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The Occupational Distribution of Maori 1997-2000

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Abstract: We focus on one aspect of labour market discrimination in New Zealand, namely *occupational segregation*. Using unit record data from Statistics New Zealand's 1997 to 2000 Income Surveys and controlling for productivity characteristics, we find evidence that Maori are consistently segregated into lower occupational classes than their measurable characteristics would predict. In addition, we estimate that discrimination of some form accounts for between 30% to 48% of the Pakeha/Maori wage differential.

Key words: labour market discrimination, occupational segregation

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1. Introduction

There are many ways in which the existence of ethnic discrimination could potentially have an economic impact on individuals. For many people, the major potential source of income is their own or a family member's labour, so that discrimination that restricts access to the labour market for certain groups can have serious consequences. "Our ultimate interest in labor market discrimination lies in the question of how discrimination affects the economic well-being of people" (Cain 1986, p. 696). As Cain also notes, this well-being is most meaningfully measured, not at the level of an individual, but for a household or family unit. It needs to be kept in mind that while, in common with most empirical work, we use the individual worker as the unit of analysis in studying earnings, the consequences of discrimination against individuals may well be broader than their immediate impact on those individuals.

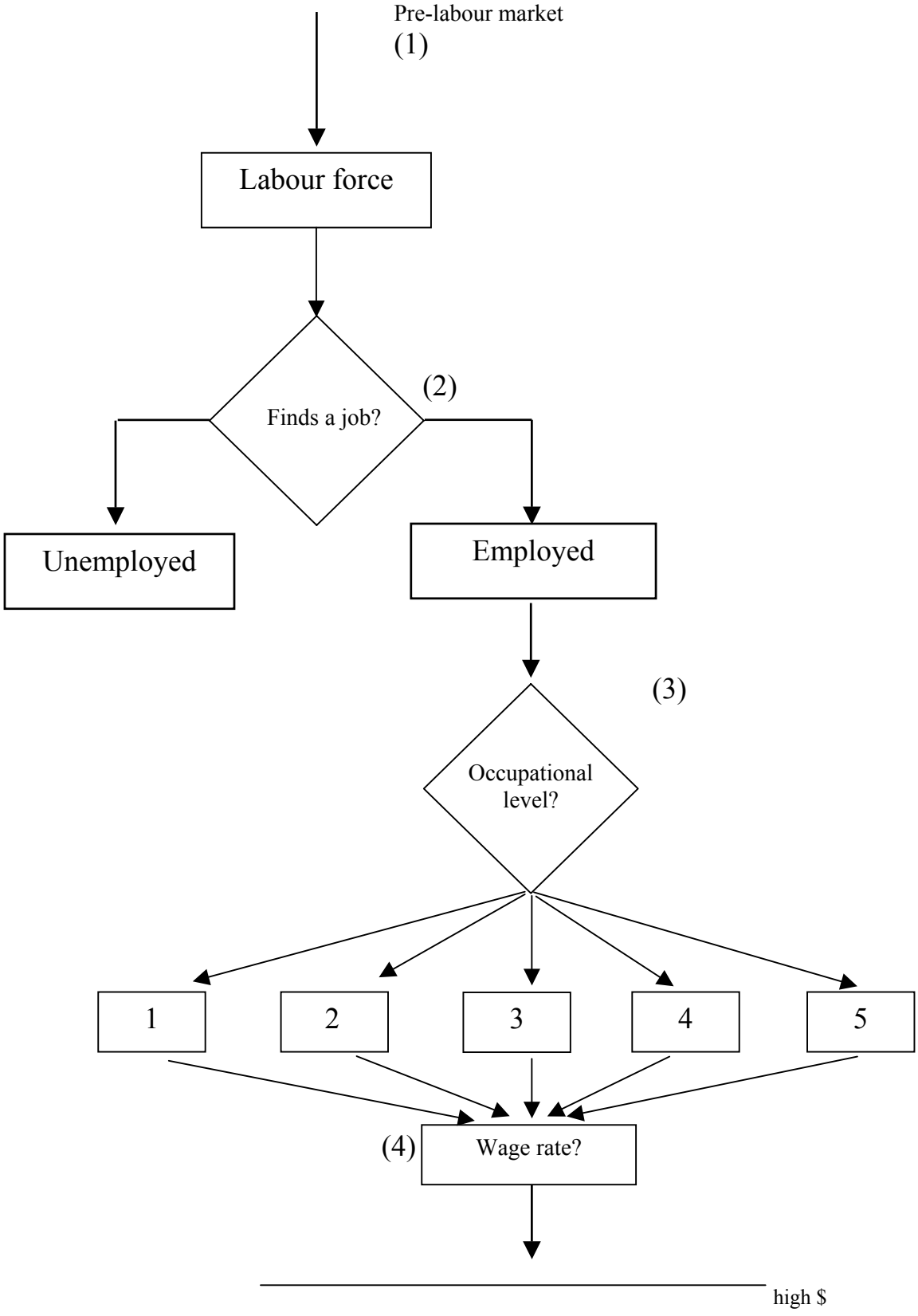
If, *ceteris paribus*[1], a member of a "minority"[2] faces a lower chance of finding employment than a member of the "majority", then we would certainly say that labour market discrimination exists. But, discrimination need not operate exclusively in this way. Alternatively, a member of a minority may find (*ceteris paribus*) access to certain types of high-paying, high-status jobs restricted. Additionally, having secured a job, a minority group member might find him or herself being paid less for work of identical or comparable worth to that of a majority group member. Relaxing the *ceteris paribus* assumption, one could allow that it is not by coincidence that members of the minority and majority groups have, for example, different educational qualifications, in that significant elements of discrimination operate *pre*-labour market entry. To take the opposing point of view, if one doubted the importance of discrimination in the labour market, one could always assert that all other things are not equal. It is always *possible* that some variable such as cognitive skill or motivation has been omitted because of our inability to measure it.[3]

Figure 1 presents a diagrammatic representation of an individual's labour market experience. Imagine an individual entering the labour market at the top of figure 1. The path that he or she takes to a wage rate at the bottom of the figure is determined by his or her characteristics. All sorts of factors associated with a person's productivity will affect a given individual's probabilities of taking certain paths through the figure. In the absence of discrimination, ethnicity would *not* be one of these factors. Discrimination could potentially operate pre-labour market (1) or, having entered the labour market, in obtaining work (2), in gaining a particular type of work (3) or in the wages one is paid for a particular type of work (4).

Given the difficulties of definition[4], the question of the extent of the economic impact of ethnic discrimination is too big to answer in one study. Our focus here is principally on one aspect of it, that of *occupational segregation* ((3) in figure 1). Put simply, we ask, to what extent do members of the minority group share the same occupational distribution as the majority group? Given differing productivity characteristics, such as age, educational qualifications and so on, we would expect a

[1] Here, *ceteris paribus* (all other things being equal) is taken to mean that individuals are comparable in the sense of having the same productivity characteristics such as age, experience, qualifications, etc.
[2] The term minority is used here to distinguish a group that potentially faces discrimination from one that faces no discrimination (the majority). Its use does not imply anything about the relative sizes of the two groups under consideration. The majority is better thought of as the culturally dominant group.
[3] Such an argument would rely on factors like these varying in a systematic way between ethnic groups.
[4] Cain (1986, p. 695) defines labour market discrimination as follows. Take "labor services as the good" and "the wage rate as the price" and ask: "*Under what conditions will essentially identical goods have different prices in competitive markets?"* He also draws "a distinction between discrimination, which refers to behavioral outcomes, and prejudice which refers to attitudes."

