# The New Zealand Socioeconomic Index of Occupational Status (NZSEI

Patrick Ongley

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# *The New Zealand Socioeconomic Index of Occupational Status (NZSEI)*

***Research Report # 2***

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*The opinions presented in this report are those of the authors and do not necessarily represent an official view of Statistics New Zealand*

Statistics NEW ZEALAND Te Tari Tatau

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# Executive summary:

This publication discusses the construction and validation of the New Zealand Socioeconomic Index (NZSEI), an occupationally derived indicator of socioeconomic status.

## Phase One: Construction of the Index:

The NZSEI is modelled on the International Socioeconomic Index (ISEI) devised by Ganzeboom et al. (1992; 1996). In phase one of the project, the Index is developed using a statistical formulation of the relationship between education, occupation and income, in which occupation acts as a latent, intermediate variable converting 'human capital' or education, into material rewards, or income.

The additional variable of age confounds the relationships observed between education, occupation and income, and is therefore also explicitly introduced into the equation.

An optimal scaling technique is used to rank the occupational groups listed in the NZSCO90, in such a way as to minimise the direct effect of education on income, and to maximise its indirect effect. Each occupational group is thus allocated a score on the continuous NZSEI scale from 10 to 90, for consistency with the international index.

Data drawn from the 1991 Census is used in the construction of the NZSEI, and the model is initially applied to all full-time workers aged between 21 and 69. The incorporation of part-time workers into the dataset is shown to have little impact on the distribution of NZSEI scores, and part-time workers are therefore excluded from the analysis.

Given the occupational segregation of women and Maori, it is necessary to ascertain whether the NZSEI performs as effectively for these groups as it does for non-Maori males. To this end, NZSEI results obtained using a female-only dataset are compared with those derived from a male-only dataset, and NZSEI results for Maori and 'European' datasets are compared. Although some differences between male and female, and Maori and European scores emerge, the NZSEI model is shown to hold for women and Maori.

The NZSEI scores are compared with those of the international index (ISEI), and are shown to be reasonably similar. The relationship between NZSEI scores and the Elley-Irving index is also examined.

## Phase Two: Validation of the Index:

In phase two of the project, a health validation exercise is conducted, in order to assess the extent to which the NZSEI replicates known patterns of socioeconomic determination for a range of health indicators.

Three health variables, which previous research has established to be patterned by socioeconomic status, are selected from the 1992-3 Household Heath Survey (HHS) for the health validation exercise. These are: *self-assessed poor health*, as an indicator of health status; *cigarette smoking*, as a behavioural indicator; and *GP visits in the last year*, as an indicator of health service utilisation.

The continuous NZSEI scale is broken down into six ‘occupational class’ categories, as a prelimiary to the health validation work, and the six NZSEI categories are plotted against the health indicator scores. The socioeconomic patterning of each health variable by NZSEI category is also compared with socioeconomic patterning by ISEI and by Elley-Irving class.

All three measures of socioeconomic status (the NZSEI, the ISEI and the Elley-Irving-Index) are found to display relationships with the health variables. In general, the health indicators are shown to conform to expected socioeconomic patterns when plotted against the 6 NZSEI categories, thereby demonstrating the NZSEI to be a valid SES indicator.

However, unexpectedly high scores on the health indicators for the lowest NZSEI category suggest that the placement of farmers within this category is problematic. It seems likely that the NZSEI provides a more accurate measure of socioeconomic status for urban sample populations.

*Section 1:*

# Introduction and background to the report:

Occupational measures of socioeconomic status (SES) are routinely used in public health research. Indeed, aside from gender and age, occupational SES is probably the most widely used explanatory variable in such research. Furthermore, occupational information such as that contained in death certificates, is frequently the only socioeconomic data available in the health setting. That two recent official compilations of health statistics in New Zealand (Public Health Commission, 1993; Statistics New Zealand and Ministry of Health, 1993) failed to deploy this analytical construct however, reflects the inadequacy of existing local occupational SES instruments.

To date, the occupational SES measure used most widely within the New Zealand research community has been the Elley-Irving scale. Designed specifically for educational research, the original Elley-Irving Index (1972) was developed utilising data from the 1966 Census to derive median education and income level scores observed for incumbents of each occupational group. The scores were then equally weighted in the assignment of occupational groups to one of six levels. The Elley-Irving scale was subsequently revised in 1976 to bring it up to date with the 1971 Census (Elley and Irving, 1976), and updated again in 1985 using 1981 Census data (Elley and Irving, 1985).

Although the Elley-Irving scale has found wide application in social research as an objectively derived occupational SES measure, the scale is now empirically antiquated. Given the shifts which have occurred over the past decade in the occupational structure, as well as broader demographic and social changes, the Elley-Irving Index may be of limited relevance for the study of social stratification in contemporary New Zealand. There is clearly a need to develop a new local instrument with which to measure occupational SES.

The current proposal for an occupationally-derived socioeconomic index (the NZSEI) will provide an advance on the Elley-Irving scale in a number of respects. The NZSEI is up-to-date, as it has been developed in line with the current reality of the New Zealand occupational structure, using data from the recent 1991 Census and the NZSCO90. In addition, the more rigorous conceptual basis underpinning the scale facilitates a greater theoretical understanding of the mechanisms linking socioeconomic status and social outcomes such as health status. Finally, a considerably more advanced statistical model has been applied in order to derive the weights and scores that form the basis of the scale. Although the focus of the current report is the measurement of socioeconomic status in the context of health research, the NZSEI is intended as an SES instrument for general use within the wider social research community.

The two essential components of the methodological approach adopted in this project may be respectively termed *scale development* and *scale validation*. Phase one of the project entails the application of an established statistical algorithm to Census data in order to generate occupational scores. An assessment of the scale's validity is then undertaken in phase two of the project, where the pattern of occupational scores obtained is tested against known health outcomes.

In the remainder of the introductory section to this report, the theoretical and methodological rationale of scale development for occupational class will be canvasssed. In particular, three issues will be addressed

in depth, at least initially prior to fuller development later in this report. These three issues, which are fundamental to the background of this exercise, are

- the measurement of socioeconomic status (SES);
- the relationship between socioeconomic position and health outcomes as a potential validation; and
- a statistical model that can successfully underpin the construction of a scale of occupational class, drawing on income and educational data derived from the Census.

The rationale of this investigation rests on two premises. Firstly, it is assumed that a person's occupation is a reasonable basis on which to allocate them a position in the socioeconomic hierarchy. Secondly, the assumption is made that differences in life chances and lifestyles flowing from placement in the socioeconomic hierarchy will be reflected in the patterning of key health indicators. These two assumptions are crucial to this exercise, and it is the object of this section to review the literature, firstly on the operationalisation (or measurement) of socioeconomic status and, secondly, on the expected relationship between socioeconomic position and health outcomes.

## 1.1 Operationalising Socioeconomic Status:

### *The Theoretical Underpinnings of SES Measures:*

Explicit acknowledgement of the sociological underpinnings of social class measures is frequently lacking in quantitative social research. In Martelin's view, epidemiological research in particular seems to have been characterised by a tendency to 'control for class' by including haphazardly chosen indicators, without reference to theories of socioeconomic stratification (1994: 1258). This "largely unthinking use of social class," as Marmot et al. contend, is "unfortunate. Not only may it contribute little to understanding of the factors affecting health and disease, it may actually retard our understanding" (1987: 111).

In the absence of any clearly stated theoretical grounding, much research manifests a paradigmatic confusion between the related concepts of 'class' and 'socioeconomic status' (SES). This is evident in the tendency to use the two terms interchangeably (Najman, 1988: 31; Johnson & Hall, 1995: 250), or to use data drawn from measures of SES to support propositions about the existence of 'class' (Davis, 1984: 143). The terms must however be recognised as conceptually distinct. A 'class,' in Marx's original sense of the word, may be defined as a group of people who share a common economic situation, based upon their relationship to the means of production, and whose interests inevitably conflict with those of others. Indeed the term 'class' is arguably rendered meaningless when removed from the context of the full theoretical arsenal of Marxism.

'Socioeconomic status,' on the other hand, must be understood in terms of *socioeconomic stratification*, the patterned unequal distribution of opportunities, advantages, resources and power among subgroups of a given population. Distinct 'socioeconomic strata' may thus be said to exhibit differential life chances, living standards and associated cultural practices. While it is commonplace for researchers to use the term 'class' to refer to the type of social stratification measured in their research, it is clear that socioeconomic status is in fact the construct that most seek to operationalise.

### *Choosing an Indicator of SES:*

It has been observed that essentially the same socioeconomic patterning of health outcomes is obtained in empirical research regardless of the SES indicator used. Thus in the case of health research, "whether SES is measured by income, education, or occupation, much the same picture emerges: those at the bottom generally have the highest rates of death and disease" (Dutton and Levine, 1989: 30). As Najman notes, this observation, combined with the high degree of intercorrelation documented among various SES indicators, has led some researchers to view the decision about which indicator to use as "largely academic" (1988: 38), having little import from a practical standpoint.

The literature is however characterised by a lack of consensus on this matter. Several researchers have demonstrated that despite the intercorrelations between SES indicators, it is in fact possible to distinguish their effects empirically. Dutton and Levine for instance found evidence of "clear income gradients in self-reported health status at every education level, and likewise, clear educational gradients at every income level" (1989: 30). Similarly, Martelin's examination of socioeconomic mortality differences among the Finnish elderly using a range of SES indicators, showed that despite intercorrelations, none of the indicators were redundant. For with few exceptions, when mortality was measured by *respondent's educational level*, *respondent's occupational class*, *spouse's educational level*, *spouse's occupational class*, *household income* and *housing conditions*, "each variable added new information even when the other variables were taken into account" (1994: 1274). The implication of these findings that "no single measure [is] comprehensive enough to portray the entire picture of socioeconomic position" (ibid.: 1277), prompts Martelin to advocate the use of multiple SES indicators.

Najman (1988) sought to disentangle the multiple components of SES by comparing individuals' scores on a range of indicators, including *income*, *occupation*, *education*, *'subjective class,'* and *'interviewer class assessment'*. He found that while all five measures were significantly correlated, the correlations on the whole were modest. This led him to conclude that the variables were measuring conceptually distinct and "substantially different" characteristics (1988: 38).

Indeed, some researchers have found different SES indicators to produce quite diverse socioeconomic patterns in health outcomes. Martelin for instance reports that "distinct and relatively consistent differences were found according to each indicator" of SES used in her study (1994: 1272). A recent international comparison of socioeconomic mortality differentials provides a clear illustration of variability in 'class gradients' according to the SES indicator used. When SES was measured by *level of education*, socioeconomic mortality differentials were found to be similar for all six countries in the sample. Interestingly however, when *employment grade* was used as the SES indicator, significant variations in the socioeconomic patterning of mortality were found between the countries (Valkonen, 1993: 409). Such differences, as Ford et al. suggest, may offer clues to the specific underlying mechanisms generating socioeconomic inequalities in health (1994: 1047).

The substantial degree of variation observed between different indicators of SES is not without its attendant dangers however. As Najman cautions, variability in the indicators "is likely to be of moderate importance when a strong health association exists but it may be positively misleading if the health effects are modest or weak, particularly if researchers choose to report only 'significant' findings" (1988: 38). In other words, variation between different SES indicators in the strength and nature of their relationships with health outcomes, may tempt researchers to select only those indicators that yield the (potentially spurious) 'desired results'. It therefore seems crucial that indicators are not merely chosen for their expediency in demonstrating associations between SES and health, but that researchers are able to justify their choice by reference to some reasonable external criteria.

Martelin is correct in insisting that the intended purposes of research must determine the choice of SES indicator. Specifically, she argues that where research is *policy-oriented*, the indicator must be chosen for its ability to delineate differences between concretely defined population subgroups, as a preliminary to intervention. The selection criteria in policy-oriented research must therefore be "the empirical distribution of the indicator and its discriminatory power" (1994: 1275). In the case of *theoretically-oriented* studies which seek to elucidate the underlying mechanisms in the SES-health relationship on the other hand, the empirical SES measure chosen must correspond unambiguously to socioeconomic stratification theory. The selection criteria in theoretically-oriented research must then be "the validity of the measures and the explicitness of interpretation" (op cit.).

### *Income-based Measures:*

Income is undoubtedly a key determinant of living standards, shaping the extent to which individuals' basic and additional needs are met through their ability to consume (Saunders, 1996: 90). As Najman points out, "few indicators of SES inequality are likely to have a higher level of face validity than do

income differentials" (1988: 37). Najman further contends that the documentation of income-related inequalities points to the possibility for "some ameliorative responses, through the redistributive potential of the welfare system" (ibid.: 38). Income measures therefore provide researchers with socioeconomic information in a readily decipherable form, the policy significance of which is easily inferred.

Measures of income tend to display strong relationships with social indicators. Several researchers have observed that income is in fact a better predictor of health status than any other SES indicator. In his comparison of educational, occupational and income-based SES indicators for example, Hay (1988) found the latter to exhibit the most consistent relationship with health status. And Krieger and Fee (1994) found income-related inequalities in health to be more pronounced than health inequalities associated with education, such that "differences in health status by income level within each educational level reached up to sixfold, but by educational level within each income strata, the differences hovered around threefold" (1994: 29-31).

As several writers have noted however, data on personal income alone tells us very little about respondents' actual living standards (Kunst & Mackenbach, 1994; Krieger & Fee, 1994; Macran et al, 1994; Saunders, 1996). Most researchers seem to agree that *the household* is the appropriate unit of analysis in the empirical study of income distribution, for "it is within such economic units that resources are pooled in order to meet needs" (Saunders, 1996: 92). It follows that in order to obtain meaningful income-based SES measures, researchers must add the net incomes of all household members and adjust the total for the number of household members (Kunst & Mackenbach, 1994: 41). The fact that children are in general cheaper to support than adults has been read by some as justification for the additional consideration of the age composition of households when measuring income (Macran et al, 1994: 190).

Saunders' contention that "in reality, what matters for people's well-being and their standard of living is .... the level of their *disposable income*" (1996: 30-31), leads him to advocate the use of an even more complex income-based indicator, designed to measure *income relative to need*. Saunders presents data from his 1995 study which showed the socioeconomic ranking of household units to change substantially when income levels were adjusted for need using the Henderson equivalence scale. Most significantly, only 55% of units initially placed in the highest socioeconomic quintile according to unadjusted income, actually remained in the upper quintile when their incomes were made relative to need (1996: 91).

For Saunders then, the development of a sufficiently meaningful income-based instrument would involve "ensuring that a comprehensive measure of monetary income is used which includes rent, interest and dividend income, in addition to wages and salaries and income from government cash payments, and takes account of payment of direct taxes which reduce the resources available for consumption" (ibid.: 90). Moreover, Saunders notes, this argument can be logically extended to suggest that income measures should also include "the value of benefits derived from the social wage in the form of education, health and housing services which are provided free or at subsidised prices by the government" (op cit.).

The arguably unworkable complexity of Saunders' prescription points to one of the pitfalls associated with income-based SES measures. Specifically, respondents must apparently be asked a veritable barrage of questions in order for researchers to obtain useful income data. As Kunst and Mackenbach point out, in the case of epidemiological research this problem may be particularly acute, for the simple reason that "most health interview and similar surveys have no room for an extensive measurement of income" (1994: 42).

Furthermore, the sensitivity of the issue may make attempts to measure income levels particularly vulnerable to high non-response and inaccurate response rates (op cit.). Najman might well be correct in asserting that "income questions appear to be relatively well answered by respondents if they are presented in categorical form" (1988: 37). However, treating income categorically mitigates against what Martelin refers to as "the undisputable advantage" of income-based measures (1994: 1276); namely, their quantitative nature, which makes them readily amenable to multivariate analysis, and permits the application of highly detailed classification schemes to sample populations.

Perhaps the most fundamental problem with income measures however, lies in their inability to capture the reality of the socioeconomic circumstances of certain population subgroups. In particular, researchers have expressed doubt as to the applicability of income-based SES indicators to elderly or retired persons (Martelin, 1994: 1276), the self-employed and farmers (Lundberg, 1991: 387), on the grounds that the socioeconomic status of respondents in these categories is likely to be underestimated by simple measures of their taxable income.

In any case, substantial fluctuations documented in individuals' income levels throughout the life course mark income as an especially unstable measure of SES (Hay, 1988: 1322). Hay is correct in insisting that income level is therefore best conceptualised as a sensitive indicator of *short-term* socioeconomic status (op cit.). Supplementing measures of current cash-flow with consideration of accumulated assets or wealth would generate more *durable* socioeconomic data. Furthermore, if we are to accept the proposition that "consumption is a major new axis of social division," (Saunders, 1986, in Arber, 1991: 428), then measures of asset-wealth, which are more directly indicative of consumption patterns than are income levels, may also generate more *meaningful* socioeconomic data.

### *Measures of wealth:*

Although they are significantly correlated, the distribution of capital assets is apparently quite distinct from the distribution of income in advanced capitalist societies. Krieger and Fee note for instance that while the median income of white households in the US is around 50% greater than that of black households, the median *wealth* of white households, in the form of economic reserves and assets, is around ten times greater (1994: 37). Thus in some cases, an exclusive reliance upon measures of taxable income may actually conceal the true extent of socioeconomic inequality between various population subgroups. The measurement of wealth, by implication, may afford a more accurate reflection of socioeconomic stratification patterns.

Researchers have attempted to measure wealth by testing for the presence of certain material resources, which function as "proxy measures" of repondents' socioeconomic status (Kunst and Mackenbach, 1994: 42). The asset-based SES indicators most commonly used in health research seem to have been *car ownership* and *housing tenure*, both of which "reveal large differences in health status" (Arber, 1991: 428). Arber, for instance, examined the socioeconomic patterning of chronic illness using data from the British General Household Survey (GHS), and found that "local authority tenants were about 40% more likely to have a limiting long-standing illness than the national average, and owner-occupiers were 14% less likely to report poor health status" (Arber, 1991: 428).

Similar patterns in health have been documented when *car ownership* is used as the SES indicator. However, given Dale's 1986 finding that car ownership is also differentiated by *gender* (in Arber, 1989: 275), its relationship with health status is probably more complicated. This would seem to be confirmed by the results of Arber's 1989 study, which showed socioeconomic health differentials measured by car ownership to be significantly greater among men than among women (op cit.).

### *Educational Indicators:*

Increasingly, researchers seem to be advocating *education* as the most reliable measure of socioeconomic status (as noted by Williams, 1990 and Krieger and Fee, 1994). For researchers seeking to uncover mechanisms of social causation underlying the socioeconomic patterning of health data, the great advantage of education-based measures over other SES indicators lies in their *stability* (Krieger and Fee, 1994: 38). Since educational attainment levels are typically established at an early age and tend to remain stable over the course of individuals' lives, any relationship observed between health status and level of education is unlikely to reflect the operation of *social selection*[1] (Hay, 1988: 1322; Valkonen, 1993: 410).

[1]As Blane et al. explain, the theory of 'social selection', sometimes referred to by health researchers as 'the drift hypothesis' (Williams, 1990), accepts the exitsence of "a causal relationship between health and social position, but reverses the normal direction of causality (1993: 1), positing that an individual's social mobility, and hence, ultimately, their socioeconomic status, is determined by their health status

Furthermore, there is a large body of evidence which suggests, contrary to the previously mentioned findings of Hay (1988) and Krieger and Fee (1994), that health is more strongly related to education than to income or any other indicator of SES. Kitagawa and Hauser (1973), Lebowitz (1977) and Liberatos et al. (1988) found the relationship between health and socioeconomic status to be most robust when education was used as the SES indicator (cited in Williams, 1990: 93). Newhouse and Friedlander (1980) and Leigh (1983) reported that the association of health status with income became insignificant when education was held constant (cited in Garber, 1989: 282-3). More recent evidence presented by van de Mheen et al. showed the socioeconomic inequalities in health associated with education level to be larger and more consistent than those associated with occupation (1994, cited in Stronks et al., 1996: 657).

Critics have however noted that educational indicators of socioeconomic status are not without their problems. In the first instance, there are difficulties associated with the coding of educational attainment categories. As Najman (1988: 38) and Garber (1989: 286) have pointed out, the measurement of education levels is complicated by the incommensurability of different kinds of education. To give an example, one might reasonably ask what basis for comparison exists between a post-secondary school qualification gained in the course of on-the-job training, and a University degree received within the same time-frame. The convention of converting individuals' educational qualifications into 'years of education' in order to rank a sample population socioeconomically, may thus gloss over substantial heterogeneity in the form of education actually received by respondents. This observation leads Garber to conclude that 'years of education' can only ever serve as a flawed 'proxy' measure of an individual's 'true' level of education (op cit.).

Furthermore, several researchers have noted that measures of educational attainment may in some cases fail to discriminate adequately between population subgroups. In the British context for example, Arber contends that the utility of education-based SES indicators in socioeconomic stratification research is severely limited due to the skewed distribution of education levels, with the vast majorty of the British population falling into the lowest educational attainment categories (1989: 271). Valkonen argues that since most industrialised democracies have prescribed compulsory schooling to a certain age, a skewed educational distribution will be replicated throughout these nations, thereby inhibiting the meaningful analysis of socioeconomic health inequalities among sample populations categorised by educational SES (1993: 411). Martelin's study of socioeconomic mortality differences among the Finnish elderly led her to conclude that the inadequate discriminatory power of education-based SES measures is particularly pronounced among aged populations. Given that only 5% of respondents in her sample had received a higher education, Martelin surmised that "education therefore distinguishes the most privileged group from the others but fails to differentiate within the majority of the population" (1994: 1276).

The conceptual underpinnings of educational SES measures have also been identifed as potentially problematic. As Krieger and Fee point out, the notion that indicators of education measure a fixed 'economic investment,' is greatly undermined by evidence which suggests that the economic return for a given level of education varies substantially by ethnicity and gender (1994: 38-9). The authors present data which shows that for the same level of education, blacks in the US earn between 72% and 86% of white salaries, and women earn between 50% and 70% of male salaries (op cit.)

Finally, the historical and cross-national fluctuation of educational standards constitute additional sources of difficulty. The growth in higher education in contemporary societies for instance, presents an obstacle for researchers seeking to compare the socioeconomic health inequalities documented for different age cohorts (Arber, 1989: 271; Blaxter, 1989: 222). Similarly, the cultural specificity of educational standards complicates attempts to undertake internationally comparative research in the field (Blaxter, op cit.).

### *Local Area Measures:*

Local area measures of socioeconomic status involve allocating individuals an SES score on the basis of their dwelling area, which, in turn, is classified according to the socioeconomic characteristics of its

population as recorded in the last census (Macintyre et al., 1993: 215). Such measures function as useful surrogate indicators of socioeconomic status when individual-based indicators are not available for sample populations (Marmot et al., 1995: 184). The greatest advantage of area-based measures lies in their wide applicability, as they enable the allocation of socioeconomic status scores to all individuals, regardless of age or employment status (Krieger and Fee, 1994: 36).

Several recent area-based socioeconomic indices seek to measure 'deprivation', as distinct from socioeconomic status. Such 'material deprivation indices' have been developed by Townsend et al. (1988), Carstairs and Morris (1989) and Crombie et al. (1989) (cited in Macintyre et al., 1993: 215). Material deprivation indices permit the socioeconomic ranking of small areas according to a combination of such variables as the percentage of unemployed males in the area, the percentage of the area's population without cars, the ratio of owner-occupied to rented homes in the area, the proportion of the population living in crowded conditions and the proportion of ethnic minority residents in the area (op cit.). Townsend et al. (1988) found their material deprivation index to correspond closely to differences in mortality levels between neighbourhoods in Northern England (in Marmot et al., 1995: 184).

### *Occupational Measures:*

The division of labour is arguably "the kernel of social inequality" (Ganzeboom and Treiman, 1996: 202) in advanced capitalist societies, and occupation, by implication, is a pivotal factor underpinning socioeconomic stratification. Indeed, as Jenkins points out, the sociological emphasis in stratification studies has been upon "*employment* as the key social relationship, and work organisations and the labour-market as the key social contexts, within which social stratification is produced, reproduced, and structured" (1991: 559). The classification of occupations thus constitutes the backbone of much socioeconomic stratification research (Ganzeboom and Treiman, op cit.).

Given that they are "supposed to provide a guide to culture as well as income" (Marmot et al., 1995: 181), occupational indicators have the potential to yield more information than any other SES indicator about the living conditions experienced by various population subgroups. As Johnson and Hall allege, occupational data not only informs researchers about the working lives of individuals, but also offers insight into "their social community, their financial and residential resources, their cultural experiences, their health-related behaviour, and even the life-course opportunities open to them and their children" (1995: 250).

In addition to its clear conceptual links with socioeconomic stratification theory in general, occupation is of special relevance to health researchers. For occupation functions not only as a key dimension of socioeconomic status, but also as an indicator of exposure to certain job-related health risks (Kunst and Mackenbach, 1994: 35, Macran et al., 1994: 182-3; Johnson and Hall, 1995: 250). Occupational influences upon health status may therefore be both *direct* (through the impact of exposure to workplace toxins, physical dangers or psychological pressures) and *indirect* (via the association of occupation with living standards).

Occupation-based SES indicators have been particularly favoured by health researchers in Britain (Stronks et al., 1996: 657), where the conventional method for measuring socioeconomic inequalities in health status has historically involved the examination of 'male mortality rates by occupational class' (Macran et al., 1994: 182-3). Contrary to evidence presented by Hay (1988) and Krieger and Fee (1994), Macran et al. found that occupational group "offered greater explanatory power than income, at least as far as self-assessed health is concerned" (1995: 204). In any case, measures of occupation have been shown to correlate highly with other SES indicators which are often more difficult to acquire (Elley and Irving, 1976: 25-6). As Najman and Bampton observe, in studies with dependent variables, "of the many candidates for an appropriate SES measure, only broad categories of occupational data are likely to be universally collected" (1991: 219).

Frequently however, in the context of health research, the available occupational data may be of poor quality. The authors of a recent local study on socioeconomic mortality differences for instance found

the occupational information recorded on women's death certificates to be particularly inadequate (Pearce et al., 1991). Since less than half of the women in their initial sample could be allocated an occupational class on the basis of the information recorded on their death certificates, Pearce et al. were unable to include women in the study (ibid.: 153).

More crucially, the utility of occupational SES indicators is undermined by their lack of applicability to individuals with no direct, current attachment to the labour market, such as housewives, beneficiaries and the retired. Such 'economically inactive' persons are certainly not exempt from processes of socioeconomic stratification. As Duke and Edgell phrase it, "a move into domestic labour, unemployment or retirement does not result in the respondent .... 'falling off' the edge of the class structure to become 'non-persons" (1987: 10).[2]

Excluding 'economically inactive' individuals from stratification studies means effectively eliminating a substantial proportion of the adult population - more than 40% in the British case (ibid.: 9). Duke and Edgell warn that such significant exclusions will logically produce "restricted and distorted" understandings of socioeconomic stratification in general (op cit.). Results will be particularly skewed for sample populations drawn from societies with high unemployment rates or aging populations. Unless the focus of the study is the sphere of production itself therefore, researchers cannot justifiably exclude 'economically inactive' persons from their sample populations (ibid.: 13).

Where occupation-based classification schemes are used to derive socioeconomic status scores then, researchers must devise methods for extending their classification schemes to apply to those persons not currently in paid employment. To this end, several researchers have adopted the convention of classifying respondents according to their *previous* occupation. Heath and Britten (1984) contend that previous occupation is a reliable proxy measure insofar as it captures a person's 'potential labour market participation'. Where sample populations exhibit high rates of long-term unemployment however, the utility of this classification method is clearly limited. Some researchers have resorted to treating the long-term unemployed as an ontologically separate 'underclass'.

The interaction of occupational class with other axes of social stratification constitutes an additional source of difficulties for researchers using occupational indicators to rank sample populations socioeconomically. In particular, the *horizontal segregation* of the labour force works to produce a pronounced clustering of certain socially stigmatised population subgroups within the lower employment grades. In addition, such marginalised groups are subject to *vertical* labour force segregation which effectively curtails their opportunities for upward occupational class mobility.

A clear illustration of labour force segregation is contained in the predominance of ethnic minority workers in those occupational categories characterised by low wages, poor job security and inferior promotion prospects. Within the New Zealand labour market for example, Brosnan reported in 1987 that despite some significant improvements since the 1950s, Maori males remained underrepresented in every occupational group except 'unskilled manual labour' (1987: 94). Evidence suggests that women are also disadvantaged by processes of labour force segregation. Female employment is concentrated in those areas of the labour market where job security and wages are inferior, and female employees are less likely than their male counterparts to move up the career ladder.

In this context, several critics have expressed doubt as to the applicability of generic occupational classification schemes to population subgroups that experience significant horizontal and vertical occupational segregation (Macfarlane, 1990; Krieger and Fee, 1994; Macran et al., 1994). Specifically, it has been alleged that generic classifications may not discriminate adequately among the occupational circumstances of women or ethnic minorities, due to the marked convergence of these individuals within a narrow range of occupational categories. In 1971 for instance, the heavy concentration of female workers into a small number of routine, non-manual, personal service and semi-skilled jobs was

[2]The case of housewives is illuminating in this sense. Socialist feminist have demonstrated that housewives play a vital role in upholding the capitalist socioeconomic order by 'reproducing the labour power of workers'.

so pronounced that almost half of all British women were assigned to only six of the 200 occupational groups listed in a conventional classification (Macfarlane, 1990, cited in Krieger and Fee, 1994: 34).[3] These findings point to the possibility that generic occupational classifications may lack the ability to dissect the female occupational structure in such a way as to identify sociologically relevant cleavages in job characterisitcs. Generic occupational class indicators may not therefore operationalise occupational stratification for female or ethnic minority sample populations as effectively as they do for ethnic majority males.

## 1.2 The Relationship between Socioeconomic Status and Health:

The first evidence of socioeconomic inequalities in health was found in Britain's earliest mortality records, with 19th century researchers documenting the existence of a strong inverse relationship between occupational class and mortality (Williams, 1990: 81). Marked 'class gradients' in health measures have persisted in Britain throughout the twentieth century, despite drastic improvements in medicine, nutrition, housing, water and sewerage systems, and the institution of a National Health Service (NHS) (op cit.).

In 1980 Britain's Working Group on Inequalities in Health published the now famous Black Report, which showed that class gradients had in fact steepened in the 30 year period since the establishment of the NHS. The report thus attested to the continuing relevance of socioeconomic factors as powerful predictors of health status, and set the stage for a subsequent profusion of research into the relationship between socioeconomic status and health. International evidence has steadily accumulated in the wake of the Black Report's publication, with relationships between measures of SES and health being documented throughout Europe, in the United States, Japan, Canada, Australia, New Zealand and several third world countries (Williams 1990: 84).

The strength and constancy of the class gradient in health data have led one author to characterise socioeconomic status as "the most powerful and consistent epidemiological risk factor" (Brenner, 1995: 213). It follows that health measures have the potential to tell us much about the living standards and general welfare of various population subgroups. As Davis notes, "in some circumstances they may prove to be the best indicators we have" (1984: 142) of the differential conditions experienced by socioeconomic strata.

### *The 'Class Gradient' in Health Data Across the Life Course:*

The relationship between socioeconomic status and health typically takes the form of a curvilinear gradient, with increments in SES precipitating successively smaller gains in health status as one ascends the socioeconomic strata (Saunders, 1996: 38). Numerous researchers have observed that socioeconomic inequality in health is therefore not merely a case of a 'gap' in health status between rich and poor; rather, a continuous gradation of difference operates throughout the entire socioeconomic distribution (Wilkinson, 1992; Ford et al., 1994; Marmot et al., 1995).

The continuity of the gradient suggests that it is *relative* rather than *absolute* socioeconomic status that produces the class patterning of health data (Wilkinson, 1992). In other words, it would seem that socioeconomic inequalities in health cannot be explained solely in terms of a 'threshold effect' of poverty (Ford et al., 1994: 1041). On this matter, however, the literature is by no means consistent. While most researchers have documented clear differences in health status between the highest and lowest socioeconomic deciles, evidence of a *continuous* class gradient operating throughout the strata is not always found (Saunders, 1996).

The magnitude of socioeconomic differentials in health varies over the life course. Several researchers have found that class gradients in measures of health status are non-existent (Lundberg, 1986: 515) or

[3]In fact, the observations that many male occupations had no female representation at all, and that seven broad occupational groups accounted for around 70% of the total female workforce, led Elley and Irving to develop a specifically female scale - the Irving-Elley index - which paralleled their generic scale (Irving and Elley, 1977).

largely absent (Ford et al., 1994: 1046) among children, lending support to the thesis that socioeconomic inequalities in health are not inherited, but are rather "constructed or revealed in adult life" (Ford et al, 1994: 1046). Others by contrast, have documented the existence of pronounced socioeconomic inequalities in measures of child health. Infant mortality rates tend to be quite clearly patterned by socioeconomic status. In general however, class gradients in measures of health status are usually found to be steepest in middle age (Antonovsky, 1967; Kitagawa & Hauser, 1973; Goldsmith & Hirschberg, 1976; cited in House et al., 1990: 385), with socioeconomic differentials tending to converge among the elderly (Haan, Kaplan & Camalco, 1987, cited in House et al., 1990: 385).[4] Research findings therefore tend to confirm that whereas in the lower socioeconomic strata, levels of morbidity and mortality increase steadily from middle age through to early old age, the higher socioeconomic strata seem to be approximating the "utopian scenario" in which morbidity and mortality are postponed until the very last years of life (House et al., 1990: 399).

