Ethnicity and Early Labour Market Experiences in the Christchurch Health and Development Study

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Abstract

This study uses data from the Christchurch Health and Development Study to investigate differences by ethnicity in early labour market experiences of a birth cohort born in Christchurch in 1977. The study finds that Maori youth acquire fewer school and post-school qualifications, and accumulate less work experience by age 21, than other youth. There is also more heterogeneity among Maori than other youth – a substantially larger proportion of Maori youth, compared to others, accumulate very little time in these productive activities. Even though measured background factors are important in explaining the relatively lower accumulation of work experience by Maori, they do not explain the entire ethnic gap in labour market outcome. However, in multivariate analyses, Maori ethnicity has an insignificant, though negative effect on work experience.

At age 21, Maori workers in this study (which is not nationally representative) on average receive higher hourly earnings than non-Maori workers, though this difference is not statistically significant. Once differences in other characteristics are taken into account, particularly educational qualifications and work experience, which have a positive effect on earnings, the earnings difference between Maori and non-Maori is statistically significant. This may be due to other unobserved differences between Maori and non-Maori who are employed, that also have an effect on earnings.

JEL CLASSIFICATION	J15 – Economics of Minorities
	J24 – Human Capital Formation; Occupational Choice: Labour Productivity
	J31 – Wage Level and Structure; Wage Differentials by Skill, Training, Occupation etc
KEYWORDS	Christchurch Health and Development Study, ethnicity, labour market outcomes

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Ethnicity and Early Labour Market Experiences in the Christchurch Health and Development Study

1 Introduction

This report presents an empirical analysis of the early labour market histories of youth in the Christchurch Health and Development Study (CHDS). We want to know the extent to which Maori might be disadvantaged relative non-Maori over their first few years in the labour market. Are 'observationally equivalent' individuals treated differently in the workforce because of their Maori ethnicity? This is an important issue for policy makers, because systematic disadvantages faced by Maori during this critical transition period into the labour market could persist (or be accentuated) over their remaining working lives.

In particular, we estimate the extent to which Maori accumulate less work experience than their non-Maori counterparts by age 21. What proportion of any gap in work experience between the ethnic groups is eliminated by controlling for differences in the total time spent outside of education and training, the attainment of formal qualifications and other measurable personal and family background characteristics? This should be an important contribution of this study. Other conventional data sets that can be used for analysing the importance of ethnicity for labour market outcomes in New Zealand (eg, the Population Census, the Household Labour Force Survey (HLFS) and the Household Economic Survey (HES)), contain no information on the accumulated work experience of individuals.

We also estimate the extent to which Maori face lower wage rates in the labour market than non-Maori at age 21. What proportion of the overall gap in hourly earnings between the ethnic groups can be eliminated by controlling for observed differences in work experience, formal qualifications and other relevant factors? Again, individual data on actual work experience is critical if we want to hold constant the relevant productivity characteristics of workers.[1]

1 It is easy to motivate the importance of having individual data on accumulated work experience for this study. Suppose earlier regression analyses suggest that Maori, on average, receive lower wages than non-Maori. Assume that age is used to proxy for actual work experience in these specifications, because the latter variable is unavailable. It is at least possible that the entire ethnic gap in wages could be explained by the ethnic gap in work experience. It would be misleading in this situation to conclude that Maori are paid systematically lower wages than non-Maori. They may be paid lower wages later in life because of ethnic differences in the rate of accumulation of work experience and on-the-job human capital.

This study uses unit record data from the CHDS on the family backgrounds, educational outcomes and labour market histories of young adults up to their 21st birthdays. The CHDS is a panel data set, which follows the subsequent progress of over 1,200 children born in Canterbury area hospitals between April and August 1977. Parents or custodial adults in the households in which these children resided were interviewed at birth and every year until age 14 of these children. Both parents and the CHDS children were interviewed when these children had reached their 16th birthdays. The most recent interviews focused entirely on the CHDS youth when they had reached the age of 18 in 1995 and 21 in 1998.

There are several unique advantages and disadvantages in using the CHDS data for examining ethnic differences in labour market outcomes. Two attributes of this panel, in particular, should add value to the existing literature in this area:

- These data concentrate on the early labour market experiences of a cohort of individuals who had reached their 21st birthdays. Most empirical studies on Maori-non-Maori disparities have relied on individual data across the entire working-age population. There are good reasons to focus our attention specifically on earlier labour market experiences. Any 'scarring effects' associated with the disadvantageous treatment of Maori youth could persist over the four or more decades remaining in their working lives. This is also the age range when government interventions are more prevalent (eg, education, training and job search), and the time when these programmes might be most efficacious and cost effective.

- The CHDS provides a wide range of information on the work, education and training histories of youth, as well as their personal and family backgrounds. This information is critical for accurate assessments of the exact nature of these labour market outcomes (eg, more-or-less continuous information on work and education histories), and the particular opportunities and constraints facing individuals that influence these outcomes. One of the strengths of the CHDS is the 'quality' of the data available on both the dependent and independent variables that will be used in this analysis.

The primary weaknesses of the CHDS are both the 'quantity' and 'geographic diversity' of the data available for this empirical analysis. Unlike the Census and HLFS data used in earlier studies with many thousands of individual observations taken from many cohorts across the entire country, we are constrained by the initial selection of families to participate in this panel (ie, a single cohort of children and their families taken from a specific geographic location). Due to attrition in this panel, slightly less than 1,000 respondents were interviewed in 1998. Small sample size makes it difficult to generate statistically significant effects. In addition, there is a lack of diversity in terms of time and geographic location. Our data come from a single cohort born within a five-month period in 1977. Although some of these individuals will have migrated out of the Canterbury region, most will have remained in this particular geographic area. This is particularly problematic in terms of this present study, because of the much lower representation of Maori in the South Island.

It is difficult to know a priori, whether the benefits of data quality will exceed the costs associated with a small, nationally unrepresentative sample. In the end, the key is that the CHDS data are relatively unique, and should at least provide an alternative perspective on the more traditional data sources for this type of analysis.

The remainder of this report is organised in the following way. Section 2 summarises and critiques the existing empirical literature on ethnic differences in labour market outcomes

in New Zealand. Section 3 develops an analytical framework for estimating the determinants of work experience and hourly earnings of youth in the CHDS. Section 4 presents some descriptive statistics from this panel data set and discusses the key issue of defining 'who is Maori' for this analysis. Sections 5 and 6 present and discuss the implications of the main regression results. Section 7 reconsiders this regression analysis in light of the endogeneity of both educational attainment and accumulated work experience. Finally, Section 8 summarises our findings, and draws some broad conclusions about this analysis.

2 Recent literature on ethnic disparities in labour market outcomes in New Zealand

There have been numerous empirical studies on labour market disparities between Maori and non-Maori in New Zealand. Only some of the more recent studies are reviewed in detail here.

Winkelmann and Winkelmann (1997) used unit record data from the 1981, 1986 and 1991 Population Censuses to examine the reasons behind the systematic differences in current labour force states between Maori and non-Maori. They choose four mutually exclusive and exhaustive states: full-time employment, part-time employment, unemployment and the residual category of being out of the labour force. The authors employed a multinonmial logit approach to estimate the effects of age, school and tertiary qualifications, marital and parental status, the local unemployment rate and urban or rural geographic location on these labour force states. The authors found that these relatively few demographic characteristics could explain a substantial proportion of the differences in labour market outcomes between Maori and non-Maori. Between one-half and two-thirds of the ethnic differences in full-time employment rates for males, for example, could be explained by these personal characteristics and geographic factors. These same independent variables could account for nearly all of the ethnic differences in full-time employment rates for females. In particular, the authors found that poor labour market outcomes of Maori are significantly linked to their relatively poorer educational qualifications. They also found that the marginal effects of formal qualifications on the probability of being in full-time employment (ie, this particular 'rate of return' on education) were consistently *larger* for Maori compared to non-Maori.

Chapple and Rea (1998) used aggregate data from the Household Labour Force Survey (HLFS) to examine trends in labour market disparities between Maori and non-Maori between 1985 and 1998. Several indices of relative disparity were used in conjunction with various labour force states. The authors concluded that little additional insight is gained from more complex indices relative to simple aggregate employment propensities for the ethnic groups. They found that Maori labour market status deteriorated relative to that of non-Maori between 1985 and 1998. However, all of this worsening in the relative position of Maori occurred between 1985 and 1992. The relative labour market performance of Maori actually improved between 1992 and 1996. The authors made no attempt, unlike Winkelmann and Winkelmann, to estimate the extent to which these ethnic gaps in employment propensities and unemployment rates could be 'explained' by differences in demographic characteristics and regional location. No regression analysis was included in their study.

Alexander, Gene and Jaforullah (2001) were able access unit record data in 1997, 1998 and 1999 from the Income Survey (a supplement to the HLFS in the June quarters

starting in 1997). They distinguished between individuals who reported Maori as their only ethnicity (referred to as 'sole Maori' in the present study), and those who reported Maori as only one of their ethnicities (referred to as 'mixed Maori' in this report). The authors note in their descriptive statistics that in terms of usual hourly earnings "… Maori males in most qualification groups actually outperform European males" (p.8). Although they make no attempt to summarise the overall ethnic difference in wages across the various qualification groups and years, these simple statistics suggest that Maori might have higher wages than non-Maori if only education is held constant.

The authors find in their regression analysis that once age, household type, region, gender, qualifications and occupation are held constant, *there is no consistent evidence across the three years that Maori workers receive lower wages than European workers*. The average estimated coefficient on the sole Maori indicator variable in these hourly earnings regression is –0.0353. This implies that sole Maori workers, holding other measured factors constant, receive wages that average 3.5% less than their non-Maori counterparts. Yet, these estimated coefficients are only clearly statistically different from zero in one of the three years (1997). The average estimated coefficient on the mixed Maori indicator variable is –0.0131. This implies that mixed Maori workers, holding other measured factors constant, receive wages that average 1.3% less than non-Maori counterparts. These estimated coefficients are never statistically different from zero in any of the three years.

Alexander et al. make a valid and potentially important observation that this finding does *not* imply that observationally equivalent Maori and non-Maori face the same wages in the labour market. Sample selection bias may be an issue here. Unobservable determinants of wages may be correlated with unobservable determinants of employment propensities. As a result, Maori who are working may receive much higher wages than those faced by Maori who are *not* working. The same may be less true for non-Maori. Only by correcting for this sample selection process can we determine whether or not observationally equivalent Maori and non-Maori face systematically different wages in the labour market.

The results reported by Alexander et al. suggest that sample selection bias *is* a crucial factor in comparing the wages facing Maori and non-Maori. Their wage regressions, corrected for this sample selection bias, show negative and significant effects of being Sole or Mixed Maori. The average estimated coefficient on sole Maori is –0.121, and significantly different from zero in all three regressions at better than a 1% level. This implies that sole Maori, holding other measured factors constant, face wages that average 11.4% less than non-Maori (an ethnic gap more than three and one-quarter times larger than the one previously estimated without the inverse Mills ratio). The average estimated coefficient on mixed Maori is –0.045, and significantly different from zero in two of the three regressions at better than a 1% level. This implies that mixed Maori, holding other measured factors constant, face wages that average 4.4% less than non-Maori (an ethnic gap, again, more than three and one-quarter times larger than the one previously estimated without the inverse Mills ratio).

Little weight should be placed on the regression results of Alexander et al. that correct for sample selection bias. It is well established in the sample selection literature that 'pseudo instruments' are needed to appropriately 'identify' the inverse Mills ratio (or 'lambda term') in regressions that correct for a sample selection process. In this case, at least one variable must be included in the probit equation on the employment propensity that is subsequently excluded from the wage equation. Even though it is technically possible to avoid perfect collinearity without this pseudo instrument, because nonlinearities will 'identify' this lambda term, most authors refuse to use Heckman's technique (1979)

without valid instruments (eg, see the discussion on this topic in recent articles by Fitzgerald, Gottschalk and Moffitt (1998a and 1998b). Yet, this is exactly what Alexander et al. do.[2] This is particularly problematic when the functional form of the regression (log-linear in this situation) is chosen only for convenience, and not due to an underlying theoretical model.

At the very least, the authors need to explore why their estimated effects of ethnicity on wages vary so dramatically between the 'uncorrected' and 'corrected' wage regressions. This is particularly important in this situation where earlier descriptive statistics suggest that male Maori workers receive *higher* hourly earnings than male non-Maori workers with the same qualifications. The sample selection issue is a potentially important factor in this study, but the authors provide little convincing evidence that this issue has been handled in an appropriate manner.

3 An analytical framework

The purpose of this study is to test the hypothesis that observationally equivalent Maori experience significantly different early labour market histories when compared to their non-Maori counterparts. The first issue that arises is how these 'early labour market histories' will be quantified. There are obviously many dimensions along which these employment experiences can be measured. Two variables are chosen for this analysis: the actual number of years of work experience between the 16th and 21st birthdays, and the hourly earnings of those working at age 21. Both are key elements of the early labour market transition period.

It is well known that Maori have fewer formal school and tertiary qualifications than non-Maori (eg, see Winkelmann and Winkelmann (1997) and Chapple and Rea (1998)). Relatively little is known about ethnic differences in human capital accumulation through the initial work experience of youth. Yet, these early experiences may be critical to the subsequent labour market success or failure of these individuals. It is also an area where discrimination may arise. Although it may be difficult for employers to discriminate on the basis of pay and promotion, unequal access to employment may be more difficult to detect and prosecute.

To gain a more comprehensive picture of any ethnic inequalities that might be present in the labour market, it is important to canvass a wide array of outcomes. Once we have investigated the possibility of systematically lower rates of work experience among Maori, we can then ask whether hourly earnings vary between Maori and non-Maori with the same qualifications, work experience and other relevant factors. We might find that ethnic differences exist in the accumulation of work experience, and not in hourly earnings. Or

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[2] The authors miss an opportunity to introduce potential instruments when they set up the regression specification on page 5 of their paper. They claim that hourly earnings are only observed when they exceed a threshold of zero. This makes little intuitive sense. It should be assumed that market wages are observed when they exceed some (nonzero) reservation wages. Market wages are simply unobserved for non-workers, and not equal to zero as claimed by Alexander et al. The fact that the probit equation determining the employment propensity depends on both the market and reservation wage provides an opportunity to identify the lambda term in the subsequent wage equation. This would be true if covariates like marital status or children in the household influence the value of non-market time, but do not influence the wages faced in the labour market. Most researchers, however, have refused to accept such variables as valid instruments. Yet, without the exclusion of such factors from the wage equation, the identification of the inverse Mills ratio in the wage regression is entirely dependent on non-linearities.

we might find that there are no ethnic differences in terms of acquiring work experience. Yet, conditional on this work experience and other factors, Maori might face lower wage rates than non-Maori. The key is that these issues need to be explored simultaneously. Accurate measures of work experience histories are needed to appropriately estimate a standard wage regression, and account for all individual differences in human capital.

3.1 Estimating the determinants of work experience

Consider the following specification for the work experience regression.

$$EXP_i = \beta POTEXP_i + \delta MAORI_i + X'_i\gamma + u_i \quad (1)$$

The dependent variable EXP_i is a measure of the actual years of work experience accumulated by the i^{th} individual between his or her 16^{th} and 21^{st} birthdays. One of key independent variables in this equation is a measure of the years of 'potential' work experience $POPEXP_i$. This is the amount time that the individual was *not* enrolled in education or training programmes over this five-year interval. If the coefficient β on this regressor is equal to one, then every year away from human capital accumulation through education and training leads to an additional year of 'on-the-job' human capital accumulation through work experience. It is expected that β will be positive, but less than one. Potential work experience generally 'facilitates' the accumulation of actual work experience. On average, only a portion of each year of potential work experience is converted into a year of actual work experience. Because of the ways in which actual and potential years of work experience are constructed, it is at least possible for $\beta>1$. The discussion in the following few paragraphs describes how these variables are constructed from data available in the CHDS. The key is that there is no 'mechanical' relationship between potential and actual work experience, and the latter can exceed the former.

Retrospective data on the activities of youth are available from the interviews at ages 18 and 21. At age 18 we know the job tenure (in months) for youth employed at the time of the survey. We also know their weekly hours worked at age 18, and the number of other jobs held between their 16^{th} and 18^{th} birthdays. At age 21 we know the work status of youth during the three-month intervals between their 18^{th} and 21^{st} birthdays. We know whether or not they were working full-time (30 or more hours per week) or part-time (fewer than 30 hours per week) during each of these 12 quarters. All of this information on work histories is independent of the enrolment in school or tertiary education of these youth over this period.

These data were used to construct a measure of the actual work experience of youth over the five-year period between their 16^{th} and 21^{st} birthdays. Each individual was assigned three months of work experience if he or she reported working full-time during a quarter, and one and one-half months work experience if he or she reported working part-time between the 18^{th} and 21^{st} birthdays. These amounts were aggregated over the twelve quarters. Each individual was assigned two years of work experience if he or she reported working full-time at age 18 in a job held for at least two years. One year of work experience was assigned if the youth was working part-time at age 18 in a job held for at least two years. These measures of full-time or part-time work experience between the 16^{th} and 18^{th} birthdays were prorated for individuals with job tenure of less than 2 years at age 18. In addition, these youth were assumed to have received two months of work experience for every additional job held between the ages of 16 and 18. Individuals were *not* allowed to accumulate more than two years of actual work experience between their 16^{th} and 18^{th} birthdays.

Although arbitrary decisions were made on how these data would be used to construct an overall measure of actual work experience between the 16th and 21st birthdays, these retrospective data at these two interviews should provide a fairly accurate picture of these work histories. This measure of actual work experience can range from a minimum of zero to a maximum of five years.

'Potential' work experience was slightly easier to construct. This is the amount of time between the 16th and 21st birthdays that youth were *not* enrolled in either education or training. This variable was also constructed from retrospective data taken from the interviews at ages 18 and 21. The CHDS contains an estimate of the age when the individual left school if this event occurred before the 18th birthday. It also contains quarterly summaries of their activities between their 18th and 21st birthdays, which indicate whether or not they were enrolled in school or tertiary education (full-time or part-time), and whether or not they were "… attending (an) educational training course (not at University or Polytechnic)" (Question B.9, CHDS 21-Year Interview). Each individual was assigned three months of potential work experience if he or she reported no education or training, and one and one-half months of potential work experience if he or she reported part-time education or training during a quarter. Youth were assigned zero months of potential work experience if they were involved in full-time education or training during a quarter.

The idea is that potential work experience 'facilitates' the accumulation of actual work experience between the 16th and 21st birthdays. Yet, actual work experience isn't necessarily limited by our measure of potential work experiences (ie, time spent in education or training and time spent in work are *not* mutually exclusive). Actual work experience can exceed potential work experience if individuals are working while studying or training. We expect, however, that actual work experience will generally be less than potential work experience for youth because of time spent in unemployment or being out of the labour force.

Once relevant factors (including potential work experience) are held constant, our hypothesis is that Maori will accumulate less work experience than non-Maori by age 21. The coefficient on the variable indicating Maori ethnicity is hypothesised to be negative ($\delta<0$). One of the key issues in this study is the way in which ethnicity might be measured. This issue is explored in detail in Section 4.

A vector of other independent variables X_i is included in equation (1). Alternative compositions of this vector are used. Under the 'short regression', this vector includes an indicator variable for gender, a series of indicator variables for the formal school, tertiary and vocational qualifications obtained, and gender interacted with the number of children born to the respondent by age 21.[3] These are typical covariates that would generally be available through other data sources (eg, the Population Census or the Household Labour Force Survey).

Under the 'long regression', this vector also includes personal and family background characteristics that generally are *not* available through other data sources. The following section provides a detailed discussion of these additional independent variables. The

[3] This raises the question of whether or not gender should be interacted with all of the independent variables in the regression. In other words, separate estimation could be considered for the male and females subsamples. Unfortunately, given the small sample size, especially for Maori, this somewhat more restrictive specification was deemed appropriate. In this case, we allow the influence of children on work experience to vary between males and females.

reason for these alternative definitions of the X_i vector is quite straightforward. If systematic differences between Maori and non-Maori are evident in the short regression specification, it is at least possible that these ethnic differences might be the result of specification error. In other words, relevant measures of family background factors that influence the accumulation of work experience by youth were erroneously excluded from this original specification. Indications of unequal outcomes between Maori and non-Maori in the accumulation of work experience found in other data sets might be related to the unavailability of detailed information on individual family backgrounds. In other words, the type of data available in the CHDS may be critical if we are to claim 'observational equivalence', and to attribute systematic differences to ethnicity alone.[4]

An alternative approach to the inclusion of ethnicity as an indicator variable is to separately estimate the work experience regressions for Maori and non-Maori.

$$EXP_i = \beta_M POTEXP_i + X'_i\gamma_M + u_i$$

$$EXP_i = \beta_{NM} POTEXP_i + X'_i\gamma_{NM} + v_i \qquad (2)$$

By essentially interacting all of the covariates with ethnicity, we can determine the extent to which the incremental effects of the independent variables might vary between the ethnic groups. For example, the effects of potential work experience on actual work experience may be quite different between Maori and non-Maori (ie, $\beta_M \neq \beta_{NM}$).

Oaxaca (1973) used separate regressions from two subsamples like these to decompose overall mean differences in wage rates into components that could and could not be explained by mean differences in observable factors between the groups. The problem that Oaxaca faced is that the coefficients from either regression model in (2) could be used to 'weight' these relative differences in productivity characteristics. Although the coefficients from the 'primary group' (eg, males in a gender decomposition or non-Maori in an ethnic decomposition) might be selected because these individuals are not expected to suffer from discrimination in the labour market, there is argument for using a weighted average of these estimated coefficients.