Figure 1


Pre-labour market
(1)
Labour force
Finds a job?
(2)
Unemployed
Employed
(3)
Occupational level?
1
2
3
4
5
(4)
Wage rate?
high $

difference to be manifest. More precisely, we ask, having controlled for such productivity characteristics as we reasonably can, do the groups have the same occupational class distribution?

The answer we give, in the New Zealand context, where the majority ethnic group is Pakeha and the minority group is Maori, is no. Using data from each of the 1997 to 2000 New Zealand Income Surveys, we find that (*ceteris paribus*) Maori are consistently under-represented in the top two occupational groups and over-represented in the bottom two groups.

We also attempt to decompose inter-ethnic wage differentials into parts explicable by job type, worker characteristics and both job segregation and *wage discrimination* ((4) in figure 1). Small sample sizes give us less confidence in these results. The issue of sample size also prevents further ethnic (or gender) breakdowns in the occupational class distributions. We argue that, given the consistently strong findings regarding the Maori occupational distribution that more extensive sampling of Maori, Pacific People and other non-European ethnic groups is essential to establish the facts in more detail.

The outline of the paper is as follows. In section 2, we briefly review the previous literature on labour market discrimination in New Zealand, illustrating that the occupational segregation issue is a notable omission to date. In section 3, we discuss the methods used, both in studying the occupational distribution and in estimating wage regressions. Section 4 examines the data, section 5 presents the results and section 6 summarises and concludes.

2. Previous literature

In a series of papers throughout the 1980s, Brosnan (1982, 1984, 1985, 1987, Hicks and Brosnan 1982, Poot and Brosnan 1982, Brosnan and Hill 1984, Revell and Brosnan 1986 and Brosnan and Wilson 1989) uses unpublished tabulations from census data to chart a detailed picture regarding unemployment. For example Brosnan and Wilson (1989), updating Hicks and Brosnan (1982), present descriptive statistics to show that women, young people and Maori bear a disproportionate burden of unemployment in New Zealand and that unemployment is more inequitably distributed here than in the other countries of their study (Australia, Norway, UK, US) with respect to those countries' minorities. However, the unemployment rates presented are not adjusted for any productivity characteristics such as education.

Maré (1995) provides an overview of the differences in population characteristics between Maori and non-Maori as a prelude to the discussion of the effects of these differences on labour market outcomes. Maré stresses that one should ask why there are differences in population characteristics and question whether these arise, in part, due to differing labour market prospects. For example, is a young Maori's attitude to gaining qualification conditioned on perceptions regarding how Maori are treated in the labour market?

More recently, since access to unit record data from Statistics New Zealand (SNZ) has been relaxed, there has been some more econometric work undertaken in this area, notably by Dixon (1996a, 1996b, 1998), Winkelmann and Winkelmann (1997), Kirkwood and Wigbout (1999), Winkelmann (1999), Chapple (2000), Maani (2000) and Alexander, Genç and Jaforullah (2001).

Winkelmann (1999) draws random samples of the male working-age population from the censuses of 1986, 1991 and 1996. Each individual is classified as in full-time employment, part-time employment, unemployed or not in the labour force. Multinomial logit models[5] are estimated using

[5] Agresti (1990), chapter 9, provides a clear introduction to multinomial logit modelling. In essence, such models attempt to explain a number of possible outcomes, such as "in full-time employment", "in part-time employment",

this unit-record data, controlling for changes in socio-economic and demographic factors. Winkelmann identifies two potential contributors to the declining labour market outcomes of Maori men which he observes from 1986 to 1996; namely an increase in the return to skill and changes in the sectoral composition of the workforce.

Winkelmann adopts the usual SNZ hierarchical definition of ethnicity whereby any person giving "Maori" as one of the responses to the question about ethnicity is classified as Maori. Chapple and Rea (1998: 129) point out that if SNZ's "rule was the equally arbitrary criteria (sic) that anyone who reported any non-Maori ethnic group was non-Maori a stroke of the statistical pen would currently convert a quarter of the Maori ethnic group in the HLFS[6] into non-Maori." This issue is taken up again when we consider our use of the data.

Winkelmann and Winkelmann (1997) also use the multinomial logit model, finding that the observed individual characteristics to be insufficient to explain *all* differences in labour force status, except in some years of their study for women. They note a very high premium on qualifications for Maori and raise the issue as to whether University-educated Maori are a "self-selected" group of higher than usual ability for graduates as a whole. This could be bound up with their facing additional obstacles to achieving a high standard of education or with the definition of ethnicity already discussed.

Maani (2000:1) uses 20% samples from the 1986 and 1996 censuses to study "the educational attainment and *income returns* to education of Maori relative to the non-Maori population." There are two difficulties in estimating earnings functions from census data. First, it is income and not earnings[7] that is reported. Second, income is reported in wide bands rather than continuously. However, within these limitations, Maani does find ethnicity to be a significant factor in her "earnings functions" with Maori with no school qualifications at a greater relative disadvantage in 1996 than in 1986.

Kirkwood and Wigbout (1999) set out to explore the gender income gap, but since ethnicity is included as one of their possible explanatory factors, there is potential to shed light on the issue of discrimination. They use data from the Household Labour Force Survey (HLFS) supplemented by the New Zealand Income Survey (NZIS) to apply "tree analysis" to identify sub-groups of the sample each with their own unique characteristics which explain the differing levels of average weekly earnings.

At each branch of the tree, the algorithm finds the variable and the associated threshold point of that variable which best discriminates between high and low earners. For example, suppose that occupational category is associated with high earnings. Of course, some individuals in a high occupational category will have low earnings (type I error) and some individuals in a low occupational category will have high earnings (type II error). The algorithm (Ghosh and Phillips 1998) searches over all observed values of the occupational category until the number of such errors is minimised.

"unemployed" or "not in the labour force", in terms of individuals' characteristics, such as age, experience, gender, qualification, etc.

[6] HLFS is the Household Labour Force Survey, conducted quarterly by Statistics New Zealand. See the discussion of data later in the paper.

[7] Income includes such things as interest income, dividend payments and social welfare benefits. Earnings includes only income earned as a return for labour services.

