute size of their effects on average female earnings, were a mixture of low-paying industries in which female employment was declining (agriculture, textiles, clothing and leather), and high-paying industries in which female employment was growing (business services, social and community services, and financial services). Employment shifts in all of these industries tended to raise average female earnings.

The industries having the largest estimated net effects on the gender wage gap, through employment share changes, included public administration, agriculture, transport, social and community services, and business services. Most of these net effects worked in the direction of a reduced gender earnings gap. Some rapidly growing industries appear in the ‘top ten’ list, such as business services and social and community services. Several industries that contracted in size between the mid-1980s and the mid-1990s also appear, such as food, beverages and tobacco manufacture and textiles, clothing and leather manufacture.

In the bottom half of Table 6.5, industries whose relative pay changes had a particularly large impact on male or female mean earnings are listed. The changes in inter-industry wage differentials between 1984-86 and 1994-96 are weighted by the initial employment level of each industry. Increases in relative wages in public administration, agriculture, wholesale trade, and communications were particularly influential in raising average male earnings. These increases for male workers operated to slow the reduction of the gender earnings gap. A reduction in the relative earnings of workers in the social and community services industry, in contrast, operated to reduce average male earnings. The largest impacts upon women’s earnings flowing from changes in the inter-industry wage structure came from the agriculture, business services, public administration, personal and household services, and wholesale trade industries. There were increases in relative wage differentials in each of these industries, which helped to raise female average earnings.

Considering the industries where wage differential changes had the largest *net* effects, shown in the bottom section of the table, it appears that a variety of types of changes were at work. These included reductions in the relative earnings of men in lower paid industries (retail trade), reductions in the relative earnings of men in higher paid industries (food, beverages and tobacco and electricity, gas and water), and increases in female industry wage differentials that exceeded the increases for males in the same industry (business services, personal and household services).

To summarise, the decomposition results suggest that changes in the distribution of employment among industries, and changes in the structure of inter-industry wage differentials, both operated to help reduce the economy-wide gender gap in average hourly earnings. Our estimates suggest that shifts in relative employment shares reduced the gap by around 20 percent, and changes in the inter-industry wage structure reduced the gap by around 12 percent, in the decade from the mid-1980s to the mid-1990s. At the level of individual industries, the changes were quite complex. They involved a mixture of contracting industries, rapidly growing industries, and industries that whose employment trends were not far away from the average.

6.6 Summary

The male and female employment distributions became more similar to each other during the 1980s and 1990s, reducing the level of gender 'segregation' in the labour market. Nevertheless, large differences remained in the types of jobs typically undertaken by men and women at the end of the 1990s. Cross-sectional decompositions of the gender hourly earnings gap in 1997-98 suggested that male–female differences in occupational and industrial distribution could account for around 20-30 percent of the total gender wage gap, when industries and occupations were defined at the most detailed, three-digit level.

HES data were used to estimate the effects of changes in the male–female distributions of employment by industry and changes in the structure of relative wages across industries. It appears that changes in the structure of employment during the late 1980s and early 1990s did help to compress the male–female gap in average hourly earnings. The decomposition estimates suggest that shifts in relative industry employment shares were responsible for about 20 percent of the total reduction of the gap, and shifts in the inter-industry wage structure were responsible for about 12 percent of the reduction, during the decade from the mid-1980s to the mid-1990s. Note, though, that we did not fully explore the sensitivity of these results to variations in data and method. Moreover, it is difficult to meaningfully separate out changes in industry wage rates from the wider changes that were transforming the aggregate wage structure. In addition, the decomposition method provides a partial analysis of the sources of change, which abstracts from the interactions that actually occur between changes in the demand for labour in specific industries, changes in supply, and changes in prices.

We have not attempted to identify the underlying causes of the employment share and relative wage changes in this analysis. It is likely that some of the shifts were the outcome of changes in patterns of consumer demand for goods and services (for example, the growth of business services, recreational and cultural services, and social and community services). Other changes were influenced by the removal or reduction of subsidies, import quotas and tariffs (for example, tariff reductions hastened the contraction of employment in the female-dominated and relatively poorly-paid clothing and textiles industry).

The analysis of change at the level of individual industries suggests that the nature of the structural changes was too complex to be characterised by a simple formula such as 'the decline of manufacturing disadvantaged male employees'. There are elements of this story in the data, for example in the employment and relative wage declines recorded in the initially male-dominated and well-paid food processing industry. The contraction of this industry worked to reduce the gender pay gap. However, changes in some of the primary sector and service industries also had quite sizeable effects on average male or female mean earnings. Average earnings in the agricultural industry moved closer to the all-industry average, raising the mean earnings of both men and women in this industry. The 'growth' industries of social and community services, financial services, business services and building services were generally the location of gender-equalising shifts, but there are some exceptions, such as business services (a well-paying industry in which the male employment share expanded more rapidly than the female employment share). The contraction of employment in public administration appears to have had a larger negative impact on male than female earnings. Although the growth of lower-paying jobs in service and sales industries, such as retail trade and restaurants and hotels, operated to lower the average earnings of both sexes, within particular industries the adverse effects on male earnings were sometimes larger than the adverse effects upon female earnings.

7. FAMILY RESPONSIBILITIES AND WOMEN'S EARNINGS

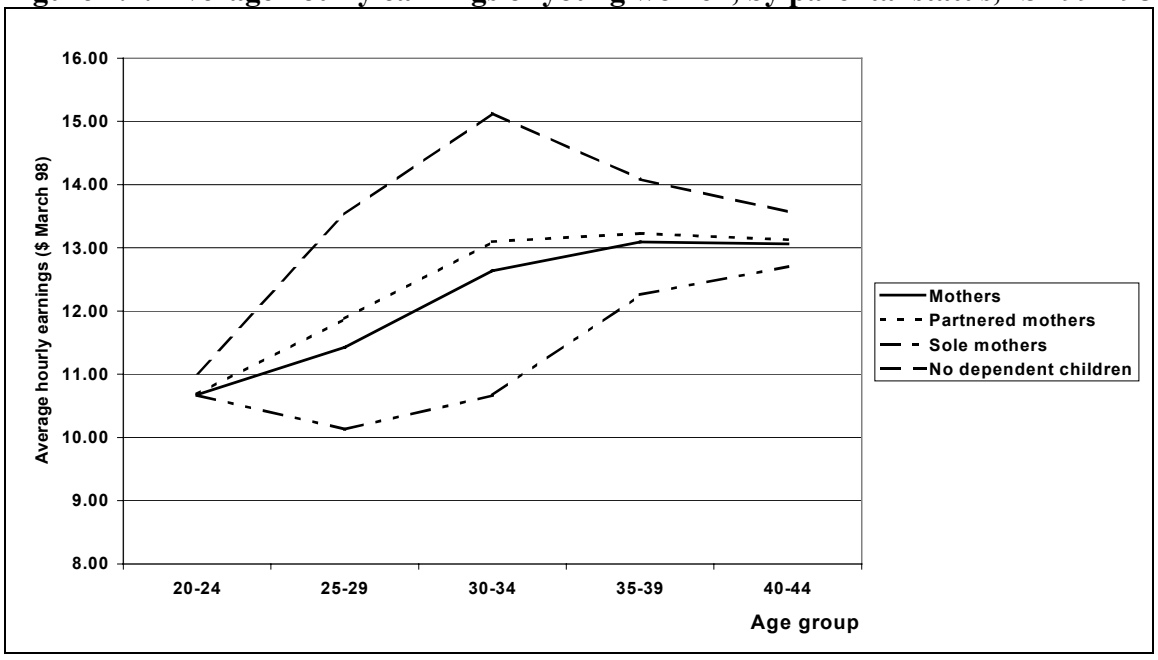
7.1 Introduction

Family responsibilities are often regarded as playing a key role in causing inequality between men and women in the labour market. There is a social convention that mothers, not fathers, should take primary responsibility for the care of children. Many women with children do in fact take time away from paid work, reduce their hours, work part-time, or move to more family-friendly occupations. Reduced experience, reduced seniority and lost training opportunities are among the 'consequences' of motherhood that have the potential to lower the hourly as well as the weekly earnings of women with children.

In the 1997-98 IS samples, the average hourly earnings of all partnered mothers with dependent children were $12.98 (in March 1998 dollars), slightly above the average hourly earnings of women without dependent children ($12.89). This average earnings ratio does not seem to provide immediate support for the idea that children reduce women's hourly earnings. However, the 'no dependent children' group includes many older women who may have had children at an earlier stage of life. It is possible that the earnings of those older women are lower than they would be if family responsibilities had not affected their decisions about paid work in the past.

A very different picture of the relationship between family status and women's relative earnings emerges if the 1997-98 IS sample is broken down by five-year age group. Figure 7.1 depicts the average earnings of all mothers, partnered mothers, sole mothers, and women without dependent children, tabulated by five-year age group. From Figure 7.1, it appears that mothers in the 25-29 and 30-34-year age groups earn substantially less than women without dependent children. This is consistent with the hypothesis that mothers face a wage penalty in the labour market, and suggests that further investigation of the effects of motherhood on women's earnings is warranted.

Figure 7.1: Average hourly earnings of young women, by parental status, IS 1997-98



The analysis undertaken in this section of the study draws largely on the Income Supplement 1997 and 1998 samples of wage-earning women aged between 20 and 39, and does not make much use of the HES. We favour the IS as a data source because it provides substantially larger samples of important sub-groups of women, such as sole mothers and part-time employees.

Section 7 begins with a brief review of the theoretical explanations that have been put forward to account for a pay gap between mothers and childless women. Section 7.3 outlines the approach taken here to identify the effects of motherhood on women's earnings in New Zealand. It also provides a descriptive summary of the child-rearing and paid employment patterns of the 20-39 year old women who were surveyed in the 1997-98 IS. In Section 7.4, estimates of the 'wage penalty' for motherhood, estimated with and without controls for the work experience gap between mothers and non-mothers, are presented. In Section 7.5, we discuss the interpretation of the New Zealand results, drawing on the findings of related overseas research. In Section 7.6, the pay gap between part-time employed and full-time employed women is explored. Section 7.7 concludes.

7.2 Theoretical background: What leads to unequal pay between mothers and non-mothers?

It is useful to begin by briefly reviewing theories about the possible causes of pay differentials between mothers and childless women. Waldfogel (1995) categories the alternative hypotheses into three groups: human capital; hetereogenity; and work–family conflict explanations.

Human capital explanations for the wage gap between mothers and childless women are based on the idea that mothers have fewer labour-market related skills than women without children. Time out of the workforce restricts mothers' ability to maintain or upgrade the types of skills that are rewarded in the labour market (Waldfogel, 1995, p.586). Following childbirth, gaps develop between the accumulated skills and work experience of women who have had children and those who have not.

The 'heterogeneity' hypothesis points to unobserved differences between mothers and non-mothers a potential cause of the wage gap. The basic idea is that even after controlling for observable differences in education, prior work experience and other relevant attributes, women who have children differ from childless women in other unmeasured ways – such as unmeasured job-related skills, commitment to a career, or motivation to be economically independent. These unmeasured attributes exist prior to childbirth, and they lead to differences across women in *both* earnings levels and family formation decisions.

The third set of explanations are based around the idea that family responsibilities lower the day-to-day productivity of mothers as a result of conflict between the demands of work and family. It is suggested that domestic responsibilities may reduce the amount of effort that mothers are able to put into their paid jobs, lead them to take time off to care for sick children, or interfere with their paid work in other ways. This reduces their productivity and leads to lower earnings or reduced wage growth. A closely-related hypothesis is that employers *believe* there is conflict between work and family responsibilities, and therefore discriminate against women with family responsibilities in hiring and promotion decisions (Waldfogel, 1995, p.586). They may believe, for example, that unreliable childcare arrangements will lead to problems in maintaining the continuity of staffing and lower productivity. Depending

on whether productivity differences actually exist between mothers and non-mothers in a particular workplace, this could constitute a form of statistical discrimination (reflecting the fact that employers have imperfect information about job candidates). Alternatively, it could represent unjustified discrimination.

Yet another version of the work–family conflict hypothesis is that institutional barriers indirectly limit the opportunities and wages of women with family responsibilities (Waldfogel, 1995, p. 587). Those institutional barriers might include, for example, workplace rules that restrict part-time employment or do not allow women adequate family leave, rigid working hours, or working hours that are incompatible with the availability of childcare services.

Another possibility, raised by Joshi and Paci (1998), is that the need or desire to balance family responsibilities with paid work may lead to mothers having different job preferences, or different job search behaviour, than non-mothers. Circumstances at home may make jobs offering flexible or reduced working time relatively more attractive for mothers. A preference for flexible or reduced working hours could lead mothers to accept a negative wage differential, compensating for the extra convenience (ibid, p.99). Family responsibilities may also reduce women's mobility and increase the costs of potential search. This could make women with young children more vulnerable to monopolistic employer strategies in local labour markets (ibid, p.99).

Some of these hypotheses regarding the lower pay of mothers are also likely to be useful in explaining the lower average earnings of part-time workers. A full-time/part-time gap in wages might be the consequence of a productivity differential between the two groups. Part-timers might be *perceived* as less productive than full-timers by employers. The wage gap might be attributable to differences in the characteristics of the jobs, if part-time jobs tend to have more flexible hours, fewer responsibilities or other features that lead to compensating (negative) wage differentials. Alternatively, if many part-timers happen to be women with children, then family responsibilities could be the true underlying cause of at least part of the part-time/full-time wage gap.

7.3 Investigating the wage effects of family responsibilities in New Zealand

7.3.1 Methods

Theory suggests that the causes of a wage penalty for motherhood could lie in supply-side differences between mothers and non-mothers, or alternatively in differential treatment within workplaces. In this study, we explore the contribution of differences in measured skills to the pay differentials that exist between mothers and childless women. The basic question addressed is 'how much of the gap in earnings is due to observable differences in attributes that we can regard as proxies for skill or human capital?' We are not able to investigate the 'unobserved hetereogeneity' or 'work-family conflict' hypotheses with the data used in this study.

The HES and IS datasets are not ideally suited to a study of the wage effects of motherhood. Neither survey obtains information on women's complete childbirth histories. Only children who are living at home at the time of the interview are recorded. Many older women are likely to have had children who have since left home. Without any means to distinguish those

who had children earlier on in their lives from those who did not, it is not possible to estimate the wage effects of motherhood for older women using these data.

The strategy adopted here is to limit the investigation to women aged under 40 years, whose children are very likely to be still living in the household. The average number of dependent children per woman peaks at age 38 in the 1997-98 IS samples. Hence, the cut-off age of 40 is just beyond the age at which the incidence of family responsibilities within the sample peaks and begins to decline. The focus of our analysis is therefore on the wage effects of motherhood among *younger* women.

Given that reduced work experience is one of the key routes through which mothers' earnings are likely to be affected by family responsibilities, it is important to measure work experience as accurately as possible. In data sets where women's actual work experience is not directly measured or not measured very well, earnings differences between mothers and non-mothers that are actually due to differences in work experience may be wrongly attributed to the presence of children (Waldfogel, 1995, p.586).

Both the Zabalza and Arrufat and the Filer methods for imputing years of experience, as they were implemented in this study, incorporate information on the effects of motherhood on women's past employment histories. The Zabalza and Arrufat method incorporates information on within-sample differences between mothers and childless women in the probability of being in waged or salaried employment. The Filer method uses information from an external sample – the Fertility Survey – on the observed relationship between women's actual years of full-time experience and the number and ages of their children.

Because they do embody some real-world information on family-linked variations in women's past employment histories, these imputed measures of women's work experience allow us to explore the wage effects of motherhood in a more illuminating way than would be possible if we relied on age or potential experience variables alone. It is important to emphasise, however, that the imputed variables are imperfect measures of past work experience. It is possible that they represent biased measures of the work experience differences that actually exist between mothers and childless women, or between full-time and part-time employed women. Because of data access limitations, we were not able to evaluate the quality of the experience imputations for childless women, mothers, or specific groups of mothers against an external source of information on the actual experience levels of these groups.[42]

7.3.2 Younger women's child-rearing and paid employment patterns – a descriptive summary

We begin by presenting some descriptive information on the incidence of motherhood and part-time employment among women aged 20-39 years who were working as employees in the 1997 and 1998 IS samples. A profile of this sub-population is given in Tables 7.1 to 7.6.

More than half (57 percent) of all women in the sub-population were mothers at the time of the survey. Rates of participation in paid employment were very strongly influenced by current family circumstances (Table 7.1). Only about 30 percent of the sole mothers in the IS sample were working in waged or salaried jobs. About 46 percent of partnered mothers, and nearly 75 percent of the childless women, were employed in waged jobs. Within the wage-

[42] The Fertility Survey (NZW:FEE) is an obvious data source for external validation.

earning sample, women without dependent children made up the largest group (57 percent), followed by partnered mothers (35 percent), and sole mothers (8 percent).

Table 7.1: Participation rates and part-time employment rates by parental status

Parental status group	Participation rate in waged empt (%)	Part-time/ employees %	Distribution of: FTers %	PTers %
Partnered mothers	45.8	54.4	24.9	54.6
Sole mothers	29.8	58.3	4.9	12.5
Childless women	74.6	20.3	70.3	32.9
All	55.8	35.2	100.0	100.0

Note: The data are for women aged 20-39 years. The source is 1997-98 Income Supplement.