Neumark (1988) suggests that the appropriate coefficients to be used in this decomposition should be based on the counterfactual of an absence of labour market discrimination. In this case, this entails an experience regression dropping ethnicity as an explanatory variable. We adopt this same approach in this study.

We begin by taking the means (represented in **bold** type) of the sample regression functions in equation (2):

$$\mathbf{EXP_M} = b_M POTEXP_M + X'_M c_M$$

$$\mathbf{EXP_{NM}} = b_{NM} POTEXP_{NM} + X'_{NM} c_{NM} \qquad (3)$$

[4] It is important to point out that it is practically impossible to 'prove' the existence of discrimination. This is because the effects of ethnicity serve as residual indicators of systematic differences in the outcomes across ethnic groups that cannot otherwise be attributed to the measured characteristics of the individuals. It is always possible that some relevant factor is excluded from the regression (or is included, but measured inaccurately). The availability of an extensive catalogue of detailed information on the child's background, as in the CHDS, at least lessens the chances that omitted-variable bias may be a factor leading to the estimated effects of ethnicity on these outcomes.

where Greek letters are replaced by their English equivalents to indicate that these are estimated parameters. The means of the residuals are equal to zero in both cases through Ordinary Least-Squares estimation.

Now introduce a set of estimated coefficients without subscripts, indicating that they come from a pooled regression. Adding and subtracting cross-products and performing some algebraic manipulation, we get the following expression.

$$\mathbf{EXP_{NM}} - \mathbf{EXP_{M}} = [(POTEXP_{NM} - POTEXP_{M})b + (X'_{NM} - X'_{M})c] + [(b_{NM} - b)POTEXP_{NM} + (b - b_{M})POTEXP_{M} + (c_{NM} - c)X'_{NM} + (b - b_{M})X'_{M}] \quad (4)$$

The terms in the first set of square brackets on the right-hand side of this equation represent the part of the observed gap in average work experience between non-Maori and Maori that *can be explained by differences in potential work experience and other independent variables*. The terms in the second set of square brackets represent the part of the work experience gap that *cannot be explained by differences in measured characteristics*.

3.2 Estimating the determinants of hourly earnings

As mentioned earlier, there is a natural sequence in estimating the determinants of work experience prior to hourly earnings. Accumulated work experience is a 'pre-determined' variable when hourly earnings are observed among workers at the interview at age 21. Thus, systematic differences in work histories between non-Maori and Maori can influence earnings capacity indirectly through experience. We want to know whether Maori face lower wages, on average, compared to non-Maori with the same experience, qualifications and other relevant factors.

Consider the following regression specification for hourly earnings:

$$ln W_i = \alpha EXP_i + \pi MAORI_i + Z'_i\zeta + \varepsilon_i \quad (5)$$

where the dependent variable is the natural logarithm of hourly earnings. The log wage is assumed to be linear function of actual work experience and other productivity characteristics contained in the vector Z_i. The coefficient π indicates whether Maori workers, on average, receive lower wages than non-Maori with the same observable characteristics.

The hourly earnings regression can be estimated only for the subsample of those who were working and reporting a wage rate at the time of the survey. We might want to ask a different question from this analysis than the one posed above. Do Maori, on average, face lower wages than non-Maori with the same experience, qualifications and other relevant factors? To answer this question we would need to consider the issue of sample selection bias. Workers at a point in time may be a non-random sample of individuals. The problem is that unobserved factors that influence the work outcome may be correlated with unobserved factors that influence the wages that these individuals face in the labour market. This could result in biased estimates of the coefficients in equation (5) for all individuals.

The procedures that could be used to correct for possible sample selection bias have been extensively examined in the literature.[5] Suppose an individual will be observed working at age 21 if a latent variable Y^*_i is positive. Furthermore, suppose that this variable is a linear function of a set of covariates that include previous work experience, ethnicity and many of family background variables used in the regression models in the previous section (X_i).

$$Y^*_i = \eta EXP_i + \tau MAORI_i + X'_i\psi + \omega_i \quad (6)$$

The problem is that the disturbance terms ε_i and ω_i may be correlated. Although the dependent variable in equation (6) is unobserved, its binary counterpart Y_i is observed and this indicator variable simply depends on the sign of Y^*_i.

$$Y_i = 1 \text{ iff } Y^*_i > 0 \text{ (the individual is working)}$$

$$Y_i = 0 \text{ iff } Y^*_i \leq 0 \text{ (the individual is } \textit{not} \text{ working)} \quad (7)$$

Hourly earnings are observed only among workers at the time of the survey. This conditional expectation can be incorporated in previous wage equation by writing:

$$E(\ln W_i \mid Y_i = 1) = \alpha EXP_i + \pi MAORI_i + Z'_i\zeta + E(\varepsilon_i \mid Y_i = 1)$$

$$= \alpha EXP_i + \pi MAORI_i + Z'_i\zeta + E(\varepsilon_i \mid \omega_I > \eta EXP_i + \tau MAORI_i + X'_i\psi) \quad (8)$$

$$= \alpha EXP_i + \pi MAORI_i + Z'_i\zeta + \theta[\phi(\eta EXP_i+\tau MAORI_i+X'_i\psi)/(1-\Phi(\eta EXP_i+\tau MAORI_i+X'_i\psi))]$$

$$= \alpha EXP_i + \pi MAORI_i + Z'_i\zeta + \theta\lambda_i$$

where λ_i is the mean of a truncated normal distribution or inverse Mills ratio. This sample selection variable can be computed from the maximum likelihood estimation of a probit model on this dichotomous work outcome.

Although not strictly necessary, identification of this sample selection term largely depends on a set of variables that are included in the work regression, but directly excluded from the wage regression. One could argue that the CHDS offers a number of variables on family background that might serve as 'instrumental variables' for λ_i. These are factors that influence the propensity to be employed, but are not directly observable by potential employers and should therefore not influence market wages. Such background characteristics are generally unavailable to researchers with cross sectional data.[6] Yet, there is little reason a priori to believe that any of these background factors should necessarily be excluded from the wage regression.

As a result, we choose a different approach in this study. The vector Z_i is allowed to alternatively exclude, and then include, the same personal and family background factors used in the earlier work experience regression. These short and long regression specifications will indicate whether or not this information has any impact on the coefficients attached to ethnicity. In other words, we use detailed information on personal

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[5] See Heckman (1979) and Maddala (1983) for background discussion on sample selection bias.

[6] See the discussion in Section 2 on the difficulties of correcting for sample selection bias in Alexander, Gene and Jaforullah (2001).

and family background characteristics in the CHDS to mitigate the possibility of omitted-variable bias in estimating the impact of ethnicity on wage rates.

To see whether or not the wages facing all Maori are systematically lower than those facing all non-Maori, we use these estimated regressions on workers to predict the wages that face all youth. It's possible that non-working Maori have lower productivity characteristics (eg, less work experience and fewer qualifications) than non-working non-Maori. Even if Maori workers aren't paid less than non-Maori workers, all Maori may face lower wages than all non-Maori. This technique essentially allows for the sample selection process to place on observable (but *not* unobservable) characteristics.

4 Data issues and descriptive statistics

4.1 Defining who is Maori

Chapple and Rea (1998), in their study on differences in labour market outcomes between Maori and non-Maori, explore the critical issue of how 'ethnicity' is defined. They note that the question related to ethnicity in the Household Labour Force Survey is only asked of 'household heads' on behalf of other household members. They claim that the question appears to be misleading, because it implies that the respondent should choose only a single ethnicity even though up to three ethnic groups may eventually be chosen. Despite this perhaps unintentional emphasis on single ethnicities, the authors find considerable evidence on the importance of multiple ethnicities for defining who is Maori.

The conventional procedure for defining ethnicity in the HLFS, and in many other statistical surveys in New Zealand, is to place Maori ethnicity in a clear hierarchical position. Individuals who identify themselves as Maori are classified as Maori, and not as one of the other ethnic groups with which they might identify. In other words, those defined as Maori include those with 'mixed' ethnicities. Those defined as non-Maori exclude anyone with Maori ethnicity. In this way, the broadest possible interpretation is used in defining Maori identity.

Chapple and Rea found that this broad Maori classification increased in the HLFS from around 10% to 10.5% of the working-age population between 1985 and 1998. Over this same period, the share of Maori reporting other ethnic affiliations increased from 22% to 27%. The authors claim that this is an important definitional issue, because Maori with mixed ethnicities may be quite different from Maori without other ethnic affiliations. Chapple and Rea (p.130) reach the conclusion that "… On average, the sole Maori group faces substantially greater labour market disadvantage than the mixed Maori group." The authors also note that those with multiple ethnicities comprise a much larger proportion of all Maori in the South Island. This implies that the issue of defining who is Maori is even more important with the CHDS, where the vast majority of respondents reside in the Canterbury region.

Alexander et al. (2001) picked up this issue of an arbitrarily broad classification of Maori ethnicity when they asked Statistics New Zealand to separately classify sole and mixed Maori. They included indicator variables for both Maori groups, Pacific Islanders and other non-European groups in their hourly earnings regressions. Without controlling for sample selection bias, the authors were unable to find consistent statistical evidence of the

greater disadvantage for sole Maori relative to mixed Maori hypothesised by Chapple and Rea.[7]

Unlike Alexander et al., we test the sensitivity of our empirical results to this issue of ethnic identification by using two different ethnic classification schemes for Maori. First, we use the conventional approach of defining 'Maori' to include anyone who claims that they are Maori at the time of the survey at age 21.[8] We call this our 'two-way' classification scheme. Second, we separate this broad ethnic group into 'sole Maori' and 'mixed Maori'. We call this our 'three-way' classification scheme. Note that the residual group of 'non-Maori' is consistent between these two ethnic classification schemes.

These panel data provide an important advantage in considering ethnic identity. In most cross-sectional data sets, ethnic affiliation is self-reported and there is little that can be done to 'verify' this information. In the CHDS we have both the self-reported ethnicity of the youth and their parents from earlier surveys. In fact, we have information on the ethnic identities from both birth parents, and from 'parental figures' at the ages of 7 and 14 of the CHDS children. These parental figures could be the same as the birth parents, or they could include the relevant custodial adults in the family in these later years (eg, subsequent partners of birth mothers). This allows us to compare the self-reported ethnicities of children with that of both their birth parents and subsequent parental figures.

Table 1 displays the information on ethnicity for the CHDS youth who provided valid information on all of the variables that will be needed for subsequent analyses in this study. A two-way classification scheme is used for the ethnicities of these 21 year-olds. Of these 973 individuals, 109 (11.2%) reported that they had at least some Maori identity. However, 61 youth (56.0% of those identified as Maori) also reported European, Pacific Island or Other Ethnicity. This means that Sole Maori comprise a *minority* of those falling under this broad, conventional classification of Maori ethnicity. By far the most common additional ethnicity among Maori is European (55.0%). The vast majority of non-Maori also identified with European ancestry (97.5%). These proportions are significantly different from one another at better than a 1% level (indicated by the two 'asterisks' in the Maori column). Although Maori are less likely to have some Pacific Island ethnicity than non-Maori, these proportions are not statistically significant.

Parents were asked about their ethnicities at the birth of their children in 1977. This information is recorded for fathers even if they weren't present in the household at the time of this birth.[9] For youth who claimed Maori ethnicity as age 21, more than one-third of their mothers (39.4%) and one-half of their fathers (54.1%) claimed Maori ethnicity at the birth of these children. Unlike the ethnicity question asked of youth at age 21, the ethnic categories for parents were 'mutually exclusive' (ie, they could not tick multiple categories). This means that a parent who 'primarily identified' with another ethnicity was unable to list Maori as 'secondary choice'. This could result in some measurement error in defining the ethnicities of parents.

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[7] See the discussion in Section 2 on the problems associated with the approach taken by Alexander et al. in correcting for sample selection bias in these wage regressions. The authors did not estimate these wage equations separately for sole Maori, mixed Maori or any other ethnic group.

[8] Unlike the HLFS where the household head identifies the ethnicity of all household members, ethnic affiliation is self-reported in the CHDS. These youth are allowed to tick any number of ethnicities in the list at the age 21 interview. These include: New Zealand Maori, New Zealand European, Other European, Samoan, Tongan, Niuean, Asian, and Other.

[9] Only one of the 973 children had no recorded ethnicity for the father at birth. Ethnic information is available for all of the mothers at birth.

Table 1 - Descriptive Statistics on Self-Reported Ethnicities: Two-Way Split in Youth Ethnicity

Proportions with:	Maori	Non-Maori
European Ethnicity – Youth	0.550**	0.975
Pacific Island Ethnicity – Youth	0.009	0.023
Other Ethnicity – Youth	0.028	0.019
At Birth of CHDS Youth:		
Some Maori Ethnicity – Mother	0.394**	0.005
Some Maori Ethnicity – Father	0.541**	0.015
Some Maori Ethnicity – Either Parent	0.807**	0.017
Pacific Island Ethnicity – Mother	0.000**	0.019
Pacific Island Ethnicity – Father	0.018	0.022
Pacific Island Ethnicity – Either Parent	0.018	0.028
By Age 14 of CHDS Youth:		
Some Maori Ethnicity – Maternal Figure	0.477**	0.006
Some Maori Ethnicity – Paternal Figure	0.587**	0.029
Some Maori Ethnicity – Either Parental Figure	0.908**	0.032
Pacific Island Ethnicity – Maternal Figure	0.009	0.019
Pacific Island Ethnicity – Paternal Figure	0.018	0.027
Pacific Island Ethnicity – Either Parental Figure	0.018	0.030
Number of Observations	109	864

** Maori mean significantly different from non-Maori mean at 1% level.
* Maori mean significantly different from non-Maori mean at 10% level.
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. Youth are defined as 'Maori' in this table if they identify Maori as *at least one of their ethnicities* at age 21. All other youth are considered to be 'non-Maori'. Ethnicity information is available for the birth parents, and the maternal and paternal figures at ages 7 and 14 of the child. Paternal figures may differ from birth parents. Youth can choose multiple ethnicities, but the ethnic categories for adults are mutually exclusive (i.e.. Maori/Part Maori, Pacific Island and Other).

More than four-fifths of Maori youth (80.7%) had at least one birth parent claiming some Maori ethnicity. This proportion is substantially greater than the 1.7% of non-Maori youth with at least one birth parent who claimed some Maori ethnicity. The difference between the means is statistically significant.

One of the reasons for any 'discrepancies' between the ethnicities of children and their parents is that children may base their ethnic identification later in life on the ethnicities of 'parental figures' other than their birth parents. To test this proposition, we use data on the recorded ethnicities of the custodial adults or parental figures in the families in which the CHDS children resided at ages 7 and 14. This is the only information available on the ethnicities of these adults after the birth of the child. Variables on the ethnicities of the parental figures are constructed using data from the three observation points, and are shown in Table 1. A higher proportion of *all* children report some Maori ethnicity associated with their paternal and maternal figures, when compared to that reported from their parents at the time of their birth.[10] For youth identifying themselves as Maori at age

[10] All of the children had a recorded ethnicity for both the paternal and maternal figures by age 14. A change in ethnicity between birth and the later surveys could come from either a change in the ethnic identification of the birth parents, or the addition of new parental figures in the family in which the child resides.

21, 80.7% had either a mother or father who was self-identified as Maori at the time of their birth. A similar statistic is 90.8% for either maternal or paternal figures up to age for 14 for these children. The correlation between the reported Maori ethnicities of youth and their paternal figures (0.82) is slightly higher than the correlation between the reported Maori ethnicities of youth and their birth parents (0.81).

Table 2 displays similar statistics for the three-way split in youth ethnicity. The group identified as 'Maori' in the first column of Table 1 is now split into 'sole Maori' and 'mixed Maori' in the first two columns of Table 2. *For youth who identified Maori as their only ethnicity at age 21*, 93.8% had at least one parent who identified him or herself as Maori at birth. *All* of the youth in this sole Maori category had at least one paternal figure identify him or herself as Maori by age 14. The intergenerational relationship in Maori identity is much weaker for mixed relative to sole Maori. *For youth who identified Maori as only one of their ethnicities at age 21*, 70.5% had at least one parent identify him or herself as Maori at birth, and 83.6% had at least one paternal figure who identified him or herself as Maori by age 14.

How do we use this information on the self-reported ethnicities of both youth and their parents in this study on the labour market outcomes of these youth? Table 3 summarises the available information on the ethnic identities of youth and their parents, and provides a set of possible alternatives for defining youth as 'Maori'. At one extreme, if we insisted that both birth parents claim at least some Maori ancestry and youth claim only Maori ancestry, then the number of observations would fall to 13 (1.3% of the entire sample). At the other extreme, if we consider youth who claim some Maori ancestry, along with those whose parents or parental figures claim some Maori ancestry, the number of observations would climb to 137 (14.1% of the sample).

Table 2 - Descriptive Statistics on Self-Reported Ethnicities: Three-Way Split in Youth Ethnicity

Proportions with:	Sole Maori	Mixed Maori	Non-Maori
European Ethnicity	0.000**	0.984	0.975
Pacific Island Ethnicity	0.000	0.016	0.023
Other Ethnicity	0.000	0.049	0.019
At Birth of CHDS Youth:			
Some Maori Ethnicity – Mother	0.542**	0.279**	0.005
Some Maori Ethnicity – Father	0.667**	0.443**	0.015
Some Maori Ethnicity – Either Parent	0.938**	0.705**	0.017
Pacific Island Ethnicity – Mother	0.000**	0.000**	0.019
Pacific Island Ethnicity – Father	0.000**	0.033	0.022
Pacific Island Ethnicity – Either Parent	0.000**	0.033	0.028
By Age 14 of CHDS Youth:			
Some Maori Ethnicity – Maternal Figure	0.583**	0.393**	0.006
Some Maori Ethnicity – Paternal Figure	0.729**	0.475**	0.029
Some Maori Ethnicity – Either Parental Figure	1.000**	0.836**	0.032
Pacific Island Ethnicity – Maternal Figure	0.000**	0.016	0.019
Pacific Island Ethnicity – Paternal Figure	0.000**	0.033	0.027
Pacific Island Ethnicity – Either Parental Figure	0.000**	0.033	0.030
Number of Observations	48	61	864

** Maori mean significantly different from non-Maori mean at 1% level.
* Maori mean significantly different from non-Maori mean at 10% level.

Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. Youth are defined as 'Sole Maori' in this table if they identify Maori as their *only ethnicity* at age 21. Youth are defined as 'Mixed Maori' if they report *both* Maori and any other ethnicity at the time of the survey. All other youth are considered to be 'non-Maori'. Ethnicity information is available for the birth parents, and the maternal and paternal figures at ages 7 and 14 of the child. Paternal figures may differ from birth parents. Youth can choose multiple ethnicities, but ethnic categories for adults are mutually exclusive (ie, Maori/Part Maori, Pacific Island and Other).

There is little doubt that all of the youth who claim sole Maori status should be included in any final definition of this ethnic group. They all have at least one parental figure with Maori ancestry, and are much more likely than the mixed Maori youth to have *both* parents or parental figures claiming Maori ethnicity. Youth claiming mixed Maori status are another story. Within this subgroup, 29.5% have no parents identifying themselves as Maori at birth, and 16.4% have no parental figures identifying themselves as Maori by age 14.

Table 3 - Potential Sample Sizes: Alternative Definitions of Maori Ethnicity

		Youth at Age 21 Claim:			
		Sole Maori	Mixed Maori	Non-Maori	Row Totals
Parents or Parental Figures Claim:	Neither Parent Maori: Birth of Child	3	18	849	870
	One Parent Maori: Birth of Child	32	42	13	87
	Both Parents Maori: Birth of Child	13	1	2	16
	Neither Parental Figure Maori: Child Age 14	0	10	836	846
	One Parental Figure Maori: Child Age 14	33	49	26	108
	Both Parental Figures Maori: Child Age 14	15	2	2	19
Column Totals		48	61	864	973

Notes: This ethnicity information is taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. Youth are defined as 'Sole Maori' in this table if they identify Maori as their *only ethnicity* at age 21. Youth are defined as 'Mixed Maori' if they report *both* Maori and any other ethnicity at the time of the survey. All other youth are considered to be 'non-Maori'. Ethnicity information is available for the birth parents, and the maternal and paternal figures at ages 7 and 14 of the child. Paternal figures may differ from birth parents. Youth can choose multiple ethnicities, but ethnic categories for adults are mutually exclusive (ie, Maori/Part Maori, Pacific Island and Other).

From this point on in this study we define the Maori status of youth in the following way:

- **Sole Maori** are youth who report 'Maori' as their only ethnicity at age 21. Note that all of these individuals have at least some intergenerational link to Maori ethnicity through birth parents or other parental figures (n=48).
- **Mixed Maori** are youth who report 'Maori' as one of their ethnicities at age 21, **and** have at least some intergenerational link to Maori ancestry through their birth parents or other parental figures (n=51).
- **Maori** are youth previously identified as either sole or mixed Maori. They all claim some Maori identity at age 21 and have some link to Maori ancestry through their birth parents of parental figures at a later stage in their development (n=99).

