Changes in the Māori Income Distribution:
Evidence from the Population Census

Sylvia Dixon, David C. Maré

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Author contact details

Sylvia Dixon
Research Analyst
Motu Economic and Public Policy Research
Level 1, 93 Cuba Street
PO Box 24390
Wellington
Email: sylvia.dixon@motu.org.nz

Dave Maré
Senior Fellow
Motu Economic and Public Policy Research
Level 1, 93 Cuba Street
PO Box 24390
Wellington
Email: dave.mare@motu.org.nz

Abstract

This paper uses census data to identify the main changes in the individual-level income distribution of working-aged Māori between 1991 and 2001, and to analyse the effects of changes in the distribution of socio-demographic attributes and labour market activity patterns on the Māori income distribution. There was substantial real income growth at most points in the income distribution, and particularly at points above the 30th percentile, but a decline in real incomes at the very lowest percentiles. The socio-demographic and labour market changes considered help to explain much of the income growth that was recorded at lower-middle to upper levels of income. However, they fail to account for the increase in the proportion of people with negative, nil, or very low incomes.

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1 Introduction

This paper uses census data to examine changes in the income distribution of working-aged Māori between 1991 and 2001. It analyses the impact of changes in population characteristics, socio-economic outcomes, and labour market activity patterns on the Māori income distribution. It is a companion paper to Dixon and Maré (2004), which examines change in the Māori income distribution during the more recent period of 1997 to 2003, using an alternative data source.

The decade from 1991 to 2001 was one of substantial changes in the socio-economic status and labour market outcomes of Māori. At the start of the decade, the New Zealand economy had experienced several years of recession and the employment rates of Māori were at a long-term low. However, employment growth resumed in 1993 and continued steadily through to the end of the decade, raising the aggregate employment rate of working-aged Māori by more than 13 percentage points. Also in this decade, growing numbers of Māori acquired tertiary qualifications and an increasing proportion moved into more highly skilled occupations at managerial or professional level. The changes in educational attainment and employment patterns were of a magnitude that could be expected to lead to significant changes in the distribution of incomes.

To date, research on the incomes of Māori has focused almost entirely on changes in average Māori incomes or on the Māori/non-Māori income gap (for example, Maani 2000 and Maani 2002).[1] However, national averages have the potential to conceal important differences in outcomes between individuals or groups. By examining the income distribution, it is possible to see whether the real income gains experienced by the Māori population in the last 10–15 years were shared by all Māori or were concentrated at particular income levels.

The Māori income distribution was recently analysed in Dixon and Maré (2004), which examined changes between 1997 and 2003 using data sourced from Statistics New Zealand's Income Survey on individuals' weekly incomes.

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[1] See Dixon and Maré (2004) for a review of related research.

That study identified some significant changes in the distribution of income among working-aged Māori, including a decline in the proportion of Māori with zero or very low weekly incomes, an increase in the proportion with incomes in the lower-middle to upper-middle range, and a reduction in the dispersion (inequality) of the income distribution. An analysis of the drivers of change between 1997 and 2003 indicated that the rising rate of employment among Māori was likely to have been the single most important source of change, affecting all parts of the income distribution. Changes in educational levels and occupational patterns were likely to have played a significant but smaller role, contributing mainly to changes in the middle to upper regions of the income distribution.

The analysis reported in Dixon and Maré (2004) was limited in scope by the properties of the data set used, the Income Survey. The purpose of the current paper is to revisit the original research questions. In this paper we consider changes over a longer time period. We use the 'full population coverage' feature of the census to analyse income distribution changes for groups such as males, females and employed Māori, as well as the total working-aged population.

The population of study in this paper is Māori adults who were aged 20–59 years at the time of the census. This age range covers the age groups in which the majority of members (more than half) are actively participating in the labour market. The choice of this study population reflects the authors' interest in understanding the effects of labour market change.

'Māori' is defined here to include all those who specified 'Māori' in the census as one of their ethnic identities, alone or in combination with other ethnic groups. This is the most inclusive and frequently used definition of 'Māori'.[2] Consistency issues arise when considering changes for the Māori population over time, because there has been an increase since 1991 in the proportion of New Zealanders who list multiple ethnic identities when completing the census form (Callister and Blakely, 2004, p. 9). This change in (reported) affiliation patterns has expanded the size of the total Māori population, and may have changed its average characteristics to some degree. There is no single satisfactory

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[2] It matches the ethnic category 'Māori' at the highest (1-digit) level of the official classification.

response to the ethnic consistency issue. However, as a check on the main findings of this paper, we provide some supplementary information on Māori income distribution changes using an alternative definition of 'Māori'—people who listed Māori as their sole ethnic identity.

The structure of the paper is as follows. Section 2 describes the data source (the Population Census) and discusses a number of measurement and data quality issues. Section 3 outlines some of the main changes that occurred between 1991 and 2001 in the demographic and socio-economic profile of working-aged Māori. Section 4 describes the main changes in the income levels and income distribution of this population. Section 5 analyses the impact of a variety of different sets of factors on the Māori income distribution, including demographic changes, educational changes, and changing labour market activity patterns. Section 6 summarises the findings of the paper and concludes.

We estimate that the average annual income of working-aged Māori increased by 17.6%, in real terms, over the decade. The distribution of incomes became markedly less 'peaked' during the decade. Overall, working-aged Māori became much less likely to have incomes between $6,000 and $20,000 a year, and more likely to have incomes between $20,000 and $70,000 a year. However, there was also a small increase in the prevalence of negative, nil, or very low annual incomes. The net effect of these changes on dispersion measures was to raise inequality.

Our analysis of the effects of demographic changes, rising educational attainment, rising employment rates and improvements in other labour market outcomes suggests that most of those factors would have helped to redistribute lower-income Māori towards incomes of $20,000 and above. Of the change factors considered in this paper, the large increase in employment rate of Māori was probably the single most powerful source of change. Taken together, the various sources of income change considered in this paper are able to account for more than half of the income distribution shifts that are actually recorded.

2 Data and measurement issues

2.1 Population definitions and sample sizes

This study uses data that were collected in the 1991, 1996, and 2001 Population Censuses. Each census collects information on personal characteristics (such as age, qualifications, and family relationships), labour force activity during the preceding week (including whether employed, hours worked in main job and all jobs, industry and occupation of the main job), and total income from all sources received during the past financial year.

The records of all Māori who completed an individual census form were used in the analysis. The records of a sample of New Zealand Europeans were also used at some points in the research to obtain comparative results and check on data quality issues. The 'European' ethnic group includes all those who specified that they were 'Pākehā', 'European', or any specific European ethnic group, but did not affiliate with any non-European ethnic group. It includes Europeans born both in New Zealand and overseas.[3] A simple random 10% sample of all Europeans in each census was taken for use in the project.

Table 1 gives information on the number of records of each ethnic group used in the analysis, by year and gender. The total population of Māori in 1991 contained around 203,000 people who were aged 20–59 years. By 2001, this figure had increased to 251,000 (a 24% increase in population size). Table 1 also gives figures on the numbers who listed Māori as their sole ethnic group, and the number who listed at least one other ethnic group. The 'Māori only' subgroup declined by 12% between 1991 and 1996, but increased again by 8% in the next inter-censual period. The 'multiple ethnicity' subgroup expanded over the decade, both in absolute size and relative to the 'Māori only' group.

The 10% sample of Europeans used in this study provided the records of about 143,000 persons in each year.

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[3] This corresponds to the ethnic category 'European' at the highest (1-digit) level of the official classification.

2.2   Concepts and measurement consistency

There are a number of important points to note about the quality of the census measures of ethnicity, income, and other personal characteristics.

Ideally, concepts like ethnicity, labour force status, and income would be measured in a consistent manner from census to census. In practice, this was not always the case during the 1990s.

A change was made to the wording of the question on ethnicity between 1991 and 1996. That change is believed to have increased the proportion of people who listed Māori as one of their ethnic identities (Statistics New Zealand, 2004, p. 22). In 2001, the 1991 version of the question was reinstated. As a result, the population classified as 'Māori' can be more consistently compared across the 1991 and 2001 censuses than from 1996 to the other years. While we report results for 1996 in this paper, the prime focus is on explaining income distribution changes between 1991 and 2001.

Although the approach taken to measuring ethnicity was similar in the 1991 and 2001 censuses, changes in ethnic affiliation patterns during the decade helped to bring about a substantial increase in the total Māori population by 2001. This raises some other consistency issues that are discussed later in the paper and in Appendix A.

Most of the other variables used in this study were measured in a reasonably consistent manner in 1991, 1996, and 2001, or can be modified so as to achieve consistency. However, there are some special issues to consider in relation to post-school qualifications and incomes.

In 1996 the questions on post-school qualifications were substantially revised to reflect changes in the official National Qualifications Framework. The categories used in 1991 to classify qualifications below degree level (ie diplomas and certificates) did not clearly distinguish qualifications at different levels of skill. These categories were replaced by the ranking system based on skill level that is embodied in the new qualifications framework. As a result of that fundamental change in measurement approach, all sub-degree post-school

qualifications must be aggregated into a single category when educational data are analysed across the 1991–1996 divide.

The census income question is designed to measure individuals' total gross annual income during the past year. The reference period for measuring income differs therefore from the reference period for the labour force activity questions, which refer to the week before census night. The difference in reference periods is likely to weaken the empirical relationship between income and some of its key predictor variables. For example, someone who worked for most of the year and obtained most of their annual income from wages may have been unemployed in the census reference week. In that case they would not be selected into our sample of 'employed' when we consider the incomes of the employed separately from the incomes of all Māori. Employment in the reference week can be used as an indicator of individuals' typical employment patterns during the past year, but it is an imperfect indicator.

The income question has a tick box format and asks respondents to record the income *range* that they fall within, not their exact income in dollars. Income is therefore measured as an interval variable not a continuous one. This means that detailed changes in the distribution of income will not necessarily be reflected in the census income measure. Only changes that alter the number of people falling into each income range will be recorded.

The level of detail recorded depends on the width of the income bands specified in the census question. Those bands are fairly narrow at low income levels but are increasingly broad at incomes of $50,000 and above. In 1991, less than 2% of working-aged Māori had nominal incomes of $50,000 or above. By 2001, however, this had risen to 6%.

In this study, area-based variables were derived using 2001 geographical boundaries. The rural/urban residence variable was defined as follows:

Main urban	Urban areas that make up the Auckland, Hamilton, Wellington, Christchurch, and Dunedin metropolitan areas.
Minor urban	All other areas that are classified as 'major urban' in the official classification. This includes most provincial cities, e.g. Whangarei, Te Awamutu, and Gisborne.
Small town	Areas classified as 'secondary urban' or 'minor urban' in the official classification. Examples of such areas are Tokoroa, Taupo, Whakatane, Dargaville, and Greytown.
Rural	Areas classified as 'rural' in the official classification.

The parental and family status variables were defined as follows:

Dependent child	A child who was aged under 18 years and was not in full-time employment. This is the official Statistics New Zealand definition.
Joint parents	Adults who were living with their spouse or de facto partner, who had one or more dependent children living with them.
Sole parents	Adults who were not living with a spouse or de facto partner, who had one or more dependent children living with them.
Adults without dependent children	Adults who did not have dependent children at home (based on the information that was available on family circumstances).
Family circumstances unknown	People whose family arrangements could not be identified because they were away from their home on census night. (The census is not designed to record the family circumstances of each individual respondent and relies on the combination of responses from all household members to derive family variables.)

The standard occupational classification (NZSCO) was revised several times during the 1990s. However, the revisions were fairly minor and they do not have much impact on occupational distributions when aggregated to 1-digit or 2-digit level. In this study, occupational groups that changed location between 1991 and 2001 were recoded to the 1-digit or 2-digit categories used in 2001.

2.3   Non-response and imputation

Levels of item non-response are high for many census variables. A substantial minority of people either do not respond to all questions in the census, or provide answers that cannot be deciphered and classified. Table 2 gives information on the percentages of working-aged Māori and Europeans who did not supply valid information for each of the main variables used in this study.

Age, sex, and labour force status were imputed by Statistics New Zealand in all three censuses if they were missing. Unfortunately, imputation flags were not created in 1991, which means it is not possible to identify which responses were imputed in that year. Imputation rates for 1996 and 2001 are shown in the table, however. Age was imputed for about 1% of the Māori population in both years. Labour force status was imputed, in part or in full, for more than 8% of Māori in both 1996 and 2001. However, the imputation rate for the 'employed' variable that is used in this study is likely to have been lower than 8%. This is because 'labour force status' is a composite variable based on a series of questions, and the first question on paid employment typically obtains a better response rate than the follow-up questions that are used to distinguish the unemployed from the inactive.

The 'hours of work' variable was imputed in 1991 if missing, but not in 1996 and 2001. Table 2 shows item non-response rates for hours worked, highest school qualification, highest post-school qualification, occupation, and income. These rates range from about 1.3% for occupation in 1991 (the non-response rate among Māori women) through to 14.7% for post-school qualification in 2001 (the non-response rate for Māori men).

Item non-response appears to be much higher in 1996 and 2001 than in 1991. This is partly due to the fact that a considerable amount of editing was undertaken by Statistics New Zealand in 1991, with the aim of generating usable and internally consistent responses. In 1996 and 2001, in contrast, editing was more limited in scope and the set of variables that were imputed was smaller.

Even taking into account a significant change in editing methods, it seems likely that there has been a trend towards poorer responses on questions such as qualifications and income. For example, in 2001, 7% of employed Māori males did not give their hours of work, up from 5% in 1996. In 2001, 15% of Māori males did not give enough information on their post-school qualifications (or lack of them) for their educational level to be fully determined, up from 5% in 1991. Item non-response rates were significantly higher for Māori than for European respondents, as can be seen from a comparison of Tables 2 and 3.

Roughly 7% of working-aged Māori did not specify their income in 1991, and this proportion rose to 10% in 2001. It is interesting to note that while Māori women have higher response rates in general than do Māori men, they were *less* likely to specify their incomes. This suggests that people who did not earn any income during the reference year may have been more likely to ignore the question, seeing it as irrelevant to them, than those who did earn some income.

Non-response is not randomly distributed. An analysis of the characteristics of working-aged Māori who did not report their incomes in 1991, 1996, and 2001 indicated that non-respondents were very likely to have had lower incomes, on average, than respondents. This reflects the fact that non-respondents were also more likely than respondents to be unemployed or not in the labour force, female, young, without formal educational qualifications, and living in a non-private dwelling.

In Appendix B, the income distribution of non-respondents is estimated, using the available information on non-respondents' characteristics and labour market activity patterns, and compared with the income distribution of respondents. We find that given the typical profile of non-respondents, the increase in the rate of non-response to the income question between 1991 and 2001 is likely to have taken additional people out of the lower end of the 'observed' income distribution. The implications for this study's central estimates of real income growth and dispersion are discussed in Appendix B and in Section 4.3 below.

3 Changing socio-demographic attributes and patterns of labour market activity

We begin by outlining some of the key changes in Māori population characteristics and patterns of economic activity that took place between 1991 and 2001 and that were recorded in the census. This information is presented first to provide a context for understanding the data on income distribution changes.

Data on the demographic profile of working-aged Māori are summarised in Table 3. One of the most striking changes is in the female-to-male ratio, which rose from 1.07 in 1991 to 1.12 in 2001. During the same period, the

female-to-male ratio also increased among working-aged Europeans but by less—from 1.01 to 1.04. People who listed Māori as one of two or more ethnic groups were the source of the shift in the Māori gender ratio, for there was no change in the sex ratio among people who identified themselves solely as Māori.[4]

The reasons for the 'feminisation' of the European and Māori populations are not well understood at present. They may be an outcome of gender differences in international migration patterns. Gender differences in ethnic affiliation patterns could also be playing some role, by influencing the numbers of men and women who are classified as Māori under the current statistical conventions for ethnic classification. More women than men could end up being classified as Māori if women of mixed ethnic heritage are more likely than men of mixed heritage to list all their possible affiliations.

The implications of the change in the sex ratio for income statistics are more obvious. Given the substantial gender gap in average annual incomes, one would expect the 'feminisation' of the total Māori population to reduce measured income growth, all other things being equal.

Between 1991 and 2001 the working-aged Māori population became older, by 1.7 years on average. Prime-aged adults became more numerous, while the younger age cohorts declined in relative size. Labour force experience typically rises with age, and therefore population ageing has the potential to raise average incomes.

The proportion of working-aged Māori who were parents with dependent children living at home declined from nearly 50% to 46% over the decade, reflecting the long-term decline in childbirth rates. Note that the census does not gather information on the family arrangements of people who were away from home on census night, so we focus here on the downward trend in rates of parenthood rather than the exact numbers. A decline in the number of dependent children might be expected to help raise the employment rates of women of childbearing age, leading to higher annual incomes. Smaller family sizes could

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[4] This can be seen from the population data in Table 1.

also raise incomes by facilitating increases in the paid hours worked by Māori women.

The data on Māori residential patterns reveal a small shift in the location of the population towards the major urban areas (defined here as the territorial authority areas of Auckland, Hamilton, Wellington, Christchurch, and Dunedin), where average hourly earnings tend to be higher (Kalb and Scutella, 2003).

The proportion of working-aged Māori with school qualifications at upper school level (sixth form or above) rose by almost 10 percentage points between 1991 and 2001. The proportion holding a post-school qualification also expanded, but due to a very large increase in the rate of non-response to this question it is difficult to determine the overall size of the shift. At higher educational levels, the percentage of Māori with a degree rose from 2% to 5%.