As it turns out, the most significant factors are occupation, hours worked, age and highest qualification, with sex a distant fifth in importance and ethnicity not rating at all in the tree analysis.[8]

Dixon (1998: 90) is an update of her earlier work (Dixon 1996a, 1996b) and uses Household Economic Survey (HES) data to model log of real hourly earnings[9] as a function of gender, age, education and ethnicity. She finds no significant difference between Maori and non-Maori, but does raise the issues of the small sample size of the HES and the possibility of systematic measurement bias in the survey, for which she presents some evidence. Overseas validation studies in which self-reports are checked against payroll data, have shown that low earners tend to over-report and high earners under-report. Such studies have not been carried out in New Zealand, but here there is concern about the growth in the numbers of individuals reporting longer hours worked in the HES. For example, from 1984 to 1987 the number of males reporting working over 60 hours per week rose from 5 to 15%, while the number over 45 hours rose from 29 to 50%. Surveys other than the HES show less such distortion.

Dixon, too, uses the standard hierarchical definition of ethnicity. Even so (footnote 8, page 93) she admits finding a significant coefficient in an unreported regression using New Zealand Income Survey (NZIS) data, but offers no explanation for this. Since her primary interest is also in changes over time there is simply insufficient data from the NZIS to address this.

Dixon's uses "age squared" as well as age to capture the effect of work experience. Given the relatively flat nature of pay scales in many occupations, particularly after rising in the initial years, this seems reasonable. It would, of course, be preferable to have more detailed data on individuals' work experience.

Chapple (2000) makes extensive use of tabulated data and exploratory regressions. At the heart of his argument is the claim that "less than one percent of individual variance in incomes … is explained directly or indirectly by being Maori (i.e. by regressions using a binary Maori dummy variable as the only explanatory variable)." This analysis consists of looking at the explained variation in a regression that is certainly mis-specified by omission of relevant variables. Much of the rest of Chapple (2000) is devoted to adding variables to regressions in a step-wise fashion in an apparent attempt to confirm the insignificant impact on income of being Maori.

Alexander, Genç and Jaforullah (2001) recognise Chapple and Rea's (1998) concerns over the hierarchical definition of ethnicity and separate out those individuals in their sample who identify as Maori and some other ethnic group from those who identify themselves solely as Maori. Alexander *et al* also draw attention to the sample selection bias problem as discussed by Heckman (1979). The sample selection bias problem arsies in this situation because those with no market income are excluded from wage regressions. This fails to account for discrimination in the hiring decision. Including the unwaged in the analysis is achieved by using a two-step procedure. First, a probit model is estimated to find the probabilities of individuals of certain characteristics being in the waged sample. Second, from the probit analysis a new variable, the inverse Mills ratio[10] is constructed, and added to the wage regressions to correct for sample selection bias. Alexander *et al* (2001) find evidence of labour market discrimination against Maori, as well as other non-European

[8] Tree analysis seems to be very similar to stepwise regression in that it attempts to maximise explanatory power. Therefore, it is subject to the same caveats (Alexander and Williams 2001).

[9] The natural logarithm of hourly earnings is used, as opposed to the dollar value of hourly earnings, because the interest is in proportional differences in wages.

[10] Taking into account the characteristics of each individual allows the estimation of the probability of such an individual's being in the sample (that is, being employed and therefore having a wage). The inverse Mills ratio is constructed for each individual as a function of that individual's characteristics and is added to the wage regression to correct for the bias that would otherwise arise from ignoring the sample selection problem (Heckman 1979).

ethnic groups. Occupational class dummies are used in their analysis but no account is taken of the possibility that occupational distributions vary across different ethnicities.

What has not been attempted in the New Zealand literature to date is to deal directly with the problem of ethnically varying occupational distributions; that is the issue of *job segregation*. What we propose to do is to use a technique developed by Brown, Moon and Zoloth (1980) to decompose the Maori/non-Maori wage differential into explained and unexplained components for both occupational distribution and wage rates. The next section explains the approach in detail.

3. Methods

Our aim here is to decompose the inter-group wage differential into five different sources. Two of these are *justifiable* in the sense that they are explained by differences in individuals' productivity characteristics. The first justifiable source of wage differences is that people of different productivity characteristics are qualified and able to enter, or choose to enter, different types of job. The second justifiable source of wage differences stems from individuals of differing characteristics in the same occupation being paid more or less according to their characteristics. The remaining three sources of wage differentials cannot be justified by reference to individuals' productivity characteristics and, thus, amount to *discrimination* of one sort or other. It could be that a member of the minority is discriminated against by being relatively less likely to attain a high occupational level even given characteristics similar to members of the majority. This is known as *job discrimination* or *job segregation*. Or it could be, within a similar occupation, that a minority member is paid less than a majority member. This is *wage discrimination* and it can be further decomposed into *overpayment* of the majority and *underpayment* of the minority. This latter distinction depends on what is regarded as the likely "norm" if there were no discrimination.

Before explaining each of the elements of the decomposition in detail, we present them here in summary:

(a) Job difference explained (by productivity characteristics).
(b) Job segregation (a type of discrimination).
(c) Wage difference explained (by productivity characteristics).
(d) Majority overpayment (a type of discrimination).
(e) Minority underpayment (a type of discrimination).

As will become evident, our definition of "discrimination" is the sum of the elements (b), (d) and (e). Discrimination is measured by that part of the wage differential that cannot be explained by differences in workers' productivity characteristics. There may be some jobs where discrimination, in this morally neutral sense, is justifiable by common sense. For example, one might sensibly discriminate against the blind in hiring bus drivers or one might prefer to employ a Maori to a non-Maori for a home-visiting service for at-risk families in certain areas.[11]

The standard definition of discrimination in the labour economics literature Oaxaca (1973) suggests that discrimination exists whenever the relative wage of one group exceeds the relative wage that would have prevailed if both groups were paid according to the same objective criteria. The relevant criteria are a set of productivity characteristics such as age, educational level and experience.[12] In the absence of discrimination, the wage structure faced by the majority would apply also to the minority.

[11] We thank Karen Baehler for pointing out this distinction and offering the examples.
[12] It is, of course, impossible to measure *perfectly* all sources of differences in productivity.

Much of the literature on discrimination makes use of the decomposition method attributed to Blinder (1973) and Oaxaca (1973). The basic idea is that differences in wages between two groups can be separated into two components. The first component is "explained" by differences in productivity characteristics and is, in this sense, *justified*.[13] The second part remains unexplained by differences in productivity characteristics and is termed *discrimination*.

Oaxaca and Ransom (1994), in applying the method to the white-black wage differential in the United States, extended the decomposition by breaking the unexplained component into what they termed an overpayment to the majority and an underpayment to the minority. The idea of breaking up the unexplained component into *overpayment* and *underpayment* arises when one considers the wage distribution that one would expect in the absence of discrimination. Lumping overpayment and underpayment together amounts to regarding the majority distribution as the norm or what would prevail in the absence of discrimination. It is however possible that, in the absence of discrimination, the population's characteristics would give rise to a distribution of wages intermediate between the majority and minority distributions. The amount of the difference in wages attributable to majority overpayment is determined by one's belief as to how much weight should be placed on the majority wage structure and the minority wage structure, respectively, in determining the distribution that would prevail in the absence of discrimination.