In this way, we use the longitudinal nature of the data to 'clean' the data, or remove possible measurement error in defining Maori ethnicity.[11]

4.2 Education and work histories

Table 4 displays descriptive statistics on mean differences between Maori and non-Maori in their education and work histories at age 21. The difference between the two ethnic

[11] The initial report in this study based mixed Maori status strictly on the self-reported ethnicities of youth at age 21. In the following sections, we discuss what effects this restriction on the mixed Maori group have on our empirical results

groups in the proportion of youth who are female (54.5% for Maori and 51.0% for non-Maori) is not statistically significant at a 10% level. However, Maori have fewer school qualifications than non-Maori. It should be noted that these qualifications are *not* mutually exclusive. We have information on all qualifications received by age 21, and not merely the highest qualification received by that date. While only 68.7% of Maori received their School Certificate, 83.1% of non-Maori had received the same qualification. This ethnic difference is statistically significant at better than a 1% level (indicated by the two 'asterisks' in the Maori column).

Table 4 - Descriptive Statistics on Education and Work Histories: Two-Way Split in Youth Ethnicity

Variables	Maori	Non-Maori
Proportion Female	0.545	0.510
Proportion with School Certificate	0.687**	0.831
Proportion with 6th Form or Higher School Certificate	0.485**	0.674
Proportion with University Bursary	0.111**	0.292
Proportion with University Diploma or Degree	0.020	0.043
Effective Years of Formal Education	12.77**	13.41
Proportion with Vocational Qualification	0.535	0.494
Ages 16 to 21, Years Not Enrolled in Education or Training	3.135**	2.569
Ages 16 to 21, Years of Work Experience	1.990*	2.278
Ages 16 to 21, Years Unemployed	0.726**	0.360
At Age 21, Proportion Working	0.576*	0.703
For those Working, Proportion Part-Time	0.211*	0.362
For those Working, Mean Weekly Hours of Work	35.93*	31.29
For those Working, Mean Hourly Earnings	$9.44	$9.26
At Age 21, Proportion Unemployed	0.162*	0.089
At Age 21, Proportion Receiving UB or DPB	0.222*	0.124
At Age 21, Proportion Enrolled in Education or Training	0.182**	0.375
For those Enrolled, Proportion Enrolled Part-Time	0.222	0.131
For those Enrolled, Proportion Working	0.444	0.610
Number of Observations	99	874

** Maori mean significantly different from non-Maori mean at 1% level.
* Maori mean significantly different from non-Maori mean at 10% level.
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. Youth are defined as 'Maori' in this table if they identify Maori as at least one of their ethnicities at age 21, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'.

Maori were also significantly less likely to have received their 6th Form or Higher School Certificate, and University Bursary than non-Maori. In fact, non-Maori in this sample were greater than two-and one-half-times more likely than Maori to receive this top school qualification. Although a relatively lower proportion of Maori received University Diplomas

or Degrees, these ethnic differences are not statistically significant at a 10% level.[12] On average, Maori and non-Maori received 12.77 and 13.41 effective years of formal education, respectively. This difference is significant at better than a 1% level. Although Maori are more likely to have a vocational qualification than non-Maori, these differences are not statistically significant.

One of the advantages of the CHDS as a data source is the availability of almost continuous information on the various experiences of youth over their years as a teenager and young adult. Between the ages of 16 and 21, we can calculate the number of years that these individuals were *not* enrolled in either formal education or job training programmes. This is defined as their years of 'potential' work experience. This variable is based on detailed retrospective information on experiences taken from the surveys at ages 18 and 21. At the survey at age 21, for example, individuals were asked to recall their activities in three-month blocks over the three-year period between their 18th and 21st birthdays. We assign all three months to potential work experience if the individual was *not* enrolled in formal education or a training programme in that quarter. We assign one-and-a-half months to potential work experience if the individual was enrolled part-time in education or training in that quarter. We assign zero months to this variable if the individual was enrolled full-time in education or training in that quarter. It is important to note that nothing precludes someone from working while he or she is either studying or training (either part-time or full-time). However, we expect that the availability of time outside of education and training should, on average, lead to the accumulation of more actual work experience.

Maori had *more* years of potential work experience (3.135), on average, than non-Maori (2.569). This difference is statistically significant at better than a 1% level. This suggests that Maori generally spent less time in training and education over this five-year period than non-Maori. Correspondingly, Maori had more potential time available for accumulating work experience.

On average, Maori accumulated *less* work experience by age 21 than non-Maori.[13] Maori had a mean of 1.990 actual years of work experience compared to a mean of 2.278 for non-Maori. This difference of 0.288 years is statistically significant at better than a 1% level, and is equivalent to 14.5% of the non-Maori mean. The disparity is even more noteworthy when we consider the fact that Maori had significantly more potential work experience than non-Maori. One way to recognise this fact is to take the ratio of actual to potential work experience. These ratios are 0.887 for non-Maori (2.278/2.569) and 0.635 for Maori (1.990/3.135). Where non-Maori youth spent nearly *nine-tenths* of their potential time in actual work experience, Maori youth spent less than *two-thirds* of their potential time in actual work experience.[14]

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[12] It is much too early in the CHDS to say anything about ethnic differences in tertiary qualifications. Future surveys will be much more useful in addressing this issue.

[13] As with potential work experience, actual work experience is based on retrospective information from the CHDS surveys at ages 18 and 21. For example, for each three-month block of time between the 18th and 21st birthdays, all 3 months were added to actual work experience if the individual worked full-time (30 or more hours during this period). Only 1.5 months were added to work experience if the individual worked part-time (fewer than 30 hours). Nothing was added to this variable if the person did not work during the quarter. Again, work and either studying or training are *not* mutually exclusive. It is possible, for example, for someone to be both enrolled in education full-time and working part-time.

[14] It should be noted that these ethnic differences are *slightly larger* if we base Maori ethnicity entirely on self-reported ethnicities at age 21. See the initial report in this study. Linking youth ethnicity to that of the parents may be one way of controlling for 'reverse causality' in this analysis. Youth who experience bad

With such a substantial difference in work experience by ethnicity, we can ask what these individuals were doing during the periods when they were not working, studying or training. Between the ages 16 and 21, Maori spent twice the amount of time unemployed (0.726 years) as non-Maori (0.360 years).[15] This difference is statistically significant at better than a 1% level. We can combine the work and unemployment experience variables in a single measure of 'labour supply'. The total time spent in the labour force between ages 16 and 21 is nearly the same for the average Maori (2.716) and non-Maori (2.638).

There are also substantial differences in the employment circumstances of Maori and non-Maori at the time of the interview at age 21. Maori were less likely to be working (57.6%) relative to non-Maori (70.3%). For those working, Maori were less likely to be working part-time (21.1%) relative to non-Maori (36.2%). Correspondingly, employed Maori worked more hours per week (35.93) compared to their non-Maori counterparts (31.29). All of these ethnic differences are statistically significant at better than a 10% level.

There is no evidence of any ethnic differences in the mean hourly earnings received by those employed in this sample. The average wage paid to Maori workers ($9.44) exceeds that paid to non-Maori workers ($9.26), although the difference is *not* statistically significant.

Consistent with earlier findings, Maori (16.2%) were more likely to unemployed at the age 21 interview than non-Maori (8.9%). Maori (22.2%) relative to non-Maori (12.4%) were also more likely to be receiving either the Unemployment Benefit (UB) or Domestic Purposes Benefit (DPB) at the time of the survey. These ethnic differences are statistically significant at better than a 10% level. Maori were significantly less likely at age 21 to be enrolled in education or training (18.2%) relative to their non-Maori counterparts (37.5%).

A three-way ethnic split is also used to examine the education and work histories of these youth. These descriptive statistics are reported in Table 5. The first column in Table 4 (Maori) is subdivided into those who report Maori as their only ethnicity (sole Maori) and those that report Maori as just one of their ethnicities (mixed Maori). Note that the non-Maori group in this table is identical to the non-Maori in the previous table. The asterisks associated with the statistics in the first two columns of Table 5 indicate whether or not the mean values of the variables for sole and mixed Maori are each significantly different from those for non-Maori.

There are no significant differences in the proportion of females across the three ethnic groups. Both sole and mixed Maori have significantly lower proportions with School Qualifications, 6th Form or Higher School Certificates and University Bursary compared to non-Maori. With all three variables, the proportions with school qualifications for mixed Maori lie between the proportions for sole Maori and non-Maori. The same relative rankings hold for effective years of formal education. Sole Maori by age 21 had spent an average of 12.58 years in education. This figure is higher for mixed Maori (12.95), and higher still for non-Maori (13.41). Where this ethnic difference in educational attainment is

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educational and work outcomes may tend to identify with Maori even if they had no *reported* connection to Maori ethnicity through either their birth parents or subsequent parental figures. We cannot rule out the possibility, however, that the ethnicities of the parents or parental figures were originally measured with error in these situations.

[15] To be unemployed by this definition, the individual must have been without work and actively seeking employment. This is close to the official definition of unemployment in the Household Labour Force Survey.

significant at better than a 1% level between sole Maori and non-Maori, it is only significant at a 10% level between mixed Maori and non-Maori.

Table 5 - Descriptive Statistics on Education and Work Histories: Three-Way Split in Youth Ethnicity

Variables	Sole Maori	Mixed Maori	Non-Maori
Proportion Female	0.458	0.627	0.510
Proportion with School Certificate	0.667*	0.706*	0.831
Proportion with 6th Form or Higher School Certificate	0.417**	0.549**	0.674
Proportion with University Bursary	0.063**	0.157*	0.292
Proportion with University Diploma or Degree	0.042	0.000*	0.043
Effective Years of Formal Education	12.58**	12.95*	13.41
Proportion with Vocational Qualification	0.521	0.549	0.494
Ages 16 to 21, Years Not Enrolled in Education or Training	3.336**	2.946*	2.569
Ages 16 to 21, Years of Work Experience	2.120	1.868**	2.278
Ages 16 to 21, Years Unemployed	0.625**	0.820**	0.360
At Age 21, Proportion Working	0.542*	0.608*	0.703
For those Working, Proportion Part-Time	0.154*	0.258	0.362
For those Working, Mean Weekly Hours of Work	39.08*	33.290	31.29
For those Working, Mean Hourly Earnings	$9.12	$9.71	$9.26
At Age 21, Proportion Unemployed	0.146	0.176*	0.089
At Age 21, Proportion Receiving UB or DPB	0.208*	0.235*	0.124
At Age 21, Proportion Enrolled in Education or Training	0.208*	0.157**	0.375
For those Enrolled, Proportion Enrolled Part-Time	0.200	0.250	0.131
For those Enrolled, Proportion Working	0.300*	0.625	0.610
Number of Observations	48	51	874

** Maori mean (sole or mixed ethnicity) significantly different from non-Maori mean at 1% level.
* Maori mean (sole or mixed ethnicity) significantly different from non-Maori mean at 10% level.
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. Youth are defined as 'Sole Maori' in this table if they identify Maori as their only ethnicity at age 21. Youth are defined as 'Mixed Maori' if they report both Maori and any other ethnicity, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'.

The same relative rankings across the three ethnic groups hold for the mean levels of potential work experience. Sole Maori have the highest years *not* enrolled in education or training (3.336), followed by mixed Maori (2.946) and non-Maori (2.569).

In terms of actual work experience, only the mean for mixed Maori (1.868) is significantly lower than the mean for non-Maori (2.278). Although means for work experience between sole Maori (2.120) and non-Maori are *not* significantly different from one another, sole Maori have much higher levels of potential work experience than non-Maori. Again, we can take the ratios of actual to potential work experience for each ethnic group. These ratios are 0.887 for non-Maori (2.278/2.569), 0.635 for sole Maori (2.120/3.336) and 0.634 for mixed Maori (1.868/2.946). Thus, these ratios of actual-to-potential work experience are nearly identical for sole and mixed Maori, and substantially below the ratio for non-Maori.

Both sole and mixed Maori were significantly less likely to be employed at age 21 (54.2% and 60.8%, respectively) relative to non-Maori (70.3%). Yet, there is no evidence of

systematic differences in hourly earnings by ethnicity. The average wages paid to workers who are sole Maori ($9.12) and mixed Maori ($9.71) were *not* significantly different from the mean wage paid to non-Maori ($9.26).

Both sole and mixed Maori acquired more time in unemployment between the ages 16 and 21 (0.625 and 0.820 years, respectively) compared to non-Maori (0.360 years). These differences are statistically significant at better than a 1% level. Although similar results are found for unemployment propensities at age 21, only the difference between mixed Maori (17.6%) and non-Maori (8.9%) is statistically significant at a 10% level.

Both sole and mixed Maori are significantly more likely to receive either UB or DPB (20.8% and 23.5%, respectively) than non-Maori (12.4%) at age 21. Both sole and mixed Maori are significantly less likely to be enrolled in either education or training (20.8% and 15.7%, respectively) than non-Maori (37.5%) at age 21.

We conclude that substantial differences exist between Maori and non-Maori youth in terms of their educational and employment histories by age 21. Although the mixed Maori group appears in some ways to be a 'weighted average' of the sole Maori and non-Maori groups (eg, school qualifications), in other respects, the sole and mixed Maori groups appear to be quite similar (eg, ratios of actual to potential work experience).

4.3 Personal and family backgrounds

One advantage of the CHDS is the availability of detailed information on the personal and family background characteristics of youth. Descriptive statistics are provided in Tables 6 and 7 for the same ethnic breakdowns used in the previous two tables.

Table 6 compares Maori with non-Maori. Both the mothers and fathers of Maori youth are significantly less likely to have post-school and university qualifications compared to non-Maori.

Maori youth, on average, spent more than twice as much time between the ages of 1 and 16 in a single-adult family (25.4%) compared to non-Maori (10.3%). Maori youth spent more than twice as much time between the ages of 1 and 14 in families receiving a social welfare benefit (26.5%) compared to non-Maori (11.8%). These ethnic differences in the likelihood of the family containing a single adult and receiving social welfare benefits are statistically significant at better than a 1% level.

Table 6 - Descriptive Statistics on Personal and Family Backgrounds: Two-Way Split in Youth Ethnicity

Variables	Maori	Non-Maori
Mother has School Qualification	0.283	0.337
Mother has Post-School Qualification	0.071**	0.206
Mother has University Degree	0.010*	0.061
Father has School Qualification	0.323	0.330
Father has Post-School Qualification	0.040**	0.137
Father has University Degree	0.020**	0.138
Ages 1 to 16, Proportion of Years in Single-Adult Family	0.254**	0.103
Ages 1 to 15, Maximum Number of Children in Family	2.737	2.505
Ages 1 to 14, Proportion of Years Family Received Benefit	0.265**	0.118
Ages 1 to 14, Mean Real Family Income	$34,934**	$43,758
Ages 7, 9, 11 and 13, Mean Conduct Problems Score	52.215**	48.941
Ages 12 to 16, Proportion Truant, Suspended or Expelled	0.049*	0.016
Ages 18 to 21, Convicted of Criminal Offence	0.222**	0.101
Ages 18 to 21, Alcohol/Drug Abuse or Dependence	0.475**	0.327
Number of Children Born to Respondent	0.343**	0.076
Number of Observations	99	874

** Maori mean significantly different from non-Maori mean at 1% level.
* Maori mean significantly different from non-Maori mean at 10% level.
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. Youth are defined as 'Maori' in this table if they identify Maori as at least one of their ethnicities at age 21, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'.

Maori between the ages of 1 and 14 lived in families with a mean real income of $34,934.[16] Over the same ages, non-Maori lived in families with a mean real income of $43,758. Maori youth grew up in families with incomes that were, on average, 20.2% lower than that of non-Maori. This difference is statistically significant at better than a 1% level. Note that the mean values for the number of children in these families were *not* significantly different between the ethnic groups. As a result, the gap in family income by ethnicity cannot be explained by the differences in 'family need' related to the number of children in the household.

The CHDS also contains information on 'Conduct Problem Scores' for children at the ages of 7, 9, 11 and 13. These measures are based on a combination of parental and teacher reports on 'conduct disorders' displayed by the child around the time of these assessments.[17] Higher values for this variable indicate more disruptive, destructive and aggressive behaviour. The mean Conduct Problem Scores over the four years are 52.215 for Maori and 48.941 for non-Maori. This difference is statistically significant at better than a 1% level.

We also know the number of years in which the child was frequently truant, suspended or expelled from school between the ages of 12 and 16. This information is taken from past

[16] All income figures were inflated to constant dollars as of June 1996 using the Consumer Price Index adjusted for the effects of interest rate changes and the introduction of GST.
[17] Details on the construction of these variables can be found in Fergusson and Horwood (1993).

interviews with both parents and children. The difference between the ethnic groups is statistically significant at better than a 10% level. The truant, suspension or expulsion rate was 4.9% for Maori and 1.6% for non-Maori.

At age 21, youth in the CHDS were asked about their criminal history and the use of alcohol and drugs since age 18. The first variable is the proportion of individuals who were convicted in court of at least one criminal offence between their 18th and 21st birthdays. These conviction rates were 22.2% for Maori and 10.1% for non-Maori, and are statistically significant at better than a 1% level. These overall conviction rates for New Zealand youth may seem fairly high at first glance. However, this variable was constructed from detailed information on the offending history of these youth, and includes court convictions for things like disorderly conduct and various driving offences. Data taken from the Ministry of Justice (2000) indicate that most criminal convictions for individuals in this age group are for 'property' or 'traffic' offences.

Combining data from the Household Labour Force Survey and the Ministry of Justice (Tables A2.1 to A2.4, 2000), we estimate that convictions per capita in 1999 were 0.295 for Maori and 0.058 for non-Maori between the ages of 17 and 24. Note that these figures are not directly comparable to those in Table 6. The CHDS variable refers to the proportion of youth with at least one criminal conviction over the ages of 18 to 20. The Ministry of Justice variable refers to the conviction rates of youth based on criminal convictions over the ages of 17 to 24. Published data on the proportion of youth with at least one conviction are unavailable. Yet, both the level and ethnic differences in the conviction data for youth in the CHDS are broadly consistent with these published, national statistics.

The second variable is the proportion of individuals who met certain criteria for alcohol or illicit drug abuse or dependence. These rates of Alcohol/Drug Abuse or Dependence were 47.5% for Maori and 32.7% for non-Maori. These ethnic differences are statistically significant at better than a 1% level.

Finally, one of the more startling outcomes from this sample is the difference by ethnicity in the number of children born to the respondent. This information is taken from several questions on the outcomes of any pregnancies experienced by females and any children fathered by males by age 21. The average number of children born to the respondent is 0.343 for Maori and 0.076 for non-Maori. This difference is statistically significant at better than a 1% level. This says that Maori, on average, are responsible for giving birth to four and one-half times the number of children as non-Maori by age 21.

Table 7 repeats this same analysis for the three-way breakdown of youth ethnicity. As with the data on education and work histories, the mean personal and family background characteristics of mixed Maori are largely a weighted average of the means of sole Maori and non-Maori. Yet, by most indicators, mixed Maori appear to be more similar to sole Maori than to non-Maori. Both Maori groups have parents with lower levels of educational attainment than non-Maori. Sole and mixed Maori are relatively more likely to have been raised in single-parented families and in families receiving a social welfare benefit. These ethnic differences relative to non-Maori are significant at better than a 1% level in three of the four situations.

Table 7 - Descriptive Statistics on Personal and Family Backgrounds: Three-Way Split in Youth Ethnicity

Variables	Sole Maori	Mixed Maori	Non-Maori
Mother has School Qualification	0.292	0.275	0.337
Mother has Post-School Qualification	0.063*	0.078*	0.206
Mother has University Degree	0.000*	0.020	0.061
Father has School Qualification	0.229	0.412	0.330
Father has Post-School Qualification	0.042*	0.039*	0.137
Father has University Degree	0.021*	0.020*	0.138
Ages 1 to 16, Proportion of Years in Single-Adult Family	0.286**	0.223**	0.103
Ages 1 to 15, Maximum Number of Children in Family	2.646	2.824	2.505
Ages 1 to 14, Proportion of Years Family Received Benefit	0.299**	0.233*	0.118
Ages 1 to 14, Mean Real Family Income	$32,667**	$37,067**	$43,758
Ages 7, 9, 11 and 13, Mean Conduct Problems Score	52.447*	51.996*	48.941
Ages 12 to 16, Proportion Truant, Suspended or Expelled	0.039*	0.059*	0.016
Ages 18 to 21, Convicted of Criminal Offence	0.229*	0.216*	0.101
Ages 18 to 21, Alcohol/Drug Abuse or Dependence	0.479*	0.471*	0.327
Number of Children Born to Respondent	0.458**	0.235*	0.076
Number of Observations	48	51	874

** Maori mean (sole or mixed ethnicity) significantly different from non-Maori mean at 1% level.
* Maori mean (sole or mixed ethnicity) significantly different from non-Maori mean at 10% level.
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. Youth are defined as 'Sole Maori' in this table if they identify Maori as their only ethnicity at age 21. Youth are defined as 'Mixed Maori' if they report both Maori and any other ethnicity, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'.

Sole and mixed Maori were raised in families with mean real incomes of $32,667 and $37,067, respectively. This says that sole and mixed Maori lived in families with incomes that were, on average, 25.3% and 15.3% lower than that of non-Maori, respectively. These differences are statistically significant at better than a 1% level.

Mean Conduct Problem Scores are significantly higher for both sole and mixed Maori relative to non-Maori. The same is true of the proportion of years that these children were frequently truant, suspended or expelled from school between ages 12 and 16, and the proportion with criminal convictions between ages 18 and 21. Alcohol or drug abuse rates were also significantly higher for sole and mixed Maori relative to non-Maori. Finally, the average number of children born to the respondent is 0.458 for sole Maori, 0.235 for mixed Maori and 0.076 for non-Maori. These differences relative to non-Maori are statistically significant at better than a 1% and 10% level, respectively. This says that sole Maori, on average, gave birth to more than six times the number of children as non-Maori by age 21.

