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Māori-Pakeha Occupational Segregation and Earnings Differentials: A Comment

JOHN D GOULD*

The article by Sutherland and Alexander is important for its topic and resourceful in its analysis (Sutherland and Alexander 2002). The joint authors play perfectly fair in indicating that its scope, though wide, is nevertheless *limited*. But it would not be surprising, in view of the continuing debate on the causes of the Māori/European income "gap", if some participants in that debate were to be tempted to read a wider significance into the paper than the authors claim for it. Major conclusions are that there is "compelling evidence" of anti-Māori discrimination in explaining the skewed profile of Māori occupational distribution, and rather less compelling evidence of discrimination in levels of remuneration once occupational distribution has been determined. This broad thrust is evidently one which will appeal strongly to some discussants in the debate, and be unwelcome to others.

Even if its conclusions were fully acceptable, two limitations of the article's scope should therefore be understood and respected. First, it is not based on the whole Māori population, but only on (a sample of) those who, in reply to an ethnicity question permitting multi-ethnicity responses, chose *only* the Māori option, the group which has come to be known, for convenience, as "Sole Māori". Those choosing the Māori option along with one or more others, "Mixed Māori" (who might with equal justification be called, for example, "Mixed Pakeha" or "Mixed Pacific") are thus not included.

This is important, since it is well established that "Mixed Māori" exhibit on average considerably more favourable socio-economic outcomes than Sole Māori (Chapple 2000:15-18; Gould 1996:176-7; Kukutai 2003: Table 5.2, 55-6). More correctly, the mixed groups Māori/European and Māori/Asian exhibit more favourable outcomes, but the group Māori/Pacific are closer to Sole Māori, and in respect of some outcomes even less favoured (calculated from Statistics New Zealand 2002c:Tables 14b, 16b, 18b, 19b). Had it been

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possible for the authors to extend their inquiry to the Mixed group it is certain that the Māori/European earnings gap to be explained would have been considerably narrower, and probable that the unexplained portion, available to be interpreted as possible evidence of discrimination, would also have been smaller.

Secondly, the article deals only with hourly rates of remuneration for those in paid work. This is in two ways a narrower concept than the "Total Income" of, for example, Census data. First, it excludes unearned and transfer incomes. More importantly, the investigation focuses on hourly wages but does not concern itself with the amount of work performed per head of the total population, except in so far as a dummy variable is included for part-time employment.

Two studies of income differences were recently completed by the writer of this Comment. Both were based on Census data, one dealing with differences between 25 ethnic groups in New Zealand and the other with differences between the Māori populations of 24 Territorial Authorities (TAs). They conclude that a major and in many cases the largest single explanation of these differences is to be found in the varying hours of paid work performed by the populations in question.

For example, at the national level Māori in 2000-01 performed, for every 100 of their population, only about 1390 hours of paid work per week, as against about 1940 hours by non-Māori (Statistics New Zealand 2002a:Tables 1, 1a, 24, 24a, 26, 26a). This was mainly owing to the smaller Māori ratio of those in paid work to total population. In the TA study, an extreme but striking difference is that between Wellington City, the highest income TA for both Māori and non-Māori, and a very low income TA for both, Opotiki. The per capita Māori income in Wellington was about 88 per cent higher than in Opotiki. But the ratio of paid labour force to population was also about 85 per cent higher in Wellington (Statistics New Zealand 2002b:Tables 2a, 12a, 13a). From the similarity of these figures one feels disinclined to look much further for the major reason for Wellington's income advantage. For all 24 TAs the correlation between paid labour force ratio and per capita income was high: $r = 0.826$.

Even if the conclusions of Sutherland and Alexander's article were fully acceptable the limitations in its scope would therefore need to be kept clearly in mind in assessing its contribution to the Māori/Pakeha "gap" debate. The remainder of this Comment will argue that in any event the conclusions are *not* fully acceptable.

Sutherland and Alexander identify two major areas in which anti-Māori discrimination may be at work. First there is *job segregation*, advanced as one reason why the Māori workforce distribution is skewed, in comparison with that of Pakeha, in the direction of under-representation in the more highly-paid occupations and over-representation in the less highly-paid. Secondly, the wage regressions suggest that even when occupational distribution is given, there is *wage discrimination*, Māori receiving, in comparison with Pakeha, lower hourly rates than their "productivity characteristics" (Sutherland and Alexander's term) explain and justify.

From Table 1 in Sutherland and Alexander's paper it seems that the largest sources of the overall wage differential are to be found in their "Merged Groups" (1) and (2), which comprise Occupations (Major Group) (=OMG) 1 to 4, and Merged Group (5), comprising OMGs 8 and 9. The first two Merged Groups generate a particularly large differential for two reasons. Not only are Māori considerably under-represented in them, but the gap of Māori hourly rates below those of Pakeha is much wider in them than in other Merged Groups. Merged Group (5), on the other hand, contributes in only one of these ways, that is, through the Māori workforce being over-represented in these low-paid areas. As for hourly rates of pay Table 1 shows only trivial differences here between Māori and Pakeha, and in two of the four years what difference there is, is in favour of Māori.

So far the evidence is in close agreement with the first of the two studies mentioned above. A further, though less important, point of agreement concerns OMG 6, *Agriculture and Fishery Workers*. Like Sutherland and Alexander, I find this something of a rogue element, difficult to explain and interpret, and Sutherland and Alexander's decision not to merge it with any other OMG but to keep it in a Group of its own is understandable. Without disagreeing with what Sutherland and Alexander do have to say about it, my TA study has nevertheless identified some further tentative explanations of its peculiarities.

There is however reason to query whether Sutherland and Alexander's bracketing of the eight remaining OMGs has been well judged. The levels of average remuneration within them, calculated from Census data, the nature of the work involved, and the qualifications suggested by the Standard Classification of Occupations to be typical (Statistics New Zealand 2001:12), combine to suggest strongly that it would have been sensible to couple together OMGs 3 (*Associated Professionals and Technicians*) and 7 (*Trades Workers*) into Merged Group (2), and OMGs 4 (*Clerks*) and 5 (*Sales and Service*) into Merged Group (3), rather than the 3 with 4 and 5 with 7 which

Sutherland and Alexander adopt.

This is one of several points at which, in reading the Sutherland and Alexander article, one finds oneself suspecting that had the authors devoted more time to preliminary study of published Census data, they could have fashioned a better model before entering the unit record laboratory.

We now address the central weakness of the Sutherland and Alexander article: its logic, unfortunately, is flawed.

The model generates only two possible outcomes:

(A) Job and wage differences which are explained by differing productivity characteristics, corresponding to (a) and (c) on p.164;

(B) Job and wage differences which are not explained by differing productivity characteristics, corresponding to (b), (d) and (e) on p. 164.

But logically, a tripartite rather than a binary division of differences is required:

(X) Job and wage differences which are *in fact* caused by differing productivity characteristics *and which are so identified by the model.*

(Y) Job and wage differences which are *in fact* caused by differing productivity characteristics *but which are not so identified by the model.*

(Z) Job and wage differences which are not explained by differing productivity characteristics.

Sutherland and Alexander interpret (B) as proof of and as a measure of discrimination. The correct measure of discrimination, however, is (Z), and Sutherland and Alexander overestimate it by allocating to (B) some differences which should in fact be in (Y).

There are three chief ways in which such misallocation may have arisen. They are dealt with below in what an educated guess would suggest to be their descending order of importance.

The first particularly applies to the crucial, high income OMGs 1, 2 and 3, constituting Sutherland and Alexander's Merged Group (1) and part of Merged Group (2). The feature leading to the danger of misallocation here is the extremely wide range of occupations and remunerations embraced within these OMGs. For example, OMG 1 (*Legislators, Administrators and Managers*), a one-digit level classification, includes, when one gets down to the Occupations at the five-digit level which compose it, individuals such as New Zealand's Ambassadors and High Commissioners (11,213), the Permanent Heads of Government Departments and of NGOs, such as the

Secretary to the Treasury and the Governor of the Reserve Bank (11211), and the CEOs and Managing Directors of New Zealand's largest private sector companies (11311). But at the same five-digit level it also includes the managers of modest motels and caravan parks in small seaside resorts (12264 and 12266). The average remuneration attaching to such specific jobs must surely differ enormously, yet the Sutherland and Alexander model cannot distinguish between them or take any note of by how much and why Māori and Pakeha distributions might differ amongst them.

There is no disagreement that this is the area of the labour market where educational level and experience count for most. But again, the Sutherland and Alexander model's specification is inadequate. The independent variables include only three levels of educational qualification (apart from the No Qualifications of the reference group), the highest of which is a university degree. There is no further disaggregation, for example by level or field of study. To Sutherland and Alexander, a degree is a degree is a degree.

Yet the annual Reports of the New Zealand Vice-Chancellors' Committee show repeatedly that different levels and fields of study of degree holders entail large earnings differences. For example, the Report on the year ending December 1999 listed the upper quartile salary for Masters or Ph.D. graduates in the Health field as $99,000, while for the upper quartile Bachelor degree in Physical Sciences it was only $29,580 (NZVCC 2000:40, 83). If then Māori degrees are differently distributed from Pakeha degrees, as we know from both Census and University data that they are, contrasting salaries will result. But income differences arising from this cause cannot be captured by the model and are accordingly bundled by Sutherland and Alexander into (B), whereas they should properly be in (Y).

A similar failure to disaggregate far enough involves vocational qualifications (which indeed are not even mentioned, *eo nomine*, in the definition of the independent variables in Table 3). Yet Census tables make clear that the median income of those with a Skilled Vocational Qualification exceeds that of those with only a Basic Vocational Qualification by 50 per cent (Statistics New Zealand 2002d:Table 12). Again, there are significant differences in the distribution of such qualifications between Māori and Pakeha which, if the model were set up to capture them, would provide non-discriminatory explanations of some of the income differences noted.

In arguing the need for more disaggregated specifications of the Qualifications variables (which, not unexpectedly, seem to do the lion's share of the explaining) one acknowledges the problem of sample size, which the authors refer to several times as placing severe bounds not only on the scope of their article but on the reliability of, particularly, the wage regressions.

But it does not seem that the five household type variables included do much explaining, so little might have been lost by reducing their number or even omitting them altogether so as to permit the inclusion of more qualifications variables without losing degrees of freedom.

The second area of concern is the influence of location, which could affect either job segregation or wage differentials in any part of the workforce. The TA study referred to earlier has greatly strengthened the writer's belief that the importance of location has been much underestimated in the "gaps" literature (Chapple 2000:18 is a rare exception). Sutherland and Alexander do show some awareness of this factor by acknowledging "regional variation in concentrations of certain types of jobs" (p.174) and by including a dummy variable testing for residence in Auckland (how defined?), Wellington (how defined?) or Christchurch. Again, more preliminary work on the Census report *Regional Summary* would have identified Auckland City, North Shore City, and Wellington City as the three TAs with the highest proportion in high income OMGs and thus best suited to test the authors' hypothesis. (Not Waitakere or Manukau Cities, and not Christchurch).

The bigger issue here, however, is that in any event the higher proportion of OMG 1 and 2 jobs in the big cities is not very important to Māori, since in the major cities Māori are only a small proportion of the total population (7.4 per cent in Auckland, North Shore and Wellington combined). So it is Māori's own competitiveness, rather than the overall number of such jobs, which limits how many Māori obtain them. In small towns and rural areas, by contrast, the number of such jobs is naturally more restricted, and this does impose a constraint on occupational distribution for Māori and Pakeha alike.

The critical difference then becomes that in the latter areas Māori form a much larger proportion of the population than they do in the big cities, so that the limitation in the number of high income jobs there skews the occupational distribution at the national level more for Māori than it does for Pakeha. A better test of location's influence might thus have been to use a dummy variable for residence in these small town and rural areas, especially the large contiguous areas of high deprivation populations such as the Far North and the area around and inland from East Cape. This corresponds closely with the boundaries of Far North, Opotiki, Gisborne and Wairoa TAs, where in the aggregate Māori are 43.7 per cent of the population. Such a dummy variable would capture the combined effect of the lower availability of high income jobs in these areas interacting with the much higher proportion of Māori residing in them. If the four TAs mentioned

had been found not to contain (in the sample) enough Pakeha to achieve statistical reliability, more high deprivation TAs could have been added. They are excellently identified and mapped in Searle (1994), which agrees closely with my own TA study.

The two foregoing sections have both suggested amendments to the Sutherland and Alexander model which seemed likely to result in an increase in the proportion of the Māori/Pakeha occupational differential and/or wage rate differential able to be explained by productivity characteristics differences, thus reducing the unexplained proportion available to be interpreted as the result of discrimination. The amendments argued for have the further feature in common of appearing to be feasible without abandoning Sutherland and Alexander's fundamental econometric approach. Addressing the issue discussed in this section would have the same goal, but unfortunately does not fully share the feasibility of its predecessors. This, basically, is because the influence alleged, namely preferences on the part of job-seekers for certain types of jobs, does not seem to be readily measureable, and so cannot easily be accommodated in an econometric model. Sutherland and Alexander several times acknowledge the possibility of a work preference influence, but the language they use in referring to it seems to hint that they would not expect it to be, at most, more than a trivial influence. They state, however, that "The variable household type is intended to measure an individual's desire or motivation to work in a particular type of occupation" (p.174). It is not easy to see why it is expected to do this.

The notion that Māori tend to have ethnically distinct preferences for certain types of work was familiar in the nineteenth century. In its modern version it goes back at least to the early years of post-war Māori urbanisation. The writer recalls it being put forward by both Māori and knowledgeable Pakeha in the Young Māori Leaders Conference held in 1959 at the University of Auckland. Amongst the preferences suggested are: a liking for working in a team, preferably alongside other Māori, rather than in a more isolated situation with individual job specifications and responsibilities; outdoor over indoor work, other things being reasonably equal; and a particular aptitude for jobs calling for physical strength and themselves offering what might be termed power-enhancing possibilities: driving heavy trucks, manipulating a bulldozer, and handling power tools.

It has to be remembered that in the classic period of Māori urbanisation, the 1950s and 1960s, New Zealand was notorious for its unusually small wage differential in favour of skilled over unskilled work. In the overfull employment conditions of the time well-paid unskilled work could be had

literally for the asking, a fact which naturally suited young, unskilled Māori men newly arrived from a rural area. Historian James Belich has captured this with admirable insight in *Paradise Reforged*:

> There is some evidence of "occupational clustering" like that of overseas immigrant groups. In the 1960s, three quarters of the men of Ngati Whatua of Orakei were said to have worked for the Auckland City Council. The beer tankers of one of the two large breweries were "almost all driven by Māori" (Belich 2000:473).

The New Zealand economy is of course no longer that of the 1950s and 1960s. But the experience of Māori urban immigrants in those decades implanted, or more likely reinforced, work preferences which it would be unjustified simply to assume to have disappeared as Māori have become more knowledgeable and more sophisticated and the skill premium has increased. Whether they have disappeared, and if not, how strong their influence remains, are things to be investigated, not assumed. Having said that, it may be repeated that, as an educated guess, this is probably the least important of the three areas of possible misallocation reviewed.

One final and obvious point should be stressed. The occupational distribution of a workforce is described in terms of the percentages of the total employed in various occupations. These percentages must add up to 100. If an ethnic group has a smaller proportion in some occupations than other ethnic groups, it must have a higher proportion in some or all other occupational groups. This applies, irrespective of whether the shortfall in the first group or groups is caused by productivity characteristics or by discrimination. There may be no need to look further for the reasons for excess in the remaining groups than simple mathematical necessity.

Though the foregoing discussion of possible inadequacies in the Sutherland and Alexander model is the core of this Comment, the historical context should not be overlooked. Econometrics is not the Holy Grail of historical explanation; it *is* a good servant, but a bad master.

From the wider perspective the only possible verdict on the thesis of widespread job and wage discrimination against Māori must be that it seems highly unlikely. For one thing, there are practical difficulties. Suppose a private company or local authority conceived the idea of cutting costs by practising some ethnic discrimination in its workforce. How could this be achieved? Given that a substantial minority of "Māori", amounting in the 1996 Census to almost one half, describe themselves as Māori/Pakeha, what does the employer do? Does he discriminate against such a job applicant, or

in his favour?

Practical difficulties apart, can one believe that widespread ethnic discrimination in the workplace would go unnoticed in the media? In a book first published in 1991 the distinguished demographer Ian Pool put it in sober and simple language:

> There is ethnic prejudice ... but legislation and a Human Rights Commission give little chance for this to be widely translated into systematic discriminatory behaviour (Pool 1991:136).

Since Pool wrote those words the situation has surely become more transparent, not less. During the last two or three decades Māori have become more and more ready to resort, when confronted by policies or practices which they interpret as ethnic discrimination against them, to legal remedies, to political pressure, and, if these fail, to direct action. Resort to such measures would hardly go unnoticed in the media, particularly since the aim of most complainants in such a situation is precisely to attract media attention. That there is ethnic discrimination in New Zealand is not to be doubted. The shameful exploitation some years ago of some Southeast Asians of dubious immigration status in the Auckland sex industry made headlines, notwithstanding that in this case the interest of the most articulate of those involved was to avoid media attention, not to court it. That the sort of discrimination of which Sutherland and Alexander write, more widespread and systematic, and directed not against Asians of dubious legal status but against New Zealand citizens, should somehow escape notice is very hard to believe.

Sutherland and Alexander are to be congratulated on a thought-provoking contribution, bringing modern techniques to bear on an old theme. Since however the basic strategy is to estimate the extent of discrimination as a residual after all "justified" causes of Māori/Pakeha differentials have been taken account of, it is clearly necessary that *all* such
justifying causes should be correctly identified and measured, so that outcome (Y) can be reduced as close as possible to zero. This Comment contends that this has not yet been achieved, and that to achieve it more disaggregation of both dependent and explanatory variables will be required. This in turn may, admittedly, call for a much larger sample.

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Can We Ever Have Evidence of Economic Discrimination? A Reply

W ROBERT J ALEXANDER*

John Gould (2004) concisely states just why it is so difficult to answer the question: "Can we ever have evidence of economic discrimination?" He correctly identifies "the central weakness" (Gould 2004:4) of Sutherland and Alexander (2002) when he notes that it is necessary that "all 'justified' causes of Māori/Pakeha differentials have been taken account of" (Gould 2004:9) before claiming evidence of discrimination. The clarity of his argument concerning the flawed logic in Sutherland and Alexander (2002) is admirable. Moreover, his stricture to devote "more time to preliminary study" of the data before "entering the unit record laboratory" (Gould 2004:4) ought to be heeded. Nevertheless, I would like to take the opportunity to mount a defence centring largely on the practicalities of empirical work.

The defence falls into three parts. The first has to do with the data. The second, which answers the core of Gould's criticism, concerns the econometric model. The third deals more broadly with some of the difficulties of definition.

Data

Gould's point about taking the time to become familiar with the data before conducting detailed econometric analysis is well made and should be taken seriously. I would argue, in the present instance, that it is even more important to familiarise oneself with the data from the New Zealand Income Survey itself than the Census or other sources. Perusal of published cross-tabulated data from any source is liable to mislead for reasons covered at some length previously in this journal (Alexander and Williams 2001). On the other hand, a clear understanding of the sampling framework of the survey under consideration, including precisely what data have been

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collected, their reliability and limitations, is essential. A good example of this is the care that was taken in Sutherland and Alexander (2002:167-168) in restricting analysis to those individuals who identify themselves as "sole" Māori and "sole" Pakeha. Another is the focus on "earnings" rather than income. Certainly, had Census data on total income been used, as Gould suggests and as has been done by Maani (2002, 2000), any income gap would be narrower. However, given that income includes transfer payments and a disproportionate receipt of transfer payments by Māori would appear to indicate, *prima facie*, greater labour market disadvantage, it is difficult to see such a use of Census data as appropriate in explaining "earnings". Note also that Gould's claim (Gould 2004:2) that variation in income is mainly explained by differences in hours worked is tautological and uncontroversial. It certainly is not evidence *against* the existence of discrimination but rather hints at it.

In the end, just how much time and effort to devote to familiarising oneself with the data before conducting analysis comes down to a cost-benefit analysis. Too much familiarity with any data set may lead one to the conclusion that its limitations outweigh its usefulness. It is probably better to proceed with caution and note the *caveats*. Sutherland and Alexander (2002) can be seen as a part of a research programme begun in Alexander, Genc and Jaforullah (2001). Since that discussion paper appeared, we have continued to refine both our econometric techniques and our understanding of the data set. The project is ongoing, with work currently under consideration for publication elsewhere, but generally we continue to find evidence for discrimination, more strongly for Pacific Peoples than for Māori.

Model

Gould's central argument, which he presents in a clear and jargon-free manner as "logically, a tripartite rather than a binary division of differences" (Gould 2004:4), amounts to what an econometrician would call "omitted variables bias". This is a charge to which any piece of empirical work is always open and Gould drives his point home by enumerating and detailing three potentially important sources of this bias: the level of detail on occupational level, the level of detail on location and the issue of systematically differing ethnic preferences for labour/leisure.

The issues of occupation and location can be dealt with together. At a practical level, the data to which we have access simply do not report occupational classification at the five-digit level, any more than they report location at the statistical mesh-block level. It was not possible to use even the

Income Survey's original nine-way classification of occupational level "because of difficulties of small sample sizes" (Sutherland and Alexander 2002:172). In other work (Alexander, Genc and Jaforullah 2001) the "main centre" dummy was replaced with a more detailed regional council area variable with no impact on other estimated coefficients.

On a more theoretical level, it is not clear how useful it is to study discrimination if one makes too fine a distinction with respect to occupation and location. Would anyone seriously expect to find a significant difference in earned income amongst Judges in the Far North classified by ethnicity, if indeed there were any observations in the relevant categories? For sensible econometrics, one needs a good deal more observations than explanatory variables.

Nevertheless, Gould's point is well taken, especially with respect to education since all degrees are most certainly not equal in the job market. The spirit of the suggestion of dropping household type variables in favour of more detailed qualification variables (thus avoiding exacerbation of the degrees-of-freedom problem) is a good one but founders on lack of data.

The question of whether preferences over labour/leisure differ along the ethnic dimension is surely a more difficult and a more controversial problem. As before, we could seek refuge in the fact that not only does the Income Survey not measure preferences, there is not even any obvious way it could do so. Let us be clear that Gould is suggesting that, were we able to account for the difference in preferences between Māori and Pakeha with respect to paid work, any finding of discrimination would be attenuated. Chapple (2000:13) has put the point this way "Māori may have stronger preferences for leisure or for producing non-market goods than non-Māori". The suggestion is that at least part of what we find as evidence of discrimination is driven by choices made by Māori to take more leisure.

The mainstream view in economics takes preferences or tastes as given or exogenous. It has to be conceded that the type of econometric approach employed in Sutherland and Alexander (2002) makes the assumption that Māori and Pakeha "are equal in their productive capacity *and* their willingness to produce", where willingness to produce "refers to equality in tastes for market work relative to leisure" (Cain 1986:698). Thus, equations are estimated holding constant variables that are believed to affect the outcome (occupational class or wages) and that are believed to be exogenous to the process of discrimination. Two problems arise here. First, are the tastes affected by discrimination, that is, are they at least to some extent, endogenous? Second, are all of the variables affecting the outcome truly

exogenous? The effects of these two problems are intertwined with just what is meant by discrimination and this is taken up in the next section.

Definitional Issues

Gould has no difficulty with the notion that ethnic discrimination exists in New Zealand, indeed it "is not to be doubted" (Gould 2004:9). However, it is not of the sort referred to in Sutherland and Alexander (2002). Māori are not affected. In fact, discrimination against Māori "seems highly unlikely" (Gould 2004:8). Māori are safe from discrimination because of the existence of legislation, the Human Right Commission and their own increasing propensities "to legal remedies, political pressure and, if these fail, to direct action" (Gould 2004:9). Putting aside the rhetorical flourishes, how is it that Gould has noticed that Māori are more and more ready to resort to such activities yet discrimination itself has escaped notice? Is not, as mentioned above, the disproportionate receipt of transfer payments by Māori worth investigation as possible evidence of discrimination in access to the labour market? What about the relatively high proportion of young Māori leaving school with no formal qualifications or relatively high unemployment rates or relatively high rates of incarceration?

It may be that what Gould has in mind when he writes about discrimination is what most people think of as discrimination of a very active variety. An employer who will employ a Pakeha instead of a Māori whenever that is possible could be said to be actively discriminating, or in terms of Becker's (1971) seminal contribution to the economics of discrimination to be exercising a taste for discrimination. It is worth stressing that this is only one form of discrimination. Discrimination that is found in the economic or statistical sense does include this sort of active discrimination, but also more passive discrimination where individuals act without even realising they are discriminating. It includes, too, what can be thought of as feedback from the disadvantaged group, as members of that group change their behaviour in response to their experience of discrimination. For example, if a young Māori person thinks that employers discriminate against Māori then that may cause him or her to become disillusioned with the pursuit of formal qualifications. A finding of discrimination in the economic sense does not indicate that the discrimination is all on the demand side, nor does it say who is to blame. The disadvantaged group suffers the consequences of discrimination, regardless.

To clarify what is meant by economic discrimination, consider the following question. Take "labor services as the good" and "the wage rate as the price" (Cain 1986:695) and ask: "*Under what conditions will essentially*

identical goods have different prices in competitive markets?" By "identical" we mean that workers have the same productivity. Productivity includes the physical production from a worker as well as various worker characteristics such as skill. Most applied economic work in the area of labour market discrimination, Sutherland and Alexander (2002) included, tries to measure the extent of discrimination by estimating the effect of ethnicity on employment, occupational level or wages, holding constant some set of worker characteristics. We ought to be able to explain labour market outcomes in terms of characteristics such as age, experience, location and educational attainment. Ethnicity ought not to matter. Finding that it does, in spite of one's best efforts to control for other factors should raise some concerns.

If one doubts the possibility of discrimination in the labour market, one could always assert that it is possible that some variable such as tastes or motivation has been omitted because of our inability to measure it. Such an argument relies on factors such as these varying in a *systematic* way between ethnic groups. This, in turn, would raise the question as to how such systematic differences could have arisen and whether they were not, to some extent, conditioned on individuals' experiences or perceptions of discrimination. Factors that are conditioned on the process under study (discrimination) are not properly exogenous, so arguably they do not need to be controlled for. Their omission will not bias the outcome of the analysis in favour of finding discrimination.

In addition, it is arguably not by coincidence that members of the minority and majority groups have, for example, different educational qualifications, in that significant elements of discrimination operate *pre*-labour market. Therefore, the extent of discrimination found may be underestimated in consequence of its focus on measuring only labour market and not pre-labour market discrimination. The analysis in Sutherland and Alexander (2002) also takes into account only those Māori and Pakeha who are employed. That is, we do not take into account those who are classified as unemployed or not in the labour force. This introduces the possibility of sample selection bias (Heckman 1979) in the wage regression estimates since it excludes discrimination in the hiring decision at the level of whether one gets a job at all as opposed to what sort of job. Therefore, the extent of discrimination that we measure is restricted to that found once individuals have overcome the initial hurdle of finding some sort of work. In that sense, it provides some sort of lower bound on the extent of discrimination, provided of course that one agrees that no serious contender as an explanatory variable has been omitted.

Conclusion

Inevitably, the reluctant answer to our question "Can we ever have evidence of economic discrimination?" is: Not using the sorts of econometric methods typical in the labour economics literature, for such approaches can never satisfy those who want to continue their search for the factor that will reduce differentials to as close to zero as possible. Econometric approaches can never be immunised against omitted variables bias.

Carefully designed audit studies of the type reviewed by Sidanius and Veniegas (2000:59-60) provide more direct evidence. These sorts of experimental studies present candidates that are equal in all respects save ethnicity (or gender) to a real job selection process. Across 19 studies in five different nations, a significant degree of discrimination against subordinate groups was always found. Of course, one could argue that New Zealand would turn out to be different from the U.S.A, Germany, Britain, Canada or the Netherlands. Such direct evidence would be very valuable. In the present New Zealand climate, considering the likely ethics' committee response to a technique that must involve quite a high degree of deception of subjects, my preference is to continue to attempt to refine the admittedly rather more indirect econometric approach.

By presenting his criticisms, Gould (2004) does us a service. However, keeping these criticisms and all the *caveats* in mind, especially the small sample sizes within certain occupational groupings for Māori, the principal conclusion of Sutherland and Alexander (2002:179-180) is worth repeating: "In each year of the NZIS we find evidence that Māori are over-represented in the lower occupational classes and under-represented in the higher ones, even having taken into account the way in which their age and qualification profiles differ from Pakeha. This finding gives us sufficient concern to call for more extensive sampling of Māori and other non-European ethnic groups in order to be able to establish a firmer and more detailed picture of the types and extent of discrimination in the New Zealand labour market."

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Information Workforce in New Zealand, 1991-2001

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Abstract

We document the size, composition and changes in New Zealand's information workforce over the period 1991 to 2001. The estimates are disaggregated into Māori and non-Māori, male and female, and into major occupational groups. The absolute as well as relative size of the information workforce has continued to grow during the period. While the findings for women in general are encouraging, those for Māori, and especially Māori men, seem less so. Māori remain underrepresented in the information workforce.

New Zealand's push toward a 'knowledge (-based) economy' has received much political attention over the past few years. Debate has focused largely on the importance of creativity, innovation and learning in the economy and society in general. One major way of analysing the changes is to focus on shifts in the occupational composition of the workforce. More specifically, the trend in the workforce away from manual labour toward information-intensive work has been well documented internationally as being an integral component of a nation's shift toward a knowledge-based economy. Originating mainly in the US, "information workforce research" was taken up by the OECD and by researchers around the world (Machlup 1962; Bell 1973; Porat 1977; OECD 1981; Katz 1986; Martin 1998). Although the exact definitions of the information workforce vary, and classifications are somewhat subjective in nature, the different authors by and large apply similar fundamental principles to form individual definitions of information workers.

More than two decades ago Conway (1981) produced detailed estimates of New Zealand's information workforce for the 1971-76 period. In addition, he provided aggregate estimates for the census years from 1956 onwards. Conway's research indicated that in 1976, 35.9 per cent of the New Zealand workforce was employed in information-related occupations. Engelbrecht

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(2000a,b,2001) updated (to 1996) and extended this research by analysing both part-time and full-time employment and by disaggregating the data by gender.

The main objective of this paper is to document the size, composition, and changes within the New Zealand information workforce between 1991 and 2001. Our analysis is complementary to more standard analyses of occupational changes (Department of Labour 2002), providing an additional perspective derived from theories of information economy and society. We use the commonly accepted OECD definition of the information workforce. It defines information occupations as those whose "primary purpose is an output of produced, processed or distributed information, or its infrastructure support" (OECD 1981:22). This definition is wider than those of "information technology workers" and "knowledge workers" often used in current studies of the impact of information and communication technologies (Blumenfeld and Thicket 2003; Lavoie *et al.* 2003).

A significant feature of this paper is the separate analysis of Māori and non-Māori. Ensuring Māori success in the emerging information and knowledge economy is central to honouring the spirit of the Treaty of Waitangi (Frederick and McIllroy 1999). The young age structure of the Māori population and its growth imply that a growing proportion of the workforce consists of those who identify themselves as Māori. In order then for the New Zealand economy to truly expand toward its full potential, Māori must be fully able to actively participate within the changing work environment. The extent to which Māori are employed in the information workforce can be seen as an indicator of New Zealand's national development and degree of social cohesion.

Some General Comments on Māori Labour Market Experiences

In 2001, one in seven New Zealanders identified themselves as being of Māori ethnicity. The Māori population so defined is relatively youthful with a median age of 22 years in 2001, compared to 35 years for the population as a whole (www.stats.govt.nz). It is also growing rapidly (by 21 per cent between 1991 and 2001). In many respects Māori appear to have been a traditionally disadvantaged minority within New Zealand society. Recent government reports including, among others, the widely publicised "closing the gaps" series (Te Puni Kokiri 1998a, 2000a) have established that Māori are economically and structurally disadvantaged across a range of areas. While, to the best of our knowledge, no research has so far been conducted into the ethnic composition of New Zealand's information workforce, a wide

body of literature exists which examines more general labour force trends in relation to ethnicity. Much of this research relates explicitly to the Māori population.

Historically, the migration of many Māori from rural to urban areas subsequent to the Second World War and continuing into the 1950s in search of emerging employment opportunities, meant that Māori tended to enter into low-skilled occupations in industries such as manufacturing and construction (Te Puni Kokiri 1998b). While employment opportunities for all continued to grow in the 1950s and 1960s, the 1970s saw a dramatic slowdown in general economic growth and by the mid 1980s the reforms conducted in New Zealand were accompanied by dramatic job losses. Job losses for Māori were particularly severe as large segments of this population were employed in industries (including manufacturing, meat works, railways and post offices) that were particularly harshly impacted upon. Many of those who had migrated to urban areas were left inadequately skilled for this emerging environment (Waldegrave and Pole 2001). Thus, job cuts and persistently high unemployment levels hit this sector of the community particularly hard.

A key investigation of Māori employment was the report by Nicol and Fisk (1991) that gave a detailed statistical profile of Māori participation in the labour market, incomes and unemployment. Amongst other things, it was noted that the three industrial sectors that experienced job growth during the 1986-1990 period (financing/insurance/real estate, wholesale/retail/trade and community/social/personal services) were the very three sectors in which Māori were underrepresented. Sutherland and Alexander (2002) found compelling evidence of occupational segregation of Māori using statistics from 1997 to 2000. They concluded that even after accounting for differences in age and qualification profiles, Māori are over-represented in lower occupational profiles and under-represented in higher ones.

A variety of explanations for the under-representation of Māori in key occupational groups have been proposed, though all of them remain contentious. One often cited factor is the youthful nature of the Māori population.[1] Disparities in educational attainment, potential labour market discrimination and geographical location of large proportions of the Māori population are other characteristics proposed as explanations for the differences in the performance of Māori and non-Māori in the labour market (Te Puni Kokiri 2000b). On a more positive note, Gibson (2000) concluded that Māori enjoy larger sheepskin effects (ie. wage returns specific to educational qualifications rather than years of education) for signals of high

productivity. Similarly, Maani (2002) found that income returns to qualifications were higher for Māori than for non-Māori.