The Oaxaca and Ransom decomposition method does not address the possibility of differences in occupational distributions between the two groups. A good deal of evidence[14] shows that the difference in occupational distribution is important in explaining differences in wages. The argument is that the minority group typically has lower occupational attainment levels than the majority. This may or may not be explainable by differing population characteristics. Any unexplained differences can be thought of as *job discrimination* or *job segregation*, in that persons from different groups, who otherwise have the same characteristics, end up working in different occupations.[15]

The standard method used to examine occupational distributions is the multinomial logit model.[16] Schmidt and Strauss (1975), one of the first to apply this model to occupational attainment levels, note that the multinomial logit model allows for an arbitrary number of occupational classes and allows the inclusion of both qualitative and continuously measurable variables as explanators of occupational choice. From such modelling, one can find the probability that a given individual is in a particular occupational class, given that individual's productivity characteristics. The idea is to estimate such probabilities from the sample of the majority group. Then, on the assumption of no discrimination (applying the majority model)[17], we calculate the proportions of the minority group that we would expect to find in each occupational class, given their productivity characteristics. If there were truly no job discrimination, then these estimated proportions would not vary significantly from the actual proportions. We could use the differences between the estimated proportions and the actual proportions of the minority in each occupational class as a measure of job segregation.

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[13] Although, it should be pointed out that in justifying a difference based on productivity characteristics we miss any discrimination faced in attaining those characteristics; that is, we fail to measure pre-labour market discrimination.

[14] See, amongst others, Gill (1989), as well as the references therein, and De Beyer and Knight (1989).

[15] The differing occupational distributions could arise either from the demand side or the supply side (as a matter of worker choice). The latter possibility would require systematically different tastes on the part of the two groups. This is often suggested as a reason why males and females differ in their occupational distributions. Women could be segregated into certain types of job based, at least partly, on their preferences rather than discrimination. England (1992, pp. 12-23) discusses the "sex segregation" of jobs. On controlling for gender, it is more difficult to sustain this sort of argument in an ethnic context without detailed knowledge and evidence of cultural differences.

[16] See footnote 5.

[17] It could also be argued that the occupational distribution in the absence of discrimination would be intermediate between those of the majority and minority. This would be similar to the approach taken in decomposing wage discrimination into overpayment and underpayment.

Brown et al. (1980) incorporated both wage regression and multinomial logit techniques to measure male-female discrimination, expressing it in terms of a wage component *and* a job component. Hinks and Watson (2001) employ similar techniques to Brown et al. (1980) to estimate racial wage and occupational discrimination in South Africa.

Our intention is to apply this framework to break down the Maori/Pakeha wage differential in New Zealand into the five elements, (a) to (e), defined above. The inter-ethnic wage differential, $\overline{\omega}^{\,p} - \overline{\omega}^{\,m}$ (average Pakeha wage minus average Maori wage), can be thought of as broken down as follows: $\overline{\omega}^{\,p} - \overline{\omega}^{\,m}$ = (a) + (b) + (c) + (d) + (e)[18].

We first use multinomial logit modelling on the Pakeha sample for each year in turn. This establishes how the various productivity characteristics explain the Pakeha occupational distribution. Then we apply this model of occupational grouping to the Maori sample to see what it predicts about the Maori occupational distribution. We can then, at this stage, compare the predicted Maori distribution with the actual one. That will tell us something directly about job segregation.

Next, we estimate a wage regression for each occupational group, Maori and Pakeha separately, as the basis for decomposing the ethnic wage differential into the five components noted above.

In the discussion of the data that follows we define more precisely who we take to be Maori and why our analysis focuses only on the Maori/Pakeha gap, omitting other ethnic groups.

4. Data

The data we use are from Statistics New Zealand's (SNZ) *New Zealand Income Survey* (NZIS), which has, since 1997, been run as an annual supplement in the June quarter to the quarterly *Household Labour Force Survey* (HLFS). SNZ has developed a Data Laboratory, which is a mechanism for providing access to unit record data. Because of the safeguards and conditions that are in place for the use of the Data Laboratory, use of the facility requires the researchers to access the data in an SNZ office in Auckland, Wellington or Christchurch. No unit-record data can be removed from these secure sites, only the completed statistical analyses. All output is meticulously checked by SNZ staff before release to eliminate the possibility of even inadvertent release of unit record material.

The HLFS has a sample size of about 15 000 households and approximately 30 000 individuals. Its drawback is that no income questions are asked. However, the NZIS collects recent gross income data on wages and salaries, self-employment, government transfers and other transfers.

SNZ made available to us, at the Wellington Data Laboratory, data from the 1997 through 2000 NZIS and HLFS. The most important difference in our data set from those used by other researchers is that we asked SNZ to classify separately those respondents who ticked only "Maori" and those who ticked both "Maori" and some other ethnic group in answering the ethnicity question. Accordingly we were able to identify separately those individuals who identify solely with the

[18] See the appendix for additional technical detail on the decomposition method.

Table 1: Sample NZIS descriptive statistics

Year	1997	1997	1998	1998	1999	1999	2000	2000
Occupational group	**Pakeha**	**Maori**	**Pakeha**	**Maori**	**Pakeha**	**Maori**	**Pakeha**	**Maori**
All								
Average wage rate (log)	**2.566**	**2.408**	**2.612**	**2.497**	**2.618**	**2.476**	**2.647**	**2.489**
Average wage rate ($ per hour)	**$13.01**	**$11.11**	**$13.63**	**$12.15**	**$13.71**	**$11.89**	**$14.11**	**$12.05**
Pakeha-Maori % difference		**17%**		**12%**		**15%**		**17%**
Average age	**37.6**	**35.6**	**38.1**	**36.2**	**38.6**	**36.8**	**38.7**	**35.9**
Part-time (%)	**23.8**	**20.4**	**24.4**	**23.2**	**26**	**23.2**	**25.4**	**22.9**
Qualifications (%)								
University	**11.6**	**2.6**	**12.2**	**3.6**	**12.5**	**3**	**11.9**	**4.6**
Post-School	**41.8**	**34.8**	**42.7**	**35.7**	**42.8**	**33.8**	**43.2**	**37.5**
School	**26**	**21.4**	**25.1**	**20.8**	**25.2**	**17.6**	**24.7**	**21.1**
None	**20.6**	**41.2**	**20**	**39.9**	**19.5**	**45.6**	**20.2**	**36.8**
1								
Average wage rate (log)	**2.827**	**2.625**	**2.894**	**2.739**	**2.912**	**2.703**	**2.944**	**2.721**
Average wage rate ($ per hour)	**$16.89**	**$13.80**	**$18.07**	**$15.47**	**$18.39**	**$14.92**	**$18.99**	**$15.20**
Pakeha-Maori % difference		**22%**		**17%**		**23%**		**25%**
Average age	**40.3**	**39.3**	**41**	**39.1**	**41.6**	**40.3**	**41.2**	**38.7**
Part-time (%)	**12.9**	**17.4**	**13.3**	**17.9**	**15**	**17.4**	**14.6**	**10.1**
Qualifications (%)								
University	**32.6**	**16.8**	**33.9**	**20.9**	**33.5**	**18.3**	**33.6**	**24.4**
Post-School	**46.3**	**57.7**	**45.4**	**52.2**	**45.4**	**46.1**	**46.1**	**48.8**
School	**13.9**	**11.4**	**14.2**	**14.2**	**14.7**	**12.2**	**14.4**	**16.7**
None	**7.2**	**14.1**	**6.5**	**12.7**	**6.4**	**23.4**	**5.9**	**10.1**