As House et al note, "neither the nature nor the reasons for this potential interaction between age and socioeconomic status is [sic] well understood" (1990: 385). The flattening of class gradients among the elderly is especially puzzling, given that one might reasonably expect the cumulative impact of socioeconomic differentials experienced throughout the life course to produce *steeper* gradients with increasing years (Ford et al., 1994: 1047). House et al. make the point that socioeconomic inequalities in health may simply be more difficult to identify among elderly populations, given "the fact that the distribution of income within the older aged group is more compressed, combined with the greater overall prevalence of ill-health" (1990: 26).

### *The Gendered Socioeconomic Patterning of Health:*

The socioeconomic patterning of *women's* health has received relatively little attention in empirical research (Macran et al., 1994: 186; Arber, 1989: 250). The few studies conducted in this area have revealed class gradients in measures of health for women which are much flatter than those observed for men (Arber 1989: 254; Arber 1991). Arber (1991) hypothesises however, that the application of *generic* SES classification schemes to female populations may mask the true extent of socioeconomic inequalities in health among women.

In any case, it seems that the analysis of class differentials yields only a partial view of the structural factors shaping health outcomes for women. Arber (1989) for instance found marital and parental status to be highly significant additional effects for women but not for men, with mothers reporting better health than women without children, and previously married women exhibiting higher rates of limiting longstanding illness than women who were single or currently married. Interestingly, marriage appeared to act as a 'buffer' for women in the lower socioeconomic strata, with single women of low SES reporting poorer health than their married counterparts in the sample (1989). Arber's findings thus point to the interaction of the axes of gender and class in the social patterning of women's health.

The documentation of considerably higher levels of morbidity among housewives than among women in paid employment (Arber, 1989; Macran et al., 1994) further confirms that gender inequality and socioeconomic stratification interact in producing health outcomes for women. Researchers in the field of mental health (Gove & Tudor, 1973; Brown & Harris, 1978; Gove, 1978; Warr & Parry, 1982, cited in Arber, 1989: 251) have attempted to explain this association by suggesting that "paid employment is conducive to better mental health because it provides a sense of self-worth and self-esteem, as well as providing social contacts, compared with the isolation, monotony and lack of prestige derived from being a housewife" (Arber, 1989: 251).[5]

Alternately, the theory of *social selection* reverses the direction of causality in the relationship between women's health and employment status, to posit that a 'healthy worker effect' is the mechanism underlying

[4]Fox, Goldblatt and Jones (1985) however found evidence that steep class gradients in mortality persist until late in life (in House et al., 1990: 398).

[5]It should however be noted that labour force participation may not always be conducive to superior health status among women. Arber, Gilbert and Dale (1985) found for instance that employment may have a negative impact on women's health when it is combined with primary responsibility for childcare and housekeeping, producing 'role conflicts' and 'role strain' (in Arber, 1989: 251).

this pattern. In other words, it is alleged that illness prevents housewives from participating in the labour market. Macran et al tested this hypothesis and found that even *after* controlling for the presence of limiting chronic illness, housewives were still more likely than women in paid work to evaluate their health as poor (1994: 182). Evidently therefore, health-related selection out of the labour market cannot entirely account for the high morbidity levels associated with the housewife role (op cit.). Rather, as several theorists have argued, it seems likely that the relationship between health status and employment status operates in both directions (Garber, 1989: 290; Brenner, 1995: 220-221; Sanders, 1996: 4-5).

Arber and Lahelma (1993) make an interesting contribution to our understanding of the intersection of gender inequality, socioeconomic stratification and health, by comparing the health status of women in Britain and Finland, dubbed 'traditional' and 'egalitarian' societies respectively. The authors hypothesised that the socioeconomic patterning of Finnish women's health would bear closer resemblance to the class gradients in health status observed for men, than that of British women. This hypothesis was based on the observation that Finnish women participate more fully in paid employment than their British counterparts, due to their enjoyment of superior provision of parental leave and state-supported childcare. British women, by contrast, were in general seen to be more loosely attached to the labour market, with a greater proportion working part-time or not at all. Women were more likely to leave the workforce after the birth of their first child in Britain, returning only when their youngest child reached school age, and this career interruption, as Arber and Lahelma note, "is often associated with subsequent downward occupational mobility" (1993: 1057). As anticipated, the results of the study demonstrated that occupational class was a more powerful predictor of health status for Finnish women. Measures of their health status displayed more pronounced socioeconomic differentials than those observed for British women (1993: 1064). Moreover, while both marital and parental status were strongly associated with health measures for women in Britain, no such relationships held for Finnish women (op cit.).

### *Ethnicity, Socioeconomic Status and Health:*

Ethnic minority status has been widely identified as an independent risk factor impacting on health outcomes (Kaplan, 1989: 49). In New Zealand, the health experience of Maori exemplifies what is broadly accepted as an international tendency in the relationship between ethnicity and health. Recent figures show that ethnic differentials hold for a wide range of health measures in New Zealand, including mortality, morbidity, health-related behaviours and the receipt of health services.

Although the gap in life expectancy between Maori and non-Maori has narrowed over this century, Maori still face considerably higher risks of mortality at all ages, with life expectancies being on average 5.1 years and 4 years shorter for Maori women and Maori men respectively, than for their non-Maori counterparts (Department of Statistics, 1993: 23). In fact currently, the largest differentials in mortality patterns in this country are those observed between the Maori and non-Maori populations (op cit.). That 30-40% of the excess mortality of Maori is attributable to diseases which should not normally be fatal reflects what Pomare et al decry as "a serious failing in the health services" to cater for the needs of the indigenous population in this country (1995: 144).

Data pertaining to health-related behaviour in New Zealand displays particularly pronounced ethnic differentials. In the case of smoking, age adjusted figures from the 1992-3 Household Health Survey showed that 44% of Maori and only 21% of Pakeha were current smokers (Department of Statistics, 1993: 46). A more recent study places the figure for tobacco-using Maori adults even higher at around 50%, and notes that approximately 650 Maori die prematurely each year from smoking-related conditions (Pomare et al., 1995: 152). Alcohol consumption is also patterned by ethnicity, with research demonstrating that although a smaller proportion of Maori drink alcohol regularly, those that do drink tend to consume much more heavily than non-Maori (Department of Statistics, 1993: 55; Pomare et al., 1995: 153). Higher consumption levels are clearly reflected in mortality statistics, such that in the period 1989-91, the number of alcohol-related deaths among Maori men was more than double the number for non-Maori males (Pomare et al., 1995: 153).

Ethnic differentials are apparent in data drawn from a variety of morbidity measures. The Household Health Survey, for instance, revealed age- standardised hospitalisation rates which were 30% higher for Maori males and 41% higher for Maori females than for their non-Maori counterparts (Department of Statistics, 1993: 90). The survey also showed self-assessed health to be patterned by ethnicity, with 15% of Maori in the sample rating their health as 'less than good', while for Pakeha the comparative figure was only 8% (ibid.: 30).

The decline in infectious and respiratory diseases over the twentieth century has been much slower among Maori than among Pakeha (Davis, 1984: 145). The implication of this pattern is that many of the Maori-Pakeha differentials observed in morbidity and mortality data occur for conditions which are conventionally considered to be 'diseases of poverty' (ibid.: 146). Health indicators such as these therefore provide crucial insight into the socioeconomic circumstances of Maori in contemporary New Zealand. As Pomare et al. contend, the increasing rates of suicide, homicide and poor mental health among Maori over the last decade in particular "indicate a classic pattern of a population undergoing an upturn in unemployment and hardship" (1995: 149).

Data on education, employment, income, wealth and housing not only confirm that Maori are concentrated in the lower socioeconomic strata, but reveal that over the past decade "Maori have become relatively worse off compared to the non-Maori population" (Pomare et al., 1995: 145). Maori today continue to face a greater risk of leaving school with no formal qualifications than non-Maori (ibid.: 147). In 1991 Maori unemployment was at 24.2%, or around three times higher than the rate for non-Maori (ibid.: 146). For Maori men in the workforce, the median income for 1991 was $12,955, while for non-Maori males it was $20,023 (op cit.), and while the average household income for the period 1986-91 improved for non-Maori of all ages except those over 60 years, it deteriorated for Maori (ibid.: 145). In 1992, 71% of Maori aged between 15 and 59 had no assets, compared with 40% of the non-Maori population (ibid.: 146), and 1991 figures showed 40% of Maori to be living in rented accomodation while the figure for non-Maori was 21% (op cit.). In short, as Pomare et al. note, "changing state sector policies and their impact on employment and income may have prevented the benefits of Maori development from reaching Maori individuals and whanau" (ibid.: 150).

Clearly then, the socio-structural factors of class and ethnicity are co-implicated in producing poor health outcomes for Maori. Indeed, the fact that 'minority group status' is sometimes employed as an indicator of low socioeconomic status in epidemiological research generally (Williams, 1990: 83), indicates that ethnic minority status and socioeconomic disadvantage are inextricably intertwined in contemporary societies. Disentangling the complex intersection of these two powerful axes of social stratification is a task which arguably continues to elude sociologists.

It is therefore hardly surprising that there is considerable disagreement on the relative importance of socioeconomic and ethnic factors in shaping health outcomes. Several researchers have documented the persistence of a substantial 'ethnic effect' on health outcomes even *after* socioeconomic status has been taken into account. A 1970-78 immigrant mortality study conducted in England and Wales for instance found that ethnic minority status influenced mortality independent of social class (in Sundquist, 1995: 777). Similarly, in Sundquist's study, ethnicity was found to be an independently powerful factor in determining self-reported illness. Finally, Balarajam and Raleigh's finding that differential postneonatal mortality rates existed for particular ethnic minorities occupying similar socioeconomic strata (Andrews and Jewson, 1993: 144), illustrates that "the socioeconomic processes affecting health may vary between ethnic groups" (Smaje, 1996: 159).

Local research has replicated similar patterns, thereby supporting the view that ethnic differences in health status cannot be reduced to socioeconomic causes. In his analysis of New Zealand mortality statistics for example, Davis found that "4/5 of the excess of Maori over 'other' deaths is not removed when the comparison is standardised for social class" (1984: 152). It seems that ethnicity must therefore be granted a degree of ontological autonomy in explanations of the socio-structural patterning of health. This evidence leads Durie to surmise that "interventions aimed specifically at lower socioeconomic

groups will therefore be unlikely to eliminate the current mortality differences between Maori and non-Maori" (Durie, 1985: 485).

As Smaje contends however, "studies which describe how much ethnic patterning of health is 'explained' by socioeconomic status, though formally accurate, elide important questions about the disparate ways in which socioeconomic status may be produced and reproduced in different ethnic groups" (1996: 159). In other words, 'controlling for class' in research into ethnic health inequalities effectively forecloses any analysis of the socio-historical processes by which ethnic minority status and poverty have come to be associated. The examination of contemporary Maori health status, for example, must take the legacy of colonial dispossession in New Zealand into account (Pomare et al., 1995: 141). Furthermore, consideration of the impact of *racism* must be integral to any explanation of the ethnicity-class-health nexus, for "racism inflects the socioeconomic position of minority ethnic groups, and thus the health of individuals in these groups" (Smaje, 1996: 163). "The question," as Andrews and Jewson insist, "is not whether racism operates, but when, where, and how" (1993: 149).

As the literature reviewed above indicates then, several theorists have made powerful arguments for a recognition of the complexity of factors structuring health outcomes in contemporary societies. Macintyre observes that "many forms of disadvantage related to ill-health are themselves inter-correlated (for example, being non-white, working in an unskilled occupation or being unemployed, living in the inner city, being the female head of a single parent family) and disaggregating these components may mis-leadingly mask the effects of these simulataneous and overlapping vulnerabilities" (1986: 399-400). In short, the complex operation of interlocking axes of social stratification means that researchers cannot justifiably treat socioeconomic status in complete isolation from the structural factors of gender and ethnicity.

## 1.3 Statistical Basis for Scale Construction:

### *Theoretical Underpinnings of the NZSEI - The Ganzeboom Study:*

The construction of the NZSEI is premised on a methodological proposition concerning the nature of the stratification process, outlined by Ganzeboom et al. (1992; 1996), in their development of an International Socioeconomic Index of Occupational Status (ISEI). Specifically, it is proposed that there exists a fundamental relationship between cultural capital or resources (education) and access to material rewards (income), and that this relationship is mediated through the occupational structure. The key relationship underpinning the stratification process is thus schematised as one in which occupation functions as a latent, intermediate variable converting education into income. In constructing the NZSEI then, a statistical formulation of this 'returns to human capital' model is developed and applied to 1991 Census data.

Ganzeboom et al. (1992) produced the ISEI using data from 31 datasets. These spanned 16 countries, ranging from India to the United States, from Taiwan to the Netherlands. The scale was initially based on the 1968 International Standard Classification of Occupations (ISCO68), but was later recalculated using the revised ISCO88 classification (Ganzeboom & Treiman, 1996). The scales were based at the three digit ISCO68 and four digit ISCO88 level, resulting in 284 and 390 categories respectively.

A restriction of 20 people was placed on each category. Any occupation with fewer than this number was combined with an adjacent or similar category. In addition, Ganzeboom restricted his analysis to full-time males, aged from 21 to 64, resulting in a total sample size of 73,901. The restriction to full-time workers (greater than 30 hours per week), was done to prevent the confounding effects that the number of hours worked may have on income. The age restriction, and the restriction to males, was partly due to the fact that many of the datasets were similarly restricted. The age restriction was also used to avoid the inclusion of people with lower than usual incomes, in 'stop-gap' jobs, as they either enter or exit the workforce.

### *The Statistical Algorithm:*

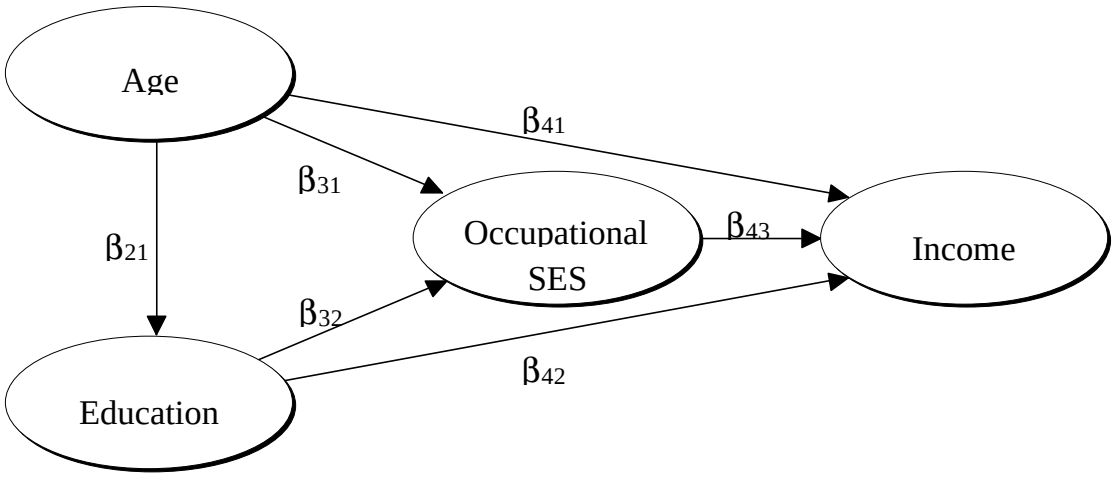
Following Ganzeboom's model, the scaling of occupation in the NZSEI is calibrated such that it maximises the indirect influence of education on income and minimises the direct effect. The solution follows the logic of a path model specified by a series of regression equations. These are estimated iteratively in such a way as to minimise the regression coefficient of income on education and maximise the indirect effect of the same relationship mediated through occupation (de Leeuw, 1989).

While this simple model provides the starting point for a method of scale construction, there are a number of methodological and conceptual issues that necessarily complicate the procedure. In the first place, age confounds the relationships in the model, since older people have lower levels of education but tend to have higher incomes. Age thus weakens the relationship between education, occupation and income, and must therefore be introduced explicitly into the analysis (Ganzeboom et al., 1992). Secondly, assuming that employers and the self-employed are sufficiently distinctive to justify special treatment (Dale, 1986), employment status will need to be incorporated into the analysis where possible. In New Zealand for instance, farmers and farm labourers share a common focus of economic activity, but have completely contrasting relationships to ownership and to the exercise of authority. Thirdly, given the occupational segregation of both women (Macran et al., 1994) and Maori (Brosnan, 1987), the robustness of the model will need to be tested for these groups, as well as for part-time and full-time members of the workforce.

The model is represented by a path model (figure 1.3.1). The arrows linking the variables are represented in the algorithm as regression coefficients, and the model as a whole is represented by a series of linear regression equations. The three explanatory variables age, income, and education, are used to derive a value for the unknown occupational socio-economic status variable. This is calculated in such a way as to minimise the regression coefficient ($\beta_{42}$) directly linking income with education. This is not worked out exactly, or in one step, but uses an iterative optimal scaling technique known as an alternating least squares algorithm to approximate scores which result in a minimal $\beta_{42}$. The result is an occupational socio-economic status scale which is an optimally weighted combination of income and education variables, corrected for age, based on the assumptions of our model (ie. no direct education-income link).

*Figure 1.3.1*

**Representation of the NZSEI path model**




The alternating least squares algorithm used is summarised in Figure 1.3.2. The age, income, and education variables are represented by a, i, and e. Occupational socio-economic status scores are represented by o, where o' and o" are revisions of this within each iteration of the algorithm and $\gamma_1 ... \gamma_k$ are the SES scores for the k occupations. The SES scores are finally scaled on a continuum from 10 to 90, yielding the NZSEI.

*Figure 1.3.2*

**The NZSEI Algorithm[6]**

Step1. Initialise the education and income weights at any reasonable starting point, and from these construct an initial o.

Step2. Regress i on a and o → $\beta_{41}$ , $\beta_{43}$
Regress o on e and a → $\beta_{31}$ , $\beta_{32}$
Regress e on a → $\beta_{21}$

Step3. Compute o' = $\beta_{43}(i - \beta_{41}a) + \beta_{32}e + \beta_{31}a$
Standardise o'
Compute scores as means of o' for $\gamma_1$,....$\gamma_k$
Compute o" using the new scaling

Step4. Regress i on a, e and o" → $\beta_{42}$
If minimum on $\beta_{42}$ , step out
Go back to step 2 and substitute o" for o

[6]See Appendix F for a more comprehensive description of the algorithm.

*Section 2:*

# The dataset:

The New Zealand Socio-Economic Index was developed using data from the 1991 Census of Population and Dwellings. The census database contains the individual records of 3,373,926 resident New Zealanders, including 2,590,284 adults. These records include information on occupation, education, income, employment status, hours worked, age, sex and ethnic group, all of which have been used in the development and testing of the NZSEI. The following discussion describes the construction of each of these variables, looks at some associated issues which have affected the development of the NZSEI and provides a profile of our subject population in the form of cross-tabulations of some of the key variables.

## Occupation

The NZSEI consists of an index of occupations classified according to the New Zealand Standard Classification of Occupations 1990 (NZSCO90). This classification is based on the 1988 International Standard Classification of Occupations (ISCO88) and supersedes an earlier classification, the NZSCO68. Occupational data from the 1991 census was coded to both the NZSCO68 and NZSCO90 classifications, which enables us to make a comparison between scores using the two different classifications and to make comparisons with the Elley-Irving scale, which used the NZSCO68 classification[1].

The NZSCO90 classification contains 10 major groups, which are sub-divided into 24 sub-major groups, 97 minor groups, 260 unit groups and 563 groups. The NZSEI analyses the 97 occupations at the minor group or three digit level. The minor group level was considered the most appropriate because the breakdown of occupations is sufficiently detailed to be of utility in social research, and at the same time there were sufficient individuals within each occupational category to allow testing of the algorithm on ten percent samples of census data.

NZSCO90 is essentially a skills based classification, grouping together occupations with similar skills requirements. While it represents an improvement on the NZSCO68, there are some aspects of the classification which proved problematic in the development of the NZSEI. These primarily relate to the diversity within some of the occupational categories, which can result in some groups having NZSEI rankings that would not be appropriate to many individuals within that group. For instance, the category of Armed Forces contains all those military occupations that have no civilian counterparts, and therefore people with widely differing levels of education and income. The NZSEI ranking for Armed Forces will thus not adequately reflect the socio-economic status of many people within that group. In the case of the Armed Forces, this problem would not be avoided by moving to a more detailed level of the classification as there is no further breakdown of the Armed Forces at those levels. Farmers are another problematic group as the two minor groups of market farmers/crop growers and market oriented animal producers include farm owners, farm managers, farm supervisors and farm workers, and hence a wide range of income and education levels. Again, there is no differentiation between farm owners/managers and farm workers at more detailed levels of the classification. A similar problem arises with trades occupations such as electricians, building trades and those in food processing trades such as bakers and butchers. In these cases it is not possible to distinguish between working proprietors and apprentices or trainees.

[1] Further revisions to the occupational classification since the 1991 census have resulted in the replacement of NZSCO90 with NZSCO95, but the changes are not major and should not affect the utility of the NZSEI.

Table 2.1 shows the distribution of the NZSEI subject population (21 to 69 year old full-time workers) by occupation at the major and minor group levels. There are large variations in the numbers of people in each minor group category, from almost 111,000 specialised managers to just 18 people in the category of fashion and other models. The smaller the occupational group, the more cautiously we should treat their NZSEI ranking, as small numbers of people with atypical levels of income or education could have a distorting effect on the results.

Table 2.1 also shows that there are major differences in the occupational distribution of males and females, which needs to be considered when developing a scale which is appropriate for both sexes. Taken at the major group level, women full-time workers are more likely than men to be clerks, service and sales workers and professionals - although female professionals are heavily concentrated in nursing and teaching occupations. Conversely, women are less likely than men to be legislators, administrators and managers, agriculture and fishery workers, trades workers, plant and machine operators and assemblers or elementary workers.

## Employment status

The employment status variable distinguishes between full-time and part-time workers and, within those categories, between wage and salary earners, self employed with no employees, self employed with employees, relatives assisting in a family business, and people who are unemployed and actively seeking work. This variable was included in the dataset primarily to distinguish self employed people from wage and salary earners if required. It was expected that such a distinction may be of particular relevance for occupations in which a significant proportion of people are self-employed and thus might be expected to have a higher socio-economic position than wage or salary earners in the same occupational group.

In order to test this, a series of results was produced with each occupation split into wage/salary earners and self employed (both with and without employees). However, this distinction did not prove to be particularly useful. In many occupations, self-employed people in fact ranked lower than wage and salary earners, largely because their stated incomes were lower (see following section). It was felt that the resulting rankings were unnecessarily complicated and that if the final scale included distinctions of employment status this might diminish its applicability to survey results which do not include information on employment status.

*Table 2.1:*

**Occupation (Minor Group) by Sex for Full-Time Workers Aged 21 to 69**

| Occupation | Sex | | |
|---|---|---|---|
| | Male | Female | Total |
| Legislators, Administrators and Managers | | | |
| 111 Legislators | 171 | 75 | 246 |
| 112 Senior Government Adminstrators | 600 | 186 | 786 |
| 113 Senior Business Administrators | 339 | 105 | 444 |
| 114 Special Interest Organisation Administrators | 444 | 300 | 744 |
| 121 General Managers | 30,726 | 5,205 | 35,931 |
| 122 Specialised Managers | 72,969 | 37,869 | 110,838 |
| *Total* | *105,249* | *43,740* | *148,989* |
| Professionals | | | |
| 211 Physicists, Chemists and Related Professionals | 1,272 | 195 | 1,467 |
| 212 Mathematicians, Statisticians and Related Professionals | 330 | 135 | 465 |

*Table 2.1: - continued*

**Occupation (Minor Group) by Sex for Full-Time Workers Aged 21 to 69**

| Occupation | Sex | | |
|---|---|---|---|
| | Male | Female | Total |
| 213 Computing Professionals | 2,598 | 720 | 3,318 |
| 214 Architects, Engineers and Related Professionals | 15,078 | 669 | 15,747 |
| 221 Life Science Professionals | 1,935 | 456 | 2,391 |
| 222 Health Professionals (except nursing) | 7,749 | 2,808 | 10,557 |
| 223 Nursing and Midwifery Professionals | 1,566 | 17,559 | 19,125 |
| 231 Tertiary Teaching Professionals | 5,967 | 3,585 | 9,552 |
| 232 Secondary Teaching Professionals | 7,443 | 6,882 | 14,325 |
| 233 Primary and Early Childhood Teaching Professionals | 4,356 | 17,133 | 21,489 |
| 234 Special Education Teaching Professionals | 201 | 876 | 1,077 |
| 235 Other Teaching Professionals | 357 | 417 | 774 |
| 241 Business Professionals | 14,217 | 8,022 | 22,239 |
| 242 Legal Professionals | 4,725 | 1,476 | 6,201 |
| 243 Archivists, Librarians and Related Information Professionals | 462 | 1,911 | 2,373 |
| 244 Social and Related Science Professionals | 1,806 | 1,695 | 3,501 |
| 245 Religious Professionals | 2,481 | 435 | 2,916 |
| *Total* | *72,543* | *64,974* | *137,517* |
| Technicians and Associate Professionals | | | |
| 311 Physical Science and Engineering Technicians | 20,274 | 2,715 | 22,989 |
| 312 Computer Equipment Controllers | 3,660 | 4,197 | 7,857 |
| 313 Optical and Electronic Equipment Controllers | 2,085 | 1,134 | 3,219 |
| 314 Ship and Aircraft Controllers and Technicians | 2,610 | 147 | 2,757 |
| 315 Safety and Health Inspectors | 2,868 | 342 | 3,210 |
| 321 Life Science Technicians and Related Workers | 1,557 | 2,298 | 3,855 |
| 322 Health Associate Professionals | 1,167 | 3,282 | 4,449 |
| 323 Nursing Associate Professionals | 237 | 2,391 | 2,628 |
| 331 Finance and Sales Associate Professionals | 29,100 | 12,666 | 41,766 |
| 332 Administrative Associate Professionals | 5,748 | 5,499 | 11,247 |
| 333 Government Associate Professionals | 765 | 276 | 1,041 |
| 334 Social Work Associate Professionals | 1,731 | 3,492 | 5,223 |
| 335 Careers and Employment Advisors | 390 | 546 | 936 |
| 336 Writers, Artists, Entertainment and Sports Associate Professionals | 6,735 | 4,692 | 11,427 |
| 337 Non-Ordained Religious Associate Professionals | 201 | 216 | 417 |
| 338 Environmental Protection Associate Professionals | 729 | 135 | 864 |
| *Total* | *79,857* | *44,028* | *123,885* |
| Clerks | | | |
| 411 Secretaries and Keyboard Operating Clerks | 1,341 | 27,426 | 28,767 |
| 412 Numerical Clerks | 4,791 | 17,559 | 22,350 |
| 413 Material Recording and Transport Clerks | 7,629 | 3,627 | 11,256 |
| 414 Library, Mail and Related Clerks | 9,762 | 25,890 | 35,652 |
| 421 Cashiers, Tellers and Related Clerks | 4,962 | 14,193 | 19,155 |
| 422 Client Information Clerks | 864 | 12,123 | 12,987 |
| *Total* | *29,349* | *100,818* | *130,167* |
| Service and Sales Workers | | | |
| 511 Travel Attendants and Guides | 1,122 | 1,158 | 2,280 |

*Table 2.1: - continued*

**Occupation (Minor Group) by Sex for Full-Time Workers Aged 21 to 69**

| Occupation | Sex | | |
|---|---|---|---|
| | Male | Female | Total |
| 512 Housekeepers and Restaurant Services Workers | 7,716 | 13,332 | 21,048 |
| 513 Personal Care Workers | 1,938 | 6,405 | 8,343 |
| 514 Other Personal Services Workers | 1,311 | 5,835 | 7,146 |
| 515 Protective Services Workers | 11,886 | 963 | 12,849 |
| 521 Salespersons and Demonstrators | 18,141 | 19,635 | 37,776 |
| 522 Street Vendors | 1,128 | 141 | 1,269 |
| 523 Fashion and Other Models | 6 | 12 | 18 |
| *Total* | *43,248* | *47,481* | *90,729* |
| Agriculture and Fishery Workers | | | |
| 611 Market Farmers and Crop Growers | 16,908 | 7,236 | 24,144 |
| 612 Market Oriented Animal Producers | 55,836 | 16,605 | 72,441 |
| 613 Forestry and Related Workers | 3,915 | 117 | 4,032 |
| 614 Fishery Workers, Hunters and Trappers | 3,069 | 375 | 3,444 |
| *Total* | *79,728* | *24,333* | *104,061* |
| Trades Workers | | | |
| 711 Building Frame and Related Trades Workers | 29,043 | 165 | 29,208 |
| 712 Building Finishers and Related Trades Workers | 16,467 | 372 | 16,839 |
| 713 Electricians | 9,879 | 93 | 9,972 |
| 721 Metal Moulders, Sheet-Metal and Related Trades Workers | 12,816 | 393 | 13,209 |
| 722 Blacksmiths, Toolmakers and Related Workers | 6,723 | 129 | 6,852 |
| 723 Machinery Mechanics and Fitters | 19,464 | 147 | 19,611 |
| 724 Electrical and Electronic Instrument Mechanics and Fitters | 2,586 | 144 | 2,730 |
| 731 Precision Instrument Makers and Related Workers | 1,554 | 255 | 1,809 |
| 732 Glass Cutters and Related Workers | 177 | 24 | 201 |
| 733 Printing Trades Workers | 5,919 | 1,647 | 7,566 |
| 741 Food and Related Products Processing Trades Workers | 6,120 | 735 | 6,855 |
| 742 Cabinet Makers and Related Workers | 3,090 | 207 | 3,297 |
| 743 Tailors and Dressmakers | 3,402 | 1,347 | 4,749 |
| 744 Leather Goods Makers | 522 | 270 | 792 |
| *Total* | *117,762* | *5,928* | *123,690* |
| Plant and Machine Operators and Assemblers | | | |
| 811 Mining and Mineral Processing Plant Operators | 1,212 | 12 | 1,224 |
| 812 Metal Processing Plant Operators | 2,886 | 105 | 2,991 |
| 813 Glass and Ceramic Kiln and Related Plant Operators | 1,023 | 333 | 1,356 |
| 814 Wood Processing and Papermaking Plant Operators | 2,640 | 135 | 2,775 |
| 815 Chemical Processing Plant Operators | 1,824 | 108 | 1,932 |
| 816 Power Generating and Related Plant Operators | 2,145 | 27 | 2,172 |
| 821 Metal and Mineral Products Processing Machine Operators | 3,327 | 330 | 3,657 |
| 822 Chemical Products Machine Operators | 888 | 468 | 1,356 |
| 823 Rubber and Plastics Products Machine Operators | 2,271 | 381 | 2,652 |
| 824 Wood Products Machine Operators | 1,077 | 75 | 1,152 |
| 825 Paper Products Machine Operators | 1,092 | 573 | 1,665 |
| 826 Textile Products Machine Operators | 3,324 | 12,267 | 15,591 |
| 827 Food and Related Products Processing Machine Operators | 15,708 | 3,510 | 19,218 |
| 828 Leather and Related Products Processors | 720 | 123 | 843 |
| 829 Assemblers | 7,647 | 2,181 | 9,828 |

*Table 2.1: - continued*

**Occupation (Minor Group) by Sex for Full-Time Workers Aged 21 to 69**

| Occupation | Sex | | |
|---|---|---|---|
| | Male | Female | Total |
| Plant and Machine Operators and Assemblers - *continued* | | | |
| 831 Railway Engine Drivers and Related Workers | 1,104 | 6 | 1,110 |
| 832 Motor Vehicle Drivers | 25,896 | 1,248 | 27,144 |
| 833 Agricultural, Earthmoving and Other Materials-Handling Equipment Operators | 8,241 | 123 | 8,364 |
| 834 Ships' Deck Crews and Related Workers | 963 | 39 | 1,002 |
| 841 Building and Related Workers | 4,524 | 42 | 4,566 |
| *Total* | *88,512* | *22,086* | *110,598* |
| Elementary Occupations | | | |
| 911 Building Caretakers and Cleaners | 6,600 | 4,668 | 11,268 |
| 912 Messengers and Doorkeepers | 2,244 | 513 | 2,757 |
| 913 Refuse Collectors and Related Labourers | 534 | 24 | 558 |
| 914 Packers and Freight Handlers | 13,017 | 5,658 | 18,675 |
| 915 Labourers | 24,612 | 4,056 | 28,668 |
| *Total* | *47,007* | *14,919* | *61,926* |
| Armed Forces | | | |
| 011 Armed Forces | 5,325 | 567 | 5,892 |
| Not Adequately Defined | 8,592 | 5,373 | 13,965 |
| Grand Total | 677,172 | 374,247 | 1,051,419 |

All cells in this table have been randomly rounded to base 3

*Source: 1991 Census of Population and Dwellings*

Nevertheless, it may be useful when interpreting the NZSEI results to be aware of those occupations in which a high proportion of people are self-employed. Figure 2.2 shows those occupations in which at least a quarter of full-time employees aged 21 to 69 are self-employed, either with or without employees (overall, 21 percent of the subject population are self-employed). Of particular interest, because their NZSEI rankings may differ from expectations, are managers (groups 121 and 122), farmers (groups 611 and 612), and trades workers (the 700 level groups).