Data on the employment rates of Māori in the reference week before the census are given in Table 4. The aggregate employment rate for all working-aged Māori increased by more than 13 percentage points between 1991 and 2001. The full-time employment rate also rose substantially, by 8 percentage points. The larger part of these increases occurred between 1991 and 1996. Employment growth was slower between the 1996 and 2001 censuses.

Data on the occupations and hours of the employed are given in Table 5. The occupational profile of Māori in employment was transformed by a large decline in the proportion working in manual occupations, and increases in the relative shares of managerial, professional, technical, and service and sales workers. Average weekly hours calculated over all persons in employment also declined slightly over the decade, by 1.2 hours. That decline may have been a consequence of part-time employment expanding more rapidly than full-time employment, altering the compositional mix.

The rise in Māori employment rates was also accompanied by a significant decline in the proportion of Māori who reported income from a government benefit as one of their annual income sources, from nearly 50% in 1991 to 43% in 2001.

To summarise, most of the changes that occurred between 1991 and 2001 in the demographic attributes, skills, and labour market activity patterns of Māori would be expected to raise incomes. The increase in the female-to-male ratio is the major exception to this pattern, as it is more likely to have lowered average incomes. The net effect of the decline in the proportion of Māori with benefit income is also unclear, as it would depend on the specific causes of the benefit income reduction.

Table 6 gives a gender breakdown of the socio-demographic profile of working-aged Māori. Similar rates of population ageing were recorded for Māori men and women. Rates of sole parenthood (as measured in the census) did not alter much over the decade, either for men or for women. The decline in the proportion of adults with dependent children reduced the parenting rates of both genders, as would be expected. The male population recorded slightly more urbanisation than did the female population. The educational attainment levels of Māori women rose more rapidly than those of Māori men, suggesting the potential for faster real income growth among women than men. Māori women maintained their lead over Māori men in terms of the proportion employed in managerial, professional, and technical occupations, although the data suggest that the rate of movement into those higher skilled occupations may have been slightly faster among men.

Data shown in Table 4 on the employment rates of each gender reveal faster growth during the 1990s in the employment rates of Māori women. This difference would also be expected to lead to faster growth in women's annual incomes.

A comparison of the socio-economic data for Māori with parallel data for Europeans (shown in the right-hand columns of Tables 3 and 4) indicates that the key dimensions of socio-economic change affected both populations in broadly similar ways. Some differences can be detected in the precise pattern or speed of change. One notable difference is that the increase in employment levels among Māori was much larger than the comparable increase for Europeans. This difference mirrors the relatively larger decline in Māori employment rates that took place between 1986 and 1991, during the recession of the late 1980s and

early 1990s. Both the downturn and the recovery phases of that business cycle had a far greater impact on Māori employment than European employment. Chapple (1999) has looked at the reasons for this phenomenon. He attributes the Māori–European differences in the severity of employment losses during the late 1980s chiefly to the greater concentration of Māori employment in regions, industries (such as manufacturing), and occupations (such as blue-collar occupations) that experienced the greatest labour demand reductions at that time.

4   Changes in the income levels and income distribution of Māori

4.1   Average income levels

A variety of methods can be used to estimate average incomes from the interval data that are collected in the census. We adopt the relatively simple approach of imputing the average income of each income band using estimates derived from the Household Economic Survey for the years ended March 1991, 1996, and 2001.

The HES measures the gross annual incomes of people living in private households, by collecting detailed information on income received from all sources during the year and deriving a total. To get the income band midpoint estimates used in our analysis, HES sample members were grouped by census income group, and a simple arithmetic average was calculated for each group (with the exception of the upper category). These income band midpoints were derived for men and women separately.[5] Due to the small number of Māori in the HES sample, however, it was not feasible to estimate midpoints for Māori and Europeans separately, and instead Māori and Europeans were assigned the same midpoints within each band. A trimmed mean (0.5%) was used to estimate midpoints for the top census income categories ($70,000 and above in 1991, and $100,000 and above in 1996 and 2001), as a means to ensure that the midpoint value used was not excessively influenced by people with very high incomes.

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[5] The mean values for men and women do not differ significantly in practice except in the highest income band, where the male mean is higher.

The average incomes of Māori and Europeans are unlikely to be very different in the majority of income bands, which are relatively narrow. However, it is possible that significant ethnic differences do exist in the midpoints of the upper income bands, which are much wider. This is a potential source of bias in the estimation of average Māori incomes in our analysis. The impact of that bias is likely to be limited by two things: the fact that we used a trimmed mean to estimate the mid-point of the upper band, and the fact that only a very small proportion of the Māori population was located in the highest income bands. The proportion of Māori with incomes of $50,000 and above was only 2% in 1991 and 6% in 2001. The proportion in the upper band of $70,000 and above in 1991 was 0.5%. In 2001, the proportion in the upper band of $100,000 and above was 0.9%.

Average incomes estimated using this method, and reported in constant, March 2001 dollars, are summarised in Table 7. The growth rates shown indicate a 17.6% increase in the average real annual income of all working-aged Māori over the 1991–2001 decade. The average income of Māori who were employed at the time of each census was 7.2% higher in 2001 than in 1991. The average income of Māori who were *not* employed at the time of the census was just 1% higher in 2001. The fact that the income growth recorded for the total population was well above the growth experienced by both the employed and not-employed sub-populations indicates that the overall income growth rate of 17% was achieved, in part, through compositional change (the redistribution of people from the non-employed to the employed group).

Estimates of the average annual incomes of Māori men and women, and Europeans are also reported in Table 7. These estimates suggest growth of 19.8% in the real incomes of Māori women, slightly ahead of the 17.2% increase in the incomes of Māori men. The total income growth experienced by working-aged Māori over the decade period was below that experienced by working-aged Europeans, indicating a widening of ethnic income gaps.

The means shown in Table 7 include people who reported that their incomes were negative or zero.[6] Somewhat surprisingly, the proportion of Māori

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[6] Negative values of income were set to zero for the analysis.

reporting negative or zero incomes increased slightly during the 1990s, from just under 2% to just over 3%. Most of the increase among women occurred between 1991 and 1996, and most of the increase among men occurred between 1996 and 2001. The data for Europeans also show an increase in the proportion of people reporting nil or negative incomes, from 2.3% in 1991 to 3.0% in 2001. Among Europeans, the change mainly affected women.

More than 80% of Māori with negative or zero incomes in 2001 (and more than 90%in 1991), were either unemployed or not in the labour force in the census reference week. Furthermore, the probability of reporting zero or negative income appears to have risen during the 1990s mainly for people who were either unemployed or not in the labour force at the time of the census. For example, the proportion of the 'inactive' group who reported zero incomes rose from 3.9% in 1991 to nearly 8% in 2001. There was also a small rise in the incidence of negative or zero incomes among currently employed Māori males. The latter trend could possibly be explained by the rise in the self-employment rate, from 7.2% of all Māori males in 1991 to 8.8% in 2001, as the self-employed are more likely to report income losses than wage and salary earners.

One possible explanation for the rise in the proportion of working-aged people with zero annual incomes is that the trend is partly (or even largely) an administrative artefact. As noted previously, there was a significant change in the approach taken to the editing of census data between 1991 and 1996. It is possible that more intensive editing of the census data set in 1991 may have reduced the number of 'zero income' cases relative to 1996 and 2001, when less intensive editing methods were applied. This would explain the large increase in the proportion of people in this situation between 1991 and 1996. However, the fraction of Māori men with negative or zero incomes continued to rise between 1996 and 2001, suggesting other factors must also have played some role.

Another possible explanation is that the general rise in employment rates between 1991 and 2001 increased the proportion of non-employed adults who were living with a full-time employed spouse or partner, and consequently were ineligible for government income support payments. The data in Table 8 confirm the fact that non-employed adults living within families, who lived with

at least one other full-time employed person, were far more likely to report zero annual incomes than those who did not live with another full-time employed adult. This was the case in both 1991 and 2001. Furthermore the proportion of this group who reported negative or zero incomes nearly doubled between 1991 and 2001, from about 8% to about 15%.

We also find that non-employed adults who were living within families were more likely to be living with another full-time employed adult in 2001 than in 1991. This is hardly surprising, given the general rise in employment rates over the decade. These changes affected both Māori and Europeans, and the supporting data are shown in Table 9.

These data cannot confirm the hypothesis that more Māori reported zero incomes in 2001 than in 1991 because non-employed adults were less likely to be eligible for government income support in 2001. However, they are broadly consistent with that hypothesis.

4.2   The distribution of Māori incomes

We turn now to describe the main changes in the distribution of incomes among Māori. The fact that income is measured in interval format in the census makes it more difficult to observe the underlying distribution and reduces the options for using sophisticated analytical methods. We begin by simply graphing the frequency data as a means to visually identify major changes in the shape of the Māori income distribution. This is followed by a numerical analysis of the income changes that are estimated to have occurred at specific points (percentile boundaries) in the income distribution.

The income bands used in the census question have varied in width from $2,500 (at the lower end of the income distribution in 1991) to $30,000 (at the upper end). Wider bands will tend to have more people falling within them, so in the construction of histograms an adjustment should be made for the variation in band widths. We do this by scaling the relative frequencies by the total width of the band, in dollars. This makes the height of each band proportional to the frequency of persons per $1,000. We arbitrarily set the upper boundary of the open-ended top category at $120,000. Because the percentage of Māori in the top

income category is extremely small, the choice of this cut-off point makes little difference to the analysis.

To enable valid comparisons across census years, the boundaries between the bands in each year are also converted to constant (March 2001) dollars. This means that the boundaries between each income band, when graphed in constant dollars, vary somewhat from census to census. Note that this is a fairly imprecise method of adjusting for inflation, but with the information available we have no alternative. If people were uniformly distributed within each income bracket, adjusting the dollar value of the boundaries would be all that was needed to adjust for the effects of inflation. In reality, it is highly likely that people are not uniformly distributed within each bracket, and therefore inflation is likely to move some people across the boundaries of income bands, altering relative frequencies in ways that we cannot capture.

Panel A of Figure 1 shows the income distribution of all working-aged Māori in 1991, 1996, and 2001. The most immediately obvious feature of this graph is the large decline in the proportion of Māori with incomes of around $8,000–$12,000 a year. Between 1991 and 1996 the frequency of this income range fell by around one-third, although it continued to be the most populated income range. There was a further but smaller decline in the concentration of the population in this income range in 2001. The proportion of Māori with incomes in the adjacent $12,000–$18,000 range also declined over the decade.

To the left of the graph, it can be seen that the proportions of Māori with incomes at or below zero (graphed here as the -$5,000–0 interval), and with incomes in the $1–$5,000 range, increased between 1991 and 1996. That trend was partially reversed between 1996 and 2001. To the right of the central peak, the frequency distribution for 2001 is almost entirely above or to the right of the 1991 distribution, indicating increases in the density of the distribution over the income ranges of $20,000 to $70,000 a year.

The decline in the relative frequency of incomes in the range $8,000 to $12,000 a year could be partly explained by a decline in the fraction of Māori who received most of their income during the year from income support payments.

This annual income range corresponds to a weekly gross income of around $150 to $230 a week (or in 1991 dollars, $130 to $195 per week).

In Panel B, the vertical gaps between the 1991 and 1996 distributions and between the 1996 and 2001 distributions are plotted to show the regions of change more clearly. Areas lying below the horizontal axis represent reductions in the population share, while areas above it represent increases. The narrow spikes and other discontinuities in the plot lines are almost certainly due to boundary effects caused by the inflation adjustment of income ranges, and should be ignored. More informative is the overall shape of these 'change histograms'. They suggest that, during the first inter-censual period, a much greater degree of income redistribution occurred than during the second. The change consisted of a move away from the $8,000 to $15,000 range towards both higher and lower incomes. Based on the size of the areas of change, it appears that most of the redistribution between 1991 and 1996 was to higher rather than lower incomes, with the greatest population gains occurring in the $18,000–$50,000 income range. Between 1996 and 2001 there was a further redistribution of people from income levels below about $18,000 to levels above. The total change in the Māori income distribution over the entire decade from 1991 to 2001 is shown in the third panel of Figure 1.

Figure 2 presents comparative data for Europeans. The European distribution was much more dispersed in 1991 (indicated by the fact that there is less of a central peak), and it shows less change in shape over the decade. While the proportion of Europeans with zero or negative incomes increased slightly, the proportion in the $1–$5,000 range clearly declined. The density of the income distribution appears to have declined over all of the $1 to $30,000 a year income range, while increasing at incomes above $30,000.

Returning to the Māori population, Figures 3 and 4 show the changes in income distributions of Māori men and women respectively. Both distributions feature reductions in the height of the frequency 'peak' centred around $10,000 a year; increases in the proportion of people at negative, zero, and very low incomes; and increases in the share of the population at higher income levels (above $30,000 for men and above $20,000 for women).

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The income distribution of employed Māori is of some interest because it is likely to be less influenced by changes in labour force participation or employment rates, and more strongly influenced by changes in employment patterns and/or the wage structure. Changes in the income distribution of employed Māori are shown in Figure 5. Even in this sub-population, there is evidence of a rise in the proportion of people with incomes below $10,000 a year between 1991 and 1996. The changes between 1996 and 2001, however, follow the expected pattern of redistribution from income levels below the average (around $27,000 in 1996) to income levels above the average.

As a way of quantifying the changes, we also estimate the position of every 5th percentile in the income distribution using the simple method of straight-line interpolation. The dollar value of each income percentile that lies between two income boundaries, *a* and *b*, is interpolated using the relative distances between the cumulative percentage of people at that point and the cumulative percentages of people located at *a* and *b*. While percentiles estimated in this manner do not capture the true shape of the income distribution, by analysing inter-censual changes in the position of each percentile, it is possible to roughly identify changes in the overall extent of dispersion.

Tables 10 to 13 give the estimated income percentiles and the inter-censual growth rates for all working-aged Māori, males, females, and employed Māori. Considering all Māori first, there is evidence of rising dispersion of incomes between 1991 and 1996. The position of the 5th to 25th percentiles declined while percentiles above the 25th show real income growth. That growth was reasonably evenly distributed across the upper half of the income distribution. Between 1996 and 2001 there was real income growth at all points in the distribution, with the exception of the very lowest percentiles. That growth was not sufficient to reverse the real income declines registered by the lowest percentiles in the first half of the 1990s.

The patterns for men and women are essentially similar, although over the decade as a whole there was more income growth in the upper half of the Māori women's income distribution than in the upper half of the distribution for Māori men.

Percentile estimates for the sub-population of Māori who were employed at the time of the census also show an increasing concentration on nil or very low incomes between 1991 and 1996, followed by a reversal of this trend between 1996 and 2001. These figures (which are less influenced by the number of zero income earners than are the figures for all Māori) show more substantial income gains between 1996 and 2001 than during the first half of the decade.

Summary measures of income inequality can be estimated using interval data if a midpoint value is assigned to each income band. For this exercise, we used the HES-derived means discussed earlier. Two popular inequality measures are the Gini coefficient and the standard deviation of log incomes. These measures, for all working-aged Māori and for males and females separately, are reported in Table 14. Comparative data for Europeans are also given in the right-hand side of Table 15.

The summary measures of inequality confirm the increase in dispersion that is suggested by the graphs. All of the inequality measures for Māori incomes rose between 1991 and 2001. European income inequality also appears to have increased (the Gini coefficient estimates indicate this was the case, although the other measure does not show such a clear pattern). As a cautionary note, recall that most of the increase in Māori income inequality occurred between 1991 and 1996, coinciding with what may have been some significant changes in Statistics New Zealand's approach to editing census income data. There is some risk that the trends reported here were biased by those changes, or by the estimation method adopted to identify the midpoint of each income band.[7]

Summarising these results, the 1991–1996 period was marked by large increases in both full-time and part-time employment rates, accompanied by widening dispersion of incomes. The income distribution graphs indicate that in 1991, the most common income level for an individual Māori of working age was $8,000–$12,000, but this income level had become markedly less common by 1996. The population was redistributed towards higher income levels, and to a

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[7] Inequality measures derived from banded income data are unlikely to be as reliable in pin-pointing small changes in dispersion as are inequality measures calculated using the actual, individual-level income distribution.

lesser extent towards income levels below about $5,000 a year. One obvious explanation for this pattern of change is that many Māori were no longer receiving a full-year income support benefit. Both full-year employment and part-year employment (possibly combined with part-year benefit receipt) were likely to have become more common, raising the proportion of Māori earning higher incomes.

The pattern of employment changes between each census suggests that movement from unemployment or inactivity into employment was a less important source of income growth between 1996 and 2001 than in the first inter-censual period. However, employed Māori experienced greater real income growth in this period than in the previous 5 years. Despite some small increases in the proportion of Māori with negative or zero incomes, the pattern of change in the income distribution in this period was chiefly one of redistribution from low annual incomes (below about $18,000) to higher incomes. The total annual income distribution continued to become more dispersed, but at a much slower rate.

4.3   Robustness of the findings

Given data quality limitations, there are some good reasons to be cautious about the results presented so far. In this section the impact of three particular data quality issues is considered in more detail. These are inconsistencies through time in the definition of 'Māori', rising non-response to the income question, and the possible impact of changes in pre-release data editing practices.