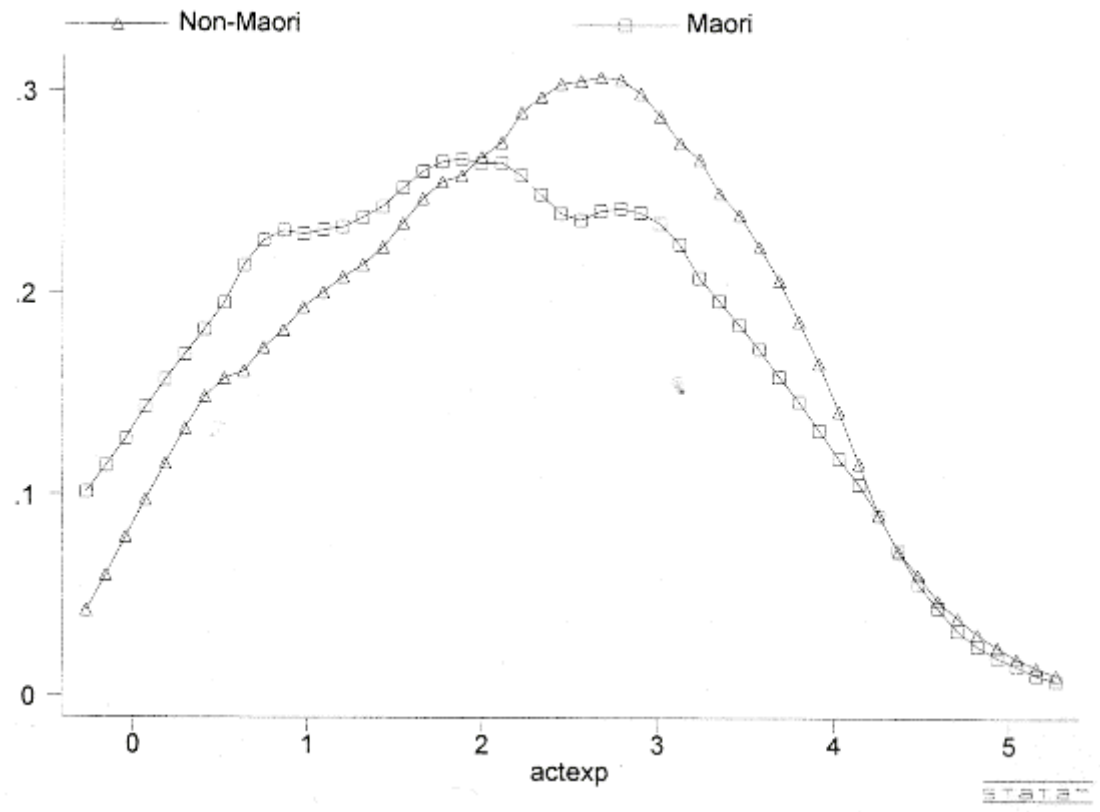
4.4 Distributions of education, training and work experience by ethnicity

Mean differences by ethnicity in time spent in acquiring human capital and work experience between the ages of 16 and 21 may tell only a part of the overall story. In this

section we compare the estimated distributions of these outcomes between Maori and non-Maori.

The software package STATA is used to estimate the probability density functions of actual work experience between the ages of 16 and 21 using a kernel smoother. Figures 1 and 2 display the results for the two and three-way splits in youth ethnicities. Table 4 showed that the mean value of work experience by age 21 was significantly lower for Maori (1.990 years) than non-Maori (2.278). Figure 1 shows that these ethnic differences in work experience come from a relatively flatter density function for Maori. Most of these differences appear in the lower tails of these distributions. The numerical results at the bottom of Figure 1 show that 50.6% of Maori have fewer than two years of work experience by age 21. The same is true for only 42.0% of non-Maori. Yet, the upper tails of the distributions appear to be quite similar.

Figure 1 – Work Experience Ages 16 21: Two-Way Split in Youth Ethnicities



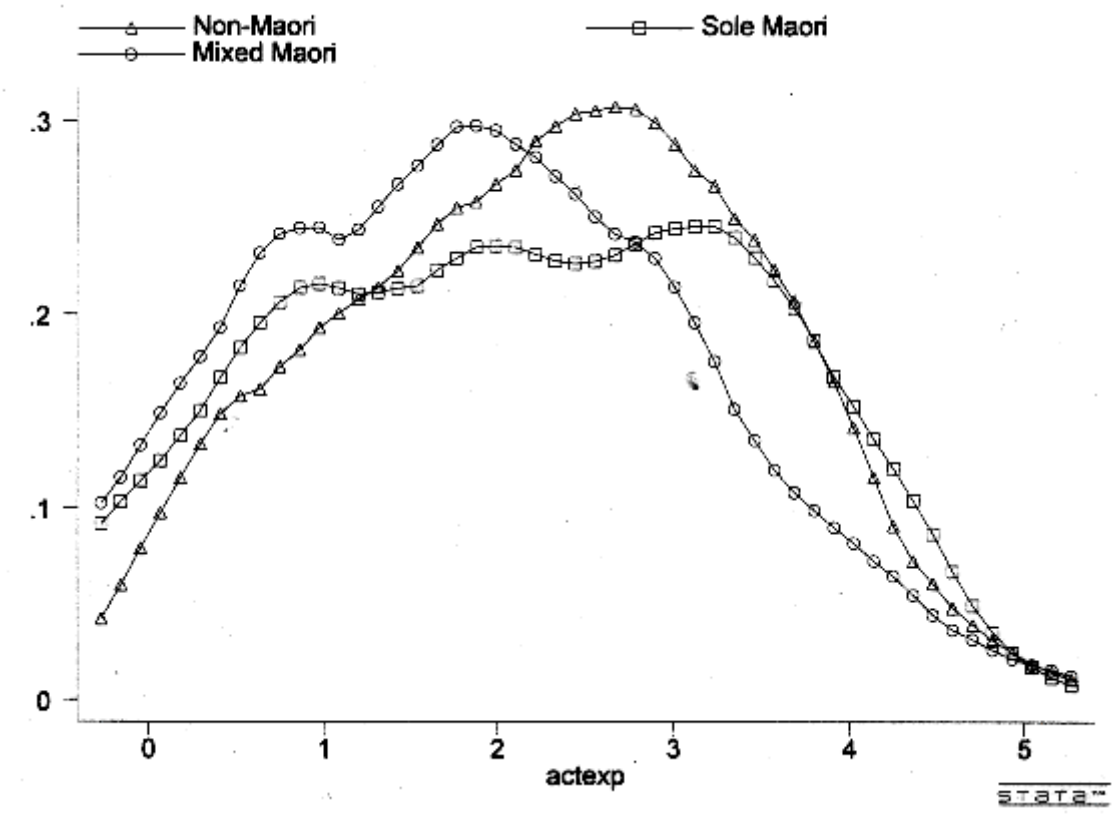
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. The probability density functions are estimated using a kernel smoother in STATA. These are the estimated distributions of the actual work experience between the ages of 16 and 21 for the two ethnic groups. Youth are defined as 'Maori' in this figure if they identify Maori as at least one of their ethnicities at age 21, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'.

Proportions with Work Experience in the Range:

	Maori	Non-Maori
0 ≤ EXP ≤ 1	0.253	0.183
1 < EXP ≤ 2	0.253	0.237
2 < EXP ≤ 3	0.283	0.296
3 < EXP ≤ 4	0.172	0.229
4 < EXP ≤ 5	0.040	0.055

Differences between sole and mixed Maori (relative to non-Maori) in their respective work experience distributions are depicted in Figure 2. Table 5 showed that the mean value of work experience was significantly lower for mixed Maori (1.868), but not for sole Maori (2.120). This is caused by a 'leftward shift' in the entire work experience density function for mixed Maori relative to non-Maori. The greater variability in experiences by Maori appears to be concentrated among sole Maori. Both mixed and sole Maori are much more likely than non-Maori to accumulate relatively little work experience by age 21. But only mixed Maori accumulate significantly less work experience by age 21 than non-Maori. However, caution should be exercised in drawing firm conclusions from this analysis because of the relatively small sample size for Maori. This is particularly true for the smoothed density functions among sole and mixed Maori with samples of 48 and 51, respectively.

Figure 2 – Work Experiences Ages 16 to 21: Three-Way Split in Youth Enthicities



Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. The probability density functions are estimated using a kernel smoother in STATA. These are the estimated distributions of the actual work experience between the ages of 16 and 21 for the three ethnic groups. Youth are defined as 'Sole Maori' in this figure if they identify Maori as their only ethnicity at age 21. Youth are defined as 'Mixed Maori' if they report both Maori and any other ethnicity, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'.

Proportions with Work Experience in the Range:

	Sole Maori	Mixed Maori	Non-Maori
$0 \leq EXP \leq 1$	0.229	0.275	0.183
$1 < EXP \leq 2$	0.250	0.255	0.237
$2 < EXP \leq 3$	0.250	0.314	0.296
$3 < EXP \leq 4$	0.229	0.118	0.229
$4 < EXP \leq 5$	0.042	0.039	0.055

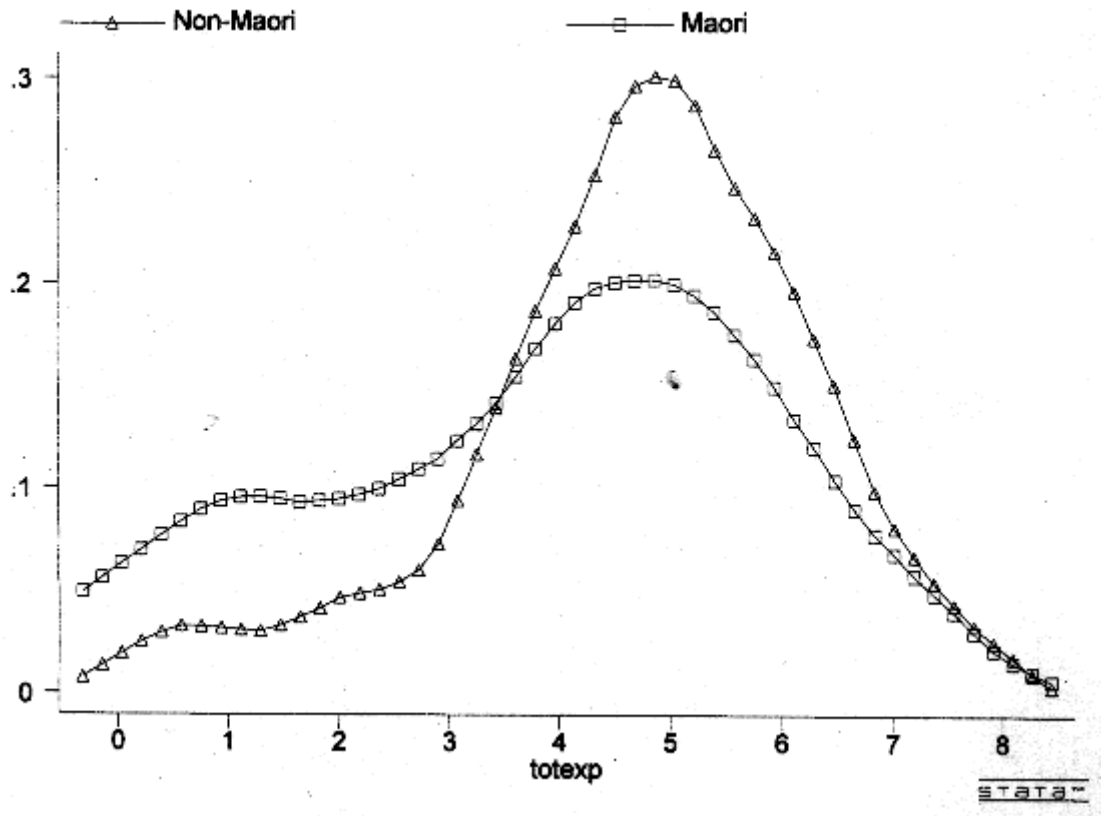
The estimated density functions on actual work experience in Figures 1 and 2 do not 'control' for the fact that work experience may have been foregone between the ages of

16 and 21 while youth accumulate human capital through formal education and training programmes. A variable is constructed that combines the effective time spent enrolled in education or training programmes with the actual years of work experience between the 16th and 21st birthdays. Again, the amounts of time spent in the two activities are *not* mutually exclusive. Individuals, for example, could be enrolled in full-time study and part-time work, or part-time study and full-time work. This means that the sum of two activities can exceed the maximum of this five-year interval in some cases. The estimate probability density functions for this 'total experience' variable are displayed in Figures 3 and 4 for the two and three-way splits in youth ethnicities.

The mean values for effective years in education, training and work experience between the ages of 16 and 21 are 4.875 for non-Maori and 4.229 for Maori. These ethnic differences are significant at a 1% level, and the gap of 0.646 years in total experience is larger than the gap of 0.288 years in work experience between non-Maori and Maori. The ethnic differences in the estimated density functions for total experience are striking. While both have a peak of slightly less than five years, the distribution for Maori is more dispersed. The biggest differences occur in the lower tails. Slightly more than one out of every eight non-Maori (12.6%) and nearly one of every three Maori (32.3%) accumulate three or fewer years of education, training and work experience between the ages of 16 and 21. (See the numbers at the bottom of Figure 3.) Many of the differences in the accumulation of human capital and work experience between the ethnic groups appear to be concentrated among the most disadvantaged in society. Yet, 42.9% of non-Maori have more than five years of combined education, training and work experience between ages 16 and 21. The same is true for only 29.3% of Maori.

Figure 4 displays the estimated density functions for total experience using the three-way split in youth ethnicity. The mean values for the effective years in education, training and work experience between the ages of 16 and 21 are 4.875 for non-Maori, 4.333 for mixed Maori and 4.208 for sole Maori. Again, the upper tails of the three density functions appear to be fairly similar. The biggest differences occur in the lower tails. Recall that slightly more than one out of every eight non-Maori (12.6%) had accumulated three or fewer years of education, training and work experience over this five-year period. Yet, these proportions are substantially higher among mixed Maori (29.4%) and sole Maori (35.4%). (See the numbers at the bottom of Figure 4.) Both groups of Maori are much more likely to 'fail' in accumulating these productive experiences relative to non-Maori. Again, 42.9% of non-Maori have more than five years of combined education, training and work experience between ages 16 and 21. The same is true for only 29.2% and 29.4% of sole and mixed Maori. Both groups of Maori are less likely to 'succeed' in accumulating these productive experiences relative to non-Maori during this critical phase in the school-to-work transition.

Figure 3 – Effective Education, Training and Work Experience Ages 16 to 21: Two-way Split in Youth Ethnicities



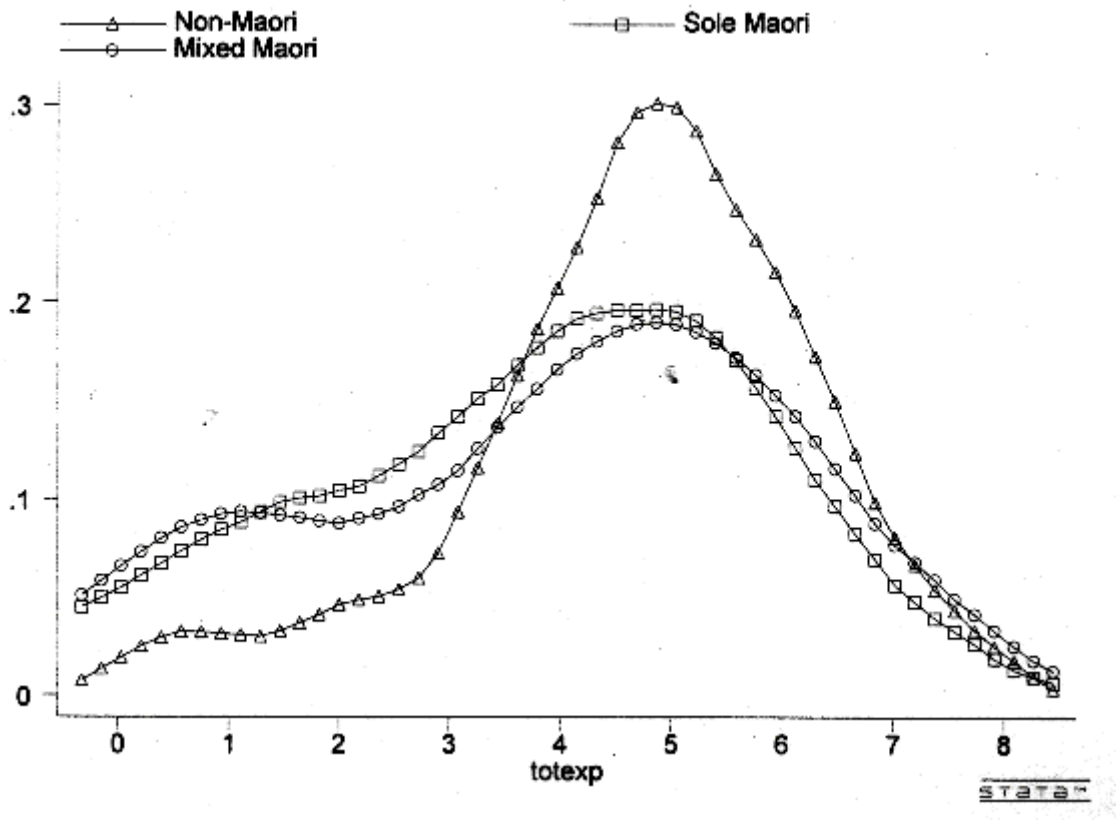
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. The probability density functions are estimated using a kernel smoother in STATA. These are the estimated distributions of the effective education, training and work experience between the ages of 16 and 21 for the two ethnic groups. This variable can exceed the time span of five years in some cases, because individuals may, for example, be working full-time and studying part-time or working part-time and studying full-time. They get 'credit' for both activities with this variable. Youth are defined as 'Maori' in this figure if they identify Maori as at least one of their ethnicities at age 21, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'.

Proportions with Total Experience in the Range:

	Maori	Non-Maori
0 ≤ TOTEXP ≤ 1	0.131	0.038
1 < TOTEXP ≤ 2	0.091	0.034
2 < TOTEXP ≤ 3	0.101	0.054
3 < TOTEXP ≤ 4	0.141	0.148
4 < TOTEXP ≤ 5	0.242	0.297
5 < TOTEXP ≤ 6	0.152	0.243
TOTEXP > 6	0.141	0.186

Finally, Tables 8 and 9 show that how the *ratio* of actual to potential work experience changes with the level of potential work experience. We take the same five categories of potential work experience used at the bottom of Figures 1 and 2, and compute the mean levels of actual work experience within these intervals. These categorical means are computed for both the two-way and three-way splits in youth ethnicity. Although actual work experience generally increases with potential work experience, the relationship is far from uniform. The ratio of actual to potential work experience declines from greater than one to approximately one-half as we move from the lowest to highest category of potential work experience.

Figure 4 - Effective Education, Training and Work Experience Ages 16 to 21: Three-way Split in Youth Ethnicities



Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. The probability density functions are estimated using a kernel smoother in STATA. These are the estimated distributions of the effective education, training and work experience between the ages of 16 and 21 for the three ethnic groups. This variable can exceed the time span of five years in some cases, because individuals may, for example, be working full-time and studying part-time or working part-time and studying full-time. They get 'credit' for both activities with this variable. Youth are defined as 'Sole Maori' in this figure if they identify Maori as their only ethnicity at age 21. Youth are defined as 'Mixed Maori' if they report both Maori and any other ethnicity, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'.

Proportions with Total Experience in the Range:

	Sole Maori	Mixed Maori	Non-Maori
0 ≤ TOTEXP ≤ 1	0.125	0.137	0.038
1 < TOTEXP ≤ 2	0.083	0.098	0.034
2 < TOTEXP ≤ 3	0.146	0.059	0.054
3 < TOTEXP ≤ 4	0.104	0.176	0.148
4 < TOTEXP ≤ 5	0.250	0.235	0.297
5 < TOTEXP ≤ 6	0.167	0.137	0.243
TOTEXP > 6	0.125	0.157	0.186

There are a couple of important points to mention about the results in Tables 8 and 9. First, note that the means of actual work experience are all greater than one for individuals with no more than one year of potential work experience across all ethnic groups. This indicates the prevalence of work while youth are enrolled in education and training programmes. Although the mean for non-Maori (1.601) is greater than the means for sole and mixed Maori (1.042 and 1.500, respectively), these differences are not statistically significant at a 10% level. (The small sample sizes for Maori groups within

these potential work experience categories make it difficult for any ethnic differences to be statistically significant.)

Table 8 - Distribution of Actual Work Experience by Potential Work Experience: Two-Way Split in Youth Ethnicity

Potential Work Experience in the Range:	Maori		Non-Maori	
	N	Actual Work Experience Mean	N	Actual Work Experience Mean
0 ≤ POTEXP ≤ 1	14	1.336	220	1.601
1 < POTEXP ≤ 2	14	2.357	167	1.856
2 < POTEXP ≤ 3	21	2.228	139	2.458
3 < POTEXP ≤ 4	19	2.829	188	2.970
4 < POTEXP ≤ 5	31	1.444**	160	2.682

** Maori mean significantly different from non-Maori mean at 1% level.
* Maori mean significantly different from non-Maori mean at 10% level.
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. Youth are defined as 'Maori' in this table if they identify Maori as at least one of their ethnicities at age 21, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'.