*Table 2.2:*

**Selected Occupations by Proportion of Workers Self-Employed* for Full-Time Workers Aged 21 to 69**

| Occupation | Percent self-employed |
|---|---|
| 121 General Managers | 54.9 |
| 122 Specialised Managers | 27.5 |
| 222 Health Professionals (except nursing) | 44.2 |
| 242 Legal Professionals | 48.1 |
| 331 Finance and Sales Associate Professionals | 25.2 |
| 336 Writers, Artists, Entertainment and Sports Associate Professionals | 35.2 |
| 514 Other Personal Services Workers | 37.8 |
| 522 Street Vendors | 75.9 |
| 523 Fashion and Other Models | 40.0 |
| 611 Market Farmers and Crop Growers | 41.3 |
| 612 Market Oriented Animal Producers | 66.2 |
| 613 Forestry and Related Workers | 32.3 |
| 614 Fishery Workers, Hunters and Trappers | 51.6 |
| 711 Building Frame and Related Trades Workers | 52.9 |
| 712 Building Finishers and Related Trades Workers | 46.6 |
| 713 Electricians | 28.7 |
| 731 Precision Instrument Makers and Related Workers | 45.7 |
| 742 Cabinet Makers and Related Workers | 33.5 |
| 743 Tailors and Dressmakers | 38.4 |
| 813 Glass and Ceramic Kiln and Related Plant Operators | 39.8 |
| 841 Building and Related Workers | 30.0 |
| 912 Messengers and Doorkeepers | 52.2 |
| 913 Refuse Collectors and Related Labourers | 33.3 |
| All Occupations | 21.4 |

* Includes self-employed with and without employees

*Source: 1991 Census of Population and Dwellings*

## Income

The income variable in the census dataset records people's total personal income for the year preceding the census, and is collected within bands, as shown in table 2.3. Over half of all full-time workers aged 21 to 69 earned between $20,000 and $40,000 in the year to March 1991. The proportions in each of the higher income brackets are relatively small. Men are considerably more likely to be in the higher income brackets (over $40,000) than women.

*Table 2.3:*

**Total Income by Sex**
**for Full-Time Workers Aged 21 to 69 (percent)**

| Total Income | Sex | | |
|---|---|---|---|
| | Male | Female | Total |
| Nil Income or Loss | 0.8 | 0.6 | 0.8 |
| $2,500 or Less | 0.4 | 1.5 | 0.8 |
| $2,501 - $5,000 | 0.6 | 1.6 | 0.9 |
| $5,001 - $7,500 | 1.3 | 2.6 | 1.7 |
| $7,501 - $10,000 | 2.4 | 4.3 | 3.0 |
| $10,001 - $15,000 | 6.3 | 12.3 | 8.4 |
| $15,001 - $20,000 | 11.9 | 17.0 | 13.7 |
| $20,001 - $25,000 | 15.4 | 19.0 | 16.7 |
| $25,001 - $30,000 | 15.7 | 17.3 | 16.3 |
| $30,001 - $40,000 | 20.5 | 16.2 | 18.9 |
| $40,001 - $50,000 | 11.7 | 4.8 | 9.3 |
| $50,001 - $70,000 | 7.7 | 1.9 | 5.7 |
| $70,001 and Over | 5.4 | 1.0 | 3.8 |
| Total | 100.0 | 100.0 | 100.0 |

*Source: 1991 Census of Population and Dwellings*

There are several issues pertaining to census income data which could have an effect on the scaling of occupational groups in the NZSEI. Firstly, because people are asked to state their income for the preceding year their responses are not necessarily indicative of their present income. Some people may have been unemployed, out of the workforce or in a different occupation for much of the year. However, the proportion of individuals whose incomes over the previous year were markedly different from the income they could expect from the occupation they held on census night should be relatively small, and should not affect the validity of the NZSEI scores. It should also be noted that census income data includes income from all sources, not just wages and salaries, and so is not a direct reflection of returns to employment for a given occupation. However, in the case of full-time workers it can be assumed that the vast majority of income will be from wages and salaries.

Secondly, because the income data is collected in bands, some of the finer distinctions between the income levels of different occupations might be lost. This is only a concern at the upper levels of the income scale where the bands are broader. In particular, the fact that the top band includes all people who earned over $70,000 means that it is not possible to distinguish the top income earners from those who are merely high earners.

Finally, there may be a reluctance amongst some people to state their true income on the census form because of privacy concerns, while others may have difficulty estimating their personal income. However, the proportion of people who did not specify their income in the 1991 census was not great (just over 5 percent) and while it is not possible to estimate how many give inaccurate responses it should not be enough to jeopardise the validity of the NZSEI scale. There is a concern, however, with those occupational groups which include relatively high proportions of self-employed people, as they may regard much of

their income as business rather than personal income and therefore their stated income may not accurately reflect their financial position. This appears to be the case with farmers, who rank lower than might be expected in the NZSEI scale, even when the self-employed are distinguished from wage and salary earners. Table 2.4 shows that the proportion of self-employed people reporting nil or very low incomes is reasonably small, but they do have a greater representation than employed people at both the lower and the higher ends of the income scale and are under-represented in the middle income bands.

*Table 2.4:*

**Total Income by Employment Status for Full-Time Workers Aged 21 to 69 (percent)**

| Total Income | Work Status | |
|---|---|---|
| | Employed | Self-employed |
| Nil Income or Loss | 0.2 | 2.7 |
| $2,500 or Less | 0.7 | 1.1 |
| $2,501 - $5,000 | 0.8 | 1.5 |
| $5,001 - $7,500 | 1.4 | 2.8 |
| $7,501 - $10,000 | 2.4 | 5.2 |
| $10,001 - $15,000 | 7.7 | 10.8 |
| $15,001 - $20,000 | 14.0 | 12.5 |
| $20,001 - $25,000 | 17.8 | 12.4 |
| $25,001 - $30,000 | 17.2 | 13.0 |
| $30,001 - $40,000 | 20.3 | 14.2 |
| $40,001 - $50,000 | 9.8 | 7.6 |
| $50,001 - $70,000 | 5.4 | 6.8 |
| $70,001 and Over | 2.3 | 9.3 |
| Total | 100.0 | 100.0 |

*Source: 1991 Census of Population and Dwellings*

Table 2.5 shows the income distribution of each major occupational group. Legislators, administrators and managers and professionals are the most highly represented in the upper income brackets (over $40,000), with technicians and associate professionals also having a strong representation amongst higher earners. Agriculture and fishery workers are the most likely to be low income earners (under $15,000). Significantly, this is a category with a high proportion of self-employed people, including farmers. People in elementary occupations, and service and sales workers also tend to be low earners.

*Table 2.5:*

**Total Income by Occupation (Major Group) for Full-Time Workers aged 21 to 69 (percent)**

| Total Income | Occupation | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Legislators, Administrators and Managers | Professionals | Technicians and Associate Professionals | Clerks | Service and Sales Workers | Agriculture and Fishery Workers | Trades Workers | Plant and Mechine Operators and Assemblers | Elementary Occupations | Armed Forces |
| Nil Income or Loss | 1.2 | 0.2 | 0.3 | 0.1 | 0.5 | 3.5 | 0.5 | 0.3 | 0.2 | 0.0 |
| $2,500 or Less | 0.6 | 0.4 | 0.4 | 0.7 | 1.1 | 2.0 | 0.4 | 0.6 | 1.1 | 0.1 |
| $2,501 - $5,000 | 0.7 | 0.8 | 0.6 | 0.8 | 1.3 | 2.5 | 0.5 | 0.6 | 1.2 | 0.2 |
| $5,001 - $7,500 | 1.2 | 1.1 | 1.0 | 1.1 | 2.5 | 4.5 | 1.0 | 1.3 | 2.6 | 0.4 |
| $7,501 - $10,000 | 2.2 | 1.6 | 1.8 | 2.0 | 4.7 | 7.9 | 2.0 | 2.8 | 4.4 | 0.5 |
| $10,001 - $15,000 | 4.8 | 2.9 | 3.9 | 6.3 | 16.0 | 16.4 | 6.3 | 12.1 | 15.7 | 0.9 |
| $15,001 - $20,000 | 6.8 | 4.0 | 7.3 | 14.9 | 22.9 | 17.6 | 14.5 | 21.6 | 27.2 | 7.8 |
| $20,001 - $25,000 | 9.1 | 7.5 | 13.5 | 29.1 | 16.9 | 14.6 | 22.0 | 20.5 | 21.0 | 22.2 |
| $25,001 - $30,000 | 12.6 | 13.4 | 18.7 | 25.1 | 11.1 | 11.7 | 22.1 | 16.4 | 11.5 | 21.7 |
| $30,001 - $40,000 | 21.9 | 28.8 | 28.6 | 15.4 | 11.4 | 9.3 | 20.4 | 14.9 | 9.2 | 30.6 |
| $40,001 - $50,000 | 15.2 | 19.2 | 12.2 | 2.7 | 8.1 | 3.8 | 6.6 | 5.6 | 3.9 | 10.2 |
| $50,001 - $70,000 | 13.5 | 11.1 | 7.3 | 1.2 | 2.6 | 2.9 | 2.9 | 2.4 | 1.6 | 4.6 |
| $70,001 and Over | 10.0 | 9.0 | 4.3 | 0.5 | 0.7 | 3.3 | 0.8 | 0.9 | 0.4 | 1.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

*Source: 1991 Census of Population and Dwellings*

## Education

The education variables from the census were not appropriate for the algorithm used to develop the NZSEI. The 1991 census collected information only on people's qualifications, not the number of years spent in formal education as required for the purposes of our algorithm. Therefore, it was necessary to undertake a translation of qualifications into equivalent years of education. This was done with the assistance of the Ministry of Education who provided information on the number of years a person would normally be expected to have spent in formal education in order to obtain a particular qualification. Using this information, the census variable "highest qualification gained" was converted into a new variable "years of education". This translation inevitably involves a degree of generalisation, as it takes some people longer than others to obtain particular qualifications. We are not assuming that all people with a given qualification will have spent the specified number of years in formal education, only that the qualification is normally expected to take that number of years and hence obtaining it represents a certain position in a hierarchy of educational attainment.

As with some of the other variables, there is a problem of diversity in some of the categories, particularly "other tertiary qualifications" and "other school qualifications". The other tertiary category, in particular, covers a wide range of post-school qualifications ranging from basic work skills training to high level professional qualifications. The category of other school qualifications includes overseas qualifications and discontinued or non-recognised local qualifications which may range from primary school to senior secondary school levels.

Table 2.6 shows the years of education attributed to each qualification category and the proportion of people with each of those qualifications. Just over half the subject population have tertiary qualifications, with the majority of these being vocational qualifications such as teaching, nursing, technician or trade certificates. Amongst those people without tertiary qualifications, School Certificate is the most commonly held school qualification. Over a quarter of the population have no formal qualifications. Men are more likely than women to hold tertiary qualifications but also slightly more likely to have no qualifications. Differences in the type of tertiary qualifications held by men and women reflect traditional occupational roles, with a relatively high proportion of women having teaching or nursing certificates or diplomas and men being more likely to hold technicians or trades certificates.

*Table 2.6:*

**Highest Qualification and Years of Education, by Sex, for Full-Time Workers Aged 21 to 69 (percent)**

| Highest qualification | Years of education | Males | Females | Total |
|---|---|---|---|---|
| Postgraduate degree | 19 | 4.0 | 3.3 | 3.8 |
| Bachelor's degree | 16 | 6.8 | 6.3 | 6.7 |
| Undergraduate certificate/diploma | 15.5 | 2.4 | 2.2 | 2.3 |
| Technician's certificate/NZ Certificate | 15.5 | 7.0 | 3.8 | 5.9 |
| Teaching/nursing certificate/diploma | 15.5 | 1.6 | 13.5 | 5.9 |
| Trade certificate | 13.5 | 21.6 | 5.4 | 15.8 |
| Other tertiary qualifications | 12.5 | 8.9 | 12.0 | 10.0 |
| | | | | |
| Bursary/Scholarship/Higher School Cert | 13 | 2.9 | 2.4 | 2.8 |
| Sixth Form Certificate/University Entrance | 12 | 6.4 | 8.6 | 7.2 |
| School Certificate | 11 | 10.1 | 15.0 | 11.9 |
| Other school qualifications | 12 | 1.7 | 2.6 | 2.0 |
| No qualifications | 10 | 26.5 | 24.8 | 25.9 |
| Total | | 100.0 | 100.0 | 100.0 |

*Source: 1991 Census of Population and Dwellings*

Table 2.7 shows the highest qualifications of people in each major occupational group. Professionals are the most highly qualified group, with over nine out of ten having some form of tertiary qualification and almost half having university qualifications. Legislators, administrators and managers, although more strongly represented in high income brackets, are generally not as highly qualified as either professionals or technicians and associate professionals. A high proportion of trades workers also have tertiary qualifications, although the vast majority of these are trade certificates. The groups least likely to have tertiary qualifications and most likely to have no qualifications are the low skilled manual categories of plant and machine operators and assemblers and people in elementary occupations. Over half the workers in these categories have no formal qualifications.

*Table 2.7:*

**Occupation by Highest Qualification (Major Group) for Full-Time Workers Aged 21 to 69 (percent)**

| Highest Qualification | Occupation | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Legislators, Administrators and Managers | Professionals | Technicians and Associate Professionals | Clerks | Service and Sales Workers | Agriculture and Fishery Workers | Trades Workers | Plant and Mechine Operators and Assemblers | Elementary Occupations | Armed Forces |
| Postgraduate degree | 4.3 | 17.0 | 4.6 | 0.9 | 0.7 | 0.8 | 0.2 | 0.2 | 0.2 | 1.2 |
| Bachelor's degree | 7.6 | 26.8 | 8.2 | 3.0 | 1.8 | 2.8 | 0.5 | 0.7 | 0.8 | 3.6 |
| Undergraduate certificate/diploma | 3.3 | 4.3 | 3.6 | 1.2 | 1.3 | 3.8 | 0.4 | 0.7 | 0.5 | 1.4 |
| Technician's certificate/ NZ Cert | 3.4 | 27.6 | 4.5 | 2.5 | 3.4 | 3.2 | 0.4 | 0.8 | 1.0 | 0.8 |
| Teaching/nursing certificate/diploma | 7.8 | 4.8 | 16.2 | 3.5 | 4.4 | 3.7 | 4.5 | 2.8 | 2.0 | 7.3 |
| Trade certificate | 13.1 | 3.7 | 12.2 | 8.5 | 14.1 | 10.2 | 54.8 | 14.2 | 10.0 | 16.1 |
| Other tertiary quals | 10.6 | 7.8 | 15.7 | 13.9 | 12.6 | 8.0 | 5.6 | 7.5 | 5.9 | 14.9 |
| Bursary/Scholarship/ Higher School Cert | 4.0 | 1.2 | 3.9 | 4.2 | 3.2 | 2.6 | 1.0 | 1.8 | 2.2 | 4.4 |
| Sixth Form Cert/UE | 9.2 | 2.3 | 9.1 | 15.7 | 7.8 | 7.3 | 2.5 | 4.0 | 4.5 | 15.7 |
| School Certificate | 13.5 | 1.8 | 9.5 | 21.0 | 15.0 | 15.8 | 6.9 | 12.7 | 13.1 | 19.1 |
| Other school quals | 2.7 | 0.6 | 1.9 | 3.3 | 2.6 | 2.1 | 1.3 | 1.8 | 2.1 | 1.2 |
| No qualifications | 20.6 | 2.2 | 10.4 | 22.3 | 33.2 | 39.7 | 21.8 | 52.7 | 57.7 | 14.3 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

*Source: 1991 Census of Populations and Dwellings*

Table 2.8 shows the income breakdown of the subject population by highest qualification. The relationship between education and income is evident in the relatively high proportions of higher income earners amongst people with university qualifications. People with post-graduate degrees are the most likely to earn over $40,000, followed by people with bachelors degrees and undergraduate certificates or diplomas. People with teaching or nursing qualifications and technicians or trade certificates are strongly represented in the middle income brackets between $25,000 and $40,000. Those with the greatest concentration in the lower income brackets are those who had only school qualifications below sixth form level or no formal qualifications.

*Table 2.8:*

**Total Income by Highest Qualification, for Full-Time Workers Aged 21 to 69 (percent)**

| Total Income | Highest Qualification | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Post-graduate degree | Bach-elor's degree | Under-graduate cert/ dip | Teach-ing/ nursing cert/ dip | Tech-nician's/ NZ Cert | Trade Cert | Other tertiary qual | Bursary/ Schol-arship/ Higher School Cert | Sixth Form Cert/ UE | School Cert-ificate | Other school quals | No quals |
| Nil or Loss | 0.5 | 0.6 | 1.1 | 0.4 | 0.6 | 0.6 | 0.7 | 0.8 | 0.7 | 0.8 | 1.2 | 0.9 |
| $2,500 or Less | 0.4 | 0.6 | 0.7 | 1.2 | 0.5 | 0.5 | 0.9 | 0.9 | 0.8 | 0.9 | 1.2 | 0.9 |
| $2,501 - $5,000 | 0.6 | 1.0 | 1.1 | 1.4 | 0.6 | 0.6 | 1.0 | 1.1 | 0.9 | 1.0 | 1.3 | 1.1 |
| $5,001 - $7,500 | 1.0 | 1.7 | 1.7 | 2.0 | 1.1 | 1.1 | 1.7 | 2.1 | 1.4 | 1.8 | 2.1 | 2.2 |
| $7,501 - $10,000 | 1.5 | 2.6 | 2.8 | 3.0 | 1.9 | 2.0 | 3.0 | 3.5 | 2.4 | 3.2 | 3.9 | 4.2 |
| $10,001 - $15,000 | 2.7 | 4.0 | 6.0 | 6.3 | 4.7 | 5.5 | 8.0 | 8.0 | 6.6 | 9.9 | 10.9 | 13.2 |
| $15,001 - $20,000 | 3.1 | 4.4 | 7.7 | 8.7 | 8.0 | 11.9 | 13.0 | 12.4 | 12.4 | 16.7 | 15.3 | 20.6 |
| $20,001 - $25,000 | 4.0 | 6.9 | 10.1 | 13.8 | 12.1 | 18.4 | 16.5 | 16.0 | 19.2 | 19.9 | 17.7 | 20.1 |
| $25,001 - $30,000 | 7.1 | 11.1 | 12.7 | 18.5 | 15.3 | 20.6 | 15.9 | 15.6 | 19.0 | 17.7 | 15.6 | 15.3 |
| $30,001 - $40,000 | 18.3 | 21.0 | 23.7 | 32.0 | 26.7 | 23.1 | 18.3 | 18.3 | 20.1 | 16.0 | 15.9 | 12.8 |
| $40,001 - $50,000 | 21.8 | 18.4 | 15.6 | 9.5 | 16.0 | 9.5 | 9.2 | 9.8 | 8.8 | 6.4 | 6.8 | 4.7 |
| $50,001 - $70,000 | 19.9 | 14.8 | 10.3 | 2.4 | 8.9 | 4.5 | 6.7 | 6.7 | 4.9 | 3.6 | 5.2 | 2.4 |
| $70,001 and Over | 19.1 | 13.0 | 6.6 | 0.9 | 3.6 | 1.8 | 5.0 | 4.8 | 3.0 | 2.1 | 3.0 | 1.5 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

*Source: 1991 Census of Population and Dwellings*

## Ethnic Group

The ethnic group question in the 1991 Census asked people to state which ethnic group they belonged to and allowed them to specify as many groups as they wished. The New Zealand Standard Classification of Ethnicity allows this data to be presented in a variety of ways. For the purposes of the NZSEI, the data was classified into four ethnic group categories: European Only, New Zealand Maori, Pacific Islands, and Other. The European Only category includes people who specified their ethnic group as New Zealand European and/or any other European ethnic groups such as English, Dutch, Australian or Caucasian, but who did not state that they belonged to any non-European ethnic group. The New Zealand Maori category includes all people who specified New Zealand Maori as either their sole ethnic group or as one of several ethnic groups. The Pacific Islands category includes people who stated a Pacific Islands ethnic group as either their sole ethnic group or as one of several ethnic groups, excluding New Zealand Maori. The Other ethnic groups category includes all people who do not fall into any of the above categories.

Consideration was given to producing NZSEI results for each of these groups, but it was felt that the Pacific Islands and Other categories were too small to provide reliable results. However, we were able to produce separate results for the Maori and European populations to enable some inter-ethnic comparisons.[2]

[2] Results which are not broken down by ethnic group include members of all ethnic groups, not just Maori and European.

The importance of ethnicity as a variable in socio-economic analysis is illustrated in tables 2.9 and 2.10 which show marked differences in the occupational distribution and income levels of Maori and Europeans. Table 2.9 shows that Europeans have a far greater representation in the higher status white collar occupational groups such as legislators, administrators and managers, professionals, and technicians and associate professionals. Maori workers are far more likely than European workers to be in the lower skilled manual categories of plant and machine operators and assemblers and elementary occupations.

*Table 2.9:*

**Occupation (Major Group) by Ethnic Group for Full-Time Workers Aged 21 to 69 (percent)**

| Occupation | Ethnic Group | |
|---|---|---|
| | European | NZ Maori |
| Legislators, Administrators and Managers | 15.3 | 7.1 |
| Professionals | 13.8 | 8.3 |
| Technicians and Associate Professionals | 12.6 | 8.2 |
| Clerks | 12.7 | 11.4 |
| Service and Sales Workers | 8.4 | 9.5 |
| Agriculture and Fishery Workers | 10.7 | 7.9 |
| Trades Workers | 12.3 | 10.0 |
| Plant and Machine Operators and Assemblers | 8.9 | 22.3 |
| Elementary Occupations | 4.7 | 13.8 |
| Armed Forces | 0.5 | 1.5 |
| Total | 100.0 | 100.0 |

*Source: 1991 Census of Population and Dwellings*

This pattern of occupational distribution is reflected in the divergent patterns of income shown in 2.10. Maori are more likely than Europeans to be in each of the income bands between $5,000 and $25,000, while Europeans have a much greater concentration than Maori in each of the income brackets over $30,000.

*Table 2.10:*

**Total Income by Ethnic Group, for Full-Time Workers Aged 21 to 69 (percent)**

| Income | Ethnic Group | |
|---|---|---|
| | European | NZ Maori |
| Nil Income or Loss | 0.8 | 0.4 |
| $2,500 or Less | 0.7 | 0.9 |
| $2,501 - $5,000 | 0.9 | 1.0 |
| $5,001 - $7,500 | 1.6 | 2.6 |
| $7,501 - $10,000 | 2.9 | 4.1 |
| $10,001 - $15,000 | 7.6 | 11.9 |
| $15,001 - $20,000 | 12.6 | 19.3 |
| $20,001 - $25,000 | 16.3 | 20.2 |
| $25,001 - $30,000 | 16.5 | 16.3 |
| $30,001 - $40,000 | 19.9 | 14.6 |
| $40,001 - $50,000 | 9.9 | 5.5 |
| $50,001 - $70,000 | 6.2 | 2.3 |
| $70,001 and Over | 4.2 | 1.0 |
| Total | 100.0 | 100.0 |

*Source: 1991 Census of Population and Dwellings*

## Other variables

Age, sex and hours worked are other variables which have been employed in the development of the NZSEI. As explained in the preceding section, age is included in the algorithm to control for its effects on education and income. In the census dataset, age is classified by individual years, from 0 to 119, with an additional category for 120 years and over. The age variable presented no particular problems in the development of the NZSEI.

The sex variable was used to enable comparison of NZSEI scores for males and females (see next section). As data presented in this section has indicated, sex is an important variable in socio-economic analysis because of the differences in employment and income patterns between males and females. The classification of sex in the census is a straightforward categorisation of male or female and again has presented no problems in the development of the NZSEI.

Information on the number of hours worked in the week preceding the census was used to explore the possibility of adding part-time workers to the analysis by scaling their incomes up to a full-time equivalent (see next section). The census dataset classifies hours worked in single hours from 1 to 98, with an additional category for 99 hours or more. As the inclusion of part-timers did not prove particularly useful, they were excluded from the analysis and the hours worked variable was not used in the final results.

## Conclusion

The census dataset provides the most comprehensive and reliable information on the demographic and economic characteritics of the New Zealand workforce. As such it is the most appropriate data on which to base the development of a socio-economic scale such as the NZSEI. As the above discussion has indicated, the construction of the census dataset has presented us with some difficulties, either because of the nature of the data that is collected or the way it is classified. While these problems need to be acknowledged, it should also be stressed that most have been relatively minor and none should compromise the reliability of the results presented in the following sections.

*Section 3:*

# Deriving occupational scores from census data:

As discussed in section 1.1, the choice of occupation as the foundation for a scale of socioeconomic position has a number of compelling practical, theoretical and methodological points in its favour. Nevertheless, there still remain some areas of debate, and these are canvassed briefly here before proceeding to the analysis of the occupational scoring exercise.

## Theoretical Underpinnings of Occupation-based SES Classification Schemes:

Duke and Edgell (1987) and Wilkes (1988) discern two competing theoretical paradigms underpinning the various occupational SES classification schemes used in empirical research. The operationalisation of occupational SES thus appears to proceed from one of two opposing "conceptual schemes" (Duke and Edgell, 1987: 2), respectively schematised by Wilkes as a Marxist-inspired conception of *social class* on the one hand, and a neo-Weberian *occupational class* approach on the other (1988: 129).

Divisions within the *social* relations of production determine the breakdown of SES categories within occupational classification schemes which are predicated upon neo-Marxist understandings of the stratification process (Duke and Edgell, 1987: 2). The crucial distinctions between occupational categories within 'social class' schemes therefore, are those dividing owners and non-owners of the technological means of production, with further divisions being made according to the degree of control possessed by individuals over their own labour power and that of others (ibid.: 4). E. O. Wright may be regarded as the preeminent stratification researcher within the neo-Marxist tradition. Wright alleges that advanced capitalist societies are characterised by a typology of four basic class locations, including *employer*, *petty bourgeois*, *controller of labour* (i.e., manager or supervisor) and *worker*. He has elaborated this typological approach in order to develop a sophisticated occupational classification scheme (ibid.: 5).

Within the neo-Weberian research tradition by contrast, distinctions between occupational categories are based upon positions within the *technical* relations of production (ibid.: 2). In distinguishing 'occupational class' categories then, primacy is generally given to the manual/non-manual divide, with further divisions being made on the basis of credentials or skill levels (ibid.: 4). A neat summary of the essential difference between these counterposed conceptions of class is provided by Therborn (1982: 235), who observes that "the Weberian question for determining what class A belongs to is: *How much does he* [sic] *have* (i.e., of market resources)? Whereas Marx asks: *What does he* [sic] *do?* What is his [sic] position in the process of production?" (cited in Johnson and Hall, 1995: 249).

The influential seven-category occupational classification developed by Goldthorpe sits squarely within the neo-Weberian tradition (Duke & Edgell, op cit.). The Weberian pedigree of the Registrar General's (RG's) social classses is perhaps less explicit. This widely-used classification scheme was introduced in Britain in 1911 for the purpose of analysing socioeconomic differentials in infant mortality rates (Morgan

et al, 1985: 209). It has subsequently undergone substantial revisions in order to take account of changes in the British occupational structure (op cit.), and is currently schematised as follows:

I upper-level executives and professionals

II middle managers, small shopkeepers, lower status professionals

III skilled labour, divided into non-manual (NM) and manual (M)

IV partly skilled labour

V unskilled manual labour.

The use of the 'social classes' misnomer to describe these broad occupational groupings exemplifies the general tendency for researchers to use the term 'social class' when the theoretical construct they are in fact referring to is clearly 'occupational class'. As the previous discussion has indicated however, there are important differences between the two. Moreover, "it is patently clear," as Wilkes contends, "that theoretical rationale and the 'practice of class analysis' are ultimately tied together - one cannot, quite obviously, separate one from the other" (1988: 133). A clear illustration of this inextricability of theory and practice is provided by Duke and Edgell, who observe that the 'working class' in a given population is larger when respondents are categorised using a social class scheme, than when they are ranked by occupational class categories (1987: 11).

The RG's social class scheme has in fact attracted much criticism for its alleged lack of any sound theoretical basis (Krieger and Fee, 1994: 34). Jones and Cameron (1984) have gone so far as to suggest that in constructing the RG's classification, occupations were simply ranked according to standard mortality ratios and "social classes artificially constructed to fit the data" (cited in Marmot and Theorell, 1988: 665). In spite of such critiques however, the empirical salience of the RG's social classes has been amply demonstrated in health research. Thus Macintyre comments that "whatever social reality is sorted by this classification does, empirically, seem to have significance for people's life chances and physical and mental health" (1986: 400). She therefore perceives a need for sociologists to "get behind the labels created by this system and to explore their meaning for the everyday lives and life chances of those on whom the labels are imposed" (op cit.).

In terms of the current project, it should be noted that a broadly neo-Weberian model of occupational stratification underpins the development of the New Zealand Socioeconomic Index.

## Categorical versus Continuous Occupational SES Measures:

Weberian-inspired occupational class indicators such as the RG's classes, share with neo-Marxist measures what might be termed a common *structural* approach to the socioeconomic stratification process. Put differently, both 'occupational class' and 'social class' indicators are *categorical* socioeconomic measures. As such, they permit the classification of respondents into a limited number of discrete, discontinuous groupings, which may in fact be isomorphic with real, identifiable communities. Structural approaches, whether neo-Marxist or neo-Weberian in origin, have been favoured by European researchers in particular (Dale, Gilbert and Arber, 1985: 284).

American researchers, in contrast, have preferred to take *individualistic* approaches to the measurement of socioeconomic stratification, tending to "conceptualise class in functional terms, measuring it on a continuum in terms of socioeconomic status or social standing" (op cit.). Such measures are premised upon the notion that socioeconomic status is a property of individuals, albeit one that derives from wider structural inequalities. Aggregates of such individuals, by implication, are seen to form a relatively *continuous* and permeable set of socioeconomic strata. Continuous SES measures thus permit the hierarchical ranking of respondents according to an almost unlimited number of graded distinctions between occupational groups. In addition to their ability to summarise a large quantity of information in a single parameter, continuous measures are expedient in that they are "more amenable to multivariate analysis than are categorical measures and yield more readily interpretable, informative and realistic models and parameters" (Ganzeboom et al., 1992: 5). Ganzeboom et al. note that continuous measures

of socioeconomic status may therefore be usefully applied to test the internal homogeneity of the discrete 'classes' derived from categorical approaches (op cit.).

The New Zealand Socioeconomic Index presented in the current report has been developed as a *continuous* measure of socioeconomic status. For presentational purposes and to permit comparisons with the Elley-Irving Index, we developed what might be broadly termed a 'categorical' version of the NZSEI, by breaking it down into six 'occupational classes'. It should however be noted that the break down of the NZSEI into six groups had no conceptual basis, with the points at which the scale was split being fairly arbitrarily assigned.

## The Assignment of Socioeconomic Status Scores to Occupational Groups:

Converting occupations into socioeconomic status scores is a two-step process. Firstly, each occupation is allocated an exclusive location on an exhaustive list of several hundred occupational categories, according to a grouping logic which may be *industry-based* or *skill-based.* Industry-based classifications group together the occupations of all workers within the same industry regardless of the nature of the work performed, the skills it requires and the degree of responsibility it entails. The arguably more meaningful skill-based classification logic on the other hand, is premised on the notion that there is an ordinal relationship between occupational categories in terms of their 'skill levels'. Occupations are thus assigned their exclusive locations in skill-based classifications according to factors designed to measure the complexity of tasks they involve, such as the extent of training or experience required of incumbents.

The exhaustive listing of occupations thus obtained is then organised into a smaller set of sociologically salient categories which constitute the occupational status classification scheme. Researchers have developed a number of different types of classifications, including *nominal classes, prestige scales,* and *socioeconomic indices.*

Nominal class schemes typically combine information on employment status and supervisory capacity with occupational title to produce a typology of discrete, discontinuous occupational class categories. The best known classificaton of this kind is the EGP scheme developed initially by Erikson, Goldthorpe and Portocarero, and later modified by Erikson and Goldthorpe (1992).

Prestige scales differ from nominal classes in their fundamental orientation towards the "symbolic dimension" of occupational stratification, their purpose being "to represent 'collective perceptions and beliefs' about the structure of occupational hierarchies" (Grusky and Van Rompaey, 1992: 1715). Scales such as Treiman's Standard International Occupational Prestige Scale (SIOPS) are thus generated from the evaluative judgements of samples of 'experts' or 'well-informed members of society', regarding the location of respective occupations within a prestige hierarchy, where 'prestige' signals "honour, reputation or eminence" (Najman, 1988: 36). In addition to capturing its general social desirability, the prestige ranking of an occupation is alleged to provide a good indication of the living standards enjoyed by its incumbents. Critics note however that the precise meaning of occupational prestige rankings, in terms of empirically observeable lifestyle factors, is far from clear (Najman, 1988: 36).