4.3.1   Ethnic group reporting patterns

Because of changes in ethnic response patterns between 1991 and 2001, the set of people who can be classified as 'Māori' within the census data sets was not a fixed population. In fact, the population figures given in this paper (Table 1) show a rapid expansion in the total population of Māori—defined as anyone who listed 'Māori' as one of their ethnic groups—during the 1990s. Almost all of that growth was in the number of people who defined themselves as Māori in combination with another ethnic group (mostly European). Those population

figures suggest there is considerable scope for 'boundary changes' to have influenced this paper's results on the Māori income distribution. They raise the possibility that some of the improvement that was recorded in the socio-economic status and incomes of the working-aged Māori population could have been due simply to compositional changes, flowing from population boundary changes.

One way to check the sensitivity of our results to the ethnic definition chosen is to compare them with the results that are obtained if we use an alternative definition of 'Māori', selecting for study only those who listed Māori as their one and only ethnic group. An analysis along these lines is presented in Appendix A. The purpose of the comparison is simply to identify whether the choice of definition substantially influences the results obtained, and not to suggest that the alternative definition of the Māori ethnic group is a preferable one. Adopting the alternative definition would not solve the problem of inconsistencies through time in group boundaries.

The results in Appendix A indicate that the average real income growth experienced by 'sole Māori' during the decade of study was less than the income growth experienced by the total Māori population—14% compared with 17%. Income distribution graphs indicate that the sole Māori sub-population lagged behind the wider Māori population in the income gains of the decade. Sole Māori were over-represented in the redistribution of individuals towards the zero and very low incomes ranges, and under-represented in the redistribution towards incomes of $30,000 a year and above.

The results in Appendix A add weight to the suspicion that the results reported in this paper may be overestimating the total income growth that would have been recorded for Māori, if it were possible to fix the boundaries around the Māori population in a consistent manner over time. Despite this important caveat, it is also worth recalling that there is a considerable degree of similarity in the socio-economic profiles and income levels of these two differently defined (but overlapping) populations. While the numerical results of this paper would change if a more stable definition of Māori could be adopted, it is likely that qualitatively similar conclusions would be reached on the direction of change in incomes, the

processes of change, and the overall impact on the shape of the income distribution.

4.3.2 Non-response rates

The results reported in the paper could also be affected by other changes in response patterns. We have noted that there was a significant increase during the 1990s in the level of non-response to the income question, from 7% of working-aged Māori to 10%. Rising rates of non-response have the potential to bias estimates of income growth and income dispersion because non-response is typically not randomly distributed.

In Appendix B, we examine the characteristics of non-respondents and estimate their income distribution, using coefficients obtained from a regression of socio-economic characteristics and labour market activity patterns on income for respondents. Using our predicted income distribution for non-respondents and the actual data for respondents, we estimate the total real income growth that would have been observed for working-aged Māori between 1991 and 2001 if there had been complete response to the income question.

Those estimates suggest that the 'true' average real income growth of working-aged Māori may have been around 1.5 percentage points lower than reported in the main section of this paper (16.0% between 1991 and 2001, not 17.6%). However, inequality trends are not so significantly affected. Our estimates suggest that the 'true' increase in the dispersion of working-aged Māori incomes, as measured by the Gini coefficient, is likely to have been fairly similar to the increase reported earlier in this paper.

The validity of these results obviously depends on the validity of the estimation method for non-respondent incomes. In Appendix B we show that the choice of a method to 'impute' the incomes of non-respondents can potentially have quite a large impact on summary statistics of trends in income levels and income dispersion for Māori. This finding underlines the importance of interpreting trend results obtained from census incomes data with particular caution, given the high levels of non-response that are a feature of the census.

4.3.3 Editing procedures

Census data editing procedures changed during the 1990s. In 1991, an extensive amount of editing was undertaken within Statistics New Zealand to reduce item non-response, where possible, and to reduce inconsistencies between different items of data supplied by the same individual. A decision was taken in the mid 1990s, however, to reduce the editing of census variables that were not considered to be core variables. This led to a lower level of editing of some variables such as income. It is possible that this change in methods could have contributed to some of the features of change in the Māori income distribution, such as the large increase between 1991 and 1996 in the percentage of Māori with incomes of zero, below zero, or below $5,000 a year.

As a way of checking on this hypothesis, we obtained comparable data on the distribution of individuals' annual incomes in the March-end years 1991, 1996, and 2001 from the HES. The HES is a Statistics New Zealand survey of people living in private households, which gathers detailed data on income from all sources during the last financial year. Because the target population for the HES is not the same as that of the census, the reference period is not exactly the same, and there are a number of other measurement differences, a comparison on the two sources requires caution.

Two sets of results are presented in Table 15. On the right, we show the proportion of Europeans who reported negative or zero incomes, incomes of $1–$5,000 in 2001 values, and incomes above $5,000, in 1991, 1996, and 2001. On the left, we show the proportion of Māori who reported each of these income levels in 1990–1992 and 1995–1997. Data from three adjacent HES years was used to calculate the figures for Māori, because of the small number of Māori in the samples of each annual HES.

Like the census data, the HES data show increases during the 1990s in the proportion of respondents—both Māori and Europeans—reporting negative or nil incomes. Unlike the census, however, the HES data indicate a decline between the start of the decade and the mid 1990s in the proportion of Māori whose incomes were in the $1,000–$5,000 range.

Although the HES results differ from those derived from the census, they are *not* different enough overall to give strong support to our hypothesis that the census data are sending misleading signals about the nature of the changes at the lower end of the Māori income distribution. We conclude that there is no reason to reject the view that the Māori annual income distribution became more unequal between 1991 and 1996, in part because of an increase in the proportion of people with negative, nil, or very low incomes.

5 Factors contributing to the income distribution changes

Changes in the income distribution of a given population (in this case, working-aged Māori), can be viewed as the product of several sets of factors.

- Changes in the level or distribution of individual attributes that are related to income, such as age, residential patterns, family size, and educational attainment. These individual attributes may be correlated with income because they are differently rewarded in the labour market,[8] because they are correlated with differences in labour supply behaviour; or because they are linked to differences in entitlements to government income support.

- Changes in levels and patterns of labour market activity, such as the employment rate or the number of hours worked.

- Changes in the wage structure (representing the level and distribution of rewards that can be earned in the labour market for different skills and attributes).

- Changes in the level or distribution of unearned income, such as income support payments from the government.

This section of the paper analyses the effects of changes in socio-demographic characteristics, educational levels, employment rates, and job

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[8] Or correlated with other unmeasured attributes that are differentially rewarded in the labour market.

characteristics on the Māori income distribution. The choice of factors to consider as potential causes of change was influenced by past research findings on the determinants of Māori incomes (for example, Maani 2000 and Maani 2002). It was also limited by the set of factors that are measured in the census.

We use an analytical method that was introduced by DiNardo et al (1996). Briefly described, the following approach is taken. To estimate the effect of the change in a particular population characteristic, such as the educational attainment of Māori, the base period (1991) sample of Māori is reweighted so that the distribution of qualifications in that sample matches the distribution that existed by the end of the study period (2001). The income frequency distribution associated with this counterfactual (reweighted for education) is then obtained and compared with the actual start- and end-period income distributions. The goal is to estimate the amount and pattern of change in the distribution of income that could potentially be explained by the change in levels of educational attainment. The counterfactual is an attempt to answer the basic question: 'what would the income density be in 1991 if educational attainment had attained its 2001 levels?'

More specifically, in the DiNardo et al approach, each observation is viewed as a vector (y_i, x_i, t_i) consisting of an income y, a vector of characteristics x and a date t, and belongs to a joint distribution $F(y,x,t)$ of incomes, characteristics, and dates. The density of incomes at a particular point in time $f_t(y)$ can be written as the integral of the density of income conditional on a set of individual characteristics and a date t_j, over the distribution of individual characteristics $F(x/t_x)$ at date t_x:

$$f_t(y) = \int f(y \mid x, t_j = t) dF(x \mid t_x = t)$$

$$\equiv f(y; t_j = t, t_x = t)$$

This notation allows us to express equations for counterfactual densities, with t_i denoting the date from which the function mapping characteristics to incomes is drawn, and t_x denoting the date from which the distribution of characteristics is drawn. For example, while $f(y; t_j=91, t_x=91)$ represents the actual density of incomes in 1991, $f(y; t_j=91, t_x=01)$ represents the

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density that would have resulted in 1991 if characteristics were as observed in 2001. This hypothetical density can be identified as follows:

$$f(y;\ t_y{=}91,\ t_x{=}01) = \int f(y/x,t_y{=}91)dF(x/t_x{=}01)$$

$$= \int f(y/x,t_y{=}91)\psi_x(x)dF(x/t_x{=}91)$$

where $\psi(x)$ is a reweighting function:

$$\psi_x(x) = dF(x/t_x{=}01)/\ dF(x/t_x{=}91).$$

The counterfactual income density is identical to the 1991 density except for the reweighting function, so once an estimate of $\psi_x(x)$ is obtained, the counterfactual income density can be analysed using the 1991 observations, the weights, and any income distribution summary measures that are appropriate (such as kernel densities or percentiles). Essentially, each individual in the 1997/98 is reweighted so as to give the same distribution of characteristics as in the 2002/03 sample.

Applying Bayes' rule to the ratio $dF(x/t_x{=}01)/\ dF(x/t_x{=}91)$ gives the following reweighting function:

$$\psi_{xi}(x) = \ \cdot\frac{\Pr_i(t_x=01\,|\,x)}{\Pr_i(t_x=91\,|\,x)}\cdot\frac{\Pr_i(t_x=91)}{\Pr_i(t_x=01)}$$

where $\Pr_i(t_x{=}01|x)$ is the conditional probability that an individual with attributes x is observed in 2001 and $\Pr_i(t_x{=}01)$ is the unconditional probability of being observed in that year. To obtain estimates of the reweighting function, for each individual i, we pool the individuals in the two periods and estimate the probability that individual i is observed in 2001, given attributes x, using a logit model for the binary dependent variable t. We then use the estimates from this model to predict, for each individual observed in 1991, the relative probability that they would be observed in 2001 versus 1991 (the first term of the equation above) and adjust this by the sample proportions, $(\Pr_i(t{=}91)/\Pr_i(t{=}01)$. Intuitively, this reweighting scheme puts more weight on households with attributes that are more likely to occur in 2001 and less likely to occur in 1991.

Because the census income variable is an interval variable, we use the counterfactual weights simply to estimate a series of alternative income band frequency distributions. The following 'explanatory' variables were used in our analysis of the effects of changes in demographic, skill, and labour market attributes between 1991 and 2001: age structure; gender composition; parental status; urbanisation; educational attainment (using information on both highest school and highest post-school attainment); whether received benefit income in the last financial year; current labour force status (whether full-time employed, part-time employed, unemployed, or not in the labour force); current weekly hours of employment; and current occupation classified at 2-digit level. Parental status is defined as one of five categories: joint parents, sole parents, childless couples, single adults, and unknown. Urbanisation is a four-category classification comprising main urban, secondary urban, provincial, and rural localities

Panel A of Figure 6 shows the counterfactual income distribution that is obtained if we reweight the 1991 population of working-aged Māori so that the distribution of all of the above attributes matches the distribution actually recorded in 2001. This counterfactual is labelled the 'full model' and is compared with the actual 1991 and 2001 income distributions. The counterfactual distribution lies below the 1991 distribution over income levels below around $18,000 a year and (typically) lies above it for income levels above that sum. This indicates that the changes in population attributes that are included in the counterfactual model would be expected to lead to an overall redistribution of the population towards higher income levels.

Figure 6 also plots the *change* in the density of the income distribution that could be expected on the basis of the attribute changes included in the counterfactual model, alongside the actual change recorded between 1991 and 2001 (panel B). It can be seen that the counterfactual income distribution 'predicts' about half of the actual decline in the density of the income distribution between $6,000 and $18,000 a year, and a reasonably large proportion of the actual increase in density at income levels above $18,000. It also predicts a decline in the proportion of working-aged Māori with incomes below around

$6,000 a year, which is at variance with the increases that were actually recorded in that region of the income distribution.

To explore the potential effects of different types of demographic and labour market change in more detail, we also constructed counterfactual income distributions using subsets of the variables included in the full model.

We constructed a 'demographic change' counterfactual using measures of change in the age structure, gender composition, parental status characteristics, and residential patterns of Māori. An 'educational change' counterfactual was constructed using the school and post-school qualification variables. These counterfactual income distributions are illustrated in Figure 7. They suggest that both the demographic changes of this period and the rise in Māori educational attainment had significant, but minor, effects on the income distribution. The overall effect of rising educational attainment is to reduce the proportion of people with incomes in the region of $6,000 to $23,000 a year, and raise the proportion with incomes of around $23,000 and above. The educational counterfactual has no real impact on densities at the very bottom end of the income distribution. The demographic change counterfactual also redistributes individuals from the lower income range ($6,000 to $18,000) to incomes above $20,000 a year. However, it also predicts a small rise in the density of the income distribution at incomes below $6,000. This may be a consequence of the increase in the proportion of women within the Māori population, a factor that is included within the demographic change model (but is possibly offset by other factors in the full multivariate model).

Three further counterfactuals are illustrated in Figure 8. A 'labour force status' counterfactual isolates the effect of the growth in the employment rate of Māori. Based on previous research findings, we would expect movements in employment rates to have relatively large impacts on the income distribution of the working-aged population. In practice, the rise in employment rates appears to have a much larger impact on the income distribution than demographic change or rising educational attainment. The overall effect is to move people from incomes below $18,000, and particularly from incomes of around $5000 to $12,000, to incomes above $18,000.

We also constructed a 'labour market activity' counterfactual that includes the effect of changes in hours worked and changes in occupational employment mix, as well as the employment rate shifts. The combined effect of those changes in labour market outcomes is somewhat larger than the effect of rising employment rates alone.

Finally, we constructed a 'benefit receipt' counterfactual that models the effect of the reduction in the proportion of Māori receiving income support payments (this includes income received at any time during the past year). Because the receipt of income support is quite strongly correlated with being out of employment, we would expect some similarity in the effects of the labour force status and benefit receipt counterfactuals. In practice, the benefit receipt counterfactual also predicts a redistribution of the population away from the $8,000 to $20,000 income range towards higher incomes,[9] but the effect is of smaller magnitude. Like the demographic counterfactual, the benefit receipt counterfactual also predicts a significant increase in the density of the very bottom end of the income distribution. This reflects the fact that Māori who did not report income support payments in 1991 had a more bipolar distribution of income than Māori who reported income support payments.

Numerical summary measures of the explanatory power of each counterfactual are given in Table 16. To quantify explanatory power, we tabulated the predicted change in population frequencies at each $1000 point in the income distribution under each of the counterfactual scenarios. We compared them with the actual change in population frequencies at each of the points. We used data for 125 income points, from -$4,000 through to $120,000. The final, right-hand column of Table 15 shows the correlation coefficients between each array of actual and predicted density changes. In the body of the table, the correlations between each of the counterfactuals are shown.

As would be expected, the 'benefit receipt', 'labour market activity', and 'full model' counterfactuals show the highest degree of correlation with the

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[9] This reflects the fact that Māori who did not report any benefit income in 1991 were more likely to be employed, and therefore to have higher incomes.

actual distribution changes, with correlation coefficients of 0.833, 0.805, and 0.810 respectively. The fact that the 'benefit' counterfactual is most highly correlated with the actual change in the income distribution may be because it is the only counterfactual that predicts an increase in the proportion of people with zero or very low incomes. The graphical analysis indicates that the full model better predicts the actual income distribution changes for all other regions of the income distribution.

The key findings of this analysis follow. First, all of the sets of factors considered here—demographic change, rising educational attainment, rising employment rates, and shifts in the occupational composition of employment—had the potential to shift some of the density of the Māori income distribution towards the lower-middle and upper-middle income ranges. These factors may all have played some role in bringing about the actual income density changes. Second, the labour force status counterfactual suggests that the large increase in the proportion of Māori who were employed had a particularly significant impact on the income distribution and was one of the most powerful sources of change. Third, we have found that both the shift in the gender ratio towards a higher proportion of women and the reduction in rates of benefit receipt had the potential to bring about growth in the proportion of Māori with nil or very low annual incomes.

Note that all of the counterfactual scenarios rely on the assumption that the relationship between the attribute(s) under consideration and the distribution of income remained unchanged over the decade. In reality, that relationship is likely to have changed to some degree. The counterfactual scenarios also ignore the impact that changes in external factors (such as government policies) may have had on the relationship between attributes and the distribution of income. The counterfactual analysis of the effects of changes in particular population characteristics is therefore only a partial one. It is useful in providing an indication of which factors are likely to have had a relatively smaller or greater impact on the income distribution.

6   Summary and conclusion

In this paper we have described the main changes in the distribution of annual incomes among working-aged Māori between 1991 and 2001. We have presented an analysis of the effects of various quantifiable factors on those income distribution changes.

We estimated that average Māori incomes increased by 17.6%, in real terms, over the decade. This was slightly below the increase in the average incomes of working-aged Europeans. The distribution of incomes among Māori also became markedly less 'peaked' during the decade. The proportion with incomes of around $8,000 to $20,000 (in 2001 dollars) fell substantially, and there was a particularly large decline in the proportion with incomes in the $8,000 to $12,000 range, previously the most common income level. Overall, Māori were increasingly likely to have income levels between $20,000 and $70,000 a year. However, there was also a small increase in the prevalence of negative, nil, or very low annual incomes. Most of that increase in the density of the lower tail of the income distribution took place between 1991 and 1996; there was little further change during the next 5 years.