Table 7.2: Parental status and employment profile, by age group

Age group	Partnered mothers %	Sole mothers %	No dep chn %	Full-time %	Part-time %
20-24	6.2	3.2	90.6	69.9	30.1
25-29	21.2	6.8	72.0	75.2	24.8
30-34	46.8	9.9	43.3	61.5	38.5
35-39	66.5	10.3	23.2	52.7	47.3
All	35.3	7.6	57.1	64.8	35.2
N	*2,268*	*607*	*3,320*	*3,939*	*2,256*

Note: The data are for women aged 20-39 years, 1997-98 Income Supplement.

Table 7.3: Mean hourly earnings by parental and employment status

	Full-time	Part-time	All	Ratio PT / FT
	($ March 1998)			
Partnered mothers	12.88	12.83	12.85	1.00
Sole mothers	11.43	10.81	11.07	0.95
Childless women	13.04	11.85	12.79	0.91
All	12.92	12.23	12.67	0.95
Parental status pay ratios				
Partnered mothers/childless	0.99	1.08	1.00	
Sole mothers/ partnered mothers	0.89	0.84	0.86	
Sole mothers/childless	0.88	0.91	0.86	

Note: The data are for women aged 20-39 years. The source is 1997-98 Income Supplement.

Table 7.4: Mean hourly earnings by parental status and age group

Age group	Partnered mothers	All mothers	No dep chn	Pay ratios: Partnered mothers/ childless	Pay ratios: All mothers/ childless
	($ March 1998)				
20-24	10.68	10.68	11.02	0.97	0.97
25-29	11.88	11.43	13.53	0.88	0.84
30-34	13.10	12.64	15.13	0.87	0.84
35-39	13.23	13.09	14.09	0.94	0.93
All	12.85	12.52	12.79	1.00	0.98

Note: The data are for women aged 20-39 years. The source is 1997-98 Income Supplement.

If employed, women with children were much less likely than women without children to be working on a full-time basis. More than half of all mothers in the sample were part-time employees, compared with just 20 percent of the childless group (see Table 7.1). Not surprisingly, therefore, mothers dominated the part-time group numerically. Approximately two-thirds of the part-time employees were mothers, compared with just 30 percent of the full-time employed women (as shown in the right-most column of Table 7.1).

There was a strong positive relationship in the sample between age and children, as shown in Table 7.2. Only 10 percent of working women aged 20-24 years had dependent children. In the 35-39 year age group, the proportion was as high as 77 percent.

The geometric mean hourly earnings of the women in this sample are summarised in Table 7.3. There was relatively little difference between partnered mothers and childless women in average hourly earnings, but sole mothers earned substantially less than the other two groups. On average sole mothers earned around 86 percent of the hourly earnings of partnered mothers, and 87 percent of the hourly earnings of childless women. Substantial pay differentials between partnered mothers and childless women emerge if we estimate average wages by five-year age group (as shown in Table 7.4). For the 25-29 and 30-34 year age groups, there were pay differentials of 12 and 13 percent between partnered mothers and childless women.

The ratio of average part-time to average full-time hourly earnings in the total sample of 20–39 year-old women was approximately 0.95 (Table 7.3). The part-time/full-time hourly earnings ratio was lowest among childless women (about 0.91) and highest among partnered mothers (about 1.00). Age group breakdowns indicated that the part-time/full time earnings ratio did not vary much across age groups.

It is worth noting that the part-time/full-time differentials shown in these tables would be substantially larger if ratios of medians, rather than geometric means, were considered. This is a consequence of the fact that the part-time earnings distribution is more dispersed, and has a more pronounced skew to the right, than does the full-time earnings distribution. Figure 7.2 illustrates this point by plotting the ratio of part-time to full-time hourly earnings, by percentile, using the IS earnings data for women aged 20-39 in 1997-98. The left-hand end of the line plotted on the graph shows the ratio of the hourly earnings of the 5th percentile part-time woman, to those of the 5th percentile full-time woman. The other points on the graph are similarly defined. It can be seen that the median part-time employee, located at the 50th percentile, earned considerably less than the median full-time employee. The part-time/full-time ratio at the median was just 86 percent. In contrast, the highest ranked 15 percent of part-time employees earned considerably more per hour than the highest ranked 15 percent of full-time employees (the ratio of earnings at the right-hand side of the graph is well over 1.00). These highly paid part-time employees raised the average hourly earnings of all part-time employees, and reduced the size of the part-time/full-time differential reported in Table 7.3.[43] As noted previously, geometric means rather than medians are used in this study as the preferred measure of average earnings, because they incorporate information from all parts of the distribution, not just the central point.

[43] Figure 7.2 looks very similar when it is plotted for all female employees, not just those aged 20-39.

Figure 7.2: The earnings gap between part-time and full-time employed women, aged 20-39 years, by percentile of earnings

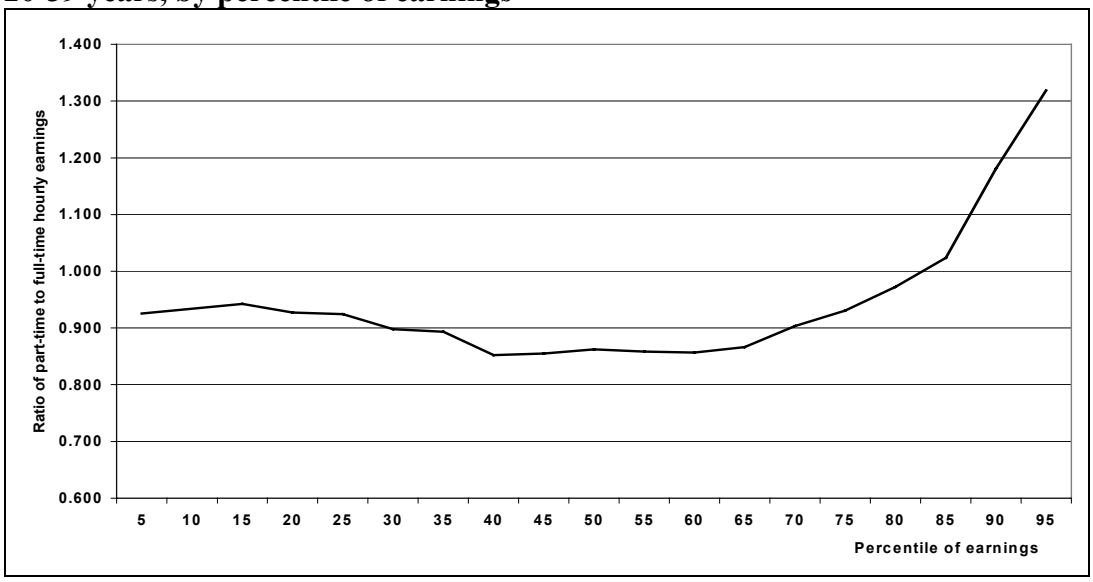


Table 7.5: Educational level, by parental and employment status

	Partnered mothers %	Sole mothers %	No dep chn %	Full-time %	Part-time %
No qualifications	18.2	25.2	7.6	11.6	14.7
School qualifications	30.7	26.2	31.0	28.2	34.7
Vocational qualifications	41.1	43.9	40.5	41.4	40.1
Bachelor degree	7.4	2.8	16.9	14.8	8.2
Postgraduate degree	2.6	2.0	4.1	4.0	2.3
Total	100.0	100.0	100.0	100.0	100.0

Note: The data are for women aged 20-39 years. The source is 1997-98 Income Supplement.

Table 7.6: Mean age and experience levels by parental and employment status

	Age	Potential exper	Z&A exper	Filer exper
Mothers	33.1	15.4	7.1	10.4
Partnered mothers	33.4	15.7	7.3	10.6
Sole mothers	31.6	14.2	6.2	9.5
No dependent chn	26.9	8.3	5.2	7.6
Full-time	28.9	10.6	5.8	8.6
Part-time	30.8	12.9	6.4	9.1

Note: The data are for women aged 20-39 years, 1997-98 Income Supplement.

The educational levels of the sample are summarised in Table 7.5. The childless group was the most highly educated, in part because this group was younger, and young women were more likely to acquire post-school qualifications in the decade immediately prior to 1997-98 than was the case in earlier decades. Partnered mothers were less well qualified, while sole mothers had the lowest levels of education. One quarter of the women in the sole parent group did not have any formal qualifications, compared with 18 percent of partnered mothers and just 9 percent of the childless group. Average educational levels were also higher among full-time than part-time employees.

The mothers in this sample of wage-earning women were on average about six years older than the childless women (Table 7.6), and had 7.1 additional years of *potential* experience.

The gap between mothers and non-mothers in estimated actual experience was much smaller, however – 1.9 years if we consider the Zabalza and Arrufat estimates, and 2.9 years if we consider the Filer estimates of experience.

Due to lack of access to appropriate external data sources, we were unable to assess the accuracy of these experience estimates for mothers and non-mothers. It is reasonable to expect that the additional experience 'margin' of the mothers in the sample would be less than their additional age margin, given evidence from other countries on women's experience distributions. The overseas evidence indicates that *at a given age*, mothers tend to have lower levels of accumulated work experience than do childless women.[44] The 'experience gap' between mothers and non-mothers begins to develop at the ages when women tend to give birth to their first child, and grows larger with increased age and increased family size.

7.4 The effects of motherhood on women's earnings: Regression evidence

This section considers the question of whether mothers earn less than childless women, after differences in their skill-related attributes are taken into account. Our approach is to estimate a series of wage regressions that include variables indicating the presence and ages of children in the family, in addition to other explanatory variables such as education and experience.

The dependent variable in all of the regressions is log hourly earnings. The skill-related explanatory variables included in the first two models are age or potential experience; educational qualifications; ethnic group; and overseas birth. Experience is entered as a quadratic function (β_1 experience + β_2 experience^2) rather than a quartic function. This simpler specification is adequate now that we are restricting the sample to the age range 20-39 years, thus reducing the complexity of the experience/earnings relationship. To bring in family responsibilities, we include dummy variables for marital status (using indicators for 'never married' and 'separated, widowed or divorced'); for one dependent child; and for two or more dependent children.

Results are shown in Table 7.7. The marital status coefficients in both specifications indicate that women who have never been formally married are predicted to earn about 8 percent less than women who live with husbands or partners, after differences in age/potential experience, education, ethnic identity and overseas birth are controlled for. Women who were previously married (5 percent of the sample) earn about 6.5 percent less than women who live with husbands or partners. These estimates provide no support for the traditional notion that marriage, and the domestic responsibilities that are associated with marriage, reduce the earnings of women who are in paid work. Rather, it appears that partnered women who work for wages tend to earn more than single women. It would be unwise to interpret these wage differentials as 'pure' marital status effects, however. They could be partly caused by unobserved characteristics that differ between the marital status groups and are correlated

[44] For example, Joshi and Paci (1998, p.108) report a one-year gap between employed mothers and employed childless women in the variable 'years employed since the age of 23', in a sample of UK women who were aged 33 in 1991. The mothers were one year behind childless women at that point in their lifecycles. Lathe and Giles (1995) report Canadian evidence on the discrepancy in years of full-year, full-time-equivalent work experience between women who had raised children, and women who had not, who were aged 45 and over in 1993. The average accumulated experience of the childless women was 1.7 times (or 11.1 years) higher than the average experience of the mothers (ibid, p.16).

with both partnership patterns and employment outcomes, rather than the direct effect of marital status.[45]

Table 7.7: Wage regressions for young women, including marital and parental status

	Model 1		Model 2		
	Coeffs.	Std errors	Coeffs.	Std errors	Means
Age	0.096 *	*0.012*			29.573
Age2 / 100	-0.001 *	*0.000*			9.077
Potential experience			0.051 *	*0.004*	11.378
Potential exp^2 / 100			-0.152 *	*0.016*	1.685
School qualifications	0.162 *	*0.017*	0.166 *	*0.018*	0.305
Vocational quals	0.235 *	*0.017*	0.271 *	*0.019*	0.410
Bachelor degree	0.408 *	*0.024*	0.494 *	*0.025*	0.125
Postgraduate degree	0.470 *	*0.039*	0.584 *	*0.040*	0.034
Maori	-0.077 *	*0.017*	-0.080 *	*0.017*	0.103
Pacific Islander	-0.048	*0.042*	-0.051	*0.042*	0.055
Other ethnicity	-0.008	*0.039*	-0.014	*0.039*	0.054
Born in the Pacific Is	-0.066	*0.046*	-0.064	*0.046*	0.039
Born in Asia	-0.141 *	*0.064*	-0.142 *	*0.064*	0.024
Never married	-0.085 *	*0.014*	-0.081 *	*0.014*	0.337
Previously married	-0.072 *	*0.026*	-0.069 *	*0.026*	0.051
One child	-0.067 *	*0.019*	-0.072 *	*0.019*	0.146
Two or more chn	-0.115 *	*0.018*	-0.114 *	*0.018*	0.283
Log wage					2.540
Adj R^2	0.177		0.185		
F	64.9		68.7		
N	6195		6195		

Notes: A constant and a dummy for observations in the 1997 sample were also included.
The data are for women aged 20-39 years, 1997-98 Income Supplement.

The coefficients for 'one child' and 'two or more children' are negative and statistically significant in both variants of the model. In model 1, the predicted hourly earnings 'penalty' for having one dependent child is around –7 percent. The predicted reduction in hourly earnings associated with two or more children is –10 percent. In the second specification, incorporating the potential experience measure, the estimated wage effects of children are similar. These estimates suggest that mothers do indeed earn relatively less than childless women, holding constant differences in age, educational qualifications, and marital status. While the mothers in this sample have lower levels of education than the women without children, they are also substantially older. After estimating 'average' returns to education and age for all women in the sample, the model results indicate that mothers earn less than would be expected on the basis of their mean levels of age and education.

Models 1 and 2 do not take account of the effects of motherhood on women's continuity of paid employment. To do so, we incorporate the Filer and the Zabalza and Arrufat imputed experience variables into the earnings equations. The inclusion of these variables can be expected to lead to lower estimates of the direct effects of children on women's earnings, because the wage variation between mothers and non-mothers is likely to be (partially at least) attributed to differences in experience levels.

[45] Health problems and physical or psychological disabilities are examples of unobserved characteristics that could play this role if their incidence is higher among single women.

Table 7.8: Effects of children on women's hourly earnings, incorporating experience as a control variable

		Z&A imputed exper		Filer imputed exper		Proportion
Specification		Coeffs.	Std errs.	Coeffs.	Std errs.	of sample
3	**Experience & experience squared**					
	One child	-0.058 *	*0.019*	-0.061 *	*0.019*	0.146
	Two or more children	-0.068 *	*0.016*	-0.089 *	*0.017*	0.283
4	**Age and experience, with interactions**					
	One child	-0.048 *	*0.019*	-0.037 *	*0.019*	0.146
	Two or more children	-0.030	*0.020*	-0.016	*0.019*	0.283

Notes: Coefficients marked with an asterisk are statistically significant at the 5 percent error level.
All models include an intercept, a dummy for observations in the 1997 sample, and controls for education, ethnicity, overseas birth, and marital status.

The consequences of substituting imputed actual experience for potential experience are summarised in Table 7.8. In model 3, experience and experience squared were substituted for age or potential experience. In model 4, five-year age dummies were also incorporated and interacted with the experience measures (thus allowing the estimates of the return to experience to vary by five-year age group). The motivation for this additional step was to ensure that age as well as experience effects were adequately controlled for.

As expected, the size of the coefficients for 'one child' and 'two or more children' is reduced by the inclusion of the experience variables. This is particularly so in the specifications that interact age with experience, where some of the child coefficients become statistically insignificant. These results are consistent with the view that the effects of children on women's earnings operate largely (though not entirely) through discontinuity of employment and reduced years of experience.[46]

Further equations were estimated in which information about the ages of the children in the family was utilised. The results are summarised in Table 7.9. In model 5, a dummy variable was included if the woman had one or more children in each of the following age groups: 0-4 years, 5-14 years, and 15-17 years. This model was estimated in three ways: with basic demographic controls only (age, education, ethnicity, and marital status), and then with each of the two imputed experience measures included in addition to the basic demographic controls.

In all versions of this model, the coefficients estimated for pre-school children are small and are not significant at the 5 percent error level. The coefficients estimated for older children, particularly the 5-14 year age group, are much larger – suggesting that school-aged children may have a more significant impact on women's job choices and resulting labour market outcomes than pre-school aged children. However, younger children are more likely to influence women's earnings through the employment or participation decision.[47]

[46] We are assuming here that the work experience differentials between mothers and women without children are largely caused by the time mothers take away from paid employment to care for their children, and are not the result of other differences between mothers and non-mothers that preceded childbirth. There is support for this assumption in overseas research findings, as discussed below in Section 6.5.

[47] In this sample, the employment rates of women with preschool-aged children ranged from 23 percent (for those with a child under 1 year) to 40 percent (for those whose youngest child was 4 years old). In contrast, the employment rates of the women whose youngest child was school-aged ranged from 48 to 61 percent (rising with the age of the youngest child). Only waged employment is counted in these employment rates, not self-employment.