Socioeconomic indices (SEIs) are premised on a model of the stratification system in which occupation functions as a latent, intermediate variable converting education into income, measuring "the potential of an occupation to convert a person's main resource (education) into a person's main reward (income)" (Kunst and Mackenbach, 1994: 38). The conceptual basis of socioeconomic indices thus "glue[s] together the two fundamental hierarchies that underlie modern occupational structures" (Grusky and Van Rompaey, 1992: 1718). Occupations are usually allocated scores on socioeconomic indices by computing a weighted sum of the average education and income levels, sometimes adjusted for age, observed for their incumbents. The basic SEI formula was first outlined by Duncan (1961), and subsequent modified versions have been developed by Nam et al. (1975), Powers and Holmberg (1978), Tyree and Smith (1978), Sewell (1985), DeGraaf et al. (1989), and most recently Ganzeboom et al. (1992). The remainder

of this section is devoted to the allocation of occupational SES scores for the New Zealand workforce, premised on this model of stratification.

## Results of the Occupational Scoring Exercise:

The first set of results presented (section 3.1) are those obtained from an analysis of a full census dataset including full-time workers only. In section 3.2, the impact of adding part-time workers to the analysis is examined. As the incorporation of part-time workers is found to have little effect on NZSEI scores, part-time workers are excluded from all subsequent analyses. NZSEI results obtained for the full census dataset are compared with ISEI scores in section 3.3. In section 3.4, the census dataset is split by sex, and NZSEI scores for women are compared with male scores. A similar process is undertaken in section 3.5, where Maori NZSEI scores are compared with those of their European counterparts. In section 3.6, the effects that adding women to the analysis had upon the NZSEI, are examined in detail. In sections 3.7 and 3.8 respectively, NZSEI results based on the NZSCO68 are presented, and a categorical version of the continuous NZSEI scale is derived, in order to permit comparisons with the Elley-Irving Index. The relationship between NZSEI scores and the Elley-Irving Index is then examined in section 3.9.

## 3.1 Full Census Results:

The NZSEI was derived at the minor group (3 digit) level of the 1990 version of the New Zealand Standard Classification of Occupations (NZSCO90), which is classified into 97 occupations. The results were scaled on a 10 to 90 range for consistency with the international index. The three digit results were used to derive sub-major group (two digit) and major group (one digit) results. At these levels, there are 24 and 10 occupational classes respectively. To get NZSEI values at the higher levels of aggregation (major and sub-major groups), a mean of the constituent three digit occupation NZSEI scores was calculated, weighted on the number of people in the constituent groups. Table 3.1 shows the index scores at the 2 digit level.

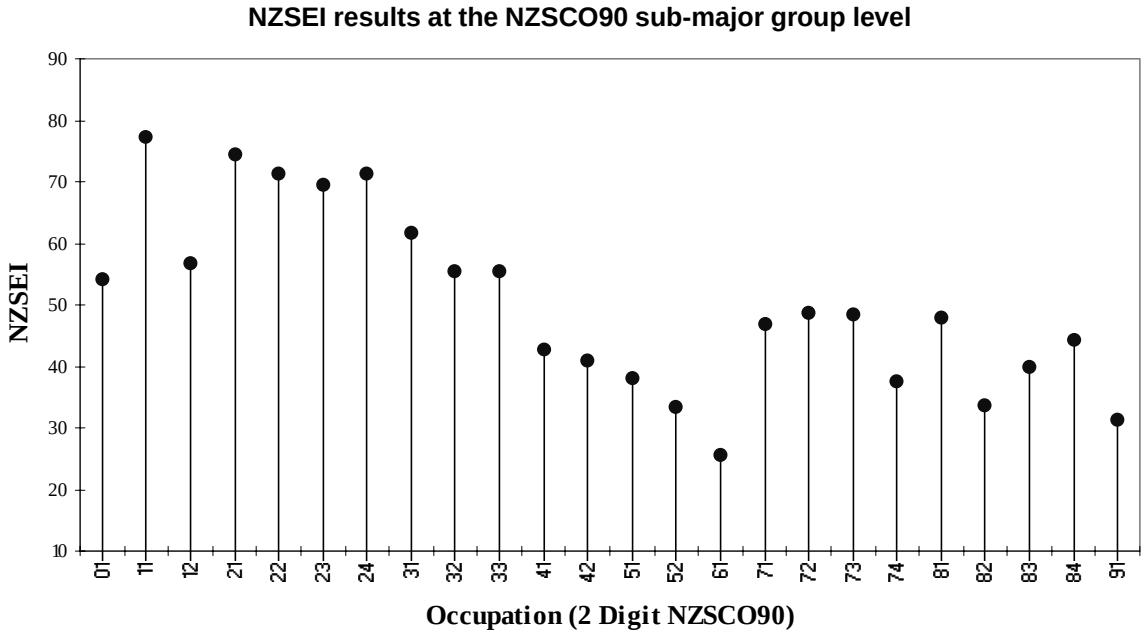
*Table 3.1*

**NZSEI Results at the Sub-Major Group (2 digit) NZSCO90 Level:**

| Code | Description | NZSEI |
|---|---|---|
| 01 | Armed Forces | 54 |
| 11 | Legislators and Administrators | 77 |
| 12 | Corporate Managers | 57 |
| 21 | Physical, Mathematical and Engineering Science Professionals | 74 |
| 22 | Life Science and Health Professionals | 71 |
| 23 | Teaching Professionals | 69 |
| 24 | Other Professionals | 71 |
| 31 | Physical Science and Engineering Associate Professionals | 62 |
| 32 | Life Science and Health Associate Professionals | 55 |
| 33 | Other Associate Professionals | 56 |
| 41 | Office Clerks | 43 |
| 42 | Customer Services Clerks | 41 |
| 51 | Personal and Protective Services Workers | 38 |
| 52 | Salespersons, Demonstrators and Models | 33 |
| 61 | Market Oriented Agricultural and Fishery Workers | 25 |
| 71 | Building Trades Workers | 47 |
| 72 | Metal and Machinery Trades Workers | 49 |
| 73 | Precision Trades Workers | 48 |
| 74 | Other Craft and Related Trades Workers | 38 |
| 81 | Industrial Plant Operators | 48 |
| 82 | Stationary Machine Operators and Assemblers | 34 |
| 83 | Drivers and Mobile Machinery Operators | 40 |
| 84 | Building and Related Workers | 44 |
| 91 | Labourers and Related Elementary Service Workers | 31 |

At the minor group level the lowest and highest scores respectively were assigned to 'Non-Ordained Religious Associate Professionals' and 'Health Professionals'. Other occupations with scores close to 90 were 'Senior Business Administrators' and 'Legal Professionals'. At the major and sub-major group levels, the lowest NZSEI score of 25 was assigned to agricultural and fisheries workers. The highest scores of 77 and 71 were given to 'Legislators and Administrators' at the two digit level, and 'Professionals' at the one digit level respectively.

*Figure 3.1*




We would obviously expect some variation between the minor group occupations within these sub-major groups. Some unusual results in the analysis could be highlighted by looking at any minor groups which vary significantly from the sub-major group to which they contribute. 'Religious Professionals' (245) have an NZSEI score of 39, 33 points lower than the 'Other Professionals' (24) category to which they belong. 'Non-Ordained Religious Associate Professionals' (337) is allocated an NZSEI of 10, which is 46 points lower than that of 'Other Associate Professionals' (33). On the other side of the coin, there are two groups with scores more than 20 points higher than the group to which they contribute. 'Protective Services Workers' (515) have a score of 61, 23 points higher than the next group up in the hierarchy, while 'Railway Engine Drivers' (831) have a score 22 higher than 'Drivers and Mobile Machinery Operators' (83).

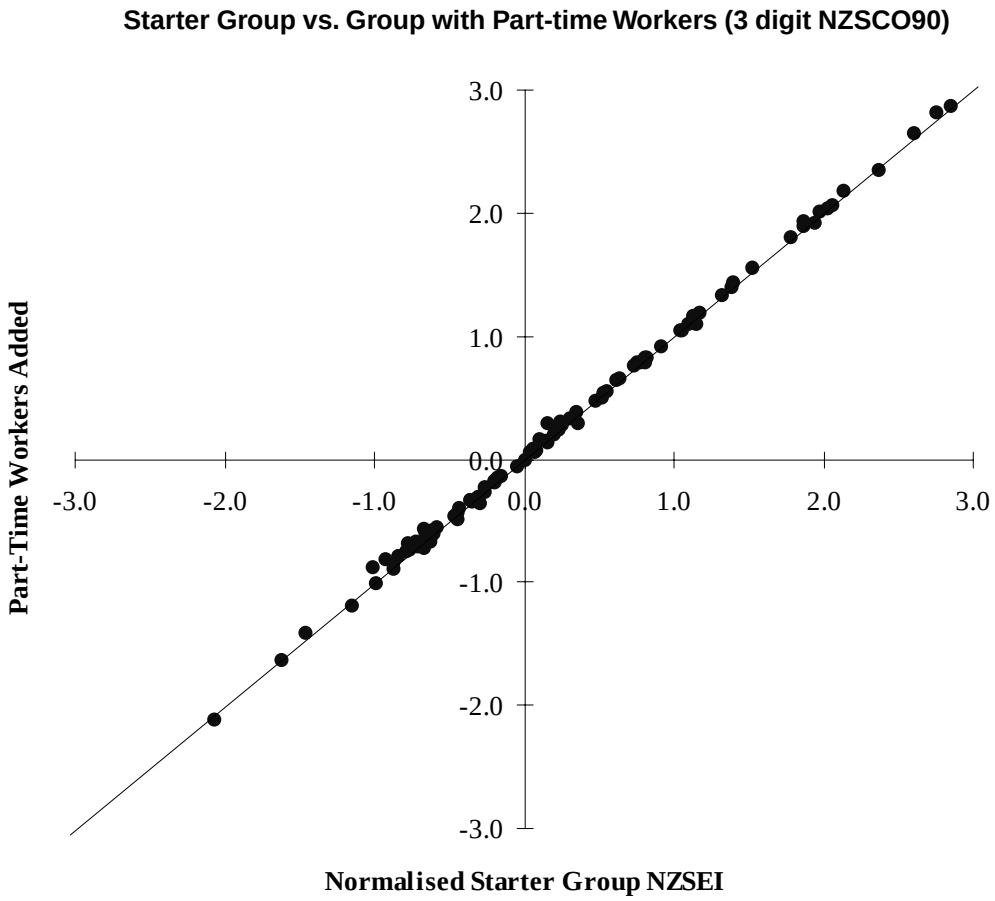
## 3.2 Adding Part-time Workers to the Analysis:

We wanted to evaluate the impact of adding part-time workers to the analysis. This was due in the first instance to the fact that we were unhappy with the imputation of a full-time income for part-time workers, and considered that a realistic imputation system would be beyond the frame of the current project. Quite apart from the conceptual issue of whether a 'full-time equivalent' income should be imputed at all, there were technical issues involved. In the Census questionnaire, the respondent supplies their annual income over the last year, and also the number of hours they have worked in the last week. In many cases this may not be representative of the hours they would usually work, and such an imputation can result in very unusual income figures.

It was decided that if the addition of part-time workers resulted in little change to the results, it would be better to leave part-time workers out of the analysis altogether. The part-time workers were added to the data, and income was scaled up by multiplying the number of hours worked in the last week by the average hours worked by a full-time worker in that occupation.

As Figure 3.2 illustrates, the index is changed only very slightly by the addition of part-time workers, and for this reason they were left out of our analyses.

*Figure 3.2*

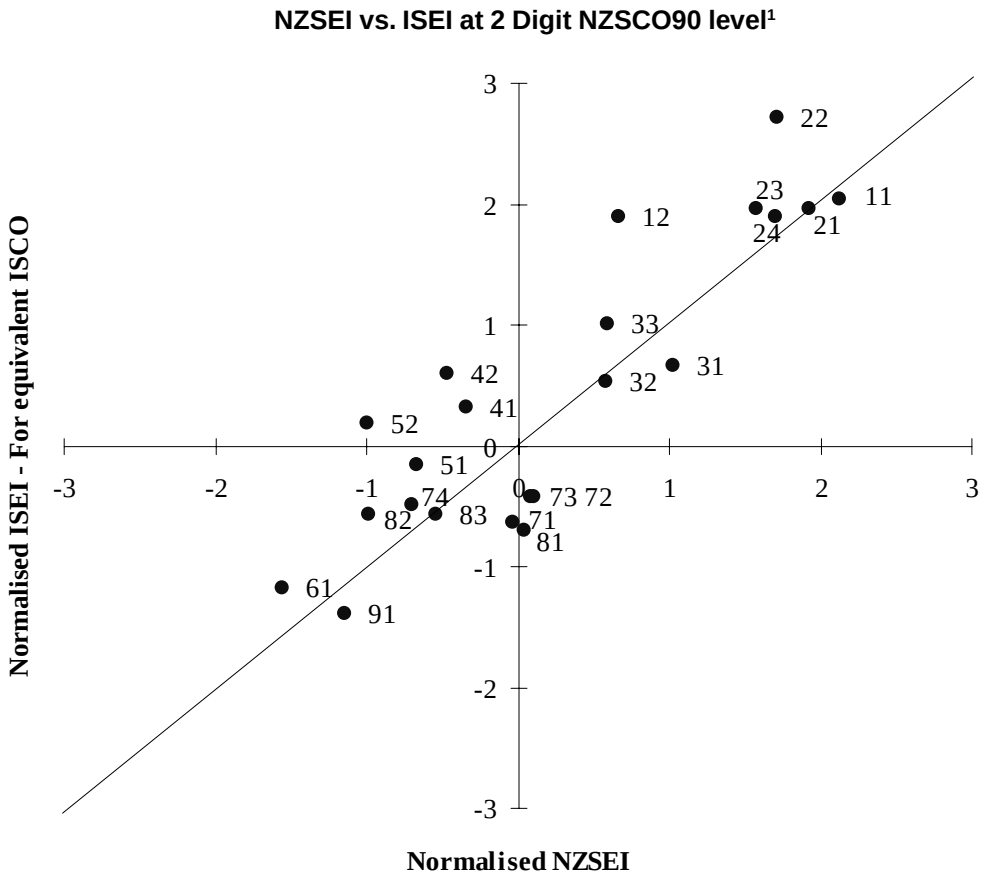



## 3.3 Comparing the Full-Census NZSEI with the ISEI:

The scaling for the NZSEI has no conceptual basis, and can be presented on a distribution of choice. In our case we adopted the ISEI 10 to 90 scale. Scaling from 10 to 90 results in scores which can have very different mean and standard deviation values depending on the distribution of the socio-economic status (SES) scores. For this reason we standardise the scales for comparison between indices. We decided to normalise the scores ie. scale to a mean of zero and standard deviation of one.

Figure 3.3 shows normalised international and New Zealand indices plotted against each other. Points on the graph represent occupations at the sub-major NZSCO90 level. Those above the 45 degree line represent occupations for which the international scale is higher than the New Zealand scale, and correspondingly points below the line indicate those occupations for which the NZSEI is higher than the ISEI. Most points lie reasonably close to the 45 degree line, showing that the indices are reasonably similar.

*Figure 3.3*




There are various reasons why we would not expect our results to be identical to the international results. The occupation structure in New Zealand is very different from many of the 16 countries used to derive the international results. We also derived our scale from a much larger sample, and have found that the method of scaling may not give robust results for small occupation groups. Having said that, at the 2 digit level results should be reasonably robust on both scales. A further point is that the occupation classifications on which the New Zealand and international results were based (NZSCO90 and ISCO88 respectively), are not directly comparable for some occupations. For example, in NZSCO90, 'Armed Forces' form a distinct sub-major (and indeed major) group, whereas they are included in either the 'Personal and Protective Services Workers' or 'Corporate Managers' groups in the international classification. For this reason, many of the international scores given are based on a similar though not identical New Zealand classification. A final reason for possible differences is the fact that the specifications for the two datasets under analysis are different. The NZSEI includes females, whereas the ISEI is based on data for males only. See Figure 3.6.1 for a comparison of the ISEI with a 'males only' NZSEI.

The areas of the major group (one digit) level where the largest differences lie are 'Clerks', and 'Service and Sales Workers'. In these cases the NZSEI is lower than the comparative ISEI by 0.7 and 0.8 respectively, on a normalised scale. There are only two out of nine major group occupations for which the normalised NZSEI is higher than the ISEI. This may appear to be paradoxical when comparing normalised scales, but the reason lies in the difference between the populations used to create the respective scales. The international data consists of a preponderance of people in jobs which tend to have lower socio-economic status. This means that the scale will tend to be skewed towards the top end, resulting in the lower (negative) groups being closer to zero.

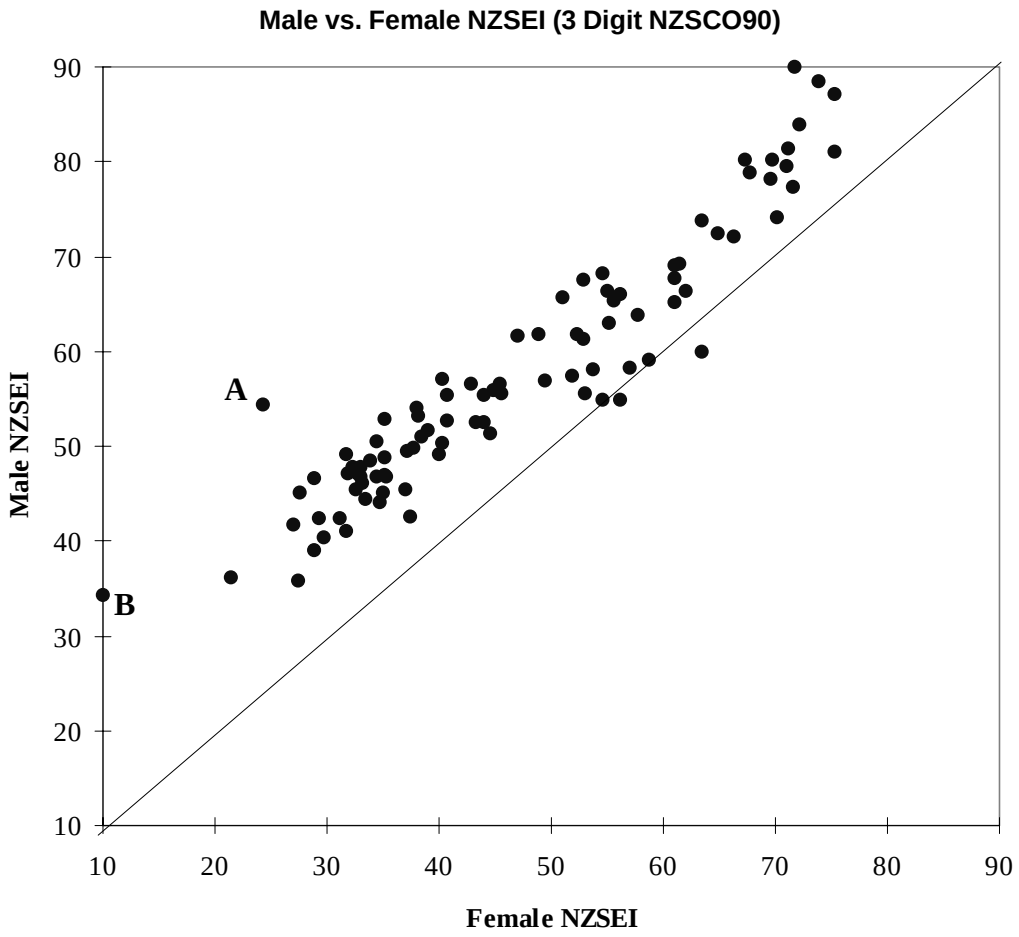
[1] numbers adjacent to dots refer to occupation codes as given in table 3.1

Although normalising the indices provides some basis for comparison, it does not help when we want to contrast two indices which are based on different population groups. It does allow us to compare how occupations relate to other occupations in the population from which their scale is derived, and the differences between these relationships for different indices. For example, although we can see from Figure 3.3 that 'Corporate Managers' (group 12) has a higher score in the ISEI than the NZSEI, this only allows us to conclude that corporate managers in New Zealand have lower socio-economic status with respect to other occupations in New Zealand than an international corporate manger would have with respect to other occupations in the 16 countries used to derive the ISEI. To enable us to compare subsets of the population such as females and males, or Maori and Europeans, we need to derive a scale with sub-populations assigned separate index scores, for each occupation. Thus the scale is derived on two (in both of these cases) 'occupations' for each occupational classification, one for each of the sub-population groups.

## 3.4 Gender Comparisons:

We can see in Figure 3.4 that at the minor group (three digit) level there is a fairly consistent difference between male and female scores, with an, albeit slight, reduced difference in the bottom half of the scale. The largest difference between the scales lies with 'Ships Deck Crew' (point A on Fig. 3.4), although perhaps the most notable difference is for 'Non-Ordained Religious Associate Professionals' (point B). This is the lowest occupation on both scales, although the step up to the next lowest occupation is much greater for the female scale. The occupations for which the female score is higher than the equivalent male score are 'Environmental Protection Associated Professionals' and 'Travel Attendants and Guides'.

*Figure 3.4*



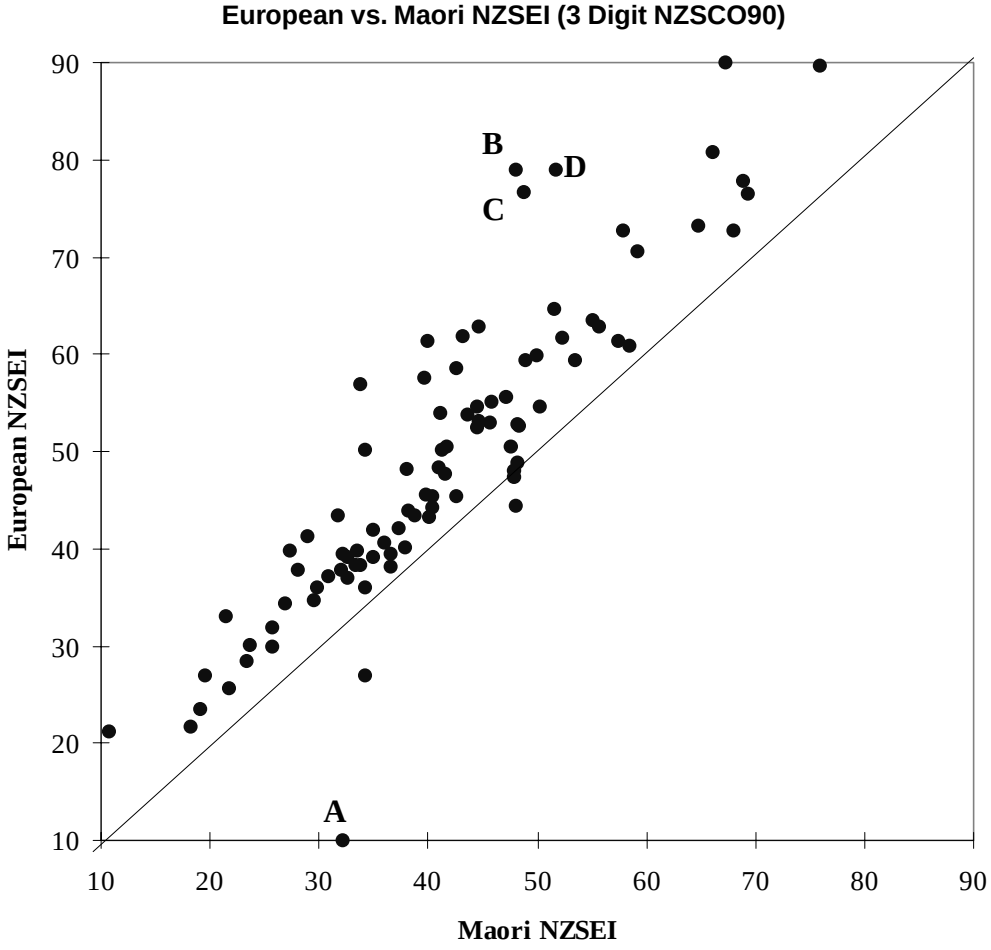
## 3.5 Ethnic Group Comparisons:

The Maori-European index is derived in the same way as the Male-Female index, i.e., with distinct occupation classifications for each group. Only the Maori and European ethnic groups are included in the analysis.

From Figure 3.5, we can see there is a clear change in the relationship between the Maori and the European NZSEI scores as the respective scales increase. As we approach the top end of the index the variability in the relationship increases, and the top occupations tend to have a European scale which is much higher than the comparable Maori scale. At the bottom end of the scale there is a fairly consistent difference between the scales.

The occupation with the largest difference is 'Non-Ordained Religious Associate Professionals' (point A), for which the Maori scale is 29 higher than the European one. On the other side of the ledger 'Tertiary Teaching', 'Social and Related Science Professionals', and 'Life Science Professionals' (points B, C, and D respectively) have European NZSEI scores higher than the Maori scores by the magnitude of 27-30.

*Figure 3.5*



## 3.6 Assessing the Effects of Adding Women to the Analysis:

Here we examine the changes in the scale that would result from adding women to what was initially a male full-time analysis, in order to check that the assumptions behind the model appeared to hold not only for the male workforce, but also for females.

Table 3.6 shows the final regression coefficients relating to the paths in the model, for three different analyses. The first is a males-only analysis of 25% of the Census, the second a corresponding analysis of females only, and the last is our full Census analysis with both females and males included. The table also shows the number of iterations it took for the algorithm to converge to these values.

The fact that the 'female only' analysis took four more iterations to converge than the male one may indicate that the model does fit better for males than females. Despite this however, the $\beta_{42}$ value which we are trying to minimise is actually smaller for the female case. When the algorithm does converge, the $\beta_{32}$ and $\beta_{43}$ coefficients which represent the strength of the direct relationships between socio-economic status and education and income respectively, are reasonably close. There is some difference, as female socio-economic status appears to be more reliant on education and less on income than the male results. This might be seen as reason for using separately modelled male and female scores, but we considered the differences small enough to be of little concern.

In all analyses the link between SES and income ($\beta_{43}$) was much stronger than the corresponding link between SES and education ($\beta_{32}$).

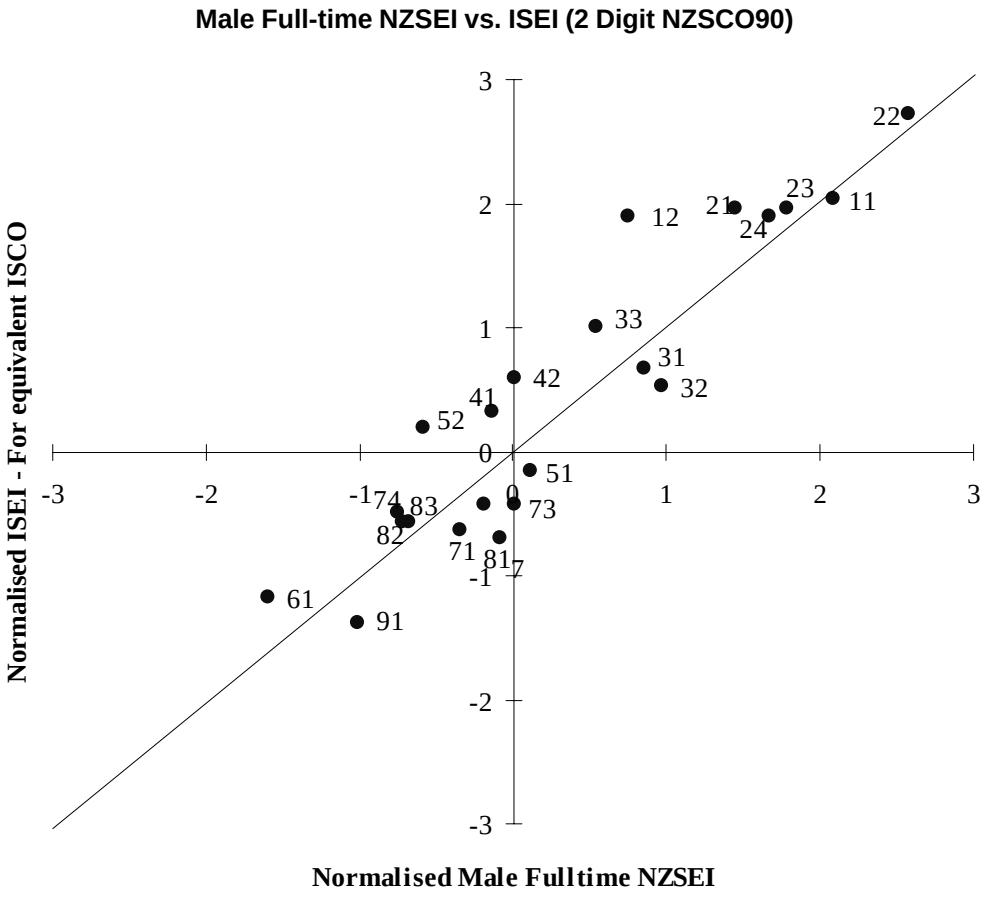
*Table 3.6*

**Beta Values and No. of Iterations for different data sets**

| Group Analysed | $\beta_{21}$ | $\beta_{31}$ | $\beta_{32}$ | $\beta_{41}$ | $\beta_{42}$ | $\beta_{43}$ | Iterations |
|---|---|---|---|---|---|---|---|
| Male Full-time | -0.054 | 0.030 | 0.24 | 0.068 | 0.059 | 0.79 | 5 |
| Female Full-time | -0.087 | 0.000 | 0.28 | 0.001 | 0.028 | 0.73 | 9 |
| Both Sexes | -0.066 | 0.019 | 0.23 | 0.055 | 0.060 | 0.79 | 7 |

The male full-time index was considered to be more directly comparable to the ISEI than the full Census NZSEI, as the data used by Ganzeboom et al. had no females. In Figure 3.6, the male full-time NZSEI is plotted against the ISEI.

*Figure 3.6*




Comparing Figure 3.6 with Figure 3.1 shows that overall the NZSEI without females is closer than the full NZSEI to the international index. The average absolute difference between the two scales is 0.37. This compares with a difference of 0.48 for the full Census index.

## 3.7 NZSEI Results Based on the NZSCO68 Classification of Occupations

We derived results using NZSCO68 in order to facilitate the use of the NZSEI with historical data, and also to allow comparisons between the NZSEI and the Elley-Irving Index. The scale was again created using the 1991 Census, as this data was fortuitously coded into both the '68 and '90 NZSCO classifications. The index was derived again at the minor group level, although in NZSCO68 this is coded at two digits and includes 84 occupations. The major group level was derived from this, and has 7 groups. Results have been presented at this major group level in table 3.7 and figure 3.7.

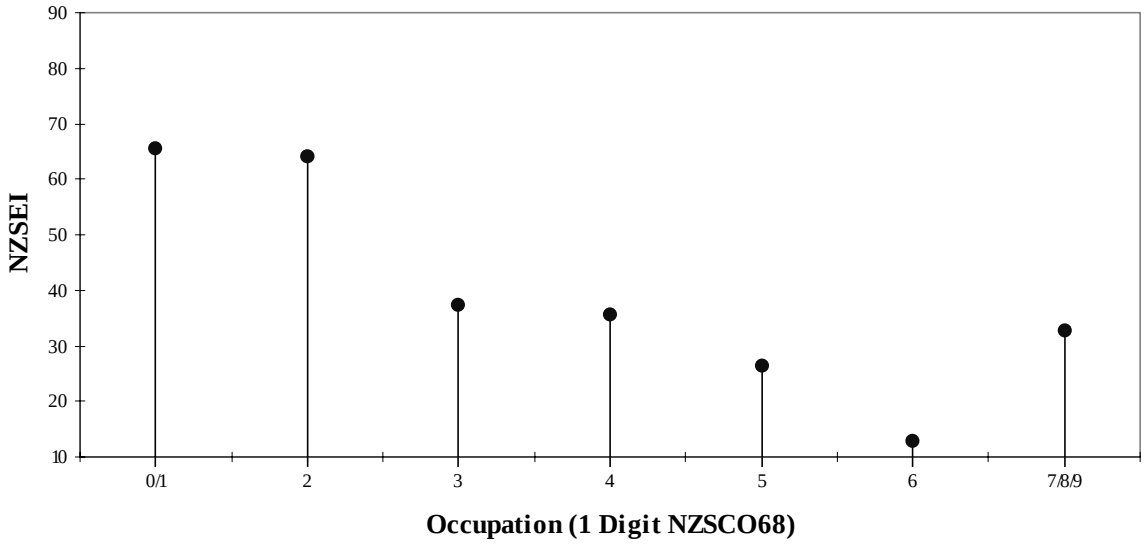
*Table 3.7*

**NZSEI Results at the Major Group (1 digit) NZSCO68 Level**

| Code | Description | NZSEI |
|---|---|---|
| 0/1 | Professional, Technical & Related Workers | 66 |
| 2 | Administrative & Managerial Workers | 64 |
| 3 | Clerical & Related Workers | 37 |
| 4 | Sales Workers | 36 |
| 7/8/9 | Production, Transport Workers & Labourers and Related Workers | 33 |
| 5 | Service Workers | 26 |
| 6 | Agricultural, Forestry & Fishery Workers | 13 |

*Figure 3.7*

**NZSEI Results at the NZSCO68 major group (1 digit) level**



## 3.8 Transforming the NZSEI into Discrete 'Occupational Classes':

There are advantages and disadvantages to a continuous scale, and for many applications a discrete scale is preferable. We split the NZSEI into 6 groups, firstly to provide a starting point for users who prefer discrete classes, and secondly to provide a basis for our NZSEI validation work in Section 6.

The groups were split in such a way as to ensure each class consisted of a reasonable proportion of the population. Apart from this consideration, the splits were done at a point which was fairly arbitrarily assigned. The wider range of 20 was assigned to class 6 as there was only one small occupation group (Non-Ordained Religious Associate Professionals) with an NZSEI score of less than 20. The breakdown of the population into each of the six NZSEI 'classes' is presented in table 3.8.