The net effect of the income distribution changes was to raise income inequality. Summary measures of dispersion such as the Gini coefficient rose between 1991 and 1996. It is not entirely clear whether inequality continued to rise between 1996 and 2001, or stabilised.

We analysed the effects of demographic changes, rising educational attainment, rising employment rates, and improvements in other labour market outcomes. Our analysis suggests that most of those factors helped to redistribute lower-income Māori towards incomes of $20,000 and above. The increased 'feminisation' of the population—a compositional change factor that probably worked to lower measures of average Māori income growth—was the main exception. Of the change factors considered in this paper, the large increase between 1991 and 2001 in the employment rate of Māori was probably the single most powerful source of change. Taken together, the various sources of income

change considered in this paper are able to account for more than half of the income distribution shifts that were actually recorded.

We also sought to assess the robustness of the paper's main findings in relation to a number of shortcomings in data quality. Because the rise in the density of the very bottom end of the income distribution was an unexpected finding, we considered whether it could be a product of changes in data editing methods within Statistics New Zealand. Because the phenomenon can also be found in the distribution of annual income measured by the HES, we concluded it was more likely to be a real event than a methodological artefact.

We explored the effects of rising non-response to the census income question. We found that any income trend results that are obtained from an analysis of census data are potentially quite sensitive to the treatment of non-respondents. The high level of non-response in the census means that it is not an ideal data source for studying income distributions. We have used it simply because it is the only long-term data source with sufficient sample sizes for Māori to support a study of this type.

Perhaps the most important caveat on the findings of this study is that we were unable to control for the effects of the changes in the composition of the Māori population which are likely to have arisen from shifts in ethnic group reporting patterns. The practice of reporting more than one ethnic identity became more common during the 1990s, particularly among people who have both Māori and European lines of ancestry. Consequently, the set of people who were classified as Māori in the 2001 census using the standard definition of 'Māori' was larger, and somewhat different in composition, than in 1991. We simply can't tell what patterns of income distribution change would have been observed had ethnicity reporting practices remained constant.

Figures

Figure 1: Income distribution of all working-aged Māori in 1991, 1996, and 2001

Panel A: Income distributions
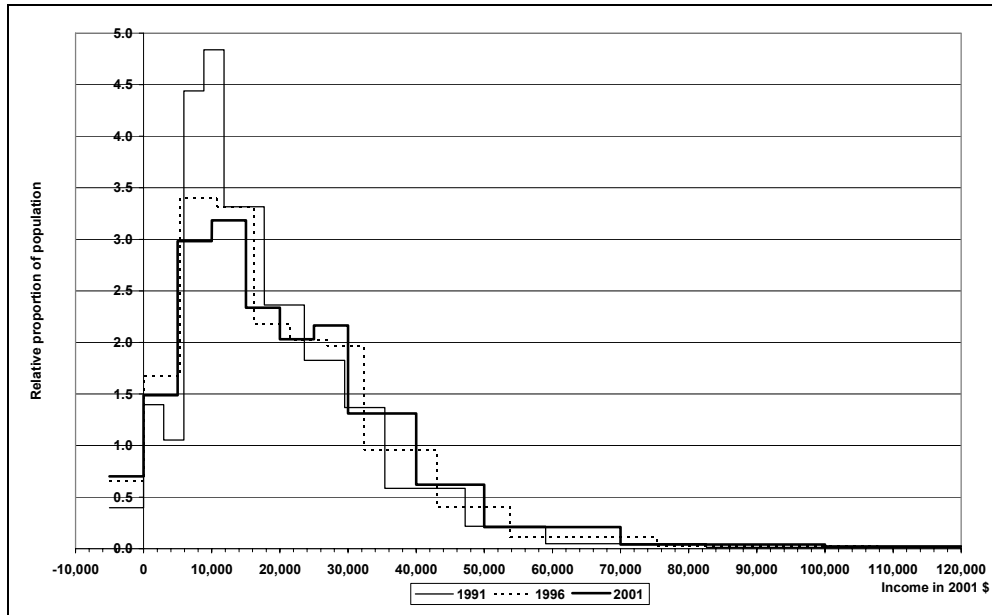
Panel B: Changes 1991–96 and 1996-2001
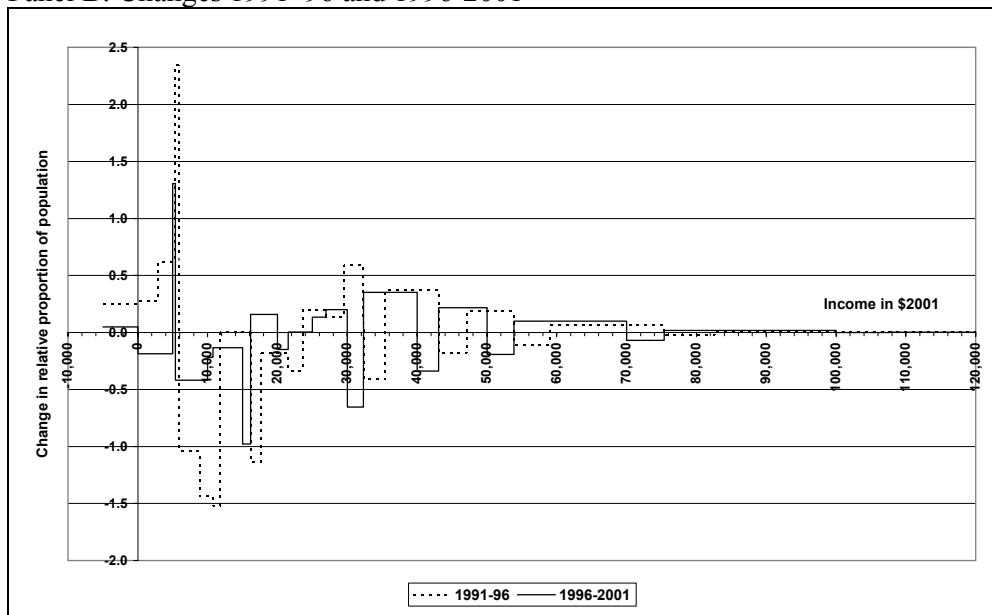
Panel C: Changes 1991–2001
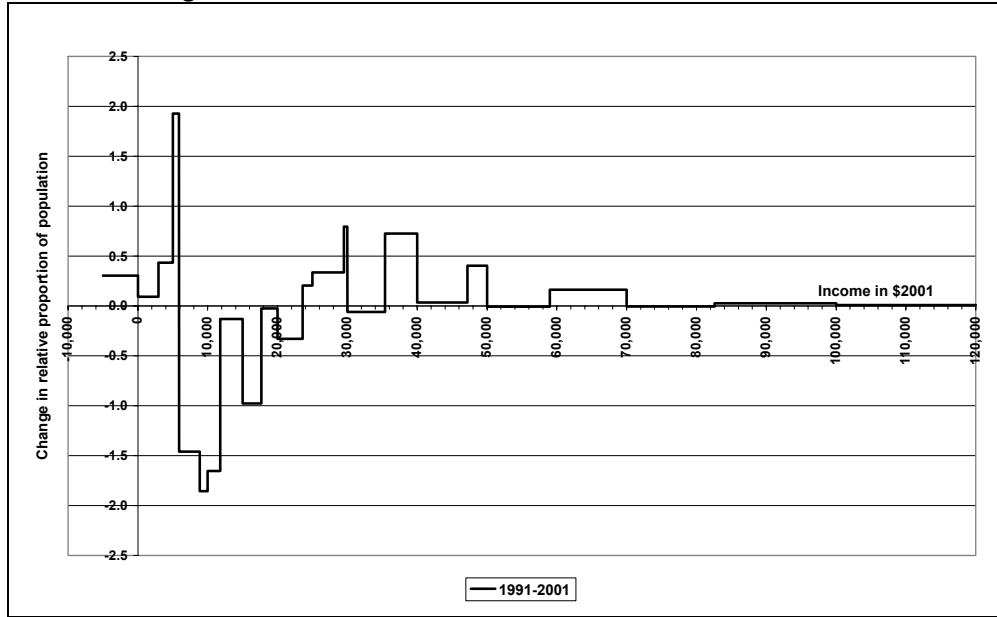
Figure 2: The income distribution of Europeans in 1991, 1996, and 2001
Panel A: Income distributions
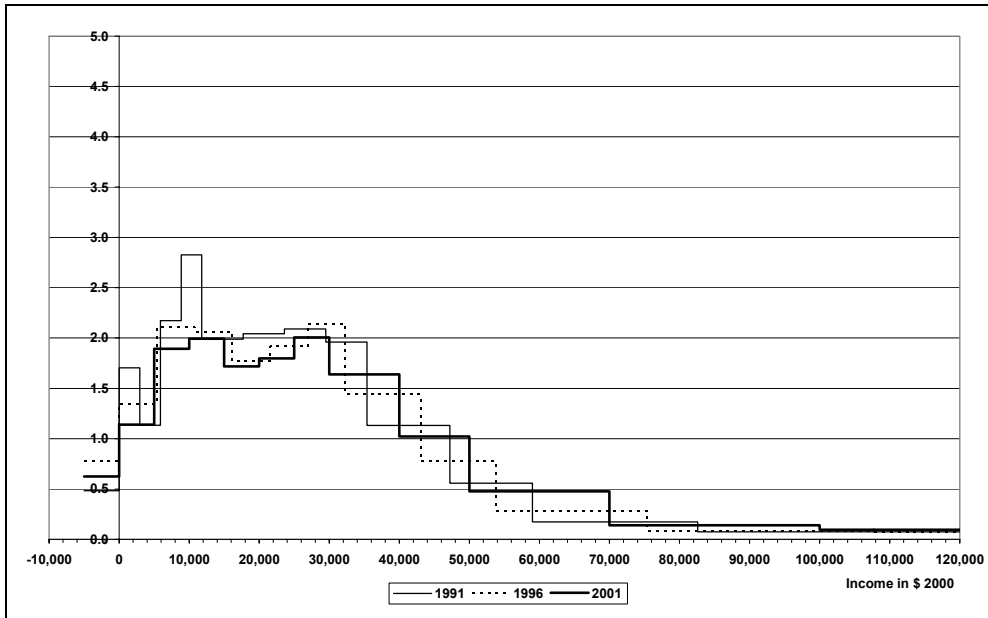
Panel B: Changes 1991–2001
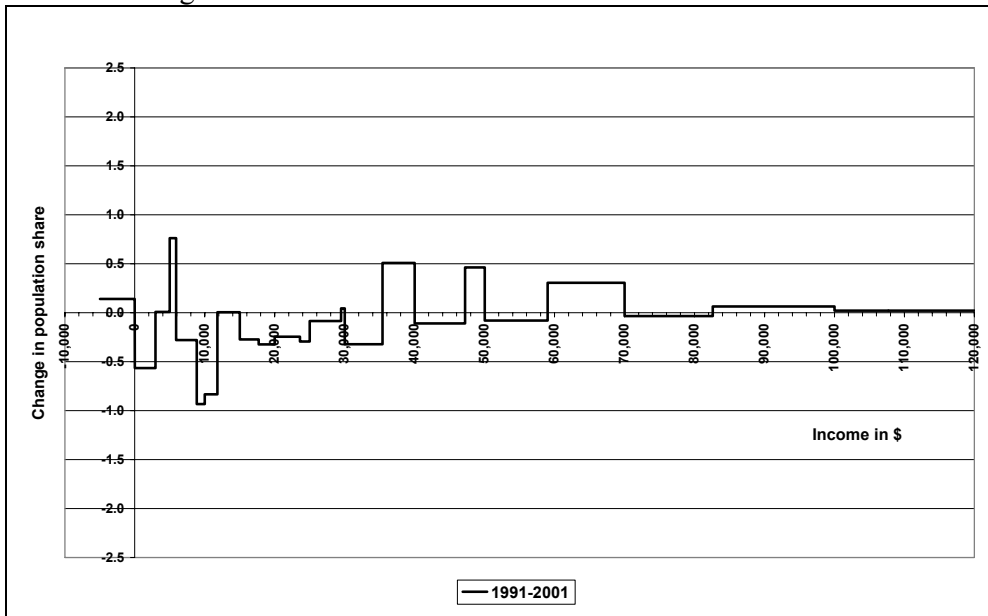
Figure 3: The income distribution of Māori men in 1991, 1996, and 2001
Panel A: Income distributions
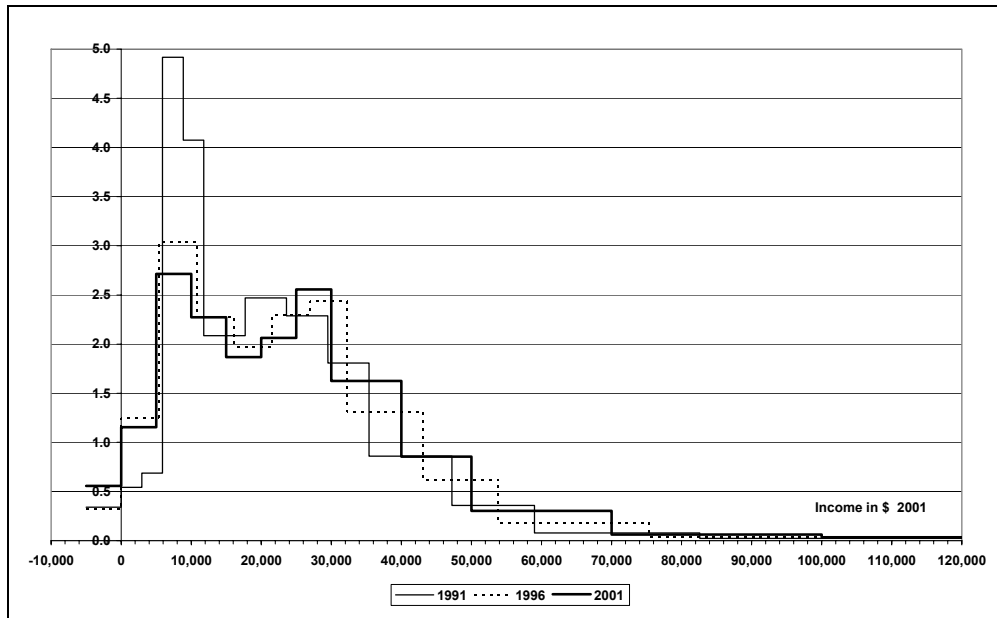
Panel B: Changes 1991–2001
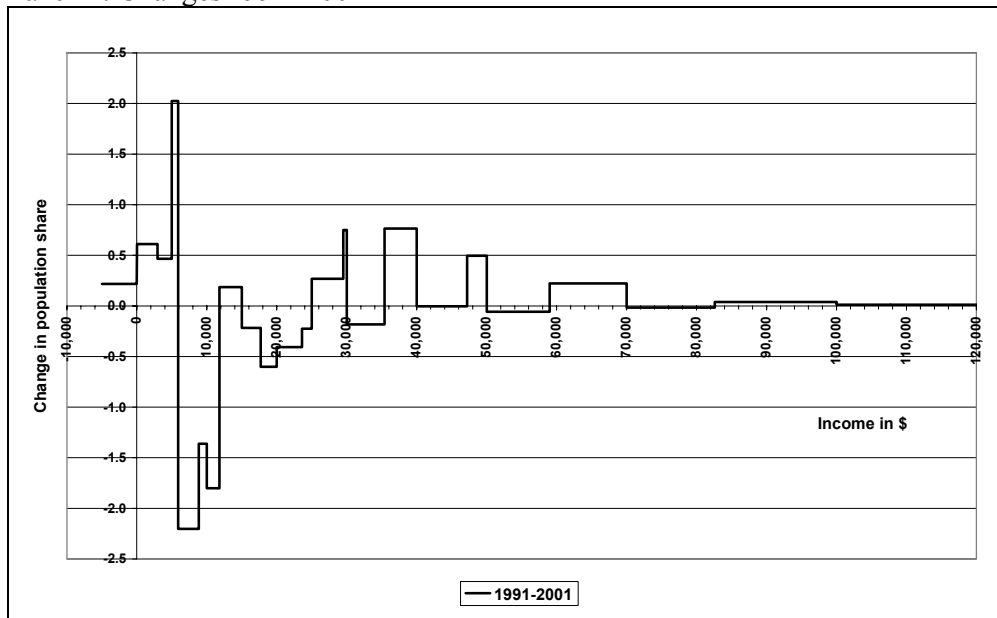
Figure 4: The income distribution of Māori women in 1991, 1996, and 2001
Panel A: Income distributions
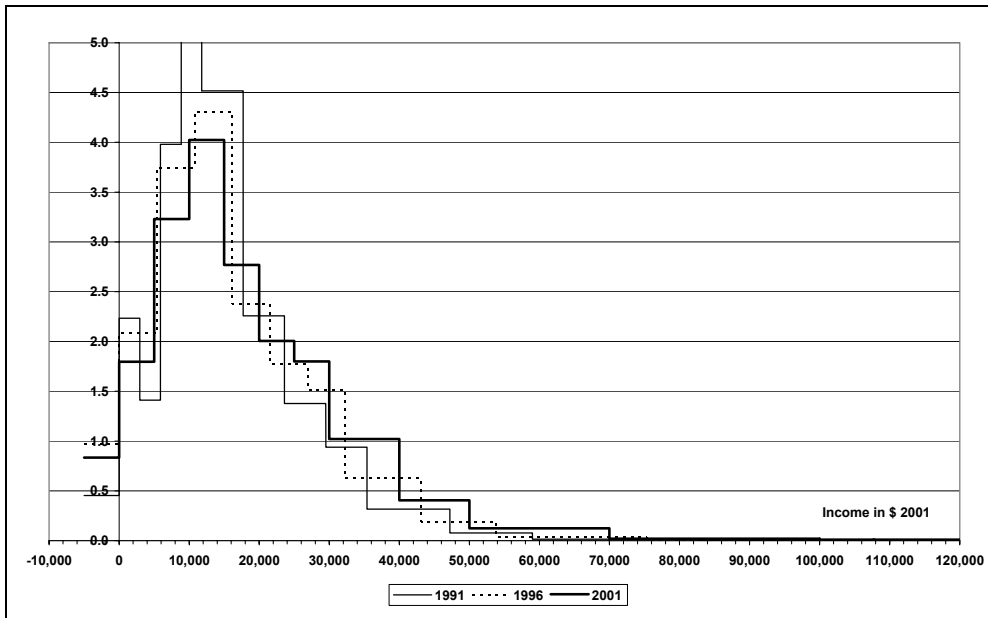
Panel B: Changes 1991–2001
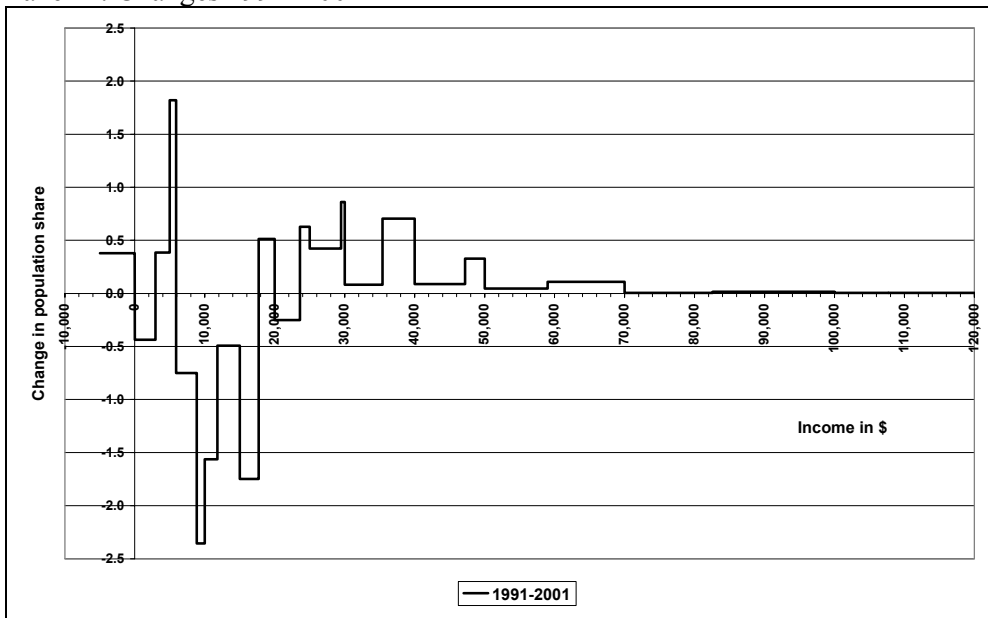
Figure 5: The income distribution of employed Māori in 1991, 1996, and 2001

