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New Zealand socio-economic index 2006

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Abbreviations used in this report

ANU4	Australian National University occupational status scale 4
ANZSCO	Australian and New Zealand Standard Classification of Occupations
AUSEI	Australian socio-economic index
AUSEI06	Australian socio-economic index 2006
ISEI	International socio-economic index
ISEI-88	International socio-economic index 1988
ISCO88	International Standard Classification of Occupations 1988
NZDep	NZDep index of deprivation
NZDep2006	NZDep index of deprivation 2006
NZiDep	New Zealand index of socioeconomic deprivation for individuals
NZSEI	New Zealand socio-economic index
NZSEI-06	New Zealand socio-economic index 2006
NZSEI-91	New Zealand socio-economic index 1991
NZSEI-96	New Zealand socio-economic index 1996
NZSCO90	New Zealand Standard Classification of Occupations 1990
NZSCO95	New Zealand Standard Classification of Occupations 1995
SES	Socio-economic status

Executive summary

This report describes the construction and initial assessment of the New Zealand socio-economic index 2006 (NZSEI-06), which is an update of the New Zealand socio-economic index (NZSEI) using 2006 Census data. Both NZSEI-06 socio-economic scores (ranging from 10–90) and NZSEI-06 socio-economic groups (a six-group classification, NZSEI-06 quartiles and NZSEI-06 deciles) are described and evaluated.

Section 1 describes the construction of the previous NZSEI indexes – NZSEI-91 derived from 1991 Census data and NZSEI-96 derived from 1996 Census data. The validation of the most-recent NZSEI-96 is also summarised. Issues to be considered in the development of NZSEI-06 are described. These include:

(i) transforming the scale to reduce skew
(ii) re-assessing the need to adjust the incomes of self-employed workers
(iii) using the recently-adopted Australian and New Zealand Standard Classification of Occupations (ANZSCO) system to classify occupations, as a replacement for the system used in previous versions of NZSEI – the New Zealand Standard Classification of Occupations (eg, NZSCO90 and NZSCO95)
(iv) examining whether the path coefficients for the education-occupation and occupation-income paths are closer to international scales than was the case for NZSEI-96
(v) validating results for a wider range of New Zealand ethnic groups than Māori versus non-Māori.

Section 2 describes the variables used to construct NZSEI-06, and cross-tabulates relevant demographic data from the 2006 Census against these variables.

Section 3 describes the construction of NZSEI-06. An 'interim' scale is first constructed using data for full-time workers only (21–69-year-olds). The finalised scale is then constructed using data for both full- and part-time workers, with income adjustments for those in part-time work. There was little evidence that the incomes of self-employed workers were underestimated. As such, the finalised scale did not include any inflation of the incomes of self-employed workers, as had been undertaken in NZSEI-96 and international scales, eg, the Australian socio-economic index (AUSEI06). The beta values obtained during construction of NZSEI-06 are presented for each of the regression paths estimated, and comparisons with the AUSEI06 and the international socio-economic index (ISEI) are made. The beta values for the education-occupation and the occupation-income paths were found to be far closer to the AUSEI06 and ISEI values than had been the case for NZSEI-96. Pragmatic ways to divide NZSEI-06 scores into discrete categorical occupational socio-economic groups are described in this section. Four-group, six-group, and 10-group categorisations are described.

Section 4 describes four assessments of the finalised NZSEI-06.

First, a comparison between NZSEI-06 and the earlier NZSEI-96 showed that both scales classified individuals from the 2006 Census similarly, but not identically.

Second, a comparison between NZSEI-06 and AUSEI06 showed that the scales classified occupations very similarly, suggesting both that NZSEI-06 is robust and that the socio-economic structure of the New Zealand and Australian workforces is similar.

Third, an assessment was undertaken of whether NZSEI-06 methodology assigns scores similarly for males and females, and similarly for different ethnic groups. This showed that, despite some differences in average scores between males and females and between different ethnic groups, occupations were classified very similarly by sex-specific

and ethnic-specific scales, suggesting NZSEI-06 is applicable to both sexes and to these ethnic groups.

Fourth, validation of NZSEI-06 against four constructs – smoking, housing tenure, motor vehicle access, and residential deprivation – revealed expected socio-economic patterning for each of these outcomes, with results clearest for smoking and residential deprivation.

Section 5 compares two methods for imputing NZSEI-06 scores when data on occupation are unavailable:

- a method based on the average NZSEI-06 score by age and education
- a method using the results of a regression model of NZSEI-06 against age and education.

An evaluation of these methods against actual scores, and validation of both methods against health and socio-economic correlates, revealed that there was little to separate the two methods. However, both methods produced a restricted range of scores compared with the actual NZSEI-06, suggesting that neither was suitable for the assignment of socio-economic groups. It is suggested that in the absence of other evidence to choose between them, and in the absence of other 'proxy' information, such as previous occupation, the simplicity of the 'averages' method favours it as the preferred approach.

Section 6 concludes the report, with a summary of key findings and their implications for future work in the assessment of occupation-based socio-economic status, as well as a discussion of advantages and disadvantages of the scale.

Using NZSEI-06

Readers wishing to use NZSEI-06 without learning about its background and construction should see appendixes III to V.

Appendix III presents a list of NZSEI-06 scores for each ANZSCO major, sub-major, and minor group occupation.

Appendix IV presents a list of NZSEI-06 groups for each ANZSCO minor group occupation.

Appendix V presents some brief notes on how to use NZSEI-06 and a table of 'imputed' NZSEI-06 scores to be used for individuals for whom there are no occupational data.

1 Introduction and background to the report

This report describes the construction of an updated version of the New Zealand socio-economic index (NZSEI), an occupation-based measure of socio-economic status (SES). The original version, NZSEI-91, was derived using 1991 Census data (Davis, McLeod, Ransom, & Ongley, P, 1997), while the follow-up, NZSEI-96, was derived using 1996 Census data (Davis, Jenkin, & Coope, 2003). The updated version described in this report, NZSEI-06, is derived using 2006 Census data and uses a new classification system for occupation, the Australian and New Zealand Standard Classification of Occupations (ANZSCO). This section describes the development of NZSEI, including some results from the most recent NZSEI-96, and outlines the issues to be tackled in the construction of NZSEI-06.

1.1 Development of NZSEI

Theoretical basis

The forerunner of NZSEI was the widely-used Elley-Irving scale (Elley and Irving 1972; 1976; 1985; Irving and Elley, 1977), which assigned occupations into one of six SES groups based on equal weighting of the education-level and income associated with each occupation. NZSEI represented an attempt to derive an occupation-based measure of SES for New Zealand that could be used both as a continuous or group measure, and was grounded on a conceptual model that differed slightly from the Elley-Irving framework, as described in the 'Statistical algorithm' section, below.

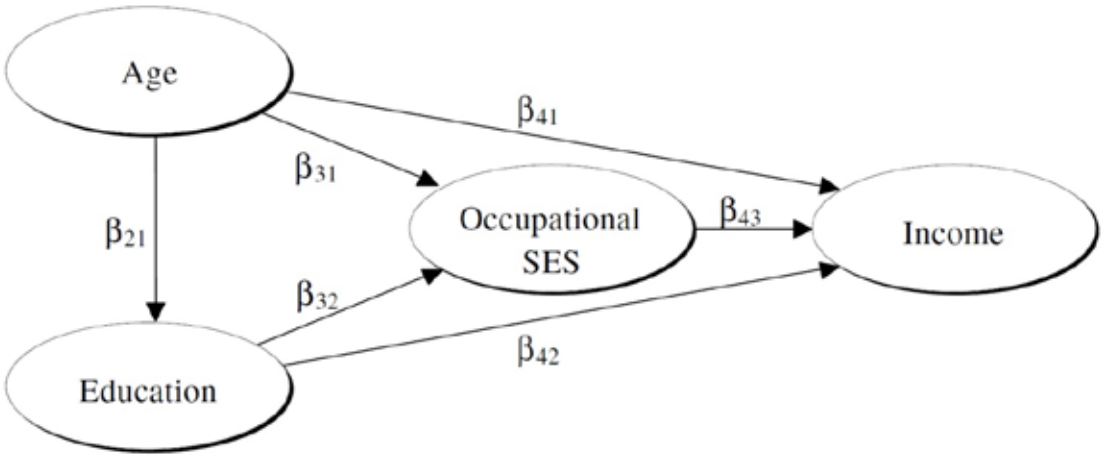
The framework used for NZSEI is the 'returns to human capital' model, which was first developed for the international socio-economic index (ISEI) (Ganzeboom, De-Graaf, Treiman, and De-Leeuw, 1992). This model posits that there is a relationship between cultural capital (ie, education) and material rewards (ie, income), and that this relationship is mediated through occupation. More simply, the 'returns to human capital' model views occupation as the means by which one's education is converted into income. Thus, differences in occupation are likely to represent differences in life chances and opportunity, and on this basis occupation can be used to stratify individuals according to socio-economic status.

Statistical algorithm

Operationalising the 'returns to human capital' model involves specifying the path model developed for the ISEI by De Leeuw in an appendix to Ganzeboom et al (1992). Regression equations are estimated iteratively such that the direct effect of education on income is minimised, while the indirect effect of education on income that is mediated by occupation is maximised. Occupational scores that maximise this mediated path are generated in the process. The effect of age is controlled in analyses because of its confounding relationship with education and income (ie, older people tend to have fewer qualifications but higher incomes). The model is represented in figure 1.

Figure 1

Representation of NZSEI path model



The arrows linking the variables are represented in the algorithm as regression coefficients. The model as a whole is represented by a series of linear regression equations. The assumption that the effect of education on income is largely mediated through occupation is implemented by setting β42 to zero, and then estimating the values of the unobserved values of occupational score together with the remaining beta coefficients by minimising the residual sum of squares. Once this minimisation is achieved, occupational scores are taken which essentially represent an optimal weighting of education and income, controlling for age. These scores are then scaled to range from 10–90 (to match the ISEI). Note that the approach taken with NZSEI algorithm contrasts with the Elley and Irving approach, in that for the Elley and Irving occupational SES scales the weighting of education and income is not optimised but is instead made equal.

Construction of NZSEI-91 and NZSEI-96

For NZSEI-91, the statistical algorithm was applied to data on age, income, and education from the 1991 Census (Davis et al, 1997) for occupations classified to minor group (three-digit) level of the 1990 version of the New Zealand Standard Classification of Occupations (NZSCO90) (Department of Statistics, 1992). For the updated NZSEI-96, the statistical algorithm was applied to data on age, income, and education from the 1996 Census (Davis et al, 2003) for occupations classified to minor group (three-digit) level of the 1995 version of the New Zealand Standard Classification of Occupations (NZSCO95) (Statistics NZ, 1995).

Data on age, income, and education were treated in the following way.

Age was coded in years for those in the workforce aged 21–69 years.

Income was taken as the total personal income (before tax) from all sources as recorded in income bands. For the purposes of analyses, a mid-point dollar value was taken for each band, with the mid-point for the upper ‘open-ended’ band assigned based on data on exact income derived from the Household Economic Survey. Log-values of income were taken to account for the skewed distribution of incomes.

Education was taken as the highest qualification, converted into years of education, using a scale provided by the Ministry of Education.

Results of the occupational scoring exercise

By way of background, construction details and descriptive results are presented here for NZSEI-96 only. Readers are referred to Davis et al (1997; 2003) for construction details and descriptive results for NZSEI-91.

NZSEI-96 scores were derived by analysing data from 1,315,395 full- and part-time workers aged 21–69 years. Scores were initially calculated for the full-time workforce alone, and then recalculated after adding in the part-time workforce. The incomes of part-time workers were inflated to a full-time equivalent, and the incomes of self-employed workers inflated to account for likely under-reporting of incomes. Final scores were assigned to 97 minor group (three-digit) occupations from NZSCO95, and scaled to range from 10 (low SES) for Textile Products Machinery Operators (minor group 826) to 90 (high SES) for Senior Business Administrators (minor group 113). NZSEI-96 scores for occupations at the sub-major group (two-digit) level of NZSCO95 are presented in table 1. Six SES 'groups' were determined from NZSEI-96 scores, based on cluster analysis and discriminant function analysis (see table 2).

To test the robustness of the NZSEI-96 scale, comparisons were undertaken between scales constructed separately for males and females, and for Māori and non-Māori. These comparisons revealed some minor sex and ethnic differences, but overall the scale classified occupations similarly for males and females, and for Māori and non-Māori.

Table 1

NZSEI-96 results aggregated at NZSCO95 sub-major group (two-digit level)

NZSCO95 code	NZSCO95 sub-major group	NZSEI-96 aggregated score
11	Legislators and Administrators	65
12	Corporate Managers	55
21	Physical, Mathematical, Engineering Science Professionals	58
22	Life Science and Health Professionals	59
23	Teaching Professionals	53
24	Other Professionals	61
31	Physical Science and Engineering Associate Professionals	48
32	Life Science and Health Associated Professionals	42
33	Other Associated Professionals	46
41	Office Clerks	31
42	Customer Service Clerks	28
51	Personal and Protective Services Workers	24
52	Salespersons and Demonstrators	22
61	Market Oriented Agriculture and Fishery Workers	30
71	Building Trades Workers	36
72	Metal and Machinery Trades Workers	35
73	Precision Trades Workers	34

Table 1 continued next page

Table 1 continued

NZSCO95	NZSCO95 sub-major group	NZSEI aggregated score
74	Other Craft and Related Trades Workers	26
81	Industrial Plant Operators	32
82	Stationary Machine Operators and Assemblers	20
83	Drivers and Mobile Machinery Operators	27
84	Building and Related Workers	29
91	Labourers and Related Elementary Service Workers	20

Source: Davis et al, 2003

Table 2

Distribution of workforce over NZSEI groups
1996

Group	NZSEI-96 range	Percent of population
1	66–90	6.3
2	56–65	6.6
3	42–55	27.6
4	32–41	20.5
5	24–31	18.7
6	10–23	20.2

Source: Davis et al, 2003

Validation of NZSEI-96

NZSEI-96 was tested against a number of health indicators (smoking prevalence, self-assessed health, and general practitioner visits) and socio-economic indicators (housing tenure, motor vehicle access, and household overcrowding) to see if it could replicate known socio-economic patterns for these indicators. NZSEI-96 validated well against all health indicators and against owning a home and motor vehicle car access, but did not distinguish individuals on household overcrowding, perhaps because this socio-economic indicator is most prevalent among those not in the workforce (Davis et al, 2003).

Extension of NZSEI to individuals outside the labour market

The construction of NZSEI-96 involved developing and testing methods for deriving scores for those not in paid employment. These involved methods to estimate 'occupational potential' (Jones and McMillan, 2001). Under this concept, in the absence of information on occupation, the three variables of age, education, and income can be used to determine occupational SES. While income cannot readily be used to determine SES for those outside of the workforce – since income is affected by employment status – the remaining variables of age and educational level may provide a close approximation of a person's potential position in the occupational hierarchy. Three methods to estimate occupational potential were undertaken for NZSEI-96, each involving assigning scores solely based on the age and education-level of respondents. These included:

(i) using the beta estimates for education and age derived from the path model equation

(ii) calculating the mean NZSEI-96 scores for each age by education-level category
(iii) regressing NZSEI-96 scores against age and education for those with an occupation.

The three different methods were evaluated by regressing actual NZSEI-96 scores against each of the imputed scores for a random 20 percent sample of the 1996 Census, and also by validating the imputed scores against smoking status. The mean and regression methods (methods (ii) and (iii)) were found to work best, and it was suggested that the mean method should be preferred because of its "intuitive appeal and underlying simplicity" (Davis et al, 2003, p83).

We will replicate the construction and evaluation of imputation methods (ii) and (iii) for NZSEI-06, as these were the two found to work best in the previous NZSEI-96.

1.2 Issues for resolution in NZSEI-06 study

Five issues will be addressed in the development of NZSEI-06:

(i) transforming the scale to reduce skew
(ii) re-assessing the need to adjust the incomes of self-employed workers
(iii) using the recently-adopted Australian and New Zealand Standard Classification of Occupations (ANZSCO) system to classify occupations, as a replacement for the system used in previous versions of NZSEI – the New Zealand Standard Classification of Occupations (eg, NZSCO90 and NZSCO95)
(iv) examining whether the path coefficients for the education-occupation and occupation-income paths are closer to international scales than was the case for NZSEI-96
(v) testing the applicability of NZSEI-06 for a wider range of New Zealand ethnic groups than only Māori versus non-Māori.

Transforming the scale

NZSEI-96 was left-skewed such that more occupations were concentrated towards the lower end of the distribution. Other similarly-constructed occupational scales (eg, AUSEI06) have successfully applied a square-root transformation to the data to reduce this skew, and create a more 'centred' distribution – ie, where the mean and midpoint of the distribution coincide (McMillan, Beavis, & Jones, 2009). Centred scales allow for easier tests of equivalence between scales, as occupational SES scores should match. Such tests of equivalence will be carried out in this report, eg:

- between the NZSEI-06 scale for full-time workers only and the finalised NZSEI-06 scale including both part- and full-time workers
- between the finalised NZSEI-06 scale and AUSEI06.

For this reason, a square-root transformation of the NZSEI-06 scale will be undertaken in an attempt to produce a more centred scale with less skew.

Self-employed workers

For NZSEI-96, the income for self-employed workers was inflated to account for the likely underestimation of income by this group (Baker, 1993; Bradbury, 1997; Parker, 1997, Pissarides & Weber, 1989). This was achieved by utilising data from the 1997/98 New Zealand Household Economic Survey to calculate the ratio of food expenditure to income for both waged and self-employed workers among NZSCO95 major occupational groups with large (>10 percent) proportions of self-employed workers. Self-employed workers were found to have a greater ratio of food expenditure to income than waged workers for four NZSCO95 major occupational groups:

- 1 (Legislators, Administrators and Managers)

- 3 (Technicians and Associate Professionals)
- 6 (Agriculture and Fishery Workers)
- 7 (Trades Workers).

The income adjustment was then calculated as the factor required to make the expenditure-to-income ratio of self-employed workers the same as that of waged workers in the same occupational group. The incomes for self-employed workers was inflated by factors of 1.77, 1.35, 1.43, and 1.31 for those in major occupational groups 1, 3, 6, and 7, respectively, and NZSEI-96 scores were calculated based on these inflated incomes (Davis et al, 2003).

Another approach to income inflation for the self-employed is to estimate the extent to which incomes are 'split' with a marriage partner (ie, the incomes of those in self-employment are thought to be underestimated by the amount 'spilt' with family). For example, in the construction of AUSEI06, incomes for all self-employed workers were inflated by 75 percent to reflect the fact that approximately 75 percent of the labour force is married (McMillan et al, 2009). This approach has the advantage of being applicable to all self-employed, not just those from a subset of occupational groups. Against this, inflation of incomes by up to 75 percent for a substantial proportion of workers (20 percent in the 2006 Census) may seem unwarranted without accompanying evidence that incomes of self-employed workers are underestimated, let alone by how much. Moreover, inflation by such a large factor results in very high incomes for those already reporting incomes in the highest bracket.

Data on the ratio of food expenditure to income for waged and self-employed workers are unavailable for the 2006 period, so it is not possible to assess underestimation in this way. However, it is possible to compare the reported incomes of waged and self-employed workers for each of the 97 occupation categories. Evidence for underestimation of incomes by self-employed workers would exist if self-reported workers report lower incomes than waged workers for a majority of occupations (comparing the mean incomes of the two groups for each occupation). Where such evidence exists, inflation of incomes by an 'equivalising' factor will be undertaken for those occupations for which incomes were underestimated. However, if self-employed workers are as likely to report greater incomes as they are to report lower incomes, then this might be considered normal variation between self-employed and waged workers and, as such, does not suggest evidence that incomes have been underestimated. Further, if self-reported workers actually report higher incomes than waged workers for a majority of occupations, this does not suggest evidence for underestimation. Where no evidence for underestimation exists, no inflation of incomes will be undertaken.

Note that it is possible for self-employed incomes to be underestimated and for self-employed workers to report earning the same or even more than waged workers. However, as there is no way to assess whether such reports are underestimates, a conservative approach will be taken whereby the incomes of self-employed workers will only be inflated where there is evidence for underestimation.

New occupational classification system – the Australian and New Zealand Standard Classification of Occupation (ANZSCO)

The occupational classification code used for NZSEI-96 was NZSCO95. Since then, this classification system has been replaced with a system to cover both Australia and New Zealand: ANZSCO (Australian Bureau of Statistics and Statistics NZ, 2006). ANZSCO has been used in Statistics NZ censuses and surveys where occupation data are collected from 2006. The classification structure for ANZSCO is similar to the NZSCO system, but differs in a number of key respects. First, the nine major groups used in NZSCO95 have been replaced by eight groups for ANZSCO (see table 3). The main differences between the nine NZSCO95 major groups and the eight ANZSCO major groups are that:

- NZSCO95 group 6 (agriculture and fishery workers) has been spread across ANZSCO groups:
    - 1 (managers)
    - 3 (technicians and trades workers)
    - 8 (labourers)
- NZSCO95 group 5 (service and sales workers) has been split into two ANZSCO groups:
    - 4 (community and personal service workers)
    - 6 (sales workers).

Table 3

Major occupational groups
NZSCO95 and ANZSCO classifications

NZSCO95 occupational group	ANZSCO occupational group
1. Legislators, Administrators and Managers	1. Managers
2. Professionals	2. Professionals
3. Technicians and Associate Professionals	3. Technicians and trade workers
4. Clerks	4. Community and personal service workers
5. Service and Sales Workers	5. Clerical and administrative workers
6. Agriculture and Fishery Workers	6. Sales workers
7. Trades Workers	7. Machinery operators and drivers
8. Plant and Machine Operators and Assemblers	8. Labourers
9. Elementary Occupations	

Beneath ANZSCO's eight major groups (one-digit) are:

- 43 sub-major group (two-digit) categories
- 97 minor group (three-digit) categories
- 358 unit group (four-digit) categories
- 998 group (six-digit) categories.

As with NZSEI-96, the 97 minor group categories will be used for constructing NZSEI-06. These are made freely available by Statistics NZ – data at the unit group and group levels are not.