Table 7.9: Variation in child wage effects, by age of child and parental status

			Age		Age + ZA exper		Age + Filer exper	
		Means	Coeffs.	Std errs.	Coeffs.	Std errs.	Coeffs.	Std errs.
5	Children aged 0-4 years	0.207	0.017	*0.015*	0.017	*0.016*	0.032	*0.016*
	Children aged 5-14 years	0.303	-0.118 *	*0.017*	-0.051 *	*0.019*	-0.041 *	*0.017*
	Children aged 15-17 years	0.056	-0.077 *	*0.026*	-0.033	*0.026*	-0.035	*0.025*
6	Partnered, 1 child	0.108	-0.052 *	*0.023*	-0.036	*0.022*	-0.027	*0.021*
	Partnered, 2 or more chn	0.245	-0.103 *	*0.021*	-0.021	*0.021*	-0.008	*0.020*
	Sole parent, 1 child	0.037	-0.101 *	*0.032*	-0.077 *	*0.032*	-0.062 *	*0.031*
	Sole parent, 2 or more chn	0.038	-0.165 *	*0.033*	-0.074 *	*0.035*	-0.050	*0.034*

Notes: Coefficients marked with an asterisk are statistically significant at the 5 percent error level.
All models include an intercept, a dummy for observations in the 1997 sample, and controls for education, ethnicity, overseas birth, and marital status.

In specification 6, the indicator variables for 'one child' and 'two-or-more dependent children' were defined and entered separately for partnered and sole mothers. This specification was also estimated in three ways: with basic demographic controls only (age, education, ethnicity, and marital status), and then with each of the two imputed experience measures included in addition to the basic demographic controls.

The estimates shown in the first column suggest that wage-earning sole mothers experience substantially larger wage penalties than do partnered mothers, once age and education are taken into account. The wage differentials for partnered mothers with one child, and with two or more children, are –5 and –10 percent respectively. The comparable wage differentials for sole mothers are –10 and –15 percent.

The inclusion of experience measures (interacted with age) reduces the estimated wage effects of children. The coefficients estimated for partnered mothers now fall within the margin of statistical error. Those estimated for sole mothers are reduced to about 5-7 percent. The coefficients for sole mothers are not estimated with great precision (probably because the sample of sole mothers is relatively small), with the result that they are only marginally statistically significant. In addition, it is possible that they are biased by deficiencies in the estimation of sole mothers' actual work experience. This issue is discussed further below.

Considered as a whole, these results suggest that reduced work experience is an important channel through which young children reduce younger women's hourly earnings. The apparent importance of lower experience in reducing the average hourly earnings of mothers is consistent with a human capital explanation of the 'family gap' in earnings. Time out of the workforce restricts the ability of mothers to maintain or upgrade the types of skills that are rewarded in the labour market. However, there are alternative explanations. For instance, the association between reduced experience and mothers' lower earnings is also consistent with a model of the labour market in which earnings are determined within firms on grounds of seniority and tenure rather than skill.

The results summarised here also suggest that sole mothers experience a more substantial wage penalty than do partnered mothers – although the size of that wage penalty for sole mothers is not very precisely estimated. There are several possible explanations for this pattern of results. One possibility is that there are unmeasured skill differences between sole mothers and partnered mothers. For example, it is quite likely that sole mothers have lower levels of prior work experience, on average, than do partnered mothers. While we do not have good direct measures of the work experience differential between sole and partnered mothers in New Zealand, the labour force participation and employment rates of sole mothers were well below those of partnered mothers through out the 1980s and 1990s (Goodger and Larose,

1998, p.5). Thus, it is very likely that an experience gap also exists. The procedures used to impute experience variables in this study were not well designed to capture any systematic differences that may exist between sole and partnered mothers in employment rates or accumulated years of experience, and therefore measurement error may be biasing the relative sizes of the coefficients reported in Table 7.9. Sole mothers may also differ from partnered mothers on other unmeasured dimensions of skill. Another possibility is that sole mothers experience greater difficulty in arranging suitable childcare than do partnered mothers, and this restricts their paid work options, or influences their performance at work.

Reviewing the results of this section, two main conclusions can be drawn. First, younger mothers (aged 20-39) do appear to earn less than similarly-aged and similarly-educated women who do not have dependent children. The estimated earnings penalty for children, averaged across all young mothers, is about 7–10 percent of the average hourly earnings of childless women. Second, it appears that reduced work experience is an important channel through which children lead to lower earnings.

7.5 Discussion and overseas research evidence

The results of Section 7.4 suggest that children do have a material impact on women's hourly earnings. The size of that impact (if we regard reductions in work experience as part of the impact), is large enough to account for an important portion of the total gender pay gap. Using the coefficients and means from Table 7.7, children reduce mothers' earnings by about 0.43 log points. This represents about one-third of the total male–female log wage gap, for employees aged 20-39 years, of 0.121 log points.

However, it would be premature to conclude that those estimates represent the true effect of children on women's earnings, or on the gender pay gap. There are a number of ways in which the current estimates are naïve. An obvious point of criticism is that women's skills, and particularly their work experience, may have been measured inaccurately. Any measurement biases in those variables have the potential to distort estimates of the child wage effects. Unobserved differences between mothers and non-mothers are another potential source of bias in these estimates of the wage effects of motherhood. Suppose, for example, that the set of mothers who participate in wage employment are positively selected, and have higher wage-earning potential than the mothers who do not participate, due to some set of unobserved characteristics. That selection bias would tend to raise the observed wages of mothers, and reduce the likelihood that any evidence of the negative wage effects of children will be detected.

Addressing these criticisms fully would require better data than are currently available in New Zealand. In the meantime, it is useful to put the New Zealand results into perspective by summarising the results of recent studies undertaken in other countries, which have used superior data sources and more advanced methods of analysis to identify the effects of children on women's earnings.

In Table 7.10, the *raw* wage differentials between mothers and childless women in New Zealand are compared with a selection of those reported in other studies. The US data are from Waldfogel (1998a), and the UK figures from Joshi and Paci (1998). The New Zealand estimates are calculated for the closest possible age groups and years. It appears that the unadjusted wage differentials between mothers and women without children are a little smaller in New Zealand than in the United States, and considerably smaller in New Zealand

than in the UK. This may mean that the wage 'penalties' associated with motherhood (estimated with controls for skill differences) are also smaller in New Zealand.

Table 7.10: International comparisons of the size of the 'family' pay gap for women

	US	UK	NZ HES	NZ IS
	%	%	%	%
	Ratios of mean hourly earnings			
All mothers / childless women				
Aged 25-45 in 1994	90.3			
Aged 25-45 in 1992-95			94.1	
Aged 25-45 in 1997-98				92.9
Married mothers / childless women				
Aged 25-45 in 1994	94.2			
Aged 25-45 in 1992-95			97.8 *	
Aged 25-45 in 1997-98				97.5 *
All mothers / childless women				
Aged 33 in 1991		72.0		
Aged 30-34 in 1990-92			88.1	
Aged 30-34 in 1997-98				93.3

Notes US figures are from Waldfogel, 1998a, p.144. The data source is the Current Population Survey.
UK figures are from Joshi and Paci, 1998, p.116. The data source is the National Child Development Study.
* Married includes defacto relationships.

Recent studies by Korenman and Neumark (1992); Neumark and Korenman (1994); Joshi and Paci (1998); and Waldfogel (1995 and 1998) have used longitudinal data sets to estimate the effects of children on the wages of women in the UK and the US. In each of these studies, the effects of motherhood are assessed when women are aged in their early thirties. Using US data drawn from the National Longitudinal Survey of Youth, Waldfogel (1998) estimated wage effects in the range of –4 to –7 percent for one child, and –8 to –12 percent for two or more children. Using UK data drawn from the National Child Development Study, she estimated wage penalties in the range of –9 to –11 percent for one child, and –15 to –24 percent for two or more children.[48]

Reviewing Waldfogel's estimates, and those reported by other researchers, it is clear that the methods used to estimate the effects of children on women's earnings materially influence the results obtained. The largest child wage effects found in these studies are estimated from cross-sectional OLS regressions without controls for differences in women's actual work experience. However, the extent to which the inclusion of controls for women's actual work experience reduces the estimated size of child wage effects varies a good deal across studies.

Waldfogel (1998, p.514 and p.519) finds that controlling for mother /non-mother differences in past work experience reduces the estimated size of the wage differential for motherhood by around one-third. Other studies report much stronger effects. Hill (1979), using a sample of US women from the Panel Study of Income Dynamics, found that incorporating detailed measures of past work history eliminated virtually all of the direct effects of children on women's earnings. Korenman and Neumark (1992) report that including work experience measures in cross-sectional OLS wage equations reduces the size of child coefficients substantially, but does not make them disappear. In another study, Waldfogel (1995, p. 595)

[48] Although it would be convenient to be able to compare Waldfogel's estimates with those estimated here for New Zealand women, any such comparisons could be misleading, because the New Zealand estimates come from a sample of women that spans a much wider range of ages (20-39 years, rather than 30-33). Child wage effects are likely to vary by the age of the woman.

reports that essentially all of the sole mother/ partnered mother wage rate differential among women in the UK is accounted for by differences in average experience levels.

The variation in results across studies may be partly due to differences in timing and sample characteristics. It could also be influenced by variations in the richness of the information utilised on past work behaviour. The greater the depth and detail of that information, the greater the potential to account for wage differences that would otherwise be attributed to children. On balance, these overseas studies suggest that reduced work experience *is* an important route through which children lower mothers' earnings, but probably not the only route: most studies continue to find some statistically significant direct wage effects.

Another issue recent studies have sought to address is whether the earnings gap between mothers and non-mothers is the product of differences in unmeasured attributes. Characteristics such as unmeasured job-related skills, commitment to a career, or commitment to be economically independent, have the potential to lead to pay differences between mothers and non-mothers even before they have children. In addition, these characteristics could interact with the presence of children to cause differences in subsequent earnings growth profiles. Researchers such as Korenman and Neumark (1992), Neumark and Korenman (1994), and Waldfogel (1995 and 1998), have explored this problem by estimating first-difference and fixed effects models using panel (longitudinal) data sets. Their analytical models are designed to net out unobserved individual effects that vary across individuals but not across time, thereby ensuring that estimates of the effects of children on earnings are not biased by this source of variation between women.

The estimates obtained from the panel data studies suggest that the 'true' effects of children on women's earnings are somewhat smaller than those identified in cross-sectional models. Hence, there is support for the notion that unobserved heterogeneity does play some role in generating wage gaps between mothers and childless women. However, this does not overturn the basic finding that motherhood is associated with lower wages (Neumark and Korenman, 1994, and Waldfogel, 1995 and 1998). The direct wage effects that are estimated in the literature could be capturing the impacts of caring responsibilities on women's job choices, their access to jobs, or the wages they are able to negotiate with their employers.

Summarising this section, previously published literature indicates that well-measured experience controls do tend to reduce the size of the negative child wage effects that are estimated in standard wage regressions for women. This suggests that the coefficients estimated in the most simple models of Section 7.4 above, indicating wage penalties of 7 percent for one child and 10 percent for two or more children, are probably overestimates. On the basis of the overseas research, we can also give a relatively low weighting to the possibility that the wage differences detected in the New Zealand data are purely the product of unmeasured differences between mothers and childless women.

7.6 The effects of part-time employment on women's earnings

Working mothers are far more likely to work on a part-time basis than are women without dependent children. It is also the case that the average hourly earnings of part-time employed women are below those of full-time employees. This raises the question of whether working part-time is a 'cause' of lower wages for mothers – that is, whether the decision to work part-time reduces their hourly earnings relative to what they would have received had they worked full-time.

In theory, part-time work might lead to lower hourly earnings if part-time workers were systematically discriminated against in the labour market, or if the opportunities to work part-time hours were restricted to specific jobs, which tended to be lower paying on average. Another potential explanation of the observed wage gap between part-time and full-time employed women is that there are systematic differences in the skills or human capital of the two groups. In this section, we seek to evaluate the latter hypothesis.

Approximately 55 percent of 20-39 year old working mothers in the 1997-98 IS samples were employed part-time. Eighty percent of the working women who did not have dependent children were working full-time. The crude wage gap between the full-time and part-time groups was about five percent of the full-timers' average hourly earnings. This average wage gap did not vary much across age groups. However, it did vary by parental status, being smallest among partnered mothers, and largest among childless women (see Table 7.3).

We begin the analysis by incorporating a set of dummy variables for part-time employees into a log hourly earnings regression for all women aged 20-39. These new dummy variables identify part-time employed mothers who have husbands or partners; part-time employed sole mothers; and childless women who are working part-time. The reference group is all full-time employed women (including both mothers and women without children). The other explanatory variables in the equations are age; experience, educational qualifications; ethnic group; overseas birth; and marital status. Four versions of the model are estimated. The first incorporates all demographic controls except experience. The second substitutes potential experience for age, while the third and fourth incorporate the imputed experience variables, interacted with age.

Table 7.11: Effects of part-time employment on earnings

	Age (1)	Potential exper (2)	Age + Z&A exper (3)	Age + Filer exper (4)	Sample means
Estimated wage differential relative to FT employed women		*Coefficients*			
Partnered mother, part-time	-0.064 *	-0.065 *	-0.038 *	-0.017	0.192
Sole mother, part-time	-0.122 *	-0.127 *	-0.090 *	-0.061	0.044
Childless, part-time	-0.012	-0.010	-0.025	0.001	0.116
		Standard Errors			
Partnered mother, part-time	*0.018*	*0.018*	*0.018*	*0.018*	
Sole mother, part-time	*0.031*	*0.031*	*0.031*	*0.031*	
Childless, part-time	*0.025*	*0.025*	*0.025*	*0.025*	

Notes: Coefficients marked with an asterisk are statistically significant at the 5 percent error level.
All models also include an intercept, a dummy for observations in the 1997 sample, and controls for education, ethnicity, overseas birth, and marital status.

The coefficients estimated for part-time employment are summarised in Table 7.11. The figures in the first row of the table give the estimated wage penalty for part-time employment if one is a partnered mother – relative to the earnings of all full-time employed women. The figures in the second row give the wage penalty for part-time employment that was estimated for sole mothers, while those in the third row the wage penalty faced by part-timers without dependent children.

The results of the first two specifications, which include age or potential experience controls but not imputed experience, suggest that partnered mothers experienced a negative hourly earnings penalty of about –6 percent if they were employed part-time. The part-time wage penalties for sole mothers were about twice as large, at –11 percent. In contrast, working

part-time appeared to have little direct effect on the predicted hourly earnings of women without dependent children, once other demographic characteristics were controlled for. More detailed inspection of the data indicated that the relatively large part-time/full-time wage gap among childless women, which is evident in the ratio of raw wage means (Table 7.3), was due to a small gap in age and a substantial gap in completed qualifications. Childless women who work part-time are both younger and less well educated than are full-time employees, and the regression models estimated here control for the effects of those age and educational differences.

The third and fourth specifications in Table 7.11 include the imputed measures of actual experience. The inclusion of the experience variables reduces the size of most of the coefficients estimated for part-time employment, rendering them statistically insignificant in the model incorporating the Filer measure of actual experience, and only marginally significant in the model incorporating the Zabalza and Arrufat measure of experience.

The models displayed in Table 7.11 impose the restriction that the returns to age, experience, education and other explanatory variables are the same across parental status groups. Relaxing this constraint, we estimate wage equations separately for the women belonging to each parental status group, incorporating a dummy variable for 'part-time' to pick up any wage differential that exists. Results are summarised in Table 7.12. None of the coefficients for 'part-time' are statistically significant. This is true of both models that rely on basic demographic controls alone (shown in the first row), and those that also include imputed experience.

Table 7.12: Part-time employment effects, estimated separately by parental status group

	Partnered mothers		Sole mothers		Childless women	
	Coeffs.	Std errs.	Coeffs.	Std errs.	Coeffs.	Std errs.
Estimated wage differential for PT employees, relative to FT employees						
Without any experience measure	-0.025	*0.024*	-0.048	*0.036*	-0.030	*0.027*
Using Z & A experience values	-0.028	*0.022*	-0.051	*0.035*	-0.032	*0.025*
Using Filer experience values	-0.012	*0.022*	-0.039	*0.034*	-0.004	*0.025*

Note: all models include an intercept, a dummy for observations in the 1997 sample, and controls for age, education, ethnicity, overseas birth, and marital status.

To summarise, the wage differentials that were estimated for part-time employment in a sample of 20-39 year old women tended to disappear once differences between part-time and full-time employed women in the distribution of parental status, age and education were taken into account. These results are consistent with the view that part-time employment is not an important *independent* determinant of earnings. Rather, the gap between part-time and full-time average hourly earnings is mainly due to differences in the demographic characteristics and skills of these two groups.

7.7 Summary

This section has explored the effects of family responsibilities on the average hourly earnings of female employees aged 20-39 years, using data from the 1997 and 1998 Income Supplement samples. The analysis compared mothers with childless women, and full-time with part-time employees. It sought to address the following question, 'what portion of the wage differentials observed between these groups is due to differences in measured attributes, such as age and education, that we can regard as proxies for skills?'

The population of study was restricted to women aged 20-39 years because the IS and HES samples do not record women's full childbearing histories, and parental-child relationships can only be identified if the children are still living in the household. Women aged 40 years and over are more likely to have had children who are no longer living at home, hence their exclusion from the study population. Given this age restriction, the findings summarised here are not necessarily representative of all mothers.