Census Data, Māori Ethnicity, and Occupational Classification

The employment data used in our analysis are from Statistics New Zealand's five-yearly Census of Population and Dwellings reports. They pertain to people aged 15 years or over, usually residents of New Zealand, who indicated that on census night they were gainfully employed.[2] Our analysis is disaggregated into Māori and non-Māori. Ethnicity is currently defined by Statistics New Zealand as the ethnic group or groups an individual *feels* they identify with or belong to. One's ethnicity is a self-perceived depiction of belonging to one or more ethnic groups. Statistics New Zealand further defines an ethnic group as a social unit whose members share not only a sense of solidarity and common origins but also claim a common and distinctive history and destiny (Lang 2002).[3] The subjective nature of one's ethnicity has led to some problems with the comparability of census data between 1996 and both the preceding Census in 1991 and the subsequent Census in 2001. While the concepts and definitions remained the same for the 1996 census, wording and layout of the questionnaire differed in ways which substantially impacted on the nature of data collected.[4]

The converse of the Māori ethnic category, the non-Māori ethnic group, consists of all respondents who identified an ethnicity, excluding those who indicated they were of Māori ethnicity.[5] The figures provided by Statistics New Zealand also included the categories "response unidentifiable", "response outside scope" and "not stated". For the purposes of occupational classification in this study, all responses in these categories were excluded from the information workforce. However, they were included within the total workforce, as respondents had indicated they were employed full or part-time. The number of respondents included under these three categories combined has increased over the past decade, to account for over five per cent of the total workforce in 2001.

The occupational groupings of respondents are classified according to the New Zealand Standard Classification of Occupations (NZSCO99 for the 2001 Census and NZSCO90 for the 1991 and 1996 Censuses) which has been developed from the 1988 International Standard Classification of Occupations (ISCO-88) (Statistics New Zealand 1999). The NZSCO is a skills-based classification of occupations and jobs where the skills are considered to be an attribute associated with the occupation rather than a

quality affiliated with an individual. An occupation is specified accordingly as "a set of jobs which involve the performance of a common set of tasks" while a job is characterized as "a set of tasks performed or designed to be performed by one individual" (Statistics NZ 1999:11). The average skill level or vocational requirement is the major characteristic used to differentiate between major groupings of occupations.

In an effort to retain comparability with the measurement of the New Zealand information workforce for years prior to 1991, we have continued to use the occupational classifications employed by one of the authors in earlier studies.[6] Information occupations have been divided into five substrata with the first two of these (professional & technical, and administrative & managerial) encompassing what are regarded as high-skilled occupations, and the remainder considered low-skilled occupations.

Empirical Estimates

We report our information workforce estimates for 1991, 1996 and 2001 at an increasing level of disaggregation. First, estimates of the relative size of the total full-time information workforce are presented. Next, differences and similarities between the Māori and non-Māori segments of the full-time information workforce are discussed. The gender dimension is examined next. Finally, the information workforce data are disaggregated by major occupational categories, as well as by ethnicity and gender. We also briefly comment on developments in the part-time information workforce.

New Zealand's Full-time Information Workforce

The vast majority of all those undertaking paid work in New Zealand are employed full-time (for more than 30 hours per week). Table 1 presents estimates of the percentage of the full-time workforce employed in information occupations over the two decades from 1981 to 2001. It has increased steadily from 35 per cent to 47.5 per cent.[7]

Comparing the estimates for 1981, 1991 and 2001, one may be tempted to conclude that the proportion of workers employed in information occupations has not increased as dramatically over the second decade compared to the first. Between 1981 and 1991, there was a 9.6 percentage point increase in the proportion of people employed in information occupations. Between 1991 and 2001, the percentage point increase was just 2.9. Such a growth slowdown would be similar to, but less extreme than, the experience of the US, where growth of the relative size of the information

workforce has been very small since about 1980 (Martin 1998). However, our 44.6 per cent estimate for 1991 is likely to be misleadingly high, because of the high level of unemployment that year which affected non-information workers to a greater extent than information workers (Engelbrecht 2000a,b). The question of a possible slowdown in overall information workforce growth in New Zealand requires further investigation.

Table 1: Relative size of total full-time information workforce

Year	Information Workers / Total Workforce (Per cent)
1981	35.0
1986	38.3
1991	44.6
1996	45.4
2001	47.5

Sources: 1981 and 1986 percentages were taken from Engelbrecht (2000b, Table 1: 268). Percentages for other years were calculated from the 1991, 1996 and 2001 New Zealand Department of Statistics Census of Population and Dwellings reports.

The Full-time Māori Versus Non-Māori Information Workforce

Table 2 reports the division of the total workforce and of the information workforce into Māori and non-Māori. As noted earlier, the 1996 Census results with regards to ethnicity are not considered directly comparable with those for 1991 and 2001. They have nonetheless been included. In 2001, although Māori made up 10.7 per cent of New Zealand's total full-time workforce, they accounted for only 7.8 per cent of its information workforce. Under-representation of Māori in the information workforce has been persistent throughout the 1991-2001 period.

In 1991 there was a 15 percentage point difference between the proportion of Māori and non-Māori employed in information occupations. By the end of the decade this gap had decreased by just under one percentage point.[8] However, there was a 66 per cent increase in the absolute size of the Māori information workforce, compared with only a 20 per cent increase for non-Māori. Clearly, starting from a lower base and in terms of actual numbers, the Māori information workforce has been growing faster than the non-Māori information workforce.

Table 2: Total Māori and non-Māori full-time information workforces

	Total Workforce		Information Workforce		% Information Workforce	
Year	Māori	Non-Māori	Māori	Non-Māori	Māori	Non-Māori
1991	96,942	1,051,470	29,724	482,871	30.7	45.9
1996	133,929	1,103,733	42,927	522,807	32.1	47.4
2001	141,597	1,173,852	49,311	577,458	34.8	49.2

Source: Calculated from the 1991, 1996 and 2001 New Zealand Department of Statistics Census of Population and Dwellings reports.

Adding the Gender Dimension

Disaggregating the data in Table 2 by gender provides important additional insights into the composition of the Māori versus non-Māori full-time information workforce (see Table 3). In particular, the very low proportion of the male Māori full-time workforce employed in information occupations stands out (about 25 per cent in 2001 compared to about 43 per cent for non-Māori men). Moreover, although for non-Māori alike the gender differences are pronounced, they are greater for Māori.

Table 3: Full-time Māori and non-Māori information workforces (total and by gender)

		Male		Female		Total	
		Māori	Non-Māori	Māori	Non-Māori	Māori	Non-Māori
1991	Total Workforce	60,657	671,898	36,288	379,566	96,942	1,051,470
	Info. Workforce	13,260	268,968	16,440	213,897	29,724	482,871
	% Info. Workforce	*21.9*	*40.0*	*45.3*	*56.4*	*30.7*	*45.9*
1996	Total Workforce	81,873	687,375	52,056	416,355	133,929	1,103,733
	Info. Workforce	19,308	286,290	23,574	236,487	42,927	522,807
	% Info. Workforce	*23.6*	*41.7*	*45.3*	*56.8*	*32.1*	*47.4*
2001	Total Workforce	84,630	718,413	56,967	455,439	141,597	1,173,852
	Info. Workforce	21,270	308,082	28,029	269,382	49,311	577,464
	% Info. Workforce	*25.1*	*42.9*	*49.2*	*59.2*	*34.8*	*49.2*

Source: See Table 2.

Māori women are significantly more likely to participate in the information workforce than Māori men. This might be in direct correlation with the growth in enrolments among Māori women in tertiary institutions. Between 1991 and 1996 female enrolments more than doubled, with women

comprising 58.8 per cent of all Māori tertiary students in 1996 (Statistics New Zealand 1998). The flow-on effect of these tertiary trained women entering the workforce might have helped boost the proportion of Māori women in the information workforce.

Full-time Information Workforce by Ethnicity, Gender and Major Occupational Categories

The disaggregation of our information workforce data by five major occupational categories is shown in Table 4. It can be seen that for the high-skilled information occupation category "professional and technical", the percentage of the information workforce accounted for by Māori and non-Māori has been very similar.[9] There are larger, but slowly shrinking differences, in the proportion of Māori and non-Māori in other major occupational categories.

The administrative and managerial component of the Māori information workforce is considerably smaller than that for non-Māori. One possible reason for this could be the youthful nature of the Māori population. One may speculate that administrative and managerial positions are often obtained through length of service within a company rather than because of technical ability or education. However, to make definite statements on this issue, the various possible factors should be tested formally using multivariate analysis.[10] Other trends in the data are the fall in the relative size of the clerical category for both Māori and non-Māori, and the rise of the proportion of Māori information workers in sales occupations (in contrast to non-Māori).

When the Māori information workforce data are separated by gender, it is apparent that the larger proportion of women in the information workforce (in 2001, women made up 59 per cent of the Māori information workforce) has had a strong influence on the observed overall trends. Māori women mirror the trends for females in the non-Māori information workforce in all categories with the possible exception of sales workers. The percentage of the female and male Māori information workforce employed in the administrative and managerial and the sales category was consistently less than that of non-Māori throughout the decade.

Table 4: Māori and non-Māori information workforces by major occupational categories (actual number and per cent)

	1991			1996			2001		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
A: Professional & Technical									
Māori	4,428 *(26.9)*	4,425 *(33.4)*	8,865 *(29.8)*	6,726 *(28.5)*	6,264 *(32.4)*	13,017 *(30.3)*	9,417 *(33.6)*	7,497 *(35.2)*	16,911 *(34.3)*
Non-Māori	53,007 *(24.8)*	89,841 *(33.4)*	142,854 *(29.6)*	63,741 *(26.9)*	95,397 *(33.3)*	159,159 *(30.4)*	84,576 *(31.4)*	109,482 *(35.5)*	194,058 *(33.6)*
B: Administrative & Managerial									
Māori	1,446 *(8.8)*	2,550 *(19.2)*	4,005 *(13.5)*	2,466 *(10.5)*	4,083 *(21.2)*	6,555 *(15.3)*	3,519 *(12.5)*	4,608 *(21.7)*	8,127 *(16.4)*
Non-Māori	25,623 *(12.0)*	76,395 *(28.4)*	102,024 *(21.1)*	32,283 *(13.7)*	80,436 *(28.1)*	112,719 *(21.6)*	44,241 *(16.4)*	88,806 *(28.8)*	133,047 *(23.0)*
C: Clerical									
Māori	8,565 *(52.1)*	2,727 *(20.6)*	11,307 *(38.0)*	10,947 *(46.4)*	4,155 *(21.5)*	15,114 *(35.2)*	10,818 *(38.6)*	4,314 *(20.3)*	15,144 *(30.7)*
Non-Māori	101,571 *(47.5)*	31,656 *(11.8)*	133,227 *(27.6)*	99,495 *(42.1)*	35,661 *(12.5)*	135,150 *(25.8)*	95,268 *(35.4)*	38,673 *(12.6)*	133,935 *(23.2)*
D: Sales									
Māori	1,530 *(9.3)*	1,941 *(14.6)*	3,468 *(11.7)*	2,754 *(11.7)*	3,240 *(16.8)*	5,991 *(14.0)*	3,552 *(12.7)*	3,219 *(15.1)*	6,783 *(13.8)*
Non-Māori	29,709 *(13.9)*	55,383 *(20.6)*	85,083 *(17.6)*	36,501 *(15.4)*	59,577 *(20.8)*	96,087 *(18.4)*	40,701 *(15.1)*	56,853 *(18.5)*	97,545 *(16.9)*
E: Production									
Māori	471 *(2.9)*	1,617 *(12.2)*	2,079 *(7.0)*	681 *(2.9)*	1,566 *(8.1)*	2,250 *(5.2)*	723 *(2.6)*	1,632 *(7.7)*	2,346 *(4.8)*
Non-Māori	3,987 *(1.8)*	15,693 *(5.8)*	19,683 *(4.1)*	4,467 *(1.9)*	15,219 *(5.3)*	19,692 *(3.8)*	4,599 *(1.7)*	14,268 *(4.6)*	18,873 *(3.3)*
Total Information Workforce									
Māori	16,440 *(100)*	13,260 *(100)*	29,724 *(100)*	23,574 *(100)*	19,308 *(100)*	42,927 *(100)*	28,029 *(100)*	21,270 *(100)*	49,311 *(100)*
Non-Māori	213,897 *(100)*	268,968 *(100)*	482,871 *(100)*	236,487 *(100)*	286,290 *(100)*	522,807 *(100)*	269,385 *(100)*	308,082 *(100)*	577,458 *(100)*

Source: See Table 2.
Note: The percentages in brackets are breakdowns of the column totals.

As is the case for the total New Zealand information workforce, Māori men do not exhibit the same degree of concentration in a single category (eg. clerical) that is displayed in the female information workforce. Still, in other respects, the male Māori information workforce differs significantly from the male non-Māori information workforce. Māori have experienced a much more rapid decline in the proportion of production workers, particularly

between 1991 and 1996, although it should be noted Māori began the decade with a much higher proportion of the information workforce employed in this category. This may be attributable to the economic recession of the early 1990s, when many Māori men, whose employment was concentrated in manufacturing industries, lost their jobs as protectionist measures were removed (Statistics New Zealand 1998). The changes in clerical workers are similar for the two population strata, but clerical workers constituted a far greater proportion of the information workforce for Māori men than for non-Māori.

When one compares the number of people employed in major occupation categories A and B with those in categories C, D and E, which broadly corresponds to high-skilled versus low-skilled occupations (see Table 5), it can be seen that the proportions of both high-skilled Māori and non-Māori information workers have increased over time, but that the percentage point gap between the two groups has shrunk little.[11] For both Māori and non-Māori, by 2001 more than half of their information workforces were made up of high-skilled people. However, as mentioned elsewhere (Engelbrecht 2001), there might well be inequalities hidden within any of the occupational categories. For instance, Māori might on average be employed at lower levels within occupations compared to others. This possibility cannot be assessed with the data used in this study, but should be kept in mind when interpreting our estimates.

Table 5: High and low-skilled information workers (per cent)

	1991			1996			2001		
Occupation	Female	Male	Total	Female	Male	Total	Female	Male	Total
High-skilled occupations									
Māori	35.7	52.6	43.3	39.0	53.6	45.6	46.1	56.9	50.7
Non-Māori	36.8	61.8	50.7	40.6	61.4	52.0	47.8	64.3	56.6
Low-skilled occupations									
Māori	64.3	47.4	56.7	61.0	46.4	54.4	53.9	43.1	49.3
Non-Māori	63.2	38.2	49.3	59.4	38.6	48.0	52.2	35.7	43.4

Notes: Calculated from Table 4. In each column, the percentages for Māori (non-Māori) add to 100.

The growth in the proportion of high-skilled information workers applies to both males and females, although it has been stronger for the latter, continuing the trend observed in Engelbrecht (2001). Despite this, in 2001, the proportion of the male information workforce classified as high-skilled

was greater than the proportion for females. The majority of the female information workforce (both Māori and non-Māori) continues to consist of low-skilled workers. In comparison to the non-Māori information workforce, Māori females appear to have approximately the same distribution of high- and low-skilled workers in the information workforce. Māori males, however, have a consistently higher proportion of low-skilled jobs compared to non-Māori males, although the difference seems to have diminished over the 1991-2001 period.

Some Comments on Part-time Employment

Finally, we report some general observations on the part-time information workforce. Engelbrecht (2000a,b,2001) analysed its changes over the 1986-96 period. It was shown that the proportion of information workers in the part-time workforce, which were mostly women, had changed little over time, despite the general rise of part-time relative to full-time employment. The conclusion drawn was that the trend toward part-time employment was much weaker for the information workforce compared to non-information work. Estimates reported by Mahon (2002) confirm this trend to the year 2001.

Despite inconsistent growth in the relative size of the part-time information workforce, there has been continual up-skilling, although low-skilled workers remained the majority in 2001. Moreover, the proportion of the total part-time workforce employed in information occupations remains considerably less than the equivalent statistic for the full-time information workforce.

Like its non-Māori counterpart, the Māori part-time information workforce experienced fluctuations in employment throughout the 1991-2001 period. A noticeably larger proportion of the Māori part-time workforce was employed in professional and technical occupations compared to non-Māori. Despite this, the profiles of the Māori and non-Māori information workforces by skill level demonstrate that differences within the part-time workforce are more marked than those in the full-time workforce. Māori of both genders are considerably more likely to be employed in low-skilled part-time jobs than non-Māori.[12] Future research should test explicitly to what extent this is due to age, ethnicity, and education effects, or other factors.

Summary and Suggestions for Further Research

We have documented the continuing trend in the New Zealand workforce toward employment in information occupations. Both the absolute as well as the relative size of the full-time information workforce grew during the 1990s, and there has been continued up-skilling, with highly skilled information workers now accounting for more than 50 per cent of the full-time information workforce. Our findings with regard to women in general in the information workforce are encouraging. Even though New Zealand men continue to dominate the highly skilled portion of the information workforce, the gender balance is less asymmetric now than it was at the beginning of the 1990s. Women are continuing to be more involved in the information workforce, despite a decreasing reliance within this sector on clerical occupations, traditionally a domain dominated by females. Our research has shown that Māori, and especially Māori men, are under-represented in the information workforce. The disparities between the relative sizes of the Māori and non-Māori information workforces and the seeming absence of any significant closing of the gaps in the participation in the information workforce are potentially causes for concern.

The subdued tendency toward information work in the part-time workforce is of some interest. Further research is needed to investigate the reasons for this finding, and to explore whether this trend is likely to persist in future.

Although our estimates are useful in the sense that they give a broad indication of the size, composition and trends of New Zealand's information workforce, they raise many questions, the answers to which lie beyond the scope of this paper. First, further trends in the information workforce should be documented. For example, it would be of interest to dissect more fully the ethnic composition of the information workforce, by including more ethnic groups (Pacific Peoples, Asians, Europeans), and by splitting Māori into sole Māori and mixed Māori. Second, before making definite statements about the persistence (or otherwise) of any gaps between Māori and non-Māori and policies to address them, the data need to be age-standardised. This is particularly relevant because of the younger age structure of the Māori population.[13] Third, whilst we have focused solely on the occupational dimension of the information workforce, it would be of interest to investigate information employment by industry in order to more explicitly assess the impact of structural changes in the economy. Finally, measurement of the information workforce is not the same as explaining the changes in the occupational structure. While some potential explanations were mentioned,

there is a need to relate the observed occupational changes to the many (and often interacting) economic, technological, organisational, social, demographic, cultural and policy factors that caused them. This requires going beyond the descriptive approach and to conduct formal testing of relevant models.

Notes

We thank the two reviewers for their valuable comments that helped improve this paper.

1 However, as pointed out by one of the reviewers, this argument may be fallacious if, like in this paper, the workforce estimates for Māori and non-Māori are not age-standardised. Using age-standardised population data, Jackson (2002) has argued that Māori are gaining a relative advantage from its age structure in relation to education.

2 A person is classified by Statistics New Zealand as being employed if they worked for one hour or more in the previous week for the purposes of pay or profit. Alternatively, they may have worked for one hour or more without pay, but contributed directly to the operation of a family owned or operated farm, business or professional practice. The definition of employed persons also extends to those people who have a job, yet were absent from work in the previous week owing to a variety of possible circumstances such as illness or holiday (see Statistics New Zealand at:http://www.stats.govt.nz). To preserve the anonymity of the data, the count of each category was randomly rounded by Statistics New Zealand to a base of three. This means there may be minor data discrepancies in (and between) the tables presented in this paper.

3 Respondents who identify themselves as belonging to more than one ethnic group are counted in the statistics for all the ethnic groups they identified. For example, a person who identifies with Māori, Samoan and New Zealand European ethnic groups will be included in the statistic for each of these groups. Statistics New Zealand includes respondents in up to six different ethnic groups.

4 In 1996 there was a marked increase in the number of multiple responses to the ethnicity question (15.5 per cent of respondents gave more than one ethnicity response compared to nine per cent in 2001) which resulted in a higher than expected increase in the Māori ethnic group population (Lang 2002). Statistics New Zealand advises that when measuring change over time, ethnicity data from the 1996 census are not comparable.

5 In a self-administered questionnaire such as a Census, not all respondents indicate an affinity with an ethnic group. This leads to the total New Zealand population being the sum of three categories, ie. "Māori", "non-Māori" and "not elsewhere included". The third category includes a relatively small proportion of the population (less than one per cent in 1991 and 2001, and a little over one per cent in 1996).

6 See an earlier version of this paper for a detailed list of the information occupations (ie. Engelbrecht and Mahon 2003:Appendix).

7 The picture is more mixed at the disaggregated level. The ten fastest growing and declining occupations over the period were a mixture of information and non-information occupations (see Department of Labour 2002).

8 Again, before advocating policies to address this apparent gap between Māori and non-Māori, the data should be age-standardised to obtain a more appropriate gap measure.

9 In absolute terms there has been a 91 per cent increase in the number of Māori employed in the professional and technical category over the 1991-2001 period, compared to a 36 per cent increase for non-Māori.

10 We thank the reviewers for pointing this out and again warning us of the danger of drawing premature or unwarranted conclusions from our estimates.

11 This division into high- and low-skilled information workers using broad occupational categories is a common short-cut approach but it is not perfect. For example, occupations 3,144 (air traffic controllers) and 3,311 (securities and finance dealers and brokers) are classified as "unskilled".

12 For further details, see Mahon (2002).

13 Another useful extension would be to calculate "indices of dissimilarity" (Jackson 2002) between sub-groups of the information workforce.

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Growth-Friendly Demography of New Zealand

JOHN BRYANT*

Abstract

New Zealand has, by OECD standards, high birth rates. This has provided New Zealand with a relatively young population and continuing labour force growth. Both these features are, on many accounts, good for economic growth. Yet most discussions of New Zealand's economic performance and its prospects for moving up the OECD income distribution have paid little attention to demography. This paper defines "demography" narrowly as population size, growth, and age-structure, and examines the likely effects on New Zealand' s growth rate in GDP capita, relative to the rest of the OECD. The overall conclusion is future demographic trends are likely to provide New Zealand with a small advantage, relative to the rest of the OECD.

New Zealand has slipped down many OECD league tables since the 1950s, but not the table for fertility rates. In 2000, New Zealand's fertility rates placed it fifth in the OECD, some way behind Turkey and Mexico, but only marginally behind the United States and Iceland.[1] Sustained higher fertility rates generally mean a younger population and continued labour force growth. Many commentators argue that a younger population and growing labour force is good for economic growth. New Zealand's relatively high birth rates may therefore give New Zealand a slight economic advantage over other OECD countries. This needs to be taken into account when assessing New Zealand's prospects for returning to the top half of the OECD. It also needs to be taken into account when assessing the relevance of imported policy prescriptions about maintaining growth rates in the face of an "old age crisis" (World Bank 1994; OECD 1998). Yet demographic trends have received little attention in recent debate on the New Zealand economy.

This paper surveys the likely effects of New Zealand's slightly unusual demographic profile on its prospects for growth in GDP per capita. "Demography" is defined narrowly to mean population size, growth, and age-structure. Some topics that are occasionally included under the heading

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of demography, such as education levels or population "quality", are deliberately excluded. The paper also abstracts away from many country-specific details. For instance, when looking at the effects of population ageing on labour force participation, the paper ignores cross-country differences in age-specific participation rates.

The decision to focus on the demographic basics was taken partly on pragmatic grounds -- the paper needed to be restricted somehow -- and partly in reaction to previous research. Some demographers have been conducting detailed analyses of demographic trends with likely economic significance (Pool 2000; McDonald and Kippen 2001), as have some economists (Bloom 2001). However, the international literature on the economics of population has placed relatively little emphasis on detailed exploration of underlying demographic trends. For instance, of the 30 background papers that the OECD commissioned for its 1998 report *Maintaining Prosperity in an Ageing Society*, none looked specifically at the demographic trends (OECD 1998:138-9). The result is that the pool of stylised demographic facts drawn on by most economic and policy analyses is very limited.

The first part of this paper gives a broad overview of trends in population size and age structure in the OECD, and at the underlying trends in fertility, mortality, and migration. It begins by looking at the OECD as a whole, and then moves on to comparisons between New Zealand and other countries and regions. The second part of the paper combines demography and a little economics. It describes selected demographic trends in more detail and discusses their potential economic significance, including their likely impact on New Zealand's ability to raise its GDP per capita closer to that of wealthier OECD countries. The emphasis of the paper is generally on relative, rather than absolute, GDP levels and growth rates. The paper does not consider the relationship between changing demography and savings, a large topic that has received detailed treatment elsewhere (Hurd 1997; Weil 1997).

The paper concludes that future trends in the proportional share of the working-age population and in the balance between young and old dependants will advantage New Zealand compared to Europe and Japan, but not compared to Australia and North America. The advantage is likely to be relatively small: it would be unrealistic to expect narrowly defined determinants such as population size and structure to have a large influence on a phenomenon as complicated as economic growth. But the predictability of demographic change means that incorporating demography into discussions of future economic prospects can nevertheless be valuable.

The Sample and Data

The paper compares only across countries in the OECD. Most policy discussion concerns New Zealand's position in the OECD income distribution rather than the world income distribution. The paper's approach of holding institutions, income levels, culture, and other determinants of long-run economic performance constant is also more sensible when comparison is limited to the OECD than it would be for a larger, more heterogeneous group.

The paper uses data for all 30 OECD countries. Results are shown for New Zealand, Australia, Japan, and the three groups defined as follows:

Group	Countries included
Europe	Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, United Kingdom
Recently developed countries (RDCs)	Korea, Mexico, Turkey
North America	Canada, United States

Australia is treated separately because the Australian and New Zealand labour markets are closely integrated, and because Australia is the principal country with which New Zealand compares itself. Japan forms its own group, as it does not fit into any of the others. The groupings are based on the conventional criteria of geography and economic similarity. Using these conventional criteria helps relate the results back to the more general policy literature. The groups would be slightly different and the demographic contrast would be more marked if the groups had been assembled on the basis of demographic similarity. France, for instance, would be included with the United States, and Canada would be included with the European countries, on the basis of current fertility rates (France, like the United States, has significantly higher fertility than Canada).

The paper uses "the OECD" as shorthand for "countries that are currently members of the OECD". This leads to a few anachronisms, such as references to the OECD population in 1950, although the OECD was not established until 1961. The justification is convenience.

The demographic estimates and projections are obtained from the United Nations Population Division's online database *World Population Prospects:*

The 2002 Revision.[2] The UN estimates and projections are the only ones available that are sufficiently detailed, consistent, and comprehensive to enable the cross-country comparisons carried out in this paper.

Uncertainty about Future Demographic Trends

The UN projections are not well suited, however, to properly representing uncertainty about future demographic trends. The UN represents uncertainty simply by calculating three different projection variants based on "high", "median" and "low" fertility assumptions, with the median assumption being the UN's preferred estimate. As demographers now emphasise, the traditional variant approach can give misleading results. The only internally consistent and readily interpretable way of representing uncertainty about future demographic trends is to construct fully stochastic population projections (Lutz, Vaupel, and Ahlburg 1998; Bryant 2003a).

Since stochastic population projections with the required level of detail are not available, this paper cannot represent uncertainty in a satisfactory way. The charts in this paper show only the UN's median variant. Warnings are, however, attached to results that demographic principles suggest are particularly uncertain. The paper also avoids spuriously precise statements of the form "Country X's population will begin to decline in year 2037".

Trends in OECD Averages

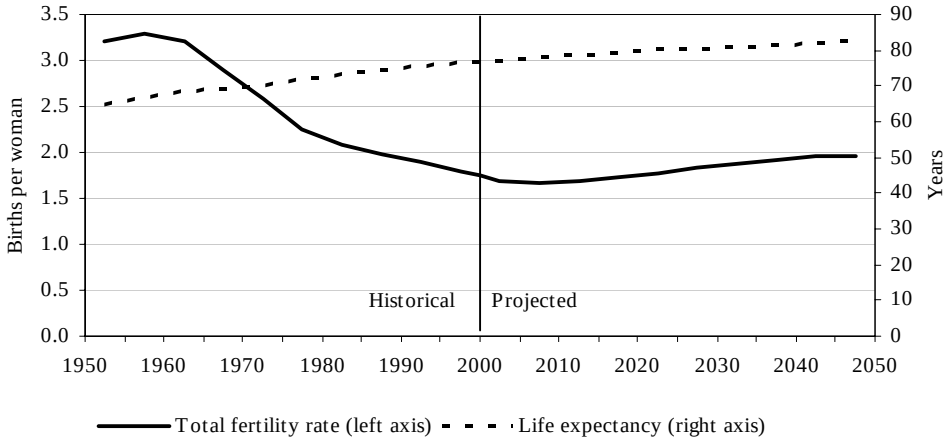
This section averages across the entire OECD, to establish the major trends. The OECD averages shown here are weighted averages, with the weights proportional to countries' populations. The United States, with a 2000 population of 283 million, has by far the largest weight. Cross-country differences are examined in the following section.

Movements in population size and age structure are driven by movements in fertility, mortality, and migration. Figure 1 shows fertility and mortality rates. Fertility is measured using the "total fertility rate". This is the sum of (single-year) age-specific fertility rates; it has an intuitive interpretation as the number of births the average woman would have over her life time if prevailing age-specific fertility rates were to prevail indefinitely. Average fertility has clearly been falling since the 1960s. Fertility rates during the 1950s and 1960s, the height of the baby boom, were in fact higher than they had been for several decades, except in the recently developed countries (RDCs) and Japan. Even in the RDCs, however, the post-war declines in infant and child mortality meant that "net" fertility

was higher than previously. The UN median variant projection shown in Figure 1 assumes that average fertility will rise somewhat in coming decades.

Mortality is measured in Figure 1 by life expectancy at birth. As is apparent in the figure, the UN assumes that gains in life expectancy will be smaller in future decades than they have been in past decades. There are as yet no signs of a slow-down, however, and demographers are increasingly arguing that the UN is underestimating future life expectancies (Vaupel 1997).

Figure 1: Estimates and projections of fertility and mortality levels for the OECD



Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

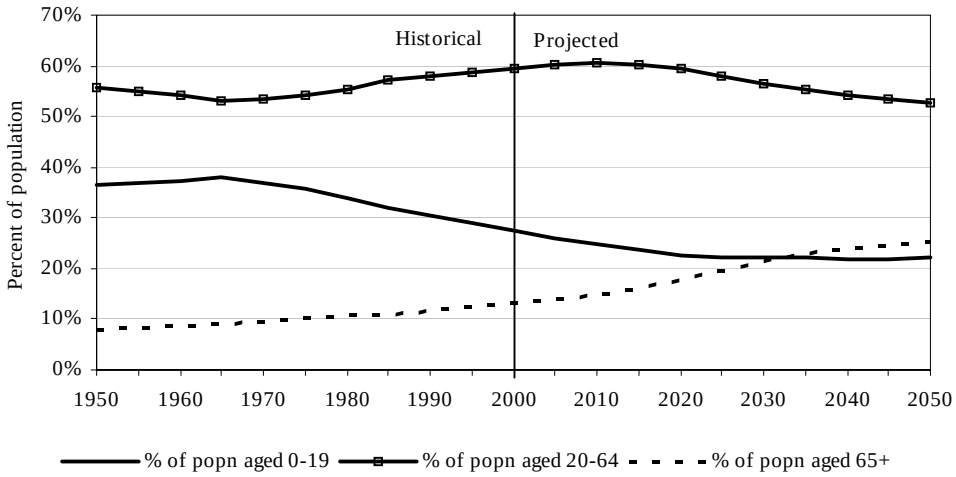
Unfortunately, data on total migration into and out of the OECD as a whole are scarce. The UN's *Population Prospects* online database does show, however, that net migration into "developed regions" in 2000 was about 1.8 migrants per thousand population. Migration on this scale is sufficient to materially affect population growth rates, but not age structure.[3]

Past and projected population sizes and growth rates for the whole of the OECD are shown in the bottom row of Table 1. The OECD as a whole grew steadily over the period 1950-2000, but the UN predicts that in-migration and future improvements in mortality will only partly compensate for lower birth rates, so that population growth will slow markedly in the future.

Figure 2 shows trends in age structure. Note that the working-age population is defined here, and throughout the paper, as ages 20-64, and not 15-64, 15+, or 20+ as is often done. Most 15-19 year olds in OECD

countries are now in education rather than work, so an increase in the size of this age group is more accurately represented as an increase in the "dependent" population than the "working age" population. An analogous argument applies to people aged 65 and over.

Figure 2: Estimates and projections for the age structure of the OECD



Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

Table 1: Estimates and projections of population size and growth rates

	Population in 1950 (millions)	Population in 2000 (millions)	% Mean annual growth rate 1950-2000	Population in 2050 (millions)	% Mean annual growth rate 2000-2050
Australia	8.2	19.1	1.7	25.4	0.6
Europe	350.8	452.7	0.5	379.1	-0.3
Japan	83.6	127.1	0.8	98.7	-0.5
New Zealand	**1.9**	**3.8**	**1.4**	**4.2**	**0.3**
RDCs	68.9	212.3	2.3	289.9	0.6
N America	171.6	314	1.2	417.9	0.6
OECD Total	685.0	1128.9	1.0	1215.2	0.2

Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

The age groups used here and in most other charts in this paper are very broad, to simplify comparisons. This means, however, that only the most pronounced structural changes are visible.

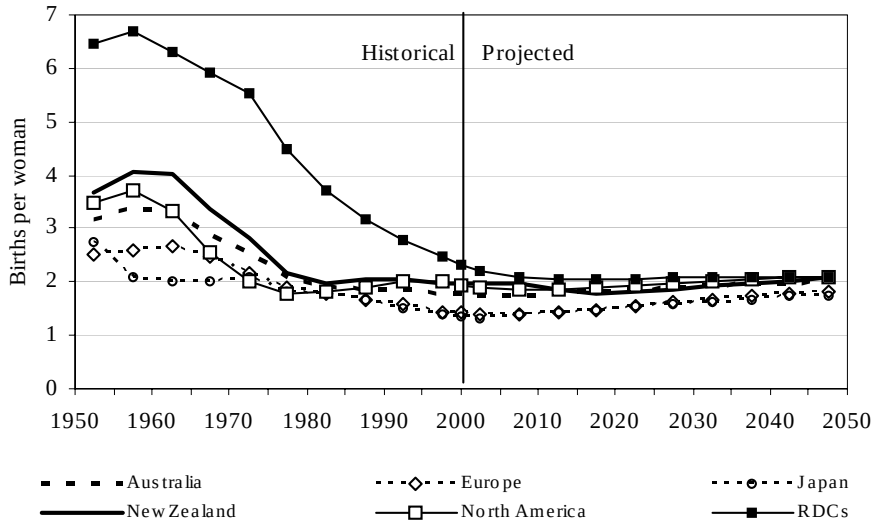
The proportional shares of the three age groups in Figure 2 show the imprint of the baby boom and subsequent baby bust.[4] The proportional share of the 0-19 age group increased, mainly at the expense of age group 20-64, during the baby boom decades of the 1950s and 1960s. From the 1970s, however, the proportional share of the age group 20-64 increased again as the baby boom cohorts began to turn 20. As long as the baby boom cohorts remain in the working ages, the proportional share of 20-64 age group will remain high. From about 2020, however, when the baby boom cohorts start to reach age 65, the proportional share of the 20-64 age group is projected to fall, and the share of the 65+ age group is projected to rise. The low fertility rates experienced since the 1980s have kept the proportional share of the 0-19 group small.

The population waves induced by the baby boom and bust have been occurring simultaneously with a rise in the proportional share of older people, resulting from continuing life expectancy gains. Given that the UN may have underestimated the potential for continued increases in life expectancy, the proportional share of the aged may well turn out to be higher than Figure 2 suggests.