Table 9 - Distribution of Actual Work Experience by Potential Work Experience: Three-Way Split in Youth Ethnicity

Potential Work Experience in the Range:	Sole Maori		Mixed Maori		Non-Maori	
	N	Actual Work Experience Mean	N	Actual Work Experience Mean	N	Actual Work Experience Mean
0 ≤ POTEXP ≤ 1	5	1.042	9	1.500	220	1.601
1 < POTEXP ≤ 2	7	2.839*	7	1.875	167	1.856
2 < POTEXP ≤ 3	10	1.858	11	2.564	139	2.458
3 < POTEXP ≤ 4	9	3.338	10	2.371	188	2.970
4 < POTEXP ≤ 5	17	1.650**	14	1.193**	160	2.682

** Maori mean (sole or mixed ethnicity) significantly different from non-Maori mean at 1% level.
* Maori mean (sole or mixed ethnicity) significantly different from non-Maori mean at 10% level.
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. Youth are defined as 'Sole Maori' in this table if they identify Maori as their only ethnicity at age 21. Youth are defined as 'Mixed Maori' if they report both Maori and any other ethnicity, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'.

Second, the most striking result from these tables is the substantially lower actual work experience accumulated by Maori relative to non-Maori with more than four years of potential work experience. Refer to the results displayed at the bottom of Table 8. The 31 Maori youth in this category have an average of 1.444 years of actual work experience. The 160 non-Maori youth in this category have an average of 2.682 years of actual work experience. These means are statistically different from one another at better than a 1% level. Among youth who discontinue their education and training early in life, Maori tend to acquire much less actual work experience than non-Maori by age 21. The results in Table 9 show that this relative disadvantage exists among both sole and mixed Maori. Maori who discontinue their human capital accumulation around age 16 are much more at risk than non-Maori of experiencing poor labour market transitions.

5 Regression results on actual work experience by age 21

We know from Tables 4 and 5 that Maori in the CHDS accumulate *less* work experience, on average, compared to their non-Maori counterparts by age 21. This is despite the fact that Maori by this age have spent *more* time than non-Maori outside of education and training. In this section, we quantify the statistical relationship between potential and actual work experience, while controlling for personal and family background factors that are known from the previous section to vary significantly between Maori and non-Maori in many cases. To what extent do these differences in personal and family background characteristics influence the accumulation of work experience?

5.1 Short and long regressions: Two-way split in youth ethnicity

Results of the regression analysis using the two-way split in ethnicity are displayed in Table 10. Two specifications are used. The 'short regression' includes the few independent variables that are typically available in most cross-sectional data sets. These regressors include the individual's years out of education and training, formal qualifications, ethnicity, gender and the number of children born to the respondent. The second 'long regression' includes various measures of personal and family backgrounds that are generally found only in panel data sets like the CHDS. They include the variables reported in Tables 6 and 7.

The dependent variable is the actual years of work experience accumulated by youth between the ages of 16 and 21. The mean of the dependent variable is 2.249 years across the sample of 973 individuals. The R^2 statistics are 0.299 and 0.346 for the short and long regressions, respectively. The addition of the 14 independent variables on family backgrounds in the long regression raises the explanatory power of the model by 15.7%. Using an *F* test, we can reject the null hypothesis that the coefficients on these family background variables are simultaneously equal to zero at better than a 1% level. Yet, just over one-third of the variation in work experience can be explained by this long regression.

Table 10 - OLS Regressions on Actual Years of Work Experience by Age 21: Two-Way Split in Youth Ethnicity

Independent Variables	Without Background Factors	With Background Factors
Constant	0.477**	0.858*
	(0.155)	(0.351)
Years Not Enrolled in Education or Training	0.418**	0.436**
	(0.030)	(0.030)
Maori	-0.247*	-0.169
	(0.110)	(0.110)
Female	-0.045	-0.117
	(0.068)	(0.070)
Male · Number Children Born to Respondent	0.042	0.137
	(0.162)	(0.159)
Female · Number Children Born to Respondent	-1.061**	-1.037**

Independent Variables	Without Background Factors	With Background Factors
	(0.129)	(0.127)
School Certificate	0.912**	0.794**
	(0.100)	(0.102)
6th Form or Higher School Certificate	0.208*	0.175*
	(0.096)	(0.095)
University Bursary	-0.217*	-0.214*
	(0.096)	(0.098)
University Diploma or Degree	0.032	-0.001
	(0.169)	(0.165)
Vocational Qualification	-0.063	-0.082
	(0.069)	(0.068)
Mother had School Qualification	---	-0.153*
		(0.076)
Mother had Post-School Qualification	---	-0.109
		(0.096)
Mother had University Degree	---	-0.607**
		(0.160)
Father had School Qualification	---	0.017
		(0.076)
Father had Post-School Qualification	---	-0.036
		(0.111)
Father had University Degree	---	-0.280*
		(0.127)
Years in Single-Adult Family	---	0.071
		(0.226)
Maximum Number of Children in Family	---	0.004
		(0.027)
Years Family Received Benefit	---	-0.468*
		(0.213)
Real Family Income (in $10,000 units)	---	0.080**
		(0.030)
Mean Conduct Problems Score	---	-0.007
		(0.005)
Years Truant, Suspended or Expelled	---	-1.058*
		(0.448)
Convicted of Criminal Offence	---	-0.057
		(0.112)
Alcohol/Drug Abuse or Dependence	---	-0.140*
		(0.071)
R^2	0.299	0.346
Adjusted R^2	0.292	0.330
Number of Observations		973
Mean of Dependent Variable		2.249

** Significantly different from zero at 1% level.
* Significantly different from zero at 10% level.
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. The dependent variable is the effective years of work experience accumulated by the individual between the ages of 16 and 21. Youth are defined as 'Maori' in these regressions if they identify Maori as at least one of their ethnicities at age 21, and had at least one parental figure claiming Maori ethnicity by age 14 of the CHDS child. All other youth are considered to be 'non-Maori'. Standard errors are in parentheses.

Table 4 showed that Maori, on average, had 0.288 fewer years of work experience by age 21 relative to non-Maori. If the other independent variables accounted for *none* of the ethnic differences in accumulated work experience between Maori and non-Maori, the estimated coefficient on Maori in these regressions would be –0.288. This estimated parameter is slightly smaller in absolute value in the short regression (-0.247), and significantly different from zero at better than a 2.5% level.

To perform the Neumark decomposition we need to re-estimate the short regression *excluding the Maori indicator variable* as a regressor. These regression results are not reported, but the R^2 statistic declines only slightly from 0.2989 to 0.2953 when we drop ethnicity from the short regression.[18] In other words, there is only a 1.2% loss in explanatory power when ethnicity is dropped from an experience regression that already includes years not enrolled in education or training, gender, gender interacted with children born to the individual, and the person's formal qualifications. Almost all of the explained variation in actual work experience across individuals can be accounted for by measured personal characteristics and circumstances other than ethnicity. Adding the Maori indicator variable does not substantially enhance the predictive performance of this regression model.

The findings from these experience regressions can be summarised by equation (4), which was developed in the Section 3 of this report. This equation is re-produced below.

$$\mathbf{EXP_{NM}} - \mathbf{EXP_{M}} = [(POTEXP_{NM} - POTEXP_{M})b + (X'_{NM} - X'_{M})c] + [(b_{NM} - b)POTEXP_{NM} + (b - b_{M})POTEXP_{M} + (c_{NM} - c)X'_{NM} + (b - b_{M})X'_{M}] \quad (9)$$

The left-hand side of the expression is the observed mean gap in actual work experience between non-Maori and Maori. The first term in the square brackets on the right-hand side is the *explained* component of the overall gap in work experience. This can be broken down into parts that can be related to ethnic differences in potential work experience and all other covariates in the regression. The second term in the square brackets is the *unexplained* component of the overall gap in work experience. Using estimated coefficients from an unreported 'pooled' regression, the estimated values for these terms can be substituted into this expression.[19]

$$\text{Observed Gap} = [(\Delta POTEXP)b + (\Delta X')c] + [\text{Unexplained}] = [\text{Explained}] + [\text{Unexplained}] \quad (10)$$

$$0.288 = [-0.238 + 0.298] + [0.228] = [0.060] + [0.228]$$

The results from this short regression can be interpreted in the following way. We know that non-Maori accumulated an average of 0.288 more years of work experience than Maori by age 21. However, this is the net effect of two offsetting forces. Maori have, on average, more years of potential work experience than non-Maori by age 21. The estimated coefficient on years not enrolled in education or training is positive (0.420), and

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[18] This difference has the same level of statistical significance (2.5%) as the estimated coefficient on being Maori in the short regression reported in Table 10.

[19] See Section 3.1 for the derivation of this Neumark decomposition. The estimated parameters from this pooled regression are generally quite close to those from the much larger subsample in the non-Maori regression.

significantly different from zero at better than a 1% level in the regression without ethnicity.[20] Table 4 shows that the average potential work experience of Maori exceeds that of non-Maori by 0.566 years. Multiplying this difference in means by the estimated coefficient on this variable suggests that the additional time spent outside of education and training by Maori would *increase* their actual work experience by slightly less than one-quarter of a year (0.566 • 0.420 = 0.238). This is the first number in the squared brackets in equation (10). In other words, if non-Maori spent the same time as Maori away from education and training, the ethnic gap in work experience would *widen* to more than one-half of a year (0.288 + 0.238 = 0.526).

Yet, we also know from Tables 4 and 6 that Maori have, on average, more children and fewer qualifications than non-Maori. If non-Maori had these same personal characteristics as Maori, the ethnic gap in work experience would *narrow* by 0.298 years. If both ethnic groups had the same amount of time away from education and training *and* the same observable factors in other areas, then the gap in experience would narrow by only 0.060 years. This says that about one-fifth (20.8%) of the observed gap in experience between non-Maori and Maori can be explained by the covariates in this short regression (0.060/0.288). Nearly four-fifths (79.2%) of this gap cannot be accounted for with this specification (0.228/0.288).

Suppose we restrict the CHDS sample to those without formal school or tertiary qualifications. By age 21, unqualified Maori (n=28) had accumulated 0.606 fewer years of work experience than unqualified non-Maori (n=132). This gap in experience between these ethnic subgroups is substantially larger than the gap for the overall ethnic groups of 0.288. This is consistent with the earlier results that showed that the gap in work experience between Maori and non-Maori was largest at the lower tails of these respective distributions (Figure 1). The covariates in the regressions reported above account for 0.060 and 0.166 years of the ethnic gaps in work between all and unqualified 21 year-olds, respectively. The results from our short regression are able to explain a larger proportion of the ethnic gap in work experience among unqualified youth (27.4%) compared to all youth (20.8%). Yet, our conclusion is that the majority of ethnic differences in the early accumulation in work experience cannot be explained by the covariates in this short regression.

We can re-estimate the short regression for the subsample of CHDS youth without formal qualifications (n=160). Of course, the regressors on school and tertiary qualifications are excluded from this estimation, because of an absence of variation in these regressors. These regression results are not reported, but the R^2 statistic declines from 0.2356 to 0.2263 when we drop ethnicity from the short regression. This means that there is a 3.9% loss in explanatory power when ethnicity is dropped from an experience regression that already includes these other covariates. Most of the explained variation in actual work experience across unqualified youth can be accounted for by measured personal characteristics and circumstances other than ethnicity. Yet, the Maori indicator variable does more to enhance the predictive performance of this regression model among unqualified youth than it did earlier among all youth.

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[20] This estimated parameter says that every additional year of potential work experience leads to an increase, on average, of 0.420 years of actual work experience. This estimated coefficient is just slightly larger than the one on the same variable in the short regression controlling for ethnicity reported in Table 10. Both results confirm our hypothesis stated at the outset of this report that this parameter would be positive but less than one in value.

The second set of empirical results reported in Table 10 relate to the long regression, which adds information on the youth's personal and family background characteristics to the previous set of independent variables. It is worth noting that the estimated coefficients on the educational qualifications of parents are generally negative, and significantly different from zero in three of the six cases. Once other factors have been held constant, the education of the parents directly *reduces* the accumulation of work experience by the child. The proportion of years living in a single-parented family and the number of children in the family have estimated effects on work experience that are not statistically different from zero.

The proportion of years in which the family received social welfare benefits while the CHDS child was between the ages of 1 and 14 has a negative impact on his or her accumulation of work experience. This estimated coefficient is statistically significant at better than a 10% level. The mean real income of the family in which the child resided between ages 1 and 14 has a positive effect on subsequent work experience, and is significant at a 1% level. To get an idea of the magnitude of this income effect, the overall gap in experience between Maori and non-Maori is equivalent to an increase in real mean family income of Maori of $36,000 ((0.288/0.080) • $10,000). This is more than four-times the actual gap in mean family income between non-Maori and Maori ($8,824 taken from Table 6).

Measured conduct problems and criminal convictions have no statistical impact on the accumulation of work experience. Yet, the proportion of years between the ages of 12 and 16 that the child was truant, suspended or expelled from school and the proportion of years between 18 and 21 that the youth showed evidence of alcohol/drug abuse or dependence both have negative effects on work experience that are significantly different from zero at better than 10% levels.

Once all of the factors in the long regression have been held constant, the estimated coefficient on Maori is now –0.169, and only significantly different from zero at a 12.5% level. This means that the estimated coefficient on Maori has fallen in absolute value by nearly one-third in moving from the short to the long regression, and is no longer statistically significant at conventional test levels. The estimated coefficient on years not enrolled in education or training is positive and significant at a 1% level, but has increased slightly in magnitude from 0.418 in the short regression to 0.436 in the long regression.

Again, to perform the Neumark decomposition we need to re-estimate the short regression *excluding the Maori indicator variable* as a regressor. These regression results are not reported, but the R^2 statistic declines only slightly from 0.3464 to 0.3448 when we drop ethnicity from the short regression. In other words, there is only a 0.5% loss in explanatory power when ethnicity is dropped from an experience regression that already includes these other personal and family background characteristics. Adding the Maori indicator variable does not substantially enhance the predictive performance of this regression model.

We can break the actual gap in work experience between non-Maori and Maori into its explained and unexplained components using the estimated coefficients from an unreported pooled regression excluding the Maori indicator variable as an explanatory variable. These results are summarised in the following equation:

$$\text{Observed Gap} = [(\Delta \text{POTEXP})b + (\Delta X')c] + [\text{Unexplained}] = [\text{Explained}] + [\text{Unexplained}] \quad (11)$$

$$0.288 = [-0.249 + 0.389] + [0.148] = [0.140] + [0.148]$$

Again, non-Maori accumulated an average of 0.288 more years of work experience than Maori by age 21. This is the effect of two offsetting forces. Maori have, on average, more years of potential work experience than non-Maori. The estimated coefficient on years not enrolled in education or training is positive (0.439), and significant at a 1% level in the regression without ethnicity. Multiplying this estimated coefficient by the observed difference in potential work experience between the ethnic groups of 0.566 years says that this effect would increase the ethnic gap in work experience by slightly less than one-quarter of a year (0.566 • 0.439 = 0.249). This effect alone would raise the ethnic gap in work experience to more than one-half of a year (0.288 + 0.249 = 0.537).

All of the other observed differences in personal characteristics and family backgrounds between non-Maori and Maori in this long regression would narrow the gap in work experience by 0.389 years. If both ethnic groups had the same amount of time away from education and training *and* the same observable factors in other areas, then the gap in work experience would narrow by 0.140 years. This says that slightly less than one-half (48.6%) of the observed gap in experience between non-Maori and Maori can be explained by the covariates in this long regression (0.140/0.288). Slightly more than one-half (51.4%) of this gap *cannot* be explained by this specification (0.148/0.288).

Suppose we again restrict the CHDS sample to those without formal school or tertiary qualifications. Recall that by age 21, unqualified Maori (n=28) had accumulated 0.606 fewer years of work experience than unqualified non-Maori (n=128). These covariates account for 0.140 and 0.385 years of the ethnic gaps in work between all and unqualified 21 year-olds, respectively. The results from our long regression are able to explain a larger proportion of the ethnic gap in work experience among unqualified youth (63.5%) compared to all youth (48.6%). Family background is particularly important in explaining the relatively poor work experience histories of Maori without school or tertiary qualifications.

We re-estimate the long regression for the subsample of CHDS youth without formal qualifications (n=160). These regression results are not reported, but the R^2 statistic declines from 0.3677 to only 0.3676 when we drop ethnicity from the long regression. This means that there is almost no loss in explanatory power when ethnicity is dropped from this specification. The variation in actual work experience across unqualified individuals that was previously explained by ethnicity is now captured by measured family background characteristics.

5.2 Interacting two-way split in youth ethnicity with other covariates

Results from the short and long regressions, estimated separately for Maori and non-Maori, are reported in Table 11. The reason for interacting ethnicity with all other regressors is to see whether or not the estimated marginal effects vary systematically between the two ethnic groups. The estimated effect of years not enrolled in education or training is significantly smaller for Maori (0.273) than non-Maori (0.434) in the short regression, but the estimated parameters are not statistically different from one another in the long regression. There is no consistent evidence in these regressions that the rates of accumulation of actual work experience relative to potential work experience vary between the ethnic groups.

Table 11 - OLS Regressions on Actual Years of Work Experience by Age 21: Two-Way Split in Youth Ethnicity: Separate Regressions by Ethnicity

Independent Variables	Without Background Factors		With Background Factors	
	Maori	Non-Maori	Maori	Non-Maori
Constant	0.416	0.468**	-0.159	0.906*
	(0.615)	(0.158)	(1.203)	(0.376)
Years Not Enrolled in Education or Training	0.273*	0.434**	0.415**	0.439**
	(0.115)	(0.031)	(0.119)	(0.031)
Female	0.026	-0.040	-0.100	-0.098
	(0.282)	(0.070)	(0.300)	(0.072)
Male · Number Children Born to Respondent	0.234	0.093	0.451	0.159
	(0.309)	(0.215)	(0.324)	(0.221)
Female · Number Children Born to Respondent	-0.571*	-1.202**	-0.761*	-1.169**
	(0.315)	(0.147)	(0.315)	(0.148)
School Certificate	0.768*	0.915**	0.436	0.840**
	(0.319)	(0.106)	(0.343)	(0.109)
6th Form or Higher School Certificate	0.715*	0.148	0.573*	0.124
	(0.335)	(0.100)	(0.330)	(0.100)
University Bursary	-0.466	-0.178*	-0.409	-0.188*
	(0.482)	(0.097)	(0.538)	(0.099)
University Diploma or Degree	0.080	0.010	2.088	-0.039
	(0.948)	(0.169)	(1.311)	(0.167)
Vocational Qualification	-0.088	-0.064	-0.088	-0.086
	(0.248)	(0.071)	(0.246)	(0.071)
Mother had School Qualification	---	---	-0.531*	-0.143*
			(0.300)	(0.080)
Mother had Post-School Qualification	---	---	0.303	-0.118
			(0.585)	(0.098)
Mother had University Degree	---	---	1.340	-0.594**
			(2.134)	(0.160)
Father had School Qualification	---	---	-0.042	-0.008
			(0.279)	(0.080)
Father had Post-School Qualification	---	---	-0.647	-0.030
			(0.691)	(0.112)
Father had University Degree	---	---	-3.241*	-0.269
			(1.768)	(0.127)
Years in Single-Adult Family	---	---	-0.421	0.171
			(0.752)	(0.242)
Maximum Number of Children in Family	---	---	-0.040	0.009
			(0.094)	(0.028)
Years Family Received Benefit	---	---	-0.357	-0.414*
			(0.717)	(0.228)
Real Family Income (in $10,000 units)	---	---	0.269	0.077*
			(0.164)	(0.031)
Mean Conduct Problems Score	---	---	0.005	-0.009*
			(0.015)	(0.006)
Years Truant, Suspended or Expelled	---	---	-2.506*	-0.474
			(1.251)	(0.508)

Independent Variables	Without Background Factors		With Background Factors	
	Maori	Non-Maori	Maori	Non-Maori
Convicted of Criminal Offence	---	---	-0.382	0.056
			(0.408)	(0.119)
Alcohol/Drug Abuse or Dependence	---	---	-0.030	-0.139*
			(0.268)	(0.075)
R^2	0.198	0.320	0.417	0.356
Adjusted R^2	0.116	0.313	0.239	0.338
Number of Observations	99	874	99	874
Mean of Dependent Variable	1.990	2.278	1.990	2.278

** Significantly different from zero at 1% level.
* Significantly different from zero at 10% level.
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. The dependent variable is the effective years of work experience accumulated by the individual between the ages of 16 and 21. Youth are defined as 'Maori' in these regressions if they identify Maori as at least one of their ethnicities at age 21, and had at least one parental figure claiming Maori ethnicity by age 14 of the CHDS child. All other youth are considered to be 'non-Maori'. Standard errors are in parentheses.

The birth of a child to female respondents significantly reduces accumulated work experience for both ethnic groups. Yet, the marginal effects are substantially greater in magnitude for Maori in both the short and long regressions. The number of children born by age 21 has a larger detrimental impact on work experience for Maori relative to non-Maori women.

The influences of formal qualifications on work experience are fairly similar between the ethnic groups. Holding years not enrolled in education and training constant, the joint effects of a School Certificate or 6th Form or Higher School Certificate are positive for both Maori and non-Maori in both the short and long regressions. The same can generally be said of personal and family background factors. However, small sample sizes, especially for Maori, make it difficult to distinguish any ethnic differences in the effects of many of these variables. We can say, however, that family background factors as a group are relatively more important for Maori than non-Maori at explaining the observed variation in work experience. The R^2 statistic is lower for Maori (0.198) than non-Maori (0.320) in the short regression, but higher for Maori (0.417) than non-Maori (0.356) in the long regression. Thus, the gain in explanatory power in adding these family background measures is substantially greater among Maori (110.6%) than non-Maori (11.3%).