Year	1997	1997	1998	1998	1999	1999	2000	2000
Occupational group	**Pakeha**	**Maori**	**Pakeha**	**Maori**	**Pakeha**	**Maori**	**Pakeha**	**Maori**
2								
Average wage rate (log)	**2.613**	**2.446**	**2.652**	**2.503**	**2.664**	**2.525**	**2.679**	**2.541**
Average wage rate ($ per hour)	**$13.64**	**$11.54**	**$14.18**	**$12.22**	**$14.35**	**$12.49**	**$14.57**	**$12.69**
Pakeha-Maori % difference		**18%**		**16%**		**15%**		**15%**
Average age	**37.9**	**35.3**	**38.6**	**35.3**	**38.6**	**36.9**	**38.7**	**35.1**
Part-time (%)	**25.5**	**25.1**	**25.7**	**27.3**	**26.3**	**30.1**	**26.6**	**22.8**
Qualifications (%)								
University	**8.9**	**0.6**	**9.6**	**3.2**	**10.7**	**1.8**	**11.1**	**4.7**
Post-School	**42.6**	**44.7**	**42.6**	**48.7**	**43.9**	**45.6**	**42.6**	**40.9**
School	**35**	**34.6**	**33.9**	**23**	**32.7**	**29.6**	**32.9**	**31.2**
None	**13.5**	**20.1**	**13.9**	**25.1**	**12.7**	**23**	**13.4**	**23.2**
3								
Average wage rate (log)	**2.396**	**2.337**	**2.431**	**2.438**	**2.435**	**2.363**	**2.468**	**2.392**
Average wage rate ($ per hour)	**$10.98**	**$10.35**	**$11.37**	**$11.45**	**$11.42**	**$10.62**	**$11.80**	**$10.94**
Pakeha-Maori % difference		**6%**		**-0.7%**		**7%**		**8%**
Average age	**34.6**	**33.6**	**35.2**	**33.8**	**35.9**	**34.4**	**36.2**	**34.3**
Part-time (%)	**32.7**	**29.6**	**33.1**	**29.3**	**36.6**	**32.2**	**35.9**	**35.7**
Qualifications (%)								
University	**2**	**0**	**2.1**	**0**	**2.3**	**1.4**	**0**	**0**
Post-School	**45.6**	**41.2**	**47.5**	**41**	**47.3**	**38.5**	**51**	**45.3**
School	**28.2**	**25**	**27.3**	**24.4**	**27.9**	**19.7**	**27**	**26**
None	**24.2**	**33.8**	**23.1**	**34.6**	**22.5**	**40.4**	**22**	**28.7**

Year	1997	1997	1998	1998	1999	1999	2000	2000
Occupational group	**Pakeha**	**Maori**	**Pakeha**	**Maori**	**Pakeha**	**Maori**	**Pakeha**	**Maori**
4	**2.362**	**2.331**	**2.362**	**2.353**	**2.343**	**2.428**	**2.402**	**2.41**
Average wage rate (log)								
Average wage rate ($ per hour)	**$10.61**	**$10.29**	**$10.61**	**$10.52**	**$10.41**	**$11.34**	**$11.05**	**$11.13**
Pakeha-Maori % difference		**3%**		**0.9%**		**-8%**		**-0.8%**
Average age	**36.7**	**32.5**	**36.6**	**32.9**	**36.4**	**33.8**	**38**	**31.9**
Part-time (%)	**19.6**	**10.9**	**20.9**	**20**	**23.1**	**14.5**	**21.1**	**16.7**
Qualifications (%)								
University	**4.1**	**0**	**3.3**	**0**	**4.1**	**0**	**0**	**0**
Post-School	**36.5**	**32.8**	**41.2**	**32.7**	**36.1**	**18.1**	**32**	**34.3**
School	**26.5**	**18.8**	**23.2**	**18.2**	**27.7**	**15.7**	**28.5**	**15.7**
None	**32.9**	**48.4**	**32.3**	**49.1**	**32.1**	**66.2**	**39.5**	**50**
5	**2.394**	**2.361**	**2.446**	**2.46**	**2.445**	**2.456**	**2.481**	**2.443**
Average wage rate (log)								
Average wage rate ($ per hour)	**$10.96**	**$10.60**	**$11.54**	**$11.70**	**$11.53**	**$11.66**	**$11.95**	**$11.51**
Pakeha-Maori % difference		**3%**		**-1%**		**-1%**		**4%**
Average age	**37.6**	**35.9**	**37.8**	**37.4**	**38.9**	**37.8**	**38.6**	**37.3**
Part-time (%)	**24.4**	**15.8**	**26.8**	**20.2**	**27.3**	**18.1**	**25.3**	**21.6**
Qualifications (%)								
University	**1.1**	**0**	**1**	**0**	**0.9**	**0**	**1.2**	**0**
Post-School	**29.3**	**18.5**	**32**	**20.4**	**31.7**	**24.3**	**30.7**	**25.8**
School	**24.8**	**17.8**	**23.8**	**20.4**	**24.6**	**12.5**	**23.8**	**15.3**
None	**44.8**	**63.7**	**43.2**	**59.2**	**42.8**	**63.2**	**44.3**	**58.9**

Maori ethnic group and those (whom we call "mixed") who identify themselves as Maori as well as at least one other classification. This enables us to address the criticism made by Chapple and Rea (1998) regarding the hierarchical system of classifying ethnicity that is more typically used. Under the hierarchical classificatory scheme, only those who identified themselves solely as New Zealand European/Pakeha would appear as such. Any person ticking multiple ethnicites on the survey form would be classified as Maori (if one of his or her choices was Maori), or Pacific Island (if one of his or her choices was Pacific and none was Maori).

Because of relatively small sample sizes, it was not possible to carry out any analysis using "mixed" data. The difficulty of identification with multiple ethnicities arises with other non-European ethnic groups as well and the small sample problem applies even more strongly. In addition, using a classification such as "Pacific Peoples" obscures considerable ethnic variation. Samoans (50%) (Ministry of Pacific Island Affairs 1999) constitute the largest group of Pacific People in New Zealand, but other groups include Cook Island (23%), Tongan (9%), Niuean (9%), Fijian (2%) and Tokelauan (1%). The classification "other" is dominated by various Asian ethnicities, many of whom have little in common with each other culturally. Consequently, our focus here is on comparing those individuals in the sample who identify themselves solely as Maori with those individuals who identify themselves solely as Pakeha.[19]

Our analysis focuses also only on those Maori and Pakeha who are employed. That is, we do not take into account those who are classified as unemployed or not in the labour force. As noted earlier (Alexander *et al* 2001) this introduces the possibility of sample selection bias in the wage regression estimates and excludes discrimination in the hiring decision at the level of whether one gets a job at all as opposed to what sort of job. Therefore, the extent of discrimination that we measure is restricted to that found once individuals have overcome the initial hurdle of finding some sort of work and, in that sense, provides some sort of lower bound on the extent of discrimination[20].