Geographical Differences in Demographic Trends

As Figure 3 shows, the recently developed countries (RDCs) have experienced the highest fertility levels in the OECD. New Zealand has, however, had the highest baby boom fertility rates of the non-RDCs shown, though in the decades since the baby boom New Zealand has had similar rates to North America, and only slightly higher rates than Australia. The UN's median projection implies substantial convergence over coming decades, except that New Zealand, Australia, the RDCs, and North America are assumed to maintain slightly higher fertility than Europe and Japan. Whether New Zealand does maintain higher fertility rates than other OECD countries is, of course, uncertain. It is worth noting, however, that New Zealand has been demographically distinctive for a long time now. And in any case, the effect of any future fertility decline would not be visible in the age structure for years or decades.

Figure 3: Estimates and median variant projections of total fertility rates, OECD countries and regions



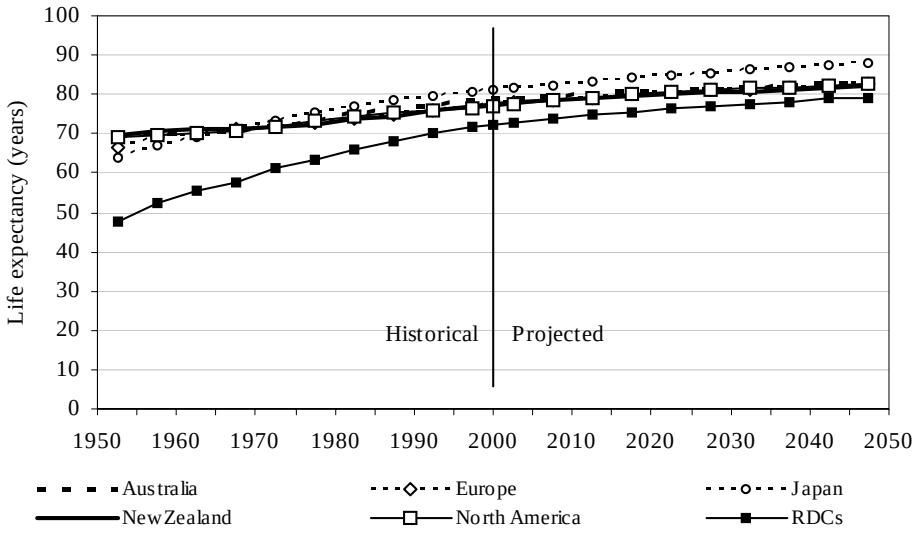
Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

Figure 4 presents estimates and projections for life expectancy. With the exception of Japan and the RDCs, the expectancies are tightly bunched. One demographer even suggests that the group of the 21 biggest and most industrialized countries "is behaving increasingly as if it had a single mortality pattern" (White 2002:74). The UN assumes that life expectancy will continue to grow faster in Japan than in other wealthy countries. Some demographers have, however, questioned this assumption (Wilmoth 1998; White 2002). The UN estimates that in recent years, New Zealand has had net inward migration levels of one to two per thousand. The corresponding figures are three to five per thousand in Australia and North America, one to two per thousand in Europe, zero to one per thousand in Japan, and –2 to –1 per thousand in the RDCs. The UN assumes that migration will continue at approximately these levels.

Geographical differences in population sizes and growth rates are shown in Table 1. The RDCs have grown fastest, followed by Australia, New Zealand, and North America, followed by Japan and Europe. The high growth rates of the RDCs reflect their history of high fertility; the relatively high growth rates of Australia, New Zealand, and North America reflect a combination of relatively high fertility and, in the case of Australia and

North America, high migration. Over the period 2000-2050, the populations of the RDCs, Australia, New Zealand, and North America are projected to continue growing, while the populations of Japan and Europe are projected to shrink. New Zealand's projected growth rate is smaller than that of Australia and North America because New Zealand is assumed to attract less migration. Growth rates differ sufficiently over the period 1950-2050 for the ranking of countries and regions by total population to change: North America overtakes Europe, and the RDCs overtake Japan.

Figure 4: Estimates and projections of life expectancy, OECD countries and regions

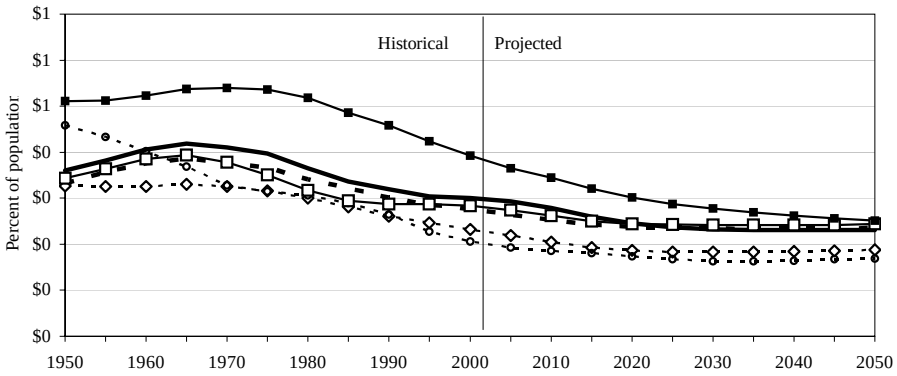


Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

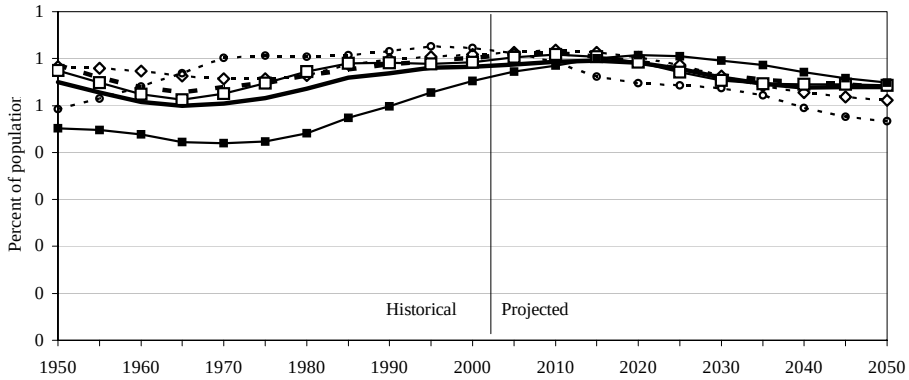
Geographical differences in trends in age structure are summarised in Figure 5. Panel (i) indicates that the countries with the highest fertility rates have the highest proportions in the youngest age group. As Panel (iii) shows, the reverse is true for the oldest age group. Panel (ii) portrays a more complicated situation. Roughly speaking, the countries with the highest fertility initially have the lowest proportion in the working ages, until around 2010, when the order reverses and these countries have the highest proportion in the working ages. This reversal occurs because a decline in fertility initially raises but then lowers the population in the working ages. In all three panels of Figure 5, New Zealand's trajectory is very similar to that of Australia and North America. This immediately suggests that any effects that age structure *per se* has on economic growth will not greatly help nor hinder New Zealand relative to these two places.

Figure 5: Estimates and projections for the age structure of OECD countries and regions

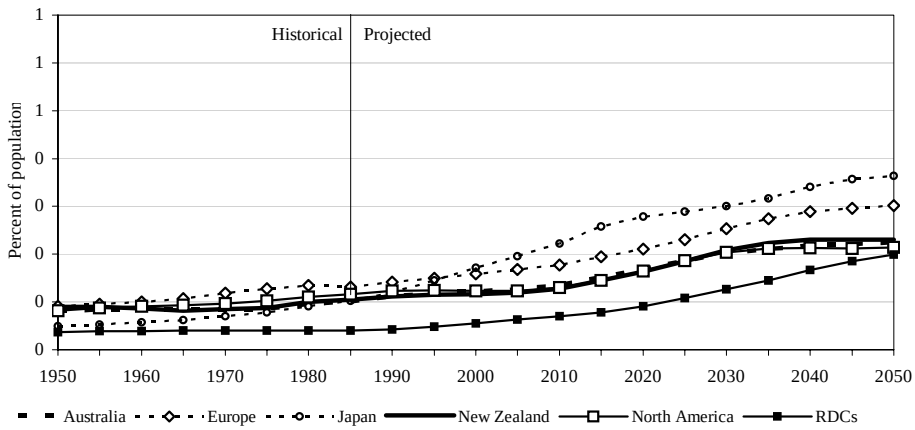
(i) Population aged 0-19



(ii) Population aged 20-64



(iii) Population aged 65+



Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

Effects on Growth in GDP Per Capita

The Framework

The effects of demographic trends on growth in GDP per capita can be approached using the decomposition

$$\frac{Y}{P} = \frac{Y}{H} \times \frac{H}{W} \times \frac{W}{P} \qquad (1)$$

where Y is GDP, P is population, H is hours worked, and W is working-age population. The decomposition implies that per capita GDP is a product of labour productivity, participation (incorporating both employment levels and hours worked), and the proportion of the population in the working ages. If a demographic trend is to affect GDP per capita, it must do so by affecting one or more of these terms.

For some purposes it is useful to look at the effect of demographic trends on growth rates rather than levels. Taking logs of Equation 1 and differentiating with respect to time yields the following equation, where $r_{\frac{Y}{P}}$, for instance, denotes the growth rate of $\frac{Y}{P}$:

$$r_{\frac{Y}{P}} = r_{\frac{Y}{H}} + r_{\frac{H}{W}} + r_{\frac{W}{P}} \quad . \qquad (2)$$

The growth rate of GDP per capita is equal to the sum of the growth rates of labour productivity, participation, and the proportion in the working ages. This equation can be used to decompose historical growth rates, or to project future growth rates.

The Proportion of the Population in the Working Ages and GDP Per Capita

Under the decomposition set out in Equation 1, the relationship between the proportion of the population in the working ages W/P and GDP per capita is purely mechanical. If, for instance, the proportion in the working ages goes from 50 per cent to 60 per cent -- an increase of 20 per cent -- then GDP per capita increases by 20 per cent. An increase in the labour force might be expected to have additional indirect effects, but these must be appear as changes in the H/W and Y/H terms, and not the W/P term. Proportions in the working ages are graphed in Panel (ii) of Figure 5; the values, plus the changes in these values, are summarised in Table 2.

Table 2: Estimates and projections for the proportion of the population in the working ages

	Percentage of population in working ages					Percentage increase* in the proportion in working ages			
	Historical			Projected		Historical		Projected	
	1950	1975	2000	2025	2050	1950-1975	1975 - 2000	2000 - 2025	2025 - 2050
Australia	58.6	54.7	60.1	57.8	54.0	-6.5	9.9	--3.9	-6.6
Europe	58.2	55.7	60.9	58.6	51.2	-4.3	9.3	--3.8	-12.7
Japan	49.3	60.6	62.2	54.3	46.7	23.0	2.6	-12.7	-14.1
New Zealand	**55.0**	**51.6**	**58.3**	**57.8**	**53.9**	**-6.1**	**12.9**	**-0.9**	**-6.7**
RDCs	45.2	42.3	55.2	60.5	54.9	-6.3	30.5	9.5	-9.2
North America	57.4	54.7	59.3	57.1	54.3	-4.7	8.3	-3.6	-5.0
OECD Total	55.6	54.1	59.5	58.1	52.8	-2.8	10.0	-2.4	-9.2

Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

* This is the percentage increase, not the percentage *point* increase. For example, the result for Australia 1950-1975 is calculated as 100 *(54.7 per cent /58.6 per cent -1) = -6.5 per cent .

As discussed earlier, for all countries and regions shown aside from Japan, the proportion in the working ages fell during the post-war baby boom, grew again afterwards, and will fall once more over coming decades. This is apparent in Table 2. Japan's unusual dynamics advantaged it in the past, relative to the other countries and regions shown, but have begun to seriously disadvantage it. The swings in the RDCs are in the same direction as the majority of the OECD, but are more dramatic.

In 1975, the proportion of the New Zealand population in the working ages was only 51.6 per cent, which was 2.5 percentage points below the OECD average, and lower than any country or region shown, other than the RDCs. Since that time, however, the gap between New Zealand and the rest of the OECD has been closing; under current projections the gap will continue to close in the near future. These population movements imply an increase in the growth rate of New Zealand's per capita income, relative to the rest of the OECD. This is one case where New Zealand's demographic profile is delivering it a small advantage over Australia and North America, as well as Europe and Japan.

Growth in the Working-Age Population and Growth in Labour Productivity

The previous section discussed the working age population's proportional share; this section discusses its absolute size. Many economists argue that

the size of the working age population can affect labour productivity, the Y/H term in Equation 1.

Changes in the size of the working age population are shown in Table 3. In all countries and regions, growth slows over time. The projected values for sizes and growth rates are quite sensitive to variations in assumptions about migration, and, over the long run, assumptions about fertility. Given these uncertainties, the most sensible way to interpret the table is probably that New Zealand, Australia, the RDCs, and North America belong to one relatively fast-growing group, while Japan and Europe belong to another relatively slow-growing group.

Table 3: Estimates and projections for the size of the population in the working ages

	Percentage of population in working ages (millions)					Percentage increase in the proportion in working ages			
	Historical			Projected		Historical		Projected	
	1950	1975	2000	2025	2050	1950-1975	1975-2000	2000-2025	2025-2050
Australia	4.8	7.6	11.5	13.6	14.3	58	51	18	5
Europe	204.3	233.6	275.6	260.3	206.7	14	18	-6	-21
Japan	41.2	67.6	79.1	67.3	51.0	64	17	-15	-24
New Zealand	**1.0**	**1.6**	**2.2**	**2.5**	**2.4**	**52**	**38**	**13**	-4
RDCs	31.1	56.9	117.2	162.6	163.1	80	106	39	0
North America	98.5	133.1	186.0	219.0	237.4	350	40	18	8
OECD Total	381.0	500.4	671.7	725.2	674.9	31	34	8	-7

Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

Many models of endogenous economic growth and of agglomeration effects posit a positive relationship between population size or growth and labour productivity. "Population" is used implicitly to mean "working age population", so these models may shed some light on the economic implications of the trends in working age population apparent in Table 3.

Some endogenous growth models assume that labour productivity is positively related to population size or growth simply because more people implies more ideas (Romer 2001). These models are sometimes cited in discussions of population ageing and countries' relative economic prospects. But it is not clear that such models are in fact relevant. After setting up one such model, for instance, Jones (1997:21) warns that "as with many ideas-based growth models, this is a model of growth for the world economy as a

whole...The Belgian economy does not grow solely or even primarily because of ideas invented by Belgians, so the model does not predict that Belgium's per capita growth rate should be related to its population growth rate".

There are other, more plausible, mechanisms through which increased population size could raise a country's productivity. An increase in the pool of workers permits increased specialization, thicker markets, and greater potential for knowledge spillovers. Such effects may be particularly salient for small, remote economies such as New Zealand (Skilling 2001).

However, not all the proposed effects of growth in the working age population are necessarily favourable. Economists have long argued that if labour becomes relatively abundant, its price falls, and employers have less incentive to provide workers with capital or new labour-saving technologies. If labour becomes relatively scarce, the converse is true. A notable formal model of this process has been developed by Romer (1990). In this model, a rise in the supply of labour draws human capital away from the production of research into the production of final goods, which lowers the rate of technical change and hence of economic growth.

There is a large literature investigating the empirical applicability of these models.[5] The remainder of this section looks briefly at some of the macro-level studies of the relationship between growth in the working age population and growth in per capita productivity or incomes.

Several studies focussing directly on the relationship between growth in the working age population and growth in productivity have found the relationship to be negative. Romer (1990:354–7) graphs movements in the working-age population and output per hour worked in the United States over the period 1839–1979 to show that, over periods of 20–40 years, increases in the growth rate of the working-age population seem to induce a one-to-one reduction in the growth rate of labour productivity. He also points out that the incomes of US applied scientists and engineers declined relative to the incomes of doctors, lawyers, and managers during the period of rapid growth in the working-age population in the 1970s and 1980s, just as his model would predict. Little and Triest (2002:145–9) carry out a simple regression analysis on US data for the period 1904–1999, and find a similar effect from growth in the population in the working ages to growth in labour productivity and multifactor productivity. Cutler, Poterba, Sheiner, and Summers (1990:38–45) carry out a regression with fixed country effects on data for 29 high-income countries in the period 1960–85. The relationship between growth in the working-age population and growth in labour productivity varies across specifications, but under all except one

specification an increase in the growth rate of the working-age population of one per cent is associated with a decrease in the growth rate of labour productivity of between zero per cent and one per cent .

Findings such as these imply that the relationship between growth in labour productivity and growth in the working age population can be approximated by an equation of the form

$$r_{\frac{Y}{H}} = a - br_W, \quad a,b>0 \qquad (3)$$

where a and b are constants, and b measures the extent to which growth in the working age population depresses growth in labour productivity. Substituting Equation 3 and the identity $r_{\frac{W}{P}} = r_W - r_P$ into Equation 2 gives

$$r_{\frac{Y}{P}} = a + r_{\frac{H}{W}} + (1-b)\, r_W - r_P \qquad (4)$$

This equation implies that if the productivity-depressing effects of growth in the working age are large, then regressions of growth in per capita GDP on growth in the working age and total population should obtain coefficients for the working age population that are close to zero or negative.

This is not what happens. In their influential study of demography and economic growth in East Asia between 1965 and 1990, Bloom and Williamson (1998) regress growth rates for GDP per capita on growth rates for the working age and total population, and on other possible determinants of economic growth. Under a range of specifications, the coefficient on growth in the working age population is slightly higher than one. This suggests that growth in the working age population did nothing to depress productivity growth. The relevance to the OECD of results from developing countries could perhaps be questioned. Brander and Dowrick (1994), however, carry out a similar analysis on data for 67 middle and high income countries over the period 1960-1985. In their preferred specification, the coefficient on growth in the working age population is also slightly higher than one (Brander and Dowrick 1994:Table 7).

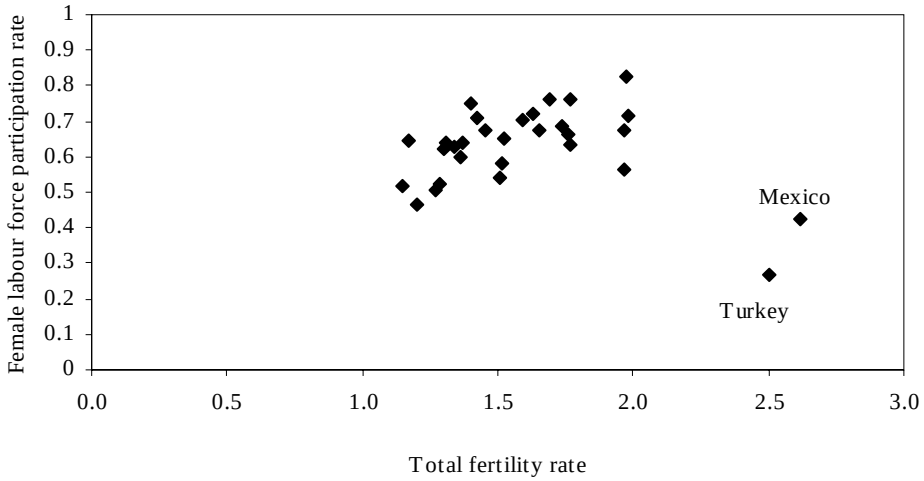
It seems, then, that neither the empirical nor the theoretical literature provide clear guidance on how growth in the working age population affect growth in labour productivity. The significance for New Zealand's labour productivity of the trends shown in Table 3 is therefore uncertain.

Fertility Rates and Female Labour Force Participation

New Zealand and the other countries with relatively young age structures owe these age structures to relatively high fertility rates. High fertility rates might be expected to depress the participation term H/W in Equation 1, on

the grounds that parenthood keeps people out of the workforce. Given the prevailing division of labour between genders, the effect on participation would presumably be most apparent for women.

Figure 6: Female labour force participation rates versus total fertility rates, OECD 2000



Source: OECD *Health* and *Labour Force Indicators* online databases
Note: The female labour force participation rate is defined here as the female labour force as a percentage of the female population aged 15-64.

Figure 6 presents 2001 OECD data on fertility rates and female labour force participation to test these ideas. The two countries with the highest fertility do indeed have the lowest participation rates. But these two countries, Turkey and Mexico, are clear outliers. Among the remaining countries, there is in fact a mildly *positive* association between fertility and labour force participation. This was not always the case: in the 1970s the association was negative (Ahn and Mira 2002). Scholars generally explain the current positive association by pointing to institutional features, such as the availability of childcare, that reduce the incompatibility of childrearing and paid work, and raise both fertility and participation (Rindfuss and Brewster 1996). The reason that Mexico and Turkey fail to conform to these generalizations is probably that they are significantly poorer than any other OECD countries, and have rather different economic and social structures.

The international literature on fertility rates and labour force participation is vast and inconclusive. Given that there is no clear relationship between fertility rates and participation, and that fertility rates have in any case been converging across the OECD (Figure 3), it seems

unlikely that differences due to fertility in participation rates will be an important source of cross-country variation in per capita incomes.

Age Structure of the Working Age Population

Within the working age population, both employment and productivity vary by age. All else equal, a change in the age structure of the working age population implies a change in average participation and productivity levels, the H/W and Y/H terms in Equation 1. Some commentators imply that these charges will be significant (OECD 1998).

The relationship between the age structure of the working age population and average participation levels across the working-age population can be expressed with an equation of the form

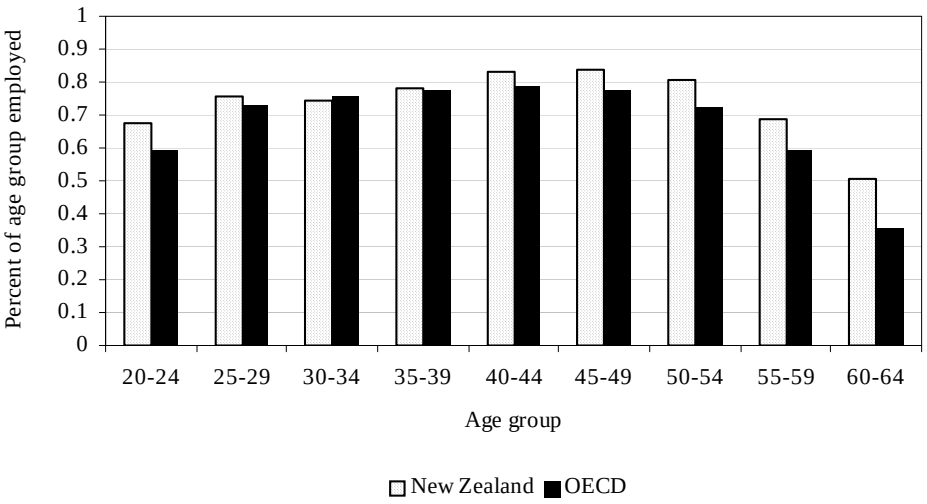
$$\frac{H}{W} = \sum_i a_i \left(\frac{H}{W}\right)_i, \qquad \sum_i a_i = 1 \qquad (5)$$

where $(H/W)_i$ is average hours worked by people in age group i, and a_i is the proportion of the working age population in age group i. A similar equation can be used for productivity, though in this case the a_i measures hours worked by people in age group i as a proportion of hours worked by the whole working age population.

Figure 7 shows the proportion of age groups 20-24 to 60-64 in employment, an approximation of the $(H/W)_i$. Estimates are shown for New Zealand and for the OECD as a whole. Obtaining analogous estimates for productivity is more difficult, since all of the usual measures such as wages or time in employment are flawed in important ways. The standard assumption is that productivity rises and then declines with age (Stephenson and Scobie 2002:9-10).

Are ongoing age structural changes sufficiently large to produce a significant effect on participation or productivity? Table 4 presents data on the age-structural changes. The projected age structures for 2050 are noticeably different from those of 1950: for instance, the proportion of the New Zealand working age population aged 60-64 increases from 7.5 per cent in 1950 to 11.6 per cent in 2050. Changes in other age groups are, however, smaller, and the mean age of the New Zealand working age population rises by only 3.3 years over the century between 1950 and 2050.

Figure 7: Employment ratios by age, New Zealand and OECD, 2001



Source: Calculated from data from the OECD Labour force data online database
Note: Employment ratios are defined here as the number employed full time or part time divided by the population in the age group.

Table 4: Distribution of working age population by age

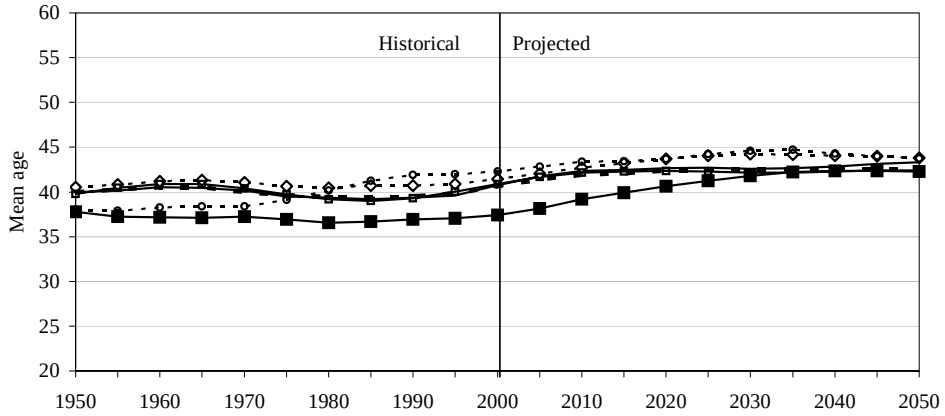
	New Zealand			OECD		
	1950	2000	2050	1950	2000	2050
20-24	13.3	11.2	10.7	14.6	12.1	10.7
25-29	13.6	11.8	10.1	14.0	12.6	10.8
30-34	13.0	12.7	9.8	11.4	12.7	10.9
35-39	13.1	14.0	10.4	12.5	12.9	10.8
40-44	12.1	13.1	11.1	12.1	12.2	10.9
45-49	10.4	11.6	11.6	10.7	11.2	11.1
50-54	9.1	10.7	12.1	9.6	10.4	11.6
55-59	7.9	8.3	12.6	8.1	8.5	11.9
60-64	7.5	6.7	11.6	7.0	7.5	11.4
Total	100	100	100	100	100	100
Mean age (years)	40.0	40.7	43.3	40.7	40.7	42.9

Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

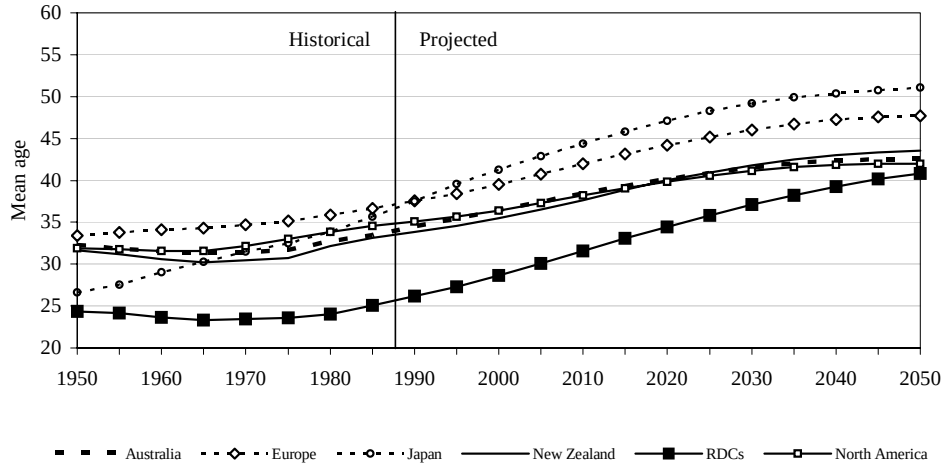
As Figure 8 shows, changes in the mean age of the working age population are relatively small across the OECD, and much smaller than changes in the mean age of the entire population. Similarly, cross-country differences in the mean age are far smaller for the working age population than for the total population. The reason is that most variation across time and between countries in the overall age structure of the population is due to variation at the youngest and oldest ages.

Figure 8: Estimates and projection of the mean age of the working age and total population, OECD countries and regions

(i) Working age population



(ii) Total population



Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

The expression for the mean age of the working age population is $\sum_i a_i m_i$ where m_i is the mean age of people in age group i. This has exactly the same form as Equation 5, the equation for average participation, with the m_i replacing the H/W. The fact that the age structural changes do not have much effect on the mean age therefore suggests that they would not have much effect on the participation rate either. This is indeed the case. If, for instance, the OECD age specific employment ratios shown in Figure 7 are applied to the age structure of the New Zealand population in 1950, the overall ratio is 69.2 per cent. If the same age specific ratios are applied to the age structure in 2050, the overall ratio is 67.2 per cent. The peak occurs in 2000, when the overall ratio reaches 69.9 per cent. The changes are small. Performing the same calculations for other countries yields similar results. In the absence of good estimates of age-specific productivity rates, no such calculations are possible for productivity. But because the relationship between overall rates, age-specific rates, and age structure is essentially the same, there is no reason to believe that the effect of changing age structures on productivity would be any more striking.

The overall conclusion is that the effects of changes in the age structure of the working age population on participation and productivity are likely to be small. There is therefore little scope for trends in the age of the working age population to advantage or disadvantage New Zealand relative to other OECD countries.

Young Dependants and Old Dependants

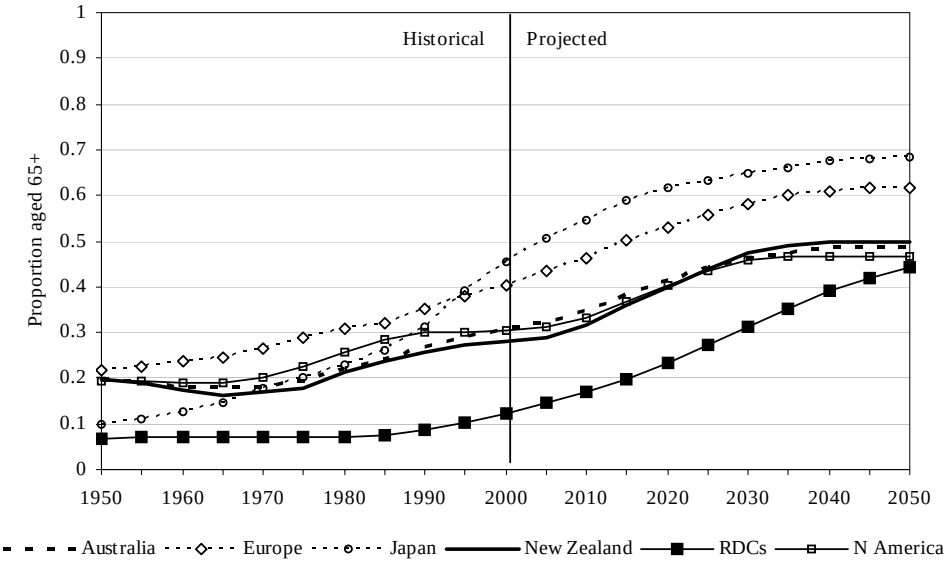
The complements of measures of the population in the working ages are measures of the dependent population. The most frequently-cited such measure is the "dependency ratio", generally defined as the ratio of the population outside the working ages to the population within the working ages. A fall in the proportion within the working ages implies a rise in the dependency ratio. As can be seen in Panel (ii) of Figure 5, the proportion in the working ages is projected to begin falling in New Zealand, and in all the other selected countries and regions, some time within the next 20 or 30 years. However, the projected declines are not large, and would only return most countries and regions to the levels of the 1970s.

As Panels (i) and (iii) of Figure 5 show, the reason the dependency ratio is relatively stable is that increases in old-age dependency are offset by decreases in youth dependency. This implies that the balance between young dependants and old dependants is shifting towards old dependants. Figure

9, showing old dependants as a percentage of total dependants, bears this out. In contrast to the changes in the share of dependants in the total population, the changes in the share of old dependants in total dependants are large. In 1950, young dependants predominated throughout the OECD, but by 2050 old dependants are projected to make up between 60 and 70 per cent of all dependants in Europe and Japan and around 50 per cent elsewhere, including New Zealand. If, as many demographers believe, the UN has underestimated the scope for future mortality declines, then the share of old dependants will be even higher than Figure 9 suggests.

Under current patterns of expenditure, the shift to old-age dependency is probably increasing the amount of resources transferred to dependants by the state. Across the OECD, government social expenditures per old person are much larger than expenditures per young person (Weil 1997:Table 10). Illustrative data for New Zealand are shown in Figure 10. Expenditures increase sharply between ages 60-64 and 65-69 as people become eligible for New Zealand Superannuation, and climb steadily after that, reflecting health care costs. As the share of the population in these high cost age groups increases, overall social expenditures can be expected to rise.

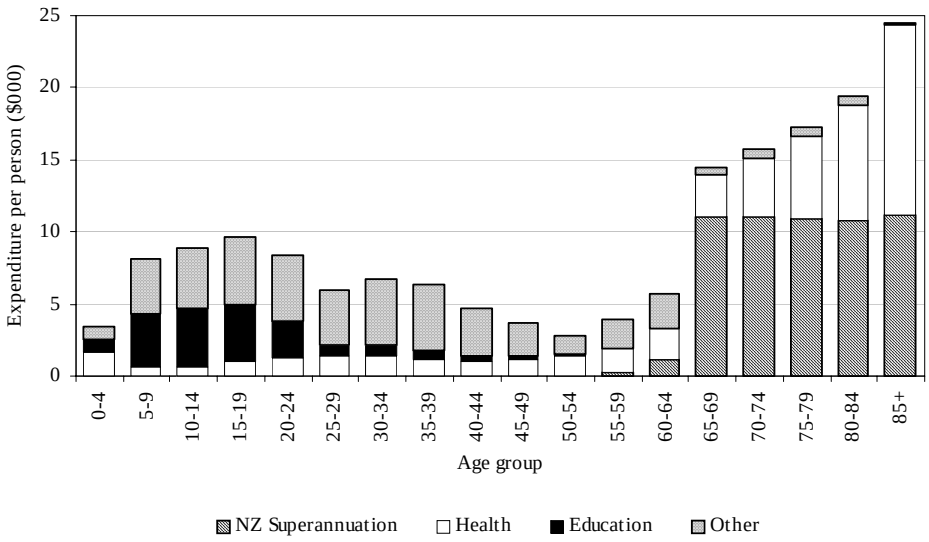
Figure 9: Estimates and projections for the population aged 65+ as a percentage of population aged 0-19 and 65+, OECD countries and regions



Source: Calculated from data from the UN Population Division's *World PopulationProspects* online database.