The use of ANZSCO for NZSEI-06 has the obvious disadvantage of hampering comparability with previous NZSEI scales, as many of the 97 group categories are different between ANZSCO and NZSCO systems. Even the major groups are not directly comparable, as described above. However, the main and arguably greater advantage is that it allows direct comparability between the New Zealand and Australian SEI scales. That is, NZSEI-06 scores can be compared with AUSEI06 scores for each of the 97 groups classified in both countries from data collected at the same time (2006). This comparison will be described in section 4.2 as part of the assessment of the finalised NZSEI-06 scale.

Coefficients for education-occupation and occupation-income paths

Previous versions of NZSEI (eg, NZSEI-91, NZSEI-96) had quite different path coefficients to those of both the Australian (Australian National University occupational status scale 4 (ANU4) and AUSEI06) and international (ISEI) scales. As shown in table 4, both NZSEI-91 and NZSEI-96 had beta values for the occupation-income path that were approximately three times that of the beta values for the education-occupation path. However, for ANU4, AUSE-I06, and ISEI, the trend was in the opposite direction: the beta value for the education-occupation path was greater, and was about twice the size of the beta value for the occupation-income path for the ANU4 and AUSEI06 indexes. An assessment of whether the path coefficients for NZSEI-06 are closer to those found in previous NZSEI scales or to those found in international scales will be presented in section 3.5.

Table 4

Comparison of beta values
New Zealand, Australian, and international socio-economic indexes

Beta value	NZSEI-91[1]	NZSEI-96[2]	ANU4[3]	AUSEI06[4]	ISEI for ISCO88[5]
β32 Education-Occupation	0.230	0.251	0.63	0.65	0.582
β43 Occupation-Income	0.790	0.786	0.30	0.35	0.465

Note:
AUSEI06 – Australian socio-economic index 2006
ANU4 – Australian National University occupational status scale 4
ISEI for ISCO88 – international socio-economic index for International Standard Classification of Occupations 1988
NZSEI-91 – New Zealand socio-economic index 1991
NZSEI-96 – New Zealand socio-economic index 1996

Sources: 1. Davis et al (1997:46); 2. Davis et al (2003:47); 3. Jones and McMillan (2001:549); 4. McMillan et al (2009:129); 5. Ganzeboom and Treiman (1996:212)

Testing the applicability of NZSEI-06 for different ethnic groups

For NZSEI-96, separate socio-economic scales were calculated and compared for Māori versus non-Māori to test if NZSEI-96 was applicable to both of these ethnic groups. For the development of NZSEI-06, the applicability of NZSEI-06 to a wider range of ethnic groups will be tested.

Ethnicity for the 2006 Census was based on self-report, where individuals could identify with more than one ethnic group. Based on these self-reports, individuals were classified into one or more of the following six 'major' ethnic groups:

- New Zealand European
- Māori
- Pacific
- Asian
- Middle Eastern, Latin American, and African (MELAA)
- Other.

The proportion of 21–69-year-old full- or part-time workers from the 2006 Census in each of these ethnic groups was as follows:

- New Zealand European (68.8 percent)
- Māori (10.6 percent)
- Pacific (4.5 percent)
- Asian (8.0 percent)
- MELAA (0.7 percent)
- Other' (14.0 percent).

Because of the similarity between the New Zealand European and Other ethnic groups (in particular, >95 percent of those in the Other ethnic group self-identify as 'New Zealander'), we will follow the Statistics NZ recommendation to combine these ethnicities into a 'European and Other (including New Zealander)' ethnic group (Statistics NZ, 2007).

The proportion of 21–69-year-old full- or part-time workers in the European and Other (including New Zealander) group was 82.2 percent. Because of the small number of MELAA among 21–69-year-old full- or part-time workers, this group will not be analysed in this report. Thus, just four ethnic groups will be compared.

Note that these four ethnic groups cannot be considered mutually exclusive, as individuals could identify with more than one group. Results need to be interpreted with this in mind. The proportion of 21–69-year-old full- and part-time workers to identify with two or more ethnic groups was:

- 6.5 percent among those identifying as European and Other (including New Zealander)
- 44.0 percent among those identifying as Māori
- 22.8 percent among those identifying as Pacific
- 6.0 percent among those identifying as Asian.

The primary analysis that will be conducted in relation to NZSEI-06 and ethnicity will be to compare NZSEI-06 scores when separate scales are constructed for each of the four ethnic groups. If occupational scores are patterned similarly across ethnic groups, NZSEI-06 will be considered to be applicable for each.

1.3 Planned validation of NZSEI-06

Validation with health indicators

As described above, NZSEI-96 was validated against three health indicators: smoking, self-assessed health, and general practitioner visits. We can only replicate analyses for one of these indicators in the current study: smoking. Data on the other two constructs are not available from the 2006 Census, and datasets that do collect information on these constructs (eg, the 2006/7 New Zealand Health Survey, Ministry of Health, 2008) do not collect occupational information.

Validation with correlates of SES

NZSEI-96 was also validated against other correlates of SES, including motor vehicle access, housing tenure, and household overcrowding. NZSEI-06 will be validated against motor vehicle access and housing tenure but will not be validated against overcrowding as this measure was not found to be associated with occupational status when tested against NZSEI-96. We will, however, validate NZSEI-06 against an area-based measure of deprivation, the NZDep index of deprivation 2006 (NZDep2006).

Deprivation

Socio-economic scales based on deprivation levels in area units have become popular in recent years. In New Zealand, a series of these have been developed for each of the

1991–2006 Censuses, called NZDep91, NZDep96, NZDep2001 and NZDep2006, respectively (Crampton, Salmond, & Sutton, 1997; Salmond, Crampton, & Sutton, 1998; Salmond & Crampton 2002; Salmond, Crampton, & Atkinson, 2007). In the scale version of these indexes, each mesh block in New Zealand (geographical units defined by Statistics NZ, typically containing less than 100 people) is assigned a score from 1 (least deprived) to 10 (most deprived), with roughly the same number of mesh blocks in each of the 10 categories. The designation of mesh blocks is based on a principal component score derived from census data for nine variables indexing deprivation. Variables are calculated as proportions for each mesh block, and are listed below in order of decreasing factor loadings:

1 Income	People aged 18–64 receiving a means tested benefit
2 Income	People living in households with income below an income threshold
3 Owned home	People not living in owned home
4 Support	People aged <65 living in a single parent family
5 Employment	People aged 18–64 unemployed
6 Qualifications	People aged 18–64 without any qualifications
7 Living space	People living in households below a bedroom occupancy threshold
8 Communication	People with no access to a telephone
9 Transport	People with no access to a car

There are a number of reasons to believe that NZDep2006 should be associated with NZSEI-06. First, both can be considered as – and both have been used as – measures of SES. Whereas NZSEI-06 measures SES via the occupation of the individual, NZDep2006 measures SES via the deprivation-level of the area in which individuals live. Second, research of health samples showed that previous versions – NZSEI-96 and NZDep2006 – were moderately correlated (r= -0.34, Metcalf et al, 2008; note that high scores indicate higher SES for NZSEI-96, whereas high scores indicate greater deprivation for NZDep2006). Third, both scales use some of the same information in their derivation: NZSEI uses income and education to derive occupation-based SES scores for the individual, whereas NZDep uses levels of income, education, and employment among residents to derive area-based deprivation scores.

Thus, NZDep2006 can be considered a reasonable measure against which to assess the validity of NZSEI-06. We expect to find an ‘SES-gradient’, whereby lower NZSEI-06 scores are expected to be associated with increasing levels of deprivation.

1.4 Summary

NZSEI-06 will be constructed using 2006 Census data and the methodological approach adopted in the development of its predecessor, NZSEI-96. The only two methodological changes planned are:

(i) to attempt to produce a centred scale by undertaking a square-root transformation of the data
(ii) to inflate the incomes of the self-employed only if there is evidence that self-employed workers underestimate incomes (ie, that self-employed workers are more likely to be report lower incomes than waged workers).

Validation of NZSEI-06 will focus on smoking, motor vehicle access, housing tenure, household overcrowding, and deprivation. As with NZSEI-96, different methods will be tried to derive socio-economic scores for the economically inactive and others for whom no occupational data are recorded. The construction and assessment of NZSEI-06 are described in the following sections of this report.

2 NZSEI-06 dataset

This section presents tabulated and cross-tabulated data on the 2006 Census variables used to construct NZSEI-06: education, income, and occupation. These variables will be compared against data from the 1996 Census used for the most recent NZSEI (NZSEI-96), and cross-tabulated against sex and ethnicity using 2006 Census data.

2.1 Construction of the variables for NZSEI-06

Education

As with the previous NZSEI versions, census data on educational qualification need to be converted into years of education for the purposes of the NZSEI-06 statistical algorithm. The conversion into years of education for both the 1996 and 2006 Censuses is shown in table 4. Note that a change to the 2006 Census highest qualification classification – and to the structure of New Zealand qualifications – means that it is not possible to make direct comparisons between the 1996 and 2006 Censuses on data for all qualification categories. However, school and vocational qualifications from 1996 can be mapped on to the 'levels' used in 2006, and this is reflected in the correspondences shown in table 5.

For example, for qualifications gained at school, school certificate maps to level 1, sixth form certificate maps to level 2, higher school certificate maps to levels 3 and 4, and 'other' school qualifications in 1996 included those with overseas school qualifications.

For qualifications obtained post-school, basic vocational qualifications map to levels 1–3 (and each of these levels will be assigned the same number of years of education), skilled vocational qualifications map to level 4, intermediate vocational qualifications map to level 5, and advanced vocational qualifications map to level 6.

The only categories that do not map are postgraduate qualifications; the 'higher degree' category in 1996 has been split into individual higher degrees in 2006. We coded these degrees – postgraduate/honours degree, master's degree, and doctoral degree – as requiring 17, 18, and 20 years of education, respectively, reflecting that they typically take 1, 2, and 4 years more than a bachelor's degree, respectively.

Table 5

Educational classifications converted to years of education
1996 and 2006 Censuses

1996 Census		2006 Census	
Highest qualification	**Years of education**	**Highest qualification**	**Years of education**
Higher degree	19	Doctorate degree	20
		Master's degree	18
		Post-graduate and honours degree	17
Bachelor's degree	16	Bachelor's degree and level 7 qualification	16
Advanced vocational qualification	14.5	Level 6 diploma	14.5
Intermediate vocational qualification	13.5	Level 5 diploma	13.5
Skilled vocational qualification	12.5	Level 4 certificate gained post-school	12.5
		Level 3 certificate gained post-school	11.5
Basic vocational qualification	11.5	Level 2 certificate gained post-school	11.5
		Level 1 certificate gained post-school	11.5
Other school qualification	12	Overseas secondary school qualification	12
Higher school qualification	13	Level 3 or 4 certificate gained at school	13
Sixth form qualification	12	Level 2 certificate gained at school	12
School Certificate	11	Level 1 certificate gained at school	11
No school qualifications	10	No school qualifications	10

Source: Statistics NZ, 1996 and 2006 Censuses

Table 6

Highest qualification and years of education
Full-time workers aged 21–69 years
1996 and 2006 Censuses

2006 Census				1996 Census	
Highest qualification	**Males**	**Females**	**Total**	**Highest qualification**	**Total**
	Percent				**Percent**
Doctorate degree	1.0	0.6	0.9	…	…
Master's degree	2.9	3.1	3.0	…	…
Post-graduate and honours degree	2.3	3.6	2.8	Higher degree(1)	4.5
Bachelor's degree and level 7 qualification	13.2	18.6	15.4	Bachelor's degree	8.9
Level 6 diploma	4.4	8.4	6.1	Advanced vocational certificate	10.0
Level 5 diploma	5.4	4.8	5.2	Intermediate vocational qualification	2.5
Level 4 certificate gained post-school	18.2	7.2	13.7	Skilled vocational qualification	10.0
Level 3 certificate gained post-school	2.4	3.3	2.7	…	…
Level 2 certificate gained post-school	1.6	1.5	1.6	…	…
Level 1 certificate gained post-school	0.4	0.4	0.4	Basic vocational qualification(2)	3.7
Overseas secondary school qualification	4.4	5.2	4.7	Other school qualification(3)	9.0
Level 3 or 4 certificate gained at school	4.6	4.3	4.5	Higher school qualification	3.7
Level 2 certificate gained at school	8.4	10.0	9.1	Sixth form qualification	11.3
Level 1 certificate gained at school	11.6	14.3	12.7	School Certificate	12.2
No school qualifications	19.2	14.5	17.3	No school qualifications	24.2
Total	100	100	100	Total	100

1. This category is the 1996 equivalent of honours, master's or doctorate degree
2. This category is the 1996 equivalent of level 1, 2, or 3 certificates
3. This category includes overseas school qualifications in 1996

Symbol: … not applicable

Source: Statistics NZ, 1996 and 2006 Censuses

Table 6 shows the distribution of male and female full-time workers by highest education qualification for the 2006 Census. The proportion of females with university degrees was greater than for males (25.9 percent vs 19.4 percent). Females were less likely than males to have no formal qualifications (14.5 percent vs 19.2 percent).

Table 6 also shows the distribution of full-time workers by highest education qualification for the 1996 and 2006 Censuses, with equivalent qualifications mapped as explained above and as described in table 6's footnotes. There were substantial changes to the highest qualification distribution for New Zealanders from 1996 to 2006. The 2006 Census showed an increase in the proportion of full-time workers classified as having a bachelor's degree (from 8.9 percent to 15.4 percent), and an increase in the proportion holding a postgraduate/honours degree, master's degree, or doctoral degree (from 4.5 percent to 6.7 percent). Conversely, there was a sizeable drop in the proportion of the population with no formal qualifications, from 24.2 percent in 1996 to 17.3 percent in 2006.

Income

Table 7 shows the income distribution for male and female full-time workers as recorded in the 2006 Census. Note that this includes income from all sources, not just income from paid employment. Approximately half (50.3 percent) of full-time workers reported incomes of $40,000 or less in the year preceding the census. Among full-time workers, proportionately more females (60.1 percent) than males (43.8 percent) were in the bottom half of the income distribution (up to $40,000 per year). The largest proportion of females (16.2 percent) reported earning $40,001–$50,000, whereas the largest proportion of males (20.0 percent) reported earning $50,001–$70,000.

Table 7 also compares the income distribution for the 1996 and 2006 Censuses. Slightly less of the full-time workforce aged 21–69 years reported a nil or loss income in 2006 (0.6 percent) compared with 1996 (0.9 percent). Substantially less of the full-time workforce reported earning up to $20,000 per year in 2006 (22.0 percent) compared with 1996 (10.3 percent). However, a greater proportion of the full-time workforce in 2006 earned more than $50,000 (33.1 percent) compared with 1996 (14.7 percent). After adjusting for inflation for 1996–2006 (=24.6 percent, using the annual inflation rates for each year (1st quarter) from 1997–2006; see Inflation), 26.2 percent of the full-time workforce earned more than $50,000 in 1996 (in 2006 dollars), which was less than the proportion who earned more than $50,000 in 2006 (33.1 percent).

Table 7

Proportion of workers in various income bands
Full-time workers aged 21–69 years
1991 and 2006 Censuses

2006 Census				1996 Census	
Income	**Males**	**Females**	**Total**	**Income**	**Total**
$NZ	**Percent**			**$NZ**	**Percent**
Nil income	0.5	0.3	0.4	Nil income or loss	0.9
Loss	0.2	0.3	0.2	…	…
1–5,000	0.8	1.4	1.0	1–5,000	1.9
5,001–10,000	1.3	2.3	1.7	5,001–10,000	3.9
10,001–15,000	2.3	3.9	2.9	10,001–15,000	6.6
15,001–20,000	3.5	6.4	4.7	15,001–20,000	9.6
20,001–25,000	5.5	9.5	7.1	20,001–25,000	13.4

Table 7 continued next page

Table 7 continued

2006 Census				1996 Census	
Income	**Males**	**Females**	**Total**	**Income**	**Total**
$NZ	**Percent**			**$NZ**	**Percent**
25,001–30,000	8.3	11.5	9.6	25,001–30,000	16
30,001–35,000	9.8	12.1	10.8	30,001–40,000	21.5
35,001–40,000	11.6	12.4	11.9	…	…
40,001–50,000	16.7	16.2	16.5	40,001–50,000	11.5
50,001–70,000	20.0	15.4	18.2	50,001–70,000	8.1
70,001–100,000	10.2	5.2	8.2	70,001–100,000	3.5
100,001 or more	9.2	3.1	6.7	100,001–or more	3.1
Total	100	100	100	Total	100

Symbol: … not applicable
Source: Statistics NZ, 1991 and 2006 Censuses

For the NZSEI-06 statistical algorithm, the log of actual income will be used, so a mid-point in each income band was assigned using data on actual income supplied by Statistics NZ. Individuals reporting zero or negative incomes were given a value of $100 so that the log of income could be determined. The mid-points assigned to the income bands are shown in table 8.

Table 8

Income bands and assigned mid points
2006 Census

Income bands ($NZ)	**Mid points**
Nil income	100
Loss	100
1–5,000	1604
5,001–10,000	7840
10,001–15,000	12345
15,001–20,000	17084
20,001–25,000	22201
25,001–30,000	27203
30,001–35,000	32119
35,001–40,000	37131
40,001–50,000	44168
50,001–70,000	57514
70,001–100,000	80725
100,001 or more	135007

Source: Statistics New Zealand, 2006 Census

Occupation

For the 2006 Census, individuals provided details about their occupation. Those working more than one job provided details about their primary occupation only (ie, the occupation in which they worked the most hours). As described in section 1.2, NZSCO95, the occupation classification used for the 1996 Census, was replaced by ANZSCO for the 2006 Census. The main impact of this change was that the nine major groups in NZSCO95 were replaced by eight major groups in ANZSCO, so these classification schemes are not comparable across time. Further, while there were 97 minor groups for both NZSCO95 and ANZSCO, many of the groups do not have equivalents across time, so comparability at this level is also not possible (eg, see appendix A of Australian and New Zealand Standard Classification of Occupations, Australian Bureau of Statistics and Statistics NZ, 2006).

The distribution of the full-time workers aged 21–69-years-old by occupation at the major and minor group levels is produced in appendix I. The number of people in each minor group category ranged from over 50,000, in the General Managers category, to just over 2,500 people, in the Textile, Clothing and Footwear Trades Workers category.

Sex differences in the number of full-time workers in each occupation were apparent. At the major group level, there was a clear male excess for four groups:

- Machinery Operators and Drivers (male : female ratio = 6.2)
- Technicians and Trades Workers (male : female ratio = 5.7)
- Labourers (male : female ratio = 2.4)
- Managers (male : female ratio = 2.1)

There was a clear female excess for two groups:

- Clerical and Administrative Workers (female : male ratio = 2.9)
- Community and Personal Service Workers (female : male ratio = 1.5).

There were approximately the same number of male and female Professionals and Sales Workers. Within the major groups, males and females also tended to be concentrated in particular types of occupations. For instance, for individuals classified as Professionals, women were more prevalent among education (except for Tertiary Teaching), health therapy, and nursing occupations, whereas men were more prevalent among Engineering Professionals, and Business and Systems Analysts and Programmers.

Age

Age, in years, is included as a control variable as it is negatively associated with education (younger workers have higher qualifications) but positively correlated with income (older workers earn more). As with the previous scales (NZSEI-91 and NZSEI-96) analyses will be restricted to those aged 21–69. Those under the age of 21 years are not included because of the likelihood that young workers first entering the workforce may take on occupations that do not reflect their education and skill level. Those over the age of 69 years are excluded because very few of this group (6.5 percent) are in the workforce. Note that those aged 65–69 years are included because involvement in occupational roles is still relatively common in this group (28.1 percent of 65–69-year-olds are in the workforce), even though the retirement age in New Zealand is 65.

2.2 Selected demographic data

This section provides tabulations and cross-tabulations of demographic data from the 2006 Census to provide context for the analyses conducted in subsequent sections of the report.

Income and occupation

Table 9 shows the income distribution for full-time workers in each major group of occupations in 2006. Managers (major group 1), and Professionals (major group 2), were the two groups with the highest proportion of members earning over $100,000 – 14.6 percent and 11.0 percent, respectively. Managers also had the highest proportion of members earning $70,001 and over (28.8 percent), followed by Professionals (24.8 percent). At the lower end of the income distribution, 24.2 percent of Labourers and 20.4 percent of Community and Personal Service Workers reported incomes lower than $20,001. It should be noted that the highest proportion of full-time workers reporting nil or loss incomes were Managers (1.4 percent).

Table 9

Income by occupation
Full-time workers aged 21–69 years
2006 Census

Total income ($NZ)	Occupation (major group)							
	Manager	Professionals	Technical and Trades Workers	Community and Personal Service Workers	Clerical and Administrative Workers	Sales Workers	Machinery Operators and Drivers	Labourers
	Percent							
Nil	1.0	0.2	0.4	0.2	0.1	0.3	0.3	0.5
Loss	0.4	0.1	0.2	0.2	0.2	0.2	0.2	0.3
1–5,000	0.8	0.6	0.9	1.8	0.8	1.2	1.0	2.3
5,001–10,000	1.4	1.2	1.5	3.1	1.3	2.2	1.5	3.7
10,001–15,000	2.4	1.6	2.7	5.6	2.1	3.8	3.0	6.0
15,001–20,000	3.4	2.2	4.6	9.5	3.5	7.1	5.2	9.6
20,001–25,000	4.4	2.8	7.4	13.3	6.5	11.4	9.8	13.9
25,001–30,000	6.3	4.2	10.8	14.1	11.4	12.8	14.2	16.5
30,001–35,000	7.5	5.8	12.7	11.8	16.4	12.9	15.2	14.1
35,001–40,000	9.2	9.1	14.9	10.1	17.7	12.2	15.1	11.7
40,001–50,000	14.0	18.5	20.2	12.1	20.8	13.9	17.4	11.0
50,001–70,000	20.5	28.8	17.1	13.1	13.6	11.5	13.2	7.6
70,001–100,000	14.0	13.8	5.0	3.8	3.6	5.0	2.7	1.8
100,000+	14.6	11.0	1.7	1.3	2.0	5.4	1.2	1.0
Total	100	100	100	100	100	100	100	100

Source: Statistics New Zealand, 2006 Census

Income and education

The distribution of incomes for full-time workers aged 21–69 years in the 2006 Census by highest educational qualification is presented in table 10. Many of those with a tertiary qualification earned high incomes ($70,001 and over). Of those with a doctoral degree, 62.7 percent reported incomes of $70,001 and over, while 38.2 percent of those with a master's degree, 33.5 percent of those with a post-graduate or honours degree, and 26.6 percent of those with a bachelor's degree reported such incomes. No other highest

qualification group had >18 percent of workers earning $70,001 and over. In the lower income bracket, 69.2 percent of those with no school qualifications, 66.5 percent of those with overseas secondary school qualifications, and 63.9 percent of those with a Level 1 certificate gained post-school as their highest qualifications reported earning $40,000 or less (the lower half of the income distribution) in the year preceding the 2006 Census.