*Table 3.8*

**Distribution of population over NZSEI Classes**

| Class | NZSEI Range | % of Population |
|---|---|---|
| 1 | 75-90 | 5.0 |
| 2 | 60-75 | 17.5 |
| 3 | 50-60 | 20.7 |
| 4 | 40-50 | 22.8 |
| 5 | 30-40 | 16.5 |
| 6 | 10-30 | 17.5 |

## 3.9 Comparing the NZSEI and the Elley-Irving Index:

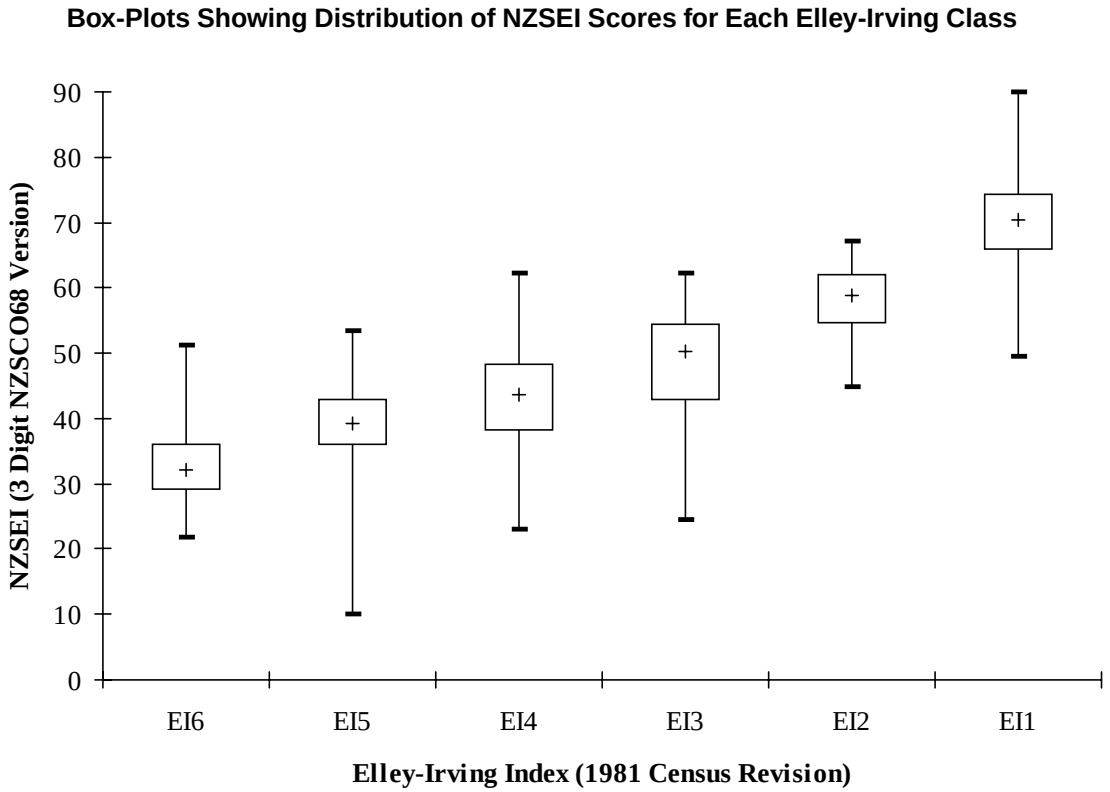
Since the NZSEI was produced in part as an update for the Elley-Irving (E-I) Index, we wanted to look at the relationship between the two scales. In the E-I Index occupations were classified into six categories using an equal weighting of median income and education scores. Class 1 is the highest, and class 6 the lowest socio-economic group.

As the E-I Index was created using NZSCO68, comparisons between the two scales were done using the NZSEI scores based on the NZSCO68 occupation groups. Each person in the 1991 Census had an occupation coded into NZSCO68, from which we can derive for them an E-I Index score, as well as our NZSCO68-based NZSEI score. Figure 3.9 shows the distribution of NZSEI scores for people who were assigned each E-I category.

The box and whisker plot shows the median NZSEI value as a cross, inside a box whose top and bottom lines represent the upper and lower quartiles of NZSEI values respectively. The lines projecting from the top and bottom of the box end at the maximum and minimum NZSEI points. The figure shows that, while NZSEI scores tend to be higher in the higher E-I classes, and vice versa, there is some overlap in the ranges, especially in the middle SES groups. In other words a person in a certain E-I class could be assigned a lower NZSEI score than a person in a lower E-I class.

Differences between the scales could be due to the different models used, changes in the population between the time the scales were derived, or due to a change in population specifications. The Elley-Irving index was based on data for males only, and also was restricted to those aged 25 to 44 years old (NZSEI was restricted to 21-69 years). NZSEI only included full-time workers.

*Figure 3.9*




## 3.10 Summary:

The results of the NZSEI analysis were largely as expected. Income was assigned a higher weighting than education, and this was the prime socio-economic status indicator in all analyses.

There were one or two unusual results, although these could be traced back to the income or education values in the Census dataset. Some occupations, such as religious professionals and farmers had very low income, and a correspondingly low NZSEI score. Problems of this kind appeared to occur most often with occupations with high numbers of self-employed, and this may indicate that self-reported income is a somewhat unreliable indicator of socio-economic status, at least in this area.

The results are shown to be similar to the international index, although sufficiently different to indicate the necessity for a distinct New Zealand index. The Elley-Irving Index is correlated with the NZSEI, although the relationship is not clear-cut, and for each E-I category, there is a large range of NZSEI scores.

Within the occupations there are obviously differences in socio-economic status firstly between males and females, and secondly between Maori and Europeans. The assumptions of the SES model, with socio-economic status as the link between education and income, appears to hold for these subsections of the population however.

*Section 4:*

# Validating occupational scores against health outcomes:

The purpose of the validation exercise is to assess the extent to which the new scale replicates known patterns of socio-economic determination for a range of health indicators. Empirical research has amply demonstrated the existence of relationships between indicators of socioeconomic status and a range of health outcomes, including health status, health-related risk behaviour and health service utilisation. We would expect these relationships to be borne out in a valid scale of occupational class. In order to ascertain the validity of the NZSEI as an SES indicator then, the pattern of scores generated will be tested against data drawn from the Household Health Survey (HHS) conducted in 1993 by Statistics New Zealand. The reliability of the NZSEI will also be assessed by comparing the results with those obtained on the same dataset by both the ISEI and Elley-Irving scales.

## 4.1 Description of the Dataset:

The data used in this section came from the 1992-93 Household Health Survey, run by Statistics New Zealand. Over 7000 New Zealanders were surveyed over a 12 month period. The purpose of the survey was to collect information about people's state of health, use of health services, and the aspects of their lifestyle which impact on health. The population for the survey was defined as the total usually resident, non-institutionalised, civilian population of New Zealand, residing in private households. We further narrowed the scope for our analyses to the full-time workforce. This resulted in a dataset containing the data of almost 3000 people.

Each respondent in the health survey has an assigned sample weight which tells us the number of people in the population that they represent. In our analyses all values were weighted up using these weights, giving population estimates.

There are various limitations in the health survey data, which could affect the analyses. Since our analyses are based on a sample, the estimates we produce are subject to sampling errors. For an estimate of 100,000 we have a sample error of almost 20%. This means that we have a 95% confidence interval ranging from about 80,000 to 120,000. This error is even larger for smaller estimates. An estimate of 20,000 has a sampling error over 40%. Since we are dealing with some estimates of as few as 2,000 people when we split the data by sex, and as few as 10,000 when looking at males and females together, many of the results should be treated with caution. Other problems include the fact that the estimates will be biased in favour of the 'healthy', as only the non-institutionalised population was surveyed, and becuase only the full-time workforce was included in the analysis.

## 4.2 Description of Statistical Methods:

For the purposes of the initial analyses the NZSEI scale was divided into six groups, as in Section 3.6. The Elley-Irving classification also consists of six groups. Dot charts of the health variables over the socio-economic status classes were produced. Various other statistics were produced, providing simple summary measures for the differences across the socio-economic status categories.

A simple linear regression of socio-economic status against the health variables was also done. The regression was at the occupation level, with the socio-economic index as the explanatory variable and the health variable as the response, and was done for both the NZSEI and the ISEI. Note that many other statistical analyses could have been carried out, but were beyond the purposes of this exercise.

## 4.3 The Health Variables:

Three health indicator variables were chosen, for which there was a body of literature attesting to the existence, or lack thereof, of a socio-economic gradient. The criterion variables selected are *self-assessed health*, as an indicator of health status, *smoking*, as a behavioural indicator, and *GP visits*, as an indicator of service utilisation. Other variables were ruled out due to the small estimates produced, which would have very high sampling errors (e.g. asthma incidence or dentist visits over a four week period).

Before presenting the results of the validation exercise, the literature examining the relationship between indicators of SES and health will be briefly reviewed.

## 4.4 The Observed Relationship between Socioeconomic Status and Health Measures:

Socioeconomic stratification appears to influence health outcomes in a number of ways. Specifically, it plays a crucial role in determining individuals' levels of exposure to health-promoting or pathogenic circumstances. Furthermore, it circumscribes the ability of individuals to maximise the beneficial effects or resist the pathological outcomes of exposure. Finally, it determines individuals' access to and shapes their experience of formal health care (Kaplan, 1989: 47). Socioeconomic health inequalities are correspondingly evident on several distinct levels. Firstly, empirical research has revealed clear socioeconomic patterning for a range of *health status* indicators, including measures of mortality and morbidity. Secondly, researchers have documented strong socioeconomic differentials in indicators of health-related *behaviour and lifestyles*. Thirdly, data collected on the receipt of *health services* has shown similar socioeconomic patterning. In the following review of the epidemiological literature, evidence for socioeconomic health inequalities on each of these three levels will be considered in turn.

### *4.4.1 The Socioeconomic Patterning of Health Status:*

Empirical research has shown low socioeconomic status to be associated with an increased probability of morbidity and mortality from a wide range of pathological conditions. Researchers have documented clear socioeconomic differentials in the incidence of illness and death resulting from conditions as diverse as congenital abnormalities, infectious diseases, cardiovascular and respiratory diseases, cancers, chronic conditions, mental illness, accidents, suicide and homicide. Incumbents of the lower socioeconomic strata therefore tend to exhibit higher rates of "adverse health experiences" (Macintyre, 1986: 400) in general. Furthermore, as Dutton and Levine point out, recent evidence suggests that this gap in health status between rich and poor is widening (1989: 36).

The apparent consistency of socioeconomic differentials across a wide range of disparate pathological conditions has led some analysts (Cassel, 1976; Berkman and Syme, 1979) to speculate that certain individuals are generally 'more susceptible' to poor health (cited in Marmot et al., 1995: 200). The 'general susceptibility thesis' posits that the mechanism generating the socioeconomic patterning of health is "a more general process of breakdown and vulnerability" (Dutton and Levine, 1989: 30), which cuts across and transcends the known causal etiologies of specific disease entities. The strength of this hypothesis lies in its ability to account for the persistence of 'class gradients' in measures of health status even *after* well-known 'risk factors' have been taken into account (Marmot et al., 1995: 200).

The general susceptibility thesis is premised on the assumption that similar socioeconomic differentials are broadly reproduced for most measures of health status. While this is largely true, several researchers

have in fact documented considerable diversity in the socioeconomic patterning of various health status indicators (Ford et al., 1994: 1046; Saunders, 1996: 111). Stronks et al. for instance showed the size of socioeconomic inequalities to vary with the particular health status indicator employed (1996: 668). The documentation of such heterogeneous patterns leads Ford et al. to insist that that "we now need to pay more attention to variation in inequalities between a wide range of health measures" (ibid.: 1038). In any case, it is clear that the relationship observed between SES and health status is contingent, to a certain degree, upon the researchers' choice of health indicator.

**A. Mortality:**

The general improvement in life expectancy observed in industrialised nations over the course of the twentieth century have been unevenly distributed across socioeconomic strata. In fact, a trend towards greater socioeconomic inequality in mortality rates has persisted in industrialised nations throughout the twentieth century (Macintyre, 1986; Marmot and Theorell, 1988; Whitehead, 1990; Valkonen, 1993; Marmot et al., 1995). With few exceptions, the inverse relationship between socioeconomic status and mortality is replicated for all major causes of death (Morgan et al., 1984: 210; Macintyre, 1986: 400; Valkonen, 1993: 413; Marmot et al., 1995: 173).

The case of *infant mortality* deserves special mention, due to its widely recognised importance as "one of the most sensitive indicators of the general socioeconomic level of a nation" (Brenner, 1995: 226; Williams, 1990: 83). Evidence of an inverse relationship between infant mortality rates and economic growth has been well-established (Brenner, 1973; Brenner, 1995: op cit.), with the consistent documentation of substantial excesses of stillbirths, neonatal and postneonatal mortality among lower socioeconomic strata relative to the general population (for example, Macfarlane and Mugford, 1984, cited in Macintyre, 1986: 394; Morgan et al., 1985: 209-210; Whitehead, 1990: 2).

Local evidence replicates these patterns, showing that although overall mortality decreased by 15% between 1975-7 and 1985-7 in New Zealand, the class gradient in mortality data persisted for the period, and may even have steepened slightly (Pearce et al, 1991: 155). The main factor underlying this overall pattern is the more rapid decline in mortality from coronary heart disease among upper occupational classes than among unskilled workers (Paul, 1993: 121).

**B. Morbidity:**

Deaths among individuals of working age are increasingly rare events, due to the substantial improvement in average life expectancy witnessed in industrialised nations over the past century. The measurement of differential mortality rates among socioeconomic strata in societies such as ours has therefore arguably become "a blunter instrument" (Paul, 1993: 121) for assessing inequalities in health status. And given that not all diseases result in death, the measurement of morbidity may yield qualitatively better information about the health status of individuals throughout the life course (Lundberg, 1986: 511).

There is however a comparative paucity of morbidity data in most industrialised nations, owing to the greater difficulties associated with its collection (Blaxter, 1989: 199). The high cost of screening studies means that "very few countries collect information on morbidity at a national level for other than a few select conditions" (Ford et al., 1994: 1048). Much morbidity research is therefore characterised by a reliance upon *self-reported* data.

Many researchers have for example employed measures of *self-assessed health*, asking individuals to rate their general state of health, and typically providing them with pre-coded response options in likert scale format. Although the vast majority of respondents answering questions of this type tend to rate their health as 'good' (Blaxter, 1985), researchers have found self-assessed health to be strongly patterned by socioeconomic circumstances. Specifically, individuals in low SES groups appear to rate their health poorly more often (Cox et al., 1987; Blaxter, 1989, 1990, 1991; cited in Macran et al., 1994: 187; Krieger and Fee, 1994: 28).

That measures of self-assessed health tap into an almost entirely *subjective* dimension of health status has however been identified as problematic. For the particular normative frameworks underpinning

respondents' evaluations remain unhelpfully obscure in the measurement of self-assessed health. "What does someone mean by good?" Macran et al. ask. "Good for their age? Good as compared with other people they know?" (1994: 187). However, several researchers have found evidence of a high degree of inter-correlation between self-reported illness and clinically diagnosed morbid conditions. Blaxter's 1985 study for instance revealed an 80% agreement between self-assessed and doctor-assessed illness (cited in Blaxter, 1989: 208). Other studies have shown self-assessed health to be a powerful predictor of subsequent mortality (Singer et al. 1976; Mosey and Shapiro, 1982; Welin et al., 1985; cited in Macran et al., 1994: 187; and Idler and Kasl, 1991; cited in Krieger and Fee, 1994: 28).

### *4.4.2 The Socioeconomic Patterning of Health-Related Behaviours and Lifestyle Factors:*

There is irrefutable evidence that the 'epidemic' changes in health-related behaviours and lifestyles which have occurred among the populations of western nations over the past half century, have been differentially distributed among the socioeconomic strata (Brenner, 1995: 217). Specifically, researchers have demonstrated that "lower socioeconomic groups have increasingly adopted (and higher socioeconomic groups have increasingly discarded) lifestyles and behaviours ... that have been identified over the past few decades as major risk factors for morbidity, disability, and mortality" (House et al., 1990: 386). Health-related behaviours and lifestyles are thus firmly embedded in the socio-structural conditions of contemporary societies (Stronks et al., 1996: 672), such that "individuals of low socioeconomic status are more likely to engage in practices that induce ill health, and they are less likely to engage in practices that forestall illness-inducing conditions" (Kaplan, 1989: 51).

Clearly then, the socioeconomic patterning of behavioural factors in turn impacts in crucial ways upon the health status of individuals in various socioeconomic strata. There is thus a sense in which behaviours and lifestyles represent "the pathways through which the effects of social stratification are mediated to individuals" (Williams, 1990: 82). Put differently, the 'cultural' factors of lifestyle and behaviour may be understood as "the superficial causes, the current intervening mechanisms, that link social status to health outcomes" (ibid.: 91).

Researchers have uncovered clear socioeconomic differentials in the exercise and dietary patterns of various population subgroups. Whether measured by such proxy indicators as dietary fibre content and sugar intake (Marmot et al., 1981, cited in Morgan et al., 1985: 220), or the consumption of skim milk, wholemeal bread and fresh fruit and vegetables (Marmot et al., 1995: 201), the diets of lower socioeconomic strata incumbents tend to be less healthy than those of their high SES counterparts. In addition, Whitehall Study researchers documented an inverse relationship between active leisure pursuits and socioeconomic status, with men in the highest employment grade being twice as likely as those in the lowest grade to engage in physically active recreation (cited in Macintyre, 1986: 408).

However, data on cigarette smoking provides the most unequivocal evidence of a relationship between socioeconomic status and lifestyle. Indeed, of all behavioural risk-factors examined in the Whitehall Study, the most striking socioeconomic differentials were observed for the smoking indicator (Marmot et al., 1995: 201). An historical examination of the relationship reveals that whereas smoking was once distributed fairly evenly throughout the strata, from the mid-1960s when the scientific community became aware of the large health risks associated with cigarettes, it has increasingly been concentrated in lower socioeconomic groupings (Chapman Walsh et al., 1995: 153).

Socioeconomic status has thus emerged in recent years as "the cardinal predictor of smoking status" (ibid.: 162). The Whitehall Study revealed men in the lowest employment grade as twice as likely as those in the highest grade to smoke cigarettes (in Macintyre, 1986: 408). And twenty years later, in the Whitehall II Study, a new cohort of civil servants reproduced the same class gradient, despite the significant decline in smoking prevalence which occurred across the board in the interim (Marmot et al., 1995: 202). GHS data for 1982 showed that 49% of unskilled male labourers in the UK smoked compared with only 20% of professional males, and the figures for women were 41% and 21% respectively (op

cit.). More recently, US data for 1991 identified 32% of high-school drop-outs as smokers, compared with only 14% of college graduates (cited in Chapman Walsh et al., 1994: 153).

### *4.4.3 Socioeconomic Patterning in the Receipt of Health Services:*

Health service utilisation is also clearly patterned by socioeconomic status. At first glance it might seem paradoxical that research has shown GP consultation rates to be generally higher among the lower socioeconomic strata (Mechanic, 1978, cited in Williams, 1990: 85; Morgan et al., 1985: 218). In a recent Irish study for example, Nolan observed the average annual number of GP visits to rise consistently with decreasing occupational class, from 2.3 for persons in professional or managerial positions, to 6.3 for unskilled manual workers (1994: 712). However, the apparent paradox is resolved once the greater prevalence of morbidity among the lower strata is taken into account. Brotherstone (1975) first formulated *use/need ratios* in order to demonstrate that the socioeconomic differentials observed in GP consultation rates correspond closely to the class gradient in health status, as proxied by chronic illness rates (in Nolan, 1994: 715). Use/need ratios have since been employed by many researchers, who have shown individuals of low SES to exhibit considerably *lower* utilisation rates when GP visiting rates are made relative to medical need (Aday, 1975, Forster, 1977, cited in Morgan et al., 1985: 218; Davis et al., 1981, Kleinman et al., 1981, cited in Kaplan, 1989: 55; Santos Lucas, 1984, Lahelma, 1986, O'Hare, 1986, and Vagero, 1986, cited in Macintyre, 1989: 326).

In any case, research has demonstrated that other health services are consumed less frequently by incumbents of the lower socioeconomic strata, regardless of medical need. For example, it is clear that lower socioeconomic groups make considerably less use of a wide range of preventative health services, including antenatal care (Aday et al., 1980, cited in Kaplan, 1989: 55), cervical screening, pap smears, mammograms and childhood immunisations (Dutton, 1986, cited in Kaplan, op cit.). Researchers have documented evidence of a similar positive association between socioeconomic status and dental care utilisation rates (Holstein, 1984, Van Wanseele, 1986, Sokou, 1986, Shuval, 1986 and Maseide, 1986, cited in Macintyre, 1989: 327-8).

However, the differentials observed in service utilisation rates do not tell the full story of socioeconomic inequality in the receipt of medical care. For researchers have long noted that the *quality* of medical care received by persons of low socioeconomic status is poor relative to that received by their high SES peers. As Scott et al. recognise then, "in terms of access and utilisation, health services may be equitable at the first point of contact but not thereafter" (1996: 45). For example, it has been consistently shown that low SES patients tend to have shorter consultations and receive less information on their condition, than their higher socioeconomic status counterparts, even when attending the same practice (Buchan and Richardson, 1973, cited in Macintyre, 1986: 406; Bain, 1976 and Bochner, 1983, cited in Scott et al., 1996: 35; and Cartwright and O'Brien, 1976, cited in Morgan et al., 1985: 220). Furthermore, low SES patients tend more often to lack continuity in their care, being more likely to see a different health service provider on each visit (Nersesian, 1988, cited in Williams, 1990: 85-6; St Peter et al., 1992, cited in Gergen, 1996: 1362). This lack of continuity may have potentially serious implications, given Gergen's contention that "familiarity with a patient can affect how quickly a physician assigns a diagnosis" (op cit.). More generally, socioeconomic differentials have been discerned in measures of doctor-patient 'rapport'. As Williams points out, this may be due to the middle class origin of medical services, such that "there is little discrepancy between the culture and organisation of health service delivery and that of middle class clients. In contrast, members of the lower-SES groups find that interaction with the medical system is a dehumanising experience" (1990: 86).

Furthermore, the literature shows GP decision-making processes to be indepedently associated with the socioeconomic status of patients. Specifically, researchers have found the likelihood of the request or performance of diagnostic tests (Scott et al., 1996), follow-up visits (Wilensky and Rossiter, 1983, cited in Scott et al., 1996: 35) and referrals to specialists (Blaxter, 1984, cited in Morgan et al., 1985: 220), to vary inversely with patient socioeconomic status.

Observations such as these demonstrate clearly the operation of the ‘inverse care law’, first articulated by Tudor Hart in 1971 (Macintyre, 1986: 406). The inverse care law proposes that those individuals most in need of adequate medical care are also least likely to receive it. In other words, it calls attention to the lesser quantity and quality of medical care received by members of the lower socioeconomic strata, in the face of their generally poorer health status.

## The Results of the Health Validation Exercise:

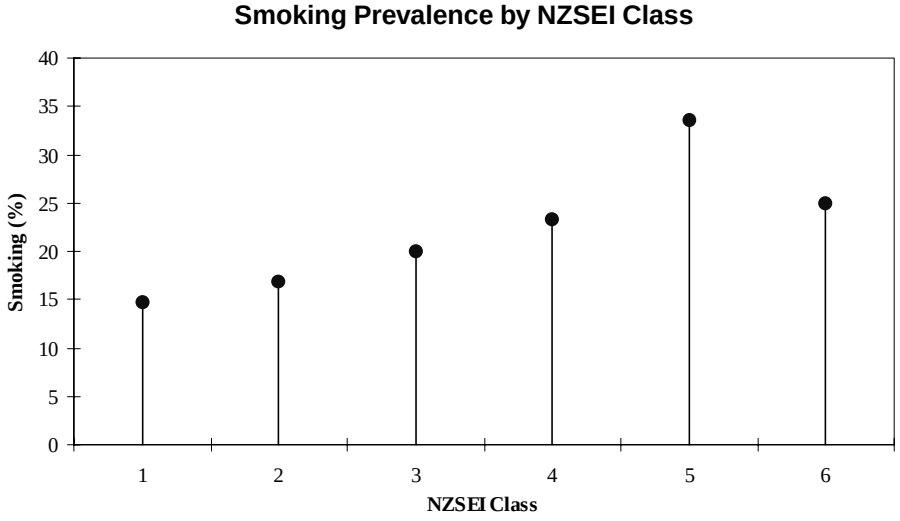
## 4.5. Comparisons by NZSEI:

Dot charts were produced of the selected health variables against the NZSEI classes. The data was standardised by age and sex.

Figure 4.5.1 shows the prevalence of smoking within each NZSEI class. The graph shows a steadily increasing percentage of smokers as we move to lower NZSEI classes, although the relationship doesn’t appear to be linear. An aberrant result is shown in NZSEI class 6, which has a lower proportion of smokers than the next NZSEI class up. This group is dominated by agriculture workers, who have an unexpectedly low reported income, resulting in a low NZSEI score. The presence of other occupations such as ‘Housekeeping and Restaurant Workers’ in this group, also with low smoking levels, indicates that there may be one or more confounding variables we have not taken into account, which may have an influence on smoking levels. If agriculture workers (NZSCO groups ‘611’ and ‘612’) are removed, the NZSEI class 6 smoking goes up to almost the same level as class 5.

The sampling errors for each of these separate NZSEI class estimates range from about 20% for NZSEI group 5 up to about 50% for group 1. Thus group 5 could realistically be anywhere from 28 to 40 percent, and group 5 from about 8 to 23. Although this should be taken into consideration, the fact that we have a fairly consistent trend, which is not unexpected apart from the group 6 anomaly, provides testimony to greater overall accuracy than is indicated by the individual sampling errors.

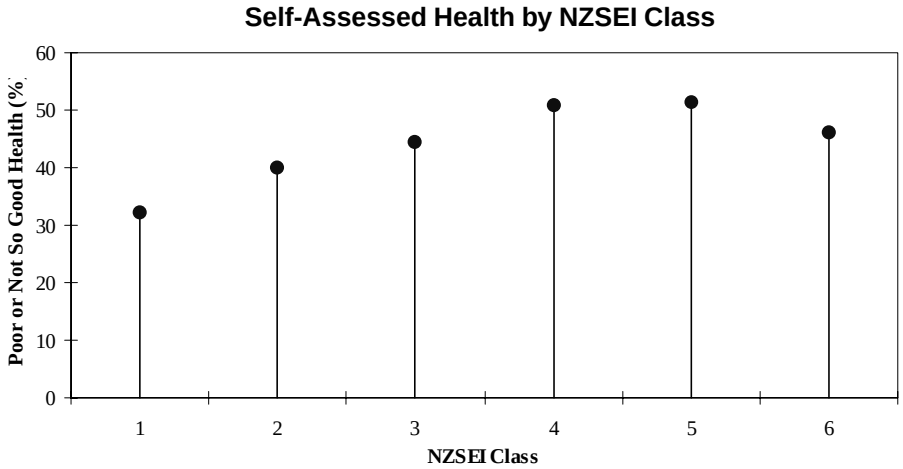
*Figure 4.5.1*




The ‘health status’ variable chosen was self-assessed health. This is expressed as the percentage of people who said their overall state of health was either ‘not so good’ or ‘poor’. This is a subjective measure, and there may be some bias in the data as a result.

Figure 4.5.2 shows a similar relationship to that exhibited with the smoking data. As we move down in NZSEI class, the percentage of people who assessed their health as poor increased. Class 6 once again went against the trend, with a lower proportion, although this group increases to about 56% if agriculture workers are removed.

*Figure 4.5.2*

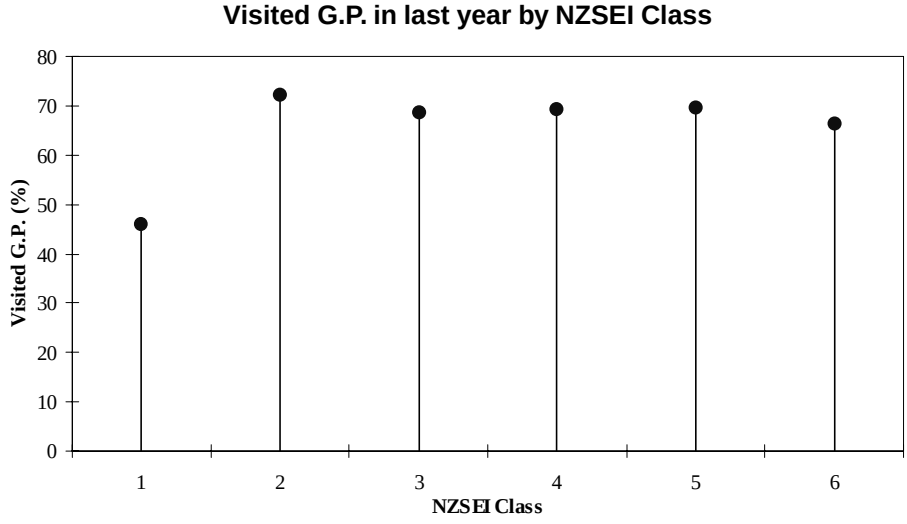



Due to the reasonably large proportions analysed here, the estimates are somewhat more sound, with sampling errors ranging from about 15 to 40 percent. As for the smoking case, the overall trend is likely to be more stable than the individual estimates, and so it is probably safe to assume that this trend represents a true SES gradient.

The service utilisation variable chosen was G.P. visits. This is given as the percentage of people who have visited a G.P. in the last year. From Figure 4.5.3 there doesn't appear to be a socio-economic gradient, although the highest NZSEI class has a lower rate than any of the other five groups by a substantial amount.

We have similar sampling errors to those for the self-assessed health variable. Group 1 would have a sampling error in the order of 40%. This means the estimate of around 50 percent could in fact be anywhere between about 30 and 70 percent. It is therefore likely that the low group 1 score reflects a true difference from the other five groups.

*Figure 4.5.3*

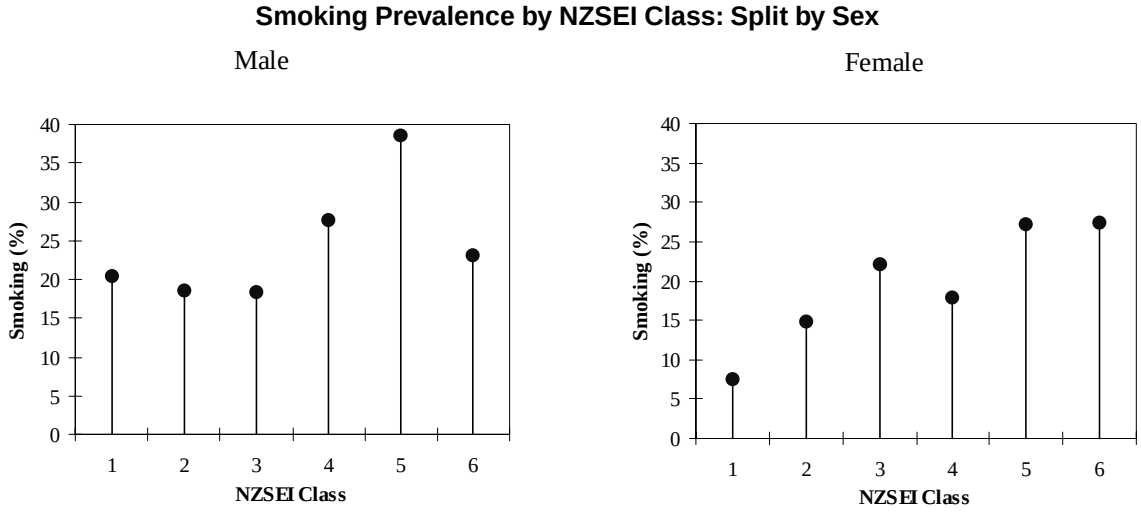


## 4.6 Comparisons for NZSEI by Sex:

After splitting the data by sex, we again produced dot charts of each health variable, by our generic NZSEI classes. These charts should be taken more cautiously, since we have smaller sample sizes again, and therefore significantly greater sample errors.

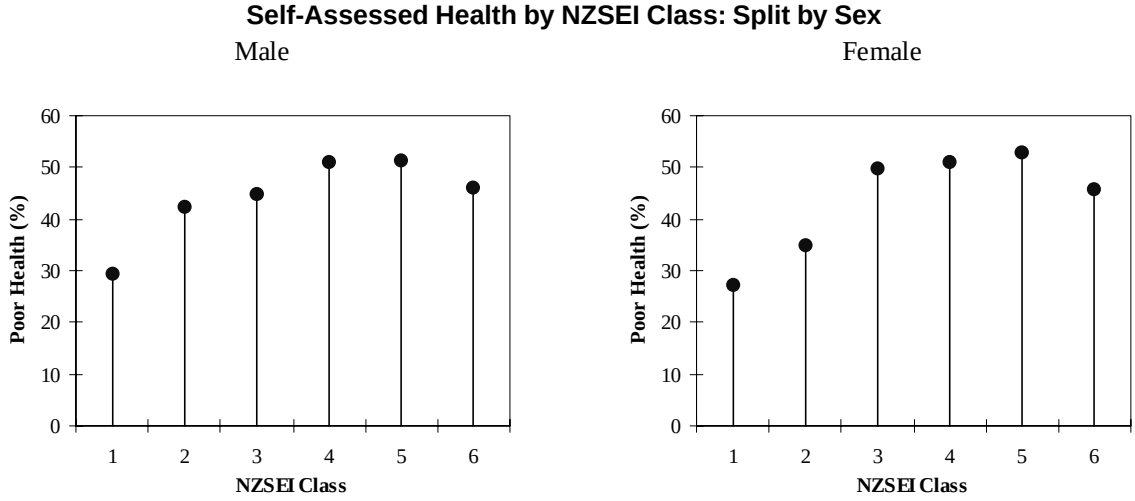
Although Figure 4.6.1 shows a more erratic trend for smoking, this may be due to the decreased sample size, and commensurate increase in uncertainty. Both graphs do however still exhibit a significant difference in smoking level between the top and bottom socio-economic status groups. Males have higher rates than females in most groups.