A recent paper by Razin, Sadka, and Swagel (2002) challenges this conclusion. Razin *et al.* construct a political-economic model in which, under certain parameter settings, an increase in the old-age dependency leads a majority of voters to support a decrease in social expenditures per capita. Razin *et al.* carry out a panel regression using data for 13 OECD countries, and obtain results suggesting that rising dependency is indeed associated with falling social expenditures per capita. Razin *et al.*'s regression does not, however, distinguish between changes in overall dependency due to rises in old age dependency and changes due to falls in youth dependency. When Razin *et al*.s regressions are adjusted to allow for this distinction, rising old age dependency is found to be associated with rising, not falling, social expenditure per capita (Bryant 2003b). The standard assumption that increases in old-age dependency imply increases in fiscal pressures appears to be vindicated.

Figure 10: Government social expenditure per person per year. New Zealand 2001



Sources: All data apart from health expenditure data were obtained from Creedy and Scobie (2002:Appendix Tables 4 and 5).

Health expenditure data were obtained from the New Zealand Treasury's Long-Term Fiscal Model (www.treasury.govt.nz/ltfm/default.asp). Combined male and female totals were obtained by weighting by population numbers from the 2001 Census, available from the Statistics New Zealand website www.stats.govt.nz.

Governments of countries where a shift towards old-age dependency is creating pressure for increased social expenditures face unpalatable choices: holding expenditure down regardless, cutting other areas of government expenditure, raising taxes, building up debt, or doing some combination of the above. There is, of course, extensive debate among economists about the extent to which these various measures reduce welfare or reduce participation and productivity. For instance, some critics of the World Bank (1994) report *Averting the Old Age Crisis* argue that the Bank exaggerates the harm done by higher tax rates (Beattie and McGillivray 1995). The Bank has, however, stood its ground (James 1996). Indeed, it is hard to believe that increased taxes would not have some effect on participation or investment decisions, and that increased public expenditure on pensions and health care would not partly crowd out productivity-enhancing public expenditure on infrastructure, schools, and research. To the extent that fiscal pressures do threaten participation and productivity, the somewhat lower old-age dependency rates in New Zealand, Australia, the RDCs, and North America are likely to give them a slight economic advantage over Europe and Japan.

Conclusion

UN estimates and projections for the OECD over the period 1950-2050 show population growth slowing, the proportion of the population in the younger age groups declining, the proportion in the older age groups rising, and intermediate age groups left relatively unchanged. For most purposes, the countries and regions considered in this paper fall into two groups, with New Zealand, Australia, the recently developed countries, and North America in one "high fertility" group, and Europe and Japan in a "low fertility" group. The slowing of population growth, reduction in the share of the young, and increase in the share of the old are more marked in the low fertility group than in the high fertility group.

Summaries of the paper's conclusions about specific demographic trends and the effect of these trends on New Zealand's GDP per capita, relative to the rest of the OECD, are given in Table 5. As the table shows, neither New Zealand's comparatively high fertility, nor its relatively young working age population, are likely to have much influence on New Zealand's relative economic performance. The fact that the proportion of the population in the working ages will decline less quickly in New Zealand than elsewhere in the OECD (other than the recently developed countries of Korea, Mexico, and Turkey) will be to New Zealand's relative advantage, though the effect is

unlikely to be large. There is much greater uncertainty about the effects of growth in the absolute size of the working age population, and the effect of differences in the balance between old and young dependants. The former may either help or hinder the high fertility countries such as New Zealand, while the latter will almost certainly be of some help, though how much is unclear. The combined effect of the demographic trends is likely to be positive, though the magnitude is uncertain.

Table 5: Summary of specific demographic trends and their effect on the growth in GDP per capita in New Zealand relative to other OECD countries and regions

Demographic trend	Effect on relative GDP per capita
Proportion of population in the working ages projected to decline less in NZ than elsewhere in the OECD, except for the RDCs.	Slight advantage over rest of OECD, other than RDCs, via "population" term W/P. Magnitude of effect moderate but predictable.
Working age population projected to continue increasing over next 20-30 years in New Zealand, Australia, North America, and RDCs, and to decline in Japan and Europe.	Potentially conflicting influences on productivity (Y/H). Positive influences through agglomeration effects, and negative influences through reduced returns to investment in capital and labour-saving technologies. Net effect extremely uncertain.
Fertility levels higher in New Zealand, Australia, North America and RDCs than in Europe and Japan.	Little evidence for common assumption that higher fertility implies lower participation (H/W). Effect likely to be small.
Working age population younger in New Zealand, Australia, North America and RDCs than in Europe and Japan.	Changes in the age structure of the working age population smaller than generally thought, and have only a minor influence on average participation (H/W) and productivity (Y/H). Effect small and predictable.
Old-age dependency low and youth dependency high in New Zealand, Australia, North America and RDCs, compared to Europe and Japan.	Fewer fiscal pressures, and hence less likelihood of tax rises or expenditures cuts threatening participation (H/W) and productivity (Y/H). Effect positive, but highly uncertain.

Assessing the importance of demographic change to growth in GDP per capita currently involves a large element of subjective judgement. It is reasonable, however, to hope that future progress in the economics of population will reduce some of these uncertainties. Of the potential areas for future research indicated in Table 5, the effects of growth in the working age population perhaps deserves the greatest attention. The size of working age population is one variable over which governments can exert significant control, through migration policy. But at present, the research literature gives no clear answers on whether the net effect on GDP per capita of continued labour force growth is positive or negative.

Despite all the uncertainties, however, there is an important sense in which judgements about the importance of demographic change can be less tentative than judgements about other influences on future economic performance. Demographic trends are one of the few social trends for which predictions 20 or 30 years into the future are not just speculative. It is reasonable to expect that demographic trends will help New Zealand gain some economic ground on Europe and Japan, though perhaps not Australia and North America. This serves as a reminder that, for all the disadvantages it may face, New Zealand's economy also enjoys a few advantages.

Recognition of New Zealand's relatively favourable demographic conditions is important when assessing the relevance of imported advice for dealing with the "old age crisis", particularly if this advice originates from Europe or Japan. The differences between New Zealand's demographic conditions and those of Europe and Japan are differences of degree rather than kind. But population issues that deserve urgent attention in Europe and Japan do not necessarily deserve the same attention here. Setting appropriate priorities depends, among other things, on a proper understanding of ongoing demographic change.

Notes

The paper has benefited from comments and suggestions by colleagues at the New Zealand Treasury and by Professor Ian Pool, Population Studies Centre, University of Waikato. The views expressed are the author's, and are not necessarily those of the New Zealand Treasury.

1 This is based on estimates of the "total fertility rate" obtained from the OECD *Health Indicators* online database. The total fertility rate is the number of births the average woman would have over her lifetime if prevailing age-specific fertility rates were to be maintained indefinitely. The OECD estimates are as follows: Mexico, 2.62; Turkey, 2.50; United States, 1.99; Iceland 1.98; New Zealand, 1.97.

2 http://esa.un.org/unpp/

3 This can be illustrated using Statistics New Zealand's projections for the New Zealand population in 2051. Projection Series 3 and 6 use identical fertility and mortality assumptions, but in Series 3 net annual migration is zero, while in Series 6 it is 20,000. Higher migration levels raise population size in 2051 by 30 per cent, but raise the proportion of the population in the age group 15-64 by only three per cent (calculated from Statistics New Zealand, National Population Projections, 2001(base)-2051, Tables 2 and 3, available online at www.stats.govt.nz).

4 A typology and framework for analysing age-structural changes is set out in Pool (2000, 2001).

5 See, for instance, the studies reviewed by Disney (1996) and Hansen (2002).

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Skill Shortages in New Zealand: Public and Private Sector Responses

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Abstract

With New Zealand's continued shift towards a knowledge-based economy, characterised by greater investment in research and development, one of the greatest issues currently facing the country is our ability to attract and retain talented people as a means of encouraging economic growth. This paper critically examines the extent to which a skill shortage exists in New Zealand, and evaluates some public and private sector responses that have been used to address this issue. Findings from the research indicate that New Zealand needs a system of partnerships between employers, government, and training providers to identify industries facing specific shortages, how these might be solved, and to plan for their future needs.

In a speech in November 2000 the Prime Minister asserted "it is educated, skilled, creative and enterprising people who are going to drive New Zealand's future as a nation" (National Business Review 2000:29). As New Zealand continues to shift towards a knowledge-based economy, characterised by greater investment in research and development, one of the greatest issues facing the country is our ability to attract and retain talented people (Colmar Brunton 2000).

The New Zealand government has estimated that the electronic and software industries are the fastest growing industries in the country. However as in many other industrialised countries, New Zealand's high-tech industry is experiencing skill shortages. A survey in June 2000 estimated that New Zealand had an information technology (IT) skill shortage of between 3,000 and 5,000 staff, and that one in five employers needed to recruit staff from overseas to fill positions. New Zealand's health sector also faces difficulties with staff shortages. A total of 4,700 doctors, nurses and other health professionals left New Zealand between 1996 and 2000 (Alexander 2000). The international shortage of nurses, and the strong reputation of New Zealand nursing qualifications overseas, has meant New Zealand staff are highly sought after. In addition, quarterly reports from the

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Department of Labour indicated skill shortages were also occurring in the business services, forestry, and construction sectors in 2000 and 2001 (Alexander 2000; Labour Market Policy Group 2001).

The Government-sponsored "Catching the Knowledge Wave" conference, held in August 2000, reiterated New Zealand's present national focus on the need to attract and retain talent if further economic growth was to be encouraged. Those involved in the conference, predominantly senior business executives, academics and politicians, emphasised the requirement to explore new ways to make use of our knowledge economy to create prosperity in New Zealand society.

One of the primary objectives of the Knowledge Wave conference was to find ways to make better use of immigration as a source of talent. Recommendations included greater emphasis on selection of skilled immigrants in immigration policy, and improvements to current settlement services to help migrants' integration into the labour market and society. Another objective raised during the conference related to efforts to retain New Zealand graduates. Incentives for keeping New Zealand graduates in the country, as well as attracting some back, such as lowering student loan debts and improving funding for tertiary education, were identified. Finally, initiatives to make use of skilled New Zealanders currently overseas, through increased networks and information flows, were also recommended (O'Sullivan and Collins 2001).

The timing of the Knowledge Wave conference, and the high caliber of the people involved, highlighted the national interest in issues of skill shortages and retention of skilled people. However, were these anxieties over skill shortages well founded? The research project, on which this paper is based, was carried out during 2001, aimed to critically examine the extent to which a skill shortage exists in New Zealand, and to evaluate some public and private sector responses that have been used to address this issue.
The specific objectives of the study were to:

i. Examine selected literature and theoretical issues relating to high-skilled migration and labour market segmentation;
ii. Analyse a range of views on the existence of skill shortages in New Zealand and the factors contributing to this problem;
iii. Evaluate some government policies and private sector responses that have been developed to alleviate this problem;
iv. Recommend some strategies that can be adopted to address the issue of skill shortages.

These objectives are addressed in five sections. The first section reviews briefly the current competition for high-skilled labour, with particular reference to New Zealand. The second outlines some theoretical perspectives that have informed the debate about skilled labour migration. In the third section the research methodology is summarised. The main findings from the study are then presented. The final section contains a suggested framework for understanding New Zealand's problem of skill shortages.

A Context

Over the past decade, the increasingly free movement of capital, technology, and goods across national borders has created intensive international competition for skilled labour. Flows of highly skilled, educated workers have become one of the most valuable economic resources, with countries now relying upon workers with specialist knowledge to retain their competitive advantage (Massey 2000; Papademetriou and Yale-Loehr 1996). In addition, declining fertility levels and ageing populations in many countries have meant they require high levels of migration to maintain the sizes of their working populations. Consequently, international labour migration has become a fundamental issue for many nations, both in terms of policy development and international relations. As Papademetriou (2000:1) clearly states, "international migration today touches the lives of more people and looms larger in the politics and economics of more states than ever before".

Management of High-Skilled Migration

Immigration policy generally aims to achieve the best method for selecting individuals who will be allowed to immigrate. With regard to the recruitment of high-skilled labour, attitudes tend to oscillate between two poles. On the one hand the "expansionists" argue that migration of the high-skilled is a positive process that benefits the domestic economy (Birrell 1998). On the other hand, there are the "restrictionists" who view skilled migrants as competitors for scarce jobs, and argue that "skilled migration undermines local training initiatives designed to maximise local opportunity" (Birrell 1998:38; Koser and Salt 1997).

In recent years, as a result of intensified global competition for skilled labour, countries such as the United States of America (USA), Canada, Australia and New Zealand have adopted an "active" immigration policy aimed at enticing skilled people to their countries for permanent residence.

A "points system" similar to the ones implemented by Australia and Canada, was introduced in New Zealand in 1991. This system assesses and ranks prospective migrants on the basis of their qualifications, work experience, age, ability to settle, and English language ability. Furthermore, work permits are issued to allow temporary workers to enter New Zealand to fill short-term skill shortages. These workers are tied to specific employers who must prove they cannot find a suitable New Zealander to fill the position.

Private employers and intermediaries, such as recruitment agencies, also play a significant role in managing migration. The growing number of transnational businesses has led to increases in company-linked labour migration (Ley 2000; Lidgard *et al.* 1995). In New Zealand methods used to bring "brains" to the country include recruitment agencies paying the wages of candidates relocating to New Zealand while they search for employment, and brokers sourcing staff from a wide pool of international talent (Rolfe 2001).

While both the government and the private sector are making active efforts to attract skilled labour to New Zealand, it is important to recognise that the competition from other countries is very strong. New Zealand, a "small player" in the global competition for skilled labour, is not only competing with countries such as the USA, Canada, and Britain, but also directly with Australia. Australia's increasing economic growth relative to New Zealand's, has improved employment opportunities for skilled workers, and created considerable salary differentials between the two countries. This difference in economic growth is likely to mean that a strong trans-Tasman flow of labour to Australia from New Zealand will continue (Birrell and Rapson 2001; Cobb-Clark and Connolly 1997).

"Brain Drain" and Related Issues

Another significant dimension of high-skilled migration is the out movement of highly skilled workers to other countries. In recent years governments in Australia, Canada and New Zealand have become increasingly concerned about the out-migration of their own nationals. Although the numbers of high-skilled migrants leaving may not be large, they can have significant impacts upon certain strategic fields (Hugo *et al.* 2001; Zhao 2000).

In Canada for example, the out movement of highly trained professionals is very selective to certain industries (Zhao 2000). In 1990-91, 40 per cent of the entire Canadian graduate nursing class left for the United States. Consequently, relative to the supply of new graduates, the annual loss has

been relatively large. As a result of this skilled emigration, Canadian taxpayers are the losers. They are the ones who subsidise the education of these skilled people under the implicit assumption that graduates remain in Canada to pay for the next generation (De Vortez 1999). In New Zealand, similar concerns have been raised as increases to the tax rate from 33 to 39 per cent for those earning more than $60,000 contributed to the loss of "the best and brightest overseas" (Morrison 2000:15).

Historically, the term "brain drain" referred to the loss of highly skilled, educated people. It implied negative consequences for the economy of the sending country, while having a positive impact on the destination country. Recent research challenges this notion of a "brain drain", arguing instead that it is more an issue of "brain exchange". The term "brain exchange" acknowledges that the movement of high-skilled workers tends to be temporary and reciprocal, rather than long term. This implies that the people who have gone overseas are not "lost" from their countries of origin. Efforts can be made to attract them back, or make use of the networks they have developed overseas (Glass and Choy 2001; Hugo *et al.* 2001; Lidgard 2001).

The Skills Shortage Debate in New Zealand

This brief overview of the current context for high-skilled migration highlights two issues. First, the problem of a skill shortage can arise if the demand for skilled labour in certain industries exceeds the local labour supply. In this situation, the recruitment of overseas workers may be the best solution. Second, the emigration of skilled workers can intensify the problem. While governments are reluctant to impose regulations to curb emigration, the short-term nature of skilled migration means efforts can be made to facilitate the return of nationals (Hugo *et al.* 2001). While these two issues broadly summarise the problem of a skill shortage in New Zealand, the present skill shortage debate suggests that more complex issues may be involved. Three of these are discussed below.

The Issue of Subjectivity

The existence of a skill shortage is difficult to both define and measure. When an industry experiences skill shortages it sends a signal that particular occupations are in demand. However it takes time for that signal to be picked up and for labour market adjustment to take place. Ideally, measuring the extent of skill shortages requires employers to provide precise data on the numbers, types and duration of job vacancies. Current indicators

of skill shortages however focus on employers' perceptions of vacancies that are "difficult" to fill (Nana *et al.* 1999).

In principle, organisations should, in the first instance, endeavor to fill skill shortages by recruiting within New Zealand. If they cannot, then they can "make do" with less desirable strategies such as recruiting from overseas (Colmar Brunton 2000:4). In reality, employers often recruit from overseas based on a subjective judgement that the skills they require for their organisation are not available in New Zealand. An example of this can be seen in our IT sector. Employers have argued that New Zealand is not producing sufficient numbers of graduates with the required specialist skills and training. However, many New Zealand trained IT graduates in 2000 and 2001 were unable to find work and had to seek employment overseas because New Zealand employers wanted professionals with considerable work experience (Talbot 2001).

Overseas Recruitment Versus Local Training

The mismatch between perceptions of labour demand and supply in the IT sector during 2000 and 2001 seemed to indicate that the necessary skills existed in the labour market. However they were not in demand because employers perceived that they were not available, or because employers were not prepared to invest in up-skilling the available labour to the required level. Training costs both time and money, and the risk of skilled staff being lured away to competing firms both locally and overseas provides a strong disincentive to invest in training. In New Zealand, many firms would rather hire workers who already have the requisite level of skills than pay for training to be carried out (Nana *et al.* 1999). Thus, the Government's scheme in 2001 to "fast-track" foreign IT workers, by allowing them to enter employment in New Zealand without waiting for approval from the New Zealand Qualifications Authority, was arguably a "quick fix" solution that would provide New Zealand employers with a disincentive to train local workers (Oldham 2001:6; Somerville 2001).

Employment Barriers

Although immigration policy has been used as a strategy for bringing in international talent, the success of the policy is contingent on migrants having a good understanding of English and the expertise to establish themselves in New Zealand's economy. Many new immigrants have entered New Zealand and then found themselves unable to gain suitable employment that allows them to make use of their skills (Spoonley and Bedford 2001).

In theory, as countries are becoming incorporated into the global market economy, highskilled workers are presented with new and increased employment opportunities (Bedford 2001; Massey 2000). In reality however, there is a growing international concern that the human capital of high-skilled migrants is not being fully realised. Despite migrants attaining high levels of education and training, issues of culture, language and ethnic differences are leading to the high-skilled immigrants encountering a "glass ceiling that curbs their career development" (Cross and Waldinger 1999: 69). Studies also show that employers' fears of minority groups not fitting the "corporate culture" of their companies, has led to their reluctance in hiring people whose first language is not English, or who are from a different cultural background to locally born job applicants (EEO Trust 1998; Migration Research Group 1999).

The theory of labour market segmentation, which is examined in the next section, provides a theoretical perspective for understanding this phenomenon. It explains why certain groups in the labour force that have the requisite "human capital" to be eligible for high skilled, high salary jobs are prevented from gaining access to this sector of the labour market and remain in lower quality jobs (Morrison 1990). It will be clear from this discussion that the groups confronted by employment barriers are not just immigrants. Local workers who lack the appropriate experience may also face barriers to employment in the "primary market".

Theoretical Perspectives

Theoretical perspectives dealing with high-skilled migration have predominantly adopted a migration systems approach, focusing on the links between the global economy, trade, finance and international demand for labour (Portes and Walton 1981; Sassen 1988). Key actors in shaping the movement of people within this global market economy are transnational corporations and nation states. Borjas' (1989) concept of an "immigration market" identifies states as well as companies as competitors for international skills. In the immigration market, "competing host countries make 'migration offers' from which individuals compare and choose" (Borjas 1989:461). The information migrants' gathered is exchanged and the various options are compared, with individuals finally making the decision either to remain in their country of origin, or to make the more "profitable" move to another country. In this regard, immigrants are considered rational actors who search for the country of residence that "maximises their well-being" (Borjas 1989:461; Skeldon 1997).

Migration Systems and Circulation of Skilled Labour

By adopting a systems approach and focusing on the origin and destination countries from a unified perspective, it is possible to assess the impacts of migration on the exchanges and interactions between countries (Kritz *et al.* 1992; Skeldon 1997). At the macro level, the political economy of the world market, inter-state relationships and the structures of the sending and receiving countries control migration and settlement. At the micro level, informal social networks developed by the migrants are fundamental. These informal networks not only link migrants with other migrants in the receiving country, and encourage the formation of ethnic communities, but also help to maintain transnational family and group ties. Overall, migration systems theorists view the modern world as a single system in which societies are linked to one another in the context of larger economic, political and social networks (Castles and Miller 1998).

The literature on migration systems has been "reticent" about placing the movement of highskilled labour into mainstream migration theory (Koser and Salt 1997:289). The term migration "has connotations of permanency, or at least long-term stay" (Koser and Salt 1997:299). However, in a world increasingly characterised by interdependent flows of capital, goods, information and people, the idea of permanent migration is no longer appropriate (Hugo 1999).

Recent theoretical initiatives have located the movement of high-skilled workers within the context of "brain drain" and "brain exchange" arguments. In the 1970s, literature explained the "brain drain" phenomenon in terms of imbalances in the world system, with the main "push" factor being an oversupply of highly trained personnel relative to the country's capacity to absorb them (Portes 1976). More recent literature has placed increasing emphasis on the "pull" factors, or the demand side of labour migration. Talented and highly educated people are drawn to the large industrialised countries of North America and Europe because of enhanced employment opportunities, higher incomes and higher living standards (Hugo *et al.* 2001). The strength of this development has been to place more emphasis on the roles played by the institutions and employers involved in the actual mobilisation and recruitment of migrants. This in turn links together the needs and aspirations of all the major actors – migrants and their families, employers and governments (Koser and Salt 1997; Kritz *et al.* 1992; Papastergiadis 2000).

A common assumption is that the decision to migrate is a rational choice made by individuals. It is unrealistic however, to expect that individuals

always make rational, economic choices with regards to their movement, especially with regard to return migration in the context of the "irrational" or emotional desire to return "home". Glaser (1978) in his study of "brain drain" argued that highly skilled personnel working abroad are strongly committed to returning to their country of origin. A survey conducted by Lidgard (2001) on return migration of New Zealand nationals further substantiates this argument. The survey "confirmed that strong attachments to people and places in New Zealand play a significant role in the decisions made by New Zealanders to return 'home'" (Lidgard 2001:11). Even if the employment prospects are not as good relative to overseas opportunities, the attraction of friends, family and familiar surroundings is enough to bring people back to their country of origin (Hugo *et al.* 2001; Lidgard 2001). Thus the notion of a "brain exchange" or a "circulation of elites" is more relevant, with the acknowledgement that the movement of high-skilled labour tends to be short-term and reciprocal (Morrison 2001:5).

Labour Market Segmentation

Labour market segmentation is the principal theory underlying the issue of employment barriers facing some skilled migrants. A segmented labour market can be defined as a "labour market divided into two or more separate segments, between which movement is difficult" (Johnston *et al.* 1995:547). Segmentation theory was developed by Priore (1979) primarily to oppose the neoclassical economic assumption that the labour force is homogenous. According to this neoclassical economic theory, the labour market simply "fits different people into different jobs by equating marginal product with wages", thus the "higher the human capital endowment, the higher the wages" (Morrison 1990:491). Labour market segmentation theorists argue however, that a principal problem with neoclassical economic theory is that "there is no simple relationship between the distribution of earnings and the human capital endowment of the employed population" (Morrison 1990:491).

Priore (1979), views the labour market as segmented into two broad categories, with the fundamental difference being the way they are "priced". The "primary market" attracts those with high levels of human capital and encourages them with higher wages and job stability. The "secondary market" on the other hand, allocates the population with relatively low levels of human capital into the low-skilled jobs with little stability, limited benefits and low rates of pay (Massey *et al.* 1998; Portes 1981).

Until the late 1970s, obtaining cheap labour was a significant reason for recruiting immigrant workers. Labour market segmentation theory was

originally applied to explain this phenomenon. Employment in the secondary sector involved unstable, unskilled jobs, with workers being laid off at little cost to employers. Consequently, the low wages and insecure conditions in the secondary sector made it difficult to attract native workers. To fill the labour shortage employers turned to immigrants (Massey *et al.* 1998).

The situation has changed however, and migrants are now increasingly diverse in educational and occupational status. Since the early 1990s, the theory has been applied to high-skilled migrants who have been restricted from gaining access to jobs in the primary labour market. Among the high-skilled immigrants in New Zealand, many are prevented from gaining access to jobs that allow them to make use of their skills and expertise. According to labour market segmentation theory, this is because the employment of workers in the "primary market" is determined partly by individuals' own preferences regarding job types, and partly through employers' judgements as to their skill level, development potential, and ability to learn the specific requirements of the job. When people enter "without local knowledge, lacking proficiency in the language and unfamiliar with local ways of working, then their entry point into the labour market is likely to be at a low level" (Castels and Miller 1998:217; Poot 1993). Moreover, rationing takes the form of discrimination, using visible tags such as "race" and sex to decide who should or should not obtain primary sector positions (Morrison 1990). The theory can also be extended to explain the situation of low-skilled native workers who are deprived of the chance of upward mobility, despite a labour shortage in the primary labour market. When a supply of skilled or educated labour can be attracted from elsewhere, employers are less likely to engage in local training or career development to fill job vacancies. Consequently, disadvantaged groups, such as ethnic minorities, may find it particularly difficult to gain access to stable jobs in the "primary market", but so can many local workers who lack the appropriate experience or have been in "unstable" secondary market employment (Gordon 1995; Nana *et al.* 1999).

Responses to Reduce Labour Market Segmentation

Clearly, labour market segmentation intensifies the skill shortage problem, as it presents a further obstacle of employer discrimination. The critical question is whether there is a chance of later upward mobility. The answer is often dependent upon whether the government and employers encourage the continuation of segmentation through their own discriminatory practices, or whether they take measures to give immigrants equal opportunities

(Castels and Miller 1998).

Countries such as Australia, Canada and New Zealand have policies to improve the labour market position of immigrants. However, while legislation exists in New Zealand with respect to the provision of equal employment opportunities, more effective implementation and monitoring of EEO policies and programs must be undertaken to ensure companies' "compliance is not perfunctory but carried out in a positive manner" (Watts and Trlin 2000:97). EEO programs need to educate employers on the advantages of a multicultural workforce, in particular the value of different cultural perspectives as a means of encouraging creativity and innovation (Colmar Brunton 2000; EEO Trust 1998).

Labour market segmentation theorists argue however, that the policy implication of the segmented labour market model "is not one which emphasises education... so much as the removal of barriers of entry to job experience and particularly on-the-job training (OJT)" (Morrison 1990:492). The pricing of labour in the market is an essential response by companies to the need to invest in the training of labour. While a general education is necessary to gain employment, many firms need to further their staff's expertise via on-the-job training. This training is costly however, and in order for the firm to recoup those returns, it is necessary to "ensure that the trained labour stays with the firm" for a considerable period of time (Morrison 1990:495). The cost of this decision to invest in enhancing the skills of existing human capital must be weighed against the expected future benefits. However as previously mentioned, firms are often reluctant to provide training because of its costs in terms of time and money. Moreover, given the "global competition for the services of skilled migrants, there is no guarantee of their availability" or that they will stay (Birrell *et al.* 1999:73; Nana *et al.* 1999).

Towards a Better Understanding of Skill Shortage

In New Zealand's case, the most significant issues appear to be related to "perceptions" regarding the actual existence of a shortage, the current pool of available talent to fill job vacancies, and the costs of both overseas recruitment and the up-skilling of local labour. Moreover, the global shortage of skilled workers is exacerbating New Zealand's labour shortage problem.

Employers want to alleviate problems of skill shortages at the lowest possible cost. Ideally, they would fill skill shortages by recruiting local talent with the appropriate expertise. However as many high-skilled New

Zealanders are seeking greater employment opportunities overseas, employers need to look to other options for reducing skill shortages. Recruitment of overseas high-skilled workers is perceived as the next best option, as employers do not have to invest the time and money for local training. However there are problems with this alternative as immigrant labour is not a perfect match for employment in New Zealand. Lack of local work experience, lack of English language proficiency and cross-cultural issues are some of the perceived problems for employers. Consequently, for employers the last, and least desirable, option as far as costs are concerned is the up-skilling of local workers.

The New Zealand government, which has a vested interest in ensuring the country's economy is functioning to the "best of its ability", does have a responsibility in addressing skill shortages. However, the government can only work with the information provided to them by employers. In other words, the government's role predominantly involves responding to employers' perceptions of skill shortages. The government's approach is to favour an active policy of overseas recruitment, but this is not entirely satisfactory. Other actors involved in the skill shortage debate argue that this provides a further disincentive for employers to engage in training local labour.

What about skilled New Zealanders overseas? It has been noted that skilled New Zealanders currently living abroad are not necessarily "lost" to New Zealand. There are opportunities to make use of their expertise overseas, and studies have shown there is significant likelihood that these people will return home at a later stage. Presently the key concern is identifying these networks and developing linkages that allow their skills and knowledge to be transferred amongst them and New Zealand.

Despite the current initiatives to alleviate skill shortages, the perspectives of those involved vary considerably on how best to address the issue. Furthermore, current information on how the private sector is attempting to deal with shortages is limited. A range of people in both the public and private sectors, and job seekers themselves, were interviewed to gain an understanding of the issues they see as crucial in dealing with skill shortages. The next two sections report on the research methodology and the key findings.

Research Methodology

In order to gain a better insight into the issue of skill shortages in New Zealand, seven key informant interviews were conducted. A qualitative

approach was chosen as the primary methodology for this research because it fitted the overall aims of the study in the limited time available for empirical research. The objective of the research was to produce "detailed information about a smaller number of people and cases" (Patton 1990:14) through in-depth exploration of certain issues. The purpose of a qualitative approach is to provide an increased understanding of human behaviour within a particular social context (Maykut and Morehouse 1994).

Qualitative research has a number of limitations, such as problems of interpretation, objectivity and representativeness due to the small number of cases (Sarantakos 1993). A potential means of overcoming some of these limitations is to combine a number of research techniques. The use of multiple methods in the examination of a research question is known as "triangulation" (Sarantakos 1993:15). Triangulation allows the researcher to obtain a variety of information on the same issue, to incorporate the strengths of several methods, and to achieve a higher degree of validity and reliability (Bryman 1988; Sarantakos 1993). In this study, the empirical research findings from the key informant interviews are complemented by secondary data provided in the literature.

The Interviews

The key informant interviews followed a "general interview guide approach" with a number of pre-determined themes explored in an informal, non-structured way (Patton 1990:280). An interview guide was prepared, covering five themes: the existence of skill shortages in New Zealand; recruitment issues; training issues; retention issues; and potential solutions. The respondents comprised people from a wide range of backgrounds, aiming to ensure as much richness as possible was gained in the data, in terms of the descriptions, ideas, meanings and issues raised. The respondents included: New Zealand Immigration Service employees, an employment manager from Work and Income New Zealand, an Equal Employment Opportunities Trust spokesperson, a spokesperson from the Auckland Chamber of Commerce, an immigration consultant, a recent "high-skilled" migrant, and a recent New Zealand graduate who has completed a qualification in an area of "skill shortage". The respondents were recruited through contact with the relevant organisations. A letter of introduction was sent to explain the nature of the study, and potential respondents were then contacted by phone. If they expressed interest in taking part in the research, an interview was arranged. The key informant interviews were conducted in Auckland, Hamilton and Wellington between June and August 2001.[1]

Data Recording and Analysis

Each interview lasted approximately one hour. All interviews were tape recorded with the respondents' consent. In addition, field notes were prepared to supplement the tape recordings. The interviews were then transcribed, and analysed.

Data analysis was conducted in two stages. Firstly, information was analysed on a case-by-case basis. Because the interview guide allowed for flexibility in the interview process, the order in which some topics were discussed differed from one interview to another. Hence, the first stage of data analysis involved restructuring the interview data so that all topics covered in the interviews could be analysed in the same order.

Secondly, a cross-case analysis was undertaken. This involved grouping the respondents' answers according to the main themes emerging from the interviews. This analysis sought to determine the similarities and differences between respondents' views on skill shortages, and potential means of dealing with the issue. By undertaking both forms of analysis, it ensured that the information was comprehensively examined, and that there was less chance for data to be excluded.

Skill Shortage and Associated Issues

The respondents had mixed opinions regarding whether a skill shortage actually existed in New Zealand. The New Zealand Immigration Service (NZIS) employees argued that skill shortages do exist, particularly in the areas of IT, health and education. Evidence for these shortages comes from employers citing difficulties finding both the desired number and skill level of applicants for jobs.

Some respondents, while pointing out that a skill shortage exists, suggested that the problem was intensified because of a failure by industry, employers and successive governments to plan strategically to meet labour force needs. The New Zealand trained nurse I spoke to cited serious problems of shortages in the hospital where he was employed. However due to the failure by the hospital management to plan strategically, the continued poor salary levels and working conditions meant there was no incentive to stay and work in New Zealand.

The Equal Employment Opportunities Trust (EEO) spokesperson argued, however, that before we could seriously claim to have a skill shortage, we needed to look very closely at whether the skills currently in New Zealand were being effectively utilised.

> Part of the issue of skill shortages is that the focus has been on training, recruiting and retaining only a small segment of the available talent base. This almost automatically dooms you to not have enough workers. I think it is an equal educational opportunity and an equal opportunity issue... We haven't understood where our employees of the future will come from, or looked to up-skill them or attract them (R1).

Recruitment Issues

All respondents agreed that job seekers faced major barriers in the New Zealand labour market. A principal barrier cited was stereotyping by employers about what was required of employees. There was a lack of understanding amongst employers with regards to what essential merits and criteria were relevant for jobs.

> The biggest barrier is stereotyping about what is required. For example they're either too old, too young, the "wrong" ethnicity, overqualified etc. We need to have practices in recruitment and selection that ensure employers are measuring applicants by job criteria that is relevant (R4).

The practical issue of time was identified as another significant barrier. Apparently employers and recruitment consultants are both very busy. Consequently they seldom take the time to extend their search base for potential employees, or conduct proper background research on migrant qualifications.

In addition, a range of specific employment barriers facing migrant job seekers were identified. The major barrier was lack of English language skills. It is not just fluency that is required, but migrants also need access to "customised" English language training (colloquialisms, business English, pronunciation). Some respondents believed that cross cultural impact and management problems were further obstacles. As a majority of New Zealand companies are small businesses employing no more than five people, many employers perceive that putting a migrant in the workplace will have a huge impact. Employers fear that their clients will not favour workforce diversity and that their company will appear "unprofessional" if their staff speak with heavily accented English, or have different cultural values.

With regard to overseas recruitment, some respondents pointed out that current government policies posed a significant barrier. The immigration consultant argued that the points system in 2001 did not allow for direct correlation between what was required by New Zealand employers and the people that were allowed to immigrate to New Zealand.