Occupation and education

Table 11 shows the range of educational qualifications across ANZSCO occupational groups. Professionals were the most highly qualified occupational group, with 56.3 percent holding a university qualification, and less than 3 percent having no school qualifications. Labourers and Machinery Operators and Drivers had the highest proportion of members with no school qualifications (both >40 percent).

Table 10

Income by highest qualification
Full-time workers aged 21 to 69 years
2006 Census

Total income ($NZ)	Highest qualification														
	Doctorate degree	Master's degree	Post-graduate and honours degree	Bachelor's degree and level 7 qualification	Level 6 diploma	Level 5 diploma	Level 4 certificate gained post-school	Level 3 certificate gained post-school	Level 2 certificate gained post-school	Level 1 certificate gained post-school	Overseas secondary school qualification	Level 3 or 4 certificate gained at school	Level 2 certificate gained at school	Level 1 certificate gained at school	No school qualifications
	Percent														
Nil income	0.2	0.4	0.3	0.3	0.4	0.4	0.4	0.3	0.4	0.3	0.8	0.4	0.5	0.5	0.5
Loss	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.5	0.2	0.2	0.2	0.3
1–5,000	0.3	0.8	0.8	1.1	0.8	0.9	0.7	1.1	1.2	1.6	2.5	1.1	0.7	0.8	1.3
5,001–10,000	0.6	1.2	1.4	1.9	1.3	1.5	1.1	2.1	1.9	2.4	3.3	2.1	1.3	1.5	2.2
10,001–15,000	0.7	1.9	1.8	2.5	2.1	2.3	2.1	3.5	3.6	3.5	5.2	3.0	2.4	2.9	4.2
15,001–20,000	0.9	2.3	2.3	3.1	3.0	3.8	3.4	6.4	5.7	7.3	7.7	4.7	4.0	5.3	7.2
20,001–25,000	1.1	2.8	2.6	3.7	4.4	5.5	5.4	9.9	9.2	9.4	10.7	7.1	6.7	8.6	11.5
25,001–30,000	1.6	3.4	3.5	4.9	6.5	8.1	8.2	12.8	12.2	12.5	12.2	10.1	10.0	12.1	14.5
30,001–35,000	1.6	4.3	4.6	6.8	8.0	9.7	10.3	13.9	13.3	13.0	11.9	11.9	12.0	13.4	14.2
35,001–40,000	2.0	5.8	7.1	9.7	9.9	11.1	13.5	13.1	13.7	13.7	11.7	12.6	13.1	13.9	13.3
40,001–50,000	5.1	12.3	14.7	16.1	19.6	16.6	20.4	14.9	16.4	16.2	13.5	16.2	17.8	17.4	14.6
50,001–70,000	23.2	26.5	27.4	23.1	26.7	21.9	22.1	13.5	14.1	13.0	11.4	16.3	17.5	14.8	10.7
70,001–100,000	28.5	18.8	17.1	13.0	10.6	10.6	8.1	5.0	5.2	4.2	5.0	7.9	7.7	5.1	3.1
100,001 or more	34.2	19.4	16.4	13.6	6.5	7.4	4.2	3.2	2.9	2.7	3.7	6.5	6.1	3.7	2.3
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Statistics New Zealand, 2006 Census

Table 11

Highest qualification by occupation
Full-time workers aged 21–69
2006 Census

Highest qualification	Occupation (major group)								
	Manager	Professional	Technical and Trades Workers	Community and Personal Service Workers	Clerical and Administrative Workers	Sales Workers	Machinery Operators and Drivers	Labourers	Total
	Percent								
Doctorate degree	0.5	3.1	0.2	0.1	0.4	0.1	0	0.1	0.9
Master's degree	3.5	7.5	0.7	1.1	1.8	1.3	0.4	0.4	3.0
Post-graduate and honours degree	2.6	7.8	0.6	1.5	1.6	1.2	0.3	0.4	2.8
Bachelor's degree and level 7 qualification	14.5	37.7	4.4	9.4	11.1	10.1	2.6	3.7	15.4
Level 6 diploma	5.4	13.4	3.6	6.3	3.8	3.5	1.4	2.1	6.1
Level 5 diploma	6.2	5.3	6.1	6.3	5.2	4.9	2.2	2.6	5.2
Level 4 certificate gained post-school	14.1	6.1	34.6	13.7	8.8	10.5	11	10.1	13.7
Level 3 certificate gained post-school	2.2	1.4	3.9	5.2	3.5	3.5	2.1	2.6	2.7
Level 2 certificate gained post-school	1.4	0.7	2.5	1.9	1.9	1.8	1.5	1.9	1.6
Level 1 certificate gained post-school	0.3	0.2	0.5	0.6	0.5	0.4	0.4	0.5	0.4
Overseas secondary school qualification	4.8	2.3	5	6	5.5	6.2	5.9	6.3	4.7
Level 3 or 4 certificate gained at school	5.2	3.3	3.2	6.1	6.4	6.6	3.1	3.4	4.5
Level 2 certificate gained at school	11	4.8	6.4	10.2	15.4	12.7	7.8	7.9	9.1
Level 1 certificate gained at school	13.9	3.8	10.6	13.9	20.1	18	17	16.3	12.7
No school qualifications	14.4	2.7	17.7	17.8	14	19.3	44.1	41.8	17.3
Total	100	100	100	100	100	100	100	100	100

Source: Statistics New Zealand, 2006 Census

Income and ethnicity

For this and subsequent ethnic comparisons we will show results for four major ethnic groups: European and Other (including New Zealander), Māori, Pacific, and Asian. Table 12 shows the incomes of full-time workers aged 21–69 years for each major ethnic group. For European and Other, the largest proportion of full-time workers reported incomes between $50,001 and $70,000. For Māori and Asian, the largest proportion of full-time workers reported incomes between $40,001 and $50,000, and for Pacific the largest proportion of full-time workers reported incomes between $35,001 and $40,000. The proportions of each ethnic group reporting full-time incomes of $40,000 or less (the lower half of the income distribution) was 46.7 percent for European and Other, 63.3 percent for Māori, 71.1 percent for Pacific, and 65.1 percent for Asian.

Education and ethnicity

Table 12

Income distribution by ethnicity
Full-time workers aged 21 to 69 years
2006 Census

Total income ($NZ)	Ethnicity				
	European and Other	Māori	Pacific	Asian	Total
	Percent				
Nil income	0.4	0.3	0.4	0.7	0.4
Loss	0.2	0.2	0.3	0.5	0.2
1–5,000	0.7	1.2	2.4	2.9	1.0
5,001–10,000	1.4	2.2	2.6	3.8	1.7
10,001–15,000	2.6	3.7	3.5	5.4	2.9
15,001–20,000	4.2	6.2	6.1	7.6	4.7
20,001–25,000	6.4	9.3	10.4	10.1	7.1
25,001–30,000	8.8	12.8	15.2	11.3	9.6
30,001–35,000	10.2	13.5	14.9	11.5	10.8
35,001–40,000	11.7	13.9	15.3	11.3	11.9
40,001–50,000	17.0	16.2	15.2	13.8	16.5
50,001–70,000	19.6	13.8	9.9	12.4	18.2
70,001–100,000	9.1	4.5	2.7	5.4	8.2
100,001 or more	7.7	2.4	1.1	3.3	6.7
Total	100	100	100	100	100

Source: Statistics New Zealand, 2006 Census

The distribution of full-time workers aged 21–69 years by highest qualification and ethnicity at the time of the 2006 Census is presented in table 13. More than one-quarter of both Māori (30.8 percent) and Pacific (27.8 percent) had no school qualification, compared with 16.3 percent for European and Other and 7.4 percent for Asian. Conversely, only around 1 in 10 Māori (11.7 percent) and Pacific (9.3 percent) full-time workers had university degrees, compared with 21.5 percent for European and Other, and 43.6 percent for Asian.

Table 13

Highest qualifications by ethnicity
Full-time workers aged 21–69 years
2006 Census

Highest qualification	Ethnicity				
	European and Other	Māori	Pacific	Asian	Total
	Percent				
Doctorate degree	0.9	0.2	0.1	1.2	0.9
Master's degree	2.7	1.2	0.9	7.8	3.0
Post-graduate and honours degree	3.0	1.3	0.9	3.3	2.8
Bachelor's degree and level 7 qualification	14.9	9.0	7.4	31.3	15.4
Level 6 diploma	6.4	4.3	3.7	5.3	6.1
Level 5 diploma	5.4	3.9	3.3	4.9	5.2
Level 4 certificate gained post-school	14.9	12.2	8.0	5.7	13.7
Level 3 certificate gained post-school	2.7	3.8	3.9	2.4	2.7
Level 2 certificate gained post-school	1.6	2.0	1.6	1.0	1.6
Level 1 certificate gained post-school	0.4	0.6	0.5	0.3	0.4
Overseas secondary school qualification	3.2	0.3	9.8	20.1	4.7
Level 3 or 4 certificate gained at school	4.6	5.1	7.3	3.4	4.5
Level 2 certificate gained at school	9.8	9.7	10.3	2.8	9.1
Level 1 certificate gained at school	13.4	15.7	14.6	3.0	12.7
No school qualifications	16.3	30.8	27.8	7.4	17.3
Total	100	100	100	100	100

Source: Statistics New Zealand, 2006 Census

Occupation and ethnicity

The proportion of each ethnicity by ANZSCO occupation (at the sub-major group level) is given in table 14.

Māori full-time workers were under-represented (ie, accounted for 30 percent fewer employees than their share of the total workforce) in many managerial and professional occupations and also among Numerical Clerks (55). They were over-represented (ie, accounted for 30 percent more employees than their share of the total workforce) in most occupations in the Community and Personal Service Workers major group, all occupations in the Machinery Operators and Drivers and Labourers occupational group, and among Clerical and Office Support Workers (56).

Pacific full-time workers were under-represented in nearly all managerial and professional occupations, and among Skilled Animal and Horticultural Workers (36), Office Managers and Program Administrators (51), and Personal Assistants and Secretaries (52). Conversely, they were over-represented in most occupations in the Community and Personal Service Workers major group, all occupations in the Machinery Operators and Drivers and Labourers occupational group, and among Clerical and Office Support Workers (56), Other Clerical and Administrative Workers (59), and Sales Support Workers (63).

Asian full-time workers showed patterns of both under- and over-representation in all major occupation groups except Sales Workers, in which they were consistently over-represented. For example, Asian full-time workers were under-represented among Construction Trades Workers (33) and Construction and Mining Labourers (82), but over-represented among Food Trades Workers (35) and Food Preparation Assistants (85).

Table 14

Ethnicity by occupation
Full-time workers aged 21–69
2006 Census

Sub-major group	Occupation	Ethnicity			
		European and other	Māori	Pacific	Asian
		Percent[(1)]			
11	Chief Executives, General Managers and Legislators	89.0	5.7	1.2	6.7
12	Farmers and Farm Managers	94.8	5.0	0.5	2.1
13	Specialist Managers	89.2	7.7	2.4	5.1
14	Hospitality, Retail and Service Managers	80.9	7.5	2.6	13.2
21	Arts and Media Professionals	90.4	8.5	2.3	4.1
22	Business, Human Resource and Marketing Professionals	85.2	6.4	2.3	10.2
23	Design, Engineering, Science and Transport Professionals	89.0	4.9	1.5	7.3
24	Education Professionals	86.2	10.7	3.2	5.1
25	Health Professionals	82.5	6.9	2.6	11.1
26	ICT Professionals	80.3	5.2	2.1	15.4
27	Legal, Social and Welfare Professionals	81.7	13.4	5.3	6.1
31	Engineering, ICT and Science Technicians	82.2	7.8	3.2	10.4

Table 14 continued next page

Table 14 continued

Sub-major group	Occupation	Ethnicity			
		European and other	Māori	Pacific	Asian
		Percent[(1)]			
32	Automotive and Engineering Trades Workers	84.4	8.8	5.3	5.4
33	Construction Trades Workers	84.6	12.8	5.0	3.4
34	Electro technology and Telecommunications Trades Workers	86.3	9.3	3.4	5.0
35	Food Trades Workers	63.1	12.0	5.3	23.6
36	Skilled Animal and Horticultural Workers	88.7	11.9	1.9	2.0
39	Other Technicians and Trades Workers	83.9	8.4	5.3	7.1
41	Health and Welfare Support Workers	77.4	18.5	6.3	4.2
42	Carers and Aides	73.4	15.6	9.1	6.9
43	Hospitality Workers	70.3	15.3	6.7	14.5
44	Protective Service Workers	80.5	17.4	7.2	2.8
45	Sports and Personal Service Workers	83.0	9.6	3.6	9.4
51	Office Managers and Program Administrators	89.5	8.9	2.7	4.2
52	Personal Assistants and Secretaries	90.5	7.6	2.9	3.9
53	General Clerical Workers	83.1	10.4	4.6	7.4
54	Inquiry Clerks and Receptionists	83.4	10.8	5.1	6.9
55	Numerical Clerks	79.6	7.2	4.8	13.4
56	Clerical and Office Support Workers	75.4	15.4	8.3	7.8
59	Other Clerical and Administrative Workers	79.7	11.0	6.7	8.8

Table 14 continued next page

Table 14 continued

Sub-major group	Occupation	Ethnicity			
		European and other	Māori	Pacific	Asian
		Percent[1]			
61	Sales Representatives and Agents	82.9	8.1	4.9	9.3
62	Sales Assistants and Salespersons	82.5	8.6	3.2	10.4
63	Sales Support Workers	71.2	9.4	6.4	17.9
71	Machine and Stationary Plant Operators	63.1	16.9	14.5	11.3
72	Mobile Plant Operators	75.7	22.3	6.7	1.7
73	Road and Rail Drivers	75.1	19.6	5.4	5.3
74	Storepersons	64.7	17.6	17.8	6.7
81	Cleaners and Laundry Workers	63.2	16.4	13.2	11.2
82	Construction and Mining Labourers	78.3	20.0	6.1	2.4
83	Factory Process Workers	60.7	24.6	13.0	8.4
84	Farm, Forestry and Garden Workers	81.1	16.5	3.1	4.2
85	Food Preparation Assistants	56.0	14.6	10.3	23.4
89	Other Labourers	69.8	21.3	10.0	6.0
Total (Workers with specified occupations)		81.9	10.6	4.6	7.7

1. Row percentages (ie, percent of workers in occupation with each ethnicity), not column percentages as in previous tables.

Source: Statistics New Zealand, 2006 Census

2.3 Summary and discussion

This section presents tabulated and cross-tabulated data on the 2006 Census variables used to construct NZSEI-06: education, income, and occupation. Higher education and income levels were reported in 2006 compared with 1996. Higher incomes were associated with higher qualification levels and being male. Ethnic groups with higher qualifications also tended to have income distributions that were skewed towards the higher end. The exception was those who identified as Asian, who were far more likely to have university degrees (43.6 percent, double the next-highest ethnic group), but were disproportionately represented in the lower half of the income distribution (65.1 percent).

3 Construction of NZSEI-06 scale

The construction of the NZSEI-06 scale is presented in this section. This involves first constructing 'interim' NZSEI-06 scores for the full-time workforce only (n = 1,309,092), and then including data from part-time workers for the finalised scale (total n = 1,690,983). This section also reports the methods used to 'equivalise' the incomes of part-time workers before their inclusion in analyses, and an assessment of the extent to which incomes for self-employed workers are understated. Finally, the division of NZSEI-06 scores into SES groups is described.

3.1 Statistical algorithm used in the construction of NZSEI-06 scale

The 'returns to human capital' model used to construct NZSEI-06 was represented by the following linear regression equations, with the unit of analysis being the individual respondent, and the variables income (*I*), age (*A*), and education (*E*) were normalised to have mean zero and variance one:

$I = \beta 41A + \beta 42E + \beta 43O + e4$, (1)

$O = \beta 31A + \beta 32E + e3$, (2)

$E = \beta 21A + e2$, (3)

The assumption that the effect of education on income is largely mediated through occupation is implemented by setting *β42* to zero, and then estimating the values of the unobserved values of occupational score together with the remaining beta coefficients by minimising the residual sum of squares,

$$\sigma_N^2 = \left\| I - (\beta_{41}A + \beta_{43}O) \right\|^2 + \left\| O - (\beta_{31}A + \beta_{32}E) \right\|^2 + \left\| E - \beta_{21}A \right\|^2 .$$

The coefficient *β21* can be estimated by minimising the last summand alone, ie by fitting the regression of *E* on *A*, so the last term can be ignored when estimating the other quantities. These were found by the following iterative process:

1. Start with an initial guess for the occupational scores (eg, the average of the *A* and *E* scores, renormalised to have mean zero and variance one).
2. For these fixed values of *O*, minimise the first two terms of σ_N^2 over the betas. This amounts to fitting the regressions (1) and (2).
3. For these fixed betas, find the values of *O* that minimise.

$$\left\| I - (\beta_{41}A + \beta_{43}O) \right\|^2 + \left\| O - (\beta_{31}A + \beta_{32}E) \right\|^2$$

If *Oi* is the occupational score of the *i*th group, this amounts to setting

$$O_i = ((\beta_{31} - \beta_{41}\beta_{43})\overline{A}_i + \beta_{32}\overline{E}_i + \beta_{43}\overline{I}_i) / (1 + \beta_{43}^2),$$

where *Āi*, *Ēi,* and *Īi*, are, respectively, the mean age, education, and income for the *i*th occupational group.

4. Re-standardise the *O*'s to have mean and variance at the individual level (note all individuals in the ith group have the same value of *O*.)
5. Repeat (2)–(3) until convergence.

Note that the full regressions (ie with *β42* not set to zero) can be refitted using the values of *O* obtained at the conclusion of the iterative process described above. However, since

our primary interest is in the occupational scores, we have not done this. The beta values we report are those obtained at the conclusion of the iterative process.

Although conceptually the regressions described above are done at the individual level, as are the standardisations of the *O*'s, the fact that the *O*'s are the same for each individual in a given occupational group means that the calculations can be carried out using only the sizes, means, and standard deviations of each occupational group.

3.2 Interim NZSEI-06 scores (full-time workforce only)

Using the algorithm described above, the interim NZSEI-06 scores were derived at the minor group (three-digit) level of ANZSCO for the full-time workforce only. The beta values obtained during this construction were 0.567 for *β32* (the path from education to socio-economic status), and 0.331 for *β43* (the path from to socio-economic status to income). The results were scaled from 10–90 (10 being the lowest socio-economic score and 90 the highest), and centred (so that the mean was around 50) by taking the square root of the original scores. NZSEI-06 scores at the sub-major group (two-digit) and major group (one-digit) levels of ANZSCO were calculated as the mean of the constituent minor group occupational scores, weighted by the number of people in each occupation. Interim NZSEI-06 scores at the major group (one-digit) level are presented in table 15, ordered from the major group with the highest NZSEI-06 score (Professionals) to the major group with the lowest (Labourers).

Table 15

Interim NZSEI-06 scores
Full-time workers

ANZSCO major group	Occupation	NZSEI-06 score
2	Professionals	71
1	Managers	53
5	Clerical and Administrative Workers	47
3	Technicians and Trades Workers	43
6	Sales Workers	43
4	Community and Personal Service Workers	41
7	Machinery Operators and Drivers	31
8	Labourers	26

3.3 Incorporation of part-time workers into the finalised scale

Part-time workers were considered to be those working less than 30 hours per week. To incorporate the data for these workers into the construction of NZSEI-06, an adjustment to their income was necessary. Using the same method used for NZSEI-96 (Davis et al, 2003), the median number of weekly hours worked by full-time workers was calculated (median = 40 hours) and the income of part-time workers inflated to a full-time equivalent, by multiplying them by 40/number of hours worked. Another approach has been trialled elsewhere – analysing hourly income instead of weekly income of all workers, thereby enabling full-time and part-time workers to be treated equally (eg, AUSEI06, McMillan et al, 2009). This approach was opted against here because preliminary analyses suggested that it produces some abnormal hourly rates, which in turn affected results. Thus, to minimise the impact of abnormal hourly rates, part-time workers whose implied

hourly incomes were either smaller than the first percentile or larger than the ninety-ninth percentile for full-time workers were excluded from the analysis.

The beta values obtained for NZSEI-06 scores after the addition of part-time workers were very similar to those for full-time workers only: 0.572 for *β32* (the path from education to socio-economic status), and 0.299 for *β43* (the path from to socio-economic status to income). NZSEI-06 scores at the major group (one-digit) level for the scale with part-time workers included are presented in table 16. These too were very similar to the scale for full-time workers only, with the rank order of major groups identical. Scores were slightly lower when part-time workers were added, however, especially for major groups 7 (Machinery Operators and Drivers) and 8 (Labourers). This in part reflects the fact that the square-root transform did a slightly poorer job of centring the scale after the inclusion of part-time workers. That is, where a perfectly centred scale has a mean of 50 (and range of 10–90), the scale including only full-time workers had a mean of 48.6, whereas the scale including both full- and part-time workers had a mean of 46.5.