5.3 Quantile regressions: Two-way split in youth ethnicity

Figure 1 shows that overall differences in work experience between non-Maori and Maori are concentrated in the lower tails of these distributions. Ordinary Least-Squares regressions estimate the effects of determinants on the mean values of work experience, once relevant factors are held constant. Quantile regressions estimate these effects at various points in the conditional distribution.[21] In particular, this regression technique indicates the extent to which our explanatory variables can capture differences between non-Maori and Maori in the lower tail of these distributions.

[21] See Buchinsky (1998) for a survey of recent developments in this semi-parametric regression technique. All quantile regressions in this report were estimated with software package STATA.

Our quantile regression results are summarised in Table 12 for the two-way split in youth ethnicity. Each column heading under the five percentile categories represents the results from two separate multiple regression models. Only the parameter estimates on the Maori indicator variable are reported. The results in the first row correspond to the short regression specification, where the additional covariates are those reported in the first column of Table 10 (ie, without background factors). The results in the second row correspond to the long regression specification, where the additional covariates are those reported in the second column of Table 10 (ie, with background factors).

Table 12 - Quantile Regressions on Actual Years of Work Experience by Age 21: Two-Way Split in Youth Ethnicity

Specification	Independent Variable	Quantile				
		0.10	0.25	0.50	0.75	0.90
w/o Background Factors	Maori	-0.500*	-0.266*	-0.130	-0.198	-0.113
		(0.216)	(0.136)	(0.115)	(0.133)	(0.126)
With Background Factors	Maori	-0.113	-0.208	-0.185	-0.174*	-0.130
		(0.219)	(0.136)	(0.113)	(0.103)	(0.171)

** Significantly different from zero at 1% level.
* Significantly different from zero at 10% level.
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. The dependent variable is the effective years of work experience accumulated by the individual between the ages of 16 and 21. Youth are defined as 'Maori' in these regressions if they identify Maori as at least one of their ethnicities at age 21, and had at least one parental figure claiming Maori ethnicity by age 14 of the CHDS child. All other youth are considered to be 'non-Maori'. Additional covariates are included in these regressions, but these results are not reported. The other explanatory variables included in these short and long specifications are listed in Table 10. Each column under a 'Quantile' lists the results from two separate regressions estimated in STATA. Standard errors are in parentheses.

An estimated coefficient in this regression model can be interpreted as a partial derivative of that conditional quantile with respect to the relevant regressor. For example, the estimated coefficient of –0.500 on Maori at the 0.10 quantile says that the estimated effect of being Maori lowers cumulative work experience by one-half year at the 10th percentile in the experience distribution, once other factors have been held constant in this short regression. This estimated coefficient is significantly different from zero at better than a 2.5% level. As we move to higher points in the experience distribution, the effects of ethnicity appear to weaken. It falls to –0.266 at the 25th percentile, and is significant at a 5.5% level. It is negative, but insignificant at higher points in the distribution. When we control only for personal characteristics, ethnic differences in the accumulation of work experience appear to be concentrated in the lower tail of the distribution.

When we control for both personal and family background factors (second row in Table 12), the disparities between non-Maori and Maori in the lower tail of the experience distribution disappear. The estimated coefficients on Maori are still negative, but insignificant in the long regressions at the 10th and 25th percentiles. Only the estimated coefficient at the 75th percentile is significantly different from zero. It appears that our family background measures capture at least some of the ethnic disparities in the accumulation of work experience at the lowest levels.

5.4 Short and long regressions: Three-way split in youth ethnicity

Column 1 of Table 13 reports the parameter estimates from the short regressions using the three-way split in ethnicity. Non-Maori continue to serve as the excluded or reference

group (as they did in the earlier two-way split in ethnicity). Although the estimated coefficients are negative for both sole and mixed Maori, only the coefficient estimate for mixed Maori is statistically different from zero at conventional test levels (1.4% level in this case). Once other personal characteristics and circumstances have been held constant, there is no statistical difference between the accumulation of work experience by age 21 between sole Maori and non-Maori.[22] As a result, we focus in the remainder of this section on the observed gap in work experience between mixed Maori and non-Maori.

Table 13 - Regression Results on Actual Years of Work Experience by Age 21: Three-Way Split in Youth Ethnicity

	Without Background Factors	With Background Factors
Constant	0.475**	0.847*
	(0.155)	(0.351)
Years Not Enrolled in Education or Training	0.419**	0.436**
	(0.030)	(0.030)
Sole Maori	-0.119	-0.041
	(0.154)	(0.152)
Mixed Maori	-0.360*	-0.283*
	(0.145)	(0.144)
Female	-0.040	-0.111
	(0.068)	(0.069)
Male · Number Children Born to Respondent	0.026	0.121
	(0.163)	(0.160)
Female · Number Children Born to Respondent	-1.074**	-1.049**
	(0.129)	(0.127)
School Certificate	0.910**	0.792**
	(0.100)	(0.102)
6th Form or Higher School Certificate	0.209*	0.176*
	(0.096)	(0.095)
University Bursary	-0.214*	-0.211*
	(0.096)	(0.097)
University Diploma or Degree	0.022	-0.010
	(0.169)	(0.166)
Vocational Qualification	-0.062	-0.081
	(0.069)	(0.068)
Mother had School Qualification	---	-0.155*
		(0.076)
Mother had Post-School Qualification	---	-0.110
		(0.096)
Mother had University Degree	---	-0.606**
		(0.160)
Father had School Qualification	---	0.022
		(0.076)
Father had Post-School Qualification	---	-0.061

[22] Recall from Table 5 that the observed mean difference in work experience between sole Maori (2.120) and non-Maori (2.278) was also *not* statistically significant at a 10% level.

	Without Background Factors	With Background Factors
		(0.111)
Father had University Degree	---	-0.281*
		(0.127)
Years in Single-Adult Family	---	0.070
		(0.226)
Maximum Number of Children in Family	---	0.004
		(0.027)
Years Family Received Benefit	---	-0.472*
		(0.213)
Real Family Income (in $10,000 units)	---	0.081**
		(0.030)
Mean Conduct Problems Score	---	-0.007
		(0.005)
Years Truant, Suspended or Expelled	---	-1.026*
		(0.449)
Convicted of Criminal Offence	---	-0.058
		(0.112)
Alcohol/Drug Abuse or Dependence	---	-0.139*
		(0.071)
R^2	0.300	0.347
Adjusted R^2	0.292	0.330
Number of Observations		973
Mean of Dependent Variable		2.249

** Significantly different from zero at 1% level.
* Significantly different from zero at 10% level.
Notes: This information is taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. The dependent variable is the effective years of work experience accumulated by the individual between the ages of 16 and 21. Youth are defined as 'Sole Maori' in this table if they identify Maori as their only ethnicity at age 21. Youth are defined as 'Mixed Maori' if they report both Maori and any other ethnicity, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'. Standard errors are in parentheses.

We saw earlier in Table 5 that mixed Maori had accumulated, on average, 0.410 fewer years of work experience than non-Maori. This difference is statistically significant at better than a 1% level. The Neumark decomposition can be used to break this observed experience gap between mixed Maori and non-Maori into its explained and unexplained components from this short regression.

$$\text{Observed Gap} = [(\Delta \text{POTEXP})b + (\Delta X')c] + [\text{Unexplained}] = [\text{Explained}] + [\text{Unexplained}] \quad (12)$$

$$0.410 = [-0.159 + 0.220] + [0.349] = [0.061] + [0.349]$$

If non-Maori spent the same time as mixed Maori away from education and training, the ethnic gap in work experience would *widen* to more than one-half of a year (0.410 + 0.159 = 0.569). Yet, we know that mixed Maori have, on average, more children and fewer qualifications than non-Maori. If non-Maori had these same personal characteristics as mixed Maori, the ethnic gap in work experience would *narrow* by 0.220 years. The net effect of all of these regressors is to narrow the gap in work experience by only 0.061 years. This is almost identical to the explained component (0.060) of the gap in work

experience between non-Maori and all Maori in the earlier short regression using the two-way split in ethnicity. Less than one-sixth (14.9%) of the observed gap in experience between non-Maori and mixed Maori can be explained by the covariates in this short regression (0.061/0.410). More than five-sixths (85.1%) of this gap cannot be accounted for with this specification (0.349/0.410).

If the sample is restricted to those without formal school or tertiary qualifications, we find that unqualified mixed Maori (n=13) had accumulated 1.104 fewer years of work experience than unqualified non-Maori (n=132). This gap in experience between these ethnic subgroups is substantially larger than the gap for these overall ethnic groups of 0.410. Where the results from this short regression are capable of explaining 14.9% of the gap in work experience among all youth in these ethnic groups, the same regression can explain 29.4% of the average work experience gap between unqualified youth in these ethnic groups.

Column 2 of Table 13 reports the parameter estimates from the long regressions using the three-way split in ethnicity. As with the short regression, although the estimated coefficients are negative for both sole and mixed Maori, only the coefficient estimate for mixed Maori is statistically different from zero at conventional test levels (5.0% level in this case). Once these personal and family background characteristics have been held constant, there is no statistical difference between the accumulation of work experience by age 21 between sole Maori and non-Maori. As a result, we focus in the remainder of this section on the observed gap in work experience between mixed Maori and non-Maori.

The Neumark decomposition can be used to break this observed experience gap between mixed Maori and non-Maori into its explained and unexplained components from this long regression.

$$\text{Observed Gap} = [(\Delta \text{POTEXP})b + (\Delta X')c] + [\text{Unexplained}] = [\text{Explained}] + [\text{Unexplained}] \quad (13)$$

$$0.410 = [-0.166 + 0.311] + [0.265] = [0.145] + [0.265]$$

If non-Maori spent the same time as mixed Maori away from education and training, the ethnic gap in work experience would *widen* to more than one-half of a year (0.410 + 0.166 = 0.576). Yet, mixed Maori have, on average, personal and family background that are negatively associated with the accumulation of work experience. If non-Maori had these same personal characteristics as mixed Maori, the ethnic gap in work experience would *narrow* by 0.311 years. The net effect of all of these regressors is to narrow the gap in work experience by 0.145 years. This is similar to the explained component (0.140) of the gap in work experience between non-Maori and all Maori in the earlier long regression using the three-way split in ethnicity. More than one-third (35.4%) of the observed gap in experience between non-Maori and mixed Maori can be explained by the covariates in this long regression (0.145/0.410). The remaining two-thirds (64.6%) of this gap cannot be accounted for with this specification (0.265/0.410).

If the sample is restricted to those without formal school or tertiary qualifications, we find that unqualified mixed Maori (n=13) had accumulated 1.104 fewer years of work experience than unqualified non-Maori (n=132). This gap in experience between these ethnic subgroups is substantially larger than the gap for these same ethnic groups of 0.410, when those with formal school or tertiary qualifications are included. Where the results from this long regression are capable of explaining 35.4% of the gap in work experience among all youth in these ethnic groups, the same regression can explain

47.8% of the average work experience gap between unqualified youth in these ethnic groups.

5.5 Interacting three-way split in youth ethnicity with other covariates

Results from the short and long regressions estimated separately for sole and mixed Maori are reported in Table 14 (the results for non-Maori are reported in Table 11). The reason for interacting ethnicity with all other regressors is to see whether or not the estimated marginal effects vary systematically between the ethnic groups. The estimated effect of years not enrolled in education or training is significantly smaller for sole Maori (0.429) than mixed Maori (0.739) in the short regression, but the estimated parameters are not statistically different from one another in the long regression. There is no consistent evidence in these regressions that the rates of accumulation of actual work experience relative to potential work experience vary between the ethnic groups.

The birth of a child to female respondents significantly reduces accumulated work experience only among sole Maori. Note that several covariates had to be dropped from this estimation because of a lack of variation in these variables for the associated subsample ('University degree or Diploma' for mixed Maori, 'Mother had University Degree' for sole Maori and 'Father had University Degree' for mixed Maori). Both regression specifications were more successful at explaining the variation in work experience among sole Maori compared to mixed Maori. The R^2 statistics are uniformly higher for sole Maori (0.260 and 0.380) than for mixed Maori (0.180 and 0.182). The gain in explanatory power in adding family background measures is also substantially greater among sole Maori (46.2%) than mixed Maori (1.1%).

Table 14 - Regression Results on Actual Years of Work Experience by Age 21: Three-Way Split in Ethnicity: Separate Regressions by Maori Ethnicity

	Without Background Factors		With Background Factors	
Independent Variables	Sole Maori	Mixed Maori	Sole Maori	Mixed Maori
Constant	0.508 (1.048)	-0.252 (0.711)	1.034 (2.419)	-2.277 (1.838)
Years Not Enrolled in Education or Training	0.429* (0.191)	0.187 (0.136)	0.739* (0.278)	0.268 (0.166)
Female	0.086 (0.445)	0.449 (0.349)	-0.136 (0.492)	0.527 (0.432)
Male · Number Children Born to Respondent	0.169 (0.417)	0.148 (0.415)	0.518 (0.484)	0.483 (0.512)
Female · Number Children Born to Respondent	-1.624** (0.484)	0.345 (0.426)	-1.554** (0.532)	-0.154 (0.503)
School Certificate	0.833* (0.466)	1.181** (0.426)	0.484 (0.746)	0.786 (0.523)
6th Form or Higher School Certificate	0.345 (0.491)	0.780* (0.430)	0.509 (0.594)	0.564 (0.476)
University Bursary	-1.220 (1.230)	-0.409 (0.519)	-1.389 (1.337)	-0.442 (0.780)

	Without Background Factors		With Background Factors	
University Diploma or Degree	1.592 (1.439)	---	4.858* (1.899)	---
Vocational Qualification	-0.344 (0.347)	0.051 (0.336)	0.111 (0.389)	0.040 (0.407)
Mother had School Qualification	---	---	-0.516 (0.506)	-0.404 (0.446)
Mother had Post-School Qualification	---	---	-1.039 (1.151)	1.093 (0.948)
Mother had University Degree	---	---	---	-1.401 (1.411)
Father had School Qualification	---	---	0.335 (0.551)	-0.019 (0.401)
Father had Post-School Qualification	---	---	-0.354 (1.133)	-0.534 (1.043)
Father had University Degree	---	---	-3.322* (1.891)	---
Years in Single-Adult Family	---	---	-0.822 (1.040)	1.462 (1.668)
Maximum Number of Children in Family	---	---	-0.217 (0.161)	0.035 (0.143)
Years Family Received Benefit	---	---	-0.203 (1.064)	-1.183 (1.642)
Real Family Income (in $10,000 units)	---	---	0.304 (0.293)	0.205 (0.250)
Mean Conduct Problems Score	---	---	-0.027 (0.023)	0.032 (0.022)
Years Truant, Suspended or Expelled	---	---	-1.591 (2.138)	-2.451 (1.839)
Convicted of Criminal Offence	---	---	-0.519 (0.619)	-0.722 (0.727)
Alcohol/Drug Abuse or Dependence	---	---	-0.106 (0.448)	-0.057 (0.482)
R^2	0.402	0.312	0.670	0.526
Adjusted R^2	0.260	0.180	0.380	0.182
Number of Observations	48	51	48	51
Mean of Dependent Variable	2.120	1.868	2.120	1.868

** Significantly different from zero at 1% level.
* Significantly different from zero at 10% level.
Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. The dependent variable is the effective years of work experience accumulated by the individual between the ages of 16 and 21. Youth are defined as 'Sole Maori' if they identify Maori as their only ethnicity at age 21. Youth are defined as 'Mixed Maori' if they report both Maori and any other ethnicity, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'. Only the regression results for the two Maori groups are reported in this table. Standard errors are in parentheses.

5.6 Quantile Regressions: Three-Way Split in Youth Ethnicity

Figure 2 showed that many of the differences in work experience between non-Maori and both sole and mixed Maori are concentrated in the lower tails of these distributions. Only

mixed Maori are less likely to have higher levels of work experience than non-Maori. Quantile regressions capture differences in work experience effects among the three ethnic groups at various points in the conditional experience distribution. These regression results are summarised in Table 15 for the three-way split in youth ethnicity. It is important to note that each column heading under the five percentile categories represents the results from two separate multiple regression models. Only the parameter estimates on the sole and mixed Maori indicator variables are reported. The results in the first row correspond to the short regression specification, where the additional covariates include those reported in the first column of Table 13. The results in the second row correspond to the long regression specification, where the additional covariates include those reported in the second column of Table 13.

Table 15 - Quantile Regressions on Actual Years of Work Experience by Age 21: Three-Way Split in Youth Ethnicity

Specification	Independent Variables	Quantile				
		0.10	0.25	0.50	0.75	0.90
w/o Background Factors	Sole Maori	-0.216	-0.125	-0.000	-0.295	-0.184
		(0.268)	(0.197)	(0.184)	(0.183)	(0.172)
	Mixed Maori	-0.636*	-0.277	-0.292*	-0.115	-0.112
		(0.287)	(0.185)	(0.172)	(0.171)	(0.168)
With Background Factors	Sole Maori	-0.178	-0.188	0.021	-0.179	-0.196
		(0.226)	(0.188)	(0.183)	(0.128)	(0.247)
	Mixed Maori	-0.277	-0.204	-0.278	-0.173	-0.050
		(0.250)	(0.180)	(0.180)	(0.128)	(0.209)

** Significantly different from zero at 1% level.
* Significantly different from zero at 10% level.

Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. The dependent variable is the effective years of work experience accumulated by the individual between the ages of 16 and 21. Youth are defined as 'Sole Maori' if they identify Maori as their only ethnicity at age 21. Youth are defined as 'Mixed Maori' if they report both Maori and any other ethnicity, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'. Additional covariates are included in these regressions, but these results are not reported. The other explanatory variables included in these short and long specifications are listed in Table 13. Each column under a 'Quantile' lists the results from two separate regressions estimated in STATA. Standard errors are in parentheses.

Among all the estimated coefficients on the Maori indicator variables, only those in the short regression for mixed Maori at the 0.10 and 0.50 quantiles are significantly different from zero. Once we control only for personal characteristics, ethnic differences in the accumulation of work experience appear to be concentrated in the bottom half of the distribution between mixed Maori and non-Maori. However, when we control for both personal characteristics and family background factors, these disparities between mixed Maori and non-Maori in the lower part of the distribution disappear. It again appears that our measures of family backgrounds capture at least some of the ethnic differences in the accumulation of work experience at the lower levels.

6 Regression results on hourly earnings at age 21

We know from Tables 4 and 5 that Maori workers in the CHDS receive *higher* hourly earnings, on average, than their non-Maori counterparts at age 21. Yet, these ethnic differences in mean wages are *not* statistically significant. In this section, we use regression analysis to control for personal and family background factors that we know, in many cases, vary significantly between Maori and non-Maori. Once we control for work experience, formal qualifications and other factors, do Maori workers receive significantly higher wages than non-Maori? Does the ethnic wage gap widen when we control for other relevant factors? Could the relatively higher wages of Maori workers be the result of a sample selection process, where Maori facing lower wages are unable to find employment?

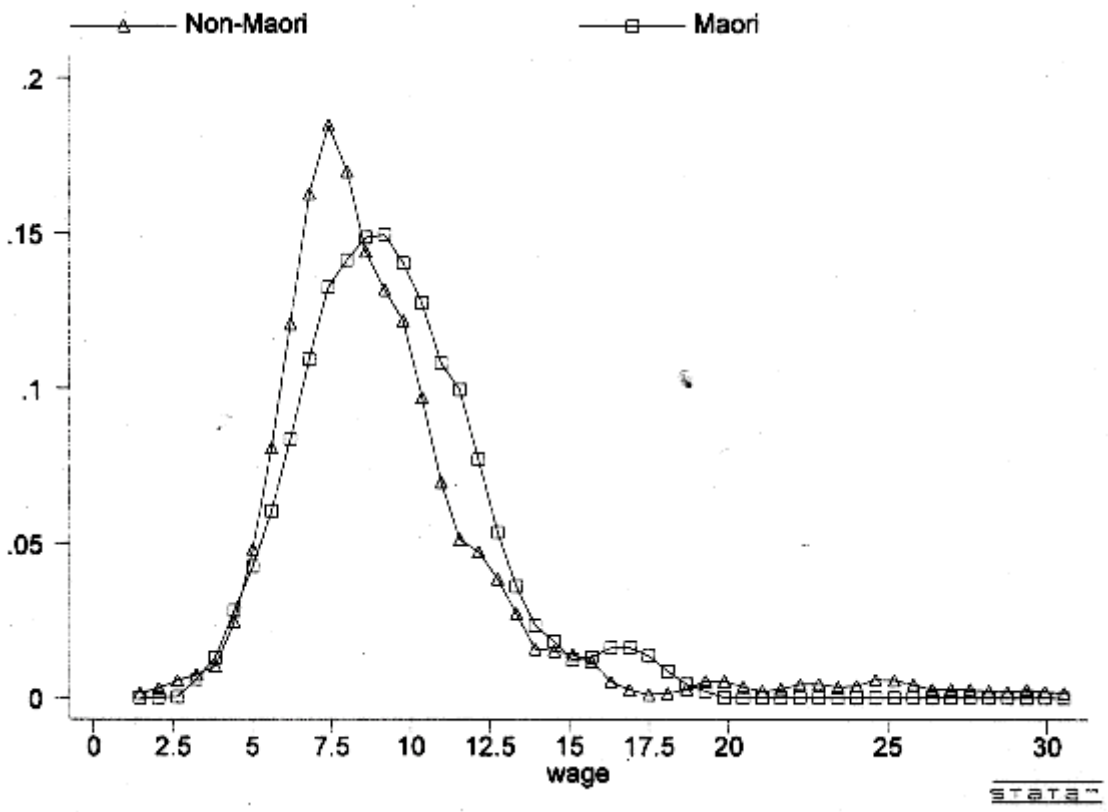
Empirical findings in the previous sections suggest that Maori accumulate less work experience by age 21 than non-Maori, and that these differences can only partly be explained by observable differences in personal and family background characteristics. We now ask whether Maori face systematically lower wage rates in the labour market than their non-Maori counterparts, once we control for factors that proxy for individual differences in productivity.