*Figure 4.6.1*



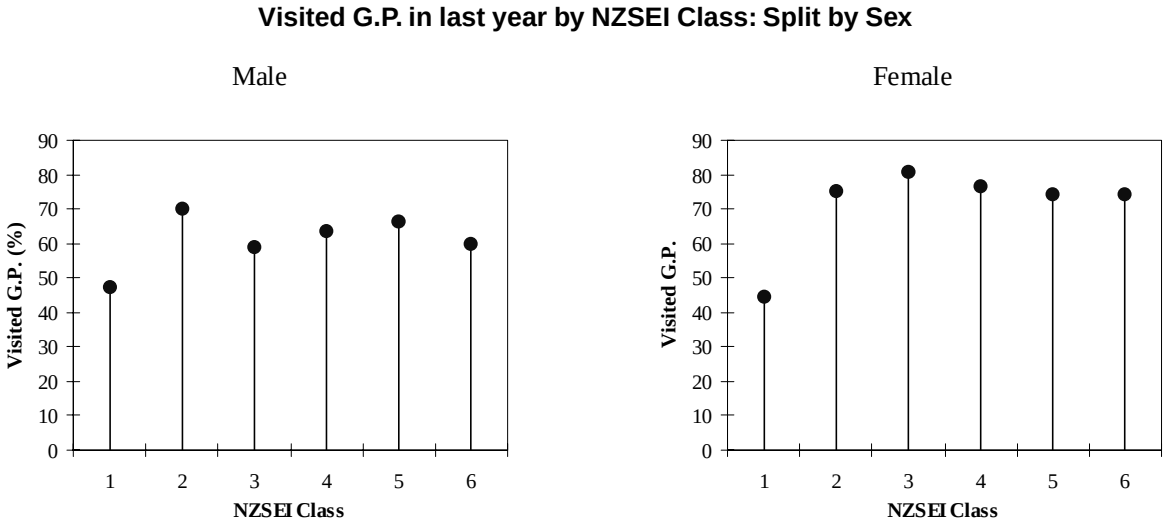

As with smoking, the self-assessed poor health variable shows some variation by socio-economic status. Figure 4.6.2 shows a greater difference between the top and bottom groups for females, although both graphs show similar relationships.

*Figure 4.6.2*



Although for G.P. visits similar relationships are exhibited for both males and females, the difference between the top socio-economic group and the other five is accentuated in the female case. For females NZSEI class 1 has a level of approximately 45%. This rises to close to 80% for the other classes.

*Figure 4.6.3*




## 4.7 Comparisons by ISEI:

In the case of the NZSEI-ISEI comparison against the health variables it was felt that the best analysis would be of the original continuous scales, since this would provide more detail and avoid the problem of creating categories for the ISEI.

As a simple comparison of the strength of the relationship between the socio-economic status indices and the health variables, a simple linear regression was done of the health data against both indices. The regression was done on all occupations with more than 5 respondents in the health data, and the occupations were unweighted.

Figures 4.7.1 and 4.7.2 show the results of these regressions for the smoking variable. Each occupation is represented as a dot on the graphs, and the regression line is overlain. Both show lower smoking levels in the higher socio-economic status groups. In both cases, the socio-economic status index was a statistically significant explanatory variable at the 1% level (p-value = 0.003 and 0.004 respectively). This means that we can be 99% confident that the gradient is not equal to zero. The results are similar for the two regressions, although the NZSEI has a slightly better fit to the data. The $R^2$ statistics are 12.6 and 11.8 for NZSEI and ISEI respectively. These values indicate the percentage of variation in the occupation smoking levels which can be explained by the respective indices.

The regression equations are:

% Smoking = 34.3 - 0.29 NZSEI

and % Smoking = 31.7 - 0.27 ISEI

Note that these equations cannot be compared directly, as the units of measurement are not equivalent.

*Figure 4.7.1*

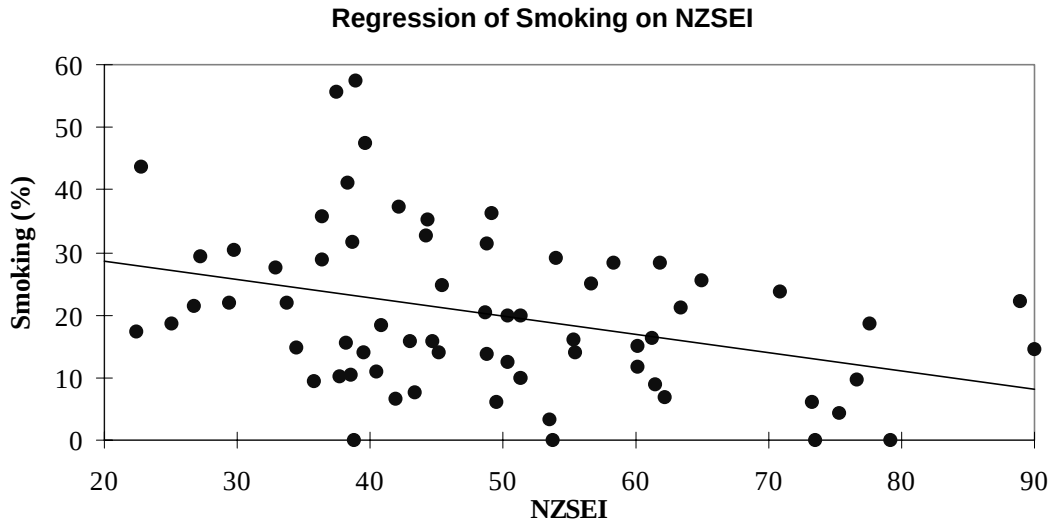
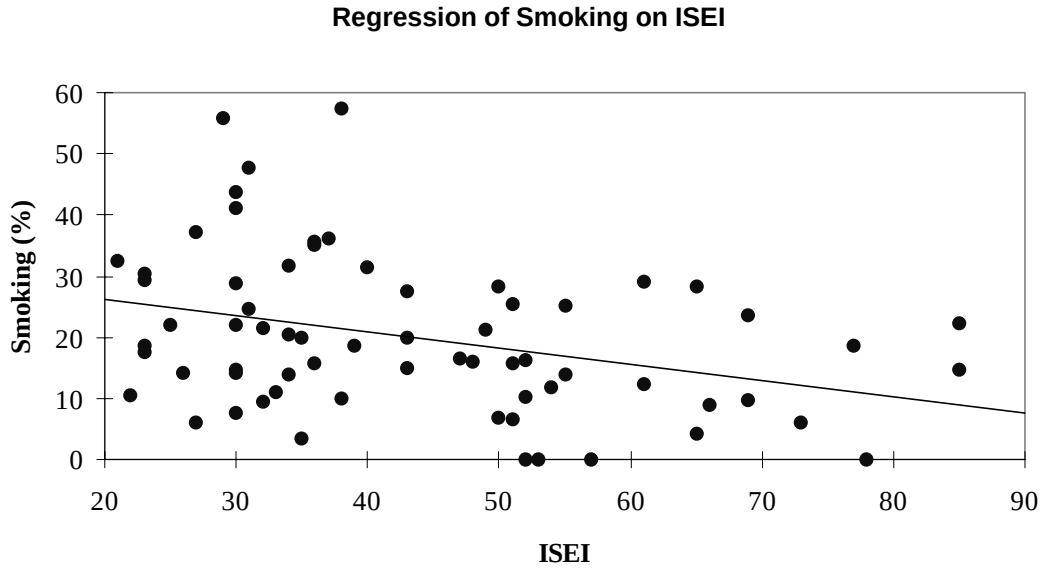



*Figure 4.7.2*




Similarly to the smoking case, both NZSEI and ISEI are significant predictors of poor self-assessed health, although the ISEI is only significant at the 5% level. The NZSEI has a better fit. The p-values are 0.0006 and 0.03 for NZSEI and ISEI respectively. The $R^2$ statistics are 16.8 and 7.1 respectively.

The regression equations are:

% Poor Health = 58.9 - 0.41 NZSEI

% Poor Health = 49.9 - 0.25 ISEI

*Figure 4.7.3*

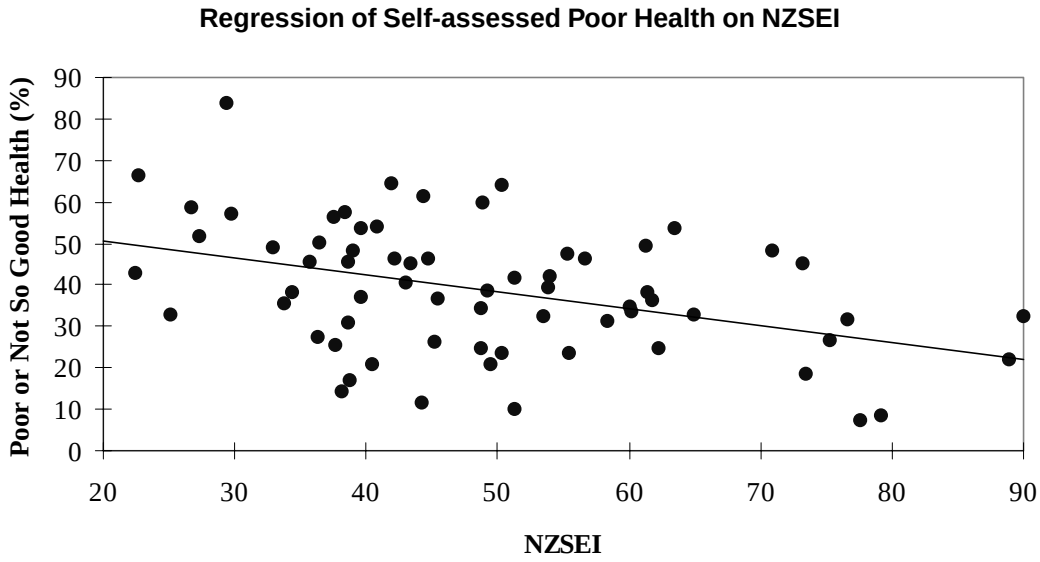
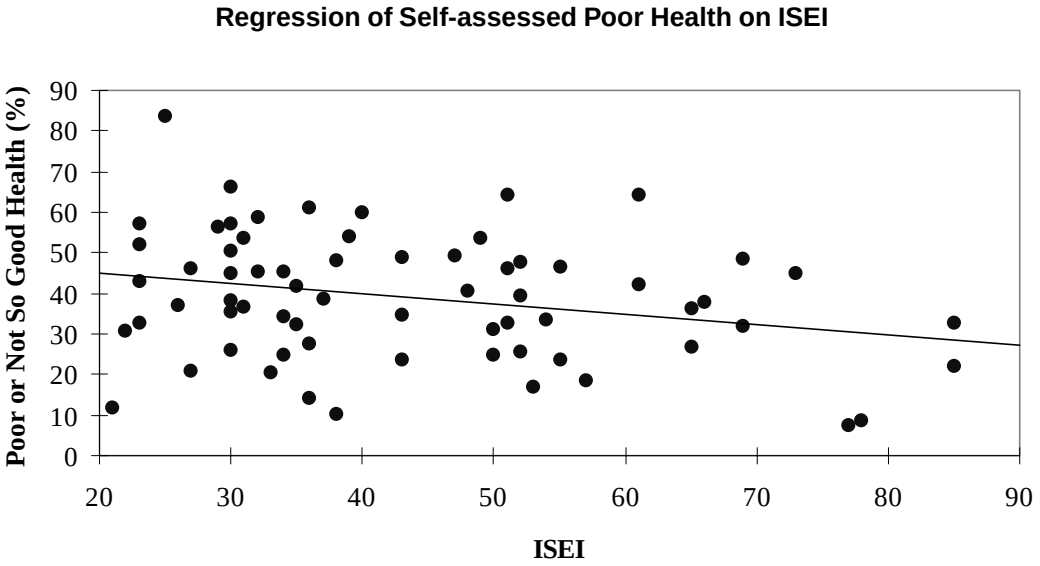



*Figure 4.7.4*




As expected, the regression of the percentage of G.P. Visits on both socio-economic indices is not significant. The p-values are 0.68 and 0.43, and the $R^2$ statistics are 0.3 and 1.2 for the NZSEI and ISEI respectively. There is a very slight negative gradient for the NZSEI, but a slight positive gradient in the ISEI case.

The regression equations are:

% Visited G.P. = 57.2 - 0.07 NZSEI

% Visited G.P. = 48.0 + 0.13 ISEI

*Figure 4.7.5*

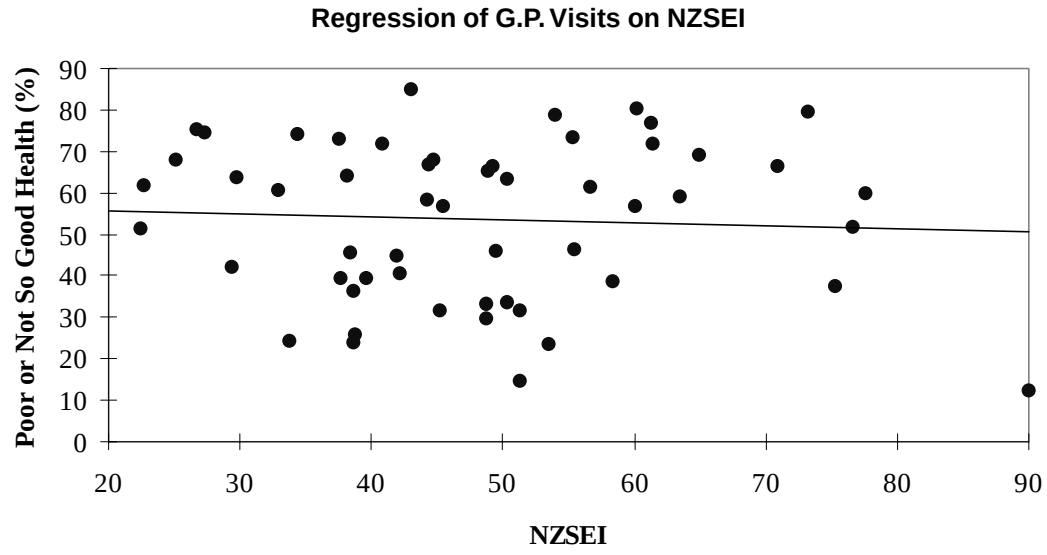
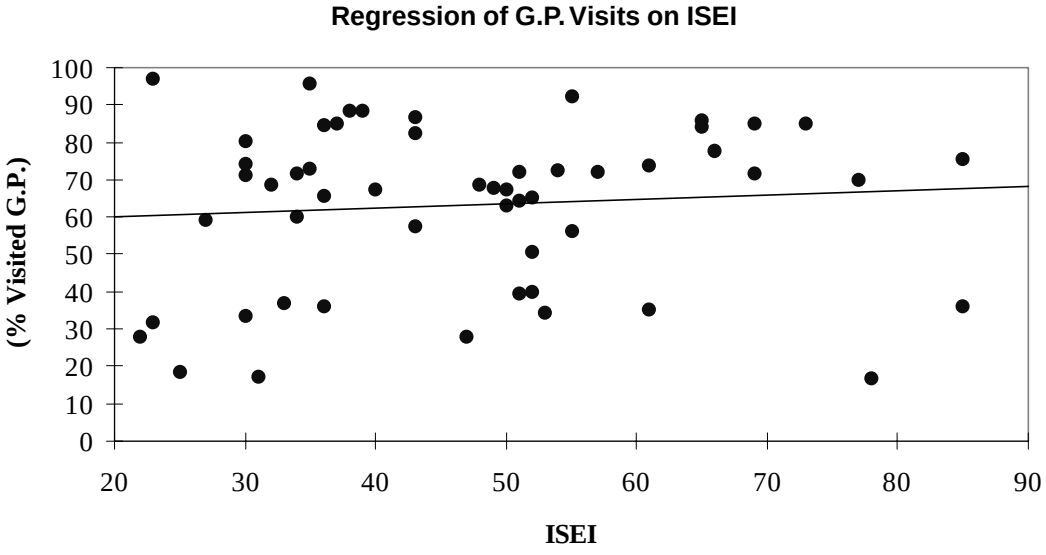



*Figure 4.7.6*




## 4.8 Comparisons by Elley-Irving:

As a comparison of how the new index compares to the Elley-Irving Index, we produced dot charts for each health variable for both NZSEI and Elley-Irving. The Household Health Survey data-set only contained NZSCO90 occupation codes, and so Elley-Irving scores couldn't be assigned directly.

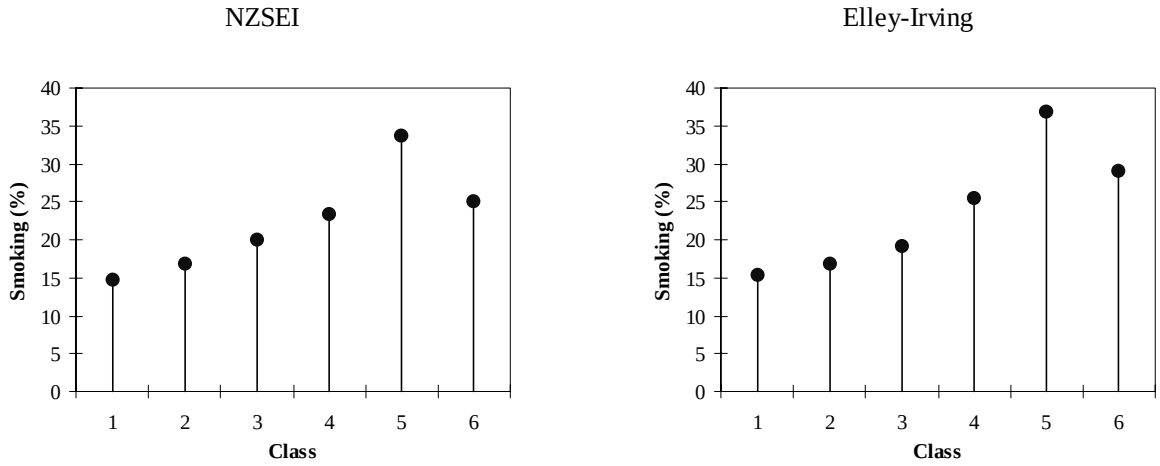
For many NZSCO90 codes, a number of different Elley-Irving codes, as based on NZSCO68, could be assigned. In these cases the Elley-Irving code assignment was based on the proportion of people in that NZSCO90 group who would be assigned each NZSCO68 code. This was done in such a way that those people with the higher income were assigned the higher Elley-Irving class.

This method may have improved the Elley-Irving Index's predictive power on the health variables, since it was in part individually as well as occupationally assigned. Another difference in the make-up of the two scales is the size of the classes. In both scales group one contains a very small proportion of the population. Elley-Irving group 6 is also very small, whereas the NZSEI has a fairly even split amongst the other five groups.

Figure 4.8.1 shows smoking levels plotted for each of the six Elley-Irving and NZSEI classes. The shape of the graph is extremely close for the two scales, although Elley-Irving shows a bigger difference between the bottom and top groups. An interesting point to note is that, despite Elley-Irving class 6 not containing Agriculture Workers, the dip in smoking levels is still present. This is further evidence that there may be effects not taken into account which explain the low smoking in the group 6 occupations.

*Figure 4.8.1*

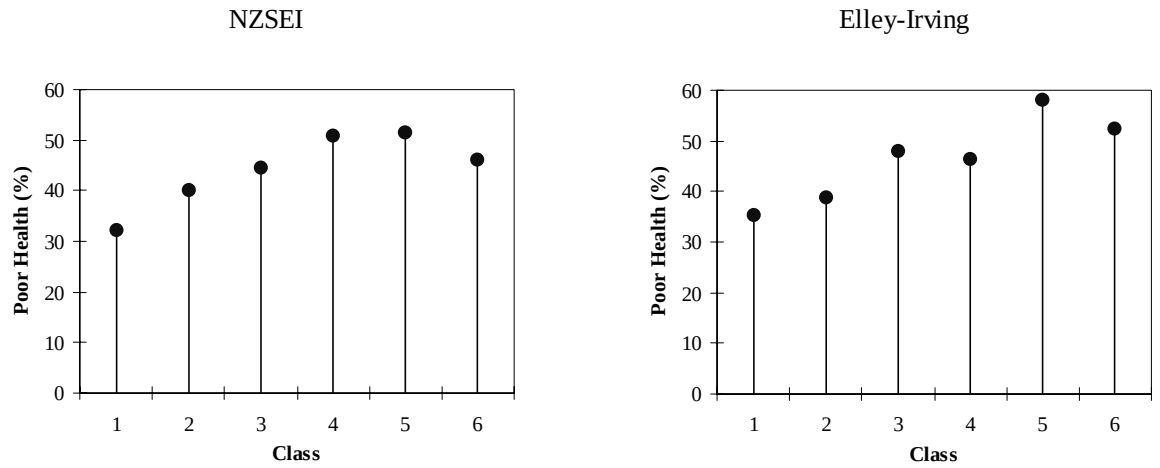
**Smoking Prevalence by SES Class: For NZSEI and Elley-Irving**




A similar distribution is again shown for the self-assessed health variable, although once again Elley-Irving shows a greater gradient, although as we can see in Figure 4.8.2, the NZSEI gradient appears to be more consistent.

*Figure 4.8.2*

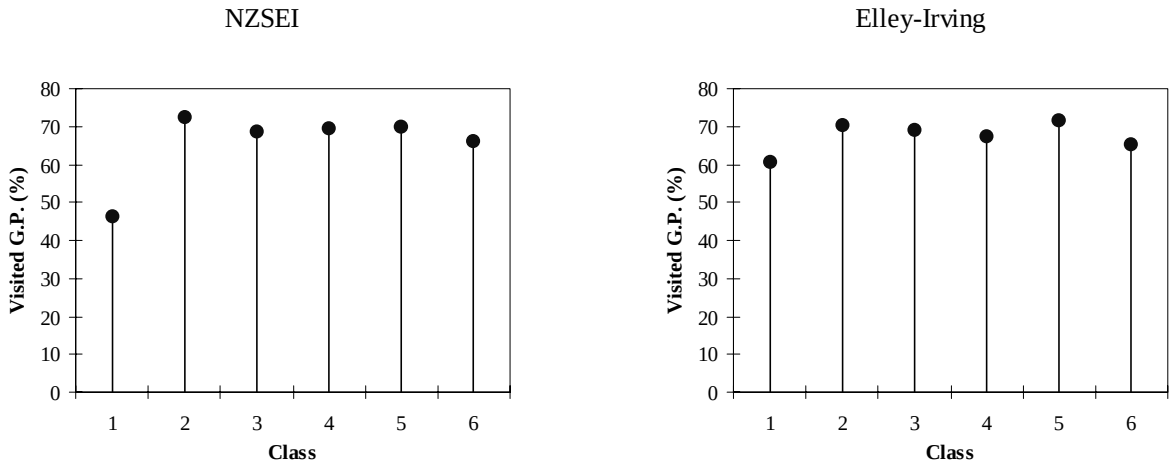
**Self-Assessed Health by SES Class: For NZSEI and Elley-Irving**



The proportion of G.P. visits in the last year shows even less of a SES effect for Elley-Irving than for NZSEI. Although group 1 is smaller than the other five, there is a less marked difference for Elley-Irving.

*Figure 4.8.3*

**Visited G.P. in last year by SES Class: For NZSEI and Elley-Irving**




## 4.9 Summary Measures:

Some simple summary measures of the magnitude of inequalities across the socio-economic status groups are presented in Table 4.9.1.

The rate ratio measures the ratio of the rate of the lowest SES group to that of the highest group. A second rate ratio is presented, showing the comparison between the top two and bottom two groups. For example, the smoking rate in the highest two NZSEI group is 1.76 times that of the two lowest groups. The rate difference, a measure of the absolute difference between the rates of the top and bottom groups, is similarly shown for these two splits. In the above case the bottom two NZSEI groups have a smoking rate 12.5 percentage points higher than the top two. Finally, population-attributable risk (P.A.R.) measures were produced. These measure the proportional or absolute reduction in rates that would occur in the hypothetical case that everyone had the rates of the highest SES group. For the above case once more, smoking would reduce by 9 percentage points if everyone was in the top NZSEI group. This would be a reduction of 38% of the current overall smoking rate.

As was shown in the dot charts above, the measures indicate that Elley-Irving shows a greater inequality in the health variable rates over the range of the classes, except possibly for G.P. visits. All of the measures show a fairly significant socio-economic effect, although as expected from Figure 4.8.3, G.P. visits does only for NZSEI and for comparisons between the top and bottom single groups.

*Table 4.9.1*

**Summary Measures of Effect**

| | Smoking | | Poor Health | | G.P. Visits | |
|---|---|---|---|---|---|---|
| Measure | NZSEI | E-I | NZSEI | E-I | NZSEI | E-I |
| Rate Ratio[1] | 1.70 | 2.13 | 1.43 | 1.65 | 1.30 | 1.09 |
| Rate Ratio[2] | 1.76 | 2.14 | 1.27 | 1.53 | 1.06 | 1.03 |
| Rate Difference[1] | 10.3 | 17.3 | 14.0 | 22.7 | 15.4 | 5.64 |
| Rate Difference[2] | 12.5 | 18.7 | 10.3 | 20.1 | 3.73 | 1.70 |
| Relative P.A.R. (%) | 37.7 | 36.0 | 30.5 | 26.1 | 24.7 | 11.9 |
| Absolute P.A.R. | 8.89 | 8.62 | 14.2 | 12.4 | 16.8 | 8.15 |

[1] Measures the difference between the top group and the bottom group.

[2] Measures the difference between the top two groups and the bottom two groups.

## 4.10 Summary and Conclusion:

While the relationship between the health variables and the NZSEI is obviously not substantial or absolute in any predictive way, equally some variables show a significant correlation to the index. Smoking and self-assessed health are obviously linked to NZSEI, and G.P. visits shows a less conclusive relationship. This is largely consistent with previous research.

*Section 5:*

# Conclusions and implications:

In this final section we summarise the main thrust of the results reported in this document and consider some of their implications.

## 5.1 Scoring Occupations

The model of the stratification process underpinning the scoring exercise was one that posited occupation as a latent, intervening variable converting a person's main resource - their education - into their principal reward (income). A statistical algorithm was used that derived scores for occupation such that, while the strength of the *direct* link between education and income was minimised, the magnitude of the *indirect* path - the two linkages between income and education respectively to the underlying, unmeasured variable, occupation - was simultaneously maximised.

The results of carrying out this exercise on the full Census dataset of all full-time workers, both male and female, had substantial face and construct validity and showed a reasonable 'fit' to the scores generated in the international scale. Removing female workers from the New Zealand dataset - in order to approximate the international analysis more closely - improved this 'fit' considerably. Although there were systematic differences in the expected direction in occupational scores between males and females, the underlying structure of the statistical model remained the same for both groups. A similar result held for the analysis by ethnic group. Adding part-time workers made little difference to the results. The final scores relate to the full-time workforce only.

An exercise was also conducted to assess the correspondence of the NZSEI scores with those derived from the existing Elley-Irving scale. Although there was a clear association between the two scales, there was also a wide spread of NZSEI scores for each Elley-Irving group.

## 5.2 Health Validation

Also central to the model of the stratification process underpinning the development of the current scale is the assumption that inequalities in the occupational order translate into corresponding variations in life chances and life styles. Central among these are those that influence health chances and health outcomes. Therefore, the next stage in the development of the scale was to assess its predictive validity for the three central domains of health - health-related behaviour (smoking), health status (self-assessed health) and health service use (GP visiting) - using data from the Household Health Survey.

In order to carry out the analysis a categorical version of the NZSEI scale was used with occupations allocated to six groups. Except for the lowest group - which departs from the expected pattern - both smoking and self-assessed health demonstrate clear class gradients. In the case of GP visits, however, the relationship is much less clear-cut. This pattern of relationships persists when the analysis is repeated for males and females and is largely consistent with previous research.

A further set of comparisons were carried out with the ISEI and with Elley-Irving scales. Regression equations confirmed the similarity of the relationship with the three criterion variables for the

international and New Zealand scales. Comparisons with Elley-Irving using simple dot charts demonstrate a close mirroring of the patterns of relationship between socioeconomic status and health outcome. On most measures of effect the Elley-Irving scale seems to have greater discriminatory power.

## 5.3 Issues for Resolution

Overall, the results of the health validation exercise demonstrate the NZSEI to be a fairly robust and reliable guide to the patterns of socioeconomic stratification in New Zealand. However, there are some qualifications to be made. Firstly, the unexpectedly low scores for the agricultural workers who predominate in category six, disturb the otherwise clear class gradients in the data on smoking and self-assessed poor health. Their aberrant scores on these health variables suggest that the NZSEI may not provide a reliable estimate of the socioeconomic status of agricultural workers. More specifically, these findings expose the placement of farmers in the lowest NZSEI category as problematic.

### *5.3.1 Agricultural Occupations*

It therefore seems likely that the NZSEI underestimates the socioeconomic status of farmers. In this respect however, the NZSEI as an indicator of SES is far from unique. Martelin's comparison of mortality rates among farmers with those of the general population for instance, leads her to conclude that "socioeconomic indicators tend to operate differently among farmers than in the other occupational groups" (1994: 1271). In particular, her results suggest that the actual socioeconomic status of farmers is substantially undervalued when measured according to their levels of education and income. Regarding the latter, the measurement of taxable income may yield spuriously low estimates of the actual living standards of self-employed persons in general, due in part to their enjoyment of additional opportunities for tax minimisation. In the case of farmers, one might reasonably expect measures of land holding or asset wealth to reflect their socioeconomic status more accurately.

The fact that both farmers and farm workers were assigned almost identical scores on the NZSEI highlights the problem. At the 2 digit level, while 'agricultural and animal husbandry workers' scored 29.5, 'farmers' were assigned a score of only 30.1 on the scale. The problem becomes even more readily apparent when moving to the 3 digit level, at which the score for 'general farm workers', at 30.4, was in fact higher than the score of 26.9 for 'general farmers'. Also at this level, 'livestock workers' were assigned a score of 32.2, while 'livestock farmers' scored only 24.9.

A review of the literature shows that farmers have always constituted a problematic category in the socioeconomic scaling of occupations (for example, Duncan, 1961). While they tend to score relatively highly on prestige scales, farmers in general have low education and income levels, which drag down their scores on socioeconomic indices. Noting that farmers who move out of agriculture tend to end up at the lowest status ranks of the manual labour force however, Ganzeboom et al. contend that socioeconomic indices effectively "give a better representation of intergenerational status attainment processes than do prestige measures" (Ganzeboom et al., 1992: 9).

The task of assigning farmers an occupational status was also problematic in the development of the revised Elley-Irving scale of 1985. The overall rating of farmers dropped from level 3 to level 4 in the newer scale, due to their relatively low reported incomes in the Census of 1981 (Elley and Irving, 1985: 118). The lack of information regarding size of holding or assets in fact forced Elley and Irving to conclude that "the index now warrants a separate level for farmers, particularly when samples are drawn with a large rural component" (op cit.). Farmers were therefore removed from level 4 and relocated in the newly created level 7.

As it currently stands then, the NZSEI may better capture the socioeconomic status of urban sample populations. In any case, it is clear that further work is required in order to develop a reliable occupational SES indicator for agricultural workers. To this end, a future project might fruitfully modify the NZSEI algorithm via the incorporation of data from the Household Economic Survey, in order to generate more reliable scores for farmers.

### 5.3.2 Household Measures

The health validation exercise demonstrates that with the possible exception of farmers, the occupational scores generated by the NZSEI represent reliable estimates of socioeconomic status for members of the New Zealand workforce. However, the scale's utility is limited by its lack of applicability to those 'economically inactive' persons outside the workforce, such as beneficiaries, housewives and the retired. Future work must therefore address the problem of how to adapt the NZSEI in order to permit the allocation of socioeconomic status scores to those outside the workforce.

The problem of allocating occupational class scores to the economically inactive may to some extent be remedied by taking the *family* or *household* as the unit of class analysis. Stratification researchers have in fact generally preferred to treat the household as the basic unit of analysis, on the grounds that its members typically pool income and share similar consumption patterns (Zipp and Plutzer, 1996: 236). In this reading, as Goldthorpe has argued, the household functions as a homogeneous unit of economic strategy, and "lines of class division and potential conflict run between but not through families" (cited in Erikson, 1984: 492).

In operationalising household measures, researchers must obviously decide *whose* occupational circumstances are to be considered as representative of the household's class location as a whole. And where households have more than one primary generation income-earner, the task of selecting an indicator acquires considerable complexity. In fact, a review of the literature reveals that the problem of how best to classify dual-earner families has precipitated "a vigorous polemic on gender issues" (Wilkes, 1988: 139), centred largely upon the class allocation of married women.