Table 1 shows some descriptive statistics for both Maori and Pakeha NZIS samples for each of the years 1997 to 2000. The hourly wage rate for the entire Pakeha sample is larger (by 12% to 17%, depending on the year) than for the Maori sample. Once the samples are sub-divided into five occupational classes[21], the difference in wage rates becomes smaller for the lower occupational groups. The highest differential recorded is 25% in favour of Pakeha in group 1 in 2000. In a few cases, Maori actually have a higher hourly wage rate.[22]

Those in the Maori sample are, on average, younger than Pakeha and it appears that a smaller proportion of Maori than Pakeha work part-time. The largest difference between the two samples is in their level of formal schooling. Overall, about 40% of Maori have no formal qualifications compared with 20% of Pakeha.

The dependent variable in the multinomial logit model is occupational class. There are nine occupational classes in the NZIS data, ranging from "Legislators, Administrators and Managers" at the top end of the occupational scale to "Elementary Occupations" (or unskilled workers) at the other end of the scale. It proved impossible to retain all of these nine occupational categories because of difficulties of small samples sizes, especially of Maori in some occupational

[19] Ideally, to study discrimination, it would be preferable to know not how one identifies oneself but how one is perceived by others. This information is simply not available. As the Bard said "Oh wad some power the giftie gie us, To see oursels as others see us!"

[20] Provided that one agrees that no serious contender as an explanatory variable has been omitted.

[21] See the discussion below and table 2 for a description of the occupational classes.

[22] Higher Maori wage rates are indicated in the table by negative percentage differences in wages. It could be suggested that these observations constitute *prima facie* evidence of a sample selection bias problem, so that our earlier comment on finding a lower bound for discrimination holds *a fortiori*.

groupings[23]. Table 2 gives the details of the construction of the five occupational groupings used in our analysis.

Table 2: Occupational group numbers

Original Group (HLFS data)	Description	Merged Group
1	Legislators Administrators Managers	1
2	Professionals	
3	Technicians Associate Professionals	2
	Clerks	
5	Service Workers Sales workers	3
7	Trades workers	
6	Agricultural workers Fisheries workers	4
8	Plant & Machine Operators Assemblers	5
9	Elementary Occupations	

The group "Agricultural and Fishery" workers was kept completely separate from all others, principally because of the difficulty that arises from its containing both self-employed farmers and farm labourers. The former may include many individuals with high incomes from self-employment while some of the latter are poorly paid. In addition, traditionally, many farmers have not been highly formally qualified. Not merging this occupational classification with any others does add to the problems of small samples and less reliance should be placed in the results for this grouping.

Table 3 contains a list and description of the explanatory variables used in the multinomial logit model as well as those used in the later wage regressions. The multinomial logit model is intended to predict the probability of an individual's belonging to a particular occupational class. The determinants of occupational attainment level will be a function both of an employer's willingness to employ a person in a particular role and that individual's desire to work in that occupation. An employer's willingness to employ a person depends on human capital considerations such as experience, education and training. An individual's desire to work in a particular job will depend on such factors as the wage rate, the individual's preferences and household factors inducing an individual to seek out stable employment.

In the logit model we use age as a proxy for experience, with its square entered to pick up diminishing returns. A number of problems have been identified with age as a proxy for experience

[23] Brown et al (1980) also mention sample size problems as a reason for condensing their occupational categories.

Table 3: Variables from NZIS	
Independent Variables	**Definition**
Age variables	
AGE	Age in years
AGESQ	Square of AGE
Household variables	
CWCH	1 if a couple with dependent children, 0 otherwise
SWCH	1 if a single parent with dependent children, 0 otherwise
SOLO	1 if a single parent without dependent children, 0 otherwise
ONEP	1 if a sole person household, 0 otherwise
OTHRH	1 if another household type (except couple with no dependent children), 0 otherwise.
Regional variables	
MCNT	1 if resident in Auckland, Wellington or Christchurch, 0 otherwise
Qualification variables	
UNIQ	1 if highest qualification is a university degree, 0 otherwise
PSCQ	1 if highest qualification is post-school but not a university level, 0 otherwise
SCHQ	1 if highest qualification is at school level, 0 otherwise
Gender variable	
GNDR	1 if female, 0 otherwise
Part-time variable	
PT	1 if work part-time, 0 otherwise
Weighting variable	
FINALWGT	See the data discussion in the text

(Brown *et al*., 1980). The main argument is that age does not account for the fact that two groups could face quite different labour market experiences. This is of considerable concern when measuring male-female discrimination since many females spend some years out of the work force for child-bearing and child-rearing. It can be argued that using age to proxy labour market experience will result in over-estimating many females' experience and therefore a potential over-estimation of discrimination. A gender dummy is included amongst our explanatory variables[24]. Having controlled for gender, it is harder to make such a case in terms of ethnic differences. Doing so requires explicit formulation of some hypothesis regarding supply side factors, perhaps to do with ethnic variations in the importance of "family".[25]

The variable household type is intended to measure an individual's desire or motivation to work in a particular type of occupation. A couple with no dependent children is used as the reference household type.

It could be argued that a household type variable is not enough to measure a person's desire to work in a particular type of work. Schmidt and Strauss (1975) point out that there are very evident systematic differences in the job preferences of men and women. For example, traditionally, men have dominated work in the trades and women have dominated in nursing and teaching. *A priori*,

[24] In both logit analysis and wage regressions, survey respondents' sex is controlled for by the use of the dummy variable GNDR, which takes the value 1 for females and 0 for males.

[25] Chapple (2000, p. 13) has put this point more negatively, arguing that "Maori may have stronger preferences for leisure or for producing non-market goods than non-Maori". This controversial view is noted here, but in the absence of evidence, we consider it is unlikely to be a major factor. Moreover, we can see no way of incorporating any measure of preferences into the model.

there is little to suggest such systematic variations in tastes across ethnicities once gender has been accounted for.

Three qualification dummies are included to measure educational level. Individuals are grouped according to their highest formal qualification, from university to post-school to school qualification. The reference group is "no qualification".[26]

A locational dummy (main centre) is also used to account for regional variation in concentrations of certain types of job.[27]

The wage regressions are run separately for Maori and Pakeha for each of the five occupational classes. The dependent variable in the wage regressions is actual total hourly earnings.

All of the independent variables from the logit model are also entered in the wage regressions, with the exception of household type. It is hard to see how that variable could affect an hourly pay rate once the occupational choice has been made. A part-time dummy is also included in the wage regressions to account for differing pay rates for casual labour.

By design, the NZIS oversamples certain population groups such as Maori and those residing in urban areas. For this reason, SNZ recommends the use of sampling weights to give a better representation of the population. The NZIS contains a weighting variable, FINALWGT, which is used throughout our analysis, although we repeat the analysis without that variable to check the sensitivity of the results to its inclusion. SNZ provided us with a description of the construction of the weighting variable:[28]

1. Estimation weights are calculated which reflect the sample design.
2. The estimation weights are adjusted to account for non-respondents, which is a particular problem amongst the highly mobile younger age groups.
3. Integrated weighting is used to adjust the weights so that each individual in the same household has the same weight and to ensure that the individual weights in each age/sex group add up to known population benchmarks.