Panel A: Income distributions

Panel B: Changes 1991–2001

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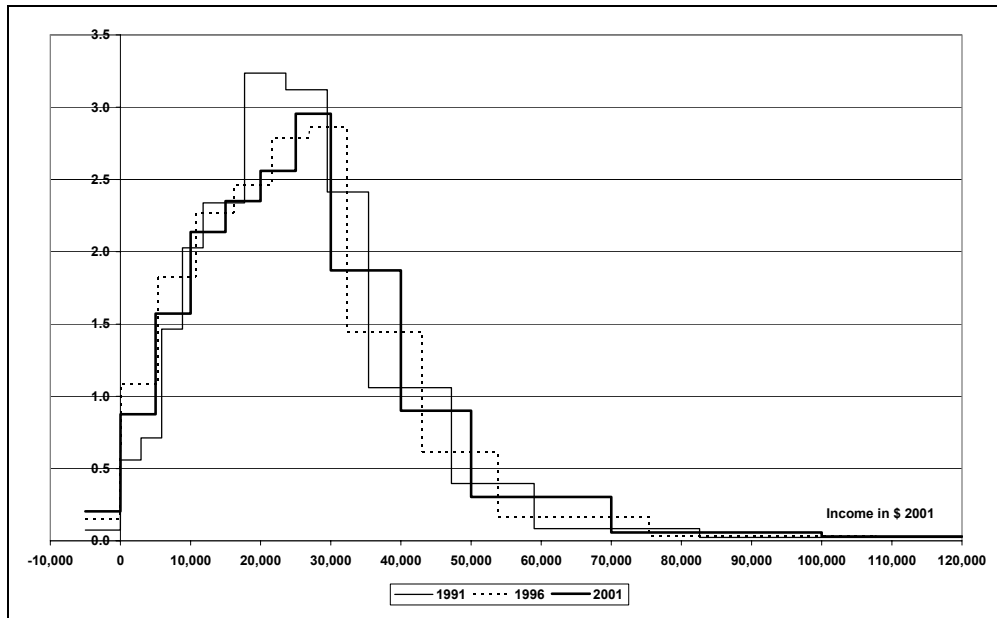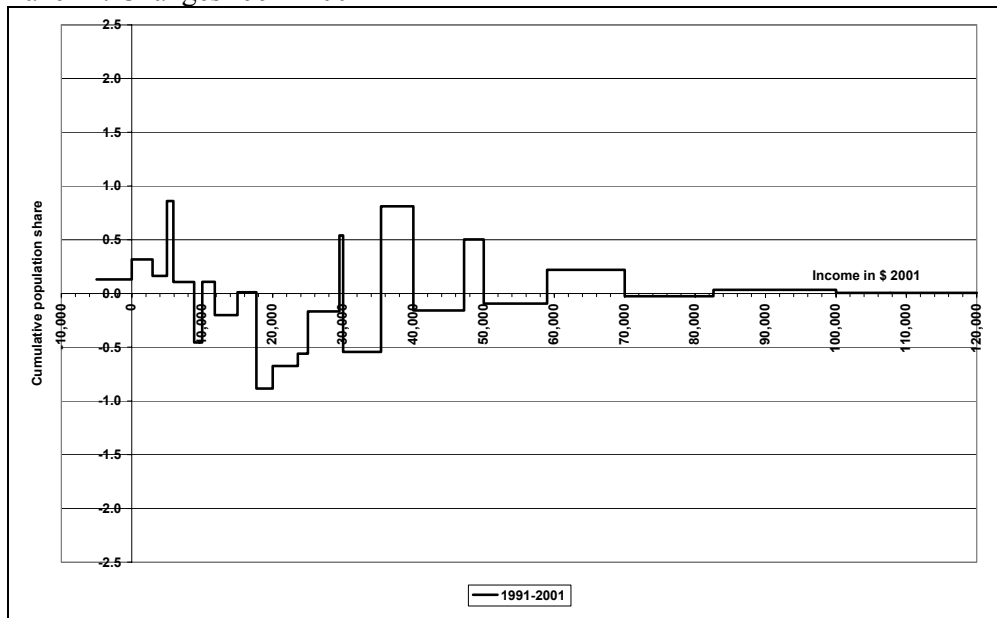
Figure 6: Counterfactual 1991 income distribution using the 2001 distribution of demographic, skill, and labour market-related attributes

Panel A: Actual and counterfactual income distributions
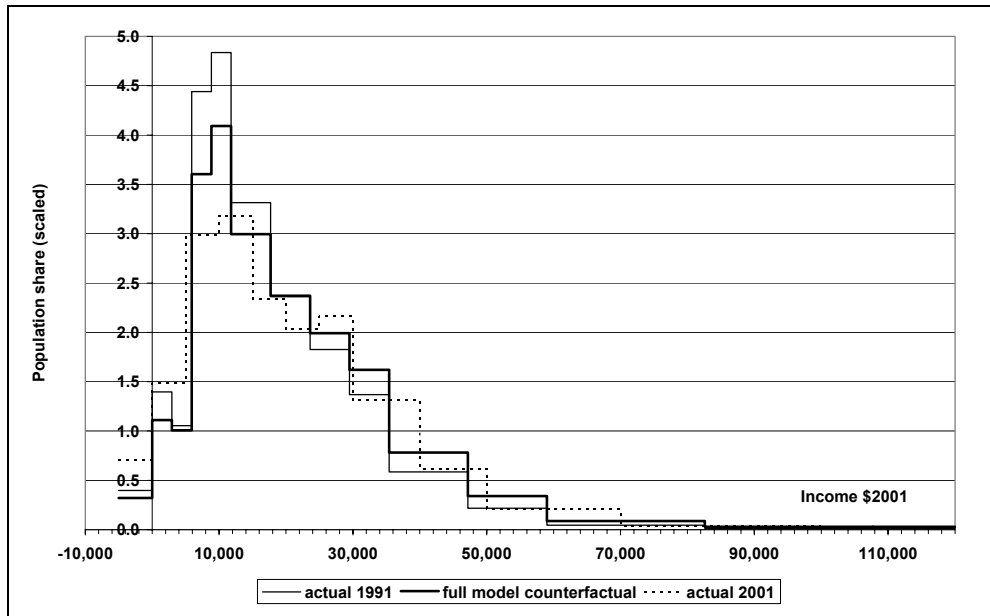
Panel B: Estimated change in the income distribution conditional on recorded changes in demographic, skill, and labour market-related attributes
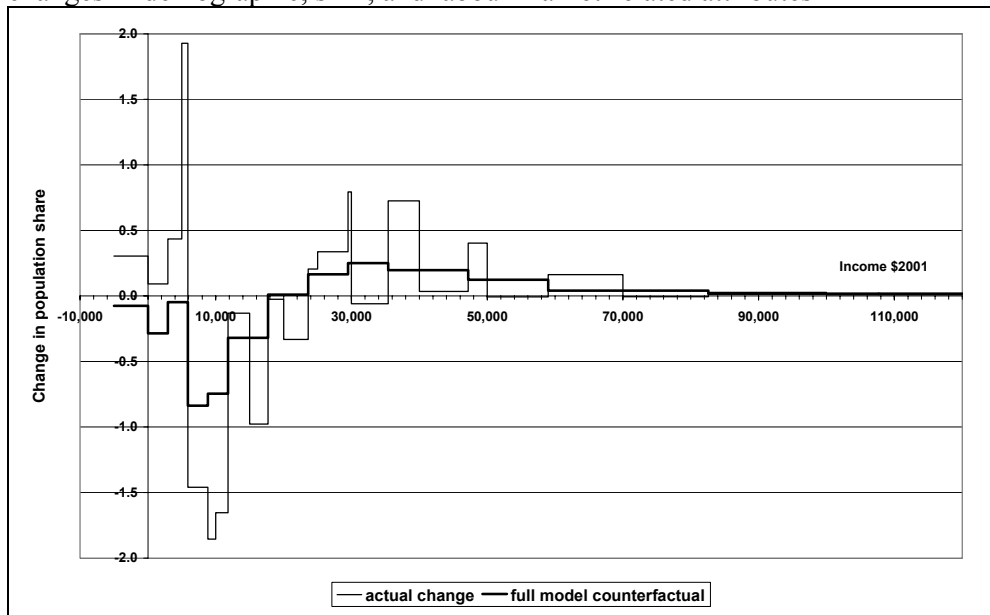
Figure 7: Demographic change and educational change counterfactuals

Panel A: Actual and counterfactual income distributions
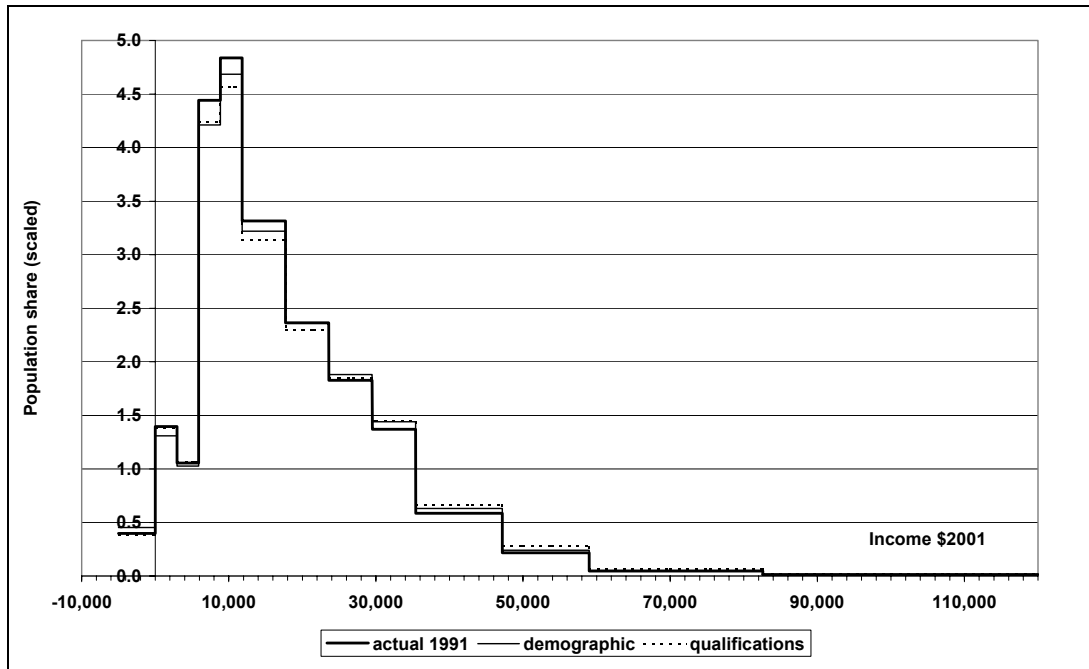
Panel B: Estimated change in the income distribution conditional on recorded demographic and educational changes

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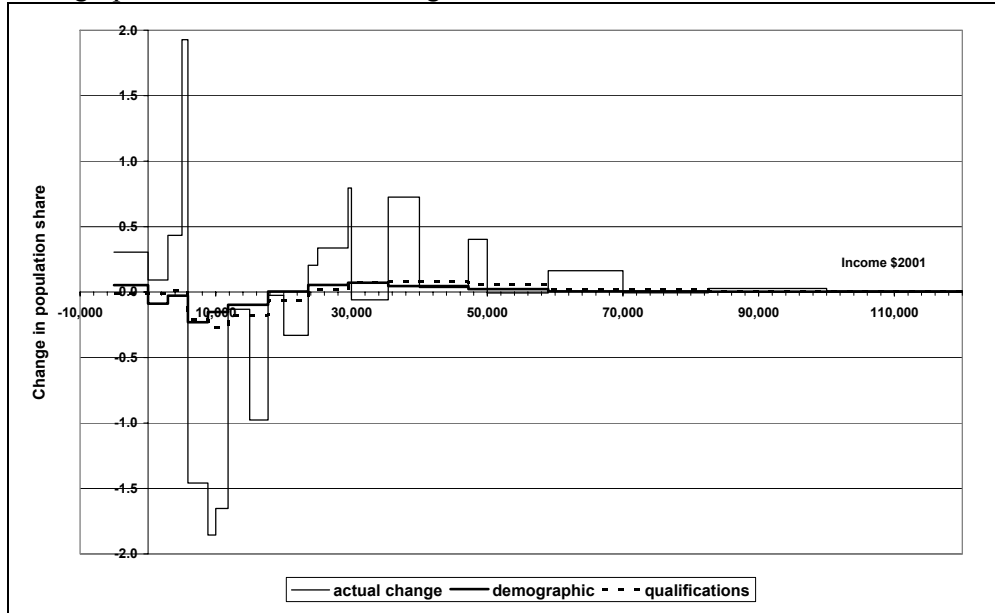
Figure 8: Labour force status, benefit receipt, and labour market activity counterfactuals