Table 16

NZSEI-06 scores
Full-time and part-time workers

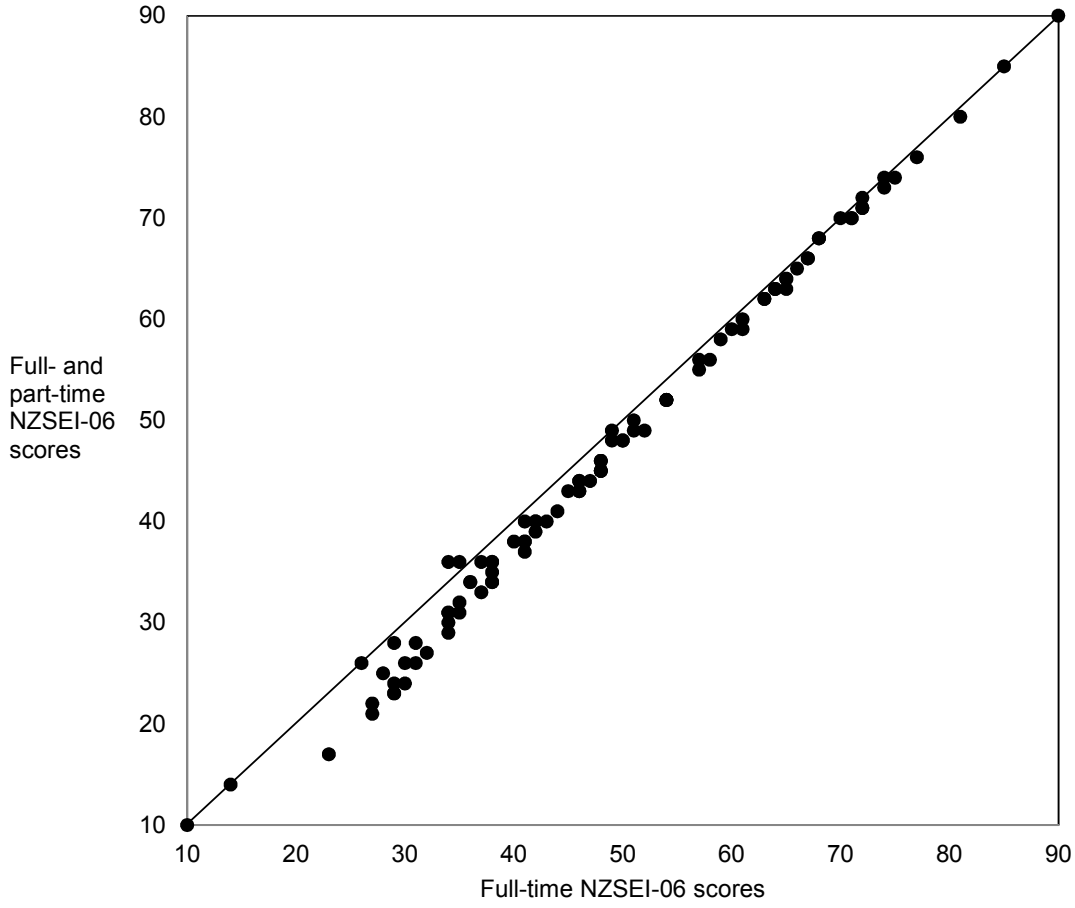
ANZSCO major group	Occupation	NZSEI-06 score
2	Professionals	70
1	Managers	52
5	Clerical and Administrative Workers	44
3	Technicians and Trades Workers	40
6	Sales Workers	39
4	Community and Personal Service Workers	38
7	Machinery Operators and Drivers	26
8	Labourers	21

A comparison of the minor group (three-digit) NZSEI-06 scale scores for full-time workers with those for all workers is shown in figure 2. As with the major group scores, there was virtually no change to NZSEI-96 scores at the minor group level after incorporating part-time workers into the analysis. Scores correlated at $r > 0.99$ and no score differed by more than six points between the scale including only full-time workers and the scale incorporating both full- and part-time workers. Occupations with the greatest difference between the two scales included: Mobile Plant Operators, Truck Drivers, Food Process Workers, Construction and Mining Labourers, and Miscellaneous Factory Process Workers – all had scores six points lower once part-time workers were included. These changes aside, the inclusion of part-time workers appears to have produced very similar results to those obtained when the scale was restricted to those in full-time work.

Figure 2

Comparison of NZSEI-06 scores

Full-time workers compared with full-time and part-time workers (both sexes)

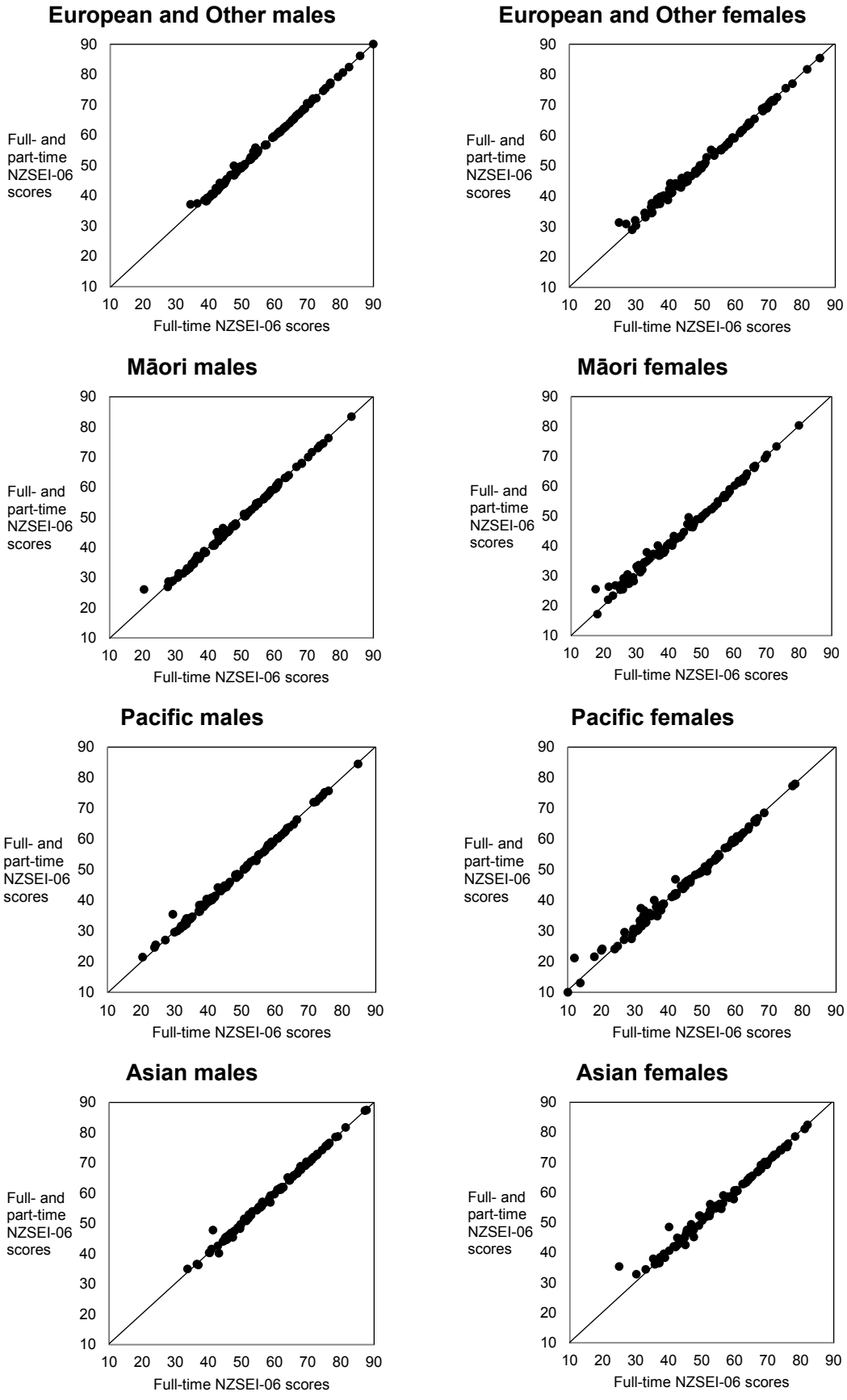


As a further test of the impact of adding part-time workers to NZSEI-06 scores, and to account for the possibility that different sexes and ethnic groups are represented differently among part-time workers, scores were calculated separately for males and females and for workers from four major ethnic groups. Sex- and ethnic-specific NZSEI-06 scores were derived using sex- and ethnic-specific beta coefficients, and the resulting scores for the full-time workforce and for the workforce including both full- and part-time workers are shown in figure 3. The figure shows near perfect correspondence between the scale including only full-time workers and the scale incorporating both full- and part-time workers for both males and females of each of the four ethnic groups (scores correlated at $r > 0.99$ for each sex-by-ethnicity combination). Thus, the inclusion of part-time workers had very little impact on scores by either sex or ethnic group.

Figure 3

Comparison of NZSEI-06 scores

Full-time workers compared with full-time and part-time workers, by sex and ethnicity

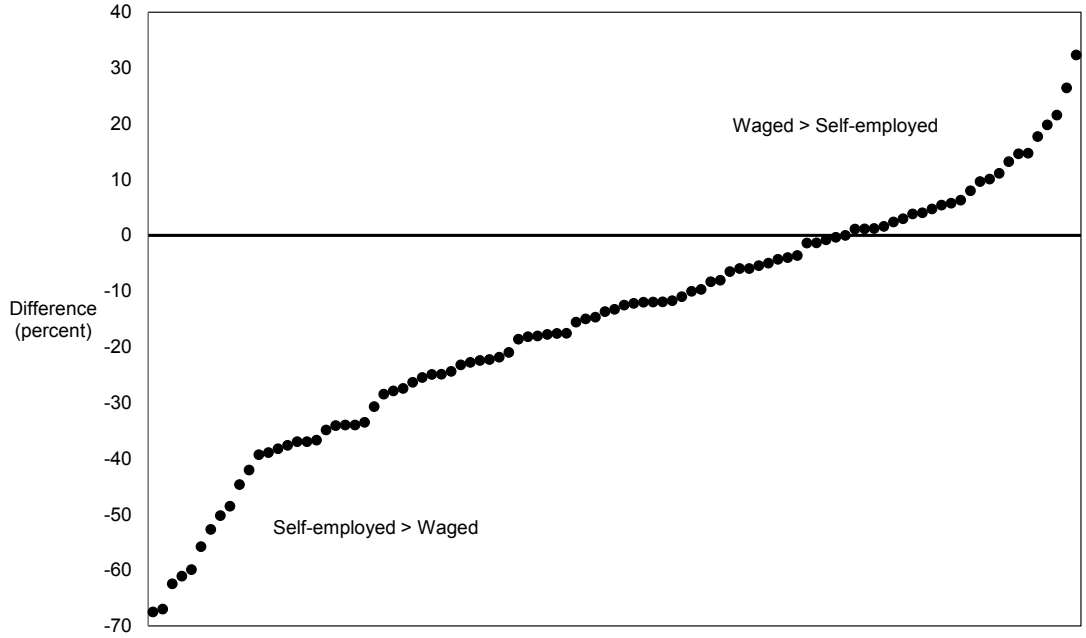


3.4 Assessment of potential understatement of income of self-employed workers

To assess the potential understatement of income by self-employed workers, the mean incomes reported by workers in each minor (three-digit) occupation group were compared between waged and self-employed workers. The equivalised incomes of part-time workers were included using the method described above. The number of waged and self-employed workers for each minor (three-digit) occupation group are shown in appendix II. The mean income differences – expressed as a percentage of the overall mean income for each occupation group – are shown in figure 4, ordered from the occupation group with the largest mean income to that with the smallest mean income for waged workers relative to self-employed workers.

Figure 4

Difference between waged and self-employed incomes for minor group occupations



Source: Statistics NZ, 2006 Census

Figure 4 shows that self-employed workers report greater mean incomes than waged workers for the majority (79 out of 97, or 81 percent) of occupation groups. For some occupation groups, mean incomes were substantially higher for self-employed workers, eg, self-employed workers reported mean incomes that were >40 percent higher than waged workers for seven occupation groups:

- Health Diagnostic and Promotion Professionals (58 percent higher)
- Packers and Product Assemblers (52 percent higher)
- Legal Professionals (49 percent higher)
- Delivery Drivers (48 percent higher)
- Clerical and Office Support Workers (45 percent higher)
- Health Therapy Professionals (41 percent higher)
- Sales Assistants and Salespersons (40 percent higher).

In contrast, there was only one occupation group for which the mean incomes of waged workers were >20 percent higher than the mean income of self-employed workers: Air and Marine Transport Professionals (29 percent higher). Given that self-employed

workers reported greater incomes for the majority of occupation groups, this indicates very little evidence of underestimation. As such, no inflation of incomes for self-employed workers will be undertaken. Thus, the finalised scale will include the incomes of full-time workers and equivalised incomes of part-time workers.

3.5 Overall effect of including part-time workers.

A comparison of the sub-major group (two-digit) NZSEI-06 scores for full-time workers, and full-time and part-time workers combined, is shown in table 17. Appendix III provides the full major group (one-digit), sub-major group (two-digit), and minor group (three-digit) NZSEI-06 scores for the finalised scale (including both full- and part-time workers).

The change to NZSEI-06 scores after the addition of part-time workers was minimal for most sub-major group occupations. The addition of part-time workers typically changed scores by no more than two points, although larger changes were apparent among:

- Machinery Operators and Drivers (occupations 71–74; average change = 5 points)
- Sales Workers (occupations 61–63; average change = 3 points)
- Labourers (occupations 81–89; average change = 3 points).

These differences might be considered especially small, given that some of the change can be attributed to the 2-point mean difference in scores between the full-time-workers scale and the scale including both full- and part-time workers (see section 3.3 above). There were few changes in relative occupational rank at the sub-major group level between the two scales, and those changes that did occur were small. Of 43 sub-major group occupations:

- 24 did not change rank
- 11 changed rank by one place
- 6 changed rank by two places
- 1 changed rank by four places (Sports and Personal Service Workers were ranked 18/43 on the scale including only full-time workers and 14/43 on the scale including both full- and part-time workers)
- 1 changed rank by five places (Carers and Aides were ranked 38/43 on the scale including only full-time workers and 33/43 on the scale including both full- and part-time workers).

Table 17

NZSEI-06 scores
Full-time workers, and full-time and part-time workers combined

ANZSCO sub-major group	Occupation	NZSEI-06 full-time workers	NZSEI-06 full-time and part-time workers
11	Chief Executives, General Managers and Legislators	60	59
12	Farmers and Farm Managers	38	36
13	Specialist Managers	60	59
14	Hospitality, Retail and Service Managers	45	43
21	Arts and Media Professionals	60	59
22	Business, Human Resource and Marketing Professionals	69	68
23	Design, Engineering, Science and Transport Professionals	68	67
24	Education Professionals	74	74
25	Health Professionals	74	74
26	ICT Professionals	68	67
27	Legal, Social and Welfare Professionals	73	72
31	Engineering, ICT and Science Technicians	56	55
32	Automotive and Engineering Trades Workers	43	40
33	Construction Trades Workers	39	36
34	Electro technology and Telecommunications Trades Workers	50	48
35	Food Trades Workers	31	28
36	Skilled Animal and Horticultural Workers	37	35
39	Other Technicians and Trades Workers	41	38
41	Health and Welfare Support Workers	51	50
42	Carers and Aides	28	29
43	Hospitality Workers	34	31
44	Protective Service Workers	49	47
45	Sports and Personal Service Workers	48	47
51	Office Managers and Program Administrators	52	50
52	Personal Assistants and Secretaries	46	44
53	General Clerical Workers	46	44
54	Inquiry Clerks and Receptionists	39	37
55	Numerical Clerks	50	47

Table 17 continued next page

Table 17 continued

ANZSCO sub-major group	Occupation	NZSEI-06 full-time workers	NZSEI-06 full-time and part-time workers
56	Clerical and Office Support Workers	40	38
59	Other Clerical and Administrative Workers	49	47
61	Sales Representatives and Agents	50	47
62	Sales Assistants and Salespersons	38	34
63	Sales Support Workers	35	33
71	Machine and Stationary Plant Operators	32	27
72	Mobile Plant Operators	29	23
73	Road and Rail Drivers	32	27
74	Storepersons	30	26
81	Cleaners and Laundry Workers	14	14
82	Construction and Mining Labourers	34	30
83	Factory Process Workers	27	21
84	Farm, Forestry and Garden Workers	28	25
85	Food Preparation Assistants	10	10
89	Other Labourers	27	22

The regression coefficients (beta values) for the associations between income, education, and socio-economic status for the NZSEI-06 final scale are shown in table 18. Relevant beta values for NZSEI-91, NZSEI-96, and three international scales (ANU4, AUSEI06, and ISEI-88) are also included in the table for comparison.

Table 18

Comparison of beta values
NZSEI-06, NZSEI-96, NZSEI-91, ANU4, AUSEI06, and ISEI-88

Scales	*β32* (education-SES)	*β43* (SES-income)
NZSEI-06	0.572	0.299
NZSEI-96	0.251	0.789
NZSEI-91	0.230	0.790
ANU4[(1)]	0.63	0.30
AUSEI06[(1)]	0.65	0.35
ISEI-88[(1)]	0.582	0.465

1. From McMillian et al, 2009.

Note:
AUSEI06 – Australian socio-economic index 2006
ANU4 – Australian National University occupational status scale 4
ISEI-88 – International socio-economic index 1988
NZSEI-91 – New Zealand socio-economic index 1991
NZSEI-96 – New Zealand socio-economic index 1996
NZSEI-06 – New Zealand socio-economic index 2006

The *β32* and *β43* coefficients for NZSEI-06, which represent the strength of the direct relationships between socio-economic status and education and income, respectively, contrast sharply with those calculated for NZSEI-96 and NZSEI-91.

For example, the coefficient for the education-socio-economic status path (*β32*) was 0.572 for NZSEI-06, but 0.251 for NZSEI-96 and 0.230 for NZSEI-91. The coefficient for the socio-economic status-income path (*β43*) was 0.299 for NZSEI-06 but 0.789 for NZSEI-96and 0.790 for NZSEI-91.

The reason for the differences in path coefficients between NZSEI-06 and the previous scales is unclear, as the construction of NZSEI scales across the three time points has been largely the same. The main difference between NZSEI-06 and the previous scales is the adoption of the ANZSCO occupational coding system. However, this should not have greatly affected the associations between education, socio-economic status, and income. Notably, the path coefficients for NZSEI-06 are now similar to those obtained for three international scales: ANU4 and AUSEI06 from Australia, and the multinational ISEI-88.

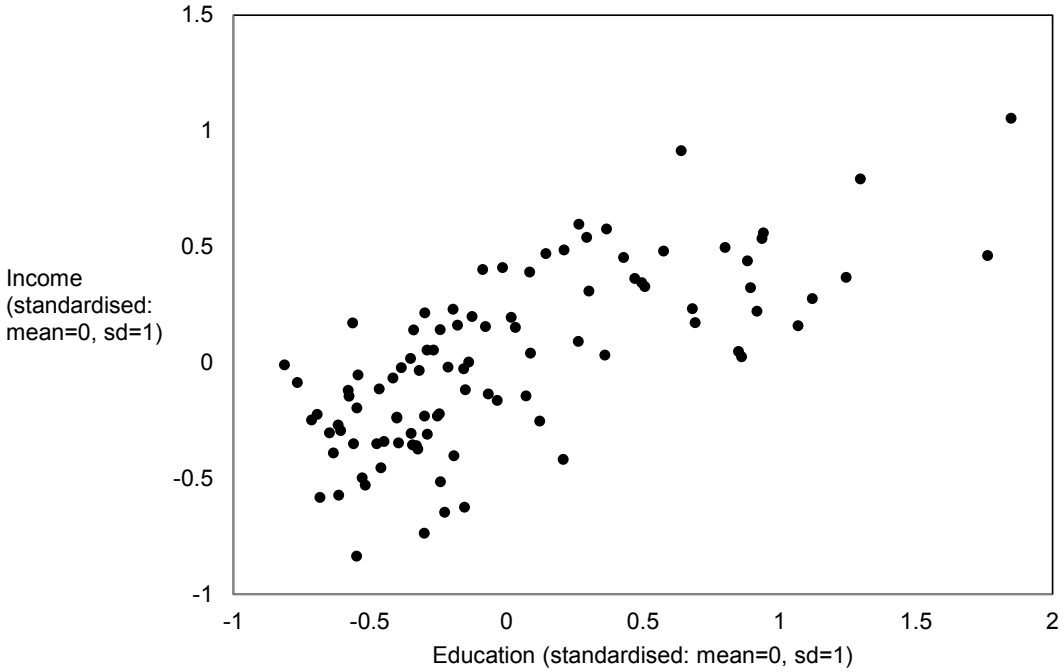
3.6 Dividing NZSEI-06 scores into socio-economic groups

As with previous NZSEI scales, it is desirable to have the option of assigning individuals to discrete socio-economic groups, rather than (or as well as) to scores on a continuous scale. In NZSEI-91, scores were split into six socio-economic groups relatively arbitrarily, but in such a way as to ensure each group consisted of a reasonable proportion of the population. In NZSEI-96, cluster analysis and discriminant function analysis was used to choose cut-points empirically, but this failed to produce groups with better statistical properties (eg with a peak in the middle of the distribution of each group) and resulted in the top two groups comprising <14 percent of the population.

For the current NZSEI-06, the NZSEI-91 method will be adopted; that is, cut-points will be chosen fairly arbitrarily but so that a reasonable proportion of the population is included in each socio-economic group. This approach will be taken because NZSEI-06 is constructed to be a uni-dimensional scale (from 10–90), so there is no good reason to suspect that there will be ‘natural’ groupings of occupations. Moreover, because peaks in the distribution represent the numbers of workers in each of the occupations, there is also no reason to suspect that these might mark the middle of some underlying groupings. It is possible that there are natural groupings across two dimensions – education and income (eg, there might be groups of low-education/high-income occupations as well as high-education/high-income occupations). However, this does not appear to be the case. Figure 5 plots each occupation by its mean education and income (standardised), and shows a largely linear trend with no strong evidence for groupings. Thus, in the absence of an empirical justification for grouping cut-points, arbitrary but convenient cut-points will be used.