### 5.3.3 The Position of Women

Married women have conventionally been assumed to derive their class position from their husbands' occupations. The conventional position is exemplified by Goldthorpe, who contends that the class fate of households is determined by "the family 'head', in the sense of the family member, typically the husband-father, who has the fullest commitment to participation in the labour market" (1983: 468, cited in Dale, Gilbert and Arber, 1985: 384). In Goldthorpe's view, the gendered division of labour is such that the participation of married women in paid work is constrained by their 'primary orientation' to childcare and domestic labour. For Goldthorpe then, the intermittent nature of their careers renders women's work subsidiary by definition, to that of their husbands.

As recently as in 1985, commentators observed that "it remains widely accepted that the class position of a married woman is determined entirely by the occupation of her husband" (Dale, Gilbert and Arber, 1985: 384). However, with the progressive erosion of traditional gender roles, the conventional approach has come under attack from contemporary analysts. Over the last half century, women in western nations have increasingly entered the labour market, and the proportion of full-time housewives has declined markedly, particularly among women married to professionals, upper level executives and senior civil servants (Erikson, 1984). By 1984, only 19% of men in the British work force provided sole financial support for a wife and dependent children (Stanworth, 1984, cited in Duke and Edgell, 1987: 7). In this context, Goldthorpe and his adherents are arguably "in danger of misdescribing dual-career families in which both husband and wife have an equal attachment to the labour market" (Dale, Gilbert and Arber, 1985: 385-6).

Several analysts have sought to ascertain whether women's occupations 'matter' for the class assignment of households. Zipp and Plutzer (1996) for instance assessed the relative importance of wife's and husband's occupational class in determining the 'subjective class identification' of household members. The results demonstrate that a woman's subjective class identification is influenced more by her husband's occupational class than by her own, thus confirming the continuing utility of the conventional approach. Although their findings clearly show *husband's* occupational class to have a greater impact on the subjective class identifications of both men and women, the authors concede that in certain situations, wife's class may play a significant role (ibid.: 235).

In the case of health research, however, empirical findings tend to support Goldthorpe's assertion of the superiority of the conventional approach. For example, as Marmot et al. note, "whatever ideological predisposition one may have toward classifying women according to their own, rather than their husband's position, it predicts mortality less well" (1987: 121). Similarly, in her 1991 study, Arber found husband's occupational class to be a better predictor of women's health status than wife's *own* class, noting further that "little explanatory power is gained by using both measures" (1991: 430). In general, researchers have documented stronger class gradients in measures of health status for married women when they are classified conventionally, as opposed to individually (Bloor et al. (1987), Arber (1989), Blaxter (1990) and Pugh and Moser (1990), cited in Macran et al., 1994: 185).

### *5.3.4 Categorical versus Continuous*

The approach adopted in this report has been to allow the statistical algorithm to generate scores on a continuous scale. There are methodological advantages to this approach and it is also one that is quite consistent with the dominant stratification model of structured inequality. However, categorical scales have their own methodological advantages and relate more closely to a social class model.

For convenience, this report has developed a categorical version of the NZSEI for presentational purposes. However, the basis for this allocation has not been tested, nor has proper thought been given to any conceptual relationships it might have to a social class rather than a stratification model of structured inequality.

## 5.4 Conclusion

This report has developed and tested a socioeconomic index using an established statistical methodology. Although tested on certain health outcomes, it has been developed with a view to its widest possible application in social science research and official statistics. These scores have been generated on the most complete dataset available and detailed information has been provided for researchers wishing to use the scale. Linking data has been provided to earlier statistical series and to the existing Elley-Irving scale. Further work is clearly required on a number of issues, including rural occupations, the place of those outside the workforce, the position of women, household versus individual measures, and a categorical scale. In the meantime, however, the New Zealand Socioeconomic Index, a continuous occupational scale of socioeconomic status, provides a robust, standardised and internationally comparable measure of occupational class.

*Section 6:*

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*Appendix A*

# NZSEI results

| Occupation (NZSCO90 Minor, Sub-Major and Major Groups) | Major Group | Sub-M. Group | Minor Group | Count[1] |
|---|---|---|---|---|
| 0 Armed Forces | 54 | | | |
| 01 Armed Forces | | 54 | | |
| 011 Armed Forces | | | 54 | 5787 |
| 1 Legislators, Administrators, And Managers | 57 | | | |
| 11 Legislators and Administrators | | 77 | | |
| 111 Legislators | | | 84 | 246 |
| 112 Senior Government Administrators | | | 82 | 738 |
| 113 Senior Business Administrators | | | 90 | 435 |
| 114 Special-Interest Organisation Administrators | | | 63 | 735 |
| 12 Corporate Managers | | 57 | | |
| 121 General Managers | | | 65 | 34737 |
| 122 Specialised Managers | | | 54 | 106671 |
| 2 Professionals | 71 | | | |
| 21 Physical, Mathematical and Engineering Science Professionals | | 74 | | |
| 211 Physicists, Chemists and Related Professionals | | | 82 | 1458 |
| 212 Mathematicians, Statisticians and Related Professionals | | | 83 | 456 |
| 213 Computing Professionals | | | 75 | 3207 |
| 214 Architects, Engineers and Related Professionals | | | 73 | 15537 |
| 22 Life Science and Health Professionals | | 71 | | |
| 221 Life Science Professionals | | | 79 | 2367 |
| 222 Health Professionals (except Nursing) | | | 90 | 10464 |
| 223 Nursing and Midwifery Professionals | | | 60 | 18948 |
| 23 Teaching Professionals | | 69 | | |
| 231 Tertiary Teaching Professionals | | | 78 | 9450 |
| 232 Secondary Teaching Professionals | | | 77 | 14247 |
| 233 Primary and Early Childhood Teaching Professionals | | | 61 | 21321 |
| 234 Special Education Teaching Professionals | | | 57 | 1062 |
| 235 Other Teaching Professionals | | | 77 | 765 |
| 24 Other Professionals | | 71 | | |
| 241 Business Professionals | | | 71 | 21888 |
| 242 Legal Professionals | | | 89 | 6150 |
| 243 Archivists, Librarians and Related Information Professionals | | | 62 | 2349 |
| 244 Social and Related Science Professionals | | | 75 | 3462 |
| 245 Religious Professionals | | | 39 | 2847 |
| 3 Technicians and Associate Professionals | 58 | | | |
| 31 Physical Science and Engineering Associate Professionals | | 62 | | |
| 311 Physical Science and Engineering Technicians | | | 63 | 22659 |
| 312 Computer Equipment Controllers | | | 55 | 7629 |
| 313 Optical and Electronic Equipment Controllers | | | 54 | 3117 |
| 314 Ship and Aircraft Controllers and Technicians | | | 73 | 2712 |
| 315 Safety and Health Inspectors | | | 62 | 3177 |
| 32 Life Science and Health Associate Professionals | | 55 | | |
| 321 Life Science Technicians and Related Workers | | | 58 | 3807 |
| 322 Health Associate Professionals | | | 55 | 4377 |
| 323 Nursing Associate Professionals | | | 51 | 2589 |

[1] Any inconsistencies between these figures and the counts given in table 2.1 are attributable to the fact that counts in Appendix A are based on the final number of people actually included in the analysis, excluding those who were removed because their education or income levels were unspecified.

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

| Occupation (NZSCO90 Minor, Sub-Major and Major Groups) | Major Group | Sub-M. Group | Minor Group | Count[1] |
|---|---|---|---|---|
| 33 Other Associate Professionals | | 56 | | |
| 331 Finance and Sales Associate Professionals | | | 57 | 40608 |
| 332 Administrative Associate Professionals | | | 60 | 10929 |
| 333 Government Associate Professionals | | | 65 | 960 |
| 334 Social Work Associate Professionals | | | 50 | 5091 |
| 335 Careers and Employment Advisors | | | 55 | 921 |
| 336 Writers, Artists, Entertainment & Sports Associate Professionals | | | 50 | 11007 |
| 337 Non-Ordained Religious Associate Professionals | | | 10 | 387 |
| 338 Environmental Protection Associate Professionals | | | 59 | 846 |
| 4 Clerks | 42 | | | |
| 41 Office Clerks | | 43 | | |
| 411 Secretaries and Keyboard Operating Clerks | | | 45 | 27732 |
| 412 Numerical Clerks | | | 42 | 21585 |
| 413 Material Recording and Transport Clerks | | | 44 | 10908 |
| 414 Library, Mail and Related Clerks | | | 41 | 34407 |
| 42 Customer Services Clerks | | 41 | | |
| 421 Cashiers, Tellers and Related Clerks | | | 43 | 18636 |
| 422 Client Information Clerks | | | 38 | 12552 |
| 5 Service and Sales Workers | 36 | | | |
| 51 Personal and Protective Services Workers | | 38 | | |
| 511 Travel Attendants and Guides | | | 52 | 2190 |
| 512 Housekeeping and Restaurant Services Workers | | | 27 | 19905 |
| 513 Personal Care Workers | | | 29 | 8031 |
| 514 Other Personal Services Workers | | | 34 | 6900 |
| 515 Protective Services Workers | | | 61 | 12528 |
| 52 Salespersons, Demonstrators and Models | | 33 | | |
| 521 Salespersons and Demonstrators | | | 33 | 36456 |
| 522 Street Vendors | | | 46 | 1230 |
| 523 Fashion and Other Models | | | - | 15 |
| 6 Agriculture and Fishery Workers | 25 | | | |
| 61 Market Oriented Agricultural and Fishery Workers | | 25 | | |
| 611 Market Farmers and Crop Growers | | | 22 | 22779 |
| 612 Market Oriented Animal Producers | | | 25 | 68943 |
| 613 Forestry and Related Workers | | | 39 | 3909 |
| 614 Fishery Workers, Hunters and Trappers | | | 40 | 3306 |
| 7 Trades Workers | 47 | | | |
| 71 Building Trades Workers | | 47 | | |
| 711 Building Frame and Related Trades Workers | | | 45 | 28398 |
| 712 Building Finishers and Related Trades Workers | | | 49 | 24807 |
| 713 Electricians | | | 49 | 1401 |
| 72 Metal and Machinery Trades Workers | | 49 | | |
| 721 Metal Moulders, Sheet-Metal and Related Workers | | | 45 | 12672 |
| 722 Blacksmiths, Toolmakers and Related Workers | | | 54 | 6702 |
| 723 Machinery Mechanics and Fitters | | | 49 | 19230 |
| 724 Electrical and Electronic Instrument Mechanics and Fitters | | | 53 | 2676 |
| 73 Precision Trades Workers | | 48 | | |
| 731 Precision Instrument Makers and Related Workers | | | 44 | 1743 |
| 732 Glass Cutters and Related Workers | | | 50 | 4626 |
| 733 Printing Trades Worker | | | 49 | 2922 |
| 74 Other Craft and Related Trades Workers | | 38 | | |
| 741 Food and Related Products Processing Trades Workers | | | 38 | 2685 |
| 742 Cabinet Makers and Related Workers | | | 40 | 3192 |
| 743 Tailors and Dressmakers | | | 36 | 4581 |
| 744 Leather Goods Makers | | | 30 | 756 |

[1] Any inconsistencies between these figures and the counts given in table 2.1 are attributable to the fact that counts in Appendix A are based on the final number of people actually included in the analysis, excluding those who were removed because their education or income levels were unspecified.

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

| Occupation (NZSCO90 Minor, Sub-Major and Major Groups) | | | Major Group | Sub-M. Group | Minor Group | Count[1] |
|---|---|---|---|---|---|---|
| 8 | Plant and Machine Operators and Assemblers | | 38 | | | |
| | 81 | Industrial Plant Operators | | 48 | | |
| | | 811 Mining and Mineral Processing Plant Operators | | | 47 | 1182 |
| | | 812 Metal-Processing Plant Operators | | | 43 | 2925 |
| | | 813 Glass and Ceramics Kiln and Related Plant Operators | | | 30 | 1233 |
| | | 814 Wood-Processing and Papermaking Plant Operators | | | 49 | 2712 |
| | | 815 Chemical Processing Plant Operators | | | 51 | 1866 |
| | | 816 Power Generating and Related Plant Operators | | | 60 | 2136 |
| | 82 | Stationary Machine Operators and Assemblers | | 34 | | |
| | | 821 Metal and Mineral Products Processing Machine Operators | | | 38 | 2268 |
| | | 822 Chemical Products Machine Operators | | | 34 | 1299 |
| | | 823 Rubber and Plastics Products Machine Operators | | | 36 | 2538 |
| | | 824 Wood Products Machine Operators | | | 38 | 2055 |
| | | 825 Paper Products Machine Operators | | | 39 | 654 |
| | | 826 Textile Products Machine Operators | | | 23 | 14814 |
| | | 827 Food and Related Products Processing Machine Operators | | | 38 | 18660 |
| | | 828 Leather and Related Products Processors | | | 36 | 1926 |
| | | 829 Assemblers | | | 40 | 8358 |
| | 83 | Drivers and Mobile Machinery Operators | | 40 | | |
| | | 831 Railway Engine Drivers and Related Workers | | | 61 | 1092 |
| | | 832 Motor Vehicle Drivers | | | 39 | 27564 |
| | | 833 Agricultural, Earthmoving & Other Materials-Handling Equip. Operators | | | 40 | 6852 |
| | | 834 Ships' Deck Crews and Related Workers | | | 49 | 945 |
| | 84 | Building and Related Workers | | 44 | | |
| | | 841 Building and Related Workers | | | 44 | 3069 |
| 9 | Elementary Occupations | | 31 | | | |
| | 91 | Labourers and Related Elementary Service Workers | | 31 | | |
| | | 911 Building Caretakers and Cleaners | | | 27 | 10821 |
| | | 912 Messengers and Doorkeepers | | | 42 | 3084 |
| | | 913 Refuse Collectors and Related Labourers | | | 36 | 132 |
| | | 914 Packers and Freight Handlers | | | 34 | 17967 |
| | | 915 Labourers | | | 30 | 27420 |

[1] Any inconsistencies between these figures and the counts given in table 2.1 are attributable to the fact that counts in Appendix A are based on the final number of people actually included in the analysis, excluding those who were removed because their education or income levels were unspecified.

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

*Appendix B*

# NZSEI scores: results by sex

| Occupation (NZSCO90 Minor Groups) | NZSEI Scores Male | Female | Difference (M-F) | % Female |
|---|---|---|---|---|
| 011 Armed Forces | 57 | 52 | 6 | 10 |
| 111 Legislators | 84 | 72 | 12 | 31 |
| 112 Senior Government Administrators | 81 | 71 | 10 | 24 |
| 113 Senior Business Administrators | 88 | 74 | 15 | 24 |
| 114 Special-Interest Organisation Administrators | 65 | 61 | 4 | 40 |
| 121 General Managers | 67 | 53 | 15 | 14 |
| 122 Specialised Managers | 62 | 47 | 15 | 34 |
| 211 Physicists, Chemists and Related Professionals | 80 | 70 | 10 | 13 |
| 212 Mathematicians, Statisticians and Related Professionals | 81 | 75 | 6 | 29 |
| 213 Computing Professionals | 74 | 70 | 4 | 22 |
| 214 Architects, Engineers and Related Professionals | 72 | 66 | 6 | 4 |
| 221 Life Science Professionals | 78 | 70 | 9 | 19 |
| 222 Health Professionals (except Nursing) | 90 | 72 | 18 | 27 |
| 223 Nursing and Midwifery Professionals | 68 | 61 | 7 | 92 |
| 231 Tertiary Teaching Professionals | 80 | 67 | 13 | 38 |
| 232 Secondary Teaching Professionals | 77 | 72 | 6 | 48 |
| 233 Primary and Early Childhood Teaching Professionals | 69 | 61 | 8 | 80 |
| 234 Special Education Teaching Professionals | 59 | 59 | 0 | 82 |
| 235 Other Teaching Professionals | 80 | 71 | 9 | 54 |
| 241 Business Professionals | 74 | 63 | 10 | 36 |
| 242 Legal Professionals | 87 | 75 | 12 | 24 |
| 243 Archivists, Librarians and Related Information Professionals | 69 | 61 | 8 | 80 |
| 244 Social and Related Science Professionals | 79 | 68 | 11 | 48 |
| 245 Religious Professionals | 47 | 33 | 14 | 15 |
| 311 Physical Science and Engineering Technicians | 65 | 56 | 10 | 12 |
| 312 Computer Equipment Controllers | 66 | 51 | 15 | 53 |
| 313 Optical and Electronic Equipment Controllers | 58 | 54 | 4 | 36 |
| 314 Ship and Aircraft Controllers and Technicians | 73 | 65 | 8 | 5 |
| 315 Safety and Health Inspectors | 64 | 58 | 6 | 11 |
| 321 Life Science Technicians and Related Workers | 66 | 56 | 10 | 60 |
| 322 Health Associate Professionals | 66 | 55 | 11 | 74 |
| 323 Nursing Associate Professionals | 55 | 55 | 0 | 91 |
| 331 Finance and Sales Associate Professionals | 61 | 53 | 8 | 30 |
| 332 Administrative Associate Professionals | 68 | 55 | 14 | 49 |
| 333 Government Associate Professionals | 66 | 62 | 4 | 27 |
| 334 Social Work Associate Professionals | 56 | 53 | 3 | 67 |
| 335 Careers and Employment Advisors | 58 | 57 | 1 | 58 |
| 336 Writers, Artists, Entertainment & Sports Associate Professionals | 57 | 49 | 7 | 41 |
| 337 Non-Ordained Religious Associate Professionals | 34 | 10 | 24 | 51 |
| 338 Environmental Protection Associate Professionals | 60 | 63 | -3 | 16 |

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

| Occupation (NZSCO90 Minor Groups) | NZSEI Scores Male | Female | Difference (M-F) | % Female |
|---|---|---|---|---|
| 411 Secretaries and Keyboard Operating Clerks | 62 | 49 | 13 | 95 |
| 412 Numerical Clerks | 56 | 45 | 11 | 78 |
| 413 Material Recording and Transport Clerks | 51 | 45 | 7 | 32 |
| 414 Library, Mail and Related Clerks | 53 | 44 | 9 | 73 |
| 421 Cashiers, Tellers and Related Clerks | 56 | 46 | 10 | 74 |
| 422 Client Information Clerks | 53 | 43 | 9 | 93 |
| 511 Travel Attendants and Guides | 55 | 56 | -1 | 51 |
| 512 Housekeeping and Restaurant Services Workers | 42 | 31 | 11 | 64 |
| 513 Personal Care Workers personal | 49 | 34 | 15 | 76 |
| 514 Other Personal Services Workers | 51 | 38 | 13 | 82 |
| 515 Protective Services Workers | 63 | 55 | 8 | 7 |
| 521 Salespersons and Demonstrators | 48 | 33 | 15 | 52 |
| 522 Street Vendors | 52 | 39 | 13 | 11 |
| 523 Fashion and Other Models | - | - | - | 80 |
| 611 Market Farmers and Crop Growers | 36 | 21 | 15 | 29 |
| 612 Market Oriented Animal Producers | 36 | 27 | 8 | 22 |
| 613 Forestry and Related Workers | 45 | 28 | 17 | 3 |
| 614 Fishery Workers, Hunters and Trappers | 47 | 33 | 14 | 11 |
| 711 Building Frame and Related Trades Workers | 50 | 38 | 12 | 1 |
| 712 Building Finishers and Related Trades Workers | 53 | 35 | 18 | 2 |
| 713 Electricians | 53 | 38 | 15 | 2 |
| 721 Metal Moulders, Sheet-Metal and Related Workers | 50 | 34 | 16 | 3 |
| 722 Blacksmiths, Toolmakers and Related Workers | 57 | 45 | 11 | 2 |
| 723 Machinery Mechanics and Fitters | 53 | 41 | 12 | 1 |
| 724 Electrical and Electronic Instrument Mechanics and Fitters | 57 | 40 | 17 | 5 |
| 731 Precision Instrument Makers and Related Workers | 50 | 40 | 10 | 14 |
| 732 Glass Cutters and Related Workers | 55 | 44 | 11 | 17 |
| 733 Printing Trades Worker | 57 | 43 | 14 | 29 |
| 741 Food and Related Products Processing Trades Workers | 48 | 32 | 16 | 22 |
| 742 Cabinet Makers and Related Workers | 47 | 35 | 12 | 6 |
| 743 Tailors and Dressmakers | 47 | 32 | 15 | 28 |
| 744 Leather Goods Makers | 41 | 32 | 9 | 33 |
| 811 Mining and Mineral Processing Plant Operators | 51 | - | - | 1 |
| 812 Metal-Processing Plant Operators | 49 | 35 | 14 | 3 |
| 813 Glass and Ceramics Kiln and Related Plant Operators | 40 | 30 | 11 | 25 |
| 814 Wood-Processing and Papermaking Plant Operators | 54 | 38 | 16 | 5 |
| 815 Chemical Processing Plant Operators | 55 | 41 | 15 | 6 |
| 816 Power Generating and Related Plant Operators | 62 | 52 | 9 | 1 |
| 821 Metal and Mineral Products Processing Machine Operators | 45 | 33 | 13 | 9 |
| 822 Chemical Products Machine Operators | 43 | 37 | 5 | 35 |
| 823 Rubber and Plastics Products Machine Operators | 44 | 33 | 11 | 14 |
| 824 Wood Products Machine Operators | 47 | 35 | 12 | 25 |
| 825 Paper Products Machine Operators | 47 | 34 | 12 | 16 |
| 826 Textile Products Machine Operators | 42 | 29 | 13 | 79 |
| 827 Food and Related Products Processing Machine Operators | 46 | 33 | 13 | 18 |
| 828 Leather and Related Products Processors | 44 | 35 | 9 | 19 |
| 829 Assemblers | 49 | 32 | 17 | 22 |
| 831 Railway Engine Drivers and Related Workers | 63 | - | - | 0 |
| 832 Motor Vehicle Drivers | 45 | 35 | 10 | 4 |
| 833 Agricultural, Earthmoving & Other Materials-Handling Equip. Operators | 45 | 37 | 8 | 1 |
| 834 Ships' Deck Crews and Related Workers | 54 | 24 | 30 | 4 |

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

| Occupation (NZSCO90 Minor Groups) | NZSEI Scores Male | Female | Difference (M-F) | % Female |
|---|---|---|---|---|
| 841 Building and Related Workers | 49 | 40 | 9 | 1 |
| 911 Building Caretakers and Cleaners | 42 | 27 | 15 | 41 |
| 912 Messengers and Doorkeepers | 49 | 37 | 12 | 16 |
| 913 Refuse Collectors and Related Labourers | 43 | - | - | 5 |
| 914 Packers and Freight Handlers | 47 | 29 | 18 | 30 |
| 915 Labourers | 39 | 29 | 10 | 14 |

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

*Appendix C*

# NZSEI scores: results by ethnicity

| Occupation (NZSCO90 Minor Groups) | NZSEI Scores Euro. | Maori | Difference (E-M) | % Maori |
|---|---|---|---|---|
| 011 Armed Forces | 55 | 46 | 9 | 20 |
| 111 Legislators | 84 | - | - | 4 |
| 112 Senior Government Administrators | 81 | 66 | 15 | 4 |
| 113 Senior Business Administrators | 90 | - | - | 4 |
| 114 Special-Interest Organisation Administrators | 63 | 45 | 18 | 10 |
| 121 General Managers | 65 | 51 | 13 | 2 |
| 122 Specialised Managers | 54 | 44 | 10 | 3 |
| 211 Physicists, Chemists and Related Professionals | 82 | - | - | 1 |
| 212 Mathematicians, Statisticians and Related Professionals | 82 | - | - | 1 |
| 213 Computing Professionals | 73 | 65 | 8 | 2 |
| 214 Architects, Engineers and Related Professionals | 73 | 58 | 15 | 2 |
| 221 Life Science Professionals | 79 | 52 | 27 | 2 |
| 222 Health Professionals (except Nursing) | 90 | 67 | 23 | 1 |
| 223 Nursing and Midwifery Professionals | 59 | 53 | 6 | 4 |
| 231 Tertiary Teaching Professionals | 79 | 48 | 31 | 10 |
| 232 Secondary Teaching Professionals | 77 | 69 | 7 | 4 |
| 233 Primary and Early Childhood Teaching Professionals | 62 | 43 | 19 | 6 |
| 234 Special Education Teaching Professionals | 57 | 34 | 23 | 5 |
| 235 Other Teaching Professionals | 78 | 69 | 9 | 12 |
| 241 Business Professionals | 71 | 59 | 11 | 3 |
| 242 Legal Professionals | 90 | 76 | 14 | 2 |
| 243 Archivists, Librarians and Related Information Professionals | 61 | 40 | 21 | 3 |
| 244 Social and Related Science Professionals | 77 | 49 | 28 | 5 |
| 245 Religious Professionals | 38 | 28 | 10 | 3 |
| 311 Physical Science and Engineering Technicians | 63 | 56 | 7 | 3 |
| 312 Computer Equipment Controllers | 53 | 48 | 5 | 5 |
| 313 Optical and Electronic Equipment Controllers | 53 | 45 | 9 | 3 |
| 314 Ship and Aircraft Controllers and Technicians | 73 | 68 | 5 | 1 |
| 315 Safety and Health Inspectors | 61 | 57 | 4 | 5 |
| 321 Life Science Technicians and Related Workers | 58 | 40 | 18 | 2 |
| 322 Health Associate Professionals | 55 | 45 | 10 | 2 |
| 323 Nursing Associate Professionals | 51 | 48 | 3 | 10 |
| 331 Finance and Sales Associate Professionals | 56 | 47 | 8 | 2 |
| 332 Administrative Associate Professionals | 59 | 49 | 10 | 5 |
| 333 Government Associate Professionals | 63 | 55 | 8 | 5 |
| 334 Social Work Associate Professionals | 51 | 42 | 9 | 20 |
| 335 Careers and Employment Advisors | 55 | 50 | 4 | 18 |
| 336 Writers, Artists, Entertainment & Sports Associate Professionals | 50 | 34 | 16 | 5 |
| 337 Non-Ordained Religious Associate Professionals | 10 | 32 | -22 | 6 |
| 338 Environmental Protection Associate Professionals | 59 | 43 | 16 | 6 |

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

| Occupation (NZSCO90 Minor Groups) | NZSEI Scores Euro. | Maori | Difference (E-M) | % Maori |
|---|---|---|---|---|
| 411 Secretaries and Keyboard Operating Clerks | 43 | 40 | 3 | 4 |
| 412 Numerical Clerks | 40 | 38 | 2 | 5 |
| 413 Material Recording and Transport Clerks | 43 | 39 | 5 | 8 |
| 414 Library, Mail and Related Clerks | 39 | 37 | 3 | 9 |
| 421 Cashiers, Tellers and Related Clerks | 42 | 37 | 5 | 4 |
| 422 Client Information Clerks | 36 | 34 | 2 | 6 |
| 511 Travel Attendants and Guides | 52 | 45 | 8 | 6 |
| 512 Housekeeping and Restaurant Services Workers | 26 | 22 | 4 | 14 |
| 513 Personal Care Workers | 28 | 23 | 5 | 11 |
| 514 Other Personal Services Workers | 33 | 21 | 12 | 6 |
| 515 Protective Services Workers | 62 | 52 | 9 | 10 |
| 521 Salespersons and Demonstrators | 32 | 26 | 6 | 4 |
| 522 Street Vendors | 44 | 48 | -4 | 3 |
| 523 Fashion and Other Models | - | - | - | 0 |
| 611 Market Farmers and Crop Growers | 21 | 11 | 11 | 5 |
| 612 Market Oriented Animal Producers | 24 | 19 | 4 | 4 |
| 613 Forestry and Related Workers | 39 | 32 | 7 | 28 |
| 614 Fishery Workers, Hunters and Trappers | 40 | 27 | 12 | 10 |
| 711 Building Frame and Related Trades Workers | 44 | 40 | 4 | 5 |
| 712 Building Finishers and Related Trades Workers | 48 | 41 | 7 | 6 |
| 713 Electricians | 48 | 48 | 0 | 2 |
| 721 Metal Moulders, Sheet-Metal and Related Workers | 45 | 40 | 5 | 9 |
| 722 Blacksmiths, Toolmakers and Related Workers | 53 | 48 | 4 | 5 |
| 723 Machinery Mechanics and Fitters | 48 | 41 | 6 | 4 |
| 724 Electrical and Electronic Instrument Mechanics and Fitters | 53 | 46 | 7 | 6 |
| 731 Precision Instrument Makers and Related Workers | 43 | 32 | 12 | 2 |
| 732 Glass Cutters and Related Workers | 50 | 41 | 9 | 6 |
| 733 Printing Trades Worker | 48 | 38 | 10 | 5 |
| 741 Food and Related Products Processing Trades Workers | 38 | 34 | 4 | 8 |
| 742 Cabinet Makers and Related Workers | 40 | 34 | 6 | 3 |
| 743 Tailors and Dressmakers | 36 | 30 | 6 | 6 |
| 744 Leather Goods Makers | 30 | 24 | 6 | 12 |
| 811 Mining and Mineral Processing Plant Operators | 45 | 43 | 3 | 13 |
| 812 Metal-Processing Plant Operators | 46 | 40 | 6 | 16 |
| 813 Glass and Ceramics Kiln and Related Plant Operators | 27 | 34 | -7 | 8 |
| 814 Wood-Processing and Papermaking Plant Operators | 49 | 48 | 1 | 27 |
| 815 Chemical Processing Plant Operators | 54 | 41 | 13 | 13 |
| 816 Power Generating and Related Plant Operators | 60 | 50 | 10 | 9 |
| 821 Metal and Mineral Products Processing Machine Operators | 39 | 33 | 6 | 15 |
| 822 Chemical Products Machine Operators | 34 | 27 | 7 | 12 |
| 823 Rubber and Plastics Products Machine Operators | 37 | 31 | 6 | 14 |
| 824 Wood Products Machine Operators | 38 | 37 | 2 | 17 |
| 825 Paper Products Machine Operators | 41 | 29 | 12 | 18 |
| 826 Textile Products Machine Operators | 22 | 18 | 4 | 15 |
| 827 Food and Related Products Processing Machine Operators | 38 | 32 | 6 | 20 |
| 828 Leather and Related Products Processors | 37 | 33 | 4 | 15 |
| 829 Assemblers | 41 | 36 | 5 | 17 |
| 831 Railway Engine Drivers and Related Workers | 61 | 58 | 2 | 18 |
| 832 Motor Vehicle Drivers | 38 | 33 | 5 | 16 |
| 833 Agricultural, Earthmoving & Other Materials-Handling Equip. Operators | 39 | 35 | 4 | 21 |
| 834 Ships' Deck Crews and Related Workers | 47 | 48 | -1 | 9 |

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

| Occupation (NZSCO90 Minor Groups) | NZSEI Scores Euro. | Maori | Difference (E-M) | % Maori |
|---|---|---|---|---|
| 841 Building and Related Workers | 44 | 38 | 6 | 15 |
| 911 Building Caretakers and Cleaners | 27 | 20 | 7 | 15 |
| 912 Messengers and Doorkeepers | 42 | 35 | 7 | 14 |
| 913 Refuse Collectors and Related Labourers | 36 | 29 | 7 | 13 |
| 914 Packers and Freight Handlers | 35 | 30 | 5 | 16 |
| 915 Labourers | 30 | 26 | 4 | 24 |