The skilled migrant I spoke to said that the greatest problem was the amount of time it took for any immigration application to be processed. If migrants entered New Zealand without a work permit, they were likely to

experience a period of unemployment lasting several months. However, those who entered under a work permit scheme, faced great difficulties trying to transfer to permanent residency because they did not meet the immigration criteria.

Nevertheless, there is no guarantee that the skilled migration to New Zealand will be successful if employers and recruitment consultants are not aware that the talent base exists, or are prepared to make use of it. One respondent, involved in the development of a website matching job applicants with employer demands, identified that of the 1,000 immigrant job seekers registered on the site, the majority were in the IT, teaching and health sectors, areas where the strongest complaints of skill shortages are found.

Training Issues

The Auckland Chamber of Commerce spokesperson informed me that $6 million had been assigned to recruit teachers from overseas. She argued "why not allocate the money to people who are already here and put them through teacher training?" (R4).

The person from the EEO Trust reiterated this argument, claiming that many employers look to overseas recruitment without identifying all the potential sources of talent in New Zealand who may not be "trained up" to the appropriate skill level. This claim was reinforced by the WINZ manager who cited extreme difficulties getting workplace experience for skilled local and migrant job seekers.

> I've noted a reduction in industry-based training. People become very focused on short-term goals because they've been restructured and are expected to do more with fewer staff and resources. Working in any way that isn't short-term and delivering immediate rewards, is asking a huge amount. I also think there's failure to take ownership for training. I think there's a broader context to this, which is whose responsibility is it to do the training? (R1).

This problem of skill level is also strongly associated with concerns of lack of local work experience. The skilled migrant I spoke to cited lack of local experience as the greatest barrier she faced gaining employment. Furthermore, she had found employers were unwilling to provide workplace experience.

> It's not necessarily "New Zealand" teaching experience, but "local" experience that employers want. They want you to have knowledge of the local area. People also want their children taught by New Zealand teachers because they have the New Zealand background (R7).

However the spokesperson from the Auckland Chamber of Commerce stated lack of local work experience is just an easy excuse. For many advertised positions local work experience will not make a difference to a person's ability to perform the job.

Retention Issues

The private sector respondents felt employers were not doing enough in the area of retention. If we are asking more people to stay or live in New Zealand, we must ask what can we offer in return? They felt that employers must acknowledge that people were more than an "economic commodity". Employers may be able to retain skilled workers if there is flexibility in recruitment and retention packages, good "worklife" policies, and a more inclusive workplace culture.

> I don't see much work being done with retention strategies for groups such as migrants. For high-skilled people, they need something in their jobs which keeps them, so they need a career path and opportunities for development. Many migrants I have spoken to have said that if they could get work and were satisfied in it, then they'd be much more likely to stay. However it's also important to ensure we're not saying "all we want are your skills" (R2).

The Auckland Chamber of Commerce spokesperson however, stated that from the employers' point of view, employers seemed to assume that because staff turnover would be high, there was no point placing effort and money into good retention schemes. Nevertheless, she also pointed out that high staff turnover was costly. Anyone employed for less than a year costs the employer. Thus she agreed that proper retention schemes were "smart business".

From the employees' point of view, poor retention strategies can exacerbate the problem of skill shortages. The trained nurse I spoke to stated New Zealand nurses currently faced poor salaries and working conditions. Overseas however, New Zealand nursing qualifications are highly regarded and they are rewarded financially. Because their skills are highly transferable, many New Zealand trained nurses find far more incentives in seeking employment overseas than remaining in New Zealand.

This discussion of retention issues leads on to another important question. How important is it for New Zealand to try and retain its own graduates? All respondents felt it was naive for New Zealand to try and retain its graduates. New Zealanders have a history of going overseas for work and travel, and will continue to do so. Respondents argued that it adds value to the New Zealand economy if our graduates get global exposure. New Zealanders live and compete in a global economy, thus having our

graduates overseas builds new networks, new business experiences and skills, and new market opportunities.

Most respondents considered that many New Zealand graduates will eventually return to settle and work in New Zealand. The graduate nurse informed me that he had a nursing position in the United Kingdom from the start of 2002, and planned to spend several years over there. However he intended returning to New Zealand when he was ready to "settle down and have a family".

Potential solutions

Finally, respondents were asked whose responsibility it was to deal with skill shortages, and to offer some solutions. All respondents argued it was primarily industry that was responsible for addressing skill shortages. This could be achieved through strategic long-term planning for their future needs, and conveying this to training providers and the government. All respondents felt overseas recruitment of skilled workers was critical for New Zealand, especially as we now compete in a global market. The benefits identified included: attracting a range of cultural and linguistic skills, gaining people with international experience and skills, new business practices and creating global networks.

Both the Auckland Chamber of Commerce and the EEO Trust have been adopting measures to educate employers of the benefits of diversity in the workforce. These actions predominantly revolve around "good news" stories regarding migrants' successful employment. Press releases, advertising, and promotional campaigns are focused on raising employers' awareness of the potential sources of talent currently available in New Zealand, and the benefits accrued by those employers making use of a multicultural workforce.

All of the private sector respondents noted the importance of involving recruitment consultants in any campaign directed at promoting the benefits of diversity. The private sector invests heavily in the use of recruitment consultants, because employers tend to think the best strategy is to "get the people to get us the people" instead of doing the recruitment work themselves. However, recruitment agencies are a commercial business, and often they believe they need to put forward the candidates they think their employer clients will want. As recruitment consultants have the ability to act as "real gate keepers or openers", the Auckland Chamber of Commerce respondent said a message needed to be sent to employers and recruitment consultants, telling them that "before complaining there's a skill shortage,

look more closely at all sources of potential employees".

According to the NZIS respondents, the New Zealand government did have a responsibility in addressing skill shortages. However they cautioned that immigration policy and overseas recruitment should not be seen as a "magic wand" to solve skill shortages. Policy must not be driven purely by the perception of a skill shortage, otherwise there is a risk of bringing in high numbers of migrants "and then changing our minds and trying to remove them". Moreover, they made a very important point that the government can only work with the information provided to them by employers. When industries complain that the government "needs to do something", they need to remember that politicians have less information on the problems than employers' do. In addition, if immigration policy is constantly under review, this sends a confusing and unstable message to potential overseas applicants.

The government needs to focus on creating and implementing an effective marketing strategy that aims at both recruiting and retaining talented workers. Additionally, when migrants arrive in New Zealand, settlement services and employers need to deliver these benefits. Immigration consultants have an important role to play both in terms of marketing and information provision. Consultants must be honest and provide potential migrants with a balanced picture of the reality of life in New Zealand and the difficulties of finding work.

Recognising that the government cannot address skill shortages by itself, it needs to work with industry to address the issues behind shortages. The NZIS respondents cited two examples of joint initiatives by government and industry in this regard. The first of these was the establishment of a Health Workforce Advisory Committee working with hospitals to consider plans on how to retain staff, including decent hours, training and better financial packages. The second initiative was the Industry Training Review assessing whether institutional arrangements are leading towards the desired goal of "up-skilling". The Labour Market Policy Group also reviews information on shortages and how to make better use of the information to attract workers with the required skills.

None of the respondents felt job seekers have a responsibility in dealing with skill shortages. One respondent argued that the labour market dictated what positions are available. Thus the only way to deal with skill shortages was to intervene in the market place with State regulation and control.

> I don't think the responsibility lies with the job seeker. What's going on in the labour market is the most important factor. At the moment, the market creates positions for "able-bodied white men" (R2).

A final note of caution from the NZIS respondents, however, reinforced the complexity of the skill shortage debate.

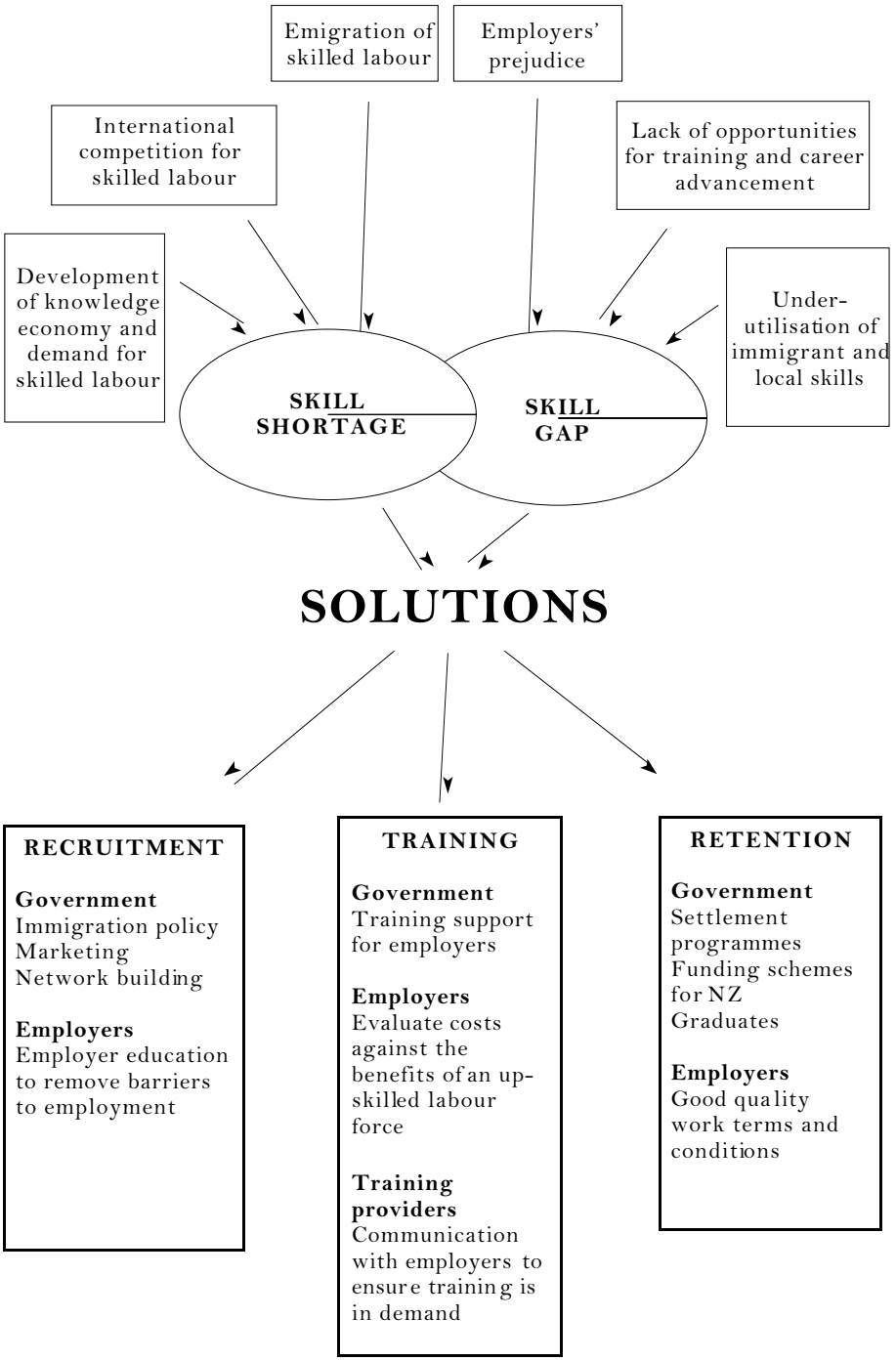
> We will always have skill shortages in an expanding/dynamic economy, and they indicate economic growth. Therefore skill shortages in themselves aren't a bad thing, what matters is if you have severe shortages for a prolonged period of time. When that happens, it indicates that the normal adjustment and matching processes aren't working or there aren't enough people to meet the employers' demands. However establishing exactly when you have that situation is very difficult (R3).

Towards a Co-ordinated Approach

On the basis of findings from the interviews and the literature, a preliminary model for understanding the issue of skill shortages in New Zealand can be provided (Figure 1). The model suggests that New Zealand's difficulty with skill shortages has several dimensions. First, as the desired shift towards a knowledge economy continues, the demand for high-skilled labour inevitably increases. However, in the current era of globalisation there is intensive international competition for skilled labour. As a result, despite the government's active policies to attract skilled migrants, such policies have not been entirely successful because New Zealand is not high on the list of potential migrant destinations.

Another dimension relates to employers. Firms aim to deal with shortages in the most cost-effective way. If possible, they will employ locally trained, skilled New Zealanders. However, sustained emigration of skilled New Zealanders since the 1970s has considerably reduced the pool of skilled workers in New Zealand. As a result, employers must look to other alternatives, such as recruitment of overseas high-skilled workers, or up-skilling the local labour force. However, both alternatives have not been effectively utilised so far.

Figure 1: A coordinated approach to addressing skill shortages



Evidence from this research suggests that employers and recruitment consultants make very subjective recruitment decisions. Many refuse to employ high-skilled migrants on the grounds that they lack local experience, have language difficulties, and present cross-cultural problems. At the same time, few employers are willing to invest in up-skilling the local labour force, arguing that the costs of training and high levels of staff turnover are major disincentives. These practices tend to indicate that underlying New Zealand's current problem of skill shortages, there is also an issue of "skill gaps" where people are available to do the job, but they are not at the ideal skill level or standard required by the employer.

On the basis of the above analysis, the model suggests that in order to deal with the current problem of a skill shortage, New Zealand has to look for solutions in three areas: recruitment, training and retention of skills (Figure 1). The government, employers and training providers all have a significant role to play in each of these areas.

The government's primary responsibility is to ensure implementation of effective immigration policies that assist employers locate skilled workers from overseas. The policy initiatives introduced in October 2001, aimed in particular, at ensuring that at least 27,000 skilled and business migrants would be approved each year. Additionally, a "Talent Visa" was introduced, allowing highly employable people to be offered more than just a work permit, but also the chance to be sponsored for residency (Dalziel 2001).

On the part of the employers and recruitment consultants, who are principally responsible for making recruitment decisions, the first priority is to raise awareness of all sources of potential talent currently available in New Zealand. It is essential that employers and recruitment consultants discard stereotypes when considering job candidates, and recruit on relevant job criteria rather than subjective opinions.

Employers also need to be aware that the most appropriate long-term approach to minimising shortages is to up-skill the available labour force. Training providers play a crucial role in ensuring the training is relevant to the current and future needs of the economy. Moreover, training providers must communicate with employers to make sure firms are aware of the available talent base.

Whereas the above initiatives are all relevant and necessary, it is argued that the most effective solutions to address the issue of skill shortages and skill gaps require a coordinated approach between the government, employers and training providers. In the current global competition for skilled workers marketing is a key strategy if New Zealand wants to

compete and distinguish itself internationally. A coordinated approach is required to market New Zealand not only as a lifestyle choice, but also as having a knowledge-based economy where skills are required. In doing so, it is absolutely essential that, on arrival, programs are available to enable skilled migrants to be integrated into the community and the workforce.

While legislation exists in New Zealand with respect to the provision of equal employment opportunities, there is no evaluation of EEO policies to ensure firms are meeting requirements. A potential solution for New Zealand would be to adopt a "productive diversity" strategy similar to the Australian program (DIMA 1999). To ensure migrants are given equal employment in the Australian labour market, an initiative has been introduced that integrates the government, business and education sectors, as well as communities, to recognise diversity as a means of achieving economic growth.

A coordinated approach is also required with regard to up-skilling the local labour force. In view of the costs of providing training by private sector employers, a level of government assistance, such as the provision of incentive schemes and subsidies for employers, may be necessary. Furthermore, the government also needs to provide support for company retention schemes to ensure both skilled foreign and local workers remain in New Zealand. The government must develop appropriate social policy that reduces settlement difficulties experienced by migrants. With regard to skilled New Zealanders, the government and employers need to consider joint funding initiatives that provide assistance to graduates. These schemes could potentially reduce graduates' student loan debts and enable them to engage in further training for career development.

In addition, the government and the private sector should also place emphasis on connecting with, and profiting from, New Zealand's expatriate networks overseas. A critical question is how to identify such people. A joint government and private sector initiative is the "New Zealand Talent Initiative" aimed at re-attracting and retaining skilled New Zealanders. This project is helping both the government and the private sector to build an international network of talented New Zealanders, and to use this network strategically for the benefit of New Zealand's economy.

Finally, it would be of benefit to examine the approaches other countries are adopting to attract and retain skilled people. In particular, because of our geographic proximity, we should look to Australia to assess their initiatives. The Australian government and the business sector have introduced a number of initiatives to minimise shortages, such as the creation of

specialised business centres in Australian immigration departments to foster closer relationships with industry, and to ensure firms remain informed of immigration policy developments (DIMA, 2001). These initiatives highlight that Australia has recognised the key to addressing skill shortages lies in strong relationships and good communication between the private sector and the government.

Note

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1 Prior to the commencement of the study, ethical approval was obtained from the Geography Department's Human Research Ethics Committee. In addition, a consent form providing information on the research project, the purpose of the interviews, and the rights of a research participant, was distributed to all potential respondents. Those who freely consented to participate were asked to sign the consent form. All participants were guaranteed confidentiality at the outset of the interviews, and at no stage during the research process were the informants' names identified. Finally, the respondents were notified that all information they provided would be destroyed at the conclusion of the research project.

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Māori/Non-Māori Ethnic Intermarriage

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Abstract

Past research on marriage suggests that a significant number of Māori had a non-Māori partner. Data from the 1996 census indicate that such ethnic intermarriage is continuing. Around half of partnered Māori men and women have non-Maori partners. Amongst those partnered Māori affiliating only with the Maori ethnic group, a third have non-Māori partners. In a household setting, such intermarriage potentially brings together the "two worlds" of Māori and non-Māori.

Intermarriage between people from different ethnic groups is of interest to social scientists and policy makers for a number of reasons. For example, it has long been used as an indicator of the process by which groups become more similar and less distinct. Intermarriage also represents an important means by which individuals belonging to minority ethnic groups can extend social and economic networks. It can also serve as an indicator of ethnic relations in a nation.

Ethnic intermarriage can be studied at a number of levels. In New Zealand, a detailed analysis might consider marriage between such groups as Italians and Greeks, Samoans and Tongans, Hungarians and Irish, and Chinese and Koreans. Even within some of these groups, intermarriage between smaller subgroups, such as by Iwi or Hapu within the wider Māori group or New Zealand born and overseas born Chinese, could be of importance. While recognising these potential layers of complexity, this research note restricts the analysis to intermarriage rates between two broad groups – those who affiliate with Māori ethnicity and those who do not.[1] These groups are chosen for two reasons. First, Walker (1997:81), in a review of "gaps" in New Zealand social science, identifies marriage between Māori and non-Māori as an important issue. Second, in debates about the Treaty of Waitangi there is often the underlying assumption that Māori and non-Māori are separate, impermeable groups. Yet, intermarriage potentially blurs such boundaries.

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In this study of intermarriage I focus on the census measure of ethnicity rather than responses to the question on ancestry. In 1991, a new question was added to the census asking respondents to record their ethnic group(s) rather than their ethnic origin. In New Zealand, it is widely accepted that ethnicity is culturally constructed, even if it is often strongly influenced by ancestry (Statistics New Zealand 2003). In the 1991 and subsequent censuses, a small, but significant, number of respondents recorded more than one ethnic group. However, dual or multiple responses were particularly common amongst the wider Māori ethnic group. Given the availability of this dual or multi-ethnic data, in this study the wider Māori ethnic group is divided into two categories. The first is where individuals recorded only Māori as their ethnic group. These are referred to as "sole Māori". The second is where Māori was one of the two or more ethnic groups recorded. I refer to these as "Māori plus other ethnic group(s)".[2] Although 2001 census data were available when preparing this paper, I chose to use 1996 data. This is because the more open and less ambiguous nature of the 1996 census ethnicity question in comparison to those asked in the 1991 and 2001 censuses potentially provides a more accurate picture of the multi-ethnic society that is emerging in New Zealand.

Influences on Assortative Mating

A variety of data sources have been used in overseas studies on assortative mating. Early international research on assortative mating includes the work of Burgess and Wallin (1943), Hollingshead (1950), Rockwell (1976) and Spanier and Glick (1980). They show that, on a variety of measures, people tend to marry people with similar characteristics, particularly with regards to age, religion and ethnicity.[3] In New Zealand, research by Pearson (1980), Jones and Davis (1986) and Jones (1987) also demonstrates a tendency for couples to have similar demographic and socio-economic characteristics.

More recent studies have been carried out in Australia, New Zealand and the U.S. using a range of data sources (eg. Callister 1998; Kalmijn 1991a,b 1994; Mare 1991; Schoen and Weinick 1993; Rimmer and Rimmer 1994). Again, these reinforce the finding that there is a tendency for individuals to marry or cohabit with people whom have similar characteristics.

However, these recent studies suggest there has been some change in the weight of particular characteristics. While in the past a key characteristic was religion, most studies now indicate that education is a very important factor in assortative mating. Education is important in two ways.[4] First,

people with similar levels of formal education tend to form couples. But of particular relevance to this research note, sorting by education can start to override sorting by other characteristics, such as ethnicity.

While education is important in influencing partner choice, there are many factors that influence the level of ethnic intermarriage within a particular country. Based on their work in the U.S., Lieberson and Waters (1988:164-165) argue that the occurrence of ethnic intermarriage depends on four main factors.

- The existence of formal legal barriers to intermarriage or of traditional ethnic taboos against intermarriage.
- The relative availability of partners from within and without the group. This is influenced by (a) group size relative to the total population (b) the distribution of groups geographically and (c) the degree of segregation or contact that particular ethnic groups have with each other.
- Informal attitudes and views about ethnic intermarriage.
- The degree of overlap between ethnic membership and non-ethnic characteristics. For example, class based endogamy may seem like ethnic based endogamy if particular ethnic groups are concentrated in particular socio-economic classes.

Some of these factors are not independent of each other. For example, education is an important factor in determining both social class and earnings. Earnings, in turn, often help determine where an individual lives, and location can be important in assortative mating processes (Lichter, LeClere and McLaughlin 1991).

Although it is difficult to assess attitudes within New Zealand to ethnic intermarriage, there are no legal barriers to such unions. However, there are demographic factors that allow a higher rate of marriage to other ethnic groups among Māori, as well as those in the Pacific Peoples and Asian ethnic groups. All of these groups are relatively small populations in relation to the total New Zealand population.[5] These populations are also not geographically isolated from other New Zealanders. For example, Johnston, Poulsen and Forrest (2003) used census data from 1991 to 2001 to examine the changing geography of New Zealand Europeans, Māori, Pacific Peoples, and Asians – across New Zealand as a whole as well as in its major urban areas, especially Auckland. They found there was little extreme segregation of Māori (or Pacific Peoples or Asians). However, reflecting the much larger size of their group, most of the Europeans lived in areas where there was little exposure to those of other ethnicities.

Much early research on intermarriage has been based on individuals recording only one ethnic group or, if ancestry was the focus of the study, one ancestral group. Increasingly however, data collections allow respondents to record more than one response. These types of data suggest that the children of mixed marriages are themselves more likely to intermarry (Lieberson and Waters 1988). Intermarriage can thus become self-reinforcing. As the pool of individuals with mixed ancestry and/or ethnicity increases then there is a greater chance of marrying someone with mixed ancestry and/or ethnicity.

In addition, it is worth keeping in mind that marriage itself can alter the recording of ethnic affiliation or ancestry. Waters (2000:1736) draws on life course research to suggest that "when some people marry, they change their ancestry to match their spouse". This has the potential to also change the ethnic group(s) to which they belong. As an example of changing recorded ancestry, Waters (2000:1736) suggests "if a women who was Italian and Polish married an Italian man, it is likely that she would drop the Polish ancestry and that both spouses would report they were Italian". According to Waters, this raises the issue of whether studies that are trying to assess whether ancestry affects the choice of partner may, in fact, be measuring the opposite phenomenon. That is, the choice of partner affects an individual's choice of ancestral and, potentially, ethnic identity.

New Zealand Studies of Marriage Between Māori and Non-Māori

Historically, in New Zealand there have been a number of studies that have discussed, either directly or indirectly, marriage between Māori and non-Māori (Ausubel 1977; Beaglehole and Beaglehole 1946; Belich 1996; Butterworth and Mako 1989; Harré 1968; Metge 1967, 1976; Ritchie 1963; Vaughan 1964). Metge (1967), using 1950s data, reports on the proportion of Māori children with a European parent, which is one indicator of the level of intermarriage between Māori and European. In a specific, but short, discussion of intermarriage in her book, Metge (1967:301) notes that "[i]n the 1970s intermarriage has become so relatively common that it no longer attracts particular interest or public attention". In the first volume of his history of New Zealand, which covers the period up to about 1900, Belich (1996) contains a detailed discussion of Māori inter-marriage. However, the subject is absent from the second volume, which takes readers from 1900 to the present day (Belich 2001).

Although not specifically studying intermarriage, Butterworth and

Mako (1989:1) argue that all Māori have some degree of non-Māori ancestry. This suggests high rates of historical intermarriage.

In his book on Māori, Pool directly discusses the high historical rate of intermarriage between Māori and non-Māori. He notes that the:

> Māori population history is clearly interlocked with that of Pakeha New Zealanders. There have been 8-9 generations of co-residence and intermarriage with post-1769 immigrant populations (Pool 1991:4).[6]

However, the topic of intermarriage is not analysed in any great depth. Bentley (1999) and King (2003) also mention intermarriage in their books, but again the topic is not explored in any detail.

Harré (1968) has produced the most detailed empirical work on ethnic intermarriage. He used Auckland marriage registration data that showed that, in 1960, 3.6 percent of married Pakeha has a Māori partner, while 42 percent of married Māori had a Pakeha partner. He notes that these are lower percentages than random sorting would predict. He also presents historical registration data that indicate (although based on low numbers) that between 1890 and 1960 there was, overall, a strong increase in the proportion of Māori who had a non-Māori spouse.[7].

Harré's empirical study of Māori intermarriage was conducted over three decades ago and it is surprising that no major study on ethnic intermarriage has been carried out since this time.[8] Even the base information is lacking. Statistics New Zealand has, to date, published no information on ethnic intermarriage. This represents a major gap and stands in contrast to countries such as the U.S. where data on ethnic intermarriage is regularly published (U.S. Census Bureau 1998).

What Can New Zealand Census Data Show Us?

Like all datasets, the census has both strengths and weaknesses. A key strength for the study of ethnic intermarriage is that a wide range of data is available on couples, both married and defacto, who live in the same household. Data are also available for almost all the population. However, there are also major problems. These include:

- Data are not available for couples who live in separate households.
- Data provide only a "snapshot" at a particular point in time. Not only are family and household arrangements more fluid than in the past, but ethnicity itself is fluid and can change over time.
- Ethnicity questions have changed over time, making year-to-year comparisons very difficult.

The fragility of some family relationships creates particular problems for interpreting census data. For instance, if for some reason relationships within an ethnic group (such as Māori with a Māori partner) were much more stable than relationships where partners do not belong to the same ethnic group, then the snapshot data might give a false impression of the sharing of cultural values within couples. As will be illustrated, there is also a problem when one group, in this situation sole Māori, have a lower rate of living as couples, including when they are raising children. Given the relatively high rate of sole parenthood amongst sole Māori women, these women must have, at some stage, had a partner.[9] However, the data do not allow any direct exploration of the ethnicity of ex-partners in these separated couples.

The fragility of family relationships is of particular relevance to those in younger age groups. Many of these relationships will be temporary arrangements, whereas in older age groups the relationships are more likely to have been longer term. In addition, underlying the data will be differences in the age that groups form couples. For instance, better-educated individuals are less likely to partner at younger age groups. Given that sole Māori, on average, have less formal education than those Māori who record more than one ethnic group, this will affect the intermarriage data.

There are also questions regarding what ethnic responses are actually indicating. For example, a person who records only one ethnic group may, in fact, have ancestors, either distant, such as great grandparents, or near, such as their parents, who come from different ethnic groups. For a variety of reasons, however, the respondent may decide to emphasise one group over another when determining their ethnicity. Therefore, while separate data is presented for the sole Māori group and those Māori who recorded more than one group, the boundary between these groups is blurred (Kukutai 2003).

Intermarriage Data from the 1996 Census

As background to the main data on intermarriage, Table 1 shows the proportion of each total ethnic group who recorded just one ethnic identity in the five yearly census. It shows changes over time as well as differences between groups. In both 1996 and 2001, people in the Maori ethnic group were the least likely to record just one ethnic identity. Of all those people who recorded Māori as one or more of their ethnic groups, only 56 per cent recorded *only* Māori in 2001. However, even amongst the one-digit level ethnic groups where single responses are high, there are subgroups where the single responses are much lower. For example within the wider

European group, in the total responses for Italian only 35 per cent of respondents recorded only one ethnic group. The figure for Irish was 38 per cent. Amongst Pacific Peoples, 46 per cent of Niueans and 13 per cent of Hawaiians recorded one ethnicity. Within the Asian group the figure was 59 percent for both Malays/Malaysians and Hong Kong Chinese, while within the "Other" group only 46 per cent of the Israeli/Jewish/Hebrew group recorded one ethnicity. While this raises the possibility that particular sub-populations of non-Māori may be more likely than others to form couples with Māori, this is not explored in this paper.

Table 1: Single ethnicity responses by each ethnic group, 1991-2001

Ethnic Group (total responses)	1991	1996	2001
European	94.6	82.7	89.9
Māori	74.4	52.2	56.0
Pacific island Peoples	77.9	61.4	67.5
Asian	87.8	81.5	88.1
Other	68.0	59.9	75.1

Source: Lang (2002) based on census data.

The following data show the ethnic intermarriage rates of Māori men and women in five yearly age groups from 20 through to 64.[10] They are taken from the 1996 census and include both married and defacto couples. These couples could be living in a couple-only household or a multi-adult household. Apart from the data presented in Table 2, the "not specified" group is excluded in both the numerator and denominator in all the calculations.

In viewing these data it needs to be kept in mind that there are two stages to assortative mating. The first stage involves whether or not someone actually forms a couple residing in one household. Figures 1 and 2 show the number of Māori men and Māori women in each age group. They show, in separate groups, Māori who identified themselves as solely Māori (sole Māori) and those who indicated Māori as one of their ethnic groups (Māori plus other). Table 2 then shows the proportion of Māori in each age group who lived in a heterosexual couple within a household.

When comparing Figures 1 and 2 and Table 2, while the number of Māori is the highest in the 20-24 age group, this age group has the lowest proportion of individuals living in couples. Table 2 also shows that, aside from sole Māori men aged 20-24, for men and women in all other age groups the proportion of sole Māori individuals living in couples is significantly

lower than for those individuals who recorded Māori plus another ethnic group(s). In addition, in most age groups a higher proportion of Māori men live in couples than Māori women. The reasons for these differences are complex and beyond the scope of this research note.

Figure 1: Number of males identifying their ethnicity as Māori and Māori plus other, 1996

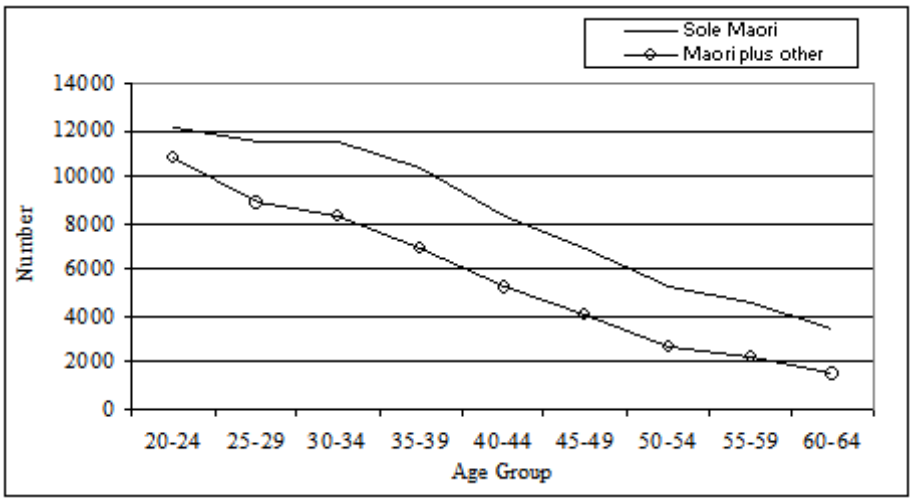
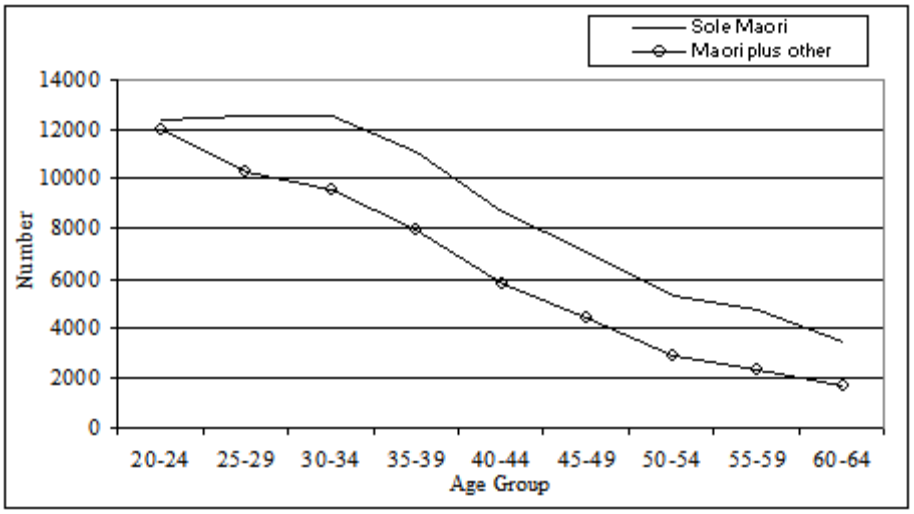


Figure 2: Number of females identifying their ethnicity as Māori and Māori plus other, 1996



Source: Census of Population and Dwellings, 1996

Table 2: Percentage of Māori men and women in each age group living in a couple, 1996

Age Group	Male		Female	
	Sole Māori	Māori plus other ethnic group(s)	Sole Māori	Māori plus other ethnic group(s)
20-24	25	25	28	32
25-29	41	46	39	50
30-34	52	61	46	58
35-39	58	69	51	62
40-44	62	72	56	64
45-49	63	73	58	65
50-54	63	71	58	64
55-59	63	72	53	60
60-64	60	71	47	56

Source: Census of Population and Dwellings, 1996
Note: The measure of couples includes those where the ethnicity of the partner is not specified.

Table 3: Percentage of partnered Māori men and Māori women with a Māori partner, 1996

Age Group	Partnered Māori men with a Māori partner (%)	Partnered Māori women with a Māori partner (%)
20-24	56	55
25-29	50	51
30-34	49	51
35-39	50	50
40-44	50	48
45-49	51	49
50-54	52	52
55-59	55	56
60-64	61	54

Source: Census of Population and Dwellings, 1996
Note: A copy of the full database from which the percentages in this and following tables were calculated is available from http://www.callister.co.nz

Keeping in mind all the caveats about the data, Table 3 shows the percentage of partnered Māori (total response) men and women who had a Māori partner (total response). The patterns are almost the same for men and women. In the middle years, around half of partnered Māori men and women had a Māori spouse, but this rises slightly in the older age groups.