Figure 5

Mean income and education for ANZSCO minor group occupations
Workers aged 21–69 years
2006 Census



Source: Statistics New Zealand, 2006 Census

Three different groupings are suggested for use by researchers:

- a six-group classification, in line with the Elley and Irving scale that has been used historically in New Zealand (eg, Elley and Irving, 1972; 1976; 1985; 2003; Irving and Elley, 1977)
- a four-group classification representing quartiles
- a 10-group classification representing deciles, to enable direct comparisons with the NZDep deciles.

Cut-points for these different socio-economic status (SES) groupings are shown in table 19. Note that, as with previous Elley-Irving scales (eg, Elley and Irving, 2003), cut-points for the six-group classification were chosen so that roughly 10 percent, 15 percent, 25 percent, 25 percent, 15 percent, and 10 percent of the population are in groups 1 to 6 (highest to lowest SES), respectively. This split has the added advantage that combining groups 1 and 2 into one group, leaving groups 3 and 4 as is, and combining groups 5 and 6 into one group maps directly onto the four-group (quartile) classification. A full list of SES groupings for all minor group (three-digit) occupations is shown in appendix IV.

Table 19

Suggested SES group divisions
Six, four (quartile), and 10 (decile) groups

Six group			Quartiles		Deciles	
SES group	**NZSEI-96 range**	**Percent of population**	**SES group**	**NZSEI-96 range**	**SES group**	**NZSEI-96 range**
1	71–90	10.8	1	62–90	1	71–90
2	62–70	15.2	2	45–61	2	64–70
3	45–61	21.5	3	34–44	3	59–63
4	34–44	29.4	4	10–33	4	49–58
5	25–33	12.0			5	45–48
6	10–24	11.1			6	40–44
					7	36–39
					8	31–35
					9	25–30
					10	10–24

3.7 Summary and discussion

This section presented details on the construction of NZSEI-06. Interim scores were first calculated for the full-time workforce only, and these patterned major group (one-digit) ANZSCO occupations largely as expected. For the finalised NZSEI-06, part-time workers were incorporated into the dataset by 'equivalising' part-time incomes to a full-time equivalent. Unlike previous scales, no income-adjustment was undertaken for self-employed workers because there was little evidence to suggest that the incomes of self-employed workers were underestimated. Three different convenience 'splits' in the hierarchy were suggested for use by researchers who wish to assess socio-economic status as a categorical variable. These splits were:

- a six-group classification, in line with the Elley and Irving scale that has been used historically in New Zealand
- a four-group classification representing quartiles
- a 10-group classification representing deciles, to enable direct comparison with the NZDep deciles.

The inclusion of part-time workers made little difference to the scores of occupational groups, with scores correlating nearly perfectly and few (small) changes in rank. Additional analyses by sex and ethnicity showed that the incorporation of part-time workers also had little impact on NZSEI-06 scores for males and females of different ethnic groups.

4 Assessing the finalised NZSEI-06

Section 4 presents the results of four tests of the stability and validity of the finalised NZSEI-06. These include:

(i) a comparison between NZSEI-06 and the previous NZSEI-96
(ii) a comparison between NZSEI-06 and AUSEI06
(iii) an assessment of whether NZSEI-06 methodology assigns scores similarly for males and females, and similarly for different ethnic groups
(iv) an assessment of the construct validation of NZSEI-06 in relation to health and other socio-economic indicators.

4.1 Comparison between NZSEI-06 and NZSEI-96

A comparison between NZSEI-06 and its predecessor, NZSEI-96, is hampered by the fact that the two scales assign scores according to different occupational classifications: the NZSEI-06 scale assigns scores based on ANZSCO, and the NZSEI-96 scale assigned scores based on NZSCO95. Nonetheless, the data release for the 2006 Census did assign NZSEI-96 scores to all individuals in an occupation. Thus, it is possible to compare the scores assigned to individuals by NZSEI-06 (based on ANZSCO) with the scores assigned to individuals by NZSEI-96 (based on NZSCO95). Note that for both scales the same scale score was often assigned to two or more occupations. For example, for the NZSEI-06 scale, 97 ANZSCO minor group occupations were assigned 52 separate scores, and for the NZSEI-96 scale, 97 NZSCO95 minor group occupations were assigned 48 separate scores.

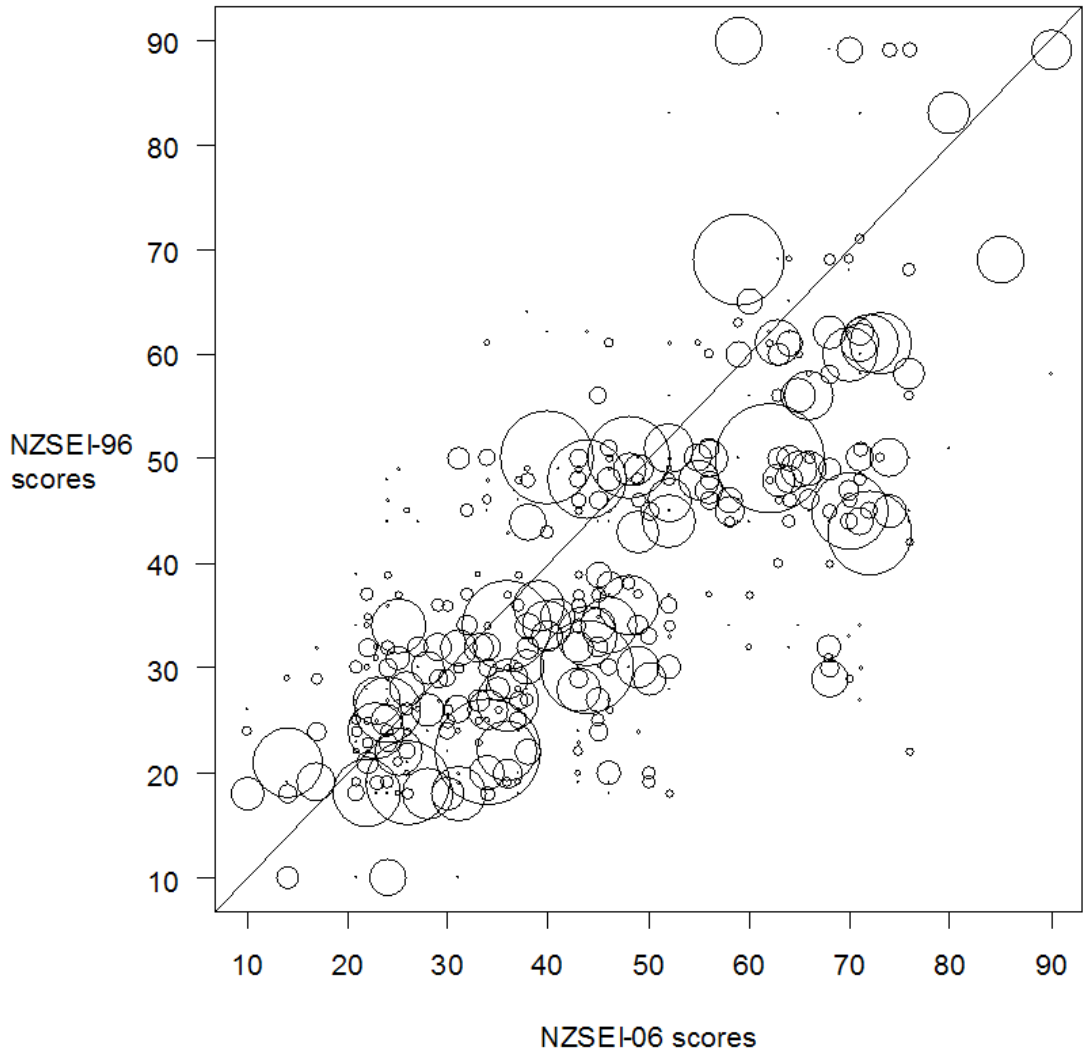
Figure 6 shows a comparison between NZSEI-06 and NZSEI-96 scores assigned to workers using data from the 2006 Census, with the size of the circles representing the number of individuals classified. The figure shows a wide range of NZSEI-96 scores assigned for a single NZSEI-06 score (and vice-versa), reflecting the fact that there were few one-to-one mappings between occupations from the two occupational scales (NZSCO95 and ANZSCO). Of the 52 NZSEI-06 scale scores assigned:

- 2 were assigned unique NZSEI-96 scores
- 5 were assigned two NZSEI-96 scores
- 5 were assigned three NZSEI-96 scores
- 7 were assigned four NZSEI-96 scores
- 20 were assigned between five and nine NZSEI-96 scores
- 13 were assigned 10 or more NZSEI-96 scores.

However, the large circles in figure 6 indicate there were many one-to-one mappings for large numbers of individuals. In fact, most (34 out of 52) NZSEI-06 scale scores mapped to a single NZSEI-96 scale score for at least half of the individuals assigned.

Figure 6

NZSEI-96 scores versus NZSEI-06 scores
NZSCO95 and ANZSCO minor group



Note: The diagonal line represents the point of equivalent value for NZSEI-96 and NZSEI-06 scores, and the size of the circles represents the number of individuals classified.

The overall correlation between the two scales was 0.79, indicating high but not perfect correspondence between the scales. Most data points are below the line in figure 6, indicating that for the most part NZSEI-06 scores were higher than NZSEI-96 scores for equivalent occupations. This can be largely attributed to the left-skew of NZSEI-96 scores in comparison to the more symmetrically distributed NZSEI-06 scores. The symmetric distribution of NZSEI-06 was by design, in that the square root of the original scores was taken in an attempt to produce a distribution that was centred and symmetric. The left skew of NZSEI-96 scores was acknowledged and the reasons were discussed in terms of outlier occupations, but no attempt was made to make this distribution less skewed (see Davis et al, 2003).

4.2 Comparison between NZSEI-06 and AUSEI06

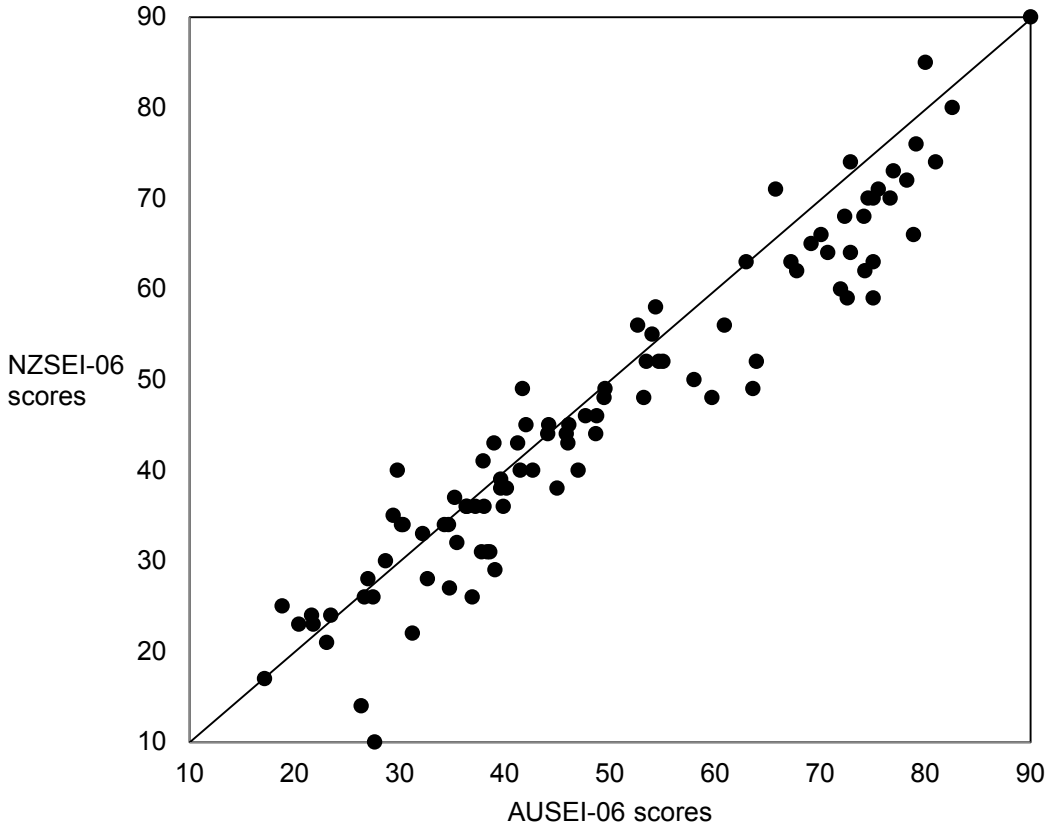
The AUSEI06 scale was constructed using very similar methodology and exactly the same occupational classification (ANZSCO) as NZSEI-06 (McMillan et al, 2009). Thus a direct comparison of the scores assigned by NZSEI-06 and AUSEI06 for the same occupations could be undertaken. This is shown in figure 7. Note that because the range of scale scores differs for the two scales (NZSEI-06 ranges from 10–90 while AUSEI06

ranges from 0–100) AUSEI06 scores have been transformed to a 10–90 scale for the purposes of comparison (by multiplying each AUSEI06 score by 0.8 and then adding 10).

Figure 7 shows a very close correspondence between the socio-economic score assigned by each scale for each occupation. Most points are near the diagonal line indicating equivalence, and the overall correlation between the two scales was 0.96. Most occupations were assigned higher scores by AUSEI06, reflecting the fact that AUSEI06 was centred better than NZSEI-06 (ie, the mean AUSEI06 score was 49.5 compared with 46.5 for NZSEI-06, where a perfectly centred scale would have a mean of 50).

Figure 7

NZSEI-06 versus AUSEI06 scores
ANZSCO minor group



Note: The diagonal line represents the point of equivalent value for NZSEI-06 and AUSEI06 scores. AUSEI06 scores have been transformed to the NZSEI-06 scale range of 10–90. A full list of AUSEI06 scale scores can be found in McMillian et al, 2009.

To further explore the similarities and differences between the NZSEI-06 and AUSEI06 scales, the occupations in each scale were ranked according to their respective SEI scores and the rank order of occupations compared. Ranking in this way negates the influence of the difference in mean SEI scores between the scales.

Overall, the rank-order of occupations between the two scales was very similar: the rank-order of NZSEI-06 and AUSEI06 scales was within five ranks of each other for 56 out of 97 occupations; and within six to 10 ranks of each other for an additional 25 out of 97 occupations. The three most-discrepantly ranked occupations (ANZSCO minor group code shown in square brackets) in which NZSEI-06 scale produced a higher ranking were:

- Automotive Electricians and Mechanics [321] (ranked 56th by NZSEI-06 but 81st by AUSEI06)

- ICT Managers [135] (ranked 9th by NZSEI-06 but 27th by AUSEI06)
- Electricians [341] (ranked 38th by NZSEI-06 but 55th by AUSEI06).

Conversely, the three most-discrepantly ranked occupations in which AUSEI06 scale produced a higher ranking were:

- Glaziers, Plasterers and Tilers [333] (ranked 62nd by AUSEI06 but 81st by NZSEI-06)
- Database and Systems Administrators, and ICT Security Specialists [262] (ranked 11th by AUSEI06 but 27th by NZSEI-06)
- Personal Carers and Assistants [423] (ranked 70th by AUSEI06 but 85th by NZSEI-06).

4.3 Analyses by sex and ethnicity

Separate analyses by sex and ethnicity were conducted to test the stability of the scale for males and females, and for four major ethnic groups: European and Other (including New Zealander), Māori, Pacific, and Asian.

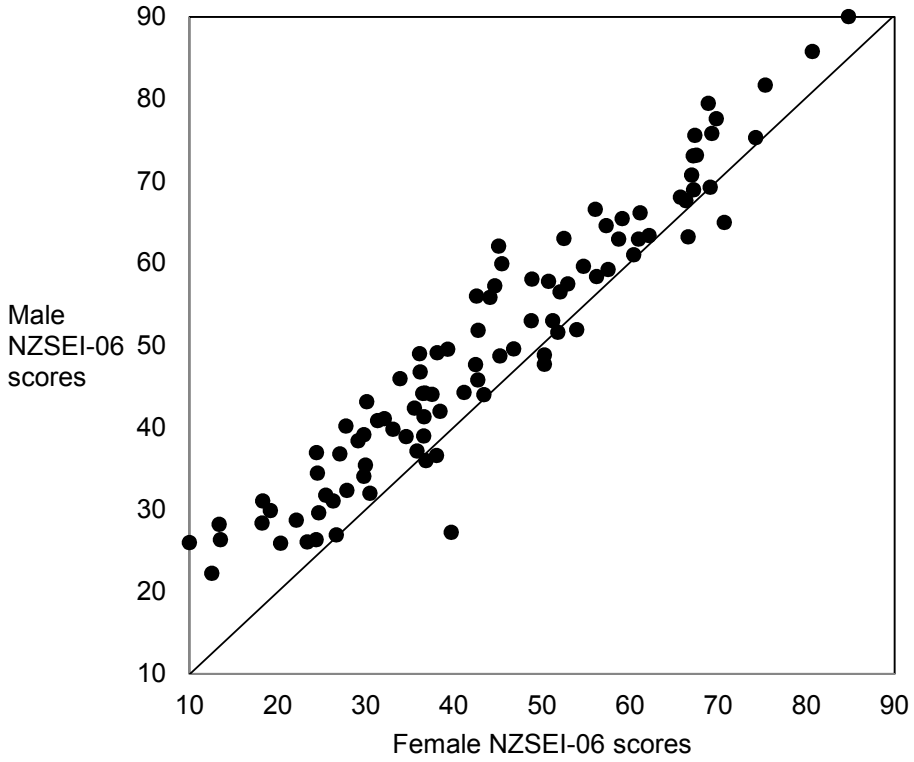
Analyses by sex

To assess the possibility that the associations between education, income, and occupation may differ for males and females (eg, family or childcare responsibilities may prompt some women to take on occupations below their qualifications), the model coefficients from table 18 were used to calculate separate scales for males and females. The minor group (three-digit) sex-specific NZSEI-06 scores are shown in figure 8.

The figure shows that males were assigned higher scores for nearly all (88 out of 97) occupations, and for 22 occupations the difference was 10 points or greater. Females were assigned scores at least 10 points greater than males for only one occupation: Animal Attendants and Trainers, and Shearers (ANZSCO minor group code 361) were assigned a score of 40 for females and 27 for males. There was a 5.8 point difference in mean male and female scores across occupations (male mean = 49.8, female mean = 44.0). Despite this difference, male and female scores correlated at $r = 0.96$, suggesting that the socio-economic structuring of occupations was similar for both sexes.

Figure 8

Comparison of male and female NZSEI-06 scores
ANZSCO minor group

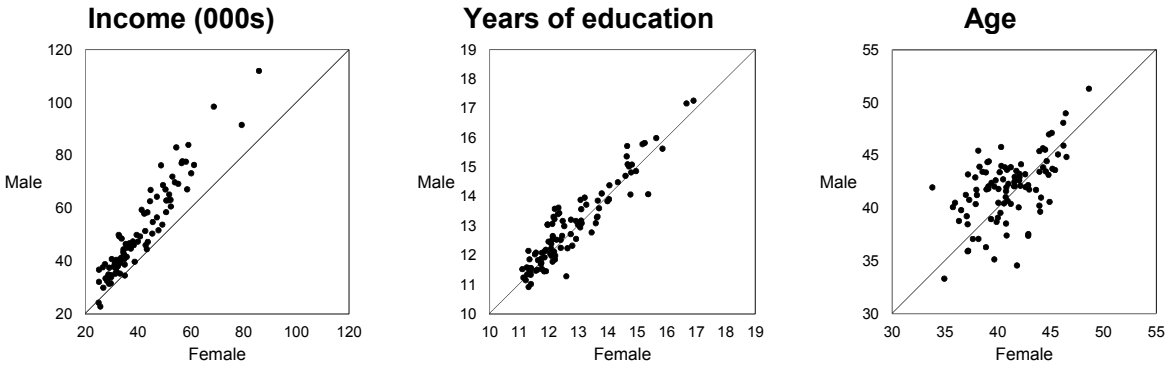


Note: Model estimates were used for both male and female scores.

To investigate reasons for the higher scores assigned to males, figure 9 compares the mean income, years of education, and age for males and females by minor group (three-digit) occupation. This shows that while there were few differences by occupation between males and females in years of education and age, males reported consistently higher incomes for most occupations, suggesting it was primarily because of the income differential that males were assigned higher scores on the sex-specific NZSEI-06 scale. The income differential between males and females was greater for higher paying occupations.

Figure 9

Mean values for income, years of education, and age
Males compared with females for each occupation (ANZSCO minor group)



Source: Statistics New Zealand, 2006 Census

As the validation sections to follow (sections 4.4 and 4.5) will use the six socio-economic groups described in table 19, the absolute and percentage differences between males and females in education and income by socio-economic group is shown in table 20. The average income was substantially greater for males (compared with females) for all socio-economic groups. This difference was larger – both in absolute and percentage terms – for higher socio-economic groups. For example, while the income difference between male and females was $8,600 (31 percent) for workers in SES group 6, it was $23,600 (45 percent) for workers in SES group 1. There were very few differences in the average education levels between males and females across socio-economic groups.

Table 20

Differences in mean income and education
Males compared with females

SES Group	Mean income ($)		Difference in income between sexes (M-F)		Mean education (years)		Difference in education between sexes (M-F)	
	Males	Females	Percent (M-F)/F	$ (M-F)	Males	Females	Percent (M-F)/F	Years (M-F)
1	75,800	52,200	45	23,600	15.8	15.2	4	0.6
2	67,100	50,600	33	16,500	14.1	14.3	-1	-0.2
3	58,600	43,900	33	14,700	12.8	12.8	0	0
4	42,600	35,000	22	7,600	12.1	12.1	0	0
5	35,400	28,200	26	7,200	11.6	11.8	-2	-0.2
6	36,700	28,100	31	8,600	11.2	11.2	0	0

Analyses by ethnicity

In order to determine the applicability of NZSEI-06 to different ethnic groups in New Zealand, the model coefficients from table 18 were used to calculate separate scales for each of the four major ethnic groups: European and Other (including New Zealander), Māori, Pacific, and Asian. Figure 10 shows ethnic-specific NZSEI-06 scores for each ethnic group by minor group (three-digit) occupation (shown as a series of two-way cross-tabulations).