We turn now to a presentation of our findings.

5. Results

As just mentioned, weighted and unweighted analyses were both performed. The results from both approaches were very similar, so that we present only the results from the weighted analysis.[29]

A multinomial logit model[30] was used to estimate an occupational function for Pakeha. The parameter estimates for one of the response categories (Plant and Machine Operators, Assemblers and Elementary Occupations) are set to zero so that the procedure used provides parameter estimates for occupational classes one to four, with the fifth category as the reference category. The parameter estimates of the multinomial logit model are not of direct interest here[31] but are used to

[26] Individuals who did not specify their qualifications have been excluded for reasons of lack of within group comparability and small sample size.
[27] In Alexander *et al*. (2001) such a regional dummy was tested for robustness by breaking it up by regional council area. The more detailed regional dummy had virtually no impact on other findings.
[28] SNZ (2001).
[29] The results from the unweighted analyses are available on request.
[30] The CATMOD procedure in SAS (SAS Institute Inc., 1989) was used.
[31] These estimates are available on request.

find predicted probabilities for Maori. Given the occupational function for Pakeha, to obtain the *predicted* occupational distribution for Maori, we calculate the predicted probability of being in a particular occupational class for each Maori individual. In essence we take the distribution for Pakeha (the "majority") and apply it to each individual Maori whose productivity characteristics we know. Put simply, we are asking the question, for each Maori survey respondent: "Given his/her productivity characteristics, what would we predict to be his/her probabilities of being in each occupational class, if we did not know his/her ethnicity?" From these individual predicted values, we calculate averages.

Table 4: Occupational distribution 1997

	Pakeha	Maori		Maori		
Occ.	Actual Proportion	Actual proportion	Predicted proportion	Actual number (O_i)	Predicted number (E_i)	$(O_i - E_i)^2$
1	0.2569	0.1552	0.1718	169	187	1.749
2	0.2712	0.1763	0.2428	192	264	19.829
3	0.2359	0.2167	0.2728	236	297.	12.558
4	0.0771	0.0680	0.1070	74	117	15.518
5	0.1588	0.3838	0.2056	418	224	168. 270
Totals	1	1	1	1089	1088	**217.924**

Table 4 shows, for the 1997 data set, the actual and predicted proportions and counts for Maori as well as the actual proportions for Pakeha [32]. The actual proportions show that Maori are under-represented in the top two occupational groups. Over half of the Pakeha sample, but only about a third of Maori, are employed in these two groups. The largest difference in the occupational distribution shows up in the lowest occupational grouping. Only about 16% of Pākeha is employed in group five but more than double that proportion of Maori work in such occupations.

Such raw data, of course, do not indicate discrimination in the sense we have defined it here, since they fail to take into account any difference in the productivity characteristics of the two populations. The predicted proportions show what one would expect the Maori occupational distribution to look like in the absence of job segregation. The predicted Maori occupational distribution does, in fact, come more closely into line with the Pakeha distribution. The probability of a Maori person being in occupational groups one to four rises, while the probability of being in group five falls. In other words, were there no job segregation, more Maori would be employed in the top four occupational groups and fewer in the lowest occupational group.

If the observed and predicted counts in each occupational group for Maori are significantly different we would take this as evidence of discrimination of the job segregation type. To determine whether the differences are statistically significant we employ a chi-square test[33]. The Pearson statistic (X^2) follows a chi-square distribution with four degrees of freedom.

[32] The counts are calculated by multiplying the total number of Māori in the sample by the proportion in each occupation group. Because of rounding errors, in some instances the proportions do not quite sum to 1 and the predicted numbers were not actually whole.

[33] The predicted counts do not come from a *known* distribution. As a result, the statistic calculated may not follow an exact chi-square distribution. However, the model is estimated using 13296 observations so that asymptotic theory allows us to assume that the observed statistic will follow an *approximate* chi-square distribution (Agresti 1990).

Table 4 shows the values for the individual components of the Pearson statistic and the sum of these components which gives a value for the test statistic. It is clear that the statistic is highly significant[34]. We therefore conclude that the actual Maori occupational distribution is different from the distribution that we obtain on assuming no job segregation.

Table 5: Occupational distribution 1998

	Pakeha	Maori		Maori		
Occ.	Actual Proportion	Actual proportion	Predicted proportion	Actual number (O_i)	Predicted number (E_i)	$(O_i - E_i)^2$
1	0.2594	0.1524	0.1801	160	189	4.480
2	0.2662	0.1905	0.2429	200	255	11.880
3	0.2398	0.2219	0.2705	233	284.	9.167
4	0.0784	0.0667	0.1094	70	115	17.527
5	0.1562	0.3686	0.1971	387	207	156.634
Totals	1	1	1	1050	1050	**199.688**

Tables 5, 6 and 7 show the same information for the 1998, 1999 and 2000 years. The same broad pattern repeats itself in each year. The details change due to variations in the samples but each sample confirms the presence of highly significant job segregation always to the detriment of Maori[35]. Given these differences in occupational distribution, we proceed with the second stage of our analysis and try to carry out wage decompositions controlling for occupational level.

A wage regression for each of the five occupational groups was estimated separately for Pakeha and Maori. For each year, this results in ten regression equations, or a total of forty regressions. Because of the small sample sizes, the resulting estimates, especially for Maori, have to be viewed with some caution. In the case of occupation group four, in particular, a number of the explanatory variables were not significant, even at the 10% level.[36]

Putting together the results from the multinomial logit model and the wage regressions, allows us to construct the wage differential composition presented in Table 8. Because of the small sample size problems, the wage regression estimates for Maori are very sensitive to the sample year. Consequently, the details of the decomposition vary considerably across the years. However, a very definite pattern does emerge. All years exhibit some form of labour market discrimination, but quantifying the exact level of each type is more problematic.

Table 6: Occupational distribution 1999

	Pakeha	Maori		Maori		
Occ.	Actual Proportion	Actual proportion	Predicted proportion	Actual number	Predicted number	$(O_i - E_i)^2$

[34] $\chi^2_{4,0.0001} = 23.506$

[35] Note that χ^2 is falling over time but always remains highly significant.

[36] The regressions for Pakeha samples performed much better with most variables showing high levels of significance, the parameter estimates having sensible signs and values, and the adjusted R^2 typically around 0.3. Tabulated results are available on request.