6.1 Distributions of hourly earnings by ethnicity

The software package STATA is used to estimate the probability density functions of hourly earnings for workers at age 21 using a kernel smoother. Figures 5 and 6 display the results for the two and three-way splits in youth ethnicities. Note that only the youth working and reporting hourly earnings at the time of the survey at age 21 are used in these calculations. This subsample consists of 671 individuals.

Table 4 shows that the mean wage of Maori workers ($9.44) is higher than the mean wage of non-Maori workers ($9.26). This difference is not statistically significant. Figure 5 shows that these ethnic differences in hourly earnings come from a relatively flatter density function for Maori. The non-Maori distribution has a sharper peak at around $7.50. The middle of the Maori distribution is placed slightly further to the right compared to the non-Maori distribution. Both density functions have similar slowly tapering right-hand tails beyond a wage of about $15.00. These skewed right-hand tails are common in wage distributions. The numbers at the bottom of the table, for example, show that 14.1% of Maori workers receive hourly earnings in excess of $12.00. The same is true of 13.8% of non-Maori workers.

Figure 5 – Hourly Earnings of Workers at Age 21: Two-Way Split In Youth Ethnicities



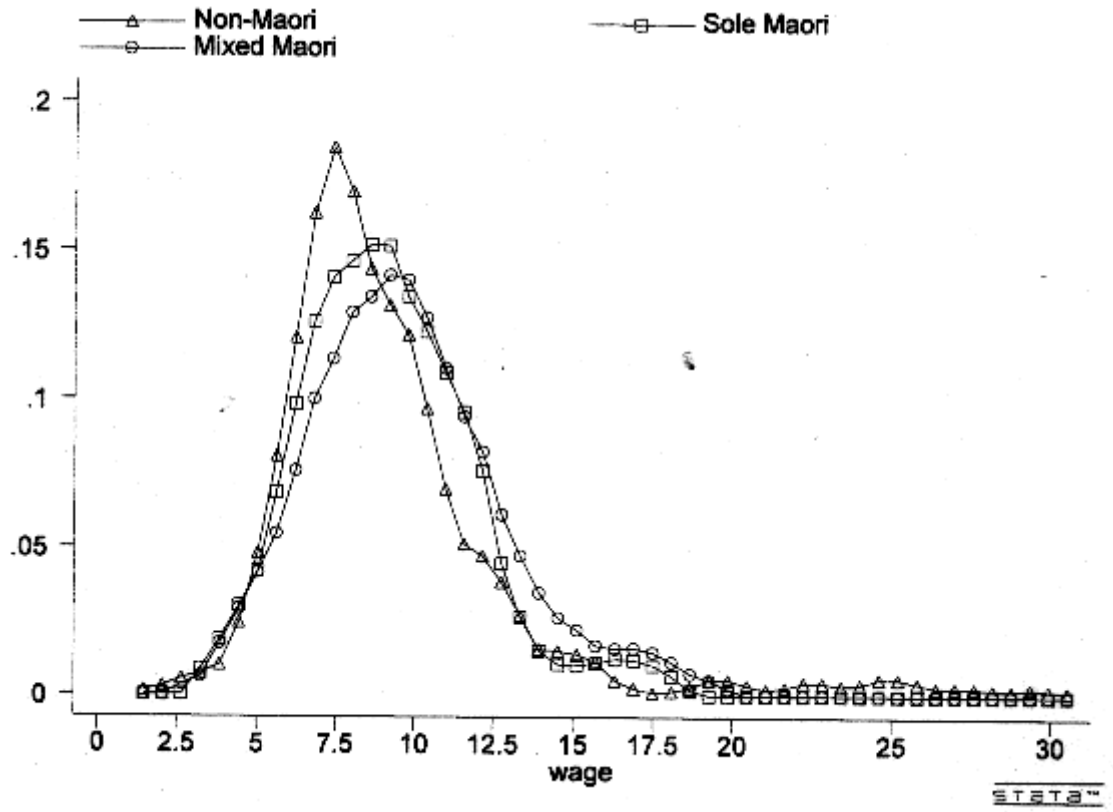
Notes: These data are taken from the 671 respondents in the CHDS who provided valid information for the purposes of this study. The probability density functions are estimated using a kernel smoother in STATA. These are the estimated distributions of hourly earnings reported by workers at the age 21 survey for the two ethnic groups. Youth are defined as 'Maori' in this figure if they identify Maori as at least one of their ethnicities at age 21, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'.

Proportions with Hourly Earnings in the Range

	Maori	Non-Maori
0 < WAGE ≤ $4.50	0.000	0.020
$4.50 < WAGE ≤ $6.00	0.105	0.096
$6.00 < WAGE ≤ $7.50	0.123	0.259
$7.50 < WAGE ≤ $9.50	0.333	0.282
$9.50 < WAGE ≤ $12.00	0.298	0.205
$12.00 < WAGE ≤ $15.00	0.088	0.083
WAGE > $15.00	0.053	0.055

The differences in the hourly earnings density functions for sole and mixed Maori (relative to non-Maori) are depicted Figure 6. Table 5 shows that only the mean wage of mixed Maori ($9.71) is higher than that of non-Maori ($9.26). Yet, none of these ethnic differences in hourly earnings are statistically significant. Figure 6 shows that this relatively higher wage for mixed Maori is the result of the central section of this distribution being positioned slightly further to the right relative to the other two distributions. Given the relatively small sample sizes for sole and mixed Maori, differences in the right-hand tails of the three density functions are difficult to distinguish.

Figure 6 – Hourly Earnings of Workers at Age 21: Three-Way Split In Youth Ethnicities



Notes: These data are taken from the 671 respondents in the CHDS who provided valid information for the purposes of this study. The probability density functions are estimated using a kernel smoother in STATA. These are the estimated distributions of hourly earnings reported by workers at the age 21 survey for the three ethnic groups. Youth are defined as 'Sole Maori' in this figure if they identify Maori as their only ethnicity at age 21. Youth are defined as 'Mixed Maori' if they report both Maori and any other ethnicity, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'.

Proportions with Hourly Earnings in the Range

	Sole Maori	Mixed Maori	Non-Maori
0 < WAGE ≤ $4.50	0.000	0.000	0.020
$4.50 < WAGE ≤ $6.00	0.115	0.097	0.096
$6.00 < WAGE ≤ $7.50	0.154	0.097	0.259
$7.50 < WAGE ≤ $9.50	0.346	0.323	0.282
$9.50 < WAGE ≤ $12.00	0.269	0.323	0.205
$12.00 < WAGE ≤ $15.00	0.077	0.097	0.083
WAGE > $15.00	0.038	0.065	0.055

6.2 Short and long regressions: Two-way split in youth ethnicity

There are two broad issues that are addressed in the regression analysis in this section. First, although we know that Maori in the CHDS have fewer qualifications and less work experience than non-Maori, these same observable differences may not exist among the subsample of workers. In other words, the gap in measured productivity characteristics between the ethnic groups might be narrowed (and even reversed) once we focus on only youth who were employed at the time of the interview. Second, there may be differences in the 'potential wages' that face all individuals in the sample. It is possible that the

sample selection process that underlies the employment outcome systematically overstates the wages that face Maori relative non-Maori. We already know from our sample that only 55.0% of Maori were working at the interview, compared to 70.7% of non-Maori. We want to control for some aspects of this sample selection process in order to estimate the extent to which the wages that face all individuals vary between observationally equivalent Maori and non-Maori.

Table 16 reports the results from the short and long regressions on wages using the two-way split in youth ethnicity. The dependent variable is the natural logarithm of hourly earnings at the time of the survey.

Table 16 - Regression Results on Log Hourly Earnings at Age 21: Two-Way Split in Youth Ethnicity

Independent Variables	Without Background Factors	With Background Factors
Constant	1.877**	1.667**
	(0.064)	(0.157)
Actual Years of Work Experience	0.067**	0.068**
	(0.015)	(0.015)
Maori	0.088*	0.083
	(0.050)	(0.051)
Female	-0.027	-0.023
	(0.028)	(0.030)
Male · Number Children Born to Respondent	-0.059	-0.063
	(0.072)	(0.072)
Female · Number Children Born to Respondent	0.141	0.129
	(0.098)	(0.100)
School Certificate	0.080*	0.079*
	(0.044)	(0.045)
6th Form or Higher School Certificate	0.010	0.011
	(0.035)	(0.036)
University Bursary	0.116**	0.131**
	(0.041)	(0.043)
University Diploma or Degree	0.062	0.067
	(0.073)	(0.074)
Vocational Qualification	-0.028	-0.025
	(0.029)	(0.030)
Part-Time Employment (<30 Hours per Week)	0.064	0.068
	(0.046)	(0.047)
Enrolled in Education	-0.018	-0.018
	(0.047)	(0.048)
Mother had School Qualification	---	0.019
		(0.033)
Mother had Post-School Qualification	---	0.056
		(0.041)
Mother had University Degree	---	0.078
		(0.074)
Father had School Qualification	---	-0.000
		(0.033)

Independent Variables	Without Background Factors	With Background Factors
Father had Post-School Qualification	---	-0.051 (0.046)
Father had University Degree	---	-0.084 (0.058)
Years in Single-Adult Family	---	0.048 (0.109)
Maximum Number of Children in Family	---	-0.008 (0.012)
Years Family Received Benefit	---	0.037 (0.108)
Real Family Income (in $10,000 units)	---	0.009 (0.014)
Mean Conduct Problems Score	---	0.004 (0.002)
Years Truant, Suspended or Expelled	---	0.068 (0.246)
Convicted of Criminal Offence	---	-0.081 (0.051)
Alcohol/Drug Abuse or Dependence	---	-0.001 (0.031)
R^2	0.064	0.080
Adjusted R^2	0.047	0.043
Number of Observations		671
Mean of Dependent Variable		2.159

** Significantly different from zero at 1% level.
* Significantly different from zero at 10% level.
Notes: These data are taken from respondents in the CHDS who provided valid information for the purposes of this study. The dependent variable is the natural logarithm of hourly earnings for the 671 individuals who were working at age 21. Youth are defined as 'Maori' in these regressions if they identify Maori as at least one of their ethnicities at age 21, and had at least one parental figure claiming Maori ethnicity by age 14 of the CHDS child. All other youth are considered to be 'non-Maori'. Standard errors are in parentheses.

The sample consists of the 671 youth (69.0% of the individuals interviewed at age 21) who were working at the time of the survey. The covariates include indicator variables on ethnicity, gender, all school and post-school qualifications, and whether or not the individual was working less than 30 hours per week and working while enrolled in tertiary education. The last two variables are included to capture any penalties associated with part-time employment and flexible work arrangements intended to fit around tertiary study. We also include the actual work experience accumulated by age 21. Formal qualifications and work experience should proxy for individual differences in human capital. The long regression specification includes the same measures of personal and family background characteristics used in the earlier work experience regressions.

Consistent with log wage regressions in other studies, the explanatory powers of these regressions are relatively low. The R^2 statistics are both 0.064 and 0.080 in the short and long regressions, respectively. The adjusted R^2 statistic actually declines slightly from 0.047 to 0.043 when these personal and family background factors are added to the model. Dropping the Maori indicator variable from these specifications causes the R^2

statistics to decline from 0.064 to 0.060 in the short regression and from 0.080 to 0.077 in the long regression.

The estimated coefficients on actual years of work experience are both positive and significant at better than a 1% level in columns 1 and 2. They are equivalent to incremental changes in hourly earnings (or rates of return) of 6.7% and 6.8%, respectively. There is no evidence in these regressions that females face systematically lower wages than males, once other factors are held constant. The estimated coefficients are negative, but insignificant. The only qualifications that have positive and significant incremental effects on hourly earnings are School Certificate and University Bursary. We estimate that a School Certificate leads to average increases in wages of 8.2% to 8.3%, while University Bursary leads to an *additional* average increase in wages of between 12.3% and 14.0%.[23]

The lack of any significant effects from a University Degree or Diploma is not surprising given that very few individuals in this sample have obtained these qualifications, and most of these university graduates would have just entered the work force by age 21. No evidence is found of any 'wage penalty' associated with either part-time employment or employment while studying. If anything, there appears to be a 'wage premium' associated with part-time work. Yet, the estimated coefficients on these two indicator variables are statistically insignificant.

Once all of these factors are held constant, Maori are found to face systematically *higher* wage rates than non-Maori. The estimated coefficient on this ethnic indicator (0.088) is significantly different from zero at an 8% level in the short specification. It is slightly smaller (0.083) and significantly different from zero at only a 10.5% level in the long specification. These estimated parameters translate into marginal effects on wages of between 9.2% and 8.7%, respectively. Recall that the overall hourly earnings of Maori and non-Maori were *not* statistically different from one another. Yet, Maori workers have less work experience and poorer qualifications than their non-Maori counterparts. The result is that observationally equivalent Maori workers receive higher hourly earnings than non-Maori workers.

We can next ask whether this same result holds for all youth, and not just those currently employed. Is there any evidence that Maori face higher wages than non-Maori? One way to answer this question is to use the results from the wage regressions to predict the hourly earnings of all individuals (regardless of their work status). This controls for sample selection in terms of these observable factors. Using actual productivity and other characteristics, we predict the mean wages of all non-Maori and Maori if they were to work full-time while not enrolled in tertiary education. Using the short specification, non-Maori and Maori face average wages of $8.36 and $8.74, respectively. Using the long regression, non-Maori and Maori face average wages of $8.37 and $8.75, respectively. In both cases, Maori youth would receive hourly earnings that are approximately 4.5% higher than their non-Maori counterparts. This can be compared to a 5.8% higher predicted wage for Maori relative to non-Maori among those working at age 21. Although the ethnic gap in hourly earnings narrows when we focus on the potential wages facing all individuals, there is no evidence in this study that Maori youth face systematically lower wages than non-Maori youth.

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[23] To compute this percentage change in the dependent variable in a semi-logarithmic regression, the following formula is used where b is the estimated coefficient on an indicator variable: $e^b - 1$.

6.3 Short and Long Regressions: Three-Way Split in Youth Ethnicity

Table 17 reports the results of the wage regressions using the three-way split in youth ethnicity. The specifications are identical to the regressions reported in Table 16, except for the inclusion of two ethnic indicator variables. This change has little impact on the other parameter estimates. The estimated coefficients on sole Maori are both positive at 0.072 in both regressions, but they are *not* significantly different from zero. The estimated coefficients on mixed Maori are 0.101 and 0.092, and they are also *not* significantly different from zero at a 10% level. Note that the R^2 statistics under this three-way split in youth ethnicity (0.065 and 0.080, respectively) are almost identical to the R^2 statistics under the earlier two-way split in youth ethnicity (0.064 and 0.080, respectively).

Table 17 - Regression Results on Log Hourly Earnings at Age 21: Three-Way Split in Youth Ethnicity

Independent Variables	Without Background Factors	With Background Factors
Constant	1.878**	1.668**
	(0.064)	(0.157)
Actual Years of Work Experience	0.067**	0.068**
	(0.015)	(0.015)
Sole Maori	0.072	0.072
	(0.072)	(0.074)
Mixed Maori	0.101	0.092
	(0.065)	(0.066)
Female	-0.028	-0.023
	(0.029)	(0.030)
Male · Number Children Born to Respondent	-0.056	-0.060
	(0.072)	(0.073)
Female · Number Children Born to Respondent	0.138	0.128
	(0.098)	(0.100)
School Certificate	0.079*	0.079*
	(0.044)	(0.045)
6th Form or Higher School Certificate	0.010	0.011
	(0.035)	(0.036)
University Bursary	0.116**	0.130**
	(0.041)	(0.043)
University Diploma or Degree	0.062	0.067
	(0.073)	(0.074)
Vocational Qualification	-0.028	-0.026
	(0.029)	(0.030)
Part-Time Employment (<30 Hours per Week)	0.064	0.068
	(0.046)	(0.047)
Enrolled in Education	-0.018	-0.018
	(0.047)	(0.048)
Mother had School Qualification	---	0.019
		(0.033)
Mother had Post-School Qualification	---	0.056
		(0.041)
Mother had University Degree	---	0.078
		(0.074)

Independent Variables	Without Background Factors	With Background Factors
Father had School Qualification	---	-0.001 (0.033)
Father had Post-School Qualification	---	-0.051 (0.046)
Father had University Degree	---	-0.085 (0.058)
Years in Single-Adult Family	---	0.049 (0.109)
Maximum Number of Children in Family	---	-0.008 (0.012)
Years Family Received Benefit	---	0.038 (0.108)
Real Family Income (in $10,000 units)	---	0.009 (0.014)
Mean Conduct Problems Score	---	0.004 (0.002)
Years Truant, Suspended or Expelled	---	0.068 (0.246)
Convicted of Criminal Offence	---	-0.080 (0.051)
Alcohol/Drug Abuse or Dependence	---	-0.001 (0.031)
R^2	0.065	0.080
Adjusted R^2	0.046	0.042
Number of Observations		671
Mean of Dependent Variable		2.159

** Significantly different from zero at 1% level.
* Significantly different from zero at 10% level.
Notes: These data are taken from respondents in the CHDS who provided valid information for the purposes of this study. The dependent variable is the natural logarithm of hourly earnings for the 671 individuals who were working at age 21. Youth are defined as 'Sole Maori' in this table if they identify Maori as their only ethnicity at age 21. Youth are defined as 'Mixed Maori' if they report both Maori and any other ethnicity, and had at least one parental figure claiming Maori ancestry by age 14. All other youth are considered to be 'non-Maori'. Standard errors are in parentheses.

We can perform the similar calculations to those associated with the two-way split in youth ethnicity. Again, there is no evidence from these regressions that either sole or mixed Maori face lower average wages than their non-Maori counterparts.

7 Endogenous regressors in the experience and wage regressions

To this point in the analysis, education and training outcomes have been treated as an exogenous set of indicator variables in both the work experience and wage regressions. We have assumed that only the receipt of formal qualifications (ie, School Certificate, 6th Form or Higher School Certificate, University Bursary, University Diploma or Degree, or Vocational Qualification) were important for the accumulation of work experience and the determination of hourly earnings. Holding these qualifications constant, any additional time spent in study or training would, on average, reduce the accumulation of work experience and thereby indirectly lower the wage rate faced in the labour market.

In this section, we experiment by measuring education and training as a single, continuous variable in terms of the amount of time spent in human capital investment. We also treat education and training as an endogenous variable in the estimation of both the work experience and wage rate regressions. As suggested by a referee in an earlier draft of this report, data on the sex-composition of the siblings in the families of the CHDS children are used as instrumental variables for this purpose. Finally, we also 'endogenise' work experience as a determinant of hourly earnings regression.

7.1 Education as an exogenous, continuous determinant of experience

We start by re-estimating the OLS regressions for work experience and hourly earnings using a single variable for the total time spent in education and training to age 21. These are essentially more restricted specifications of the regressions discussed in previous sections. In the work experience regressions, time spent in education was found to have offsetting effects on this accumulation process. On the one hand, more time spent in education meant less time available for work (a negative impact on the accumulation of work experience). On the other hand, the attainment of formal qualifications meant more employment opportunities and stability (a positive impact on the accumulation of work experience). Similar offsetting forces existed in the hourly earnings regression. Time spent in education directly raised wages through formal qualifications, but indirectly lowered wages by reducing work experience.

To simplify this discussion, we report only the results from the regressions using the two-way split in youth ethnicity. The first two columns in Table 18 display the results from re-estimating the OLS regressions reported in Table 10, where the variable 'Effective Years of Education and Training' essentially replaces the six previous variables ('Years Not Enrolled in Education and Training', 'School Certificate', '6th Form or Higher School Certificate', 'University Bursary', 'University Diploma or Degree' and 'Vocational Qualification'). As expected, the estimated coefficients on this new explanatory variable are negative in both the short and long regressions. The net effect of additional time spent in education and training is to reduce, on average, the accumulation of work experience between ages 16 and 21. The estimated coefficients of –0.292 and –0.352 suggest that every year of effective full-time study or training reduces work experience by between 3.5 and 4.2 months (–0.292•12 and –0.352•12). Both effects are significantly different from zero at better than a 1% level.

Collapsing this information on education and training into a single explanatory variable has little impact on the estimated effects of ethnicity on the accumulation of work experience. Recall from Table 10 that the estimated coefficients on this variable were –0.247 and –0.169 in the short and long regressions, respectively. Only the former estimated coefficient was statistically significant (at better than a 2.5% level). The estimated coefficients on the same variable in the short and long regressions, reported in the first two columns of Table 13, are –0.306 and –0.181. Only the former is statistically significant (at better than a 1% level). Although the effects of ethnicity increase slightly in magnitude in this new specification, these differences are not statistically significant.

Overall, the explanatory power of these new regression specifications declines when we collapse the effects of education and training into a single variable. The R^2 statistics were 0.299 and 0.346 on the short and long regressions in Table 10, respectively. The new R^2 statistics are 0.194 and 0.273 in similar OLS regressions in Table 13. Moreover, the adjusted R^2 statistics decline with these new specifications. It appears that the more

flexible specification used originally, which included both the time spent in education and training and the qualifications gained from these activities, can be justified on this dimension.