To explore the effect of motherhood on earnings, a series of wage regressions incorporating indicators of whether a woman had children aged under 18 years, and controls for other personal and skill-related characteristics, were estimated. The results suggested that mothers do indeed earn relatively less than childless women who are similar in their demographic characteristics and educational level. In the most basic models that control included controls for age, education, ethnicity and marital status, the estimated hourly earnings 'penalty' (or negative wage differential) for having one dependent child is around –7 percent, and the predicted differential for two or more dependent children is around –10 percent. These estimates should be regarded as preliminary estimates of the effects of children on New Zealand women's hourly earnings, because the data and methods on which they are based have some significant limitations.

Estimates of the wage effects of motherhood varied by partnership status. Sole mothers in waged employment were predicted to experience substantially larger wage penalties than were partnered women (about 1.5 times larger), after differences in basic demographic characteristics were controlled for. Without further research aided by better data, we cannot tell whether the wage gaps between sole and partnered mothers were mainly due to unmeasured differences between the two groups, to differences in their treatment in the labour market, or to other causes.

A human capital explanation of the wage gap between mothers and childless women would suggest that time out of the workforce restricts the ability of mothers to maintain or upgrade the types of skills that are rewarded in the labour market. Hence, the lower average hourly earnings of mothers are a reflection of lower average skills. Using the imputed experience variables, we attempted to explore the contribution of differences in prior work experience to the wage gap between mothers and childless women. Incorporating imputed experience into the wage models substantially reduced the size of the coefficients that were estimated for children, and rendered them insignificant in some models. This evidence is consistent with the view that the adverse effects of children on women's earnings operate partly through discontinuity of employment and reduced years of labour market experience. It lends some support for a human capital explanation of the 'family gap' in earnings, but does not rule out other possible explanations.

Mothers are more likely to work on a part-time basis than are women without dependent children. In Section 7.5 we considered the question of whether working part-time is a 'cause' of lower wages for mothers – that is, whether the decision to work part-time reduces their hourly earnings relative to what they would have received had they worked full-time. A series of wage regressions were estimated to explore the wage effects of working part-time, for younger women, using alternative sets of controls for in-sample variations in age, education, experience, and parental status. The part-time coefficients estimated in these regressions were reduced in size by the inclusion of the demographic control variables, and tended to become statistically insignificant. This evidence suggests that the observed part-

time/full-time wage gap among younger women was mainly due to demographic and skill differences between the two groups, not an independent part-time employment effect.

All of the wage models that were estimated in this section included controls for the effects of marital status upon earnings. An incidental finding was that living in a legal or defacto marriage was associated with a wage premium, rather than a wage penalty, in this sample of women aged 20-39. Consistently in all the models estimated, never-married women were estimated to earn 6-8 percent less than women currently living with their husbands or partners. Women who were widowed, separated or divorced were also predicted to earn less than partnered women, although the negative coefficients estimated for 'previously married' were generally smaller than those for 'never married'. These results are inconsistent with the traditional notion that marriage, and domestic responsibilities associated with marriage, reduce the earnings of women who are in paid work. It would be unwise to interpret these estimated wage differentials by marital status as 'pure' marital status effects, however. They may be influenced by unobserved characteristics that differ between the marital status groups, and are correlated with both partnership patterns and employment outcomes.

The findings of this section have some broad implications for our understanding of the gender pay gap in New Zealand. They offer preliminary evidence that the negative effect of caring responsibilities on women's hourly earnings is one of the sources of the gender wage gap. We have not been able to estimate the size of motherhood wage effects in a very rigorous way, and it would require superior data sources, containing richer information on women's child-rearing and employment histories, to do so. The current estimates suggest that the wage effects of motherhood are statistically significant, and materially important, but they account for less than half of the total wage gap between men and women aged 20-39 years.

8. CONCLUSION

8.1 Summary and discussion of implications

This study examined changes in the gender earnings gap in New Zealand between 1984 and 1998. It used data from two household surveys, the HES and the HLFS Income Survey, to examine trends in the size and dimensions of male–female pay disparities. It investigated the contribution of shifts in men's and women's relative skills and employment distributions to the size of the gap and its reduction through time. The population of study was all wage and salary earners aged 20-59 years. A final segment of the research explored the effects of family responsibilities on the pay gap between younger men and women (those aged 20-39 years).

Improvements in women's relative earnings can come about through increases in women's real earnings, reductions in men's real earnings, or a combination of the two. Both processes were operating in New Zealand during the period of study. Women at all levels of the female hourly earnings distribution experienced some real earnings growth. In contrast, the hourly earnings of lower-paid men declined in real terms, and those of men in the middle ranges of male earnings did not rise much. Appreciable real earnings growth was recorded only at the upper end of the male pay distribution. Thus the long-term contraction in the gender pay gap was partly a reflection of limited growth in the real hourly earnings of men.

As a result of the growth in the dispersion of male earnings, the gender pay gap faced by lower-paid women narrowed more rapidly than did the gap faced by higher-paid women. By the late 1990s, the male–female wage differential at the 10^{th} percentile boundary of the male and female earnings distributions was only about half the size of the differential at the 90^{th} percentile boundary. Younger women also experienced greater improvements in their relative earnings than did older women. A probable reason is that women in younger birth cohorts entered the labour force less disadvantaged by lower educational qualifications than did earlier generations of women. Greater similarity in the employment rates and paid work patterns of younger men and women would also have helped. Despite these variations, all age groups and cohorts appear to have experienced *some* reduction in gender pay inequality, suggesting that some common forces – operating within the labour market as a whole – were at work.

This study followed the standard approach of dividing the total male–female pay differential between the portion attributable to differences in measured skill-related characteristics, and the rest. Table 8.1 summarises the findings of cross-sectional decompositions of the gender gap in the late 1990s. The top section of the table repeats results obtained in Section 5, focusing on the wage effects of education and experience. Those results suggest that the portion of the total male–female wage differential that was attributable (statistically) to male–female differences in education and experience lay between 30 and 60 percent. Thus, gender differences in average levels of these two proxies for skill continued to be large enough at the end of the 1990s to explain a sizeable chunk of the gender gap in earnings – between one-third and three-fifths.

There is room for debate about the extent to which the education and experience variables are really good proxy measures of skill and productivity differences. It is possible they also capture the wage effects of attributes that are rewarded in labour markets but are not strictly related to productivity, such as seniority.

The bottom section of Table 8.1 repeats results obtained in Section 6, showing the estimated effects of male–female attribute differences after information on occupation and industry of employment is included in the wage models. The 'explained' component of the gender wage differential rises, and lies in the range of about 40 to 80 percent of the total male–female wage gap.

Table 8.1: Summary of the decompositions

	Measure of experience for women			
	Filer 'High'	Z & A 'Low'	Filer 'High'	Z & A 'Low'
Personal characteristics/skills only	**HES 1996-98**		**IS 1997-98**	
Total log hourly earnings gap	0.153	0.153	0.171	0.171
Weighting the gap in characteristics with male returns				
Gap in characteristics	0.061	0.098	0.034	0.097
Parameter gap	0.092	0.054	0.137	0.074
Percentage due to characteristics	39.6	64.4	19.7	56.5
Weighting the gap in characteristics with average returns				
Gap in characteristics	0.065	0.091	0.045	0.087
Parameter gap	0.088	0.062	0.126	0.084
Percentage due to characteristics	42.6	59.3	26.4	50.8
Personal plus job characteristics	**HES 1997-98**		**IS 1997-98**	
Total log hourly earnings gap	0.136	0.136	0.171	0.171
Weighting the gap in characteristics with male returns				
Gap in characteristics	0.078	0.108	0.058	0.107
Parameter gap	0.058	0.028	0.113	0.064
Percentage due to characteristics	57.2	79.2	34.0	62.3
Weighting the gap in characteristics with average returns				
Gap in characteristics	0.095	0.109	0.102	0.124
Parameter gap	0.041	0.027	0.069	0.047
Percentage due to characteristics	69.8	80.2	59.8	72.2

Education, experience, industry and occupation are all treated as exogenous in these decompositions. In reality, none of these variables are fully independent of recruitment and wage-setting processes within the labour market. In addition, their levels may have been influenced by the unequal treatment of men and women outside the labour market, in educational institutions, within families and elswhere. Consequently, the component of the gender wage gap that is 'explained' in the decompositions should not be interpreted as the portion that is 'fair', efficient, or uninfluenced by gender discrimination. A more useful interpretation is to see it as the portion of the gap that should be amenable to reduction by further shifts in the distribution of the explanatory variables – education, experience, industry and occupation – that bring the male and female means closer together.

Differences between male and female employees in average levels of educational attainment became much less pronounced during the 1980s and 1990s. It seems likely that gender differences in average levels of past work experience declined, though data limitations meant we were unable to reliably estimate the size of that contraction within the population of employees. Indexes of occupational and industrial segregation showed that the industrial and

occupational profiles of the jobs undertaken by men and women also moved closer to each other during the 1980s and 1990s, albeit slowly. Consequently, the jobs held by men and women are also likely to have become more similar in their typical characteristics.

Estimates from the decompositions of the *change* in the male-female wage gap suggested that increases in the relative educational levels of women were responsible for around 15 percent of the total reduction of the gender gap between 1989-91 and 1996-98. Increases in the relative educational attainment of younger women propelled this trend. The effects of the most recent shifts in educational patterns have yet to penetrate fully though all age groups in the labour force. Our estimates of the effects of the narrowing of male–female experience differentials indicated that this source of change was potentially important, but we were unable to quantify its size. Using data for a somewhat different time period, and using somewhat different wage models, we estimated that changes in the industrial employment shares of men and women, and shifts in the inter-industry wage structure, could explain up to one-third of the total reduction of the gender wage gap. Because of the different time periods and wage models used, these different sets of estimates cannot be added together to get an overall estimate of the total 'explained' component of the gender pay gap reduction.

A substantial part of the long-term contraction of the earnings gap was due to the reduction of 'unexplained' or 'residual' inequality. Researchers have debated the question of how much of the 'residual' component of gender pay inequality is due to measurement error and unmeasured skill differences between men and women, and how much is due to the unequal treatment of men and women in the labour market. This study does not throw any new light on this question. The reduction of residual inequality may have been due to declining gender segregation in the labour market, to reductions in unmeasured skill differences between men and women, or a combination of both.

8.2 Future scenarios

It seems likely that existing gender differences in measured skills and job characteristics will narrow somewhat further in future, due to the continuing impact of recent increases in the relative educational attainment of women, and the long-run tendency for men's and women's paid work patterns to become very gradually more similar. The reduction of male–female differences in educational level and paid employment patterns should help to bring about some additional narrowing of the aggregate gender earnings gap in future years. There is no *guarantee* that further declines in the aggregate gender pay gap will occur, however, because the wage structure is influenced by shifts in the demand for different skills, as well as by shifts in supply.

Like other OECD countries, New Zealand experienced quite marked growth in earnings inequality during the 1980s. Juhn, Murphy and Pierce (1993) drew attention to the fact that aggregate wage differentials between two groups of workers that differ in their mean earnings, such as men and women, are influenced by the amount of wage dispersion that is present in the labour market as a whole. In an era of rising dispersion, the gap between average male and average female earnings could expand purely because of the fact that the total earnings distribution had spread out. Blau and Kahn (1997) examined the impact of wage structure changes on the evolution of the gender pay gap in the United States during the 1980s. They concluded that rising wage inequality in the US acted to slow down the contraction of the aggregate gender earnings gap. While women were improving their skill levels relative to men, wage differentials along educational and experience lines were growing

larger, due to increases in the relative demand for workers with higher levels of skill. Blau and Kahn argued that the contraction in the gender gap recorded during the 1980s would probably have been larger had earnings inequality not increased at the same time.

The growth of earnings inequality in New Zealand between 1984 and 1997 followed a somewhat different path from that of the US. While there was some growth in educational and age-related wage differentials, particularly during the 1980s, the majority of the growth in total earnings inequality was not directly linked directly to increases in the 'returns' to these measured skills (Dixon, 1998, p.97). The growth of within-group dispersion (increased inequality within groups of workers with similar observed characteristics) appears to have played a more important role in the New Zealand than in the US case.

No attempt was made in this study to estimate what reduction in the gender earnings gap *might* have occurred in New Zealand in the absence of a general trend towards increased wage dispersion. If the New Zealand labour market were to experience very rapid growth over the next decade in the relative demand for experienced workers, workers with university qualifications, or any other 'skills' that men hold in greater amounts than women, this would tend to raise male earnings, and would tend to expand the gender pay gap. Based on current trends, a reversal of the long-run trend towards reduced gender inequality seems unlikely, however.

The study was not designed to evaluate specific gender equity policies, and therefore it does not lead directly to conclusions about the appropriateness or relative merits of policies that might influence the gender earnings gap. At a general level, the results of this study support the view that individuals' past employment patterns influence their current wages, and therefore policies that make the paid work patterns of men and women more similar would be likely to have an impact. Those policies might include, for example, the promotion of part-time working options for both men and women within all occupations and firms, the promotion of parental leave arrangements, or the promotion of parental leave sharing between mothers and fathers; and policies that make childcare services accessible to working parents.

8.3 Further research

The reasons for the limited growth in the real earnings of men during the 1980s and early 1990s deserve to be better understood. Several possible contributing factors were identified here. They include a decline in male participation and employment rates, which reduced average levels of past work experience among men; an increase in the incidence of part-time working, which may have raised the proportion of male employees who had relatively low levels of past work experience; compositional changes in the population of male employees, caused by movements out of waged employment into self-employment; and the impact of unfavourable demand conditions on employment and wage rates within some 'traditionally-male' industries and occupations. Future research work could usefully investigate these and other possible explanations for sluggish male wage growth.

The average *observed* wages of men and women in employment are likely to be influenced by movements in employment and unemployment rates, which affect the 'selection' of individuals into the employee population. During the late 1980s and 1990s New Zealand experienced quite large movements in aggregate employment rates, particularly those of men. In this study we noted the probable importance of selection factors, but did not attempt to estimate their impact on the average earnings of men and women. Future research could

explore the nature and size of selection effects on the distribution of male and female earnings.

Further work on the effects of women's family responsibilities on their earnings would also be valuable. Analysis of longitudinal data sets, providing measures of women's earnings before and after the formation of their families, could enhance understanding of the effects of motherhood and interruptions to paid employment on women's earnings.

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APPENDIX 1 – VARIABLE DEFINITIONS

A1.1 Measures of earnings

The dependent variable in this study is *usual* weekly or hourly earnings, including regular overtime payments, but excluding any irregular payments. Earnings are summed across all currently-held wage or salary jobs. This section defines the dependent variable in more detail, and discusses the implications of choosing this particular definition of earnings for measures of the gender earnings gap.

Collection methods

The method of recording earnings varies somewhat between the HES and the IS. In the Income Supplement, those paid on an hourly basis are asked to report their hourly wage rate directly. Other employees report their earnings in the manner it is paid, generally weekly or fortnightly. For these respondents, hourly earnings are estimated by dividing the most recent usual pay by the number of hours usually worked in the corresponding period.

In the HES, respondents generally report their earnings either in terms of a weekly or fortnightly usual payment, or in terms of an annual salary. In the first situation, hourly earnings are estimated by dividing earnings by usual hours. In the latter situation, information on weeks worked must also be used to estimate weekly and hourly earnings. As the start and finish dates of jobs are recorded in whole months in the HES, the number of weeks worked is estimated with some level of error in cases where the respondent did not work in the job for the entire reference year.[1] It is likely that weekly earnings are underestimated for some individuals in this situation, and overestimated for others. These estimation errors should not cause any systematic upwards or downwards bias in the earnings estimates, however.

Usual rather than actual earnings

The HLFS Income Supplement collects information on both actual and usual earnings. The HES records usual earnings only.

Table A1.1: Comparison of usual and actual earnings in the 1998 IS sample

	Males			Females		
	Usual	Actual	Gap as %	Usual	Actual	Gap as %
	($ Mar 1998)		of usual	*($ Mar 1998)*		of usual
Hourly earnings						
Mean	17.11	17.24	*-0.79*	14.13	14.10	*0.24*
Geomean	15.48	15.51	*-0.23*	13.00	13.01	*-0.03*
90th percentile	26.35	26.52	*-0.64*	20.98	20.99	*-0.05*
75th percentile	19.91	19.91	*0.00*	16.32	16.32	*0.00*
50th percentile	14.93	14.93	*0.00*	12.59	12.65	*-0.47*
25th percentile	11.52	11.55	*-0.26*	9.95	9.95	*0.00*
10th percentile	9.55	9.55	*0.00*	8.56	8.57	*-0.12*
Weekly earnings						
Mean	727.54	729.21	*-0.23*	458.19	460.31	*-0.46*
Geomean	618.69	619.92	*-0.20*	360.34	361.38	*-0.29*

In practice, the actual and usual earnings measures captured by the Income Supplement are very close to each other in both level and spread. This is illustrated in Table A1.1, giving data

[49] Exact weeks are recorded if the job has lasted for fewer than four months.

for the 1998 IS sample. Regardless of the earnings measure considered, actual earnings were in all cases less than one percent higher or lower than the comparable usual earnings figure. This suggests that an analysis of gender pay differences using the IS data on actual earnings would have been likely to yield similar results to those presented in this report.

Overtime included, but irregular earnings excluded

The HES records the ordinary time and *regular* overtime elements of earnings in one total amount. Income from irregular earnings, such as bonuses and commissions, are also measured through a series of additional questions. In contrast, ordinary time and overtime earnings are recorded separately in the IS, but no information is gathered on irregular earnings.