				(O_i)	(E_i)	
1	0.2621	0.1291	0.1710	125	166	9.923
2	0.2516	0.1860	0.2231	180	216	5.988
3	0.2450	0.2376	0.2739	230	265	4.656
4	0.0901	0.0992	0.1311	96	127	7.526
5	0.1512	0.3481	0.2009	337	194	104.460
Totals	1	1	1	968	968	**132.553**

Table 7: Occupational distribution 2000

	Pakeha	Maori		Maori		
Occ.	Actual Proportion	Actual proportion	Predicted proportion	Actual number (O_i)	Predicted number (E_i)	$(O_i - E_i)^2$
1	0.2678	0.1602	0.1929	194	234	6.714
2	0.2374	0.1916	0.2094	232	254	1.837
3	0.2522	0.2263	0.2749	274	333	10.422
4	0.0871	0.1024	0.1277	124	155	6.073
5	0.1555	0.3196	0.1952	387	237	95.962
Totals	1	1	1	1211	1211	**121.008**

Table 8: Percentage decomposition of the wage differential

		1997	1998	1999	2000
Job explained	(a)	24.8	37.1	32.8	24.2
Job discrimination	(b)	13.0	15.9	16.7	9.9
Wage explained	(c)	27.5	33.3	37.9	28.1
Pakeha overpayment	(d)	1.4	3.0	4.3	4.0
Maori underpayment	(e)	33.3	10.7	8.3	33.7
Total "explained"	(a) + (c)	52.3	70.4	70.7	52.3
Total "discrimination"	(b) +(d)+ (e)	47.7	29.6	29.3	47.7

The results from 1998 indicate the smallest degree of discrimination. In that year, about 70% of the Pakeha/Maori wage differential can be attributed to differing population characteristics. The remaining 30% of the differential can be divided into 16% due to job segregation and 14% due to wage discrimination (11% Maori underpayment and only 3% Pakeha overpayment). The results for the 1997 and 2000 years indicate a much greater degree of discrimination. In those years, only about 52% of the differential can be attributed to differing individual characteristics, with the remaining 48% attributable to some form of discrimination. Maori underpayment explains most of this 48%, job discrimination much less, while Pakeha overpayment is quite unimportant.

Regardless of which year is examined, Maori are disadvantaged both in terms of the occupations they enter[37] and the subsequent wages they are paid once in employment. According to these results, Maori, *at best*, face discrimination that accounts for 30% of the Pakeha/Maori wage differential and, *at worst*, nearly half of the inter-ethnic differential.

6. Conclusion

The question of labour market discrimination is a complex one. If there is a difference in average wages between two groups of people, however those groups are defined, that difference might be due to discrimination. On the other hand, it might be due to differing productivity characteristics of the individuals comprising the two groups and, in that sense, be "justified" or "explained". Such justifications or explanations, however, might in turn raise questions about how the differing characteristics came about.

Any difference that does exist could be partially explained by the types of occupation people are in and partly by the wages they are paid within those occupations. Thus, potentially, discrimination could also operate at the level of sorting individuals into jobs (what we have termed *job segregation*) or at the level of payment within jobs (*wage discrimination*).

In this study, we examined the earned incomes of samples of Pakeha and Maori from the 1997 to 2000 NZIS. In every year, we found evidence that not all of the inter-ethnic wage differential was explicable by individuals' productivity characteristics. Between 29.3% and 47.7% of the Pakeha/ Maori wage differential is attributable to some form of discrimination, with both underpayment of Maori within occupational classes and job discrimination evident.

These findings are subject to certain *caveats* concerning the reliability of the estimates from wage regressions from Maori samples, because of the small sample sizes within certain occupational groupings. These data problems prevent us from studying the experience of other non-European ethnic groups and from disaggregating such results by gender.

We do, however, find compelling evidence of job segregation of Maori. In each year of the NZIS we find evidence that Maori are over-represented in the lower occupational classes and under-represented in the higher ones, even having taken into account the way in which their age and qualification profiles differ from Pakeha. This finding gives us sufficient concern to call for more extensive sampling of Maori and other non-European ethnic groups in order to be able to establish a firmer and more detailed picture of the types and extent of discrimination in the New Zealand labour market.

[37] Recall that we have also not considered in our analysis the unemployed (Alexander *et al* 2001).

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Appendix

We explain here, in more detail, the method used to decompose the Pakeha-Maori wage differential. This differential is measured by the difference between the mean wage of pakeha and the mean wage of Maori) as follows:

$$(1) \qquad \bar{\omega}^{p} - \bar{\omega}^{m}$$

$$= \sum_{j} \tilde{\beta}_{jp} \bar{X}_{jp} \left(p_{jp} - \hat{p}_{jm} \right) + \sum_{j} \tilde{\beta}_{jp} \bar{X}_{jp} \left(\hat{p}_{jm} - p_{jm} \right)$$

$$+ \sum_{j} p_{jm} \tilde{\beta}_{j}^{*} \left(\bar{X}_{jp} - \bar{X}_{jm} \right) + \sum_{j} p_{jm} \bar{X}_{jp} \left(\tilde{\beta}_{jp} - \tilde{\beta}_{j} \right)$$

$$+ \sum_{j} p_{jm} \bar{X}_{jm} \left(\tilde{\beta}_{j}^{*} - \tilde{\beta}_{jm} \right)$$

To understand the notation in (1), note that there are five summation terms in (1). Rewriting these by labelling them (a) through (e) (corresponding to the elements of the decomposition (a) to (e) described in the text) we have:

$$(1) \qquad \bar{\omega}^{p} - \bar{\omega}^{m} = (a) + (b) + (c) + (d) + (e)$$

The subscript j refers to occupational classes. The summation is over j=1 to 5 in each case because there are five occupational classes defined.

The subscripts p and m refer to Pakeha and Maori.

A doubly subscripted p refers to the proportion of an ethnic group in an occupational class; so, for example, p_{2m} is the proportion of Māori in occupational class two.

A hat over a proportion refers to the predicted value of that proportion for Maori derived from the Pakeha occupational distribution.

The betas are parameter estimates from wage regressions. For example, β_{3p} are the estimated coefficients from a wage regression for Pakeha in occupational class three. An asterisked beta (with neither an m nor a p subscript) indicates parameters from the non-discriminatory wage structure for that occupational class.

By examining each of the components on the right hand side of (1) in turn, it becomes apparent what each is attempting to measure.

The first component (a) contains the expression $(p_{jp} - \hat{p}_{jm})$ which measures any differences in the occupational distributions of Pakeha and Maori due to differences in population productivity characteristics.[38]

Turning to the second component (b), we see that, if there were no job segregation, we would expect the term $(\hat{p}_{jm} - p_{jm})$ to be close to zero. A large value for the second component therefore indicates that Maori end up in low paying occupations not because they have poor productivity characteristics but because they suffer discrimination (job segregation).

In the third component, the term of interest is $\bar{\beta}_j^* (\bar{X}_{jp} - \bar{X}_{jm})$, which picks up any difference in the mean hourly wage between Maori and Pakeha due to differences in productivity characteristics.

The term $\tilde{\beta}_{jp} - \tilde{\beta}_j^*$ in the fourth component (d) measures the difference between the existing wage structure for Pakeha and the one that would exist if there were no wage discrimination. It can therefore be thought of as measuring *overpayment* to Pakeha.

By a similar argument, the fifth and final component (e) of (1), which contains $\tilde{\beta}_j^* - \tilde{\beta}_{jm}$, captures Maori *underpayment*.

[38] The term $\tilde{\beta}_{jp}\bar{X}_{jp}$ simply estimates the mean hourly wage for Pakeha.