Panel A: Actual and counterfactual income distributions
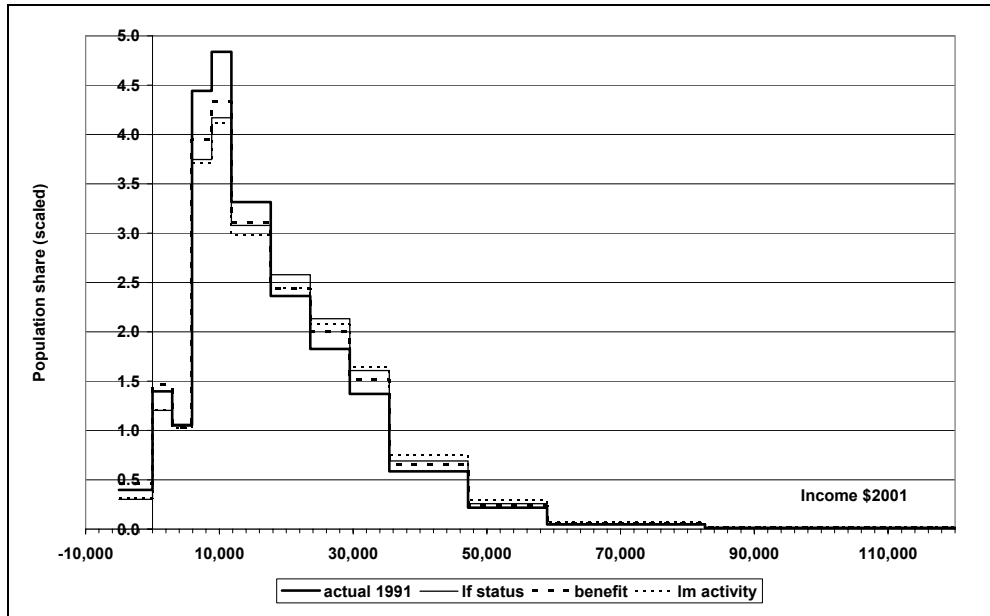
Panel B: Estimated change in the income distribution conditional on recorded labour force status, benefit receipt, and labour market activity changes
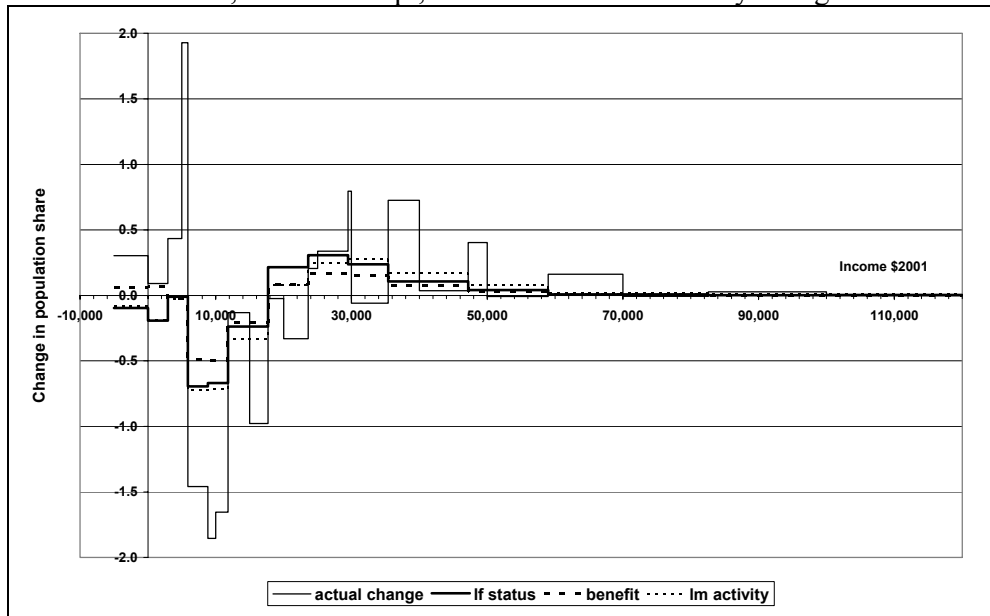
Tables

Table 1: Population and sample sizes

	1991	1996	2001	*% growth 1991-2001*
Total Māori population				
All	203,100	249,220	251,080	*23.6*
Males	98,020	119,650	118,580	*21.0*
Females	105,070	129,570	132,500	*26.1*
Identified as Māori only				
All	164,680	145,040	157,150	*-4.6*
Males	80,620	70,670	77,470	*-3.9*
Females	84,060	74,370	79,680	*-5.2*
Identified as Māori plus one or more other ethnic groups				
All	38,420	104,180	93,930	*144.5*
Males	17,400	48,980	41,110	*136.3*
Females	21,010	55,200	52,820	*151.4*
European sample (10 percent of population)				
All	142,970	144,200	143,430	*0.3*
Males	71,230	71,200	70,260	*-1.4*
Females	71,740	73,010	73,170	*2.0*

Note: The numbers in this table are rounded for confidentiality reasons.

Table 2: Imputation and non-response rates for Māori and Europeans
Part A: Māori

	Males			Females		
	1991	1996	2001	1991	1996	2001
Imputation rates						
Sex	NA	0.4	1.5	NA	0.3	1.0
Age	NA	1.1	1.1	NA	0.8	0.8
Labour force status	NA	7.8	9.1	NA	7.5	7.8
Item non-response rates						
Highest school qualification	2.4	9.3	6.6	2.4	10.0	6.0
Post-school qualifications (level)	5.1	10.3	14.7	6.4	10.1	12.9
Hours worked *	NA	4.8	6.9	NA	4.3	4.8
Occupation *	1.6	4.3	5.1	1.3	3.7	3.9
Income	4.7	8.1	9.0	9.1	10.8	11.4

Part B: Europeans

	Males			Females		
	1991	1996	2001	1991	1996	2001
Imputation rates						
Sex	NA	0.1	0.7	NA	0.1	0.5
Age	NA	0.5	0.5	NA	0.4	0.4
Labour force status	NA	3.4	3.6	NA	3.4	3.6
Item non-response rates						
Highest school qualification	1.2	6.9	3.2	1.2	7.1	2.8
Post-school qualifications (level)	2.8	5.6	7.9	4.0	5.5	7.6
Hours worked *	NA	2.5	4.2	NA	2.4	3.3
Occupation *	0.9	2.8	3.1	0.9	1.9	2.1
Income	1.7	3.4	4.2	5.5	4.0	5.3

Notes: NA = Not available because of the method of imputation used in 1991. * These rates are calculated for the employed only.

Table 3: Income-related personal characteristics

	Māori				Europeans		
	1991	1996	2001	Chge	1991	2001	Chge
Ratio females to males	1.07	1.08	1.12	0.05	1.01	1.04	0.03
Mean age	34.3	35.1	36.0	1.7	37.7	39.8	2.1
Age group	%	%	%		%	%	
20-24	21.1	19.0	16.8	-4.3	14.0	10.2	-3.8
25-29	19.5	17.3	16.0	-3.5	14.1	11.2	-2.9
30-34	16.7	16.8	15.6	-1.1	14.6	13.1	-1.5
35-39	12.8	14.6	15.3	2.5	13.9	14.5	0.6
40-44	10.2	11.3	13.1	2.9	14.1	14.5	0.4
45-49	7.6	9.0	10.0	2.4	11.2	13.2	2.0
50-54	6.8	6.5	7.8	0.9	9.6	13.1	3.5
55-59	5.2	5.6	5.5	0.3	8.5	10.2	1.7
Parental status and partnership	%	%	%		%	%	
Joint parent of dependent children	35.5	32.7	30.8	-4.7	37.1	32.6	-4.5
Sole parent of dependent children	14.3	14.0	14.8	0.5	4.5	5.4	0.9
No dependent children	49.9	46.7	45.7	-4.2	53.9	57.2	3.3
Family situation unknown	7.9	5.1	7.0	-0.9	4.5	4.8	0.3
Residential area	%	%	%		%	%	
Main urban	40.6	42.1	42.8	2.2	52.1	51.9	-0.2
Minor urban	21.9	21.7	22.3	0.4	18.0	17.4	-0.6
Small town	20.7	19.7	19.1	-1.7	14.6	14.2	-0.4
Rural	16.7	16.5	15.8	-0.9	15.4	16.4	1.0
Highest school qualification	%	%	%		%	%	
None	62.0	51.6	48.1	-13.8	37.0	26.3	-10.7
Fifth form	19.0	17.6	20.4	1.4	23.4	21.9	-1.5
Sixth form	10.3	13.2	15.1	4.8	19.2	22.7	3.5
Higher school qualification	5.1	7.7	9.6	4.6	13.1	18.1	5.0
Other or overseas qualification	1.3	0.3	0.5	-0.8	6.1	8.1	2.0
Not specified	2.4	9.7	6.3	3.9	1.2	3.0	1.8
Highest post-school qualification	%	%	%		%	%	
None	69.0	69.1	60.1	-8.9	50.8	49.1	-1.7
PS qual but level unknown	0.0	3.8	4.8	4.8	0.0	4.6	4.6
Diploma or certificate	23.3	13.7	16.3	-6.9	37.1	24.3	-12.8
Bachelor degree	1.4	2.4	3.9	2.5	5.7	9.7	4.0
Higher degree	0.6	0.8	1.2	0.6	3.0	4.5	1.5
Not specified	5.8	10.2	13.8	8.0	3.4	7.8	4.4

Table 4: Employment rates

	Māori				Europeans		
	1991	1996	2001	Change	1991	2001	Change
All							
Total	50.3	60.6	63.6	13.3	74.1	81.1	7.0
Full-time	42.9	48.4	50.7	7.8	62.3	65.8	3.5
Males							
Total	60.2	69.4	71.2	11.0	83.8	87.1	3.3
Full-time	55.9	61.7	63.7	7.8	80.1	81.5	1.4
Females							
Total	41.1	52.4	56.8	15.7	64.5	75.3	10.8
Full-time	30.7	48.1	39.1	8.4	44.7	50.7	6.0

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Table 5: Occupational distribution and hours worked of the employed

	Māori				Europeans		
	1991	1996	2001	*Chge*	1991	2001	*Chge*
	%	%	%		%	%	
Managerial	6.1	6.9	7.7	*1.6*	13.3	14.7	*1.4*
Professional	7.8	7.9	9.7	*1.9*	13.5	16.0	*2.5*
Technical	7.8	8.8	9.8	*2.0*	12.0	12.4	*0.4*
Clerical	11.9	11.6	11.3	*-0.6*	14.7	12.8	*-1.9*
Service and sales	12.5	14.0	13.9	*1.4*	11.2	12.1	*0.9*
Agricultural	7.8	8.7	7.5	*-0.3*	9.7	8.1	*-1.6*
Trade workers	8.9	8.3	7.3	*-1.6*	11.0	9.2	*-1.8*
Plant and machine operators	20.1	15.5	15.8	*-4.3*	8.2	7.0	*-1.2*
Elementary	14.3	11.8	9.9	*-4.4*	5.3	4.4	*-0.9*
Not specified	2.9	6.6	7.0	*4.1*	1.2	3.3	*2.1*
Mean weekly hours	40.3	39.9	39.1	*-1.2*	41.3	41.4	*0.1*

Table 6: Characteristics and labour market activity of Māori, by gender

	Males				Females			
	1991	1996	2001	*Chge*	1991	1996	2001	*Chge*
Mean age	34.4	35.1	36.1	*1.7*	34.2	35.0	35.9	*1.7*
Age group	%	%	%		%	%	%	
20-24	21.2	19.2	17.0	*-4.2*	21.0	18.8	16.6	*-4.4*
25-29	19.2	17.0	15.7	*-3.5*	19.8	17.6	16.3	*-3.5*
30-34	16.4	16.6	15.3	*-1.1*	17.1	17.1	15.9	*-1.2*
35-39	12.8	14.5	15.1	*2.3*	12.8	14.7	15.4	*2.6*
40-44	10.3	11.4	13.1	*2.8*	10.1	11.2	13.1	*3.0*
45-49	7.7	9.2	10.2	*2.5*	7.5	8.8	9.8	*2.3*
50-54	7.0	6.6	8.0	*1.0*	6.6	6.3	7.6	*1.0*
55-59	5.4	5.7	5.6	*0.2*	5.1	5.4	5.4	*0.3*
Parental status	%	%	%		%	%	%	
Joint parent of dependent children	36.0	33.5	31.8	*-4.2*	35.1	32.0	30.0	*-5.1*
Sole parent of dependent children	4.7	4.3	4.9	*0.2*	23.3	23.0	23.7	*0.4*
No dependent children	49.9	56.1	55.0	*5.1*	35.1	40.8	40.4	*5.3*
Family situation unknown	9.4	6.1	8.3	*-1.1*	6.5	4.2	5.9	*-0.6*
Residential area	%	%	%		%	%	%	
Main urban	40.4	42.1	42.9	*2.5*	40.9	42.1	42.8	*1.9*
Minor urban	21.4	21.3	21.9	*0.5*	22.4	22.2	22.7	*0.3*
Small town	20.6	19.4	18.7	*-1.9*	20.9	20.0	19.5	*-1.4*
Rural	17.6	17.2	16.5	*-1.1*	15.9	15.8	15.1	*-0.8*
Highest school qualification	%	%	%		%	%	%	
None	63.8	53.6	50.9	*-12.9*	60.2	49.7	45.6	*-14.6*
Fifth form	17.7	16.8	19.2	*1.5*	20.1	18.4	21.4	*1.3*
Sixth form	9.1	11.9	13.3	*4.2*	11.3	14.4	16.7	*5.4*
Higher school qualification	5.7	8.2	9.5	*3.8*	4.4	7.2	9.7	*5.3*
Other or overseas qualification	1.2	0.3	0.5	*-0.7*	1.5	0.3	0.6	*-0.9*
Not specified	2.4	9.3	6.6	*4.2*	2.4	10.0	6.0	*3.6*
Highest post-school qualification	%	%	%		%	%	%	
None	66.6	67.7	60.1	*-6.5*	71.2	70.4	60.0	*-11.2*
Level unknown	0.0	4.2	5.1	*5.1*	0.0	3.3	4.4	*4.4*
Diploma or certificate	26.0	14.4	15.6	*-10.4*	20.8	13.0	17.0	*-3.8*
Bachelor degree	1.6	2.5	3.3	*1.7*	1.2	2.4	4.4	*3.2*
Higher degree	0.7	0.9	1.2	*0.5*	0.5	0.8	1.2	*0.7*
Not specified	5.1	10.3	14.7	*9.6*	6.4	10.1	12.9	*6.5*
Occupational group	%	%	%		%	%	%	
Managerial	6.1	7.0	7.4	*1.3*	6.1	6.8	8.0	*1.9*
Professional	4.9	5.4	6.7	*1.8*	11.8	11.1	13.1	*1.3*
Technical	7.0	7.3	7.6	*0.6*	8.7	10.5	12.3	*3.6*
Clerical	4.1	4.8	5.0	*0.9*	22.5	19.9	18.4	*-4.1*
Service and sales	8.5	9.2	9.0	*0.5*	18.0	20.0	19.4	*1.4*
Agricultural	9.9	10.9	9.8	*-0.1*	5.0	6.0	4.9	*-0.1*
Trade workers	14.1	13.9	12.8	*-1.3*	1.8	1.4	1.1	*-0.7*
Plant and machine operators	27.1	22.7	24.1	*-3.0*	10.4	6.7	6.6	*-3.8*
Elementary	15.5	12.7	10.5	*-5.0*	12.6	10.7	9.3	*-3.3*
Not specified	2.7	6.2	7.2	*4.5*	3.2	7.1	6.9	*3.7*

Table 7: Income statistics

	Māori				Europeans		
	1991	1996	2001	Chge	1991	2001	Chge
All							
Mean incomes ($)	19,366	21,066	22,777	17.6	27,827	33,838	21.6
Mean incomes of empd ($)	26,551	26,791	28,471	7.2	32,951	38,338	16.3
Mean incomes of non-employed ($)	11,306	11,397	11,414	1.0	11,679	12,833	9.9
Zero income or loss (%)	1.9	3.0	3.1	1.2	2.3	3.0	0.7
Some government income support last year (%)	49.6	45.3	42.8	-6.8	22.5	19.7	-2.8
Males							
Mean incomes ($)	23,096	25,692	27,074	17.2	35,722	43,330	21.3
Mean incomes of empd ($)	30,231	31,044	32,615	7.9	39,619	47,113	18.9
Mean incomes of non-employed ($)	11,469	12,383	11,681	1.8	14,886	16,165	8.6
Zero income or loss (%)	1.6	1.5	2.5	0.9	1.3	1.4	0.1
Some government income support last year (%)	46.1	39.1	35.1	-11.0	21.0	16.6	-4.4
Females							
Mean incomes ($)	15,719	16,666	18,826	19.8	19,670	24,619	25.2
Mean incomes of empd ($)	21,478	21,518	23,821	10.9	24,328	28,634	17.7
Mean incomes of non-employed ($)	11,198	10,803	11,250	0.5	10,083	11,106	10.1
Zero income or loss (%)	2.1	4.3	3.7	1.6	3.3	4.5	1.2
Some government income support last year (%)	53.0	51.0	49.8	-3.2	24.0	22.8	-1.2

Notes: Incomes are reported in March 2001 dollar values. Mean incomes were calculated using midpoint estimates for each income interval. The midpoints were estimated using HES annual incomes data for the years ended March 1991, 1996, and 2001.

Table 8: Own income levels of non-employed adults living in families, by whether or not there were other full-time employed adults in the family

	Maori				Europeans			
	1991		2001		1991		2001	
	No FTE	FTE others	No FTE	FTE others	No FTE	FTE others	No FTE	FTE others
	%	%	%	%	%	%	%	%
Income not reported	9.0	19.6	17.1	17.0	5.4	16.6	10.1	11.9
Positive income	89.7	71.9	79.1	68.1	91.2	71.7	84.4	63.5
Nil income	1.3	8.5	3.7	14.9	3.4	11.7	5.5	24.6

Note: Only people living in families and who were at home on census night are included in these figures.

Table 9: Number of full-time employed adults in the families of non-employed adults

	Maori		Europeans	
	1991	2001	1991	2001
	%	%	%	%
None	70.9	68.7	45.9	46.9
One	25.0	27.2	46.4	47.6
Two or more	4.1	4.1	7.7	5.5
All combinations	100.0	100.0	100.0	100.0

Note: Only people living in families and who were at home on census night are included in these figures.