Figure 10

NZSEI-06 scores (ANZSCO minor group)
Comparison of ethnicities

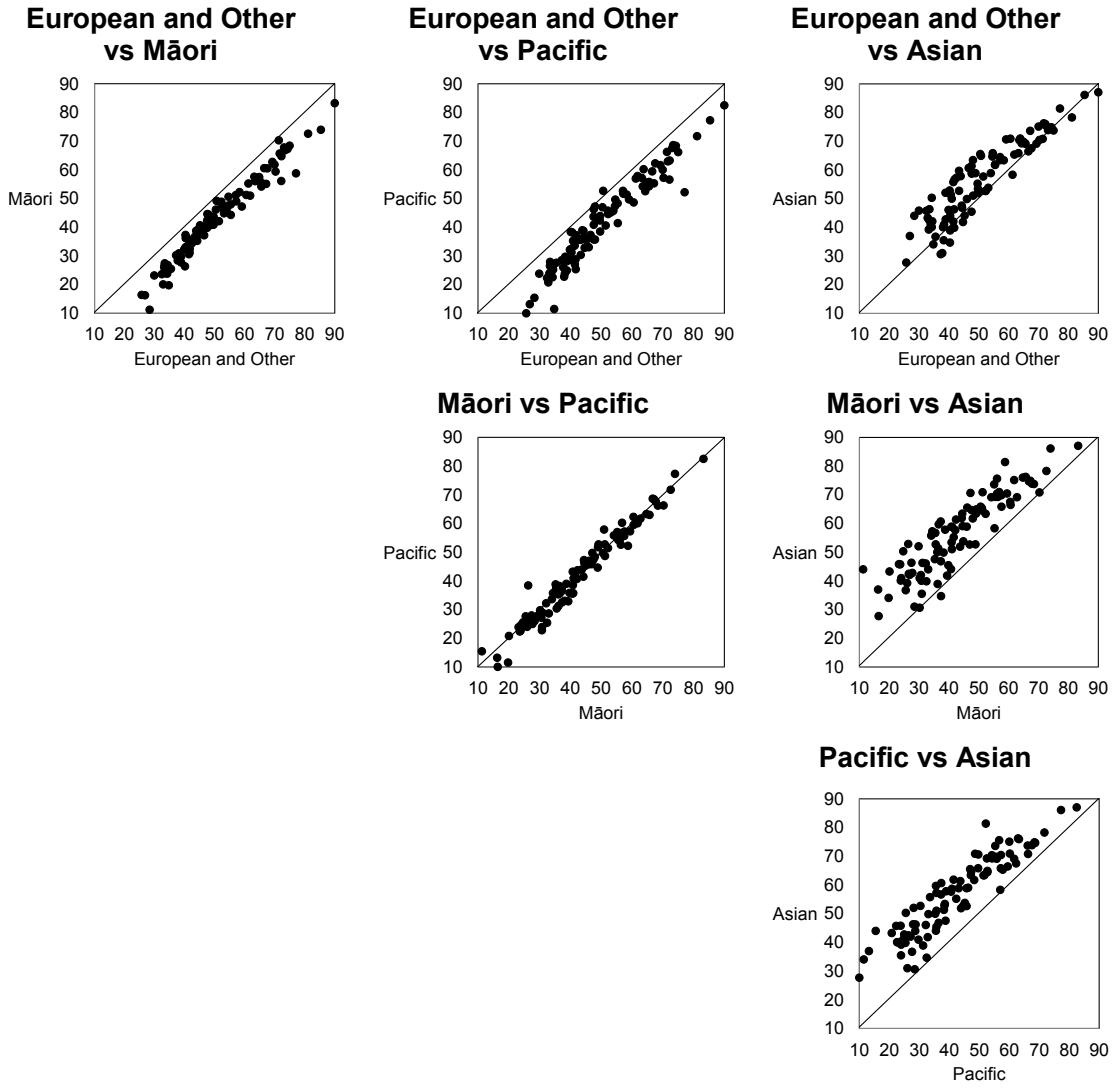


Figure 10 shows that for most occupations Asian workers were assigned higher NZSEI-06 scores than all other ethnic groups (mean score across occupations = 56.4). European and Other workers (mean score = 51.0) were assigned higher scores than either Māori (mean score = 43.1) or Pacific workers (mean score = 42.2).

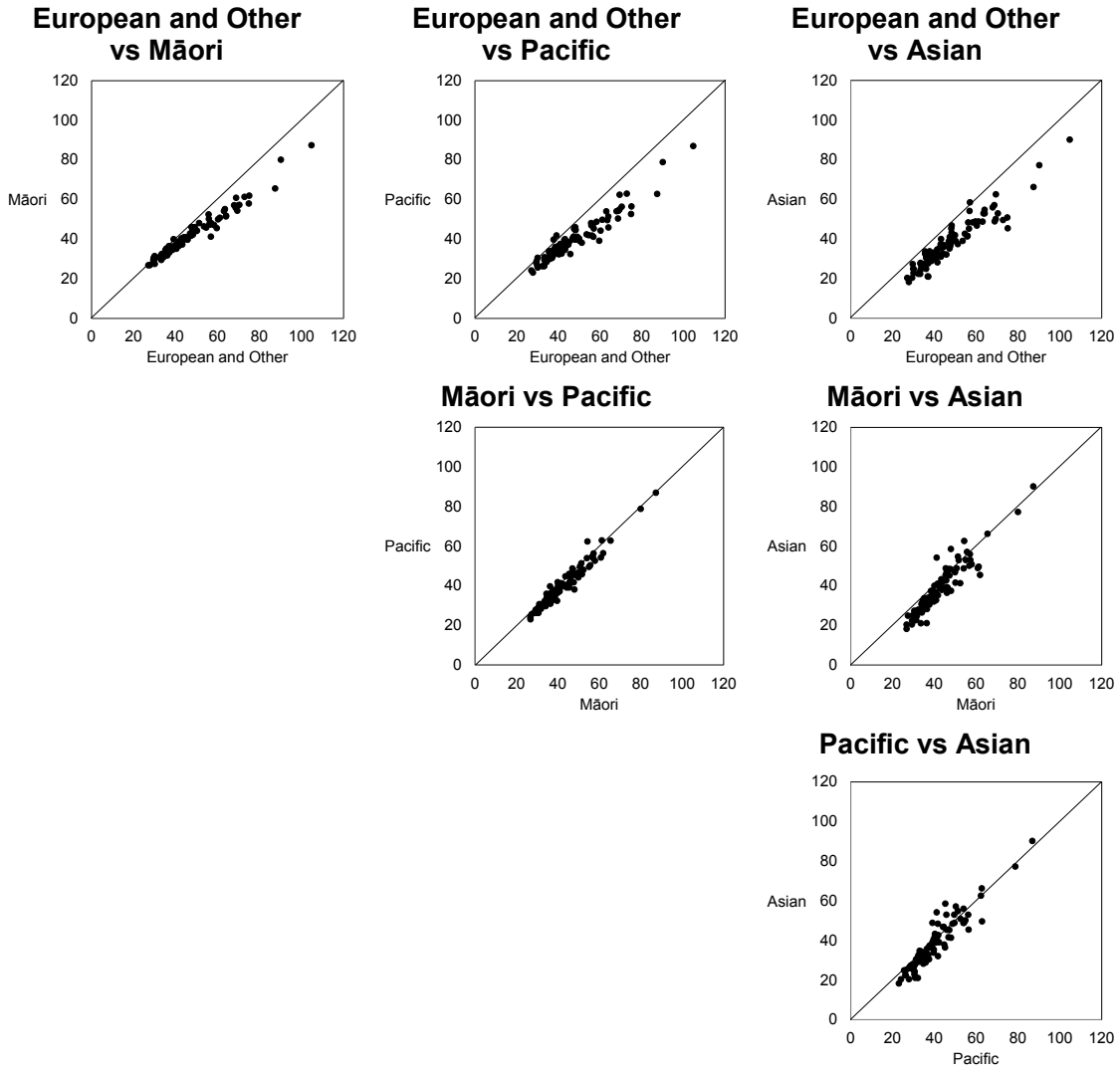
NZSEI-06 scores for Māori and Pacific workers were similar for most occupations. Pairwise correlations between ethnic-specific scores were all $r >= 0.90$, suggesting the socio-economic structuring of occupations was similar for each ethnic group. It was noteworthy, however, that the pairwise correlations between Asian workers and all other ethnic groups were lower ($r = 0.90 - 0.92$) than the pairwise correlations among European and Other, Māori, and Pacific workers (all correlations $r >= 0.96$).

To investigate reasons for this pattern of ethnic differences in NZSEI-06 scores, figure 11, figure 12 and figure 13 compare the mean income, years of education, and age, respectively, for each ethnic group by minor group (three-digit) occupation (shown as a series of two-way cross-tabulations).

Figure 11 shows that European and Other workers reported higher incomes than Māori, Pacific, or Asian workers, especially for higher paying occupations. Māori and Pacific workers reported slightly higher incomes than Asian workers for most occupations, and particularly for low paying occupations. Similar incomes were reported between Māori and Pacific workers.

Figure 11

Mean income ($000s) for ANZSCO minor group occupations
Comparison of ethnicities

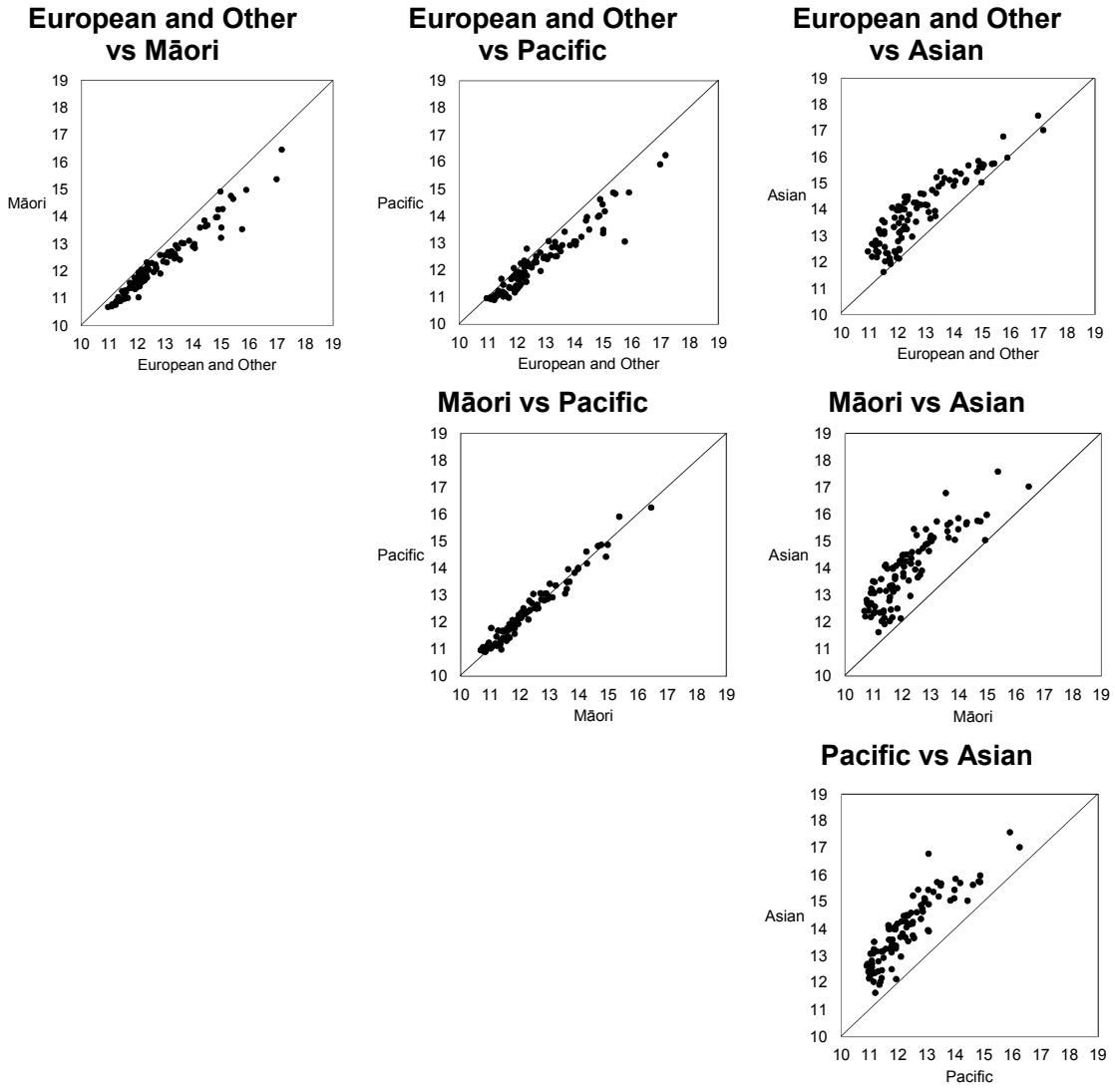


Source: Statistics New Zealand, 2006 Census

Figure 12 shows that, across occupations, Asian workers reported higher levels of education than all other ethnic groups. European and Other workers reported higher levels of education than either Māori or Pacific workers. Similar levels of education across occupations were reported between Māori and Pacific workers.

Figure 12

Mean years of education for ANZSCO minor group occupations
Comparison of ethnicities

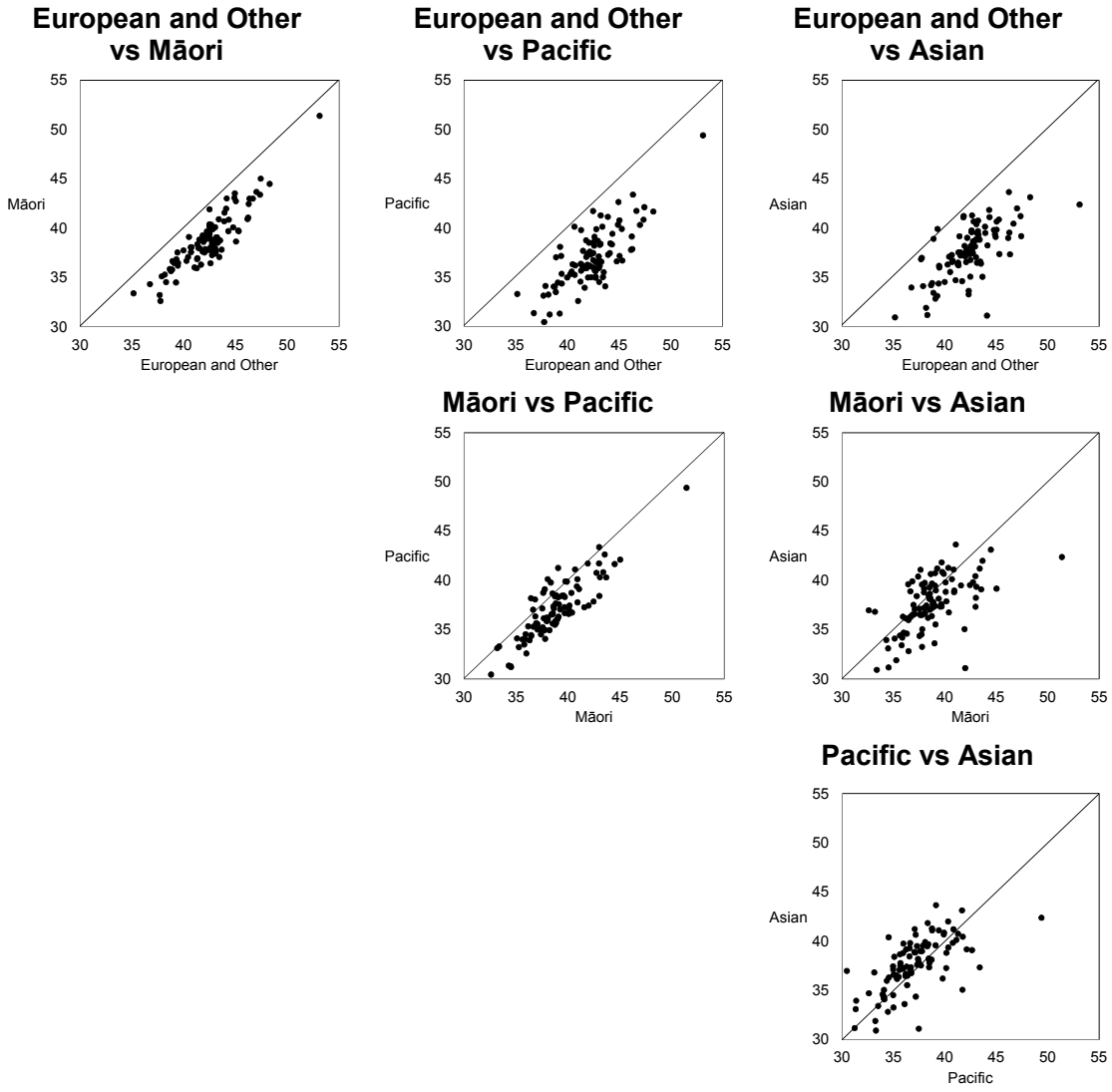


Source: Statistics New Zealand, 2006 Census

Figure 13 shows that the European and Other workforce was older than the Māori, Pacific, and Asian workforce. The Māori workforce was older than either the Pacific or Asian workforce for most occupations, while the Asian workforce was older than the Pacific workforce for most occupations.

Figure 13

Mean age (years) for ANZSCO minor group occupations
Comparison of ethnicities



Source: Statistics New Zealand, 2006 Census

Taken together, the pattern of findings shown in figures 11–13 suggest that it is primarily because of higher years of education in most minor group occupations that Asian workers were assigned higher ethnic-specific NZSEI-06 scores than all other ethnic groups. This may seem surprising, given that Asian workers also reported lower incomes than other ethnic groups for most occupations. However, education contributes more to NZSEI-06 scores than income – the education-SES path ($\beta 32$ = 0.572) is nearly double the SES-income path ($\beta 43$ = 0.299). Moreover, a comparison of figure 11 and figure 12 shows that educational differences between Asian workers and workers in other ethnic groups were larger than the income differences between them, so it is plausible that higher years of education explain the high ethnic-specific NZSEI-06 scores for Asian workers.

Lower years of education for most occupations and lower incomes for most occupations were the likely reason for the low ethnic-specific NZSEI-06 scores assigned to Māori and Pacific workers.

To aid interpretation of the validation sections to follow (sections 4.4 and 4.5), which use the six socio-economic groups, table 21 shows the absolute and percentage differences in income by sex, ethnicity, and socio-economic group, for full- and part-time workers aged 21–69 years from the 2006 Census.

Within each socio-economic group, European and Other (including New Zealander) workers reported higher incomes on average than every other ethnic group, mirroring the pattern shown in figure 11. Differences between European and Other workers and Māori, Pacific, and Asian workers tended to be larger for males (median difference = 22 percent, range = 9–31 percent) than females (median = 12 percent, range = 2–26 percent).

Differences between European and Other workers and Māori workers were larger for higher socio-economic groups. For example, the difference between European and Other and Māori males was 23 percent for SES group 1 but only 9 percent for SES group 6; the equivalent differences for females were 12 percent and 2 percent, respectively.

Table 21

Differences in mean income
European and Other ethnic group compared with Māori, Pacific, and Asian

SES group	Mean income ($)				Mean difference in income compared with European and Other					
					$			Percent		
	Ethnic group									
	European and Other	Māori	Pacific	Asian	Māori	Pacific	Asian	Māori	Pacific	Asian
Males										
1	77,900	59,600	56,900	66,800	18,300	21,000	11,100	23	27	14
2	69,400	55,800	49,600	52,700	13,600	19,800	16,700	20	29	24
3	60,700	49,500	44,300	43,600	11,200	16,400	17,100	18	27	28
4	44,400	39,700	35,000	31,200	4,700	9,400	13,200	11	21	30
5	37,300	33,800	31,400	25,600	3,500	5,900	11,700	9	16	31
6	38,800	35,300	30,900	27,500	3,500	7,900	11,300	9	20	29
Females										
1	53,100	46,600	43,800	49,000	6,500	9,300	4,100	12	18	8
2	51,700	45,400	44,100	45,200	6,300	7,600	6,500	12	15	13
3	45,000	40,400	39,000	36,400	4,600	6,000	8,600	10	13	19
4	35,900	33,300	32,600	27,800	2,600	3,300	8,100	7	9	23
5	29,400	28,700	26,600	21,900	700	2,800	7,500	2	10	26
6	29,600	29,000	25,800	22,400	600	3,800	7,200	2	13	24

Differences between European and Other workers and Pacific workers were also slightly larger for higher socio-economic groups, but in general large across all socio-economic groups. For males, the difference was 27–29 percent for SES groups 1–3 compared with 16–21 percent for SES groups 4–6. For females, the difference was 18 percent for SES group 1 compared with 9–13 percent for SES groups 4–6.

In contrast, differences between European and Other workers and Asian workers were larger for lower socio-economic groups. For males, the difference was 14 percent for SES group 1 compared with 29–31 percent for SES groups 4–6. For females the difference was 8 percent for SES group 1 compared with 23–26 percent for SES groups 4–6.

Table 22 shows the absolute and percentage differences in education (in years) by sex, ethnicity, and socio-economic group. Differences in education between ethnic groups were typically less marked than the differences in income shown in table 21. However, as with income, European and Other (including New Zealander) workers reported higher education than both Māori and Pacific workers for all socio-economic groups. These differences were similar for males and females, but typically larger for higher socio-economic groups (eg, 4–6 percent for SES groups 1–2, and 1–4 percent for SES groups 5–6).

In contrast, European and Other workers reported lower education than Asian workers for all socio-economic groups. These differences were similar for males and females, but typically larger for lower socio-economic groups (eg, 4–9 percent for SES groups 1–2, and 10–14 percent for SES group 6).