The estimates given in Table A1.2 show that at the aggregate level, average hourly *regular* earnings and average hourly *total* earnings have tracked each other fairly closely over the life of the HES. However, the gap between the two has increased in recent years, due to increases in the percentage of workers who report irregular earnings, as well as increases in the average size of the irregular payments received. The percentage of male employees reporting some irregular earnings rose from 14.3 percent in 1984 to 18.1 percent in 1998. The comparable percentage of female employees rose from 8.2 to 14.6 percent. Among males, the gap between regular and total hourly earnings rose from 0.8 percent of regular earnings in 1984 to 2.0 percent in 1998. Among females, the gap increased from 0.3 percent in 1984 to 1.0 percent in 1998. By 1998, these differences were large enough to affect the size of the aggregate gender earnings gap. The ratio of female-to-male average hourly earnings was around one percentage point lower when the total earnings measure was used, rather than the regular earnings measure.

Table A1.2: Comparison of regular and total hourly earnings in the HES

	1984	1990	1994	1998
		$ March 1998		
Males				
Regular hourly earnings	16.42	17.64	16.14	17.37
Total hourly earnings	16.55	17.87	16.37	17.72
Gap (% of regular)	0.78	1.26	1.43	2.05
Females				
Regular hourly earnings	13.05	14.44	13.84	14.67
Total hourly earnings	13.08	14.51	13.95	14.82
Gap (% of regular)	0.29	0.47	0.77	1.04

Note: the figures in this table are calcuated as arithmetic means.

Gender pay ratios using *ordinary* time and *total* time definitions of earnings were compared using data from the 1998 IS. The results of this analysis (not shown here) indicate that the ratio of female-to-male average hourly earnings is similar regardless of whether ordinary time or total time measures are considered, for this sample of wage earners at least. The ratio of female-to-male average weekly earnings is slightly (one percentage point) higher when ordinary time earnings are selected.

Earnings from all currently-held jobs

Both the HES and the IS measure earnings on a job-by-job basis, and hence they provide measures of earnings in respondents' 'main' jobs as well as their secondary jobs. In this study, we use the information on earnings in all current jobs. The weekly earnings figure is

the sum of earnings from all current jobs. For multiple job holders, the hourly earnings figure represents a (weighted) average of the wage earned in each job.

Approximately 4 percent of male employees in the HES samples reported earnings from more than one currently job. This percentage remained fairly stable over the years from 1984 to 1998. On average, around 6.0 percent of female employees reported earnings from secondary jobs during the first three years of the study period (1984-86). This proportion had risen to around 7.5 percent by the final three years (1996-98).

The Income Supplement records substantially lower numbers of secondary earners than does the HES. In the June 1998 survey, only 1.5 percent of male employees and 2.6 percent of female employees reported earnings from second or third jobs. These low reporting rates may be partly due to the fact that the IS is a telephone survey. Possibly some respondents fail to mention second jobs in order to shorten their interview time. It is interesting to note that HES estimates of average weekly earnings are higher than IS estimates (see Table 3.8 in Section 3). The Income Supplements' poorer capture of earnings from secondary jobs is probably one of the reasons for the difference.

In this study, the respondents' main job was taken to be the one for which total weekly earnings were highest. Using the HES data, we analysed the differences between the 'main job' and 'total' estimates of earnings. For both males and females, the difference between average hourly earnings calculated from sample members' main jobs, and average hourly earnings calculated using information from all jobs, was less than 0.5 percent throughout the study period. The ratio of female to male hourly earnings was not materially affected by this choice of definition.

Similarly, substituting a measure of hourly earnings from the individual's main job for a measure of hourly earnings from all their jobs, and using the former as the dependent variable in wage regressions, had little impact on the coefficients that were estimated in regressions using the HES data. The reason is simply that so few respondents reported secondary jobs.

A1.2 Other variables

Explanatory variables used in the research are defined in the following table.

School qualification	Any school qualification, from School Certificate through to Higher School Certificate and Higher Leaving Certificate
Vocational qualification	All tertiary qualifications below degree level
Bachelor degree	Bachelor's degree
Post-graduate degree	Post-graduate degree
Maori	Respondent identified himself/herself as Mäori, alone or in combination with other ethnic groups
Pacific Islander	Respondent identified himself/herself as a Pacific Islander, alone or in combination with other ethnic groups (except Mäori)
Other ethnic group	Respondent reported an ethnic identity other than Pakeha/European, but was not classified to the Mäori or Pacific Island groups
Asian birth	Born in an Asian country
Pacific Island birth	Born in a Pacific Island country
Joint parent	Has a legal or defacto marriage partner, and one or more children aged 0-17 years living at home
Sole parent	Does not currently have a legal or defacto marriage partner, and has one or more children aged 0-17 years living at home
Married/partnered	Is living in a legal marriage or a de facto relationship

Widowed/separated	Is widowed, divorced or separated
Never married	Has never been legally married
Part-time	Usually employed for fewer than 30 hours a week
Region	Region is defined in terms of the Regional Council boundaries. This variable is available for the IS only.
Industry	In the HES, industry is coded to 2-digit NZSIC 87 codes from 1984 to 1996, and to 2-digit ANZSIC codes in 1997 and 1998. Industry is coded to 3-digit NZSIC 87 codes in the Income Supplement.
Occupation	Prior to 1992, occupation was coded to 2-digit NZSCO 68 codes in the HES. From 1992 to 1998 occupation was coded using the NZSCO 91. Occupation was coded to 3-digit level using the NZSCO 91 in the Income Supplement.

APPENDIX 2 – DATA CLEANING

A2.1 Editing of usual earnings records in the Income Supplement

Between 1997 and 1998, a change was made in Statistics New Zealand's editing procedures for the Income Supplement, affecting records that contained a value for 'actual' earnings in the reference week, but no information on 'usual' earnings. In 1998, the relevant information on actual earnings and actual hours worked in the reference week was transferred to each of the blank 'usual' fields, thus expanding the sample of respondents with useable 'usual' data. The data were not edited in this way in 1997. Consequently, in the datasets supplied by Statistics New Zealand to the author, the sample of employees with a complete set of usual hours and earnings data was significantly smaller in 1997 than in 1998.

To increase the comparability of the two annual samples, the 1997 records were modified for this research project. Information on respondents' actual hours and actual hourly earnings, where available, was used to fill empty usual hours and hourly earnings fields. The additional records enlarged the sample of 1997 employees available for the study by 1428 people, representing 12 percent of the total waged sample in 1997.

The resulting employee sample for 1997 is slightly larger in size than the 1998 employee sample. This is consistent with the fact that wage and salaried employment – measured independently of the Income Supplement – was slightly higher in 1997 than in 1998.[50]

The impact of this editing procedure on the demographic profile and mean earnings the 1997 sample was investigated. Results are displayed in Table A2.1 below. The enlargement of the 1997 sample of male employees increased the relative proportions of young males; men with no qualifications; Mäori; Pacific Islanders; and men working in less skilled occupations. It lowered the mean earnings of men in 1997 by approximately 1.2 percent. The demographic and job profiles suggest that the men who reported an 'actual' earnings figure in the Income Supplement but not a 'usual' earnings figure tended to be those working in more casual or temporary employment situations.

The enlargement of the female sample for 1997 had a smaller impact on the demographic profile of the sample and its mean hourly earnings. The relative proportions of Mäori and Pacific Islanders, and employees in sales and service occupations were raised. Mean hourly earnings were not materially affected by the addition of the extra records, however.

Overall, the demographic and occupational profile of the 1997 male sample was more similar to the 1998 male sample after the addition of the extra records. For females, the effect was not so clear cut. The impact of the enlargement of the sample on the aggregate female-to-male hourly earnings ratio was to increase it by around one percentage point.

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[50] The Household Labour Force Survey contains a question that records the employment status of employed people in their *main* job. That question provides an independent measure of the level of wage and salaried employment among 20-59 year olds in the June quarters of 1997 and 1998.

Table A2.1: Effects of adding additional wage and salary earners to the 1997 Income Supplement sample

	Males				Females			
	1997				1997			
	Core sample	Additional records	Total sample	1998	Core sample	Additional records	Total sample	1998
Age								
20-24	13.6	20.1	14.4	14.4	14.0	13.9	14.0	14.1
25-29	15.8	14.7	15.7	16.1	15.1	15.6	15.1	13.4
30-34	15.5	15.8	15.5	14.9	13.7	15.0	13.8	13.4
35-39	15.2	15.0	15.2	15.2	14.8	14.7	14.8	14.3
40-44	12.6	10.6	12.3	12.8	13.6	14.3	13.7	14.3
45-49	11.7	11.0	11.6	10.8	13.1	12.1	13.0	13.3
50-54	9.0	7.2	8.8	8.9	9.8	9.4	9.8	10.9
55-59	6.6	5.6	6.5	6.8	6.0	5.0	5.8	6.3
Qualifications								
No qualifications	19.6	27.4	20.5	18.9	18.7	21.7	19.0	18.6
School	21.0	20.2	20.9	20.8	28.1	21.1	27.3	26.5
Vocational	43.7	47.0	44.1	45.2	40.3	48.9	41.3	40.7
Bachelor	10.4	4.7	9.7	9.8	9.4	6.6	9.1	10.4
Post-graduate	5.1	0.6	4.6	4.8	3.5	1.6	3.3	3.5
Ethnicity								
Pakeha	82.1	75.3	81.3	81.5	83.4	79.9	83.0	82.2
Mäori	9.0	13.4	9.5	9.6	8.2	9.4	8.3	8.6
Pacific Islander	4.1	8.6	4.7	4.1	4.1	7.1	4.5	4.6
Other	4.8	2.6	4.5	4.8	4.2	3.6	4.2	4.6
Occupation								
Mangerial	15.7	4.7	14.3	13.2	7.7	4.9	7.4	8.9
Professional	13.3	7.2	12.5	12.8	18.2	16.9	18.1	18.8
Technical, ass prof	13.4	8.0	12.7	12.0	13.6	12.0	13.5	14.0
Clerical	6.3	4.1	6.0	6.3	28.3	20.7	27.4	25.5
Sales and service	9.4	13.5	9.9	9.5	17.8	25.7	18.7	18.5
Agricultural, fisheries	5.7	4.7	5.6	6.0	2.2	4.0	2.5	2.2
Trades	14.5	19.1	15.1	16.2	1.3	2.1	1.4	0.9
Operators, assemblers	13.0	26.7	14.7	15.3	4.0	5.1	4.1	4.2
Labourers, elementary	8.3	11.9	8.8	8.5	6.6	8.0	6.7	6.7
Mean hourly earnings	16.96	15.35	16.76	17.03	13.85	14.36	13.91	14.05
Sample size	*5145*	*746*	*5891*	*5548*	*5068*	*682*	*5750*	*5533*
Weighted sample size	*548,390*	*76,449*	*624,839*	*606,220*	*76,449*	*67,034*	*582,220*	*568,177*
Independent HLFS estimates of total people aged 20-59 who were working as an employee in their main job			*627,951*	*587,272*			*620,196*	*581,903*

The practice of including 'actual' wage earners within a sample of 'usual' wage earners may seem questionable. The primary motivation for modifying the 1997 Income Supplement sample in the manner described here was simply to ensure that the 1997 and 1998 samples were as similar as possible. An incidental benefit is that the enlarged IS samples are likely to be more similar to the HES samples than would have been the case if the respondents who reported their actual earnings only were excluded. This is because the structure of the HES questionnaire ensures that an earnings estimate is obtained for *every* respondent who was employed in a wage or salaried job at the time of their interview.

A2.2 Exclusion of outliers

Two slightly different samples of employees were used in this study. The *full waged* samples from the HES and the IS include all wage or salary earners with complete and valid information on usual weekly and hourly earnings, and usual hours worked. These samples are used in Section 4 of the report. The *analytic* samples are slightly smaller, because individuals

without valid information for qualifications, ethnicity, and occupation are also excluded. These samples are used in Sections 5–7 of the report.

Full waged samples

Individuals whose usual regular hourly earnings were between zero and $1 (in March 1998 values) were transferred out of the waged samples. Twenty-one such records were excluded from the Income Supplement samples and 47 from the HES samples.

A small number of wage earners with very high values of weekly or hourly earnings, located well above the rest of the distribution, were also excluded. The rationale for this was to reduce the sensitivity of summary statistics of the centre of the distribution to outliers. Thresholds for the exclusion of upper-end outliers were set after visual inspection of the data. A total of nine records with weekly earnings of $5,000 or above, or hourly earnings of $150 or above, were excluded from the Income Supplement samples. A further 18 records with usual weekly hours of 100 or more were also excluded from the Income Supplement samples. Twelve records with very high values of weekly or hourly earnings were excluded from the HES samples. In this case the weekly earnings threshold was set at $6,000 and the hourly earnings threshold at $250.

Analytical samples

A total of 376 observations (205 males and 171 females) were excluded from the HES analytic samples covering the years 1989 to 1998. This represents 1.3 percent of the 'full waged' sample for those years. Most of the observations were excluded because information on educational qualifications had not been supplied. The remainder lacked information on occupation.

A total of 125 observations (77 males and 48 females) were excluded from the analytical samples for the Income Supplement, representing 0.3 percent of records in the full waged samples. As in the case of the HES, the majority of these cases were dropped because of missing information on qualifications.

APPENDIX 3 – SELECTION BIASES ASSOCIATED WITH PARTICIPATION IN WAGED EMPLOYMENT

Wages can only be observed for those women and men who are in paid employment. If there are systematic unobservable differences between the people who are in employment and the rest, then confining the analysis of earnings to the sample of current employees may lead to biased estimates of the parameters that determine individual earnings.

Many studies in the gender earnings gap literature attempt to 'correct' their earnings function estimates for women (surprisingly, however, not those for men) using the procedure suggested by Heckman (1979). The first step of this procedure is to estimate a probit model of the probability of being observed in waged employment, using all of the women in the sample. This generates a 'selection-correction parameter' for each woman. In the second step, the estimated selection parameter is included as a right-hand-side variable in the wage equation for the wage-earning women. The coefficient on this term could have either a positive or a negative sign, depending on whether the unmeasured characteristics of the wage-earning women, compared with those of the non-participants, lead to higher or lower wages.

A difficulty with this procedure is that estimating the participation selection factor correctly requires the use of information on characteristics that 'predict' participation, but do not simultaneously determine wages (Hamermesh, 1999, p.18). Such variables are difficult to find.

In this study, the potential role of unobserved sample selection factors in the determination of earnings was explored using the 'Heckman' procedure in STATA. In that procedure, a selection (participation) equation and a wage equation are simultaneously estimated, and a likelihood ratio test of whether the errors of the two equations are independent of each other is carried out.

Selection models were estimated in which: (i) self-employed people were included in the population of non-waged, along with the unemployed and non-participants; and (ii) the records of self-employed people were excluded entirely.

In the HES samples, the following variables were available for use in predicting the participation of men and women in waged employment separately from their wage: the non-earned annual investment income of the respondent and his/her partner; whether the respondent was a home owner; and the educational level of the respondent's partner (captured by a set of dummies). In the IS samples, the only information available for predicting participation was the educational level of the respondent's spouse.

Information on the number and ages of the respondent's children was not used as identifying information in the participation equations for women, because it is seems likely that children have direct effects on women's wages. The variables included in both the wage and the selection equations were years of experience and experience squared; highest qualification; ethnic identity; geographic place of residence; defacto marital status; parental status and numbers of dependent children.

The 'Heckman' procedure in STATA carries out a likelihood ratio test of whether the errors of the two equations are independent of each other. It also reports the estimates and standard errors of ρ, σ and λ. For the all of the models that were estimated for women, and for some

(but not all) of those estimated for men, the selection effect estimates were positive in sign but not statistically significant. In some of the models estimated for males, estimates of the sign and size of ρ and λ were very sensitive to the exclusion or inclusion of alternative 'identifying' variables in the participation equation.

The author's failure to estimate significant and stable selection parameters may be due to the limited range of information that was available in the HES and IS datasets to predict participation separately from wages.

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APPENDIX 4 – THE ESTIMATION OF EXPERIENCE

Overseas studies have indicated that the gap between men and women in average years of prior work experience is a factor often making a significant contribution to the gender pay gap. Women tend to have less work experience than otherwise similar men, and this is associated with lower earnings. Hence, prior work experience should be measured as accurately as possible in gender pay gap studies.

In New Zealand, the official household and population surveys have not collected measures of work experience. Consequently, estimates of experience must be imputed.

This Appendix begins by presenting new evidence on the actual work experience histories of New Zealanders, drawn from the New Zealand Women: Fertility, Employment and Education Survey 1995 and from the Population Census. In the second section, the methods that were used in this study to estimate prior work experience values for the members of the HES and IS samples are outlined. In the third section, the results of the imputation are summarised and their quality is evaluated. The limitations of the imputation methods are noted.

A4.1 Evidence on Work Experience Histories in New Zealand

Evidence from the Fertility Survey

The New Zealand Women: Fertility, Employment and Education Survey 1995, which we refer to here for brevity as the Fertility Survey, is currently the only statistical source that provides information on the employment histories of a sizeable and representative sample of New Zealanders. The Fertility Survey was designed and administered by the Population Studies Centre of the University of Waikato. It collected information relating to fertility and family formation issues, including detailed employment histories, from a sample of about 3,000 women aged between 20 and 59 in 1995.[51]

The response rate to the Fertility Survey was 54 percent (Marsault, 1997, p.30). The demographic profile of respondents indicates that the sample contains a somewhat higher share of older women (aged 35-54) and more highly educated women than the target population. This indicates a risk that estimates of women's average work experience levels obtained from the survey may be biased. However, incorporating controls for the age and qualifications profile of the Fertility Survey sample in analyses of these data should help to reduce the impact of any biases.