This represents a significant level of ethnic intermarriage by the wider Māori ethnic group, with about half of this group who were partnered having a non-Māori spouse. In 1960, Harré (1968) found that intermarriage rates in Auckland were higher for younger Māori, but these 1996 data show rates are not as sensitive to age. While caution is needed in making such comparisons, in 1960 it appears that young people were breaking new ground in their marriage patterns, whereas now the patterns of intermarriage by younger cohorts are similar to that of their parents.

Figures 4 and 5 show the association between education and having a Māori partner. Again, these figures show the total Maori ethnic group. Those partnered Māori men and women with no formal qualification were more likely to have a Māori spouse.[11] It is likely that there is some geographic influence underlying this pattern. A more detailed breakdown by educational qualifications shows this pattern to be even more pronounced amongst those with university qualifications (Callister 1998).

While the 1996 data include both married and defacto couples, these data seem to be in contrast to some of Harré's findings for married couples in Auckland in 1950 and 1960. At this time it was more common for a Pakeha man to have a Māori wife than for a Māori man to have a Pakeha wife. If, despite his small sample size, Harré's data was somewhat representative of patterns of intermarriage across the whole of New Zealand, then this suggests the gendered nature of intermarriage has substantially declined.[12]

Figure 4: Percentage of partnered Māori women with a Māori partner by highest educational qualification, 1996

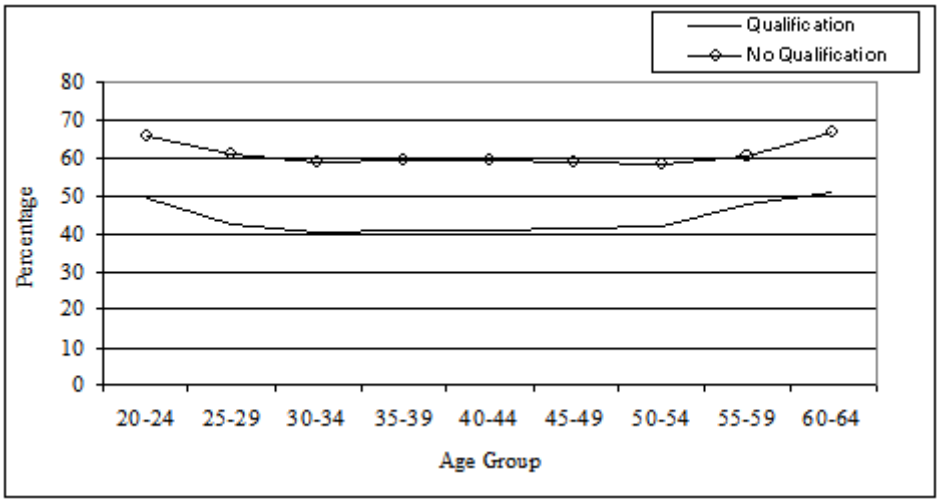
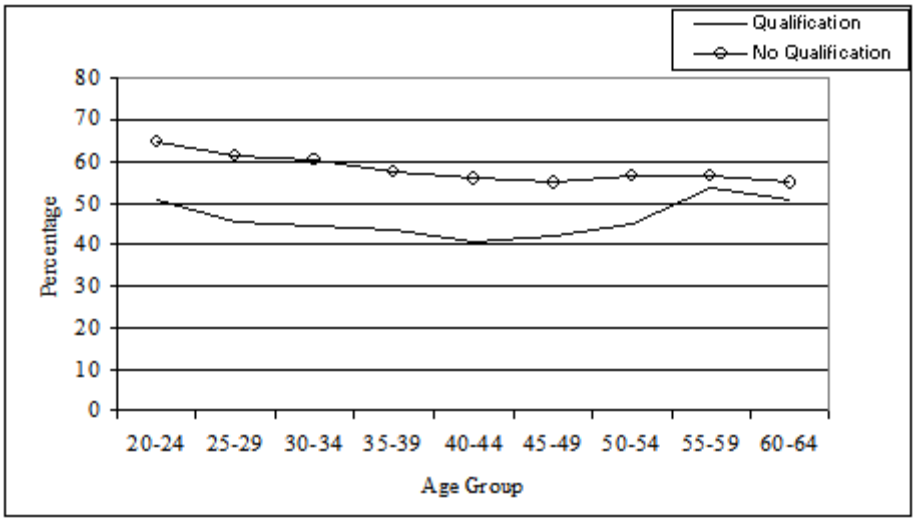


Figure 5: Percentage of partnered Māori men with a Māori partner by highest educational qualification, 1996



Source: Census of Population and Dwellings, 1996

Tables 4 to 7 divide partnered Māori men and women into those who are sole Māori and those recording more than one ethnic group. They then show the percentage of each group who had a sole Māori or Māori plus other ethnic group(s) partner as well as a total for those with a Māori partner.

In each age group, sole Māori women and men are far more likely to have a Māori partner than are women and men in the "Māori plus other" ethnic group. If a sole Māori does have a Māori partner it is also far more likely to be a sole Māori partner (like themselves). Women and men in the "Māori plus other" ethnic group are also slightly more likely to have a partner like himself or herself. The data suggest that for Māori with more than one ethnic group, there is a far greater chance of having a non-Māori partner. However, it is worth keeping in mind that the relationship may be working in the opposite direction. An individual recording Māori ethnicity may be more likely to record an additional ethnicity if in a couple with a non-Māori partner.

Table 4: Percentage of partnered sole Māori women with a Māori partner, 1996

Female age group	With a sole Māori partner (%)	With a "Māori plus other" partner (%)	Total with a Māori partner (%)
20-24	56	12	68
25-29	55	11	65
30-34	56	10	66
35-39	54	9	63
40-44	55	8	63
45-49	55	7	62
50-54	58	7	65
55-59	60	8	68
60-64	58	7	65

Source: Census of Population and Dwellings, 1996

Table 5: Percentage of partnered women in the "Māori plus other" ethnic group with a Māori partner, 1996

Female age group	With a sole Maori partner (%)	With a "Maori plus other" partner (%)	Total with a Maori partner (%)
20-24	19	25	44
25-29	16	22	38
30-34	14	21	35
35-39	14	20	34
40-44	13	17	30
45-49	13	18	31
50-54	14	17	31
55-59	14	20	34
60-64	13	20	33

Source: Census of Population and Dwellings, 1996

Many of these couples have children. While the children are dependent, the parents will generally either determine or strongly influence their ethnic choices. However, as they age, these children will be determining their own ethnicities in everyday life and in social surveys. In the decades ahead they will be part of the population projections that are now being made by Statistics New Zealand. Even if other ancestors, such as grand or great grandparents who might provide a range of ancestral backgrounds, are ignored the ethnic intermarriage data presented here suggest that in the future a significant proportion of individuals who had a Māori parent will have the potential to select from more than one ethnic group when responding to surveys.

Table 6: Percentage of partnered sole Māori men with a Māori partner, 1996

Male age group	With a sole Māori partner (%)	With a "Māori plus other" partner (%)	Total with a Māori partner (%)
20-24	49	18	67
25-29	48	16	64
30-34	48	13	61
35-39	50	13	63
40-44	53	11	64
45-49	55	10	65
50-54	56	8	64
55-59	59	8	67
60-64	65	10	75

Source: Census of Population and Dwellings, 1996

Table 7: Percentage of partnered men in the "Māori plus other" ethnic group with a Māori partner, 1996

Male age group	With a sole Māori partner (%)	With a "Māori plus other" partner (%)	Total with a Māori partner (%)
20-24	14	29	43
25-29	10	25	35
30-34	11	22	33
35-39	11	22	32
40-44	11	20	31
45-49	11	18	29
50-54	12	20	31
55-59	13	21	33
60-64	14	20	34

Source: Census of Population and Dwellings, 1996

Conclusion

Past research on marriage between Māori and non-Māori suggests a significant level of ethnic intermarriage. Data from the 1996 census show that such intermarriage is continuing at a relatively high rate. In a household setting, such intermarriage potentially brings together the "two worlds" of Māori and non-Māori (Rata 2003). For both Māori and non-Māori it can be an example of partnership and/or biculturalism at a very personal level. Assuming that ancestry continues to be a strong influence on

ethnic choices, such intermarriage also potentially provides children of such unions with a greater choice of which ethnic group(s) to affiliate with.

While most New Zealanders have some understanding of the high rate of current and historical marriage between Māori and non-Māori, this awareness is often forgotten in policy debates. Instead, concepts of single ethnic individuals and single ethnic families and households with impermeable boundaries often come to the fore.

This research note only scratches the surface of the topic of ethnic intermarriage. It would be interesting to consider the intermarriage rates of other ethnic groups in New Zealand, including their rates of marriage to Māori. Trends in the intermarriage rates of various new immigrant groups would also provide one measure of integration into New Zealand society. Given that ethnic intermarriage is a useful social indicator, it would be helpful if Statistics New Zealand provided tables showing ethnic intermarriage rates based on the main ethnic groups as standard output from each census.

Finally, in addition to providing simple measures of rates of intermarriage, census data could be usefully explored in order to gain some further insights into what factors might influence partner choices amongst a range of ethnic groups. Variables such as geographic location (including the spatial concentration of particular ethnic groups), country of birth, and specifically for Māori, responses to the ancestry, iwi affiliation and language questions, could be tested in models in order to gain better insights into influences on partner choice.

Notes

An early version of this research note was presented at the 2003 Ministry of Social Development conference *Connecting Policy, Research and Practice*. I would like to thank Simon Chapple, Martha Hill and David Pearson who provided insightful comments on early drafts of that paper. An anonymous referee of this journal also provided some very helpful comments on this research note. However, while I have been influenced in my thinking by a range of people, I take full responsibility for the ideas expressed in this paper. Finally, I acknowledge the funding that the Foundation for Research, Science and Technology provided for this research.

1 In this type of analysis Māori are an ethnic group but non-Māori are simply a residual made up of a wide range of ethnic groups.

2 Other researchers have used the terms "sole Māori" and "mixed Māori" (eg. Chapple 2000).

3 However, the term "race" is generally used in US studies.

4 This reflects a general decline in the influence of religion in most industrialised countries

5 Qian and Lichter (2001) make the point that if population sizes are quite different, then it is not possible by looking at intermarriage rates to assess whether groups exhibit discriminatory behaviour relative to another group. For example, in New Zealand it would be possible for 100 percent of Pacific Peoples to have a European partner but, given the much larger size of the European ethnic group, relatively few Europeans would be able to have a Pacific Peoples partner

6 Pool (1991:4) nevertheless goes on to state that "[i]n spite of this interdependence New Zealand has also seen two very different population histories: the Māori, and the Pakeha, the latter a population predominantly of European descent".

7 Although there was a low point in 1910.

8 Kukutai (2001) provides some basic data from the 1996 census on marriage between Māori and non-Māori as an introduction to more detailed data on the transmission of ethnicity to children.

9 These partnerships could have been of very short duration or relatively long term.

10 This type of analysis could be repeated for same sex couples.

11 When broken down by sole Māori and the "Māori plus other" group, this relationship between education and marriage to person from another ethnic group(s) holds for all age groups amongst men. For female Māori this relationship holds also in most age groups. However, in the 55-59 and 60-64 age groups there is a slightly higher chance that sole Māori women will have a Māori partner when they are qualified rather than unqualified (For the 55-59 age group 70 per cent of qualified sole Māori had a Māori partner versus 67 per cent of those Māori who recorded more than one ethnic group. For the 60-64 age group, the figures are 67 per cent versus 65 per cent).

12 Many factors are likely to have contributed to the past gender imbalance in intermarriage. For example, a reviewer suggested that in the 1950s and 1960s non-Māori men were more likely than non-Māori women to have been working in areas where they were in contact with Māori.

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A Cohort History of Mortality in New Zealand

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Abstract

This paper uses the generational life tables to track historical mortality experience for New Zealand Pakeha and Māori. The key research questions we seek to explore concern with why was Pakeha life expectation so high so early, and why did this survival advantage disappeared by the mid 20th century and what has happened since? For the Māori population what was the impact of contact on Māori mortality, what were the changes that have occurred and why, and what has happened to Māori mortality recently? A key finding from the cohort mortality analysis is that gains in survivorship have momentum effects that propel this advantage forward as survivors move up through the age-groups. That said, however, periods of gain may be followed later by cohort deterioration occurring among the same generations later in their life-cycle, and even by further cycles of reprise and deterioration. These cycles of gain, deterioration, reprise etc are more evident for males, and particularly for Māori. Policy implications of these findings are discussed.

This paper maps the history of mortality in New Zealand over the last 100-200 years. It is heavily empirical, yet it also addresses major theoretical and policy issues. Its starting point is the observation that there are still people living amongst us in New Zealand who were born in the 19th century, at a time when life expectation for a Pakeha child was less than 60 years, and for a Māori was below 25 years. That did not, of course, mean that these were average ages at death, or that these figures represented upper limits of longevity. Then as now some persons died at "grand old ages", but the key point was that the force of mortality, the ages at which high proportions of the population fail to survive, was very different.

According to the generation life-tables we have estimated,[1] when Dame Whina Cooper, who lived into her nineties, was born, 37 per cent of her cohort would not have survived to their first birthday (see Table 1). In fact,

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fewer than 50 per cent of these young Māori girls would have reached their 10th birthday and thus only a minority would have reached adulthood. Those who passed their 40th birthday would, however, have had in front of them the same number of years of longevity that the cohort had had at birth – about 25 years. And a very small minority would expect to reach very old ages (see also Pool 1991). This is what we call the force of mortality at the outset of an epidemiological transition. In contrast, Pakeha were already well into an epidemiological transition, and thus more than 85 per cent of Pakeha girls born at this time would not only reach adulthood, but would survive to the end of their reproductive span. Yet, their expectation of additional years of life at menopause was then not dramatically different from that of their Māori counterparts.

Table 1: The Māori and Non-Māori generations born in the early 1890s: Survivors to a given age, and *cohort* life expectations at given ages

	Maori		Non-Maori	
	Males	Females	Males	Females
Life-expectation at given ages in years (e_x)				
At birth	29.6	25.9	59.6	64.8
At 45 years	22.8	22.4	27.9	32.2
Number of original cohort of 100,000 surviving to 1, 10 and 45 years				
Reaching 1	62,913	60,627	97,409	97,476
Reaching 10	57,177	46,673	87,564	89,329
Reaching 45	36,818	30,666	77,457	80,164
Probability of surviving from exact age x to x+n				
Birth to 10	0.572	0.467	0.876	0.893
10-45 years	0.644	0.657	0.885	0.897

Sources: see Appendices.
Note: Cohort tables normally give higher e_x values than do synthetic tables of the corresponding birth periods because of improvements in survivorship over the cohorts' life-spans.

In the 1890s, at birth the gap in life expectation for females between Pakeha and Māori girls was 39 years; at 45 it had dropped to 10. For males the comparable differences in years were 30 down to only five. Equally well gaps in the probabilities of surviving diminished significantly over the life-span (ages 0-10 years, as against 10-45).

In contrast, for both Māori and Pakeha cohorts born in the second half of the 20th century, the majority could expect to reach their sixties or

beyond. This is the force of mortality at the last stages of an epidemiological transition (Pool 1994), at least as human populations have experienced up till now. Later in this paper we will ask whether past experience is a guide to the future, a question that has enormous implications for health services and policies.

The passage through this epidemiological transition (the term of Omran 1982), particularly of the sort that Māori achieved, is very complex. It involves, *inter alia*,

- a shift in the force of mortality by age, as we have just described,
- a shift from the predominance of communicable disease mortality to non-communicable, a point we will cover here in passing, and
- a shift from lower levels of female life-expectation between the two genders to lower levels of male (Stolnitz 1955-56),[2] a transition that Māori went through between 1945 and the 1950s, at a time when mortality data were of sufficiently good quality for us to have confidence in this observation (here we are talking about the reporting of deaths from all causes, not the certification of their causes). In the late 19th century, at reproductive ages Pakeha females had had higher risks of mortality than males, across a wide range of causes and not just maternal mortality.

The determinants of the different aspects of the epidemiological transition are also complex. Bio-medical technologies became really critical for public health only after World War II, when service methods allowed the newly developed antibiotics and chemotherapeutics, and vaccines, to be delivered to mass populations. Thus we must search for other factors before this time. These include general social and economic change. From a public health standpoint, community health programmes (of the model suggested in the Alma Ata, WHO Assembly 1978), and the promulgation and application of a wide range of health regulations relating to sanitation, hygiene, food preparation and patient care, and the improved delivery of health services were all important. The link to other aspects of public policy is also important.

As much of the Pakeha transition had occurred before World War II, we must look beyond bio-medical explanations. Moreover, between the 1890s and 1945 Māori life expectation at birth (e_0) had edged up from the low 20s to 48 years, so again we have to go beyond bio-medical explanations. Māori life expectancies then increased rapidly between World War II and the late 1950s. It would be easy to suggest bio-medical explanations for this improvement, and certainly they played a role, but with 50 per cent of the decline coming from tuberculosis alone (75 per cent for adults), a disease for

which no simple bio-medical explanation applies for that era, we have to look elsewhere. Finally, observations from the period 1960 into the late 1980s on a slowing of improvements for both Māori and Pakeha, including clear evidence of cohort deterioration, require explanations that are also outside the purely bio-medical framework.

Why is the History of Mortality Important for Present Day Public Health Concerns?

This could be seen as academic, an interesting history but of little relevance for contemporary public health. Such a viewpoint would be badly mistaken, for the following reasons.

As an individual carries into later stages of their life cycles health problems to which they were exposed at younger ages, so too do cohorts carry forward what they have experienced over their life cycles. These include exposure to risks of mortality, their access to health care, and changes in policy environments over their life spans. In sum what we have outlined earlier. For example, even assuming that care was of equal quality, compared with their Pakeha peers cohorts of post-menopausal Māori women still carry with them the extra wear and tear, the physiological burden of childbearing (Waldron 1982), of the several more pregnancies they will have experienced. To take another case, classical cause-specific cohort studies on tuberculosis for populations in which declines did not result from access to powerful antibiotics, show a "recrudescence" at older ages.

From a public health policy standpoint, the most important questions relate to the future of longevity – the "burden of disease" is a sub-plot to this. Debate revolves around different postulates on this: whether it will extend and to what age, indeed whether there are limits at all, whether the gaps between premature and much later deaths in any cohort will compress or extend, and then the related question of whether extensions in longevity (Oeppen and Vaupel 2002) will be accompanied by a longer or shorter duration in ill-health. Each postulate has a different implication for public health. To provide accurate projections of different trends cohort analyses of mortality are needed, and particularly generation life-tables (Cheung 1999; 2001).

Less directly, for both health trends and service programmes this history may provide information and lessons that are very relevant to the formulation of public health policy and services. We will illustrate this by referring to Māori at the dawn of the 20th century.

The remainder of this paper is a history that draws on cohort life tables, reproduced in the appendices, for Non-Māori (Appendix A) and Māori (Appendix B), on recent synthetic tables (Appendix C). Appendix D relates to the construction of the life-tables and to problems with data sources, especially Maori historically and recently. To organise this history it attempts to respond to six questions relating to:

i. The very early achievement of high levels of life-expectation by Non-Māori – Pakeha women were probably the first population anywhere to see e_0 reaching 60 years.
ii. The carrying forward of this advantage into the twentieth century, and the subsequent cohort deterioration (defined later).
iii. Then the recent gains in Pakeha life-expectation.
iv. The decline in Māori life expectation from levels probably among the highest anywhere in 1769 (e_0 = 30-32 years) to very low levels (<25) in the 1890s.
v. The improvements in e_0 for Māori between the 1890s and 1910 (from <25 years to perhaps 35).
vi. The gaps between Māori and Pakeha that still exist.

Question 1: Why was Pakeha life expectation so high so early?

Addressing a more theoretical debate, Oeppen and Vaupel (2002) used New Zealand in the early 20th century as a case-study to argue that observed e_0 might already exceed limits to longevity being posited by the pundits of any period. They then raised the question why New Zealand should have been so advantaged, and the present authors responded to this in an invited paper at the Max Planck Institute, Germany, in September 2002 (Pool and Cheung 2002). We briefly summarise our results here.

Firstly, before one can ask "why", it is necessary to verify whether the data were satisfactory. Moreover, given that the official tables of the day excluded Māori, we asked what would have been the effect on the overall levels if Māori had been included.

Sceats and Pool (1985a) had argued that under-registration of Pakeha neonatal deaths occurred in the late 19th century. But by comparing observed values for the life-table function p_x (probability of surviving from exact age x to x+n) with model life tables we were able to show that if this "had occurred in the 1880s and 1890s, it would have been very slight. At $_1p_0$ in 1874… there does, however, seem to be an indication of the effects of under-registration at infancy" (Pool and Cheung 2002:13). This actually

strengthens later arguments below about the carry-over of this advantage for cohorts into the 20th century.

The exclusion of Māori does have some effect despite the fact that Māori were only 9 per cent of the total population in the 1880s. The e_0 for New Zealand as a whole drops from 56 years (Pakeha alone) to 51 years (Total), the same as Norway's at that time, but e_{20}, e_{40} and e_{60} fall below the values for Norway. If Māori are excluded, values for Pakeha at younger ages are well above those for Norway and Sweden, but older ages (eg. e_{40}) fall below. Thus it seems that adult New Zealanders faced relative, albeit minor, disadvantage by comparison with some northern European populations, a trend that continues in 20th century tables (Pool and Cheung 2002:14–15).

Turning to "why" Pakeha were advantaged in this way, one has to dismiss bio-medical explanations as major factors, and even public health can not be cited (as is clearly documented in MacLean 1963). We point instead to several underlying factors (drawn principally from Pool and Cheung 2002).

The economic factors favoured Pakeha. Despite the "long depression" from the late 1870s to the early 1890s, the economy "started from a high level relative to other countries, and maintained a high level…" (Hawke 1985:77). Lifestyles and living conditions may have been the best anywhere. There was a surplus of meat proteins in the diet (a good factor in those days), population densities even in urban areas were low, housing was detached, typically with their own gardens, the climate was temperate and most people could garden all year. Public policy, particularly under the Seddon government, reinforced all of these effects.

But there were also other factors that had more direct effects on health (Pool and Cheung 2002). The first was the migration process and the second was decline in fertility.

In the 1880s and 1890s the younger Pakeha population was mainly born in the colony with all the advantages that this bestowed; the older population by contrast was immigrant in origin arriving in the peak flows of the late 1860s and 1870s and carrying with them the cohort morbidity histories of Europe. Migration then dried up in the long depression until another significant inflow especially from Australia in the early 1900s. This explains why e_0, affected by both childhood and adulthood patterns were above Nordic levels, yet e_x for adult ages alone were below. The migrant selection processes of the Vogel government (including for "phthisis") in the late 1860s and 1870s, when some of our highest inflows ever occurred, may have had a minor effect, compounded by "six months on a leaky boat".

The greatest improvements in Pakeha survivorship in the late 19th century occurring from 1876 to 1896, in fact the most rapid at these ages at any time in their history, were at childhood ages, before any specialist paediatric health programmes, such as Plunket, were established. For boys, for example, only 82 per cent of the cohort born in the early 1870s would reach 10 years; by 1896 it was 88 per cent. From 1896 improvements were much slower; the proportion of the 1911-16 cohort of boys reaching 10 years had increased only to 91 per cent. These changes at infancy and childhood had such important overall effects that they produced an aberrant pattern of mortality decline for Pakeha. Other industrialised countries saw more rapid improvements after 1900, whereas for New Zealand they had occurred before 1900.

The improvements in survivorship at infancy and childhood in the absence of either a bio-medical or public health explanation is easily explained. There was a very rapid fertility decline at this time, from almost seven births per woman to three, and again there was not a technological reason for change. Instead, a very significant shift in marriage patterns for women took place, from early and almost universal to late and with increased spinster-hood rates (Sceats and Pool 1985b). The decrease in family sizes would have affected cross-sibling infection levels, overcrowding in households especially in bedrooms, the capacity of families to feed and clothe children, and a decline in the need to pass childcare of younger siblings from parents to older siblings. These impacts show up in the cause- and age-specific mortality rates across almost every group of causes, in data terms most robustly for accidental death rates that drop very rapidly. Interestingly, this fertility decline also seems to have determined a sex crossover for mortality from a range of causes at the reproductive ages. In 1876, males had higher survivorship at these ages, but by 1916 the situation had totally reversed (Pool 1994).

We have discussed in some detail the very early period for Pakeha because trends established then laid down everything that has happened since. In essence the major advances in survivorship had already been achieved by early in the 20th century.

Question 2: Why did this advantage for Pakeha continue into the 20th century, and why then did it disappear?

These issues can be dealt with quite summarily using data in Appendix A. Public health reforms came in a burst in the early 1900s, with the establishment of a Department of Health, and the passing of some important

regulations, and again in some areas in the 1920s and early 1930s (eg. maternity hospital standards, and maternal and child health services). But an important factor was endogenous to cohorts, and came from the changes noted just above. The gains to cohorts when at young ages in the late 19th century produced a momentum effect that resulted in improved survivorship when they reached older ages. As shown above, by 1900 far more children in each cohort were surviving to 10 years of age, and then with some further reinforcement by period improvements this meant far more persons in the cohort were still alive at 50 years. The key factor, however, was to survive to age 10 (Pool and Cheung 2002).

From the birth cohorts of the 1920s, however, cohort deterioration set in across a range of adult ages, particularly for males. This can be seen in the cohort tables. Thus for several decades across some active ages succeeding cohorts' survivorship probabilities were lower than had been the rates for their predecessors (Pool 1983; Cheung 1999). It could have been due to the effects of improved regimes of maternal and child health care introduced in the inter-war decades of the 20th century. This may have permitted the survival of high-risk babies, who would have died under previous regimes, to survive to become at risk or "frail" adults. An alternative explanation is linked to period effects related to the lifestyles that cohorts adopted later in life (Pool 1983) – this comment refers, of course, to the exposure of cohorts born before the war to the lifestyles, behaviours and environments prevalent in the 1950s and 1960s. Changes in all of these, for factors such as the prevalence of smoking, have been significant in recent decades.

Regardless, the force of mortality had clearly shifted upwards from children to the middle aged, and by the post-war period was having an impact at pre-retirement and retirement ages. For male cohorts, 67 per cent born in 1871 would reach 50 years, and 32 per cent 75; 82 per cent of boys born in 1911 reached 50 years, and 41 per cent 75 years; but over 90 per cent born in 1951 reached 50, and at least three-quarters will have a 75th birthday.

Question 3: Has cohort deterioration for Pakeha become less evident, has there been a reprise, and what are the implications?[3]

Systematic deterioration was observed at an even younger adult ages for the cohorts of 1951-56. Indeed declines in inter-cohort survivorship probabilities among males at young adulthood were particularly marked. The fact that this same cohort had also benefited handsomely from a

prolonged period of substantial improvements in infant and early childhood survivorship almost suggests that the deterioration at reproductive ages is a compensating mechanism for the enhanced survivorship at younger ages. We should also note that the pace of decline in infant and early childhood mortality has dropped off since what was achieved by the 1951-56 cohort.

When middle-aged, however, the 1951-56 cohort had recovered sufficiently (as observed from its trends in the 1990s) to retain a level of mortality below that of its predecessors. This thus opens up interesting questions: do gains observed over the more recent periods represent real gains in survivorship, or are they simply an effect of cohorts regaining their trajectories? Is the period improvement the start of a longer-term trend, or merely a temporary phenomenon?

Projections of mortality constructed by Cheung (1999) address this. He shows that for younger cohorts survivorship improvements continue well into old ages. More importantly, for the cohort of 1951-56 over 81 per cent of men and 88 per cent of women will reach 70 years. Thus the force of mortality is clearly not just at retirement, but even at much older ages. This point raises what might be seen as among the most important questions, discussed above in the second section of this paper, for population health in the developed countries: the question of compression vs extension. That is, whether the force of mortality has shifted up sufficiently, so that the great majority of deaths are increasingly concentrated in a narrower age range, or whether the force of mortality is continuing its upward shift leading to a broadening of the age-at-death distribution at the advanced ages.

These questions are not merely academic, for the issue of mortality compression has far-reaching policy implications. The eventual outcome will determine the size and the mix of the future older population, and, through interactions with morbidity, will define the health status and health needs of future populations. The lack of a robust knowledge on mortality in New Zealand limits speculation about this last point.

An analysis of mortality focusing on the second part of the 20th century carried out by Cheung (1999) has found some weak evidence to support the compression hypothesis. The issue becomes even less clear-cut when viewing the data from a cohort perspective. Considerable variations, at times deterioration, in cohort mortality patterns underline marked inter-cohort differentials coming from accumulated exposure to risk, and in terms of carrying risk at earlier ages forward to later ages. This latter finding indicates that life expectancy is not yet approaching its biological limit, and some further increases can be realistically expected, albeit at a decelerating pace.

Question 4: What was the impact of contact on Māori mortality levels?

The skeletal evidence for pre-contact Māori is really our only source of information on possible levels of mortality at the time of Cook. One must note that the data are at best fragmentary, and with very few specimens.[4] But they suggest that Māori e_0 may have been of the order of 32+ years at birth at that time. In the paleo-demographic literature this level is high. It approximates the figure for the British aristocracy at that time, and also the level for Sweden -- the nation probably with the highest expectancy at that era. It was above the level for England as a whole, or for other European countries such as Italy or France. From what can be deduced retrospectively about this geographically isolated population, Maori were not exposed to the "apocalyptic" diseases such as the plague, cholera or smallpox,[5] but absent too were tuberculosis, influenza and the so-called acute infectious childhood disorders, such as measles (Pool 1991:chapt 3).

Māori mortality increased after contact, and especially after 1840, to reach extreme levels in the last 40 years of the 19th century (see above). From then on life-expectation improved in the early 1900s significantly to achieve, and then pass, pre-contact levels. The reasons why this path was followed has been fully documented elsewhere (Pool 1991:chapts 4 and 5), and thus can be briefly summarised here.

Clearly Māori had no natural immunity to the diseases that were introduced. The sailors arriving here came from some of the most squalid urban environments of Europe and the Americas (Crosby 1986:232; Pool 1991:62), and thus brought with them the wide spectrum of virulent diseases that would have been prevalent in their home ports. Even the settlers would have been previously exposed, and would have carried with them respiratory and other acute infectious diseases. The "childhood" disorders wreaked particular havoc – the first nationwide measles epidemic, in 1854, probably killed about seven percent of all Māori, across all ages, as no one had immunity except a few in the far south previously exposed in a local outbreak. As epidemics occurred more frequently, say the next national measles epidemic in the early 1870s, those previously exposed had some immunity and death tolls were high among the young, but overall they were lower than they had been in 1854. Once introduced the chronic infectious disorder tuberculosis was particularly virulent, and this was reinforced, especially after the 1860s, by malnutrition and extremely poor living conditions attendant upon land loss. It should be noted that levels of direct mortality resulting from the so-called "Musket Wars" before Waitangi, and

even from the "Land Wars" of the 1840s and 1860s, were a minor factor. In contrast, the indirect effects of war, especially of the Land Wars, would have been far more important, and in the latter case were reinforced and extended over time because of raupatu.

But for diseases to be successfully introduced and spread, especially to some parts of the interior of the North Island where large populations lived, there had to be several pre-conditions. The early frequent contacts of Europeans were with coastal iwi in a relatively few locations; this then changed. The immigrant population had to grow so as to provide a sufficient "reservoir of infection", and large numbers of settlers had to have contact with significant components of the Māori population. The Treaty of Waitangi permitted contact to increase. But even then the greatest and longest impacts came only through what Belich calls "swamping", with the huge inflows of Pakeha in the late 1860s and 1870s. For this to occur land had to be available for settlement, the key development mechanism of New Zealand's most explicit ever population policy: the *Immigration and Public Works Act* (1870). Land availability, in its turn, depended on breaching the Treaty through the application of raupatu to opponents to the crown, and through land sales, at first mainly in the South Island. But later these actions shifted more and more to the heavily settled accessible areas of the North, and eventually to the remote Tuhoe, Ngati Tuwharetoa and Ngati Maniapoto heartlands (Pool 2002). Major sales were still being forced through the courts in the early 20th century.

One can not over-emphasise how significant for Māori health was land loss through raupatu, land sales that were essentially forced, and the taking of land say for public works, enforced by court action and other ostensibly legal processes. This direct taking of the major economic resource of Māori reinforced other factors so as to maintain and entrench high levels of mortality for Māori at the very time when Pakeha rates were dropping rapidly. Although raupatu was limited in duration and geographical coverage, it obviously had severe immediate effects on iwi such as Waikato and Taranaki, particularly when linked to a "scorched earth" campaign, as in the Urewera in 1868, and it was not just confined to iwi who had fought the crown. Some iwi subject to raupatu also suffered loss through forced land sales – Taranaki was an extreme case of this.

The other major cause of land loss was the sales that occurred throughout New Zealand, over a very long duration, that were far from benign and thus whose long-term impact was arguably more severe than raupatu. Court-driven land loss processes had both immediate and long-

term effects. Immediate in that all members of hapu (even babies) owning lands brought under the jurisdiction of the courts had to attend hearings or forego all rights, often travelling long distances to do so, and living near the courts under crowded, unhygienic and squalid conditions. Some hearings became infamous for the loss of life of Māori participants. Moreover, the process severely disrupted their normal social and economic life, in particular causing major declines in the production of food.

Even more serious were the long-term effects of raupatu and land sales. Māori had to restructure entirely their economic and social lives, as land loss meant that they no longer had recourse to the previous extensive use of land to gather food and for mahinga kai. They also lost their most fertile land on which kumara production and other gardening had occurred, and often they lost access to moana kai resources. Finally, many were uprooted and had to migrate.

This all produced malnutrition-infection cycles, the effects of which can be indirectly documented through indicators relating to dependent children, the most vulnerable sub-population, and one whose survivorship is taken internationally as a sensitive indicator of social development. Systematically then, iwi by iwi, region by region, in the years following major losses through raupatu or land sales, child survivorship (measured by a very crude index) decreased. It then picked up again only when Māori had been able to find some mechanism for coping with the loss of their economic base. Some iwi, notably Tuhoe, even went through two cycles: raupatu → decreased survivorship → a start towards recuperation → land sales forced through the courts → once again decreased survivorship (Pool 1991:chapts 4 and 5).

Question 5: When and why did changes occur for Māori?

By the early 1890s Sir James Carroll, a Māori minister in Seddon's cabinet holding a key post, Lands and Forests, discerned a demographic reprise occurring, and recruited Māori students to the Young Māori Party to help forge a strong renaissance. By then immunity to introduced diseases was increasing, while communities were finding mechanisms by which they could cope with land loss (Pool 1991: chapts 4 and 5).