Table 10: Income growth by percentile, all Māori

	1991	1996	2001	1991-1996	1996-2001	1991-2001
Zero or neg income (%)	1.9	3.0	3.1	*1.1*	*0.1*	*1.2*
Percentiles		*March 2001 $*			*% growth*	
5	2,157	1,039	1,002	-51.9	-3.5	-53.5
10	6,082	4,020	4,362	-33.9	8.5	-28.3
15	7,208	6,183	6,359	-14.2	2.8	-11.8
20	8,335	7,654	8,035	-8.2	5.0	-3.6
25	9,413	9,125	9,712	-3.1	6.4	3.2
30	10,447	10,596	11,301	1.4	6.6	8.2
35	11,481	12,100	12,871	5.4	6.4	12.1
40	12,839	13,608	14,441	6.0	6.1	12.5
45	14,349	15,115	16,378	5.3	8.4	14.1
50	15,858	16,866	18,516	6.4	9.8	16.8
55	17,368	19,157	20,754	10.3	8.3	19.5
60	19,346	21,448	23,214	10.9	8.2	20.0
65	21,464	23,910	25,634	11.4	7.2	19.4
70	23,582	26,377	27,944	11.9	5.9	18.5
75	26,307	28,907	30,421	9.9	5.2	15.6
80	29,043	31,454	34,237	8.3	8.8	17.9
85	32,540	35,775	38,054	9.9	6.4	16.9
90	37,227	40,993	43,952	10.1	7.2	18.1
95	45,785	50,542	55,982	10.4	10.8	22.3

Table 11: Income growth by percentile, Māori men

	1991	1996	2001	1991-1996	1996-2001	1991-2001
Zero or neg income (%)	1.6	1.5	2.5	*-0.1*	*1.0*	*0.9*
Percentiles		*March 2001 $*			*% growth*	
5	5,425	2,733	1,916	-49.6	-29.9	-64.7
10	6,857	5,942	5,532	-13.3	-6.9	-19.3
15	7,874	7,588	7,375	-3.6	-2.8	-6.3
20	8,900	9,233	9,218	3.7	-0.2	3.6
25	10,128	10,916	11,268	7.8	3.2	11.3
30	11,356	13,110	13,469	15.4	2.7	18.6
35	13,321	15,304	15,815	14.9	3.3	18.7
40	15,719	17,709	18,491	12.7	4.4	17.6
45	18,055	20,246	21,058	12.1	4.0	16.6
50	20,082	22,607	23,482	12.6	3.9	16.9
55	22,108	24,784	25,732	12.1	3.8	16.4
60	24,176	26,959	27,688	11.5	2.7	14.5
65	26,363	29,009	29,644	10.0	2.2	12.4
70	28,550	31,059	32,519	8.8	4.7	13.9
75	31,059	33,800	35,598	8.8	5.3	14.6
80	33,829	37,619	38,676	11.2	2.8	14.3
85	37,888	41,438	43,334	9.4	4.6	14.4
90	43,711	47,662	49,181	9.0	3.2	12.5
95	52,740	60,059	64,239	13.9	7.0	21.8

Table 12: Income growth by percentile, Māori women

	1991	1996	2001	1991-1996	1996-2001	1991-2001
Zero or neg income (%	2.1	4.3	3.7	*2.2*	*-0.6*	*1.6*
Percentiles		*March 2001 $*			*% growth*	
5	1,224	73	463	-94.0	533.8	-62.2
10	3,762	2,472	3,246	-34.3	31.3	-13.7
15	6,404	4,872	5,574	-23.9	14.4	-13.0
20	7,661	6,436	7,121	-16.0	10.6	-7.0
25	8,902	7,772	8,669	-12.7	11.5	-2.6
30	9,797	9,108	10,175	-7.0	11.7	3.9
35	10,693	10,444	11,417	-2.3	9.3	6.8
40	11,588	11,649	12,660	0.5	8.7	9.2
45	12,643	12,809	13,902	1.3	8.5	10.0
50	13,751	13,970	15,210	1.6	8.9	10.6
55	14,859	15,131	17,015	1.8	12.5	14.5
60	15,967	16,404	18,820	2.7	14.7	17.9
65	17,075	18,504	20,863	8.4	12.8	22.2
70	18,650	20,603	23,355	10.5	13.4	25.2
75	20,867	23,106	25,945	10.7	12.3	24.3
80	23,084	25,931	28,722	12.3	10.8	24.4
85	26,373	29,072	32,645	10.2	12.3	23.8
90	30,228	32,487	37,542	7.5	15.6	24.2
95	35,809	40,488	46,149	13.1	14.0	28.9

Table 13: Summary measures of income dispersion

	1991	1996	2001	1991-1996	1996-2001	1991-2001
Zero or neg income (%)	0.4	0.8	1.0	*0.4*	*0.3*	*0.6*
Percentiles		*March 2001 $*			*% growth*	
5	6,507	3,926	4,543	-39.7	15.7	-30.2
10	9,629	7,261	7,927	-24.6	9.2	-17.7
15	12,058	10,002	10,815	-17.0	8.1	-10.3
20	14,199	12,358	13,156	-13.0	6.5	-7.3
25	16,340	14,563	15,452	-10.9	6.1	-5.4
30	18,269	16,721	17,579	-8.5	5.1	-3.8
35	19,815	18,753	19,706	-5.4	5.1	-0.5
40	21,362	20,784	21,684	-2.7	4.3	1.5
45	22,909	22,669	23,637	-1.0	4.3	3.2
50	24,486	24,465	25,512	-0.1	4.3	4.2
55	26,090	26,261	27,204	0.7	3.6	4.3
60	27,694	28,026	28,897	1.2	3.1	4.3
65	29,297	29,772	30,931	1.6	3.9	5.6
70	31,304	31,517	33,603	0.7	6.6	7.3
75	33,377	34,198	36,275	2.5	6.1	8.7
80	35,477	37,654	38,947	6.1	3.4	9.8
85	40,201	41,110	43,367	2.3	5.5	7.9
90	44,925	46,589	48,922	3.7	5.0	8.9
95	53,661	57,142	63,257	6.5	10.7	17.9

Table 14: Summary measures of income dispersion

	Maori			Europeans		
	1991	**1996**	**2001**	**1991**	**1996**	**2001**
All						
Gini coefficient	0.383	0.414	0.418	0.413	0.439	0.446
Std deviation of log income	0.811	0.836	0.837	0.958	0.914	0.917
Males						
Gini coefficient	0.373	0.394	0.408	0.359	0.392	0.417
Std deviation of log income	0.755	0.817	0.816	0.759	0.798	0.827
Females						
Gini coefficient	0.360	0.404	0.405	0.424	0.443	0.435
Std deviation of log income	0.817	0.809	0.823	1.010	0.917	0.918

Table 15: HES data on changes at the bottom tail of the income distribution

	Maori		Europeans		
	1990/92	**1995/97**	**1990/91**	**1995/96**	**2000/01**
	(%)	(%)	(%)	(%)	(%)
Negative or zero incomes	1.6	2.4	3.4	4.6	3.3
$1-$5,000	8.7	6.1	10.0	8.2	6.9
Above $5,000	89.7	91.5	86.6	87.3	89.8

Notes: The figures for Maori were obtained by pooling data from three adjacent HES surveys: 1990/91 through to 1991/92, and 1994/95 through to 1996/97. The figures for Europeans were obtained from a single HES year ending 31 March.

Table 16: Correlations between the income counterfactuals and the actual change in the Māori income distribution

	Demog	Educ	LF status	Benefit	LM activity	Full model	**Actual**
Demographic	1.00	0.86	0.89	0.93	0.94	0.95	0.791
Education		1.00	0.78	0.85	0.92	0.92	0.795
Labour force status			1.00	0.95	0.96	0.94	0.750
Benefit receipt				1.00	0.95	0.93	0.833
Labour market activity					1.00	0.99	0.805
Full model						1.00	0.810
Actual change							1.000

Appendix A: Changing ethnic affiliation and reporting patterns

Concepts of ethnicity and ethnic affiliation patterns have changed over time. Between 1991 and 2001, there was a significant increase in the number of New Zealanders who listed more than one ethnic group in the census ethnicity question, from 4% in 1991 to 8% in 2001. A change in the wording of the ethnicity question is generally regarded as one of the causes of the increase between 1991 and 1996 (Statistics New Zealand, 2004). However, the percentage of respondents giving two or more ethnicities fell only marginally from 1996 to 2001, when the 1991-style question was reinstated.

The boundaries of the Māori population, when defined to include all those listing Māori as one of their ethnic groups, have been particularly strongly influenced by these trends. The population figures given in Table 1 indicate a rapid expansion in the total population of Māori during the 1990s. An increased willingness of people with complex lines of ancestry to list Māori as one of their ethnic groups may be one of the reasons for that rise. At the same time, relatively fewer people were listing Māori as their sole ethnic group.

Callister and Blakely (2004) have examined changes in the ethnicity responses of people of all ages. Like us, they note that the number of Māori who recorded Māori as their sole ethnicity declined strongly between 1991 and 1996 (p. 9). Despite an increase in the absolute size of the sole Māori group from 1996 to 2001, it remained smaller than in 1991. The percentage of Māori that recorded more than one group, in contrast, was far higher in 2001 than in 1991 (44% compared with 26%).

These shifts in the boundaries of the Māori population challenge the ability of researchers (who are working with cross-sectional data sets) to make consistent comparisons of Māori experiences and outcomes across time. Researchers who have experimented with different definitions of 'Māori' have consistently found that people who identify *solely* as Māori are relatively more disadvantaged, in terms of their employment rates, average incomes, educational attainment, occupational status, and health outcomes, than people who affiliate

with *both* the Māori and European ethnic groups (Gould, 2000; Chapple, 1999; Maani, 2000 and 2002; Callister and Blakely, 2004). This raises the possibility that improvements in measures of the socio-economic status of the total Māori population during the 1990s could be due, in part, simply to the expansion of the size of the mixed-ethnicity component of the Māori population relative to the size of the sole Māori component.

It is clear from Table 1 that neither the more 'inclusive' nor the more 'restrictive' definitions of the Māori population provide stable boundaries, although the boundaries of the 'sole Māori' group appear to have changed rather less. Given fluidity in the way in which individuals report their ethnic identities, and the fact that the cross-sectional nature of the census prevents us from linking the records of the same individuals through time, there is probably is no feasible way to fix the boundaries of an ethnic sub-population for study purposes.

The best we can do to check the sensitivity of our results to the ethnic definition chosen is to compare them with the results obtained if we use an alternative definition. To this end, data on the socio-economic profile and mean incomes of the 'sole' Māori population is set out in Table A.1. These figures can be compared with the figures in Table 4 for the total working-aged Māori population.

In each of the census years, sole Māori were slightly older, more likely to be male, less likely to have school or post-school qualifications, and less likely to be employed than the total working-aged group. A comparison of the changes from 1991 to 2001 reveals broadly similar rates of improvement in educational attainment, employment rates, and occupational attainment for both populations. However, the estimated average income of the sole Māori population did not rise as rapidly as that of the total Māori population. Total real income growth for 'sole' Māori over the decade was 14% rather than 17%. In relative terms, the sole Māori group slipped behind. The average income of sole Māori declined from around 96% of the figure for all Māori in 1991, to 93% in 2001.

Figure A.1 compares the income distributions of the 'sole' Māori and 'all' Māori groups in 1991 and 2001. Figure A.2 plots the change in income

distribution for these two groups. This graph also suggests that the sole Māori sub-population lagged behind the wider Māori population in the income gains of the decade. Sole Māori were over-represented in the redistribution of individuals towards the zero and very low incomes ranges, and under-represented in the redistribution towards incomes of $30,000 a year and above.

These results add weight to the suspicion that the results reported in this paper may be overestimating the total income growth that would have been recorded for Māori, if we could fix the boundaries around the Māori population consistently over time. Figure A.3 illustrates the possible impact on the income distribution of the change in the composition of the total Māori population. It assumes that most or all of the growth in the 'multiple ethnicity' group was due to the entry of people who were previously outside the Māori population (as opposed to switching categories within it). Figure A.3 is derived by simply reweighting the relative proportions of 'sole Māori' and 'multiple ethnicity Māori' within the 1991 population to match the proportions that existed in 2001. Because Māori who report multiple ethnic identities tend to have higher incomes, the hypothetical compositional shift has an appreciable impact on the income distribution. Of course, we have no way of knowing how realistic this 'compositional shift' scenario actually is because we are unable to track the ethnic categorisation of the same individuals from census to census.

Having identified the likely importance of compositional change as a source of change in the Māori income distribution, it is also important not to exaggerate its significance. There is considerable similarity in the socio-economic profiles, income levels, and income distributions of 'sole Māori' and 'multiple ethnicity Māori'. The numerical results of this paper would change in statistically significant ways if a more stable definition of Māori could be adopted. However, it is very likely that qualitatively similar conclusions would be reached on the direction of change in Māori incomes, the processes of change, and the overall impact on the shape of the income distribution.

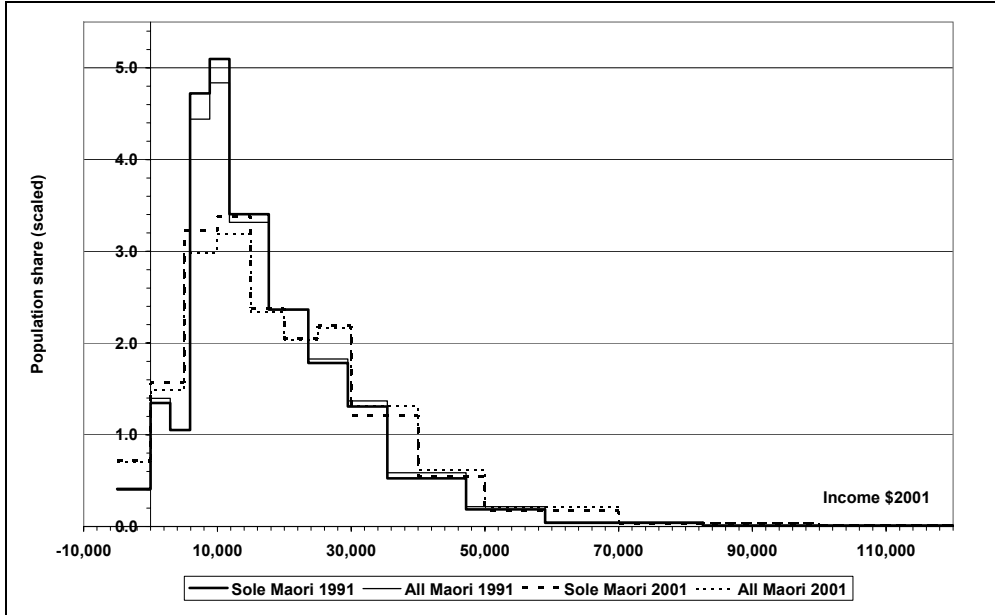**Figure A.1: Comparison of the total Māori and sole Māori income distributions**

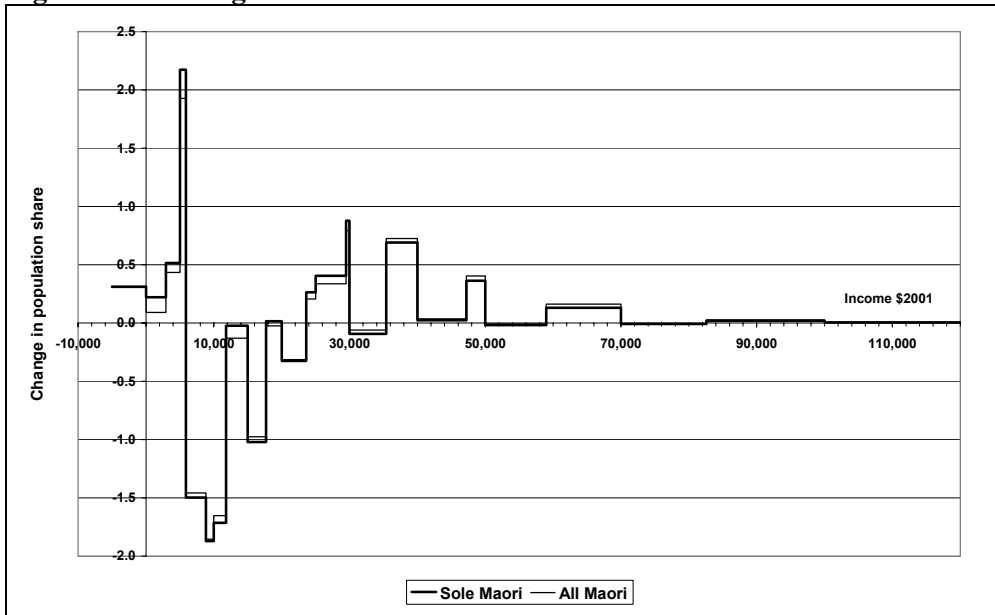**Figure A.2: Change in the total Māori and sole Māori income distributions**