In the collection of the work history information, respondents were asked to recall the start and end dates of each job they had held since leaving school. Wherever possible both the month and the year were recorded for start and finish dates. Respondents were also asked to recall their age when starting and finishing each job, and the usual hours worked in each job. Due to recall difficulties, the information collected from many respondents for these variables was incomplete. The first step in using the Fertility Survey data was to address the missing data problem.

The following approach was adopted. Only a small percentage of the jobs reported in the survey were recorded without information on the starting or finishing *year*. Where it was not

[51] See Marsault et al, 1997, for detailed information on the survey.

possible to impute the start or end year using the information supplied about the respondent's chronological age, jobs with missing values for the start or finish year were dropped from the pool of data used in the estimation of cumulative years of work experience. Only 0.6 percent of jobs were excluded from the job database for this reason. Missing values for the *month* in which a job started or finished were then imputed, essentially by random assignment of a value between 1 and 12.[52] Twenty-six percent of all starting and finishing month fields were imputed in this manner. Other imputation methods were also experimented with, but the impact of variations in imputation method on the mean and distribution of the final variable of interest, cumulative total months of work experience, appeared to be small. Finally, a value for hours of work was imputed when missing, so that all jobs in the database could be classified as either full-time or part-time. Hours were imputed for 1.5 percent of jobs. The assignment of a value was based on the full-time or part-time status of the job held by the respondent immediately before the one with missing hours data.

The distribution of the experience variable thus obtained is shown in Table A4.1. Two measures of women's cumulative years of past paid work experience are shown. The 'total experience' measure counts every month in which any type or level of employment was undertaken, including all spells of part-time employment. Part-time and full-time employment are effectively given equal weighting in this measure. The 'full-time experience' measure counts only jobs involving 20 or more hours of work per week. The 20 hour threshold was chosen to enable comparison of the Fertility Survey experience estimates with alternative estimates that were obtained from the Census (summarised below).

Table A4.1: Fertility Survey estimates of women's average years of past paid work experience

	All women		*Women in W&S empt*	
	All jobs	*FT jobs**	*All jobs*	*FT jobs**
20-24	2.7	2.4	3.7	3.2
25-29	6.4	6.0	7.5	7.1
30-34	9.5	8.9	11.4	10.5
35-39	12.5	11.5	14.2	12.8
40-44	15.8	14.5	17.9	16.3
45-49	19.6	17.8	21.8	20.1
50-54	22.1	20.4	25.8	23.8
55-59	23.9	21.7	30.5	27.2
All ages	**13.3**	**12.2**	**15.5**	**14.2**

* Counts experience in jobs of 20 or more hours per week

Source: New Zealand Women: Fertility, Employment and Education Survey, University of Waikato, 1995

The average woman in the Fertility Survey had 13.3 cumulative years of past paid work experience, of which 12.2 were full-time. The rather small difference between the 'total' and 'full-time' experience figures suggests that there may have been some underreporting of part-time jobs in the survey.

Women who were employed in waged or salaried jobs at the time of the survey (54 percent of the total sample) had higher levels of experience on average – around two years more than all women (15.5 years of total experience, and 14.2 years full-time experience).

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[52] Information supplied by respondents about their age when starting or finishing a job was also built into the imputation process when it was available. This information was used to restrict the set of possible imputation values to the months in which the respondent's age would have corresponded to their reported age.

The age-group means in Table A4.1 indicate that women gain additional experience most rapidly during their twenties and between the ages of 40 and 54. The typical woman who was in her late 50s in 1995 had accumulated around 22 years of full-time work experience. If working in a waged job at the time of the survey, she was likely to have a total of 27 years of full-time experience.

Table A4.2: Fertility Survey estimates of the work experience of female employees

	Mean years
Highest qualification	
No qualifications	16.1
Secondary qualifications	13.3
Other tertiary qualifications	14.7
Bachelors degree	10.0
Post graduate degree	14.2
Full-time status	
Part-time	12.1
Full-time	15.2
Parental status	
Sole mother with dep chn	11.7
Couple with dep chn	12.9
No dep chn	15.6
Occupational group	
Management	15.9
Professional	15.1
Technical, ass prof	14.4
Clerical	15.4
Service and sales	12.1
Agricultural	13.4
Trades	11.9
Operators, drivers	15.0
Labourers	12.2

Source: New Zealand Women: Fertility, Employment and Education Survey, University of Waikato, 1995

Table A4.2 tabulates the full-time work experience levels of demographic sub-groups of currently-employed women. The means shown in Table A4.2 do not control for differences in age or other compositional factors that could be contributing to the variations in average levels of experience. Women without any educational qualifications had accumulated more experience than those in any other educational group (which is likely to be at least partly due to their higher average age). Women currently working on a full-time basis had significantly higher levels of experience than those working part-time. By occupational group, women employed in management jobs had the highest mean level of experience, and women in trade-related occupations the lowest.

The Fertility Survey data also provide some insight into the changes in women's work behaviour and experience patterns across time. Table A4.3 tabulates the experience levels attained by successive birth cohorts by the time they had reached a given age. The rows in Table A4.3, read from left to right, show the growth of experience as cohort members age. The columns of Table A4.3 can be read downwards to identify trend increases or decreases in the full-time work experience that was attained by women of successive cohorts. For example, women born in the years 1936-40 had attained 5.7 years of full-time experience by the time they were aged 25, on average, while women born in the years 1966-70 had attained only 4.7 years of full-time experience on average by that age.

Table A4.3: Experience levels attained by successive birth cohorts: all women

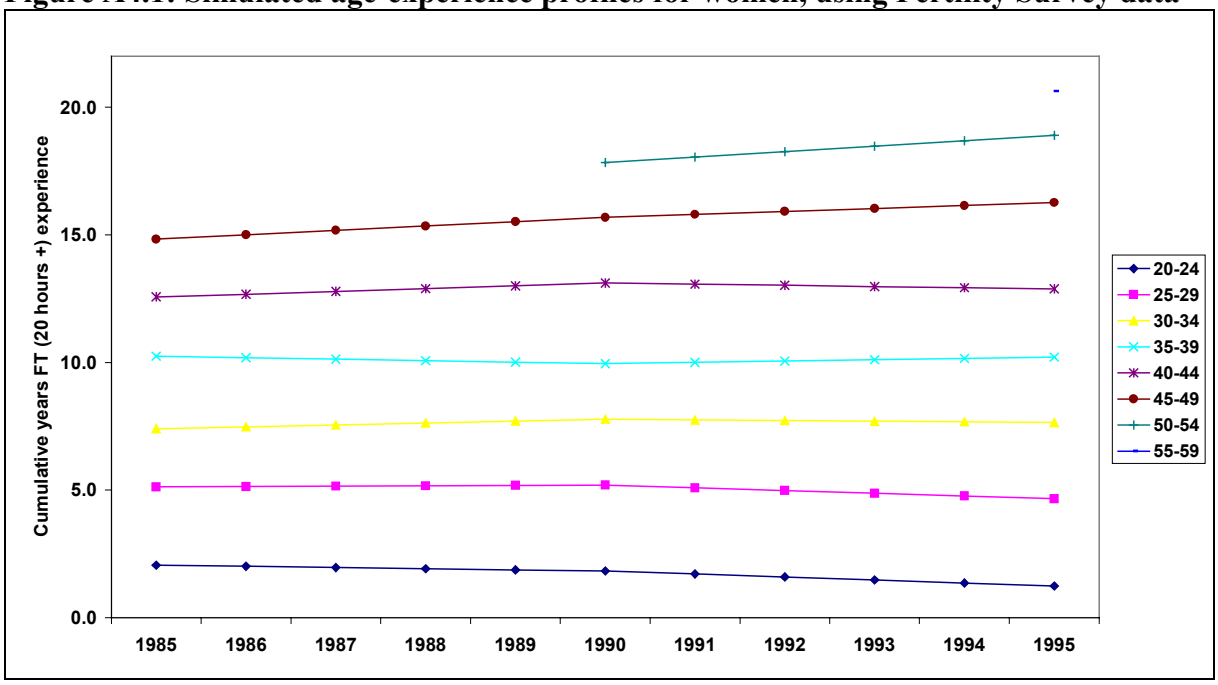
	Cumulative full-time experience attained by age….							
Birth cohort	***20***	***25***	***35***	***40***	***45***	***50***	***55***	***60***
1936-40	2.8	5.7	7.5	9.5	12.0	14.8	17.8	20.6
1941-45	2.7	5.6	7.6	9.9	12.6	15.7	18.9	
1945-50	2.6	5.6	7.9	10.2	13.1	16.3		
1951-55	2.2	5.0	7.4	10.0	12.9			
1956-60	2.0	5.1	7.8	10.2				
1961-65	2.1	5.2	7.6					
1966-70	1.8	4.7						
1970-75	1.2							
All birth cohorts	**2.1**	**5.2**	**7.7**	**10.0**	**12.7**	**15.8**	**18.4**	**20.7**

Source: New Zealand Women: Fertility, Employment and Education Survey, University of Waikato, 1995

The columns for ages 20 and 25 show declining levels of experience, while the columns for ages 40, 45, 50 and 55 show rising levels of experience. Presumably the decline in the full-time experience of younger women is the consequence of the increases that have occurred in school and tertiary education participation rates. In neither case are the changes over time particularly large.

Figure A4.1 gives a visual representation of this information, focusing on the age-specific experience levels that might have been observed over the decade from 1985 through to 1995, had cross-sectional surveys been conducted before 1995. Figure A4.1 reinforces the point that the experience patterns of women are changing, as the experience levels of very young women fall and the experience levels of older women rise. While the cumulative changes are probably quite substantive, the pace of change is not dramatic.

Figure A4.1: Simulated age-experience profiles for women, using Fertility Survey data



Evidence from the Population Census

The Population Census has measured New Zealanders' employment rates repeatedly over many decades. By tracking the average employment rates of successive birth cohorts from census to census, it is possible to build up 'synthetic' estimates of the average number of

years of work experience that men and women are likely to have undertaken during their past working lives.

Until 1981, Census employment measures counted workers who were employed for 20 or more hours a week only. This means that only *full-time* work experience estimates can be derived for the majority of age and birth cohorts, where full-time is defined as 20 or more hours per week.

Census-based estimates of the full-time work experience profiles of men and women in 1986, 1991 and 1996 are shown in Table A4.4. Very substantial gender differences are apparent. In 1986, a typical 55-59 year old male was likely to have worked full-time for nearly 40 years during his past working life. A typical woman of the same age group was likely to have accumulated only 16.4 years of full-time experience – a difference of nearly 23 years. Weighted mean experience levels, averaged across all age groups are shown at the bottom of the table. In 1986 men had 19.3 years of full-time experience on average, 9.1 years more than the mean of 10.1 among women.

Table A4.4: Census estimates of full-time experience levels

	Males			*Females*			*Difference (M-F)*		
	1986	***1991***	***1996***	***1986***	***1991***	***1996***	***1986***	***1991***	***1996***
20-24	4.5	3.9	2.9	3.6	3.3	2.4	*0.9*	*0.6*	*0.5*
25-29	9.2	8.4	7.4	6.5	6.4	5.9	*2.6*	*2.1*	*1.4*
30-34	14.1	13.4	12.3	8.6	8.8	8.7	*5.5*	*4.6*	*3.6*
35-39	19.4	18.4	17.3	10.7	11.0	11.0	*8.7*	*7.4*	*6.3*
40-44	24.7	23.9	22.5	12.9	13.6	13.7	*11.9*	*10.3*	*8.7*
45-49	29.7	29.1	28.0	14.5	15.9	16.6	*15.2*	*13.3*	*11.3*
50-54	34.7	34.0	33.2	15.9	17.2	18.8	*18.8*	*16.8*	*14.4*
55-59	39.3	38.7	37.7	16.4	18.0	19.5	*22.9*	*20.7*	*18.2*
Mean experience, all ages*	**19.3**	**18.8**	**18.4**	**10.1**	**10.7**	**11.2**	***9.1***	**8.1**	**7.2**
Mean age	**36.8**	**37.1**	**37.8**	**36.7**	**37.0**	**37.6**	***0.1***	***0.1***	***0.1***

Source: New Zealand Population Censuses, 1945 to 1996

* Weighted mean using age group frequencies as weights

Notes: Figures are estimated from the employment rates of 5-year synthetic birth cohorts

Full-time work experience is defined as time spent employed in jobs of 20+ hours per week

The Census figures for men show a decline in average full-time experience levels of in all age groups between 1986 and 1996. Individual age-group means typically declined by 1-2 years. The decline in the weighted mean for all 8 age groups (from 19.3 to 18.4) was smaller, reflecting the fact that the ageing of the population partially offset the effects of the decline in experience levels at any given age. The average age of the male population rose by about 1 year (as did the average age of the female population).

The experience levels of women who were in their twenties also declined over the decade, by a year or so. At higher ages, women's experience levels rose over the decade, most notably among women aged between 45 and 59. The 50-54 year age group, for example, gained nearly 3 years in average years of full-time work experience. The mean experience level of all women averaged, across age groups, increased by 1.1 years. This increase was aided by the ageing of this population.

Figure A4.2: Simulated full-time experience profiles of men, based on employment rates of quasi-birth cohorts, Census

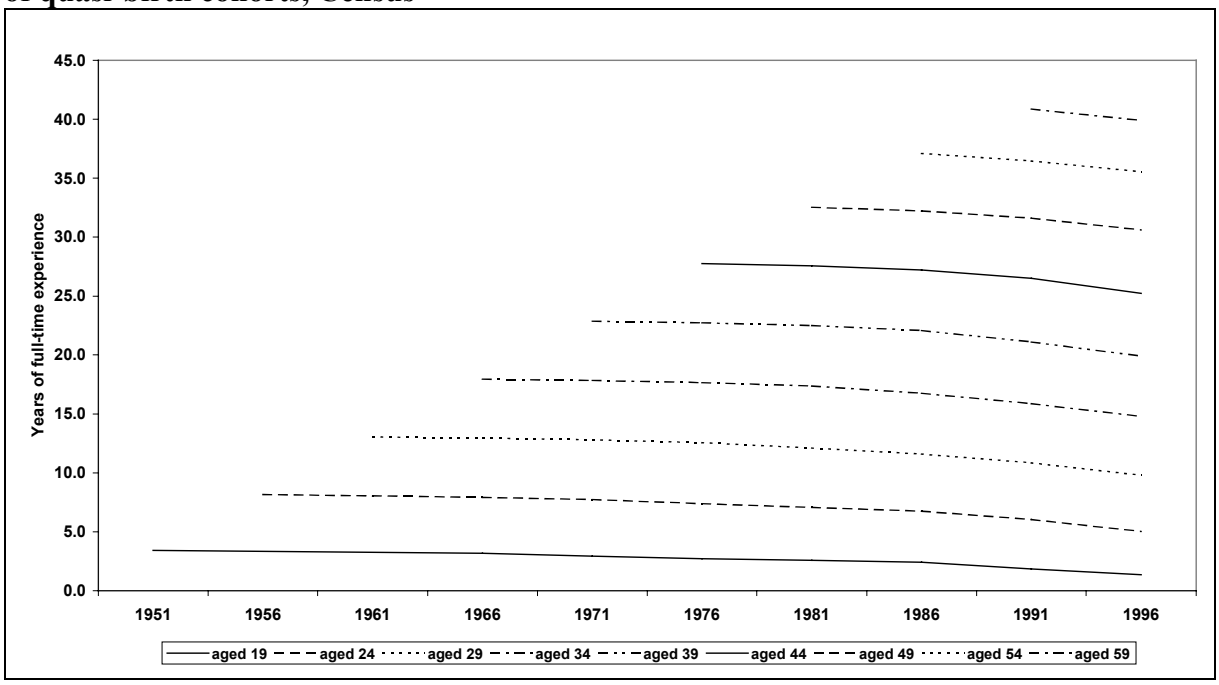
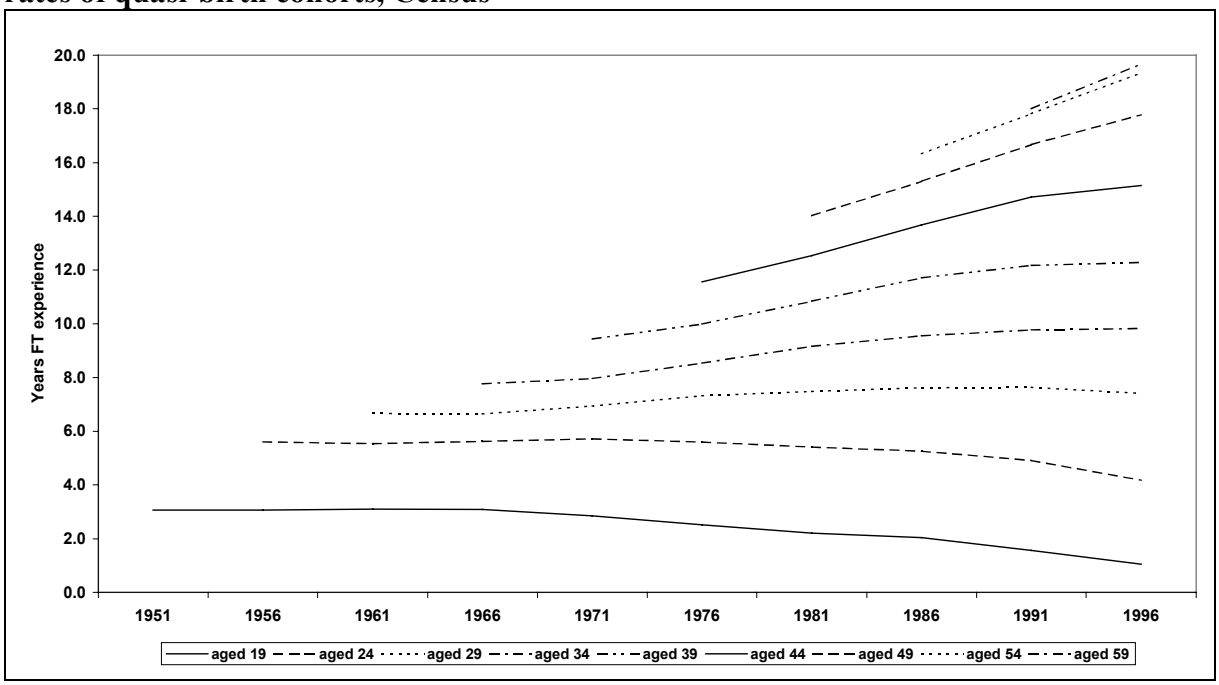


Figure A4.3: Simulated full-time experience profiles of women, based on employment rates of quasi-birth cohorts, Census



Figures A4.2 and A4.3, which plot Census-derived experience estimates over the years from 1951 to 1996, show these developments in a longer-term perspective. The lines plotted for 19-year-olds slope downwards very gradually from the 1960s, suggest that rising school retention rates were having an impact well before the 1980s (although the pace of change may have speeded up during the 1980s). The lines plotted for women aged 29 and above suggest that rising employment rates were raising the average experience profiles of older women during the 1970s and possibly earlier.