But there was another factor. The passing of the *Public Health Act* (1900), and the establishment of a Department of Health – the provision of services had been chaotic prior to that (MacLean 1963) – saw the creation of a Division of Māori Hygiene staffed by Māori medical graduates who had also been mentored by Carroll. In turn they launched a public health

campaign, devised by them, and with all the features that 70 years later were to be heralded as an inspired new initiative by the Alma Ata Assembly of WHO. Critical to this were community involvement and empowerment (eg. the *Māori Council's Act*, popularly termed *Te Pire Kiore*) and the implementation of basic modes of sanitation, often introduced by appealing to iwi lore.

Between the 1890s and the early 1900s there was, in fact, a rapid improvement in Māori life expectation, from 23-25 years to 30-35 years over a decade.[6] Unfortunately, this momentum was not maintained, and e_0 increased gradually by only 12 years over the next four decades (1945, e_0 = 49 years among males and 48 years among females).

During and after World War II came perhaps the proudest moment in the history of public health in New Zealand, when health policy was nested into social policy. The fundamental principles for both emanated from the 1938 *Social Security Act*, that ensured equal provision of services to both Māori and Pakeha. Moreover, the newly introduced armoury of bio-medical technologies often reinforced this, but the real factor was public health, in the broad sense of that term (Pool 1994).

As was noted earlier, it was the rapid decline in the tuberculosis death rate that was the most remarkable aspect of this. In his fascinating pioneer public health study on the East Coast, Dr Turbott (1935) had identified the prevalence of tuberculosis among Māori and had analysed its co-variates, while Edson wrote a seminal paper on this in the *New Zealand Medical Journal*, identifying the importance of the problem (1943). Armed with this evidence-base, 10 per cent of Māori (and nurses, the other population deemed to be most at risk) were x-rayed annually by mobile x-ray units. Sufferers were sent to sanatoria, while the social welfare system moved in to help their families find adequate housing, normally a state rental, and other financial and nutritional support. Cohort analyses show a radical decline for every single cohort, a very different trajectory from the much slower decrease of Pakeha. Yet it is worth noting that, apart from population screening and diagnosis, this was not due to high technology bio-medical interventions: an appropriate anti-biotic became available only at the end of the period of most rapid decline (1945-56). By the 1970s, however, residual cohort effects were showing up at older ages, perhaps because of the methods used for treatment, or perhaps because of a failure to maintain screening programmes (Pool 1985, 1994).

As had been the case in the first documented Pakeha mortality decline discussed earlier, much of the total decline for Māori during the period

1945-66 came at the youngest ages. Decreases at 0-4 years constituted 60 per cent of the male total, and 46 per cent of the female. In short, by the end of this period the force of mortality had shifted up from childhood, whereas fewer changes had occurred at older ages, particularly for men. Indeed, at older ages for men there was deterioration, whereas for women there were consistent gains at all ages, and a sex crossover occurred. That said, women still faced major health problems. For example, male rates of coronary heart disease were closer to Pakeha. Although Māori female rates were below those of Māori men, they were still "extraordinarily high by world standards…" (Beaglehole 1977)

This is seen in the e_x in the following table. By way of comparison data are also shown for e_0 for Pakeha. This was clearly a period in which some of the "gaps" were partly, but not completely, closed.

Table 2: Life-expectation (years) at selected ages, Māori, 1945-66

	Birth	15	30	45	60	Non-Māori at birth
Males						
1946	49	44	35	23	14	67
1966	61	50	36	23	13	69
Females						
1946	48	42	32	22	13	71
1966	65	52	38	25	15	75

At this point it is worth reflecting on Māori health issues until say the 1980s, for these are still having a residual impact on recent trends, particularly because of the latent effects on cohorts being carried forward as each generation ages, as is seen in the data in Appendix B. Our argument here is that, when looking at the present, one can not ignore the history of cohorts.

Two points are pertinent. Firstly, for numerous Māori male cohorts, from those born in the 1890s to the 1920s, and again for those born in the period of rapid mortality decline after World War II, improvements in survivorship often went forward in bursts. There would be a gain, and then not just a period of standing still but Māori cohorts would suffer survivorship deterioration. In the 1960s the effects of this were so marked that the Māori male e_0 actually decreased slightly. This would be followed

by a second period of gain, and this then led the population into the 1990s, when further deterioration seems to have occurred (see below next section).

Secondly, for Māori women it is useful to go back to Beaglehole's comment quoted above to posit a public health issue that we feel is not discussed enough. Clearly living conditions, smoking levels, lifestyles and diet must play some role for a cluster of factors, including obesity, diabetes and cardiovascular mortality. But we would add another: the physiological burden of childbearing. All Māori female cohorts born up to the early 1950s will have differed markedly from their Pakeha peers in this regard. Some cohorts now at older ages will have had over six live births, and thus on average, allowing for foetal loss, perhaps eight, or even nine, pregnancies, often under less than optimal conditions. While fertility has dropped very significantly, to just over two births per woman, the locus of Māori reproduction is still disproportionately at youngest ages that might be more at risk of negative effects.

Question 6: What has happened to Māori mortality recently?

This then sets the scene for the last decade or so. What is remarkable is the evidence of very recent cohort deterioration for numerous cohorts, male and female, across a broad range of ages. There could be three explanations for this trend. (We draw here on recent synthetic tables, see Appendix D.)

i. It could be artefactual, a result of shifts in definition of ethnicity affecting, in different ways at different times, both numerators and denominators.
ii. It could be a function of the carrying forward from the past of cohort "frailties", to use the technical term.
iii. It could be the impacts of radical restructuring on Māori. Other work at the Population Studies Centre (Honey 2001) has pointed to the disparate impact of job loss on the Māori workforce. Not only was there a net loss during 1986-96, but when demographic supply is taken into account the impacts are seen to be far worse. Other work still being completed also estimates regional differences in "discouraged worker" effects, and related factors.

Turning to these postulates, the artefactual explanation may seem immediately appealing, as it is an issue that has been widely discussed in policy and research circles. In part, we have obviated this because we have used averages over several years, thus dampening fluctuations, but also producing rates that cover periods with different data collection protocols. But on closer examination it may even prove to be counterfactual.

The recent cohort deterioration was between 1991 and 1996, and was typically followed by a reprise by 2001. For the oldest male cohorts, the most recent cycle of deterioration was already evident as early as 1981. Yet the argument about data quality has been that, by comparison with the censuses of 1991 and 2001, the census of 1996 may have inflated the size of the Māori population, thereby inflating denominators and artefactually reducing mortality rates. In contrast, we have shown that they increased – by comparison with immediately preceding cohort, the survivorship probabilities had actually decreased in our generation tables. Vital registration changes were introduced in 1995, becoming effective in 1996. Thus both our 1996 average figure and that for 2001 will have been governed by the same protocol.

There is another issue here that has been seldom discussed: displacement of registration of Pacific Island deaths. If the life-tables for this population in the early 1990s were taken literally, they would have had the highest levels of life expectation in the world. In contrast, in the late 1990s levels appear much more reasonable, close to Māori. Thus Pacific island deaths must have been displaced elsewhere, most likely classified as Māori (Pool 1991).

To analyse the effects of this the authors used the Pacific Island death rates for the late 1990s applying them to the population at that time. Differences between these "expected" Pacific Island deaths and that used in the original Pacific Island life table calculations (the "observed") were significant, at more than 300 deaths among males and more than 200 among females. These differences were then subtracted from the Māori tables. The results are a six years increase in life expectancy at birth for Māori males and a four years increase in Māori females in the early 1990s. These Māori expectancies seem too high. Thus a second simulation was carried out allocating only half of the differences in Pacific Island deaths as wrongly registered as Māori. The net results are roughly halved: three years increase for Māori males and two years for Māori females.

Regardless of which of these simulations is accepted, it seems that Māori deaths might have been *over*-reported at that time, not *under*-reported; that is Pacific Island deaths were wrongly recorded as Māori. If these models have any validity, then a new set of questions must be raised. They would suggest that Māori life-expectation in the early 1990s was higher than at the end of the decade, even when official tables are accepted for the latter date. These results would reinforce the arguments we outline in the following paragraphs.

Thus we are forced back to a substantive postulate:

> That the deterioration in 1991-96, especially for Māori male cohorts, was a residual effect of a history of cycles of cohort gain and deterioration reinforced by period effects coming from restructuring.

We might adjust this slightly for females by postulating:

> That the negative effects of restructuring on Māori reinforced the residual cohort effects coming from a history of high fertility and its attendant physiological burdens.

Restructuring involved not just job loss, but also a shift in patterns of work through casualisation, contracting out and long hours often involving night shifts for women workers. Thus we would postulate:

> That casualisation etc fell disproportionately on Māori and Pacific Islanders, especially women in unskilled jobs such as office cleaning, and that, this would have reinforced residual cohort effects emanating from the physiological burdens of high levels of childbearing and pregnancy at young ages.

Finally, a detailed internationally peer-reviewed study of regional differences in hospitalisation and survivorship, using a new life-table technique[7] that analyses the prevalence and duration of hospitalisation for those still surviving, along with more conventional methods, is raising new questions about recent mortality trends. Specifically, initial results show that health restructuring in the 1990s seems to have had an effect on access to hospitalisation in some regions. This appears to have had more impact on Māori than on other population (Pool *et al.* forthcoming).

Towards a Conclusion

This paper has used a very robust well-established conventional technique, the life-table, employing it in a less familiar form, for generations or cohorts. The estimates come also from widely used robust demographic techniques developed since World War II, and based, in turn, on a significant body of bio-metric and actuarial theory.

The utility of the generation table approach is that, at least at a population level, it allows one to show how exposure to health risks in one period may produce residual effects that have negative health implications later in the life-spans of the cohorts one is observing. A key finding is that gains in survivorship have momentum effects that propel this advantage forward as these cohorts' survivors move up through the age-groups. That said, however, periods of gain may be followed later by cohort deterioration occurring among the same generations later in their life-cycle, and even by

further cycles of reprise and deterioration. These cycles of gain, deterioration, reprise etc are more evident for males, and particularly for Māori.

This raises a major question for policy. Given that we have cohorts, particularly of Maori men, that have disproportionate levels of frailty, they may require extra measures of monitoring. For Māori women it is the history of reproduction that seems critical. Cohorts of both genders, however, may have seen their exposure to health risks in the past compounded by recent negative social and economic experiences that carry health risks (eg. the links between job-loss and uni-polar depression, seen in burden of disease exercises as a major cause of future problems). In this regard there seem few advocacy groups pushing for the monitoring of Māori middle aged men, yet they have the highest risks of premature mortality.

This is clear in the following tables for the cohorts born in the early 1940s. Not only have fewer Māori than Pakeha in any cohort reached 40 years but their health risks are much greater. The life-table data for the cohort of males born around 1940 show, for example, that fifteen per cent of all their deaths over the cohorts entire life span until now occurred at late middle-ages. This can be compared with the 11 per cent from the same cohort who died in infancy, or the 16 per cent who failed to survive to age five years, at a period in the past when death rates at young ages were still very high, but about to fall. In contrast, the high loss at late middle-ages comes at a period when only 1.4 per cent of the cohort born in the 1990s will have died at infancy, and only 1.7 per cent before five years.

Table 3: Numbers of survivors (l_x), by sex of a cohort of 100,000, born in the early 1940s, reaching 40 years, and 60 years, the probability of failing to survive through late middle-age ($_{20}q_{40}$), and the deaths ($_{20}d_{40}$) that will occur among them

	Māori		Non-Māori	
	Males	Females	Males	Females
l_{40}	75,781	80,168	92,199	94,858
l_{60}	60,581	68,015	87,662	91,633
$_{20}q_{40}$	0.201	0.152	0.049	0.034
$_{20}d_{40}$	15,200	12,153	4,537	3,195

Our concluding point relates to a different issue and is paraphrased from our 2002 paper to the Max Planck Institute. The cohort analysis provides a sobering thought for those researchers and policy analysts who see almost

no limits to human longevity. There may be a risk of confounding short-term effects with longer term ones. The older cohorts of today in most developed countries (but not Pakeha New Zealand whose epidemiological transition, as we have seen, was earlier) benefited from improvements in cohort survivorship between 1900 and 1930. The momentum of this may still be being felt today when these cohorts are at early old age. But, if the Pakeha New Zealand experience were to apply, say to the Nordic countries or Western Europe, then these gains would be followed by smaller gains, or even by deterioration. Extending this logic, then Māori will be one further step behind.

Notes

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1 For Māori, we have drawn on Pool (1983, 1991 and 1994). These studies used a range of indirect estimation techniques employed widely in demography to estimate vital rates and construct life-tables where vital data are non-existent or of poor quality. See Appendices A and B.

2 George Stolnitz based his conclusion on the analysis of every available life-table, including historical ones. His work, building on the work of Jean Bourgeois-Pichat and the United Nations Population Division, plus theoretical work by Alfred Lotka, then fed into the development by Ansley Coale and Paul Demeny of model life-tables, auguably the most important development in 20th century demography.

3 In this section of the paper we also draw on recent official synthetic life-tables, see Appendix C.

4 There are also problems relating to the ages of persons in burial places, a common issue in paleo-demography. This technical issue is elaborated in Pool (1991:chapt 3), that was peer-reviewed prior to publication by Dr Janet Davidson, a leading NZ pre-historian.

5 Smallpox threatened only twice and this was much later, once when a ship with it on board was quarantined in Wellington harbour, and thus it was not introduced; and once in 1913 when it was quickly contained. In 1913, public health specialists, led by Sir Peter Buck (Te Rangihiroa) immediately addressed the epidemic. His paper on this (*Aust Med Congress, 10th Session*, Feb 1914:212-24) was probably New Zealand's first modern epidemiological study. In these days of threats of bio-terror, it is worth revisiting his paper as it has a "quasi-

experimental" design, comparing death rates for those innoculated by missionaries decades before with those not innoculated.

6 Recent detailed work using indirect estimation techniques by Portal Consulting (Tahu Kukutai, Ian Pool and Janet Sceats) for the Crown Forestry Rental Trust on the Central North Island provides interesting micro-level confirmation of this global finding. The rates estimated by indirect estimation could be confirmed, in one instance, by data coming from a totally independent source from health information collected by Sir Maui Pomare on the Rotorua district.

7 Developed at the Population Studies Centre; see Pool *et al.* (2000) and Cheung *et al.* (2001).

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Appendix A: Non-Māori Cohort Life Tables

Probability of Surviving from Exact Ages x to x+n

Males

Birth Cohorts

Exact age x	1871-76	1876-81	1881-86	1886-91	1891-96	1896-01	1901-06	1906-11	1911-16	1916-21	1921-26	1926-31	1931-36	1936-41
0	0.88670	0.89356	0.89984	0.90233	0.90958	0.91535	0.91819	0.92731	0.93967	0.94603	0.95224	0.95997	0.96341	0.96497
1	0.94068	0.95699	0.96419	0.96747	0.97409	0.97216	0.97721	0.98087	0.97882	0.98028	0.98524	0.98813	0.98822	0.99026
5	0.97942	0.98340	0.98539	0.98968	0.98829	0.98875	0.99051	0.98775	0.98975	0.99200	0.99307	0.99332	0.99503	0.99503
10	0.98804	0.99019	0.99075	0.99145	0.99186	0.99192	0.99232	0.99238	0.99379	0.99474	0.99464	0.99490	0.99546	0.99661
15	0.98165	0.98472	0.98566	0.98746	0.98894	0.98807	0.98986	0.99075	0.99063	0.99094	0.99199	0.99281	0.99330	0.99414
20	0.97754	0.98065	0.98217	0.98515	0.97602	0.98459	0.98670	0.98735	0.98862	0.98609	0.98758	0.99175	0.99141	0.99340
25	0.97820	0.98128	0.98284	0.97911	0.98314	0.98549	0.98687	0.98837	0.98749	0.98895	0.99244	0.99281	0.99422	0.99323
30	0.97768	0.97904	0.97663	0.97930	0.98274	0.98568	0.98759	0.98710	0.98969	0.99116	0.99210	0.99315	0.99202	0.99330
35	0.97292	0.97162	0.97400	0.97825	0.98064	0.98234	0.98504	0.98794	0.98824	0.99017	0.99037	0.98959	0.99027	0.99105
40	0.96748	0.96830	0.97386	0.97499	0.97521	0.97844	0.98292	0.98431	0.98552	0.98515	0.98436	0.98465	0.98537	0.98722
45	0.95792	0.96152	0.96526	0.96697	0.96793	0.97168	0.97333	0.97576	0.97417	0.97234	0.97441	0.97413	0.97816	0.98092
50	0.94774	0.94953	0.95098	0.94746	0.95358	0.95535	0.95731	0.95742	0.95342	0.95588	0.95662	0.96373	0.96385	0.97202
55	0.92996	0.92717	0.92135	0.92830	0.92611	0.92934	0.92957	0.92299	0.92614	0.93018	0.93596	0.94184	0.95279	0.96182
60	0.88785	0.88381	0.88355	0.88786	0.88689	0.88544	0.88093	0.88101	0.88797	0.89611	0.90532	0.92195	0.93571	0.94885
65	0.82377	0.83039	0.82684	0.82689	0.82816	0.81941	0.81869	0.83000	0.83862	0.84859	0.87258	0.89197	0.90738	*0.91748*
70	0.73757	0.74828	0.74321	0.74333	0.72952	0.73568	0.73655	0.75924	0.76732	0.80236	0.82618	0.84748	*0.85963*	*0.87262*
75	0.63064	0.63108	0.62749	0.61699	0.61503	0.63100	0.64528	0.65780	0.69969	0.72975	0.76199	*0.77878*	*0.79359*	*0.80948*
80	0.49214	0.47893	0.47943	0.47407	0.49784	0.51053	0.52340	0.55785	0.59190	0.63855	*0.64438*	*0.66686*	*0.68406*	*0.69944*
85	0.30176	0.33287	0.31851	0.30447	0.35756	0.37633	0.42275	0.43557	0.45077	*0.48423*	*0.50212*	*0.51919*	*0.53433*	*0.54777*
90	0.19687	0.18256	0.16870	0.20274	0.23050	0.27319	0.26875	0.22872	*0.30331*	*0.32349*	*0.33679*	*0.35084*	*0.36154*	
95	0.05432	0.05285	0.09706	0.11664	0.13868	0.11291	*0.13588*	*0.14960*	*0.16134*	*0.17469*	*0.19109*	*0.20175*		
100		0.03670	0.04094	0.04913	0.02299	*0.03328*	*0.03693*	*0.04978*	*0.05121*	*0.05747*	*0.06551*			

Females

Birth Cohorts

Exact age x	1871-76	1876-81	1881-86	1886-91	1891-96	1896-01	1901-06	1906-11	1911-16	1916-21	1921-26	1926-31	1931-36	1936-41
0	0.90460	0.91094	0.91539	0.91789	0.92517	0.92925	0.93264	0.94174	0.95275	0.95785	0.96175	0.96813	0.97144	0.97296
1	0.94383	0.95899	0.96718	0.97277	0.97476	0.97362	0.97701	0.98201	0.98078	0.98178	0.98541	0.98942	0.99070	0.99155
5	0.98333	0.98677	0.98663	0.98958	0.99054	0.99134	0.99179	0.98972	0.99156	0.99321	0.99408	0.99452	0.99557	0.99651
10	0.98876	0.99042	0.99174	0.99106	0.99207	0.99439	0.99344	0.99408	0.99436	0.99671	0.99594	0.99687	0.99644	0.99847
15	0.98185	0.98435	0.98520	0.98691	0.98899	0.98996	0.98981	0.99217	0.99277	0.99401	0.99540	0.99585	0.99703	0.99775
20	0.97884	0.98158	0.98229	0.98526	0.98479	0.98488	0.98763	0.98948	0.99076	0.99202	0.99310	0.99632	0.99738	0.99770
25	0.97724	0.97814	0.98114	0.98046	0.98078	0.98635	0.98675	0.98892	0.99029	0.99180	0.99519	0.99672	0.99716	0.99697
30	0.97612	0.97816	0.97965	0.98000	0.98353	0.98393	0.98720	0.98890	0.99118	0.99390	0.99558	0.99561	0.99606	0.99583
35	0.97412	0.97724	0.97672	0.98163	0.98290	0.98520	0.98597	0.98762	0.99150	0.99249	0.99319	0.99392	0.99373	0.99410
40	0.97373	0.97308	0.97897	0.98048	0.97957	0.98266	0.98462	0.98733	0.98940	0.99012	0.98875	0.98944	0.98921	0.99107
45	0.96562	0.96791	0.96984	0.97234	0.97367	0.97350	0.97878	0.98273	0.98393	0.98244	0.98252	0.98344	0.98390	0.98683
50	0.95537	0.96056	0.96194	0.96277	0.96204	0.96748	0.97144	0.97525	0.97319	0.97426	0.97591	0.97782	0.97775	0.98103
55	0.94123	0.94385	0.94240	0.94439	0.95025	0.95803	0.96038	0.95931	0.96153	0.96278	0.96338	0.96591	0.97064	0.97634
60	0.91265	0.91105	0.92043	0.92343	0.93259	0.93593	0.93467	0.93905	0.94044	0.94589	0.94637	0.95530	0.96191	0.96606
65	0.85900	0.87412	0.88285	0.89015	0.89882	0.89712	0.90223	0.90961	0.90844	0.91716	0.92874	0.93775	0.94575	*0.95429*
70	0.79073	0.81028	0.82342	0.82833	0.83660	0.83985	0.84679	0.85992	0.86346	0.88299	0.89769	0.91239	*0.91947*	*0.92979*
75	0.69370	0.71199	0.71460	0.73539	0.73797	0.76166	0.77951	0.78110	0.81552	0.83168	0.85197	*0.85439*	*0.86931*	*0.87910*
80	0.56192	0.56187	0.58382	0.58917	0.62881	0.64715	0.66045	0.68951	0.71872	0.74603	*0.75980*	*0.76972*	*0.78266*	*0.79341*
85	0.38006	0.39374	0.39662	0.44557	0.48920	0.49048	0.53600	0.54851	0.57916	*0.60145*	*0.62003*	*0.63444*	*0.64692*	*0.65505*
90	0.23124	0.23080	0.24174	0.29267	0.29818	0.34312	0.34383	0.36667	*0.40187*	*0.42067*	*0.43392*	*0.44831*	*0.46534*	
95	0.07451	0.06458	0.14015	0.15210	0.18849	0.15591	*0.19504*	*0.21332*	*0.23244*	*0.25435*	*0.26923*	*0.27860*		
100	0.00352	0.04962	0.05058	0.07471	0.03407	*0.04919*	*0.05958*	*0.07073*	*0.08228*	*0.08927*	*0.09593*			

Probability of Surviving from Exact Ages x to x+n (continued)

Males

Exact age x	Birth Cohorts 1941-46	1946-51	1951-56	1956-61	1961-66	1966-71	1971-76	1976-81	1981-86	1986-91	1991-96	1996-01
0	0.96749	0.97176	0.97617	0.97792	0.97962	0.98189	0.98329	0.98550	0.98817	0.99063	0.99340	0.99440
1	0.99143	0.99465	0.99504	0.99568	0.99609	0.99623	0.99633	0.99691	0.99742	0.99781	0.99838	0.99863
5	0.99671	0.99743	0.99773	0.99780	0.99797	0.99782	0.99830	0.99856	0.99870	0.99903	0.99934	
10	0.99741	0.99763	0.99747	0.99791	0.99787	0.99839	0.99807	0.99830	0.99870	0.99863		
15	0.99486	0.99394	0.99293	0.99180	0.99368	0.99255	0.99381	0.99471	0.99570			
20	0.99243	0.99248	0.99092	0.99171	0.99114	0.99074	0.99271	0.99399				
25	0.99391	0.99358	0.99311	0.99243	0.99280	0.99359	0.99446					
30	0.99345	0.99349	0.99324	0.99332	0.99426	0.99384						
35	0.99179	0.99217	0.99182	0.99395	0.99388							
40	0.98875	0.99004	0.99181	0.99184								
45	0.98362	0.98696	0.98858									
50	0.97762	0.98157	*0.98338*									
55	0.96980	*0.97515*	*0.98015*									
60	*0.95798*	*0.96542*	*0.97120*									
65	*0.92911*	*0.93813*	*0.94596*									
70	*0.88026*	*0.88917*	*0.89675*									
75	*0.82104*	*0.82886*										
80	*0.70674*											
85												
90												
95												
100												

Females

Exact age x	Birth Cohorts 1941-46	1946-51	1951-56	1956-61	1961-66	1966-71	1971-76	1976-81	1981-86	1986-91	1991-96	1996-01
0	0.97522	0.97793	0.98139	0.98323	0.98482	0.98643	0.98749	0.98907	0.99052	0.99253	0.99469	0.99552
1	0.99294	0.99539	0.99564	0.99654	0.99675	0.99692	0.99703	0.99755	0.99793	0.99864	0.99872	0.99876
5	0.99784	0.99837	0.99825	0.99865	0.99835	0.99844	0.99889	0.99870	0.99897	0.99935	0.99923	
10	0.99815	0.99847	0.99862	0.99851	0.99840	0.99879	0.99882	0.99917	0.99899	0.99933		
15	0.99790	0.99784	0.99737	0.99717	0.99701	0.99739	0.99759	0.99760	0.99811			
20	0.99742	0.99730	0.99711	0.99668	0.99694	0.99736	0.99759	0.99836				
25	0.99717	0.99693	0.99711	0.99685	0.99752	0.99759	0.99774					
30	0.99598	0.99636	0.99643	0.99678	0.99721	0.99774						
35	0.99496	0.99489	0.99556	0.99645	0.99707							
40	0.99241	0.99263	0.99471	0.99508								
45	0.98809	0.99109	0.99181									
50	0.98513	0.98667	*0.99000*									
55	0.97912	*0.98591*	*0.98797*									
60	*0.97564*	*0.97819*	*0.98004*									
65	*0.96374*	*0.96702*	*0.96914*									
70	*0.93767*	*0.94244*	*0.94626*									
75	*0.88824*	*0.89331*										
80	*0.79849*											
85												
90												
95												
100												

Source: Computed and projected by Cheung (1999), based on published official statistics.
Note: Numbers in italics indicate projections.

Number of Survivors at Exact Age x

Males

Birth Cohorts

Exact age x	1871-76	1876-81	1881-86	1886-91	1891-96	1896-01	1901-06	1906-11	1911-16	1916-21	1921-26	1926-31	1931-36
0	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000
1	88670	89356	89984	90233	90958	91535	91819	92731	93967	94603	95224	95997	96341
5	83409	85513	86761	87298	88601	88986	89727	90957	91977	92737	93818	94857	95206
10	81693	84094	85494	86397	87564	87986	88876	89843	91035	91995	93168	94223	94733
15	80716	83269	84703	85659	86851	87275	88193	89158	90470	91512	92668	93743	94303
20	79234	81996	83488	84584	85890	86234	87299	88334	89622	90683	91926	93068	93671
25	77455	80410	81999	83328	83830	84905	86138	87217	88602	89422	90784	92301	92867
30	75766	78905	80592	81587	82417	83673	85007	86202	87494	88434	90098	91637	92330
35	74075	77251	78709	79899	80995	82475	83952	85090	86592	87651	89386	91009	91593
40	72068	75058	76662	78161	79426	81018	82697	84064	85573	86790	88526	90061	90702
45	69725	72679	74658	76206	77457	79271	81284	82745	84334	85501	87141	88679	89375
50	66791	69882	72065	73689	74973	77026	79116	80739	82155	83136	84911	86385	87423
55	63300	66355	68532	69818	71492	73587	75738	77301	78328	79468	81227	83252	84263
60	58867	61522	63142	64812	66210	68388	70404	71348	72543	73919	76025	78410	80284
65	52265	54374	55789	57544	58721	60553	62022	62858	64416	66240	68827	72290	75123
70	43054	45152	46129	47582	48630	49618	50776	52172	54021	56210	60058	64480	68165
75	31756	33786	34283	35369	35477	36503	37399	39612	41451	45101	49619	54646	*58597*
80	20026	21322	21513	21823	21819	23033	24133	26057	29003	32912	37809	*42557*	*46502*
85	9856	10212	10314	10345	10862	11759	12631	14536	17167	21016	*24363*	*28380*	*31810*
90	2974	3399	3285	3150	3884	4425	5340	6331	7738	*10177*	*12233*	*14735*	*16997*
95	585	621	554	639	895	1209	1435	1448	*2347*	*3292*	*4120*	*5169*	*6145*
100	32	33	54	74	124	137	*195*	*217*	*379*	*575*	*787*	*1043*	
105		1	2	4	3	*5*	*7*	*11*	*19*	*33*	*52*		

Females

Birth Cohorts

Exact age x	1871-76	1876-81	1881-86	1886-91	1891-96	1896-01	1901-06	1906-11	1911-16	1916-21	1921-26	1926-31	1931-36
0	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000
1	90460	91094	91539	91789	92517	92925	93264	94174	95275	95785	96175	96813	97144
5	85378	87358	88534	89289	90182	90474	91120	92480	93444	94040	94771	95789	96241
10	83955	86202	87350	88358	89329	89690	90372	91529	92655	93402	94210	95264	95814
15	83011	85376	86629	87568	88620	89187	89779	90987	92133	93094	93827	94966	95473
20	81504	84040	85347	86422	87645	88291	88865	90275	91466	92536	93395	94572	95189
25	79780	82492	83835	85148	86312	86956	87766	89325	90621	91798	92750	94223	94940
30	77964	80689	82254	83484	84653	85769	86603	88335	89741	91045	92305	93915	94670
35	76103	78926	80580	81814	83259	84390	85494	87354	88950	90489	91897	93502	94297
40	74133	77130	78704	80311	81835	83142	84295	86273	88194	89810	91271	92934	93706
45	72185	75053	77048	78743	80164	81700	82999	85179	87259	88922	90244	91952	92695
50	69704	72645	74725	76565	78053	79535	81237	83708	85857	87361	88667	90429	91203
55	66593	69780	71881	73715	75090	76948	78917	81636	83555	85113	86531	88424	89174
60	62679	65861	67740	69616	71355	73719	75790	78314	80340	81945	83361	85409	86556
65	57204	60003	62350	64285	66545	68995	70838	73541	75555	77511	78891	81591	83259
70	49138	52450	55046	57223	59812	61897	63913	66893	68637	71090	73269	76512	78742
75	38855	42499	45326	47400	50039	51984	54120	57523	59266	62772	65773	69809	*72401*
80	26954	30259	32390	34857	36927	39594	42187	44931	48332	52206	56036	*59644*	*62939*
85	15146	17002	18910	20537	23220	25624	27863	30981	34737	38947	*42577*	*45909*	*49260*
90	5756	6694	7500	9151	11359	12568	14934	16993	20118	*23425*	*26399*	*29127*	*31867*
95	1331	1545	1813	2678	3387	4312	5135	6231	*8085*	*9854*	*11455*	*13058*	*14829*
100	99	100	254	407	638	672	*1002*	*1329*	*1879*	*2506*	*3084*	*3638*	
105		5	13	30	22	*33*	*60*	*94*	*155*	*224*	*296*		

Number of Survivors at Exact Age x (continued)

Males

Birth Cohorts

Exact age x	1936-41	1941-46	1946-51	1951-56	1956-61	1961-66	1966-71	1971-76	1976-81	1981-86	1986-91	1991-96	1996-01
0	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000
1	96467	96749	97176	97617	97792	97962	98189	98329	98550	98817	99063	99340	99440
5	95557	95920	96656	97133	97369	97579	97818	97968	98245	98562	98846	99179	99304
10	95.82	95604	96408	96912	97155	97381	97605	97802	98104	98433	98751	99113	
15	94759	95357	96180	96667	96952	97173	97448	97613	97937	98305	98616		
20	94204	94867	95597	95983	96157	96559	96723	97009	97419	97883			
25	93582	94149	94878	95112	95360	95704	95827	96302	96833				
30	92949	93576	94269	94456	94638	95015	95212	95769					
35	92326	92962	93655	93818	94006	94470	94625						
40	91500	92199	92922	93050	93436	93892							
45	90331	91162	91997	92288	92674								
50	88607	89669	90797	91234									
55	86128	87662	89123	*89718*									
60	82840	85015	*86909*	*87937*									
65	78602	*81443*	*83903*	*85404*									
70	*72116*	*75669*	*78712*	*80789*									
75	*62930*	*66608*	*69989*	*72448*									
80	*50940*	*54688*	*58011*										
85	*35630*	*38650*											
90	*19517*												
95													
100													
105													

Females

Birth Cohorts

xact age x		1941-46	1946-51	1951-56	1956-61	1961-66	1966-71	1971-76	1976-81	1981-86	1986-91	1991-96	1996-01
0	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000
1	97296	97522	97793	98139	98323	98482	98643	98749	98907	99052	99253	99469	99552
5	96474	96834	97342	97711	97983	98162	98339	98456	98664	98847	99118	99342	99429
10	96137	96624	97184	97540	97851	98000	98185	98346	98536	98745	99053	99265	
15	95990	96445	97035	97405	97705	97844	98067	98229	98454	98646	98987		
20	95775	96243	96825	97149	97429	97551	97811	97992	98218	98459			
25	95555	95995	96564	96869	97106	97252	97553	97756	98057				
30	95265	95723	96268	96589	96800	97011	97318	97535					
35	94867	95338	95918	96244	96488	96740	97098						
40	94308	94858	95428	95817	96145	96456							
45	93466	94138	94725	95310	95672								
50	92235	93017	93880	94530									
55	90485	91633	92629	*93585*									
60	88344	89720	*91324*	*92459*									
65	85346	*87534*	*89332*	*90613*									
70	*81444*	*84360*	*86386*	*87817*									
75	*75726*	*79102*	*81414*	*83098*									
80	*66571*	*70262*	*72728*										
85	*52819*	*56103*											
90	*34599*												
95													
100													
105													

Source: Computed and projected by Cheung (1999), based on published official statistics.
Note: Numbers in italics indicate projections.