7.2 Education as an endogenous determinant of experience

Our concern is that the time spent in education and training should be considered an endogenous variable in determination of subsequent work experience. Unmeasured factors may influence both human capital investment processes. These correlated disturbance terms would bias the estimated effects of time spent in education and training on the accumulation of work experience. The key is to find at least one instrumental variable, which influences education and training, but is directly unrelated to the accumulation of work experience.

One possibility is to use detailed information on the siblings of the youth in the CHDS. Butcher and Case (1994) used this family background information in the PSID to estimate rates of return to education. In particular, they claimed that the sex composition of siblings served as a valid instrument for the educational attainment of females. Women who were raised with sisters tended to acquire less education. Yet, the number and sex composition of siblings had little impact on the education of males.

The CHDS also contains excellent data on siblings. We know their number, gender and birth order. A regression specification that is even more general than the one used by Butcher and Case is used in this study. We regress the number of effective years of education and training of CHDS youth by age 21 against five variables that measure whether or not they were 'only children', and the numbers of younger and older male and female siblings. All five regressors are also interacted with the gender of the CHDS youth to capture any systematic differences in the influence of siblings on human capital investment between males and females.

The results of this 'first stage' estimation are disappointing. The R^2 statistic on this regression is 0.030, indicating that only 3% of the variation in effective years of education and training in our sample can be explained by these regressors. In particular, the number of siblings had a negative and significant effect on educational attainment, but the differences between their gender and birth order relative to the CHDS youth were unimportant. Unlike Butcher and Case, there is no statistical evidence in this regression that the sex composition of siblings serves as a better instrument among females. All of the estimated coefficients on the explanatory variables interacted with the gender of the CHDS youth were *not* statistically different from zero.

Despite these disappointing results from the first-stage estimation, the second-stage estimates from this Two-Stage, Least-Squares (2SLS) procedure are reported in the last two columns of Table 18. The predicted values replace the actual observations on 'Effective Years of Education and Training' in these regressions, and the appropriate standard errors are reported. The estimated coefficients on Education and Training declined in absolute magnitude relative to the earlier OLS results. Only the estimated parameter in the short regression is statistically different from zero.

Table 18 - Regressions on Actual Years of Work Experience by Age 21: Two-Way Split in Youth Ethnicity

Independent Variables	OLS		2SLS	
	Without Background Factors	With Background Factors	Without Background Factors	With Background Factors
Constant	6.249** (0.288)	7.810** (0.460)	3.945** (0.574)	5.917 (3.325)
Effective Years of Education and Training	-0.292** (0.021)	-0.352** (0.023)	-0.119** (0.043)	-0.218 (0.233)
Maori	-0.306** (0.117)	-0.181 (0.116)	-0.250* (0.121)	-0.219 (0.134)
Female	0.007 (0.072)	-0.103 (0.072)	-0.058 (0.076)	-0.115 (0.076)
Male · Number Children Born to Respondent	-0.089 (0.173)	0.072 (0.167)	0.076 (0.181)	0.132 (0.198)
Female · Number Children Born to Respondent	-1.151** (0.137)	-1.085** (0.133)	-0.883** (0.152)	-0.950** (0.271)
Mother had School Qualification	---	-0.112 (0.080)	---	-0.130 (0.086)
Mother had Post-School Qualification	---	-0.085 (0.101)	---	-0.153 (0.155)
Mother had University Degree	---	-0.577** (0.168)	---	-0.601** (0.174)
Father had School Qualification	---	0.095 (0.080)	---	0.049 (0.113)
Father had Post-School Qualification	---	-0.042 (0.116)	---	-0.138 (0.204)
Father had University Degree	---	-0.314* (0.132)	---	-0.434* (0.247)
Years in Single-Adult Family	---	0.226 (0.237)	---	0.233 (0.239)
Maximum Number of Children in Family	---	-0.004 (0.028)	---	0.005 (0.033)
Years Family Received Benefit	---	-0.807** (0.221)	---	-0.740** (0.252)
Real Family Income (in $10,000 units)	---	0.073* (0.031)	---	0.056 (0.043)
Mean Conduct Problems Score	---	-0.016** (0.005)	---	-0.012 (0.009)
Years Truant, Suspended or Expelled	---	-1.207* (0.471)	---	-0.899 (0.715)
Convicted of Criminal Offence	---	-0.172 (0.117)	---	-0.099 (0.174)
Alcohol/Drug Abuse or Dependence	---	-0.107 (0.075)	---	-0.089 (0.081)
R^2	0.194	0.273	0.139	0.249
Adjusted R^2	0.190	0.259	0.134	0.234
Number of Observations				973
Mean of Dependent Variable				2.249

** Significantly different from zero at 1% level.
* Significantly different from zero at 10% level.

Notes: These data are taken from the 973 respondents in the CHDS who provided valid information for the purposes of this study. The dependent variable is the effective years of work experience accumulated by the individual between the ages of 16 and 21. Youth are defined as 'Maori' in these regressions if they identify Maori as at least one of their ethnicities at age 21, and had at least one parental figure claiming Maori ethnicity by age 14 of the CHDS child. All other youth are considered to be 'non-Maori'. Standard errors are in parentheses. The variable 'Effective Years of Education and Training' is treated as an endogenous variable under Two-Stage Least-Squares (2SLS) estimation in the last two columns. The instrumental variables include an indicator for the CHDS child being an only child, and the number of older and younger male and female siblings in the family. These five variables are also interacted with the gender of the CHDS child to allow for the impact of sex composition of siblings on educational attainment to vary by the gender of the CHDS child. See Butcher and Case (1994) for the use of a similar approach with panel data in the U.S. Using this flexible specifications, the R2 statistic from the regression of 'Effective Years of Education and Training' against these instrumental variables is only 0.030.

Little weight should probably be placed on these 2SLS results for a number of reasons. First, the instruments capture only a small proportion of the variation in this human capital investment. Second, due to the close relationship in time between this formal human capital investment and early work experience, these same family background factors might directly influence the accumulation of work experience by age 21.[24] Finally, endogenising years of education and training has little impact on the measured effects of ethnicity on the accumulation of work experience. The absolute values of the estimated coefficients on Maori under 2SLS are slightly smaller in the short regression, but slightly larger in the long regression compared to earlier OLS results. Once we control for measured family background differences there are no significant differences in the accumulation of work experience between Maori and non-Maori under both estimation procedures.

7.3 Education as an exogenous, continuous determinant of hourly earnings

We next re-estimate the regressions on the hourly earnings of workers at age 21 using 'Effective Years of Education and Training' as a regressor in place of the five indicator variables for formal qualifications. These OLS estimates in the first two columns of Table 19 can be compared to those under this somewhat more flexible specification reported in Table 16. We found earlier that the receipt of both School Certificate and University Bursary had positive and significant effects on hourly earnings. Yet, the estimated coefficients on this continuous measure of education or training are *not* statistically different from zero in both the short and long regressions. There is no evidence from these regressions that the investment in education or training raises potential wage rates in the labour market. It must be said, however, that these results do not rule out the possibility that these same investments raise hourly earnings beyond age 21.

[24] In fact, the 'Maximum Number of Children' was included at the outset as an explanatory variable in the long regression. Our only solace is that number of siblings had no measurable effect of work experience, even though it did directly reduce years of education and training.

Table 19 - Regression Results on Log Hourly Earnings at Age 21: Two-Way Split in Youth Ethnicity

Independent Variables	OLS		2SLS	
	Without Background Factors	With Background Factors	Without Background Factors	With Background Factors
Constant	1.848** (0.184)	1.816** (0.251)	1.358** (0.488)	1.351 (2.338)
Effective Years of Education and Training	0.008 (0.013)	0.001 (0.014)	0.046 (0.032)	0.020 (0.152)
Actual Years of Work Experience	0.063** (0.016)	0.062** (0.017)	0.067 (0.059)	0.134 (0.152)
Maori	0.081 (0.050)	0.089* (0.051)	0.081 (0.053)	0.109 (0.069)
Female	-0.017 (0.028)	-0.023 (0.030)	-0.026 (0.029)	-0.019 (0.031)
Male · Number Children Born to Respondent	-0.079 (0.072)	-0.085 (0.073)	-0.063 (0.077)	-0.109 (0.098)
Female · Number Children Born to Respondent	0.105 (0.100)	0.098 (0.102)	0.170 (0.111)	0.121 (0.243)
Part-Time Employment (<30 Hours per Week)	0.079* (0.047)	0.081* (0.047)	0.060 (0.072)	0.144 (0.134)
Enrolled in Education	0.034 (0.050)	0.036 (0.051)	-0.029 (0.070)	-0.001 (0.234)
Mother had School Qualification	---	0.021 (0.033)	---	0.033 (0.041)
Mother had Post-School Qualification	---	0.065 (0.041)	---	0.065 (0.060)
Mother had University Degree	---	0.075 (0.074)	---	0.112 (0.113)
Father had School Qualification	---	0.011 (0.033)	---	0.003 (0.048)
Father had Post-School Qualification	---	-0.042 (0.047)	---	-0.043 (0.059)
Father had University Degree	---	-0.044 (0.058)	---	-0.019 (0.079)
Years in Single-Adult Family	---	0.048 (0.110)	---	0.047 (0.110)
Maximum Number of Children in Family	---	-0.010 (0.012)	---	-0.012 (0.016)
Years Family Received Benefit	---	0.039 (0.108)	---	0.029 (0.143)
Real Family Income (in $10,000 units)	---	0.017 (0.014)	---	0.013 (0.020)
Mean Conduct Problems Score	---	0.001 (0.002)	---	0.002 (0.004)
Years Truant, Suspended or Expelled	---	0.027 (0.250)	---	0.094 (0.397)
Convicted of Criminal Offence	---	-0.092* (0.051)	---	-0.095 (0.074)
Alcohol/Drug Abuse or Dependence	---	-0.013 (0.031)	---	-0.002 (0.050)

Independent Variables	OLS		2SLS	
	Without Background Factors	With Background Factors	Without Background Factors	With Background Factors
R^2	0.035	0.052	0.020	0.025
Adjusted R^2	0.023	0.020	0.008	-0.008
Number of Observations				671
Mean of Dependent Variable				2.159

** Significantly different from zero at 1% level.

* Significantly different from zero at 10% level.

Notes: These data are taken from respondents in the CHDS who provided valid information for the purposes of this study. The dependent variable is the natural logarithm of hourly earnings for the 671 individuals who were working at age 21. Youth are defined as 'Maori' in these regressions if they identify Maori as at least one of their ethnicities at age 21, and had at least one parental figure claiming Maori ethnicity by age 14 of the CHDS child. All other youth are considered to be 'non-Maori'. Standard errors are in parentheses. The variables 'Actual Years of Work Experience' and 'Effective Years of Education and Training' are both treated as endogenous variables under Two-Stage Least-Squares (2SLS) estimation in the last two columns. The instrumental variables include an indicator for the CHDS child being an only child, and the number of older and younger male and female siblings in the family. These five variables are also interacted with the gender of the CHDS child to allow for the impact of sex composition of siblings on educational attainment to vary by the gender of the CHDS child. See Butcher and Case (1994) for the use of a similar approach with panel data in the U.S. Using this flexible specifications, the R2 statistic from the regression of 'Effective Years of Education and Training' against these instrumental variables is only 0.030.

At the same time, the estimated rates of return on a year of work experience are positive and statistically significant at better than a 1% level in these OLS regressions. These estimated effects are nearly identical in the short (0.063) and long (0.062) specifications. With or without measured family backgrounds, the average rate of return on a year of work experience is slightly more than 6%.

The change in the way education is measured in these regressions has little impact on the estimated coefficients on ethnicity. The estimated coefficients on Maori in Table 16 were 0.088 and 0.083 in the short and long regressions, respectively. The estimated coefficients on the same variable in Table 19 are 0.081 and 0.089 in the short and long regressions, respectively. All four estimated coefficients are significantly different from zero at between a 9% and 11% level.

7.4 Education as an endogenous determinant of hourly earnings

Instrumental variables are used to endogenise both 'Effective Years of Education and Training' and 'Actual Years of Work Experience' in these wage regressions. These 2SLS results are reported in the last two columns of Table 19. Again, the number, gender and birth order of siblings are used as instruments. Like the 2SLS findings on the accumulation of work experience, these results are disappointing. There is no evidence of any effects of years of education and training on hourly earnings. Although the estimated coefficients increase in magnitude when we move from the OLS to 2SLS results, they are still statistically insignificant. In addition, the estimated coefficients on work experience are now also statistically insignificant. The fact that the instrumental variables capture a small proportion of the variation in actual work experience has caused the standard errors on these estimated coefficients 'blow up'.

The key for our purposes is whether or not the endogenising of the variables on education and training and work experience has any impact on the estimated effects of ethnicity on hourly earnings. The answer to this question is 'no'. Both estimated coefficients on Maori

continue to be positive, but are *not* statistically significant at a 10% level. Observationally equivalent Maori face higher, and not lower, wages in the labour market.[25]

8 Summary

The Christchurch Health and Development Study (CHDS) is a panel data set of over 1,200 children born in 1977 in Canterbury area hospitals. These longitudinal data are used in this report to isolate any ethnic differences in the early labour market experiences of youth by the time of their 21st birthdays in 1998. We test the specific hypotheses that Maori accumulate less work experience and face lower wages than non-Maori, once other relevant factors are held constant. The following results are obtained:

- Maori youth acquire fewer school and post-school qualifications, and have more years of *potential* work experience than non-Maori in the CHDS. Despite this fact, Maori accumulate more than one-quarter of a year *less* in actual work experience than non-Maori by age 21. Most of this difference in accumulated work experience occurs between mixed Maori and non-Maori. Yet, the ratios of potential to actual work experience are similar between sole and mixed Maori, and significantly lower than that of non-Maori.

- Substantial ethnic differences in personal and family background characteristics are found. Maori parents are relatively less likely to have post-school qualifications. Maori youth are relatively more likely to be raised in single-parented households and in families receiving social welfare benefits. Average real family incomes are substantially lower for Maori compared to non-Maori. Before the age of 16, Maori are more likely to have behavioural problems and inconsistent attachments to school. After the age of 18, Maori are more likely to be convicted of a criminal offence, diagnosed with an alcohol or drug problem or held responsible for the birth to a child. These mean differences in personal and family background experiences are generally larger between sole Maori and non-Maori than between mixed Maori and non-Maori.

- The distributions of the total time spent in education, training and work between the ages of 16 and 21 indicate that there is more heterogeneity among Maori than non-Maori. A substantially larger proportion of Maori youth accumulate very little time in these productive activities compared to non-Maori. These ethnic differences narrow considerably at the upper ends of these distributions. These data suggest that average differences in labour market outcomes between ethnic groups may be concentrated among a small, particularly disadvantaged group of both sole and mixed Maori. Ethnicity may play a role in the outcomes for the most disadvantaged in society. For example, among the youth who discontinue their education and training early in life, Maori acquire about one-half of the work experience of non-Maori by age 21.

- Regression analysis indicates that only about one-fifth of the observed gap in work experience between Maori and non-Maori can be explained by differences in gender,

[25] Several attempts were made in an earlier version of this report to correct for sample selection bias for contemporaneous working behaviour in the wage regression by including the usual Heckman term. These procedures yielded estimated coefficients on the indicator variables for Maori that were always positive, and generally insignificantly different from zero at even a 10% level. The problem is that the lack of valid instruments for the IV procedure reported in this section also hamper efforts to identify this sample selection term.

formal qualifications and number of children (ie, variables typically available from cross-sectional data sources). Once personal and family background characteristics are included in these regressions (ie, variables almost unique to the CHDS), nearly one-half of the observed gap in work experience between Maori and non-Maori can be explained. Even though measured backgrounds are important factors behind the relatively lower accumulation of work experience by Maori, they do not explain the entire ethnic gap in this labour market outcome.

- Adding ethnicity to the other explanatory variables does very little to enhance the predictive performance of our regression models on work experience. The estimated coefficients on the indicator variable for Maori in these regressions are negative, but insignificant at conventional test levels when family background factors are included.

- One of the more surprising results in this study is that ethnic differences in early work histories seem to be largely relegated to the relationship between mixed Maori and non-Maori. Although sole Maori have less work experience than non-Maori by age 21, these differences are *not* statistically significant either outside or inside our regression analysis. Mixed Maori, on the other hand, have significantly less work experience than non-Maori by age 21, and these differences remain significant even after we have controlled for other factors in our regression models. This general conclusion is robust to changes in the definition of mixed Maori. The previous report in this project used a more liberal definition of Maori that was based entirely on the self-defined ethnicities at age 21. All of the ethnic differences in the accumulation of work experience in this earlier analysis were relegated to the relationship between this larger group of mixed Maori and non-Maori.

- Ethnic differences in work experience are even larger among youth in the CHDS without formal school or post-school qualifications. For example, Maori have slightly more than one-quarter of a year less in work experience by age 21 compared to non-Maori. The equivalent gap between unqualified Maori and non-Maori is about two-thirds of a year. Regression analysis can account for only a fraction of the differences in work experience between the ethnic groups.

- Quantile regressions are used to assess whether ethnic differences in the accumulation of work experience can be attributed to specific sections of the experience distribution. We find that the observed gaps between Maori and non-Maori in the lower tails of these distributions remain when we control for only the gender, qualifications and children born to these youth. However, when we control for observed family backgrounds, these ethnic differences in the lower tails largely disappear. Our family backgrounds measures may be particularly important for explaining the relatively poor performance of Maori among the disadvantaged in society.

- At age 21, Maori workers receive *higher* hourly earnings than non-Maori workers. This is despite the fact that Maori in this sample have fewer qualifications and less work experience than non-Maori. Although this ethnic difference in wage rates is not significant overall, it is generally significant once we control for these other factors in our regression analysis. Once observable factors have been held constant, we find that Maori workers receive hourly earnings that are around 9% *higher* than observationally equivalent non-Maori.

- The possibility exists that Maori workers receive relatively higher hourly earnings because of sample selection effects (ie, only the most productive Maori are able to

find employment). To test this proposition, we use our regression results to predict the hourly earnings that face all youth in our sample regardless of their current work status. Our results suggest that Maori, on average, face wages that are around 4.5% higher than those faced by non-Maori. It should be noted, however, that this analysis does *not* consider the possibility that this sample selection process on work status is related to unobservable factors that systematically reduce the wages faced by non-employed Maori relative to non-Maori.

- Attempts are also made to 'endogenise' both educational attainment in the work experience regressions, and educational attainment and work experience in the hourly earnings regressions. The number, birth order and sex composition of siblings are used as instrumental variables. These results are disappointing. Firstly, there is loss in explanatory power in our regressions when educational attainment is measured as actual years in education and training. Secondly, the instrumental variables capture only a small fraction of the variation in educational attainment. Thirdly, the net result is an increase in the standard errors on these endogenous explanatory variables, and no appreciable change in the results on the ethnic differences in the accumulation of work experience and hourly earnings.

9 Conclusions

Recent literature on ethnic differences in labour market outcomes in New Zealand points to two broad conclusions. Firstly, there are substantial differences in current labour force status. Maori are less likely to be employed and more likely to be unemployed relative to non-Maori. Secondly, there are negligible differences in wage rates among observationally equivalent workers. Employed Maori receive roughly comparable hourly earnings relative to employed non-Maori, once educational attainment and other demographic factors are held constant.

The present study looks at ethnic differences in early labour market experiences for a sample of youth born in the Canterbury area in 1977. These CHDS data provide important insight into the origin and nature of these early ethnic differences in labour market outcomes. Firstly, we have extensive information on the education, training and labour market histories of these youth up to their 21st birthdays. Unlike cross-sectional surveys, this allows us to construct a fairly comprehensive picture of the accumulation of work experience between the ages of 16 and 21. We ask whether this early accumulation of work experience varies between Maori and non-Maori. Secondly, we have access to an extensive catalogue of personal and family background histories for these youth. Unlike cross-sectional surveys, this allows us attribute at least some of the ethnic differences in labour market outcomes to measurable differences in individual and family circumstances. These data also allow us to consider in greater detail the important question of how ethnicity might be defined.

The specific findings of this analysis have already been set out in the summary preceding this conclusion. Two questions were posed in this project. Firstly, do Maori accumulate less work experience than non-Maori by age 21, and can these ethnic differences be explained by observable personal and family background characteristics? Secondly, do Maori face systematically lower wage rates in the labour market, and can these ethnic differences be explained by observable productivity and job-related factors?

We find that Maori, on average, accumulate *less* work experience than observationally equivalent non-Maori in the CHDS by age 21. Although detailed information on the

personal and family background characteristics allows us to explain a larger portion of these ethnic differences in work histories, we are unable to account for the entire gap in work experience between Maori and non-Maori. We do know that these ethnic differences in work experience are largely relegated to mixed Maori (ie, individuals who identify with both Maori and non-Maori). We also know that this ethnic gap in work experience is even wider among individuals without school or post-school qualifications. The general disparities by ethnicity appear to be relegated to the most disadvantaged in society. Maori make up a much larger proportion of those who fail to acquire human capital through both education and training, and work experience.

Maori workers, on average, receive *higher* hourly earnings than non-Maori workers at age 21. This wage premium received by Maori is even larger in our regression analysis once we control for the fact that Maori have less actual work experience and fewer formal qualifications than non-Maori. There is no evidence in this study that Maori, regardless of current work status, face lower wages than non-Maori. Thus, any systematic disadvantage experienced by Maori would have to operate through the accumulation of work experience, and not through the wage rates they face in the labour market.

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