As a result of the shifts in employment patterns, the gender gap in experience levels – shown in the right-hand section of Table A4.4 – was reduced across all age levels. The experience gap between men and woman aged in their twenties was roughly halved between 1986 and 1996. The experience gap between older men and women (those aged 40 or above) was reduced by around one-quarter. Despite this convergence, the gender gap in experience for adults aged 30 or above remained substantial in both relative and absolute terms. In 1996, a 55-59 year old man was still likely to have accumulated nearly twice the full-time experience as a 55-59 year old woman. The gender gap for the total population was 7.2 years.

The Census experience estimates for women in 1996 can be compared with those recorded by the Fertility Survey in 1995 (shown in the 2nd column of Table A4.1). The age-group means are reasonably close to each other. Older women in the Fertility Survey sample have somewhat higher experience levels. There is a difference of about 2 years for the 55-59 year age group. However, the similarity of the two sets of estimates is reassuring.

A4.2 The imputation of work experience

Three types of experience variable were used in this study:

- Potential work experience, which was estimated in the conventional manner;
- Imputed actual experience, estimated using in-sample data and the Zabalza and Arrufat (1985) method;
- Imputed actual experience, estimated using the Filer (1993) method and data from the Fertility Survey 1995.

The imputation methods are outlined in this section.

The goal of the imputation work was to estimate the *full-time* work experience of the men and women in the HES and IS samples, where full-time is defined as employment of 20 hours or more. There were two main reasons for focusing on this particular measure of experience. First, it is a compromise between the two extremes of: (a) giving a zero weighting to all part-time employment (any job of less than 30 hours, in the official definition); or (b) assigning part-time and full-time employment equal weights. One would expect spells of part-time employment to increase employees' skills and experience, but not as rapidly as spells of full-time employment. Second, the Census-derived estimates of experience, which are based on employment in jobs of 20 hours or more, provided a convenient external baseline against which to compare and evaluate both the Fertility Survey data on actual experience and the predictions generated through the imputation work.

The Fertility Survey measures of full-time and total years of work experience are fairly close to each other (see Table A4.1). This means that the alternative approach of predicting *total* experience may not have led to very different predictions.

Potential work experience

Potential work experience was calculated as age minus estimated years of schooling minus 5. 'Years of schooling' was estimated on the basis of the individual's highest qualification, as follows:

In the Income Supplement:

No qualifications – 10 years;

School Certificate – 11 years;
Sixth Form Certificate or UE – 12 years;
Bursary, Higher School Certificate or Higher Leaving Certificate – 13 years;
Other school qualifications not easily classified – 12 years;
Non-university diplomas or certificates – 14 years;
Bachelor degrees – 16 years;
Post-graduate degrees – 18 years.

In the Household Economic Survey, which collected slightly less detail on school qualifications, everyone with a highest school qualification above School Certificate was assumed to have completed 12 years of schooling. Otherwise, the estimation of years of schooling was the same as in the Income Supplement.

The Zabalza and Arrufat imputation method

The imputation method developed by Zabalza and Arrufat (1985) begins with the estimation of a probit model describing the tendency of the individuals in the sample to be employed. The coefficients obtained from this probit equation are used to predict the probability of employment for each individual backwards through time, back to the year when they finished their full-time education. In making the backward predictions, any variables in the employment equation that change through time in a predictable way (such as age, and number and ages of children) are backdated.

A prediction of each individuals' cumulative years of work experience is then obtained by summing their predicted probabilities of being employed across all past years, from the year of their entry into the labour force to the year of the survey. Essentially, individuals are assumed to have been employed for a portion of each year corresponding to their predicted employment probability in that year. For example, a woman with a predicted full-time employment probability of 0.65 in 1990 is assumed to have worked full-time for 65 percent of 1990.

Previous applications of this method (Zabalza and Arrufat 1985; Kidd and Shannon, 1994) included a real wage variable in the employment probability equation. A wage variable was *not* included in the employment equations for the current study. Predicting the wages of New Zealand workers in the 1950s, 1960s and 1970s would have been a difficult task given the absence of individual-level wage data for those decades. Kidd and Shannon (1994, p.738) report that they obtained better results from the imputation procedure when they did *not* include a wage variable in their employment equations for Canadian and Australian women.

In this study, a logit rather than probit model was used to predict employment probabilities. The use of logit rather than probit estimation should not materially affect the results obtained in this particular application. The logit employment equations were estimated separately on the samples of men and women. The dependent variable was a (1,0) indicator of full-time employment, defined as employment of 20 or more hours a week. Both self-employed and waged employees were included in the 'employed' group. The reference group comprised all part-time employees, and people who were unemployed or out of the labour force.

The explanatory variables were: age; age squared; highest qualification; ethnic group; and number of children in each of four age groups (0-4, 5-9, 10-14, and 15-17). Marital status was not included as it was not possible to reconstruct individuals' past marital status histories.

The data for adjacent annual samples were pooled, to give more stable estimates. The 1997 and 1998 samples of the Income Supplement were combined. Only the HES samples from 1988 through to 1998 contained the full set of variables required for the imputation procedure. Estimates were therefore obtained using the following HES sub-samples: (i) 1988-90; (ii) 1996-98; and (iii) all 11 samples from 1988 through to 1998, pooled. It was expected that the 1988-90 coefficients would lead to the most accurate predictions of cumulative lifetime work experience, particularly for older men and women, as the employment patterns in 1988-90 are likely to have resembled those of earlier decades (when older workers acquired most of their experience) more closely than those of 1996-98. In practice, the coefficients obtained using the three alternative samples were fairly similar to each other, however. The coefficients that were estimated from the 1988-90 sample were used in the construction of the final experience variable within the HES, as outlined below.

The logit employment equations all had highly significant log likelihood ratios. Typically the equations for men were able to correctly predict around 70 percent of cases, and those for women around 75 percent of cases.

The Filer imputation method

Filer (1993) proposed an alternative method for estimating women's experience. The basic approach is to find a supplementary data source that contains a direct measure of work experience, regress the experience variable on an appropriate set of independent variables within the context of the supplementary sample, and then use the coefficients obtained to predict experience within the primary sample. Spilsbury and Kidd (1997) used this method to predict experience in two Australian datasets.

In Filer's version of the method, the predicting regression equations, which include age, education, race, marital status and number of children as explanatory variables, were estimated separately for the members of each major occupational group. The rationale for this was that women's experience levels vary significantly by occupation. Filer was able to obtain better predictions using separate equations for each occupation.

In this study, a simpler approach using a single regression equation was adopted because the supplementary dataset – the Fertility Survey – was not large enough to justify disaggregation of the sample by occupational group. However, occupational dummies were included in some specifications in order to improve the predictive power of the models.

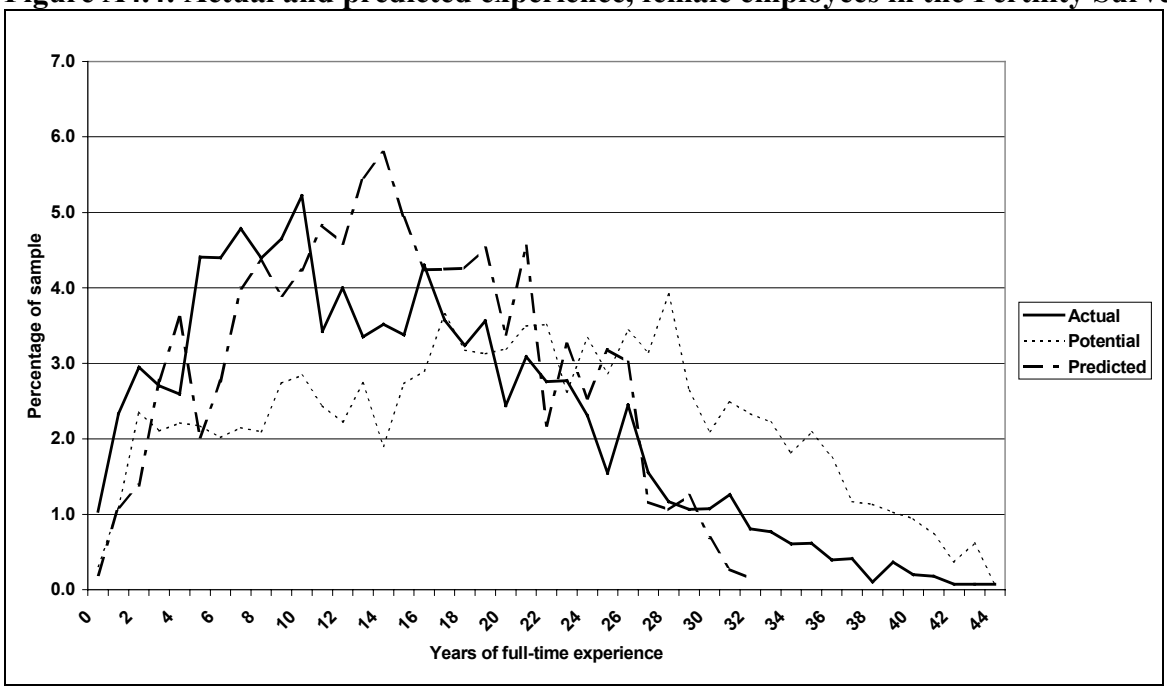
Women's experience could have been modelled using the records of all women, or the sub-sample of wage earners. Both approaches were explored. The dependent variable was years of full-time work experience. The explanatory variables used to predict experience were age, highest qualification, ethnic group, marital status, and number of children in each of four age groups (0-4, 5-9, 10-14, and 15-17). Age was entered using dummies for each separate year, in order to increase the scope for variation across individuals and improve the identification of experience in subsequent wage equations containing many of the same variables as would be used in the prediction of experience. Highest qualification was entered using four dummy variables, ethnic group using three dummies, and marital status using dummies for 'never married' and 'divorced, separated or widowed'. One-digit occupational group dummies were included in some of the specifications.

The preferred specifications, which gave the best in-sample predictions for the wage-earning women in the Fertility Survey, were estimated using the wage earner records only (n=1618).

The regression equation that was used to predict experience in the context of the Income Supplement included occupational dummies. This equation (1) had an adjusted R^2 of 0.617 and an F score of 43.8. The regression equation used to predict experience in the context of the HES did not include occupation because the coding of occupation within the HES has changed through time. This equation (2) had an adjusted R^2 of 0.607 and an F score of 49.1.

The correlation between actual experience and potential experience for wage-earning women in the Fertility Survey was 0.75. The correlation between actual and predicted experience, using the preferred prediction equations, was 0.79 in both cases. Figure A4.4 compares the frequency distributions of actual, potential and predicted experience (predicted using equation 1) within the Fertility Survey sample of waged women. The predicted experience profile is somewhat more clustered at the centre of the distribution than is actual experience, but the predicted and actual distributions are reasonably close to each other.

Figure A4.4: Actual and predicted experience, female employees in the Fertility Survey



A4.3 Results of the imputations

Income Supplement

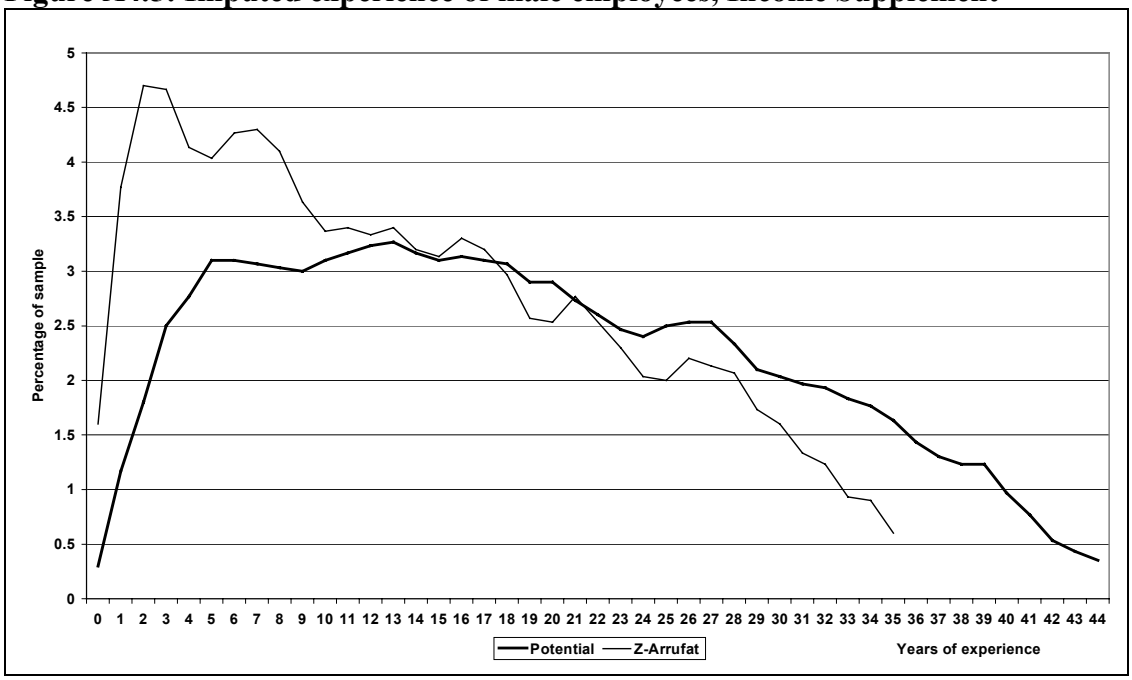
The experience predictions obtained for waged men and women in the Income Supplement samples are shown in Table A4.5 and Figures A4.5 and A4.6. The 1997 and 1998 samples are combined in this table.

Men in the 20-24 year age group were estimated to have an average of 4.3 years of potential experience. The potential experience estimates increase fairly uniformly to reach a mean of 38.9 years for the 55-59 year old age group. The overall mean for all males is 18.7. Women's potential experience estimates are slightly higher than men's for all age groups except the youngest two. This is probably a reflection of the fact that women in the older age groups spent less time on average acquiring post-school qualifications than did their male counterparts.