Table 22

Differences in mean education
European and Other ethnic group compared with Māori, Pacific, and Asian

SES group	Mean education (years)				Mean difference in education compared with European and Other					
					Years			Percent		
	Ethnic group									
	European and Other	Māori	Pacific	Asian	Māori	Pacific	Asian	Māori	Pacific	Asian
Males										
1	15.8	14.9	15.0	16.4	0.9	0.8	-0.6	6	5	-4
2	14.0	13.3	13.3	15.3	0.7	0.7	-1.3	5	5	-9
3	12.8	12.2	12.2	14.1	0.6	0.6	-1.3	5	5	-10
4	12.0	11.6	11.6	13.5	0.4	0.4	-1.5	4	4	12
5	11.6	11.1	11.2	12.5	0.5	0.4	-0.9	4	4	-8
6	11.2	10.8	11.0	12.8	0.4	0.2	-1.6	4	2	-14
Females										
1	15.2	14.5	14.6	15.9	0.7	0.6	-0.7	5	4	-4
2	14.3	13.6	13.5	15.2	0.7	0.8	-0.9	5	6	-6
3	12.7	12.3	12.4	14.2	0.4	0.3	-1.5	3	2	-12
4	12.1	11.7	11.9	13.5	0.4	0.2	-1.4	3	1	-12
5	11.7	11.3	11.4	12.9	0.4	0.3	-1.2	4	3	-10
6	11.1	10.8	11.0	12.3	0.3	0.1	-1.2	3	1	-10

4.4 Construct validation of NZSEI-06 – bivariate results

In this section, NZSEI-06 is applied to data from the 2006 Census to assess whether the socio-economic index replicated known patterns for smoking, housing tenure, motor vehicle access, and residential deprivation. Multi-variable regression analyses will be presented in section 4.5 to further assess the validity of NZSEI-96 and to determine the relative contribution of age, sex, ethnicity, and socio-economic group to the four outcomes.

Smoking prevalence

Data on current smoking prevalence were available from the 2006 Census. The overall prevalence of smoking for workers aged 21–69 years was 21.3 percent. Figure 14 shows the prevalence of smoking across the six NZSEI-06 socio-economic groups. There was a graded association between smoking prevalence and socio-economic group, with the prevalence of smoking increasing with declining socio-economic groups. The prevalence of smoking in the lowest socio-economic group was nearly four times as high (35.4 percent) as that reported by the highest occupational group (9.2 percent). It should be noted that this gradient was steeper and more consistent across the strata than that reported in the validation of NZSEI-96, where socio-economic group 2 recorded a lower, rather than the expected higher, smoking prevalence than group 1 (Davis et al, 2003).

Figure 14

Smoking prevalence
By NZSEI-06 SES group

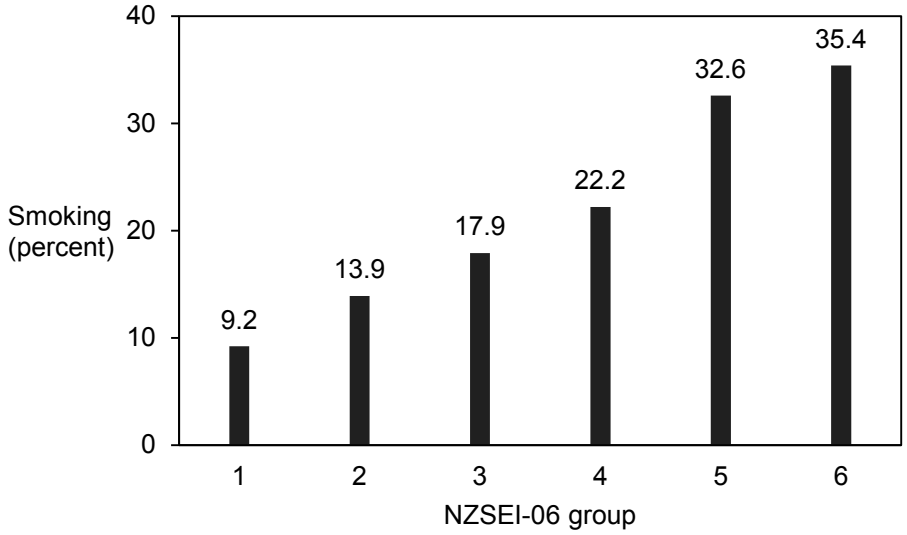
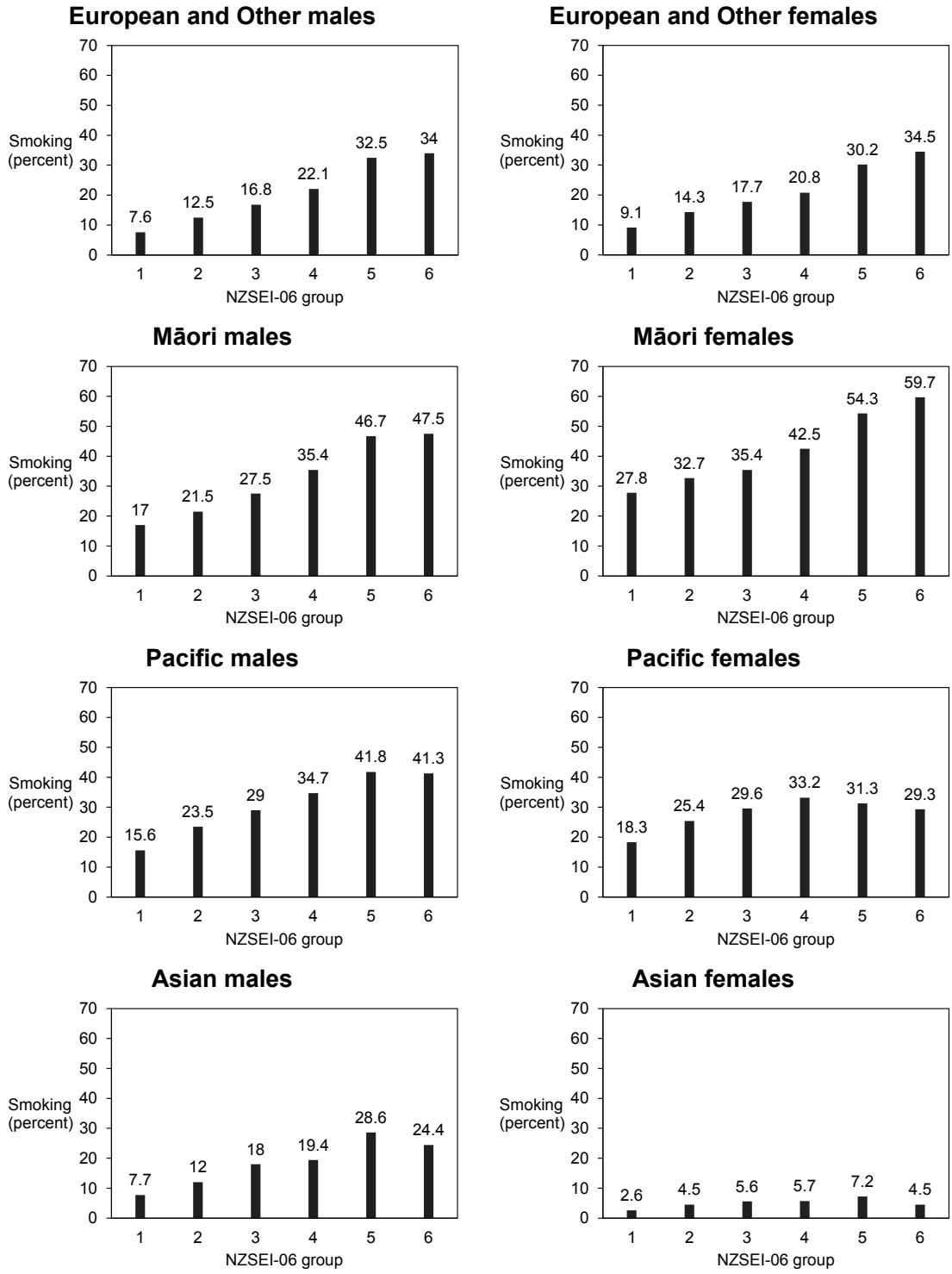


Figure 15 shows that the socio-economic gradient in smoking was apparent for both males and females of each ethnic group. This is most obvious among European and Other and Māori males and females.

Figure 15

Smoking prevalence
By NZSEI-06 SES group, sex, and ethnicity



For Pacific males and Asian males and females, there was a clear gradient for socio-economic groups 1–5, but smoking prevalence was slightly lower among those in group 6 compared with group 5. For Pacific females, there was a gradient for socio-economic groups 1–3 but little to distinguish those in groups 3–6.

A male excess in smoking was apparent for those of Pacific and Asian ethnicity, while a female excess was apparent among Māori. Smoking prevalence was particularly low among Asian females.

Housing tenure

In the 2006 Census, a dwelling was defined as owned if any of its occupants owned the home, with or without a mortgage. For the purposes of analyses here, individuals were assigned the home ownership status of the dwelling in which they live.

The prevalence of home ownership in New Zealand among workers aged 21–69 years was 61 percent, somewhat lower than the equivalent figure in 1996 of 74 percent (Davis et al, 2003). There was a clear socio-economic gradient in home ownership (figure 16). The prevalence of home ownership among those in groups 1–3 was nearly 20 percent greater than the prevalence of home ownership among those living in groups 5 and 6. This association is stronger than that found for NZSEI-96, for which there was just an 8 percent difference across socio-economic groups (Davis et al, 2003).

Figure 17 shows the prevalence of home ownership within each NZSEI-06 socio-economic group, by sex and ethnicity. Socio-economic gradients were apparent for males and females of each ethnicity. As with the overall trend, groups 1–3 differed very little for each ethnicity, but prevalence of home ownership was 10–20 percent larger among those in groups 1–3 compared with those in groups 5 and 6. Socio-economic gradients were strongest for Māori and Pacific. Prevalence of home ownership among European and Other workers was somewhat greater than in Asian workers, and substantially greater than in Māori and Pacific workers. For example, the prevalence of home ownership among European and Other workers in lower socio-economic groups (5 and 6) was greater than the prevalence of home ownership among Māori and Pacific workers in higher socio-economic groups (1 and 2) in all but one case.

Figure 16

Home ownership
By NZSEI-06 SES group

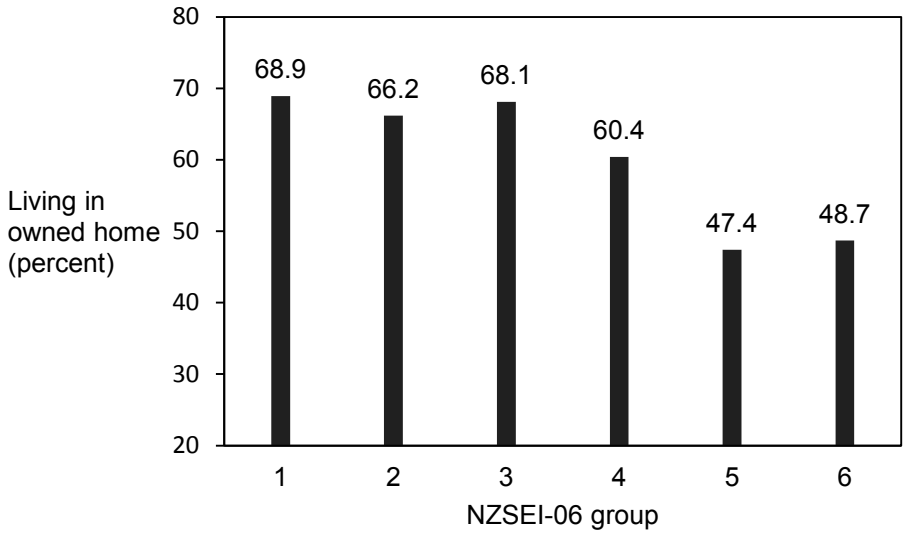
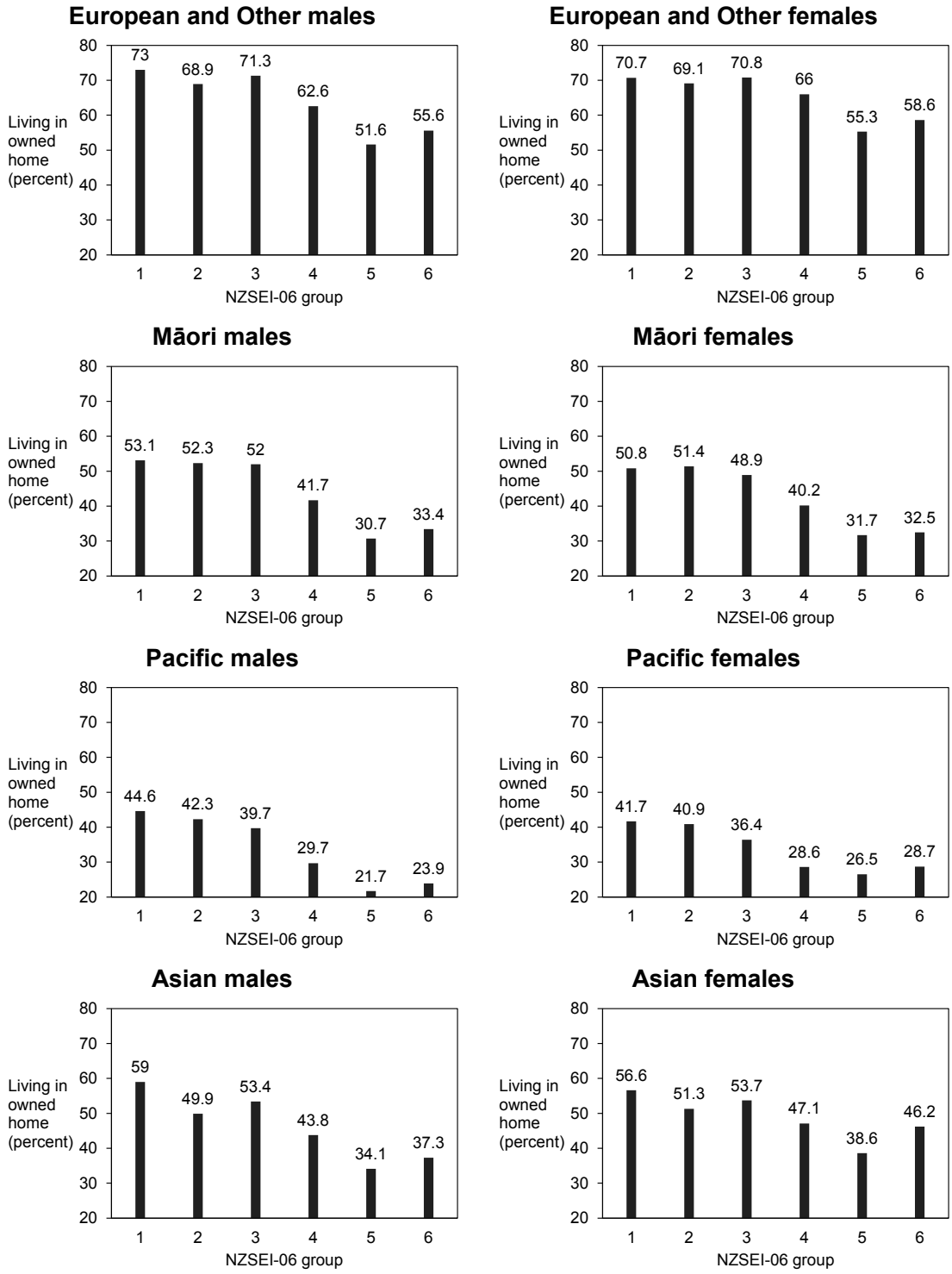


Figure 17

Home ownership
By NZSEI-06 SES group, sex, and ethnicity



Access to a motor vehicle

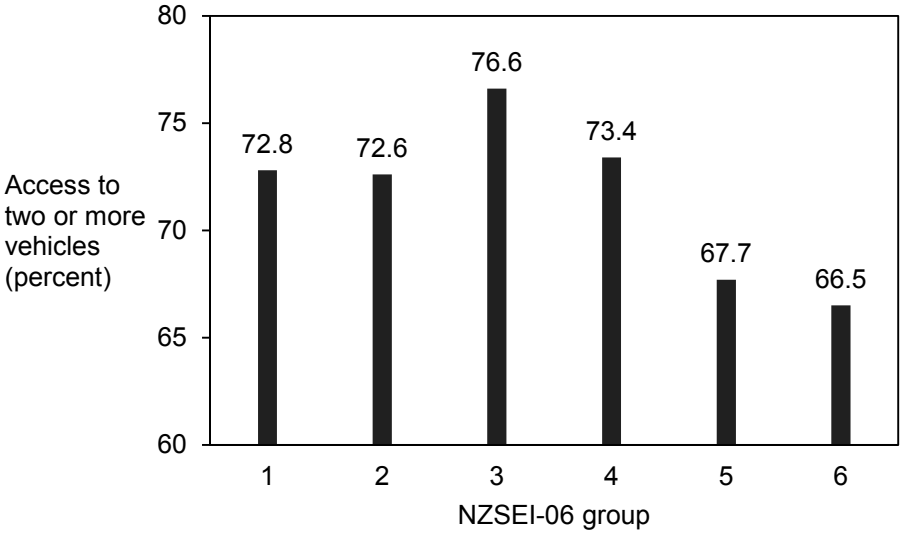
The 2006 Census assessed the number of motor vehicles that were available for use by members of each dwelling, excluding vehicles available for work only, vehicles owned by visitors, and vehicles that any of the household occupants borrowed from time to time.

Thus, as with the measure of housing tenure, individuals were assigned motor vehicle access based on the dwelling in which they lived. Access to at least one motor vehicle was nearly universal in New Zealand (around 95 percent), so, as with the validation for the previous NZSEI-96 (Davis et al, 2003), *access to two or more motor vehicles* was analysed here. Approximately 72.5 percent of workers aged 21–69 years reported having access to two or more motor vehicles.

Figure 18 shows the prevalence of access to two or more motor vehicles for each NZSEI-06 socio-economic group. Access to a motor vehicle was slightly (6 percent) more prevalent in socio-economic groups 1–4 than in socio-economic groups 5 and 6. However, access to a motor vehicle was marginally more prevalent in socio-economic groups 3 and 4 than in socio-economic groups 1 and 2. These associations were less marked than those found for NZSEI-96 (Davis et al, 2003).

Figure 18

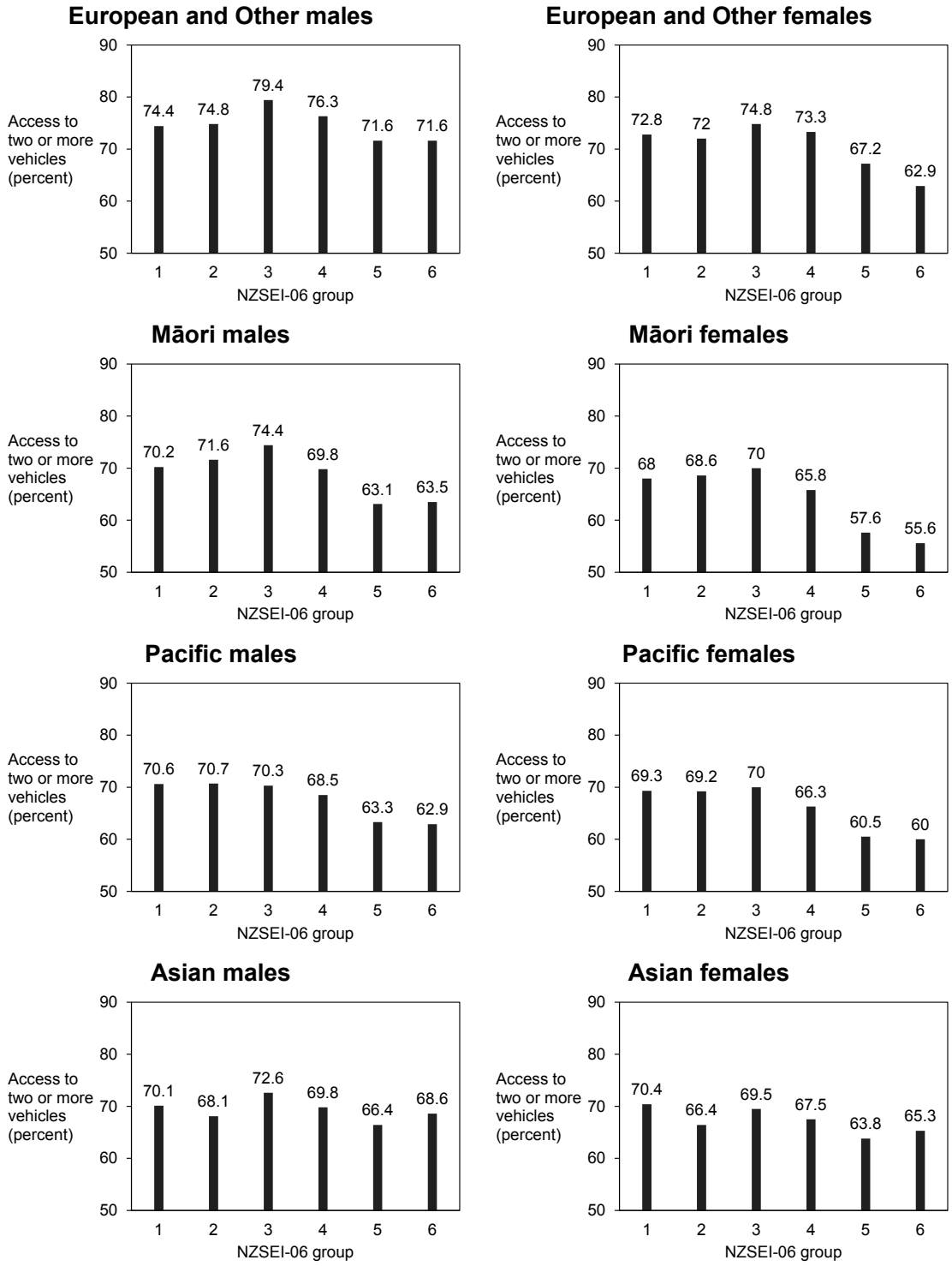
Access to two or more vehicles
By NZSEI-06 SES group



Separate analyses by sex and ethnicity (see figure 19) show, for males and females of each ethnicity, very little difference in the prevalence of motor vehicle access between groups 1, 2, 3, and 4 but slightly higher prevalence in groups 1–4 compared with groups 5 and 6.