Appendix B. Māori Cohort Life Tables

Probability of Surviving from Exact Ages x to x+n

Males

Birth Cohorts

Exact age x	1891-96	1896-01	1901-06	1906-11	1911-16	1916-21	1921-26	1926-31	1931-36	1936-41	1941-46
0	0.62913	0.62913	0.73413	0.73413	0.75667	0.77801	0.79826	0.88100	0.88100	0.88100	0.89350
1	0.84513	0.87171	0.89828	0.90353	0.91361	0.92293	0.93321	0.93575	0.92925	0.92925	0.93575
5	0.96253	0.96937	0.97079	0.97352	0.97608	0.97266	0.96900	0.97100	0.97300	0.97500	0.98269
10	0.96955	0.97339	0.97598	0.97592	0.97355	0.97200	0.97600	0.97850	0.97950	0.98576	0.99208
15	0.95918	0.96272	0.96604	0.95632	0.96000	0.97000	0.96425	0.96275	0.97192	0.98448	0.98830
20	0.95387	0.95804	0.95803	0.95725	0.95975	0.95800	0.95250	0.96210	0.97905	0.98450	0.98595
25	0.95270	0.95151	0.95200	0.96000	0.96275	0.96025	0.96610	0.97641	0.98044	0.98478	0.98698
30	0.95179	0.95650	0.95750	0.96075	0.96625	0.96876	0.97151	0.97609	0.98020	0.98213	0.98480
35	0.95275	0.95025	0.95075	0.95425	0.95833	0.96572	0.97101	0.97299	0.97362	0.97590	0.98162
40	0.93875	0.94150	0.94450	0.95035	0.95980	0.98063	0.98098	0.96241	0.96163	0.96860	0.97562
45	0.92925	0.93375	0.93685	0.94065	0.93940	0.94344	0.94448	0.94020	0.94999	0.96017	0.96492
50	0.90325	0.90547	0.90494	0.91057	0.91726	0.91355	0.90917	0.92131	0.93560	0.94473	0.94262
55	0.85766	0.86683	0.87844	0.87315	0.85620	0.86318	0.88137	0.89782	0.91092	0.90502	0.90088
60	0.79405	0.79587	0.79483	0.79126	0.80465	0.82579	0.84470	0.85961	0.85506	0.85864	
65	0.72366	0.73498	0.74101	0.73362	0.74856	0.77878	0.79814	0.79410	0.79588		
70	0.67321	0.67014	0.67432	0.68110	0.70191	0.72762	0.72308	0.71758			
75	0.68952	0.71607	0.58435	0.60964	0.63343	0.63822	0.62719				
80	0.44799	0.46708	0.48374	0.50326	0.51700	0.49475					
85	0.32776	0.32483	0.36512	0.35225	0.37882						
90	0.17829	0.22041	0.17901	0.14562							
95	0.10499	0.07053									
100											

Females

Birth Cohorts

Exact age x	1891-96	1896-01	1901-06	1906-11	1911-16	1916-21	1921-26	1926-31	1931-36	1936-41	1941-46
0	0.60627	0.60627	0.71731	0.71731	0.74070	0.76273	0.78353	0.88800	0.90100	0.91400	0.91700
1	0.81044	0.84300	0.87556	0.88181	0.89378	0.90478	0.91902	0.92850	0.92950	0.93325	0.94175
5	0.94990	0.95927	0.96115	0.96479	0.96819	0.96741	0.96775	0.97325	0.97600	0.97600	0.98392
10	0.95896	0.96082	0.96441	0.96776	0.96519	0.96200	0.96400	0.96800	0.97150	0.98065	0.99038
15	0.94995	0.95442	0.95859	0.94980	0.94200	0.94800	0.95400	0.96000	0.97377	0.98724	0.99150
20	0.94613	0.95098	0.94666	0.94150	0.94450	0.94700	0.94900	0.96400	0.98273	0.98926	0.99263
25	0.94477	0.94419	0.94425	0.94975	0.95150	0.95050	0.96303	0.98104	0.98777	0.99005	0.99142
30	0.94561	0.94725	0.94175	0.94375	0.95325	0.96666	0.97892	0.98350	0.98641	0.98851	0.99007
35	0.92625	0.92475	0.92825	0.93675	0.95241	0.96850	0.97222	0.97664	0.98020	0.98129	0.98612
40	0.92125	0.92325	0.93175	0.94173	0.95112	0.95595	0.96477	0.96975	0.97080	0.97712	0.98247
45	0.89775	0.90725	0.91765	0.92487	0.93407	0.94568	0.95306	0.95597	0.96073	0.96960	0.97383
50	0.87775	0.88348	0.89792	0.89965	0.90614	0.91781	0.92674	0.93536	0.95165	0.95777	0.95487
55	0.86335	0.86039	0.85748	0.86271	0.87798	0.89167	0.90912	0.92450	0.93120	0.92887	0.92866
60	0.80645	0.80619	0.82572	0.83278	0.84350	0.86824	0.88529	0.89793	0.89387	0.88858	
65	0.75654	0.78034	0.78159	0.78995	0.80997	0.83725	0.85794	0.84899	0.83725		
70	0.71436	0.71997	0.73119	0.75547	0.78319	0.80526	0.79333	0.78671			
75	0.63310	0.66793	0.70046	0.71790	0.73526	0.72507	0.71324				
80	0.55971	0.60451	0.60866	0.62266	0.62567	0.60511					
85	0.41699	0.43635	0.46732	0.47720	0.44741						
90	0.25013	0.28383	0.27693	0.25863							
95	0.14073	0.12122									
100	0.03613										

Probability of Surviving from Exact Ages x to x+n (continued)

Males

Exact age x	Birth Cohorts 1946-51	1951-56	1956-61	1961-66	1966-71	1971-76	1976-81	1981-86	1986-91	1991-96	1996-01
0	0.90600	0.92024	0.93307	0.94988	0.96650	0.97498	0.98025	0.98168	0.98400	0.98594	0.98868
1	0.95464	0.97500	0.98239	0.98768	0.99101	0.99351	0.99579	0.99665	0.99700	0.99719	0.99749
5	0.98910	0.99122	0.99443	0.99552	0.99619	0.99726	0.99815	0.99841	0.99854	0.99875	
10	0.99341	0.99511	0.99591	0.99657	0.99761	0.99768	0.99774	0.99791	0.99825		
15	0.98957	0.98940	0.99032	0.99174	0.99212	0.99268	0.99302	0.99329			
20	0.98582	0.98577	0.98764	0.98956	0.99004	0.98928	0.99020				
25	0.98646	0.98818	0.99041	0.99094	0.98881	0.98837					
30	0.98816	0.98972	0.99132	0.98954	0.98766						
35	0.98562	0.98733	0.98744	0.98802							
40	0.97794	0.97999	0.98091								
45	0.96615	0.96692									
50	0.94297										
55											
60											
65											
70											
75											
80											
85											
90											
95											
100											

Females

Exact age x	Birth Cohorts 1946-51	1951-56	1956-61	1961-66	1966-71	1971-76	1976-81	1981-86	1986-91	1991-96	1996-01
0	0.92000	0.92960	0.94909	0.96114	0.97531	0.97547	0.98529	0.98278	0.98655	0.99080	0.98975
1	0.96062	0.97800	0.98564	0.99057	0.99275	0.99441	0.99598	0.99739	0.99795	0.99804	0.99817
5	0.99294	0.99500	0.99678	0.99769	0.99787	0.99825	0.99849	0.99861	0.99886	0.99874	
10	0.99380	0.99659	0.99736	0.99790	0.99822	0.99846	0.99881	0.99870	0.99862		
15	0.99432	0.99477	0.99442	0.99561	0.99674	0.99719	0.99658	0.99666			
20	0.99401	0.99406	0.99502	0.99622	0.99682	0.99617	0.99628				
25	0.99345	0.99480	0.99563	0.99643	0.99606	0.99575					
30	0.99176	0.99348	0.99465	0.99443	0.99440						
35	0.98970	0.99173	0.99174	0.99164							
40	0.98562	0.98566	0.98586								
45	0.97347	0.97542									
50	0.95647										
55											
60											
65											
70											
75											
80											
85											
90											
95											
100											

Source: Computed by Pool (1983). Pool employed a mix of indirect estimation techniques to identify the model life tables for the period up to 1921, adjustments to the official data using indirect estimation techniques for the period 1926 to 1941, direct computation with adjustments to overcome problems in the vital data for 1946, official tables from 1951 to 1996, and direct computation for 2001.

Note: Cells shaded in gray indicate calculations adversely affected by changes in ethnicity coding introduced in the late 1990s (see text).

Number of Survivors at Exact Age x

Males

Birth Cohorts

Exact age x	1891-96	1896-01	1901-06	1906-11	1911-16	1916-21	1921-26	1926-31	1931-36	1936-41
0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
1	62,913	62,913	73,413	73,413	75,667	77,801	79,826	88,100	88,100	88,100
5	53,170	54,842	65,945	66,331	69,130	71,805	74,494	82,440	81,867	81,867
10	51,177	53,162	64,019	64,574	67,477	69,842	72,185	80,049	79,657	79,820
15	49,619	51,747	62,481	63,019	65,692	67,886	70,453	78,328	78,024	78,684
20	47,594	49,818	60,360	60,267	63,064	65,850	67,934	75,410	75,833	77,462
25	45,398	47,728	57,826	57,690	60,526	63,084	64,707	72,552	74,244	76,262
30	43,251	45,414	55,051	55,383	58,271	60,576	62,514	70,841	72,792	75,101
35	41,166	43,438	52,711	53,209	56,305	58,684	60,733	69,147	71,350	73,759
40	39,221	41,277	50,115	50,775	53,958	56,672	58,972	67,279	69,468	71,981
45	36,818	38,862	47,334	48,254	51,789	55,574	57,850	64,750	66,803	69,721
50	34,213	36,288	44,344	45,390	48,651	52,431	54,638	60,878	63,462	66,944
55	30,903	32,857	40,129	41,331	44,625	47,899	49,676	56,088	59,375	63,244
60	26,504	28,482	35,251	36,088	38,208	41,345	43,783	50,356	54,086	57,237
65	21,046	22,668	28,019	28,555	30,744	34,142	36,983	43,287	46,247	49,146
70	15,230	16,660	20,762	20,948	23,014	26,590	29,518	34,374	36,807	
75	10,253	11,165	14,000	14,268	16,154	19,347	21,344	24,666		
80	7,070	7,995	8,181	8,698	10,232	12,348	13,387			
85	3,167	3,734	3,958	4,378	5,290	6,109				
90	1,038	1,213	1,445	1,542	2,004					
95	185	267	259	225						
100	19	19								

Females

Birth Cohorts

Exact age x	1891-96	1896-01	1901-06	1906-11	1911-16	1916-21	1921-26	1926-31	1931-36	1936-41
0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
1	60,627	60,627	71,731	71,731	74,070	76,273	78,353	88,800	90,100	91,400
5	49,135	51,109	62,805	63,253	66,202	69,010	72,008	82,451	83,748	85,299
10	46,673	49,027	60,365	61,026	64,096	66,761	69,686	80,245	81,738	83,252
15	44,757	47,106	58,216	59,058	61,865	64,224	67,177	77,677	79,408	81,641
20	42,517	44,959	55,806	56,094	58,277	60,885	64,087	74,570	77,326	80,599
25	40,227	42,755	52,829	52,812	55,043	57,658	60,818	71,886	75,990	79,734
30	38,005	40,369	49,884	50,158	52,373	54,804	58,570	70,523	75,061	78,940
35	35,938	38,239	46,978	47,337	49,925	52,977	57,335	69,359	74,041	78,033
40	33,288	35,362	43,607	44,343	47,549	51,308	55,743	67,739	72,575	76,573
45	30,666	32,648	40,631	41,759	45,225	49,048	53,779	65,690	70,456	74,821
50	27,531	29,620	37,285	38,622	42,243	46,383	51,254	62,798	67,689	72,546
55	24,165	26,169	33,479	34,746	38,278	42,571	47,499	58,739	64,416	69,482
60	20,863	22,515	28,708	29,976	33,607	37,959	43,183	54,304	59,984	64,540
65	16,825	18,151	23,705	24,963	28,348	32,958	38,229	48,761	53,618	57,349
70	12,729	14,164	18,527	19,720	22,961	27,594	32,799	41,398	44,891	
75	9,093	10,198	13,547	14,898	17,983	22,220	26,020	32,568		
80	5,757	6,811	9,489	10,695	13,222	16,111	18,559			
85	3,222	4,118	5,776	6,659	8,273	9,749				
90	1,344	1,797	2,699	3,178	3,701					
95	336	510	747	822						
100	47	62								

Number of Survivors at Exact Age x (continued)

Males

Exact age x	Birth Cohorts 1941-46	1946-51	1951-56	1956-61	1961-66	1966-71	1971-76	1976-81	1981-86	1986-91	1991-96	1996-01
0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
1	89,350	90,600	92,024	93,307	94,988	96,650	97,498	98,025	98,168	98,400	98,594	98,868
5	83,609	86,490	89,723	91,664	93,818	95,781	96,865	97,612	97,839	98,105	98,317	98,620
10	82,162	85,548	88,936	91,153	93,397	95,416	96,600	97,431	97,683	97,962	98,194	
15	81,511	84,984	88,501	90,780	93,077	95,188	96,376	97,211	97,480	97,790		
20	80,558	84,097	87,563	89,902	92,309	94,437	95,670	96,533	96,826			
25	79,426	82,905	86,317	88,790	91,345	93,497	94,644	95,587				
30	78,392	81,782	85,296	87,938	90,517	92,450	93,544					
35	77,200	80,814	84,419	87,175	89,570	91,309						
40	75,781	79,652	83,350	86,081	88,497							
45	73,934	77,895	81,682	84,438								
50	71,340	75,258	78,980									
55	67,247	70,966										
60	60,581											
65												
70												
75												
80												
85												
90												
95												
100												

Females

Exact age x	Birth Cohorts 1941-46	1946-51	1951-56	1956-61	1961-66	1966-71	1971-76	1976-81	1981-86	1986-91	1991-96	1996-01
0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
1	91,700	92,000	92,960	94,909	96,114	97,531	97,547	98,529	98,278	98,655	99,080	98,975
5	86,358	88,377	90,915	93,546	95,208	96,824	97,002	98,133	98,021	98,453	98,886	98,794
10	84,970	87,753	90,460	93,245	94,988	96,618	96,832	97,985	97,885	98,340	98,761	
15	84,152	87,209	90,152	92,999	94,788	96,445	96,683	97,868	97,758	98,205		
20	83,437	86,714	89,680	92,480	94,372	96,131	96,412	97,533	97,431			
25	82,822	86,194	89,148	92,020	94,015	95,824	96,043	97,171				
30	82,112	85,630	88,684	91,617	93,679	95,446	95,634					
35	81,296	84,924	88,106	91,127	93,157	94,912						
40	80,168	84,049	87,377	90,374	92,379							
45	78,762	82,810	86,124	89,096								
50	76,701	80,613	84,007									
55	73,239	77,104										
60	68,015											
65												
70												
75												
80												
85												
90												
95												
100												

Source: Computed by Pool (1983). Pool employed a mix of indirect estimation techniques to identify the model life tables for the period up to 1921, adjustments to the official data using indirect estimation techniques for the period 1926 to 1941, direct computation with adjustments to overcome problems in the vital data for 1946, official tables from 1951 to 1996, and direct computation for 2001.

Note: Cells shaded in gray indicate calculations adversely affected by changes in ethnicity coding introduced in the late 1990s (see text).

Appendix C: Synthetic Life Tables

2001
Māori Males

Exact age x	l_x	p_x	L_x	T_x	e_x
0	100,000	0.99176	99,300	6,831,583	68.32
1	99,176	0.99760	396,229	6,732,283	67.88
5	98,938	0.99890	494,419	6,336,054	64.04
10	98,830	0.99867	493,818	5,841,636	59.11
15	98,698	0.99364	491,918	5,347,818	54.18
20	98,069	0.99133	488,222	4,855,900	49.51
25	97,219	0.98929	483,494	4,367,677	44.93
30	96,178	0.98771	477,936	3,884,183	40.39
35	94,996	0.98851	472,253	3,406,248	35.86
40	93,905	0.97970	464,760	2,933,995	31.24
45	91,999	0.96792	452,615	2,469,236	26.84
50	89,047	0.94703	433,444	2,016,620	22.65
55	84,330	0.90293	401,188	1,583,177	18.77
60	76,145	0.86961	355,902	1,181,989	15.52
65	66,216	0.80547	298,877	826,087	12.48
70	53,335	0.71893	229,197	527,210	9.88
75	38,344	0.61827	155,127	298,013	7.77
80	23,707	0.46708	86,949	142,887	6.03
85	11,073	0.43907	39,837	55,937	5.05
90	4,862	0.18033	14,346	16,100	3.31
95	877		1,753	1,753	2.00

Māori Females

Exact age x	l_x	p_x	L_x	T_x	e_x
0	100,000	0.99267	99,377	7,239,334	72.39
1	99,267	0.99839	396,750	7,139,957	71.93
5	99,108	0.99851	495,171	6,743,207	68.04
10	98,960	0.99887	494,523	6,248,036	63.14
15	98,849	0.99739	493,598	5,753,513	58.21
20	98,591	0.99716	492,254	5,259,915	53.35
25	98,311	0.99596	490,560	4,767,661	48.50
30	97,913	0.99432	488,175	4,277,101	43.68
35	97,357	0.99193	484,819	3,788,927	38.92
40	96,571	0.98671	479,646	3,304,107	34.21
45	95,287	0.97734	471,039	2,824,461	29.64
50	93,128	0.95842	455,960	2,353,422	25.27
55	89,256	0.93131	430,950	1,897,462	21.26
60	83,124	0.88983	392,728	1,466,511	17.64
65	73,967	0.83603	339,512	1,073,784	14.52
70	61,838	0.79334	277,242	734,272	11.87
75	49,059	0.71405	210,222	457,029	9.32
80	35,030	0.58678	138,963	246,807	7.05
85	20,555	0.43072	73,521	107,844	5.25
90	8,853	0.27536	28,228	34,323	3.88
95	2,438		6,095	6,095	2.50

2001
Non-Māori Males

Exact age x	l_x	p_x	L_x	T_x	e_x
0	100,000	0.99442	99,526	7,680,944	76.81
1	99,442	0.99863	397,496	7,581,418	76.24
5	99,306	0.99934	496,366	7,183,922	72.34
10	99,240	0.99863	495,862	6,687,556	67.39
15	99,104	0.99570	494,457	6,191,694	62.48
20	98,679	0.99399	491,910	5,697,237	57.74
25	98,085	0.99446	489,068	5,205,327	53.07
30	97,542	0.99384	486,206	4,716,259	48.35
35	96,941	0.99388	483,221	4,230,052	43.64
40	96,348	0.99184	479,774	3,746,832	38.89
45	95,562	0.98858	475,080	3,267,058	34.19
50	94,470	0.98157	467,998	2,791,977	29.55
55	92,729	0.96980	456,643	2,323,980	25.06
60	89,928	0.94885	438,143	1,867,337	20.76
65	85,329	0.90738	406,885	1,429,194	16.75
70	77,425	0.84748	357,605	1,022,309	13.20
75	65,617	0.76199	289,040	664,704	10.13
80	49,999	0.63855	204,816	375,664	7.51
85	31,927	0.45077	115,797	170,848	5.35
90	14,392	0.22872	44,209	55,051	3.83
95	3,292		10,842	10,842	3.29

Non-Māori Females

Exact age x	l_x	p_x	L_x	T_x	e_x
0	100,000	0.99582	99,645	8,184,966	81.85
1	99,582	0.99876	398,083	8,085,321	81.19
5	99,459	0.99923	497,104	7,687,238	77.29
10	99,382	0.99933	496,745	7,190,134	72.35
15	99,315	0.99811	496,107	6,693,390	67.40
20	99,127	0.99836	495,230	6,197,283	62.52
25	98,965	0.99774	494,265	5,702,053	57.62
30	98,741	0.99774	493,149	5,207,788	52.74
35	98,518	0.99707	491,868	4,714,640	47.86
40	98,229	0.99508	489,937	4,222,771	42.99
45	97,746	0.99181	486,729	3,732,834	38.19
50	96,946	0.98667	481,499	3,246,105	33.48
55	95,654	0.97912	473,276	2,764,607	28.90
60	93,656	0.96606	460,335	2,291,331	24.47
65	90,478	0.94575	440,117	1,830,996	20.24
70	85,569	0.91239	409,104	1,390,879	16.25
75	78,073	0.85197	361,469	981,774	12.58
80	66,515	0.74603	290,343	620,305	9.33
85	49,622	0.57916	195,903	329,962	6.65
90	28,739	0.36667	98,192	134,058	4.66
95	10,538		35,866	35,866	3.40

Source: Estimated by the authors based on the 2001 Census population and vital data.

Appendix D

Non-Māori tables were constructed either by Jit Cheung or were drawn from official sources. The recent tables for 2001 were computed by Jit Cheung since the official life tables were not available at the time of the preparation of this paper. There is a small difference to official tables.

Enumerations of Non-Māori population and deaths have been relatively reliable since the late 19th century. Historical Non-Māori mortality data are considered of very high quality by international standard (Kannisto 1994)

Māori tables were constructed either by Ian Pool or were drawn from official sources. The tables for year prior to 1945 were constructed using the Coale-Demeny indirect estimation techniques. The rationale and methods were discussed in Pool (1964, 1977, 1991).

Māori data suffer from reporting problems. For historical periods these are covered in Pool (1964, 1977, 1991).

The text covers some data issues over recent periods. We have chosen here to use official tables. Ajwani *et al.* (2003) have recently reworked Māori tables to allow for estimated under-reporting. In the text we suggest another scenario. Neither re-computation would change our basic argument.

That said, a detailed regional study being edited at present (Pool *et al.* forthcoming) has raised another set of issues relating to regional differences in reporting not just of deaths but also of hospitalisation data. An analysis being completed at present reviews these differences, the results of which will throw further light on national trends.

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Contribution of Demographic Structure to Regional Migration, 1991-2001

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Abstract

Shift share analysis is applied to the change in regional migration over two time periods (1991-1996 and 1996-2001) to indicate how regional differences in age structure and the mobility of individual age cohorts influence changes in migration. Their impact is found to be important in the case of some regions but only a small part of the overall change in migration flows.

The tendency for migration propensities to vary sharply between characteristic stages of the life cycle is one of the strongest empirical regularities observed in studies of migration (Plane 1992). In New Zealand, inter-regional migration peaks for the cohort aged 25-29 years (Newell 2001). The high mobility of this cohort is an outcome of a life cycle stage where the propensity to move is accentuated by departure from the parental home, graduation from educational institutions, employment shifts and family formation. In the five years to 1996, the proportion of regional migrants among 25-29 year olds was over twice that of all five-year age groups over age 44. In the most recent Census period (1996-2001), the rate of regional migration among 25-29 year olds (16 percent) was more than double that for the 45-64 age group (7 per cent). Reflecting these differences, and given no evidence of a consistent labour market impact on regional migration, a lifecycle analysis of migration has been recommended to gain further understanding of New Zealand's internal migration (Newell 2002).

This note summarises one approach to assessing the impact of changes in age structure on migration. The technique is a shift share analysis that is applied to regional migration flows over two inter-censal periods: (i) 1986-1991 to 1991-1996; (ii) 1991-1996 to 1996-2001.

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Shift-share analysis is a well-established technique for disaggregating regional measures into some component parts and has less frequently been applied to regional migration. The standard formulation recognises three sources of change: a *global* (national or general) shift that reflects the average change across all regions and sectors within them; a *sectoral* shift that relates to the differential patterns for sectors within the regions; and a *residual* or *geographic* shift, that is the "unexplained" part -- normally interpreted as pertaining to the peculiar characteristics of each region. Using Green's (1994) formulation for the analysis of migration change ($\triangle M_{*jk}$), the global shift is represented by population change for each age cohort (A_{*jk}); the sectoral shift relates to the differential mobility of each age cohort (B_{*jk}); and the residual shift is that part of the actual migration change that is not accounted for by the other two shifts (C_{*jk}). These three shifts are additive and in this analysis are specified thus:

(i) The *population-base* component (A_{*jk}) measures the incremental migration volume expected from the changing size of each age cohort in the regional population. This captures, for example, the impact of a higher proportion of young adults on total migration. The component assumes age specific migration propensities remain unchanged and that there are no changes in inter-regional destination.

(ii) The *mobility* component (B_{*jk}) applies the overall change in each age cohort's rate of migration to individual migration flows. It assumes that each migrant flow changes at the same rate as for the age cohort as a whole. This assumption recognises that an overall change in age-specific rates of regional mobility is likely to affect the scale of individual flows. A general expectation, for example, is that age-specific mobility varies with the size of the cohort. A generation that is larger than the previous generation tends to face greater competition in the labour market than a smaller generation. Thus the impact of a bulge in the size of a high-migration cohort is moderated by the change in age-specific migration. Conversely, shrinkage of a high-migration cohort may result in an increased rate of migration.

(iii) The *geographic-distribution* component (C_{*jk}) is a residual amount arising from the volume of individual migrant flows that is not accounted for by the population-base and mobility components. This residual volume is interpreted as showing the change in attractiveness of specific destinations for out-migrants from

individual regions. It is generally expected that the population base and mobility components will not account for all migration change. For example, it has been claimed that when competition for employment increases, the proportion of migrants responding to differences in economic opportunity increases (Plane 1992:67). In turn, increased sensitivity to economic conditions is expected to reduce the two-way exchange of residents, increasing migration effectiveness and the geographic concentration in the main regional flows.

Shift share has relevance to New Zealand given the changing relative size of the most migration-active age cohorts (Table 1). The ageing of the 25-39 cohorts since the mid-1970s provides a demographic bulge whose potential impact on migration reduced as this group left their peak migration years. The significantly lower growth or even decline in the younger and potentially most migration-active cohorts indicates the potential importance of demographic change as an influence on the volume of migration. How significant this influence has been will be influenced by the age profile of individual regions and their relative attractiveness.

Table 1: Changes in age composition of the working age resident population, 1971-2001

	Percentage changes in age group size					
Age group	1971-1976	1976-1981	1981-1986	1986-1991	1991-1996	1996-2001
15-19	15.2	2.5	-2.1	-5.0	-7.7	0.9
20-24	10.3	5.2	4.9	-4.2	0.2	-11.8
25-29	32.8	-3.3	12.0	2.0	0.4	9.7
30-34	19.4	20.1	3.6	10.7	7.8	-4.8
35-39	17.0	9.0	25.4	2.9	15.5	4.3
40-44	-5.69	11.6	13.3	24.0	7.5	12.0
45-49	1.8	-8.6	12.8	12.5	29.1	4.4
50-54	9.9	0.4	-6.2	10.5	16.9	26.5
55-59	3.1	8.5	1.9	-7.4	14.9	14.9
60-64	11.0	1.4	10.0	1.5	-4.0	14.3
65+	13.9	12.6	10.4	11.0	11.3	6.6
Total	9.0	1.3	3.8	3.4	7.2	3.3

Source: Census of Population and Dwellings

Results from a Shift Share Analysis, 1986--2001

The shift share analysis was applied to Census records of internal regional migration, which are derived from the Census question about the respondents' places of residence five years ago[1]. In the application, it examines how far demographic influences can account for the change in migration flows across two periods: (i) from 1986-1991 (the base period) to 1991-1996 (the terminal period); and (ii) from 1991-1996 to 1996-2001. The analysis was conducted for regional migrants in the main working age range (15-64) broken into 10 age cohorts each spanning 5 years (15-19, 20-24 and so on)[2].

With respect to the 1986 to 1996 period, when there was a comparatively large incremental increase in migration (19,176), the main findings are as follows.

- Most regions have a small, positive population-base component, which suggests that overall regional population change contributes little to the changes in migration over the period. Some exceptions include the inward migrations to three regions -- Wellington, Manawatu-Wanganui and Northland -- where the population base component accounted for around a quarter or more of the change in in-migration. In addition, Taranaki presents a special case where the population base component accounts for a significant proportion of the small, negative migration change but is in fact considerably smaller than the two other components, which have opposite and off-setting effects. For outward migration, the population base component accounts for over a third of Auckland's increased out-migration but is much less influential for all other regions.
- The mobility component is generally indicated to be of more influence on migration change than the population component, although once again the overall importance is low accounting for around 16 per cent for inward migration and 19 per cent for outward migration across all regions. Notable exceptions for inward flows include Manawatu-Wanganui, Gisborne and Otago where over a quarter of the migration change is accounted for by the mobility component -- in the case of the former this is around two-thirds. For outward migration, the mobility component makes the largest relative contribution in the case of Wellington and Otago, but accounts for over a fifth of the migration change in Northland, Hawke's Bay, Taranaki, West Coast and Southland.
- For most regions, the geographic distribution component is the

dominant influence on changes in internal migration. Its importance suggests that the changes in population flows may be accounted for by regional attractiveness– actual or perceived. For inward migration, the geographic distribution component accounts for around two-thirds to three-quarters of the actual change in migration for all regions except Taranaki and Manawatu-Wanganui. The results for Taranaki are distorted by its small, negative migration change; while for Manawatu-Wanganui inward migration change appears to be almost completely accounted for by demographic factors alone. For outward migration, the geographic distribution component is similarly dominant, especially so for Gisborne and the West Coast. However, it is comparatively less important -- accounting for only half of the outward migration change -- for Wellington and Otago.

For the decade ending 2001, the change in migration was comparatively modest and so the absolute component values are smaller (Table 2) and in several cases this was negative: Northland, Manawatu-Wanganui, Marlborough, West Coast, Otago and Southland. In these cases, the values of the components can be distorted as positive and negative values may be off-setting one another. Care is required in their interpretation but nonetheless comparative analysis of the values reveals the relative importance of demographic and geographic factors.

- The population base component had a positive influence on inward and outward migration with the exception of out-migration from West Coast. In respect to inward migration, the population base component was generally more significant than in the previous period, accounting for more than the other components in the case of Waikato, Hawke's Bay, Nelson and Tasman. However, for outward migration in no case was the population base component the most significant factor, although it accounted for more than a third of the change for Manawatu-Wanganui.
- Overall, the mobility component is the smallest of the three components and in most cases produces a positive impact on migration. For inward migration, this component makes a substantial contribution in the case of Hawke's Bay, Wellington, Canterbury, Nelson and Tasman; and although less significant nonetheless exceeds the population base component for Manawatu-Wanganui, West Coast and Southland. For outward migration, the mobility component is significant for Auckland, Gisborne, Marlborough and West Coast.
- The geographic distribution component has an overall importance of similar magnitude to the population base component but has greater

importance when the experience of individual regions is examined. For 12 regions, it is the dominant influence on in-migration and for all regions it is the dominant influence on out-migration. For inward migration, the majority of regions had a negative geographic distribution component indicating that they were attracting fewer migrants than can be explained by changes in demographic structure or age specific rates of migration. For outward migration, nine regions had a negative geographic distribution component indicating that the regions had increased attractiveness to existing residents compared with the option of relocating to other regions.

Table 2: Shift share analysis of change in migration of population aged 15-64, 1991-96 to 1996-2001 (figures in table are population counts)

	In-migration				Out-migration			
Region	$\triangle M_{*jk}$	A_{*jk}	B_{*jk}	C_{*jk}	$\triangle M_{*jk}$	A_{*jk}	B_{*jk}	C_{*jk}
Northland	-330	175	23	-528	-246	152	-13	-386
Auckland	1110	364	67	679	4518	1016	1208	2293
Waikato	384	499	138	-253	-225	278	-37	-466
Bay of Plenty	660	293	-10	377	912	185	53	674
Gisborne	-360	61	40	-460	420	29	102	288
Hawke's Bay	294	179	94	21	24	134	100	-210
Taranaki	-231	121	74	-426	-150	104	-20	-234
Manawatu-Wanganui	-2277	404	450	-3131	522	181	50	292
Wellington	3879	65	914	2900	-3150	407	429	-3986
Nelson	102	114	66	-78	603	59	92	452
Tasman	111	105	51	-45	-306	68	19	-392
Marlborough	-57	142	128	-327	468	29	140	199
Canterbury	1116	255	333	529	-777	322	24	-1123
West Coast	-843	78	231	-1151	363	-6	84	285
Otago	-321	244	-9	-556	66	105	231	-269
Southland	-669	51	70	-790	-474	86	12	-573
Total	2568	3150	2658	-3240	2568	3150	2474	-3056

Note: $\triangle M_{*jk}$ change in the volume of migrants; A_{*jk} population base component; B_{*jk} mobility component; C_{*jk} geographic-distribution component;
Source:: Census of Population and Dwellings 1991, 1996 and 2001

Comparing the two periods, the analysis highlights change in the distribution of regions experiencing the most growth or decline in their internal migration flows and a change in the relative importance of the

individual migration components. As a general observation, it appears that demographic factors -- the population base and mobility components -- are more significant contributors to migration change in the second, more recent period of lesser regional migration growth. In contrast, when migration growth was greater – and almost all regions experienced increasing inward and outward migration -- the geographic distribution component, representing regional attractiveness, was a stronger influence.

Examination of age-specific migration components provides a further level of detail to the explanation of changes in migration flows. By way of illustration, results for three regions with contrasting migration experiences are highlighted for 1996-2001: Auckland, Bay of Plenty and Southland. Highlights are the decreased migration among younger age cohorts and the continued dominance of the geographic-distribution component. In all regions the change in migration for the 20-24 age cohort generates the single largest contribution to migration change.

- In the case of Auckland, the decreased in-migration of persons aged 20-29 is a significant contrast with the earlier period. This change is at odds with both the population base and mobility components, and accounted for almost entirely by the geographic-distribution component. In addition, there is a marked increase in out-migration for the 35-54 cohorts -- again, largely attributable to the geographic-distribution component.
- Bay of Plenty too, experienced a greater increase in out-migration than in-migration for the recent period. As with Auckland, the increased migration was a feature of the 30-64 age cohorts, with a decreased migration for the 20-29 groups. Southland's experience differed largely in the patterns of the 30-64 age groups, for which in-migration decreased consistently but out-migration was generally increased.

Conclusion

The potential value of the shift share accounting framework is in separating the influence of changes in demographic structure and age-specific migration rates on the overall change in migration. In recent decades, the extent of demographic and age specific mobility change has been comparatively modest and the geographic distribution component has dominated. This geographic component measures changes in the relative attractiveness of different regions in a way that is not immediately apparent from changes in gross migration flows. Even so, when this component is dominant it tends to reduce the insight provided by shift share analysis as there is no guide as

to why relative attractiveness should be changing. For example, there are regions that maintain a large migration deficit such as Taranaki, Gisborne and Southland -- even after demographic and age-specific mobility effects are discounted. Shift share provides no new insight as to the reasons for this outcome but the discounting these two components does reveal a truer picture of the regional variations in migration that are beyond demographic and mobility trends. On the other hand, although identified as a secondary influence on the overall change in regional migration, age structure helps interpret flows between some individual regions as well as emphasising the contribution of specific age groups to migration change. The population base component makes a proportionately significant contribution, for example, to movement to and from Auckland.

Notes

1 The base and terminal populations for the calculation have been selected as the end points of the two periods examined, these are 1991 & 1996 and 1996 & 2001, respectively. The analysis excludes in-migrants identified as originating outside a specific region, including those of "no fixed abode", "New Zealand not further defined", "not applicable" and "overseas".

2 All values have been rounded by Statistics New Zealand to base three. When applied to data on changes in migrant flows between specific regions, the volumes are frequently less than 10. This means that, in practice, rounding of the data can add a significant proportional change. It also renders the sum of the age groups different from the total provided in the original data. If no allowance is made for this then there will be a discrepancy between shift share components and actual migration data. This study proceeded by using the sum of the individual age groups rather than total for all age groups.

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