Table A4.5: Experience imputations by age group, IS employees

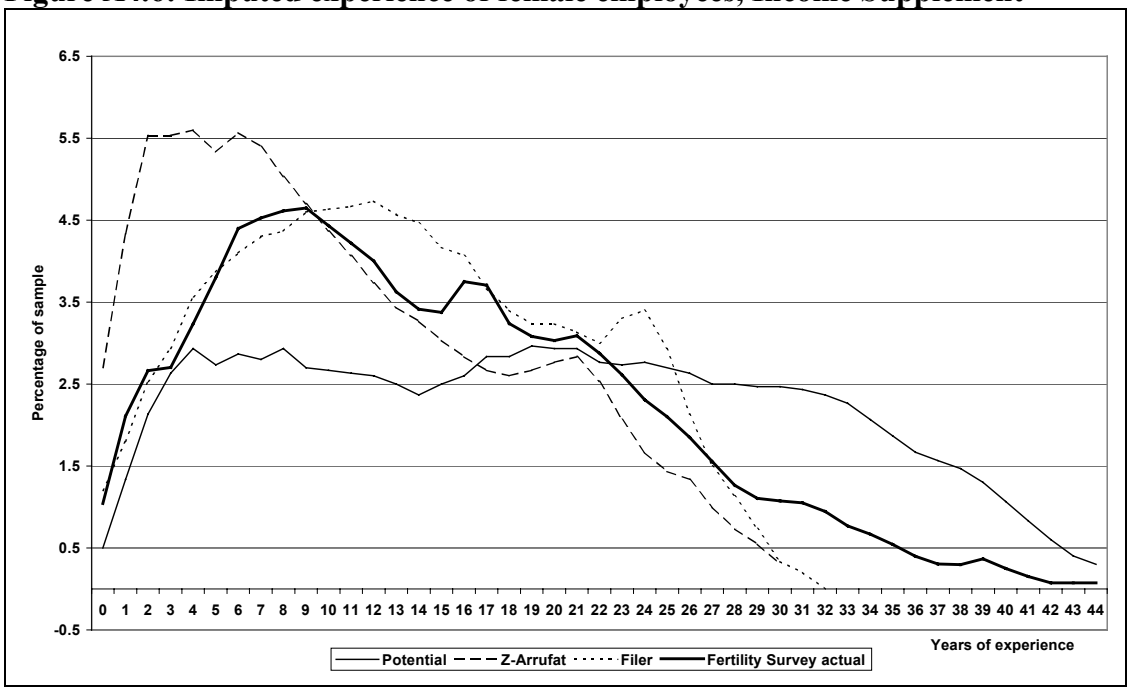
	Males		Females			*Fert Survey*
Age group	**Potential**	**Z-Arrufat**	**Potential**	**Z-Arrufat**	**Filer**	***(actual)***
20-24	4.3	2.3	3.8	2.0	3.7	*3.2*
25-29	8.9	5.8	8.5	4.8	7.4	*7.1*
30-34	13.8	9.6	13.9	7.4	10.7	*10.5*
35-39	18.7	13.9	19.1	9.9	13.3	*12.8*
40-44	23.8	18.3	24.1	13.0	16.5	*16.3*
45-49	28.7	22.7	29.4	17.6	20.5	*20.1*
50-54	33.8	27.1	34.3	21.8	24.2	*23.8*
55-59	38.9	31.2	39.3	24.8	26.9	*27.2*
All ages	**18.7**	**14.2**	**19.6**	**11.3**	**14.1**	***14.2***
Mean age of sample		**36.9**	**37.5**			

Figure A4.5: Imputed experience of male employees, Income Supplement



The Zabalza and Arrufat estimates of actual years of full-time experience, for both men and women, are much lower. Male employees are predicted to have only 14.2 years of full-time experience on average – which is several years below the 1996 Census estimate (for all men, not just current employees) of 18.3 years. Female employees are predicted to have an average of 11.3 years of experience. That average is a little higher than the 1996 Census estimate for all women (11.2) but lower than the Fertility Survey measure for waged women of 14.2 years. The age-profile of women's experience, estimated using the Zabalza and Arrufat method, is also steeper than the Fertility Survey and Census measures suggest it ought to be. The Zabalza and Arrufat method assigns young women too few years of full-time experience, but the predictions rise quickly with age, with the result that the estimates for older women may be a bit of the high side if one regards the Census estimates as the most plausible guide to actual experience levels (although not if one takes the Fertility Survey estimates as the standard).

Figure A4.6: Imputed experience of female employees, Income Supplement



The Zabalza and Arrufat method utilises only information on current employment patterns, while in reality IS sample members accumulated most of their work experience in earlier periods when employment patterns were different. The significant underestimation of male work experience levels may be due to the fact that male full-time employment rates in 1997-98 were well below the long-term averages over the post-war years. Another bias in the method arises from the fact that the data source, in this case the Income Supplement, does not include information on the children that were born to older women but have since left home. Thus, information about those children cannot be taken account of in the prediction of individuals' employment probabilities at various years in the past. As a result, one would expect the predictions for older women to be less accurate than those for younger women.

The column headed 'Filer' in Table A4.5 gives the imputed experience values that were obtained using the Filer method. Those estimates are higher than the Zabalza and Arrufat estimates for all age groups. They give an overall mean experience level of 14.1 years. The Filer predictions are very similar to measures of actual experience obtained from the Fertility Survey itself (shown in the final column of Table A4.5), suggesting that compositional differences between the two survey samples were not large enough to lead to substantively different experience profiles.

In the analysis of the gender earnings gap in this study the following imputed measures of experience for IS sample members were used:

- For males – potential experience only. The potential experience measure is preferred because the age-group and overall means for potential experience are closest to the estimates of men's actual experience that were derived from the Population Census (which is our only external evidence on men's actual experience levels).
- For females – both the Zabalza and Arrufat and the Filer imputations were used, serving as 'low' and 'high' estimates of the actual experience levels of the IS sample members.

These imputed variables are summarised in Table A4.6. The right-hand section of the table gives the male-female differences in estimated experience levels.

Table A4.6: Final experience imputations for Income Supplement employee samples

	Males	Females			*Male-female experience gaps*		
	Potential	Potential	Z-Arrufat	Filer	*Potential*	*Z-Arrufat*	*Filer*
Age group	(1)	(2)	(3)	(4)	*(1-2)*	*(1-3)*	*(1-4)*
20-24	4.3	3.8	2.0	3.7	*0.5*	*2.3*	*0.6*
25-29	8.9	8.5	4.8	7.4	*0.4*	*4.1*	*1.5*
30-34	13.8	13.9	7.4	10.7	*-0.1*	*6.4*	*3.1*
35-39	18.7	19.1	9.9	13.3	*-0.5*	*8.8*	*5.4*
40-44	23.8	24.1	13.0	16.5	*-0.4*	*10.7*	*7.3*
45-49	28.7	29.4	17.6	20.5	*-0.7*	*11.0*	*8.1*
50-54	33.8	34.3	21.8	24.2	*-0.5*	*12.0*	*9.7*
55-59	38.9	39.3	24.8	26.9	*-0.4*	*14.1*	*12.0*
All ages	**18.7**	**19.6**	**11.3**	**14.1**	***-0.8***	***7.4***	***4.7***

Household Economic Survey

Estimates of the potential experience levels of waged employees in the HES are shown in Table A4.7. The age-group means are fairly similar to the age-group means calculated for the IS sample members. Female employees in the HES, like the IS, have slightly higher levels of potential experience than do males. For both sexes, mean potential experience levels were rising over the decade from 1989 to 1998, increasing by around 1 year. This trend is almost certainly due to the ageing of the employee population.

Table A4.7: Potential experience by age group, HES employees

	Males			Females			*Male-female gap*		
Age group	1989-91	1993-95	1996-98	1989-91	1993-95	1996-98	*1989-91*	*1993-95*	*1996-98*
20-24	4.9	4.8	4.7	4.6	4.6	4.1	*0.3*	*0.2*	*0.6*
25-29	9.4	9.3	9.1	9.6	9.2	9.1	*-0.2*	*0.1*	*0.0*
30-34	14.2	14.1	14.0	14.7	14.2	14.5	*-0.6*	*-0.1*	*-0.4*
35-39	19.2	19.0	18.8	19.8	19.6	19.4	*-0.6*	*-0.6*	*-0.6*
40-44	24.1	23.7	23.7	24.9	24.7	24.3	*-0.8*	*-1.0*	*-0.7*
45-49	29.1	29.1	29.0	29.8	29.6	29.6	*-0.7*	*-0.6*	*-0.5*
50-54	34.1	34.4	33.9	34.9	34.9	34.9	*-0.8*	*-0.5*	*-1.0*
55-59	39.7	39.2	38.9	40.1	39.9	39.5	*-0.4*	*-0.7*	*-0.6*
All ages	**19.0**	**19.3**	**20.1**	**19.5**	**19.5**	**20.5**	***-0.4***	***-0.3***	***-0.3***
Mean age of sample	**36.7**	**37.0**	**38.0**	**36.7**	**36.9**	**38.1**	***0.0***	***0.1***	***-0.1***

Estimates obtained using the Zabalza and Arrufat imputation method are shown in Table A4.8. The upper half of the table gives the predictions obtained using employment logit coefficients calculated from the 1988-90 samples, while the lower half gives the predictions obtained using coefficients calculated from the 1996-98 samples. The latter are shown for illustrative purposes only. Those in the upper section of the table are preferred, and were used in the analysis of the gender pay gap in this study.

Table A4.8: Experience predictions by age group, HES employees

8.a: Using 1988-90 samples to estimate underlying employment equations

	Males			Females			*Male-female gap*		
Age group	**1989-91**	**1993-95**	**1996-98**	**1989-91**	**1993-95**	**1996-98**	***1989-91***	***1993-95***	***1996-98***
20-24	3.6	3.5	3.5	2.9	2.9	2.7	*0.7*	*0.7*	*0.8*
25-29	7.4	7.3	7.1	5.9	5.8	5.7	*1.5*	*1.6*	*1.5*
30-34	11.6	11.6	11.6	7.9	8.3	8.4	*3.7*	*3.4*	*3.2*
35-39	16.2	16.1	15.9	10.4	10.5	10.6	*5.8*	*5.5*	*5.3*
40-44	20.7	20.5	20.3	13.8	13.9	14.2	*6.9*	*6.6*	*6.1*
45-49	25.3	25.2	25.4	18.0	18.3	18.4	*7.3*	*6.8*	*7.0*
50-54	29.6	29.9	29.6	21.7	22.3	22.6	*7.9*	*7.6*	*7.0*
55-59	34.1	33.9	33.7	24.8	25.2	25.3	*9.3*	*8.7*	*8.4*
All ages	**16.1**	**16.3**	**17.1**	**11.3**	**11.7**	**12.5**	***4.8***	***4.7***	***4.7***

8.b Using 1996-98 samples to estimate underlying employment equations

	Males			Females			*Male-female gap*		
Age group	**1989-91**	**1993-95**	**1996-98**	**1989-91**	**1993-95**	**1996-98**	***1989-91***	***1993-95***	***1996-98***
20-24	2.7	2.7	2.7	2.3	2.3	2.1	*0.4*	*0.5*	*0.6*
25-29	6.1	6.1	5.8	5.0	4.9	4.8	*1.1*	*1.2*	*1.1*
30-34	10.0	10.0	10.0	6.9	7.3	7.4	*3.1*	*2.7*	*2.6*
35-39	14.4	14.3	14.1	9.4	9.5	9.6	*5.0*	*4.8*	*4.5*
40-44	18.8	18.5	18.3	12.6	12.7	13.1	*6.2*	*5.8*	*5.2*
45-49	23.2	22.9	23.2	16.7	17.1	17.3	*6.4*	*5.9*	*6.0*
50-54	27.4	27.6	27.3	20.4	21.1	21.3	*7.0*	*6.5*	*5.9*
55-59	31.6	31.6	31.4	23.7	24.1	24.5	*7.9*	*7.4*	*6.9*
All ages	**14.4**	**14.6**	**15.4**	**10.2**	**10.7**	**11.5**	***4.1***	***4.0***	***3.9***

The Zabalza and Arrufat predictions, like those obtained for the IS samples, are quite low. For men they are well below the levels suggested by the Population Census. When using the employment data for 1988-90 to make the estimates, male employees were predicted to have 16.1 mean years of experience in 1989-91, 16.3 years in 1993-95 and 17.1 years in 1996-98. Female employees were predicted to have an average of 11.3 years of full-time experience in 1989-91, 11.7 years in 1993-95 and 12.5 years in 1996-98.

The predictions obtained using employment data for 1996-98 (shown in the lower half of Table A4.8) are a little lower, particularly for males. Predictions obtained when the employment data for all 11 years from 1988 through to 1998 was pooled (not shown here) lie between the other two sets of estimates.

Experience estimates obtained for female employees using the Filer method are given in Table A4.9. Once again, the Filer method leads to a higher experience profile than does the Zabalza and Arrufat method. Taking the Filer estimates, the mean full-time experience of women in waged employment was 13.3 years in 1989-91, rising to 14.2 years in 1996-98. The predictions for 1996-98 are fairly close to those obtained for the Income Supplement sample using this method.

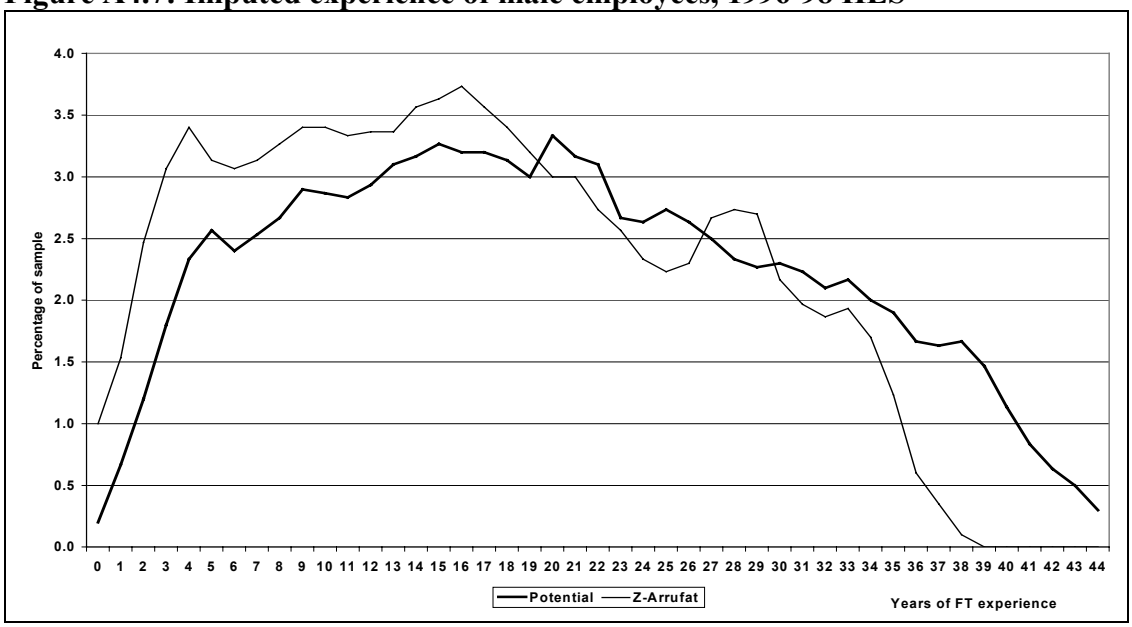
The Census-derived experience estimates (Table A4.4) show the gender experience gap (for all men and women) declining in size over the decade from 1986 to 1996. In contrast, neither the Zabalza and Arrufat nor the Filer estimates capture a trend towards convergence. The male–female gap in predicted experience in both Table A4.8 and Table A4.9 is fairly static over time.

Table A4.9: Filer experience imputations, HES employees

Age group	1989-91	1993-95	1996-98
20-24	3.5	3.5	3.4
25-29	7.4	7.2	7.1
30-34	10.3	10.4	10.7
35-39	13.0	12.9	12.9
40-44	16.3	16.4	16.5
45-49	20.3	20.2	20.3
50-54	23.6	23.8	23.7
55-59	27.0	27.1	27.0
All ages	**13.3**	**13.5**	**14.2**

Neither the Zabalza and Arrufat nor the Filer imputation methods take full account of any long-term changes that may have occurred in the employment propensities of women. Women's labour supply behaviour has changed structurally over time, in ways that are probably not fully captured by the personal and family characteristics variables that are included in the imputation models. Over the post-war period, the participation and employment propensities of women aged 25 and over have undergone long-term increases, while those of women aged under 25 have tended to decline. The use of fixed estimates of employment propensities, estimated as at the late 1980s or the late 1990s, will tend to overestimate the work experience that has been accumulated by the older women in the sample, and to underestimate the experience of younger women.

Figure A4.7: Imputed experience of male employees, 1996-98 HES



In addition, the use of fixed estimates of women's employment propensities in the imputation procedure means that any *changes* that occurred in women's average experience levels over the study period – from the late 1980s to the late 1990s – are likely to be underestimated. Ideally, birth-cohort effects on women's employment propensities should be taken into account when women's past employment histories are predicted backwards in time, in order to address this problem. Zabalza and Arrufat (1985), using data for the UK, adjusted their back-cast employment projections using year-by-year estimates of women's participation probabilities – obtained using data from a separate survey of women's working life histories. The Fertility Survey is currently the best source of New Zealand data on women's working life histories, and it could potentially be used to estimate birth-cohort effects on women's

changing employment propensities over the post-war decades. Because the author's access to this data source was quite limited and indirect in nature, the option of using Fertility Survey data for this purpose was not pursued in the current study.

Figure A4.8: Imputed experience of female employees, 1996-98 HES

Figures A4.7 and A4.8 show the distributions of the HES imputed experience variables within the male and female 1996-98 samples. For males, the distributions have a roughly similar shape. The Zabalza and Arrufat distribution lies to the left of the potential experience distribution, as one would expect. For females, the distribution of the potential experience measure diverges significantly from that of the other measures, being too far skewed to the right. The Zabalza and Arrufat and the Filer distributions resemble the distribution of actual experience, as measured in the Fertility Survey, much more closely, suggesting they are likely to be more accurate measures of women's actual experience.

In the analysis of the gender earnings gap in this study the following imputed measures of experience were used for HES sample members:

- For males – potential experience only.
- For females – both the Zabalza and Arrufat and the Filer imputations were used, serving as 'low' and 'high' estimates of the actual experience levels of sample members.

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