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

*Appendix D*

# Standardised NZSEI scores

| Occupation (NZSCO90 Minor Groups) | Standardised NZSEI Scores All | Male | Fem. | Euro. | Maori |
|---|---|---|---|---|---|
| 011 Armed Forces | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 |
| 111 Legislators | 1.1 | 1.2 | 0.8 | 1.1 | 1.1 |
| 112 Senior Government Administrators | 1.0 | 1.1 | 0.8 | 1.0 | 0.6 |
| 113 Senior Business Administrators | 1.3 | 1.4 | 0.9 | 1.3 | 1.0 |
| 114 Special-Interest Organisation Administrators | 0.5 | 0.5 | 0.4 | 0.5 | 0.0 |
| 121 General Managers | 0.5 | 0.6 | 0.0 | 0.5 | 0.2 |
| 122 Specialised Managers | 0.2 | 0.4 | -0.2 | 0.2 | -0.1 |
| 211 Physicists, Chemists and Related Professionals | 1.0 | 1.1 | 0.7 | 1.1 | 0.4 |
| 212 Mathematicians, Statisticians and Related Professionals | 1.1 | 1.1 | 0.9 | 1.1 | 1.2 |
| 213 Computing Professionals | 0.8 | 0.9 | 0.7 | 0.8 | 0.5 |
| 214 Architects, Engineers and Related Professionals | 0.8 | 0.8 | 0.6 | 0.8 | 0.3 |
| 221 Life Science Professionals | 1.0 | 1.0 | 0.7 | 1.0 | 0.2 |
| 222 Health Professionals (except Nursing) | 1.3 | 1.5 | 0.8 | 1.3 | 0.6 |
| 223 Nursing and Midwifery Professionals | 0.4 | 0.6 | 0.4 | 0.4 | 0.2 |
| 231 Tertiary Teaching Professionals | 0.9 | 1.1 | 0.6 | 1.0 | 0.1 |
| 232 Secondary Teaching Professionals | 0.9 | 1.0 | 0.8 | 0.9 | 0.7 |
| 233 Primary and Early Childhood Teaching Professionals | 0.4 | 0.7 | 0.4 | 0.5 | -0.1 |
| 234 Special Education Teaching Professionals | 0.3 | 0.3 | 0.3 | 0.3 | -0.4 |
| 235 Other Teaching Professionals | 0.9 | 1.1 | 0.7 | 0.9 | 0.7 |
| 241 Business Professionals | 0.7 | 0.9 | 0.5 | 0.7 | 0.4 |
| 242 Legal Professionals | 1.3 | 1.4 | 0.9 | 1.3 | 0.9 |
| 243 Archivists, Librarians and Related Information Professionals | 0.4 | 0.7 | 0.4 | 0.5 | -0.2 |
| 244 Social and Related Science Professionals | 0.8 | 1.0 | 0.6 | 0.9 | 0.1 |
| 245 Religious Professionals | -0.3 | -0.2 | -0.7 | -0.3 | -0.5 |
| 311 Physical Science and Engineering Technicians | 0.5 | 0.5 | 0.2 | 0.5 | 0.3 |
| 312 Computer Equipment Controllers | 0.2 | 0.5 | 0.0 | 0.2 | 0.1 |
| 313 Optical and Electronic Equipment Controllers | 0.2 | 0.3 | 0.1 | 0.2 | 0.0 |
| 314 Ship and Aircraft Controllers and Technicians | 0.8 | 0.8 | 0.5 | 0.8 | 0.6 |
| 315 Safety and Health Inspectors | 0.4 | 0.5 | 0.2 | 0.5 | 0.3 |
| 321 Life Science Technicians and Related Workers | 0.3 | 0.6 | 0.2 | 0.3 | -0.2 |
| 322 Health Associate Professionals | 0.2 | 0.6 | 0.1 | 0.2 | -0.1 |
| 323 Nursing Associate Professionals | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 |
| 331 Finance and Sales Associate Professionals | 0.3 | 0.4 | 0.1 | 0.3 | 0.0 |
| 332 Administrative Associate Professionals | 0.4 | 0.6 | 0.1 | 0.4 | 0.1 |
| 333 Government Associate Professionals | 0.5 | 0.6 | 0.4 | 0.5 | 0.3 |
| 334 Social Work Associate Professionals | 0.1 | 0.2 | 0.1 | 0.1 | -0.1 |
| 335 Careers and Employment Advisors | 0.2 | 0.3 | 0.2 | 0.2 | 0.1 |
| 336 Writers, Artists, Entertainment & Sports Associate Professionals | 0.1 | 0.2 | -0.1 | 0.1 | -0.4 |
| 337 Non-Ordained Religious Associate Professionals | -1.1 | -0.7 | -1.6 | -1.1 | -0.4 |
| 338 Environmental Protection Associate Professionals | 0.3 | 0.3 | 0.5 | 0.4 | -0.1 |

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

| Occupation (NZSCO90 Minor Groups) | Standardised NZSEI Scores All | Male | Fem. | Euro. | Maori |
|---|---|---|---|---|---|
| 411 Secretaries and Keyboard Operating Clerks | -0.1 | 0.4 | -0.1 | -0.1 | -0.2 |
| 412 Numerical Clerks | -0.2 | 0.2 | -0.3 | -0.2 | -0.2 |
| 413 Material Recording and Transport Clerks | -0.1 | 0.0 | -0.3 | -0.1 | -0.2 |
| 414 Library, Mail and Related Clerks | -0.2 | 0.0 | -0.3 | -0.2 | -0.3 |
| 421 Cashiers, Tellers and Related Clerks | -0.1 | 0.2 | -0.2 | -0.1 | -0.3 |
| 422 Client Information Clerks | -0.3 | 0.0 | -0.3 | -0.3 | -0.4 |
| 511 Travel Attendants and Guides | 0.2 | 0.1 | 0.2 | 0.2 | -0.1 |
| 512 Housekeeping and Restaurant Services Workers | -0.6 | -0.3 | -0.8 | -0.6 | -0.7 |
| 513 Personal Care Workers | -0.5 | -0.1 | -0.7 | -0.5 | -0.7 |
| 514 Other Personal Services Workers | -0.4 | 0.0 | -0.5 | -0.4 | -0.7 |
| 515 Protective Services Workers | 0.4 | 0.4 | 0.1 | 0.5 | 0.2 |
| 521 Salespersons and Demonstrators | -0.4 | -0.1 | -0.7 | -0.4 | -0.6 |
| 522 Street Vendors | 0.0 | 0.0 | -0.5 | -0.1 | 0.1 |
| 523 Fashion and Other Models | -0.7 | -0.2 | -0.9 | -0.9 | 0.0 |
| 611 Market Farmers and Crop Growers | -0.8 | -0.6 | -1.2 | -0.7 | -1.1 |
| 612 Market Oriented Animal Producers | -0.7 | -0.6 | -0.9 | -0.7 | -0.8 |
| 613 Forestry and Related Workers | -0.3 | -0.2 | -0.9 | -0.2 | -0.4 |
| 614 Fishery Workers, Hunters and Trappers | -0.2 | -0.2 | -0.7 | -0.2 | -0.6 |
| 711 Building Frame and Related Trades Workers | -0.1 | -0.1 | -0.5 | -0.1 | -0.2 |
| 712 Building Finishers and Related Trades Workers | 0.0 | 0.1 | -0.6 | 0.1 | -0.2 |
| 713 Electricians | 0.1 | 0.1 | -0.5 | 0.1 | 0.0 |
| 721 Metal Moulders, Sheet-Metal and Related Workers | -0.1 | 0.0 | -0.7 | 0.0 | -0.2 |
| 722 Blacksmiths, Toolmakers and Related Workers | 0.2 | 0.2 | -0.2 | 0.2 | 0.1 |
| 723 Machinery Mechanics and Fitters | 0.0 | 0.0 | -0.4 | 0.0 | -0.1 |
| 724 Electrical and Electronic Instrument Mechanics and Fitters | 0.2 | 0.2 | -0.4 | 0.2 | 0.0 |
| 731 Precision Instrument Makers and Related Workers | -0.1 | 0.0 | -0.4 | -0.1 | -0.4 |
| 732 Glass Cutters and Related Workers | 0.1 | 0.1 | -0.3 | 0.1 | -0.1 |
| 733 Printing Trades Worker | 0.0 | 0.2 | -0.3 | 0.1 | -0.2 |
| 741 Food and Related Products Processing Trades Workers | -0.3 | -0.1 | -0.7 | -0.2 | -0.4 |
| 742 Cabinet Makers and Related Workers | -0.2 | -0.2 | -0.6 | -0.2 | -0.4 |
| 743 Tailors and Dressmakers | -0.3 | -0.2 | -0.8 | -0.3 | -0.5 |
| 744 Leather Goods Makers | -0.5 | -0.4 | -0.8 | -0.5 | -0.7 |
| 811 Mining and Mineral Processing Plant Operators | 0.0 | 0.0 | -0.5 | 0.0 | -0.1 |
| 812 Metal-Processing Plant Operators | -0.1 | -0.1 | -0.6 | 0.0 | -0.2 |
| 813 Glass and Ceramics Kiln and Related Plant Operators | -0.5 | -0.4 | -0.8 | -0.6 | -0.4 |
| 814 Wood-Processing and Papermaking Plant Operators | 0.1 | 0.1 | -0.5 | 0.1 | 0.1 |
| 815 Chemical Processing Plant Operators | 0.1 | 0.2 | -0.4 | 0.2 | -0.2 |
| 816 Power Generating and Related Plant Operators | 0.4 | 0.4 | 0.0 | 0.4 | 0.1 |
| 821 Metal and Mineral Products Processing Machine Operators | -0.3 | -0.2 | -0.7 | -0.2 | -0.4 |
| 822 Chemical Products Machine Operators | -0.4 | -0.3 | -0.5 | -0.4 | -0.6 |
| 823 Rubber and Plastics Products Machine Operators | -0.3 | -0.3 | -0.7 | -0.3 | -0.5 |
| 824 Wood Products Machine Operators | -0.3 | -0.2 | -0.6 | -0.2 | -0.3 |
| 825 Paper Products Machine Operators | -0.3 | -0.2 | -0.7 | -0.1 | -0.5 |
| 826 Textile Products Machine Operators | -0.7 | -0.3 | -0.9 | -0.7 | -0.8 |
| 827 Food and Related Products Processing Machine Operators | -0.3 | -0.2 | -0.7 | -0.2 | -0.4 |
| 828 Leather and Related Products Processors | -0.4 | -0.3 | -0.6 | -0.3 | -0.4 |
| 829 Assemblers | -0.2 | -0.1 | -0.8 | -0.2 | -0.3 |
| 831 Railway Engine Drivers and Related Workers | 0.4 | 0.4 | -0.2 | 0.4 | 0.4 |
| 832 Motor Vehicle Drivers | -0.3 | -0.2 | -0.6 | -0.2 | -0.4 |
| 833 Agricultural, Earthmoving & Other Materials-Handling Equip. Operators | -0.2 | -0.2 | -0.6 | -0.2 | -0.3 |
| 834 Ships' Deck Crews and Related Workers | 0.1 | 0.1 | -1.0 | 0.0 | 0.1 |

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

| Occupation (NZSCO90 Minor Groups) | Standardised NZSEI Scores All | Male | Fem. | Euro. | Maori |
|---|---|---|---|---|---|
| 841 Building and Related Workers | -0.1 | -0.1 | -0.4 | -0.1 | -0.2 |
| 911 Building Caretakers and Cleaners | -0.6 | -0.4 | -0.9 | -0.6 | -0.8 |
| 912 Messengers and Doorkeepers | -0.2 | -0.1 | -0.6 | -0.1 | -0.3 |
| 913 Refuse Collectors and Related Labourers | -0.3 | -0.3 | -0.4 | -0.3 | -0.5 |
| 914 Packers and Freight Handlers | -0.4 | -0.2 | -0.9 | -0.3 | -0.5 |
| 915 Labourers | -0.5 | -0.5 | -0.9 | -0.5 | -0.6 |

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

*Appendix E*

# NZSEI results: NZSCO68

| Occupation (NZSCO68 Minor and Major Groups) | | | Major Group | Minor Group | Count |
|---|---|---|---|---|---|
| 0/1 | Professional, Technical and Related Workers | | 66 | | |
| | 01 | Physical Scientists and Related Technicians | | 65 | 4758 |
| | 02/03 | Architects, Engineers and Related Technicians | | 68 | 34593 |
| | 04 | Aircraft and Ships Officer | | 69 | 2271 |
| | 05 | Life Scientists and Related Technicians | | 62 | 5787 |
| | 06/07 | Medical, Dental, Veterinary and Related Workers | | 65 | 39396 |
| | 08 | Statisticians, Mathematicians, Systems Analysts and Related Technicians | | 73 | 5424 |
| | 09 | Economists | | 75 | 2955 |
| | 11 | Accountants | | 73 | 16278 |
| | 12 | Jurists | | 90 | 6510 |
| | 13 | Teachers | | 68 | 49074 |
| | 14 | Workers in Religion | | 26 | 3261 |
| | 15 | Authors, Journalists and Related Writers | | 59 | 4644 |
| | 16 | Sculptors, Painters, Photographers and Related Creative Artists | | 38 | 5124 |
| | 17 | Composers and Performing Artists | | 48 | 2856 |
| | 18 | Athletes, Sportsmen/Sportswomen and Related Workers | | 35 | 1254 |
| | 19 | Professional, Technical and Related Workers N.E.C. | | 56 | 15588 |
| 2 | Administrative and Managerial Workers | | 64 | | |
| | 20 | Legislative Officials and Government Administrators | | 88 | 606 |
| | 21 | Managers | | 64 | 74310 |
| 3 | Clerical and Related Workers | | 37 | | |
| | 30 | Clerical Supervisors | | 48 | 20733 |
| | 31 | Government Executive Officials | | 65 | 4137 |
| | 32 | Stenographers, Typists and Card and Tape Punching Machine Operators | | 36 | 24951 |
| | 33 | Bookkeepers, Cashiers and Related Workers | | 35 | 37224 |
| | 34 | Computing Machine Operators | | 38 | 5835 |
| | 35 | Transport and Communications Supervisors | | 51 | 4728 |
| | 36 | Transport Conductors | | 38 | 84 |
| | 37 | Mail Distribution Clerks | | 32 | 5496 |
| | 38 | Telephone and Telegraph Operators | | 30 | 2451 |
| | 39 | Clerical and Related Workers N.E.C. | | 33 | 57759 |
| 4 | Sales Workers | | 36 | | |
| | 40 | Managers (Wholesale and Retail Trade) | | 39 | 14538 |
| | 41 | Working Proprietors (Wholesale and Retail Trade) | | 20 | 16926 |
| | 42 | Sales Supervisors and Buyers | | 47 | 6387 |
| | 43 | Technical Salespersons, Commercial Travellers and Manufacturers' Agents | | 53 | 20595 |
| | 44 | Insurance, Real Estate and Securities Salespersons and Auctioneers | | 53 | 14640 |
| | 45 | Salespersons, Shop Assistants and Related Workers | | 22 | 34446 |
| | 49 | Sales Workers N.E.C. | | 24 | 90 |

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

| Occupation (NZSCO68 Minor and Major Groups) | | | Major Group | Minor Group | Count |
|---|---|---|---|---|---|
| 5 | Service Workers | | 26 | | |
| | 50 | Managers (Catering and Lodging Services) | | 31 | 3312 |
| | 51 | Working Proprietors (Catering and Lodging Services) | | 11 | 9117 |
| | 52 | Housekeeping and Related Service Supervisors | | 20 | 1068 |
| | 53 | Cooks, Waiters/Waitresses, Bartenders and Related Workers | | 16 | 14292 |
| | 54 | House Staff and Related Housekeeping Service Workers N.E.C. | | 11 | 6924 |
| | 55 | Building Caretakers, Charworkers, Cleaners and Related Workers | | 14 | 9765 |
| | 56 | Launderers, Dry-cleaners and Pressers | | 13 | 2262 |
| | 57 | Hairdressers, Barbers, Beauticians and Related Workers | | 25 | 4500 |
| | 58 | Protective Service Workers | | 54 | 19515 |
| | 59 | Service Workers N.E.C. | | 26 | 10434 |
| 6 | Agricultural, Animal Husbandry and Forestry Workers, Fishermen and Hunters | | 13 | | |
| | 60 | Farm Managers and Supervisors | | 31 | 4194 |
| | 61 | Farmers | | 11 | 61161 |
| | 62 | Agricultural and Animal Husbandry Workers | | 10 | 29307 |
| | 63 | Forestry Workers | | 33 | 4194 |
| | 64 | Fishermen, Hunters and Related Workers | | 30 | 2676 |
| 7/8/9 | Production and Related Workers, Transport Equipment Operators and Labourers | | 33 | | |
| | 70 | Production Supervisors and General Foremen/Forewomen | | 50 | 5517 |
| | 71 | Miners, Quarrymen, Well Drillers and Related Workers | | 35 | 1191 |
| | 72 | Metal Processors | | 37 | 1821 |
| | 73 | Wood Preparation Workers and Paper Makers | | 33 | 4764 |
| | 74 | Chemical Processers and Related Workers | | 39 | 1590 |
| | 75 | Spinners, Weavers, Knitters, Dyers and Related Workers | | 21 | 2913 |
| | 76 | Tanners, Fellmongers and Pelt Dressers | | 29 | 780 |
| | 77 | Food and Beverage Processers | | 28 | 22770 |
| | 78 | Tobacco Preparers and Tobacco Product Makers | | 13 | 75 |
| | 79 | Tailors, Dressmakers, Sewers, Upholsterers and Related Workers | | 11 | 13359 |
| | 80 | Shoemakers and Leather Goods Makers | | 16 | 1293 |
| | 81 | Cabinet Makers and Related Woodworkers | | 29 | 3912 |
| | 82 | Stone Cutters and Carvers | | 40 | 222 |
| | 83 | Blacksmiths, Toolmakers and Machine Tool Operators | | 34 | 4716 |
| | 84 | Machinery Fitters, Machine Assemblers and Precision Instrument Makers | | 43 | 33255 |
| | 85 | Electrical Fitters and Related Electrical and Electronic Workers | | 50 | 20268 |
| | 86 | Broadcasting Station and Sound Equipment Operators and Cinema Projectionists | | 53 | 591 |
| | 87 | Plumbers, Welders, Sheet-metal and Structural Metal Preparers and Erectors | | 38 | 15432 |
| | 88 | Jewellery and Precious Metal Workers | | 32 | 852 |
| | 89 | Glass Formers, Potters and Related Workers | | 21 | 1497 |
| | 90 | Rubber and Plastics Products Makers | | 26 | 3279 |
| | 91 | Paper and Paperboard Products Makers | | 25 | 714 |
| | 92 | Printers and Related Workers | | 40 | 8277 |
| | 93 | Painters | | 31 | 10395 |
| | 94 | Production and Related Workers N.E.C. | | 35 | 2721 |
| | 95 | Bricklayers, Carpenters and Other Construction Workers | | 36 | 33252 |
| | 96 | Stationary Engine and Related Equipment Operators | | 56 | 2064 |
| | 97 | Material Handling & Related Equipment Operators, Dockers & Freight Handlers | | 25 | 23514 |
| | 98 | Transport Equipment Operators | | 31 | 29796 |
| | 99 | Labourers N.E.C. | | 17 | 24834 |

Note: NZSEI scores replaced with a '-' have 15 or fewer observations.

*Appendix F*

# Description of the algorithm

Here we provide a more detailed description of the alternating least squares algorithm than in Section 3.2. The algorithm is also described by Jan de Leeuw in Appendix C of Ganzeboom et al (1992).

The path model can be represented by three linear regression equations.

$$i = \beta_{41} a + \beta_{42} e + \beta_{43} o + \varepsilon$$
$$o = \beta_{31} a + \beta_{32} e + \varepsilon$$
$$e = \beta_{21} a + \varepsilon$$

i, e and a are normalised income, education and age variables, and o is our unknown occupational SES variable, also normalised. The beta coefficients represent the arrows on the path diagram.

By changing the values of o we alter the relationships between the three observable variables. What we want to do therefore is assign each individual an o score such that we get a minimal $\beta_{42}$. Since we are interested in an occupation-based SES scale, we have an added restriction that everyone in an occupation will have the same o score.

In order to approximate a minimal $\beta_{42}$, the loss function we minimise is the total residual sum of squares, $\sigma_N$, for the model with the education-income path represented by $\beta_{42}$ left out. Each of the variables can be described as a (jx1) vector containing values for each of the j people in the population. As input to the algorithm at each iteration we have vectors $\underline{i}$, $\underline{a}$, $\underline{e}$ and the SES estimate, $\underline{o}$.

$$\sigma_N = \left\| \underline{i} - (\beta_{41} \underline{a} + \beta_{43} \underline{o}) \right\|^2 + \left\| \underline{o} - (\beta_{31} \underline{a} + \beta_{32} \underline{e}) \right\|^2 + \left\| \underline{e} - \beta_{21} \underline{a} \right\|^2$$

This can also be written as:

$$\sigma_N = \sum_j [(i_j - \beta_{41} a_j - \beta_{43} o_j)^2 + (o_j - \beta_{31} a_j - \beta_{32} e_j)^2 + (e_j - \beta_{21} a_j)^2]$$
$$= \sum_j [(i_j - \beta_{41} a_j - \beta_{43} h_{jk} \gamma_k)^2 + (h_{jk} \gamma_k - \beta_{31} a_j - \beta_{32} e_j)^2 + (e_j - \beta_{21} a_j)^2]$$

The alternating least squares algorithm alternates between two steps in each iteration. The first step is to derive optimal transformations (beta coefficients) based on given SES scores. In the second step we derive SES values, optimal on our loss function, for the transformations calculated in the first step. The steps are alternated until the algorithm converges. Since in each iteration we are improving on the results of the previous iteration, the loss function we are minimising necessarily reduces. The loss function, $\sigma_N$, has a lower bound of zero, and therefore the algorithm will always converge.

To initialise the $\underline{o}^{(0)}$ vector before the first iteration of the algorithm we decide on initial income and education weights (we used 0.5 for both, but experimented with other values), and from these construct a vector of weighted averages of income and education. This is then averaged over each occupation and normalised to give us our initial SES estimate, $\underline{o}^{(0)}$.

We represent $\underline{o}^{(0)}$, which contains the occupation SES estimates for each individual in the sample, as being equal to $H\underline{\gamma}^{(0)}$, where $\underline{\gamma}^{(0)}$ is the (kx1) vector containing the SES estimates for each of the k occupations represented in the sample and H is the dummy corresponding to $\underline{o}^{(0)}$.

i.e.

$$\begin{bmatrix} o_1 \\ o_2 \\ \vdots \\ \vdots \\ \vdots \\ \vdots \\ \vdots \\ \vdots \\ o_j \end{bmatrix} = \begin{bmatrix} \gamma_1 \\ \gamma_1 \\ \vdots \\ \gamma_1 \\ \gamma_2 \\ \vdots \\ \gamma_k \\ \vdots \\ \gamma_k \end{bmatrix} = \begin{bmatrix} 1 & 0 & \cdots & 0 \\ 1 & 0 & \cdots & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 1 & 0 & \cdots & 0 \\ 0 & 1 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \cdots & 1 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \cdots & 1 \end{bmatrix} \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \vdots \\ \gamma_k \end{bmatrix}$$

After initialising $\underline{o}^{(0)}$, the next step is to calculate the beta coefficients for the three regressions, with the $\beta_{42}$ path excluded. These five coefficients represent our initial beta estimates, $\beta^{(0)}$.

Next we revise our SES estimates by minimising $s_N$ over $\underline{\gamma}^{(0)}$. A minimum point, $\underline{\gamma}'$ is calculated by differentiating $s_N$ by $\underline{\gamma}^{(0)}$.

$$\frac{d\sigma_N}{d\underline{\gamma}} = \sum_j [2\beta_{43}^2 \underline{h}_j^2 \underline{\gamma} + 2\beta_{41}\beta_{43} a_j \underline{h}_j - 2\beta_{43} i_j \underline{h}_j + 2\underline{h}_j^2 \underline{\gamma} - 2\beta_{31} a_j \underline{h}_j - 2\beta_{32} e_j \underline{h}_j]$$

$$= 2\sum_j [(\beta_{43}^2 + 1)\underline{h}_j^2 \underline{\gamma} - \beta_{43}(i_j - \beta_{41} a_j)\underline{h}_j - \beta_{31} a_j \underline{h}_j - \beta_{32} e_j \underline{h}_j]$$

The resulting equation is set equal to zero, allowing us to calculate an optimal $\underline{\gamma}'$.

$$\underline{0} = 2[(\beta_{43}^2 + 1)H^T H\underline{\gamma}' - \beta_{43} H^T(\underline{i} - \beta_{41}\underline{a}) - \beta_{31} H^T \underline{a} - \beta_{32} H^T \underline{e}]$$

$$= (\beta_{43}^2 + 1)H^T H\underline{\gamma}' - H^T(\beta_{43}(\underline{i} - \beta_{41}\underline{a}) + \beta_{31}\underline{a} + \beta_{32}\underline{e})$$

$$(\beta_{43}^2 + 1)H^T H\underline{\gamma}' = H^T(\beta_{43}(\underline{i} - \beta_{41}\underline{a}) + \beta_{31}\underline{a} + \beta_{32}\underline{e})$$

$$\underline{\gamma}' = \frac{(H^T H)^{-1} H^T(\beta_{43}(\underline{i} - \beta_{41}\underline{a}) + \beta_{31}\underline{a} + \beta_{32}\underline{e})}{(\beta_{43}^2 + 1)}$$

The $\underline{\gamma}'$ scores are then used to derive a vector $\underline{o}'$, which is normalised to obtain a new SES estimate, $o^{(1)}$.

$$\underline{o}' = H\underline{\gamma}'$$

$$= \frac{1}{(\beta_{43}^2 + 1)} \; H(H^T H)^{-1} H^T \; (\beta_{43}(\underline{i} - \beta_{41}\underline{a}) + \beta_{31}\underline{a} + \beta_{32}\underline{e})$$

The $\beta_{42}^{(1)}$ coefficient is next calculated by regressing i on a, e, and $o^{(1)}$. The $o^{(1)}$ scores become the estimates for the next iteration, $\underline{o}^{(0)}$, and the process is repeated. The algorithm converges to a stationary $\beta_{42}$, stopped in our case when the difference between the new $\beta_{42}$ estimate and the last is less than 0.01.

The technique described doesn't actually minimise $\beta_{42}$, or correspondingly maximise $\beta_{43}\beta_{42}$. Instead we minimise the residual sum of squares of the saturated model, with $\beta_{42}$ included, plus the square of our usual least squares estimate for $\beta_{42}$. So, we are minimising $\sigma_n$ where:

$$\sigma_n = \min_{\beta_{42}} \sigma_s + \hat{\beta}_{42}^2$$

While this is roughly the same as minimising $\beta_{42}$, it is not identical.

Although assigning a different criterion would result in a different solution, any such differences should not be large.

*Appendix G*

# Elley-Irving classes by NZSCO90

| Occupation (NZSCO90 Minor Groups) | Elley-Irving Index 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 011 Armed Forces | - | - | - | 100% | - | - |
| 111 Legislators | 100% | - | - | - | - | - |
| 112 Senior Government Administrators | 42% | 58% | - | - | - | - |
| 113 Senior Business Administrators | - | 100% | - | - | - | - |
| 114 Special-Interest Organisation Administrators | - | 100% | - | - | - | - |
| 121 General Managers | - | 100% | - | - | - | - |
| 122 Specialised Managers | - | 44% | 32% | 24% | - | - |
| 211 Physicists, Chemists and Related Professionals | 100% | - | - | - | - | - |
| 212 Mathematicians, Statisticians and Related Professionals | 100% | - | - | - | - | - |
| 213 Computing Professionals | 33% | 67% | - | - | - | - |
| 214 Architects, Engineers and Related Professionals | 79% | 11% | 11% | - | - | - |
| 221 Life Science Professionals | 100% | - | - | - | - | - |
| 222 Health Professionals (except Nursing) | 85% | 15% | - | - | - | - |
| 223 Nursing and Midwifery Professionals | - | - | 100% | - | - | - |
| 231 Tertiary Teaching Professionals | 100% | - | - | - | - | - |
| 232 Secondary Teaching Professionals | 100% | - | - | - | - | - |
| 233 Primary and Early Childhood Teaching Professionals | - | 100% | - | - | - | - |
| 234 Special Education Teaching Professionals | - | 100% | - | - | - | - |
| 235 Other Teaching Professionals | 25% | 75% | - | - | - | - |
| 241 Business Professionals | 86% | 14% | - | - | - | - |
| 242 Legal Professionals | 100% | - | - | - | - | - |
| 243 Archivists, Librarians and Related Information Professionals | 100% | - | - | - | - | - |
| 244 Social and Related Science Professionals | 80% | 20% | - | - | - | - |
| 245 Religious Professionals | - | - | 100% | - | - | - |
| 311 Physical Science and Engineering Technicians | - | 68% | 32% | - | - | - |
| 312 Computer Equipment Controllers | - | 57% | 43% | - | - | - |
| 313 Optical and Electronic Equipment Controllers | - | 39% | 48% | 13% | - | - |
| 314 Ship and Aircraft Controllers and Technicians | 70% | 15% | 15% | - | - | - |
| 315 Safety and Health Inspectors | - | 57% | 31% | - | - | 12% |
| 321 Life Science Technicians and Related Workers | - | 100% | - | - | - | - |
| 322 Health Associate Professionals | - | 74% | 26% | - | - | - |
| 323 Nursing Associate Professionals | - | - | 14% | 86% | - | - |
| 331 Finance and Sales Associate Professionals | - | - | 50% | 50% | - | - |
| 332 Administrative Associate Professionals | - | 57% | 43% | - | - | - |
| 333 Government Associate Professionals | - | 100% | - | - | - | - |
| 334 Social Work Associate Professionals | - | 100% | - | - | - | - |
| 335 Careers and Employment Advisors | - | 100% | - | - | - | - |
| 336 Writers, Artists, Entertainment & Sports Associate Professionals | - | 29% | 42% | 29% | - | - |
| 337 Non-Ordained Religious Associate Professionals | - | - | 100% | - | - | - |
| 338 Environmental Protection Associate Professionals | - | 66% | - | 34% | - | - |

| Occupation (NZSCO90 Minor Groups) | Elley-Irving Index 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 411 Secretaries and Keyboard Operating Clerks | - | 60% | 40% | - | - | - |
| 412 Numerical Clerks | - | - | 100% | - | - | - |
| 413 Material Recording and Transport Clerks | - | - | 25% | 75% | - | - |
| 414 Library, Mail and Related Clerks | - | - | 81% | 19% | - | - |
| 421 Cashiers, Tellers and Related Clerks | - | - | 100% | - | - | - |
| 422 Client Information Clerks | - | 12% | 54% | 34% | - | - |
| 511 Travel Attendants and Guides | - | - | - | 38% | 62% | - |
| 512 Housekeeping and Restaurant Services Workers | - | - | - | 58% | 16% | 27% |
| 513 Personal Care Workers | - | - | - | - | 100% | - |
| 514 Other Personal Services Workers | - | - | 24% | 76% | - | - |
| 515 Protective Services Workers | - | 64% | 20% | 16% | - | - |
| 521 Salespersons and Demonstrators | - | - | - | 100% | - | - |
| 522 Street Vendors | - | - | - | 100% | - | - |
| 523 Fashion and Other Models | - | - | - | 100% | - | - |
| 611 Market Farmers and Crop Growers | - | - | - | 43% | - | 57% |
| 612 Market Oriented Animal Producers | - | - | - | 75% | - | 25% |
| 613 Forestry and Related Workers | - | - | - | - | 69% | 31% |
| 614 Fishery Workers, Hunters and Trappers | - | - | - | 81% | 19% | - |
| 711 Building Frame and Related Trades Workers | - | - | - | 100% | - | - |
| 712 Building Finishers and Related Trades Workers | - | - | 16% | 34% | 50% | - |
| 713 Electricians | - | - | - | 100% | - | - |
| 721 Metal Moulders, Sheet-Metal and Related Workers | - | - | 38% | - | 62% | - |
| 722 Blacksmiths, Toolmakers and Related Workers | - | - | 100% | - | - | - |
| 723 Machinery Mechanics and Fitters | - | - | 22% | 78% | - | - |
| 724 Electrical and Electronic Instrument Mechanics and Fitters | - | - | 100% | - | - | - |
| 731 Precision Instrument Makers and Related Workers | - | - | 30% | 52% | 18% | - |
| 732 Glass Cutters and Related Workers | - | - | - | 100% | - | - |
| 733 Printing Trades Worker | - | - | 39% | 62% | - | - |
| 741 Food and Related Products Processing Trades Workers | - | - | - | 100% | - | - |
| 742 Cabinet Makers and Related Workers | - | - | - | 100% | - | - |
| 743 Tailors and Dressmakers | - | - | - | - | 100% | - |
| 744 Leather Goods Makers | - | - | - | - | - | 100% |
| 811 Mining and Mineral Processing Plant Operators | - | - | - | 17% | 83% | - |
| 812 Metal-Processing Plant Operators | - | - | - | 32% | 68% | - |
| 813 Glass and Ceramics Kiln and Related Plant Operators | - | - | - | - | 67% | 33% |
| 814 Wood-Processing and Papermaking Plant Operators | - | - | 43% | - | 11% | 46% |
| 815 Chemical Processing Plant Operators | - | - | 30% | 16% | 54% | - |
| 816 Power Generating and Related Plant Operators | - | 37% | 53% | 11% | - | - |
| 821 Metal and Mineral Products Processing Machine Operators | - | - | - | 25% | 75% | - |
| 822 Chemical Products Machine Operators | - | - | - | 57% | 43% | - |
| 823 Rubber and Plastics Products Machine Operators | - | - | 47% | 53% | - | - |
| 824 Wood Products Machine Operators | - | - | 20% | 17% | 63% | - |
| 825 Paper Products Machine Operators | - | - | 17% | 27% | 57% | - |
| 826 Textile Products Machine Operators | - | - | - | - | 77% | 23% |
| 827 Food and Related Products Processing Machine Operators | - | - | - | 88% | - | 12% |
| 828 Leather and Related Products Processors | - | - | 14% | - | 46% | 40% |
| 829 Assemblers | - | - | - | 22% | 50% | 28% |
| 831 Railway Engine Drivers and Related Workers | - | - | 100% | - | - | - |
| 832 Motor Vehicle Drivers | - | - | - | - | 100% | - |
| 833 Agricultural, Earthmoving & Other Materials-Handling Equipment Operators | - | - | - | 12% | 88% | - |
| 834 Ships' Deck Crews and Related Workers | - | - | 100% | - | - | - |

| Occupation (NZSCO90 Minor Groups) | Elley-Irving Index 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 841 Building and Related Workers | - | - | 15% | 85% | - | - |
| 911 Building Caretakers and Cleaners | - | - | - | - | 42% | 58% |
| 912 Messengers and Doorkeepers | - | - | - | 59% | 26% | 15% |
| 913 Refuse Collectors and Related Labourers | - | - | - | - | - | 100% |
| 914 Packers and Freight Handlers | - | - | - | 100% | - | - |
| 915 Labourers | - | - | - | - | - | 100% |