Figure A.3 Possible effect of the change in the sole Māori/mixed Māori composition of the Māori population
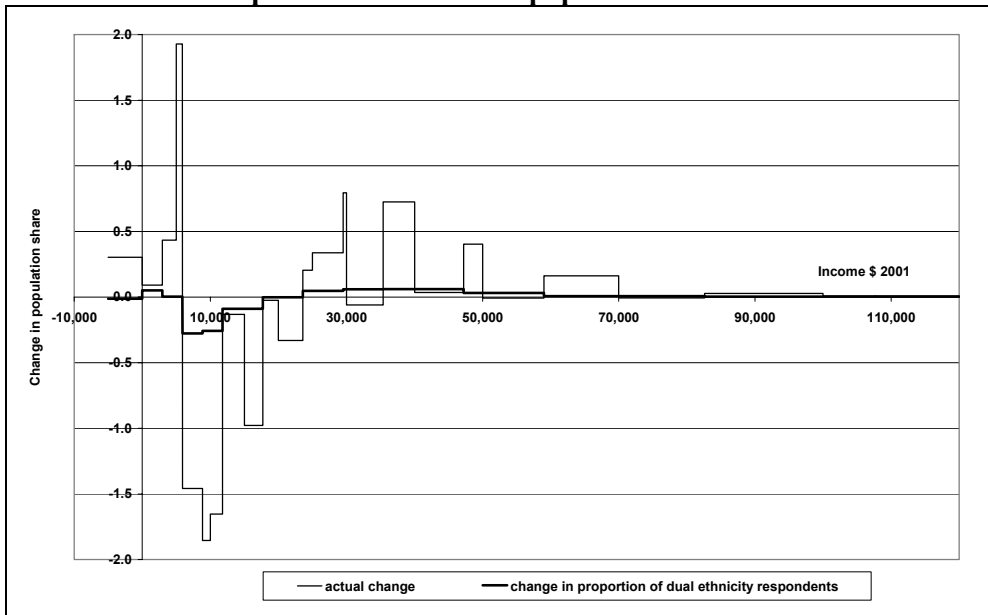
Table A.1: Income-related characteristics of sole Māori

	1991	1996	2001	*Chge*
Ratio women to men	1.04	1.05	1.03	*-0.01*
Mean age	34.6	35.8	37.1	*2.4*
Age group	%	%	%	
20-24	20.3	16.9	14.3	*-6.1*
25-29	19.2	16.6	14.4	*-4.7*
30-34	16.6	16.6	15.3	*-1.3*
35-39	12.8	14.8	15.6	*2.8*
40-44	10.3	11.7	13.9	*3.6*
45-49	7.9	9.6	11.1	*3.1*
50-54	7.2	7.3	8.8	*1.6*
55-59	5.6	6.4	6.6	*1.0*
Parental status and partnership	%	%	%	
Joint parent of dependent children	35.0	31.6	29.6	*-5.5*
Sole parent of dependent children	15.1	16.0	15.7	*0.7*
No dependent children	41.6	46.9	47.2	*5.6*
Family situation unknown	8.3	5.5	7.6	*-0.7*
Residential area	%	%	%	
Main urban	39.1	38.7	39.6	*0.5*
Minor urban	22.2	22.7	23.3	*1.1*
Small town	21.5	21.3	20.5	*-1.0*
Rural	17.1	17.3	16.5	*-0.6*
Highest school qualification	%	%	%	
None	66.3	60.0	55.6	*-10.7*
Fifth form	17.7	14.8	18.5	*0.7*
Sixth form	8.3	9.2	11.6	*3.3*
Higher school qualification	3.8	4.6	6.4	*2.6*
Other or overseas qualification	1.3	0.2	0.4	*-0.9*
Not specified	2.6	11.2	7.6	*4.9*
Highest post-school qualification	%	%	%	
None	71.6	73.0	62.8	*-8.8*
Level unknown	0.0	3.5	4.6	*4.6*
Diploma or certificate	21.2	10.1	13.7	*-7.5*
Bachelor degree	0.9	1.3	2.6	*1.7*
Higher degree	0.4	0.4	0.8	*0.4*
Not specified	6.0	11.6	15.6	*9.6*
Total employment rate	47.8	54.7	60.2	*12.3*
Full-time employment rate	40.8	43.6	48.1	*7.3*
Occupational group	%	%	%	
Managerial	5.3	4.9	6.1	*0.8*
Professional	6.8	6.7	8.3	*1.5*
Technical	6.8	7.0	8.5	*1.6*
Clerical	10.9	9.7	10.0	*-0.9*
Service and sales	12.4	13.2	12.8	*0.5*
Agricultural	8.0	9.3	8.2	*0.2*
Trade workers	8.7	7.5	6.7	*-2.1*
Plant and machine operators	22.1	18.9	18.9	*-3.3*
Elementary	15.8	14.4	11.9	*-4.0*
Not specified	3.2	8.4	8.7	*5.5*
Mean incomes ($)	18,631	19,193	21,266	*14.1*
Mean incomes of employed ($)	25,915	25,070	27,032	*4.3*
Mean incomes of non-employed ($)	11,222	11,342	11,175	*-0.4*
Zero income or loss (%)	1.9	2.8	3.2	*1.3*
Some government income support last year (%)	51.8	50.7	46.0	*-5.8*

Appendix B: Effects of declining rates of response to the census income question

Approximately 7% of working-aged Māori did not respond to the income question in 1991. That proportion rose to 10% in 2001. This Appendix considers the possibility that estimates of Māori income distribution changes, based on the data supplied by respondents, could be biased by selective and rising non-response.

Non-response is not randomly distributed. In all census years, non-response was relatively higher among sole Māori (12% in 2001), females (11% in 2001), young people, people who were unemployed or not in the labour force in the week before the census, people with low levels of formal qualifications, and people who lived in non-private households. More than 60% had a labour force status of either unemployed or not in the labour force. Considering only people whose labour force status was not imputed by Statistics New Zealand, 67% were unemployed or not in the labour force in 1996 and 69% in 2001.

To assess the impact of rising non-response, we estimate the income distribution of non-respondents in 1991 and 2001. We combine those predicted distributions with the actual income distributions of respondents to simulate the 'true' income distribution of all Māori. We then compare the estimated changes in the 'true' income levels and income dispersion of Māori between 1991 and 2001 with the recorded changes.

More specifically, the income distribution of non-responding Māori in each year was predicted using an ordered logistic regression model. We used the following explanatory variables: gender, 5-year age group, marital and parental status, labour force status, whether living in a private or non-private dwelling, the urban/rural classification of place of residence, highest school and highest post-school qualification, hours worked if employed, and occupational group if employed. The regression model was estimated on the sample of respondents to obtain coefficient estimates. These were then used to predict the income distribution of non-respondents. People whose age, sex, or labour force status was imputed by Statistics New Zealand were included in the samples for estimation,

for completeness, and because imputed fields cannot be identified in the 1991 data set. However, we tested the sensitivity of our results in 2001 to the exclusion of some or all of the imputed cases, and found no significant change in results.

Figures B.1 and B.2 show the actual income distribution of respondents, the predicted income distribution of respondents (calculated using the model coefficients), and the predicted income distribution of non-respondents, for 1991 and 2001 respectively. The actual and predicted distributions for respondents are quite close to each other. Non-respondents are predicted to have very different income distributions, with a much larger share of the population located in the negative/zero and $1–$15,000 income bands.

The 'true' income distribution of all Māori in 1991 and 2001 can be estimated as the weighted sum of the proportion of respondents and non-respondents in each income band. In Figure B.3 these are graphed alongside the observed income distributions to illustrate the overall impact of adjusting for non-response.

Figure B.4 compares the change in the observed income distribution over the decade with the change in the estimated 'true' income distribution. Areas plotted above the horizontal axis represent increases in the proportion of people (i.e. increases in the density of the income distribution). Areas plotted below the horizontal axis represent reductions in population shares. Despite the striking differences between respondents and non-respondents, non-respondents do not make up a large enough share of the total population to significantly alter the overall picture of change. Nevertheless, the results suggest that the 'true' Māori income distribution became somewhat more skewed to the left than did the observed one. Less growth occurred in the population with incomes of $30,000 and above, and more growth occurred in the population with incomes below $10,000 a year.

We also estimate the average incomes of non-respondents, using the same midpoints for each income band that are used to estimate the average incomes of respondents elsewhere in this analysis. The predictions generated by the ordered logistic regression model assign each individual a predicted

probability of being in each of the 12/13 income bands. A predicted income for each individual non-respondent can be calculated as the sum of the 12/13 income band means, weighted by that individual's predicted probabilities of receiving each income level.

Results for 1991 and 2001 are shown in Table B.1. The estimated average real income growth of non-respondents is 13.5%, well below the figure of 17.6% estimated for respondents. Average real income growth estimated for the total population (respondents and non-respondent combined) is 16.0%, around 1.5 percentage points below the estimated growth rate for respondents.

The validity of these estimates of non-respondent incomes depends on the assumption that the prediction model used is a reasonable one. In reality, the model could be biased for a number of reasons, such as the existence of unmeasured variables that are correlated with the explanatory variables in the model as well as the error term. To assess the sensitivity of our results to the 'correct' specification of non-respondent incomes, we give estimates of Māori income growth calculated under two hypothetical and extreme assumptions in the final rows of Table B.1. We assume first that all non-respondents had zero incomes, and second that all non-respondents were located in the highest income band. The results obtained are very different from those of our preferred predictive model. They underscore the fact that, due to high overall rate of non-response to the census income question, the choice of a prediction model for non-respondents does in fact materially affect any conclusions that are drawn on Māori income growth.

Figure B.1: Income distributions of respondent and non-respondent Māori in 1991
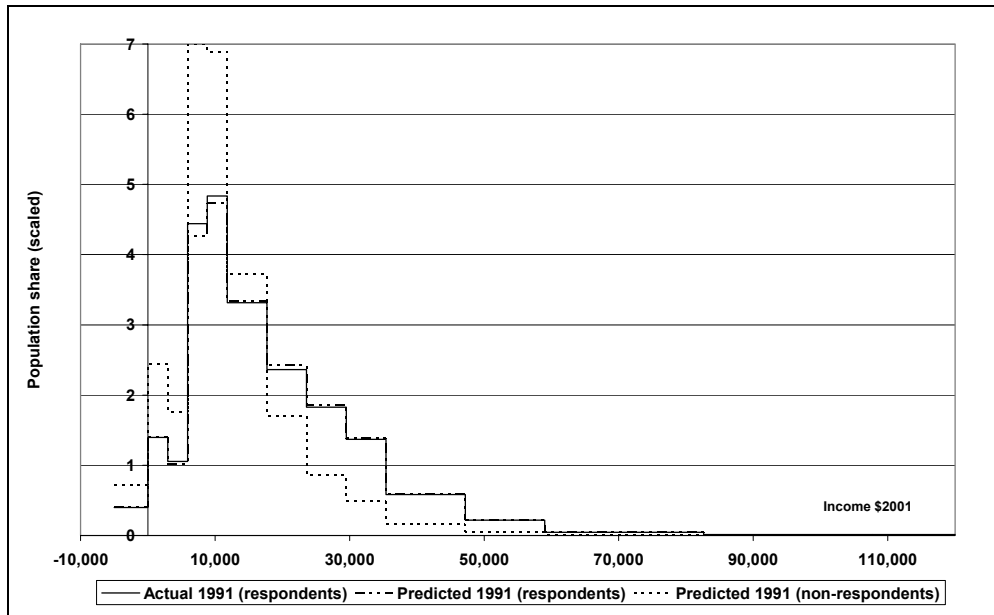
Note: The predicted distributions were estimated using an ordered logistic regression model of income. See text for details.
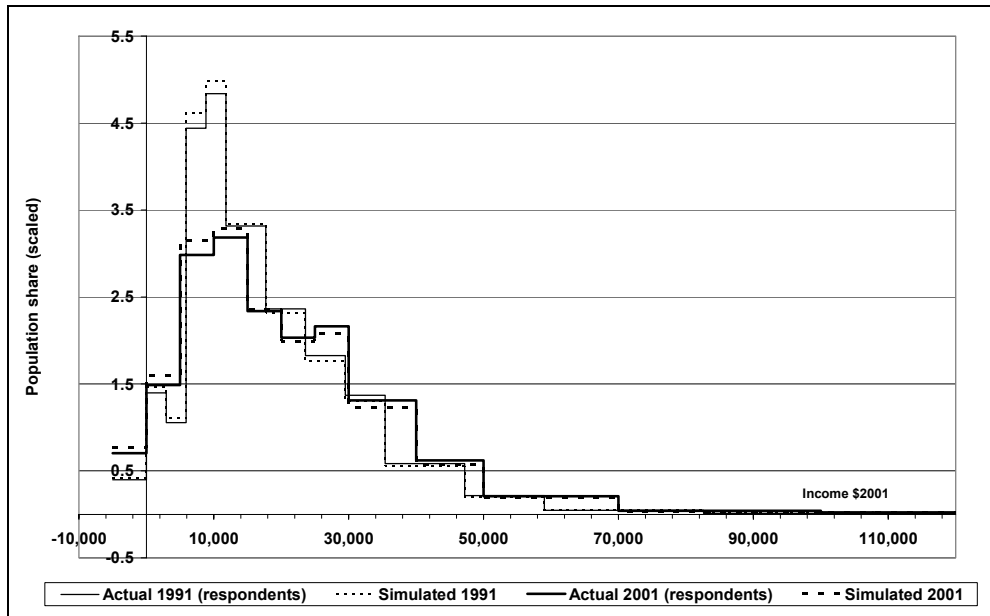

Figure B.2: Income distributions of respondent and non-respondent Māori in 2001
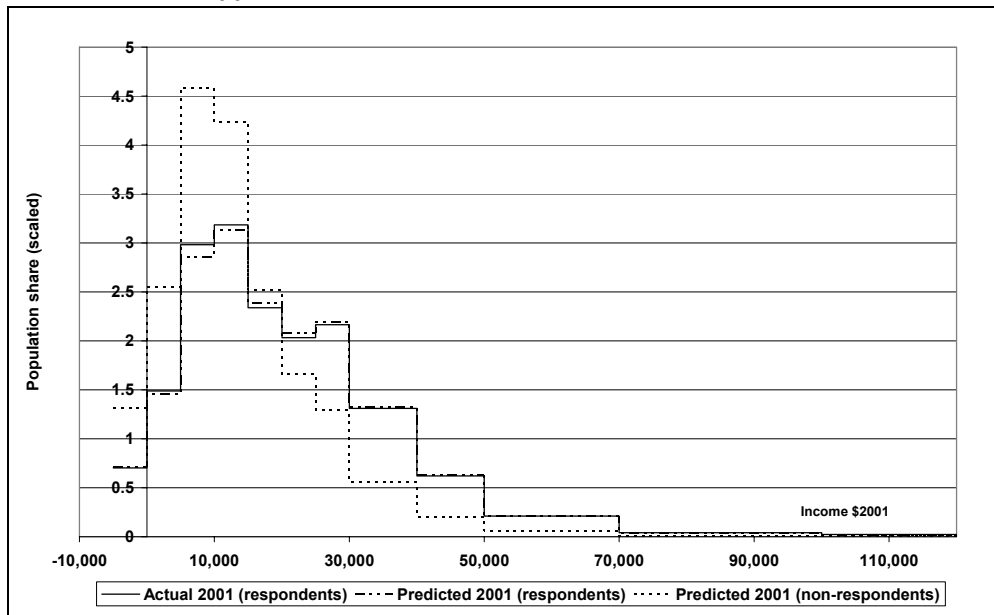
Note: The predicted distributions were estimated using an ordered logistic regression model of income. See text for details.

Figure B.3: Comparison of the observed and estimated 'true' income distributions
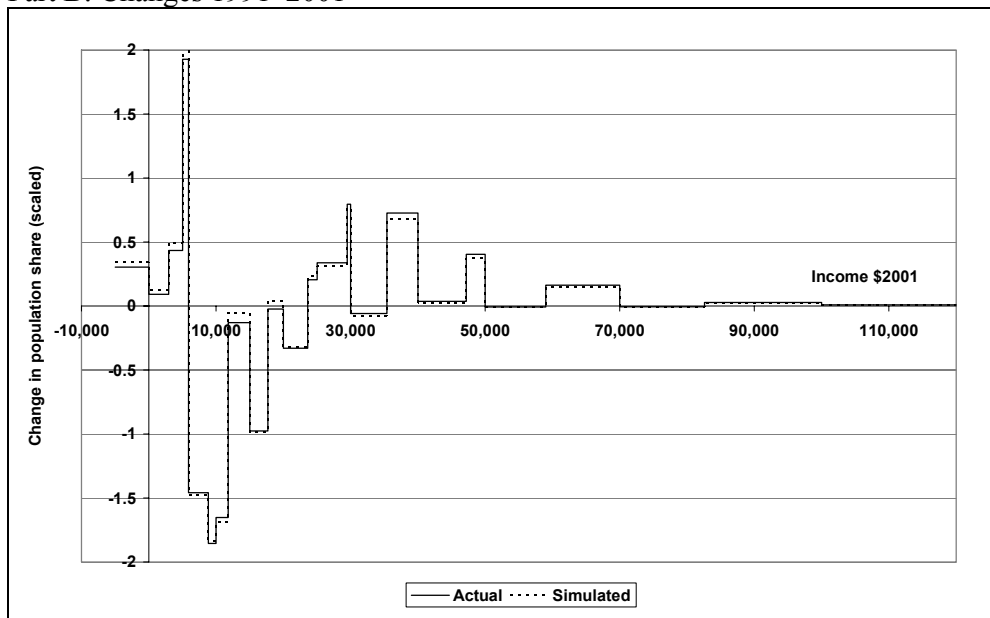
Part A:

Part B: Changes 1991–2001

Table B.1: Estimated average incomes of respondent and non-respondent Māori in 1991 and 2001

	1991 ($)	2001 ($)	Change (%)
Respondents (actual)	19,366	22,778	17.6
Non-respondents (estimated)	12,918	14,661	13.5
Total - using preferred estimates for non-respondents	18,915	21,945	16.0
Males	22,729	26,174	15.2
Females	15,357	18,161	18.3
Extreme case A - setting non-respondent incomes to zero	18,010	20,432	13.4
Extreme case B - setting non-resp incomes to upper band mid-point	26,580	35,942	35.2

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