Figure 19

Access to two or more vehicles
By NZSEI-06 SES group, sex, and ethnicity



Deprivation

As described in section 1.3, an area-based measure of deprivation has been developed for New Zealand, the latest version of which – NZDep2006 – is derived using data from the 2006 Census. NZDep2006 assigns each mesh block in New Zealand a score from 1 (least deprived) to 10 (most deprived) with roughly the same number of mesh blocks in each of the 10 categories. The NZDep2006 scale scores for each dwelling – based on the mesh block containing the dwelling – are made available as part of the 2006 Census. For the analyses presented here, each individual was assigned the NZDep2006 score of the dwelling in which they lived.

Figure 20

Mean scores on NZDep2006 scale
By NZSEI-06 SES group

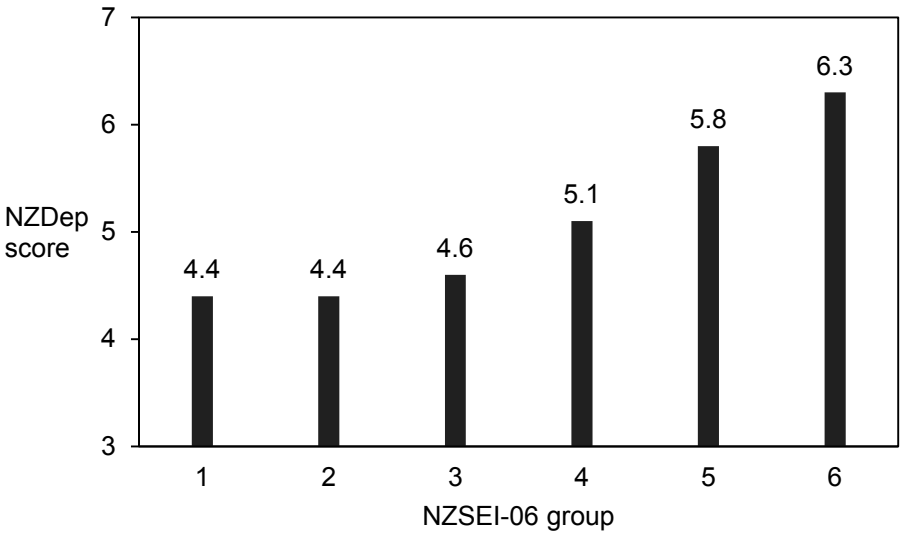
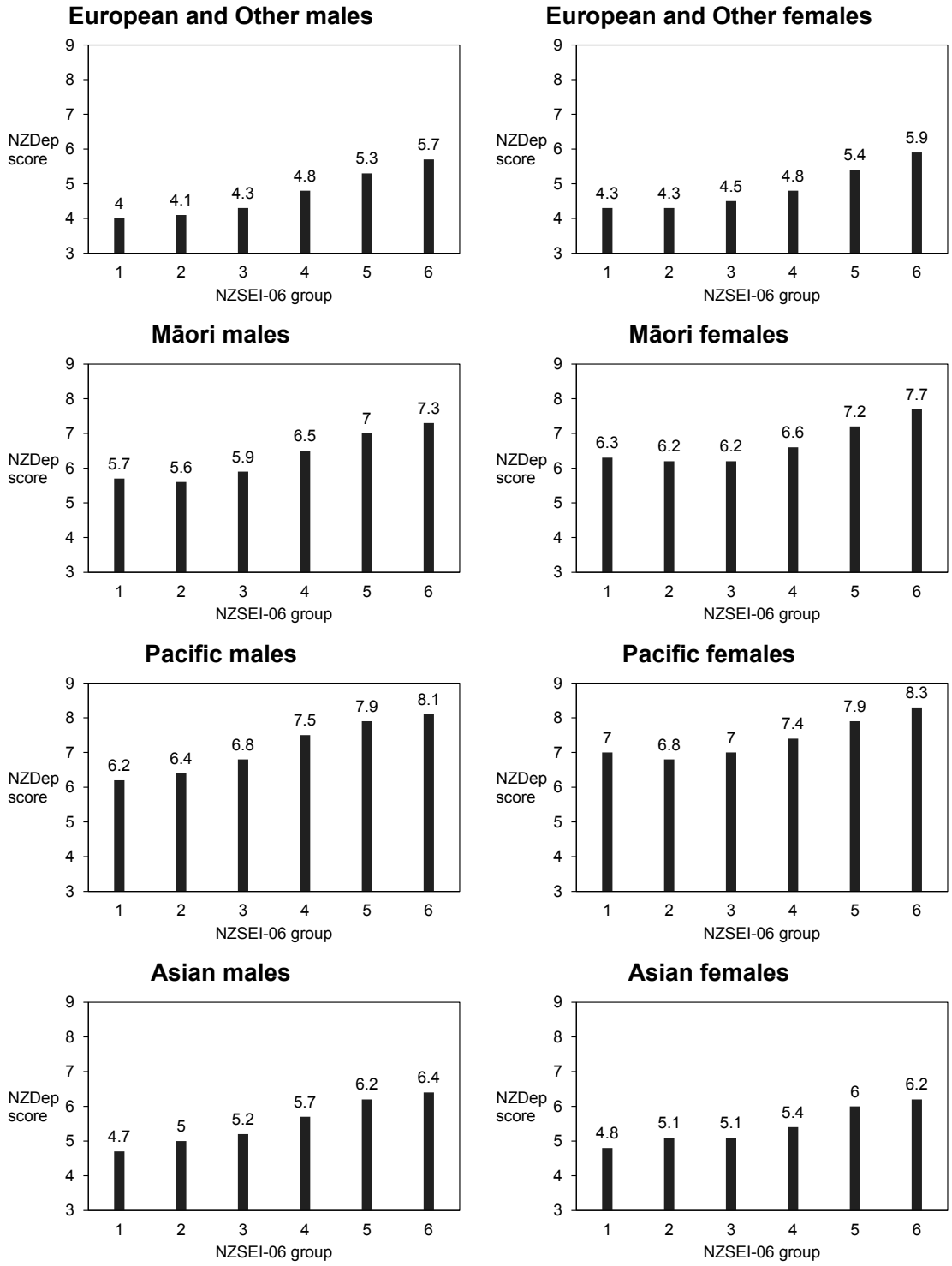


Figure 20 shows the mean NZDep2006 scores for each NZSEI-06 socio-economic group. Note that the mean NZDep2006 score across all workers aged 21–69 years was 5.0. This was slightly closer to 1 than the expected mean for the total household population (expected mean = 5.5, ie, the mid-point between 1 and 10). This was presumably because those out of the workforce were excluded, and were also more likely to live in deprived areas. As expected, a consistent association between NZSEI-06 socio-economic group and deprivation was evident, with mean NZDep2006 score increasing with declining socio-economic group.

There was also a clear socio-economic gradient in deprivation by sex and ethnicity, as shown in figure 21. This was consistent across males and females in each ethnic group, though for both Māori and Pacific females there was little to distinguish those in socio-economic groups 1–3. Few sex differences were evident, but there were clear ethnic differences in deprivation. European and Other workers (mean across socio-economic groups = 4.7) lived in the least deprived areas, followed by Asian workers (mean = 5.5), Māori workers (mean = 6.7) and Pacific workers (mean = 7.5).

Figure 21

Mean scores on NZDep2006 scale
By NZSEI-06 SES group, sex, and ethnicity



4.5. Construct validation of NZSEI-06 – multi-variable analyses

To assess the independent effects of sex, ethnicity, and socio-economic status on the four socio-economic correlates – smoking, housing tenure, motor vehicle access, and household deprivation – regression models were undertaken. Logistic regression

analyses were undertaken for binary outcomes (smoking, housing tenure, motor vehicle access), while least-squares regression analyses were undertaken for the continuous NZDep2006 measure. For each correlate, two models were fitted, one using the continuous measure of NZSEI-06, and the other using the categorical six socio-economic group measure of NZSEI-06.

All models included age, sex (male versus female), and ethnicity (European and Other (including New Zealander), Māori, Pacific, and Asian; for each ethnicity, the comparison group is those not identifying with that ethnic group). The odds ratios for age and NZSEI-06 scores are reported on a scale converted into units of 10 (that is, per 10 years and per 10 NZSEI-06 score units, respectively).

Smoking prevalence

Table 23 shows the results for the logistic regression model on smoking, using the continuous measure of NZSEI-06. After controlling for age, sex, and ethnicity, the odds of smoking decreased 23 percent for each 10-unit increase in NZSEI-06. As expected, age, sex, and ethnicity all had significant effects on the odds of smoking, independently of socio-economic status.

Table 23

Odds ratios for smoking
NZSEI-06 continuous measure

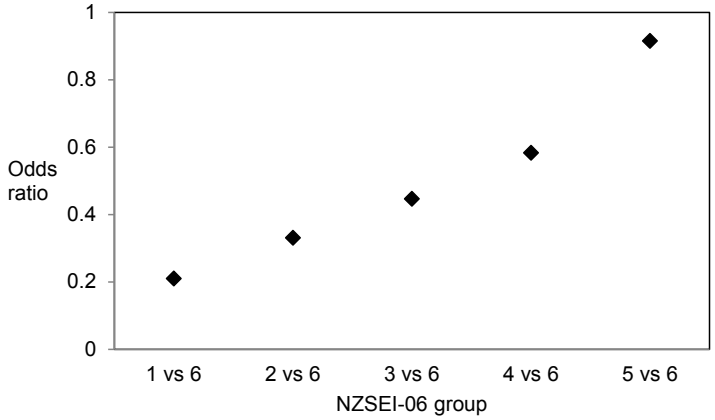
Factor	Odds ratio (95 percent CI)	P value
NZSEI-06 (per 10 units)	0.769 (0.767 - 0.771)	<.0001
Age (per 10 years)	0.811 (0.809 - 0.814)	<.0001
Sex (male vs female)	1.083 (1.074 - 1.091)	<.0001
European and Other (vs non-European and Other)	0.779 (0.766 - 0.792)	<.0001
Māori (vs non-Māori)	1.992 (1.964 – 2.020)	<.0001
Pacific (vs non-Pacific)	1.177 (1.153 - 1.202)	<.0001
Asian (vs non-Asian)	0.376 (0.367 - 0.385)	<.0001

The results of the logistic regression model using the categorical group measure of NZSEI-06 are shown in figure 22, with odds ratios shown for each socio-economic group, controlling for age, sex, and ethnicity (reference group = socio-economic group 6).

There was a linear association between socio-economic group and smoking. Those from socio-economic groups 1–5 all had reduced odds of smoking compared with socio-economic group 6. Those from socio-economic group 1 had greatly reduced odds of smoking (0.21) while the odds of smoking were also reduced for each of the remaining socio-economic groups, with the strength of the difference diminishing in a linear fashion. All odds ratios were significant, ie, the confidence intervals did not include one.

Figure 22

Odds ratios for smoking
NZSEI-06 categorical measure



SES group	Odds ratio (95 percent CI)
1 v 6	0.210 (0.206 - 0.214)
2 v 6	0.331 (0.326 - 0.336)
3 v 6	0.446 (0.440 - 0.452)
4 v 6	0.583 (0.575 - 0.590)
5 v 6	0.915 (0.902 - 0.928)

Note: because of the large sample analysed, the confidence intervals for the odds ratios are so narrow that they do not appear on the graph above.

Housing tenure

The odds of living in an owned versus a rented home, for a 10-unit change in NZSEI-06, are given in table 24. The table shows that the odds of living in an owned home increased by 19 percent for each 10-unit increase in NZSEI-06 score. Age, sex, and ethnicity also had significant associations with housing tenure. For example, older age, and identifying as being of European and Other or Asian ethnicity were associated with increased odds of living in an owned home, while being male, and identifying as being of Māori or Pacific ethnicity were associated with decreased odds of living in an owned home.

Table 24

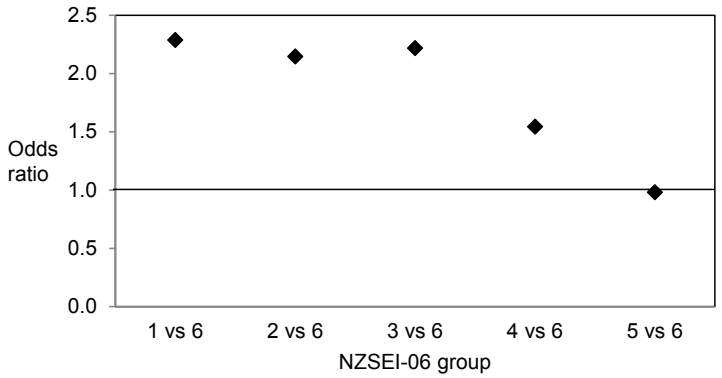
Odds ratios for living in an owned home
NZSEI-06 continuous measure

Factor	Odds ratio (95 percent CI)	P value
NZSEI-06 (per 10 units)	1.190 (1.188 - 1.192)	<.0001
Age (per 10 years)	2.488 (2.481 - 2.500)	<.0001
Sex (male vs female)	0.901 (0.894 - 0.907)	<.0001
European and Other (vs non-European and Other)	2.066 (2.033 – 2.101)	<.0001
Māori (vs non-Māori)	0.663 (0.653 - 0.672)	<.0001
Pacific (vs non-Pacific)	0.552 (0.541 - 0.564)	<.0001
Asian (vs non-Asian)	1.294 (1.267 - 1.319)	<.0001

Figure 23 presents the analysis using the categorical measure of NZSEI-06. With the effects of age, sex, and ethnicity controlled, the odds of living in an owned home for those in socio-economic groups 1–3 were more than double those in socio-economic group 6.The odds of living in an owned home for those in socio-economic group 4 were approximately 1.5 times those in socio-economic group 6. The odds of living in an owned home did not significantly differ between those in socio-economic groups 5 and 6.

Figure 23

Odds ratios for housing tenure
NZSEI-06 categorical measure



SES group	Odds ratio (95 percent CI)
1 v 6	2.288 (2.257 - 2.326)
2 v 6	2.146 (2.119 - 2.179)
3 v 6	2.217 (2.188 - 2.247)
4 v 6	1.543 (1.524 - 1.565)
5 v 6	0.981 (0.967 - 0.996)

Note: because of the large sample analysed, the confidence intervals for the odds ratios are so narrow that they do not appear on the graph above

Access to a motor vehicle

Controlling for the effects of age, sex, and ethnicity, the odds of having access to two or more cars is shown in table 25. For each 10-point increase in the continuous NZSEI-06 measure, the odds of having access to two or more cars increased marginally (by around 5 percent). The odds of having access to two or more cars increased with increasing age, and was higher among males, and those of European and Other ethnicity, but lower among those of Māori, Pacific, and Asian ethnicity.

Table 25

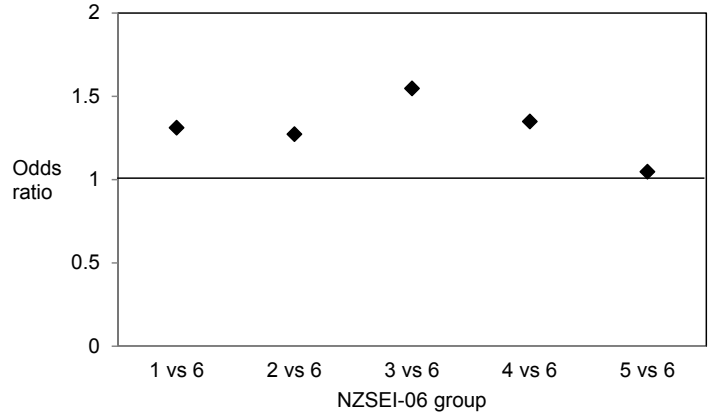
Odds ratios for having access to two or more vehicles
NZSEI-06 continuous measure

Factor	Odds ratio (95 percent CI)	P value
NZSEI-06 (per 10 units)	1.051 (1.049 - 1.053)	<.0001
Age (per 10 years)	1.032 (1.029 - 1.035)	<.0001
Sex (male vs female)	1.195 (1.187 - 1.203)	<.0001
European and Other (vs non-European and Other)	1.355 (1.334 - 1.376)	<.0001
Māori (vs non-Māori)	0.853 (0.842 - 0.865)	<.0001
Pacific (vs non-Pacific)	0.928 (0.909 - 0.946)	<.0001
Asian (vs non-Asian)	1.043 (1.024 – 1.063)	<.0001

Analysing NZSEI-06 as a six-group categorical variable (see figure 24) revealed that those in socio-economic groups 1–4 each had 1.27 to 1.55 times the odds of having access to two or more cars compared with those in socio-economic group 6. Those in socio-economic group 5 had marginally (but significantly) increased odds of having access to two or more cars compared with those in socio-economic group 6.

Figure 24

Odds ratios for access to two or more vehicles
NZSEI-06 categorical measure



SES group	Odds ratio (95 percent CI)
1 v 6	1.310 (1.291 - 1.329)
2 v 6	1.272 (1.255 - 1.289)
3 v 6	1.546 (1.527 - 1.566)
4 v 6	1.348 (1.332 - 1.364)
5 v 6	1.046 (1.031 - 1.060)

Deprivation

Table 26 shows the effect of the continuous NZSEI-06 measure on scores on the NZDep2006 scale, controlling for age, sex, and ethnicity. The table shows that NZDep2006 scores decreased by 0.27 points for every 10-point increase in the continuous NZSEI-06 measure.

Table 26

Beta coefficients for scores on the NZDep2006 scale
NZSEI-06 continuous measure

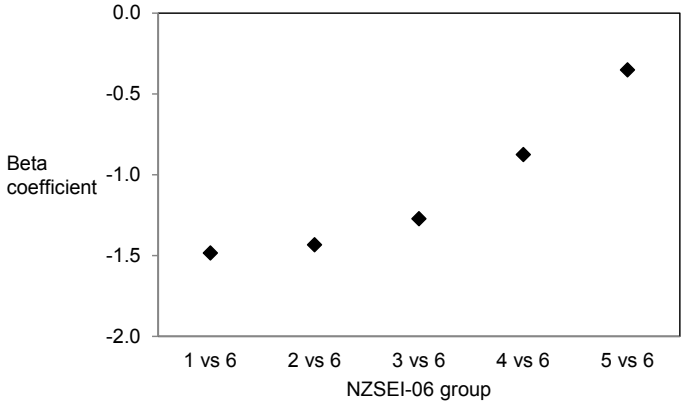
Factor	Beta coefficients (95 percent CI)	P value
NZSEI-06 (per 10 units)	-0.268 (-0.270 - -0.265)	<.0001
Age (per 10 years)	-0.180 (-0.183 - -0.177)	<.0001
Sex (male vs female)	-0.069 (-0.076 - -0.061)	<.0001
European and Other (vs non-European and Other)	-1.234 (-1.252 - -1.215)	<.0001
Māori (vs non-Māori)	1.044 (1.028 - 1.060)	<.0001
Pacific (vs non-Pacific)	1.484 (1.460 - 1.507)	<.0001
Asian (vs non-Asian)	-0.492 (-0.514 - -0.469)	<.0001
Note: NZDep2006 scale = index of deprivation 2006		

Note that while increasing scores on the continuous NZSEI-06 scale represent **higher** SES, increasing scores on the NZDep2006 scale represent higher deprivation, so a negative association is expected. NZDep2006 scores also decreased with age, and were lower for males and those of European and Other and ethnicity. NZDep2006 scores were higher for those of Māori and Pacific ethnicity.

Analysing NZSEI-06 as a six-group categorical variable (see figure 25) revealed that those in socio-economic groups 1 and 2 had NZDep2006 scores that were nearly 1.5 points less than those in socio-economic group 6. The effect on NZDep2006 scores for each of the remaining socio-economic groups was less, with the strength of the difference diminishing in a linear fashion.

Figure 25

Beta coefficients for scores on the NZDep2006 scale
NZSEI-06 categorical measure



SES group	Beta coefficients (95 percent CI)
1 v 6	-1.484 (-1.501 - -1.467)
2 v 6	-1.434 (-1.449 - -1.418)
3 v 6	-1.272 (-1.287 - -1.258)
4 v 6	-0.875 (-0.889 - -0.861)
5 v 6	-0.352 (-0.368 - -0.335)

4.6 Summary and discussion

The purpose of this section was to assess NZSEI-06 in relation to:

(i) the previous NZSEI-96
(ii) an Australian scale, AUSEI06, which uses a similar method of construction
(iii) sex and ethnicity
(iv) a number of health and other socio-economic indicators.

Comparison with NZSEI-96

It was possible to compare the scores assigned to individuals by NZSEI-06 (based on ANZSCO) with the scores assigned to individuals by NZSEI-96 (based on NZSCO95). This revealed that NZSEI-06 assigned socio-economic scores to occupations similarly, but by no means identically, to NZSEI-96 (the scores correlate at $r = 0.79$). The lack of a perfect correlation was perhaps not surprising, given that the two scales used different occupational classification systems, and that the relative influence of education and income on final socio-economic scores differed markedly between the two scales.

Researchers wishing to assess socio-economic status as a time series should be mindful of the imperfect correlation between the two scales. Given each NZSEI scales is based on contemporary associations between education, occupation, and income (eg, NZSEI-91 is based on associations derived from the 1991 Census, NZSEI-96 is based on associations derived from the 1996 Census, and NZSEI-06 is based on associations derived from the 2006 Census), it is recommended that contemporary versions of NZSEI are used for time-series occupational data. However, researchers undertaking time-series analyses might wish to consider undertaking 'sensitivity analyses' to determine whether results are substantially affected by the NZSEI version used (eg, using different versions for different time points or the same version across all time points).

Comparison with AUSEI06

A more direct comparison between NZSEI-06 and AUSEI06 was possible, given that both scales assigned scores to the same 97 occupations (as classified by ANZSCO). The comparison revealed a strong correlation ($r = 0.96$), supporting the robustness of the scale, and also suggesting a great deal of similarity between the socio-economic structure of the New Zealand and Australian workforce.

Sex and ethnic comparisons

Using the path coefficients determined for the sample as a whole, NZSEI-06 scores were constructed separately for males and females and then compared. Comparisons between males and females showed that males were assigned higher scores for the vast majority of occupations (mean difference across occupations was 5.8 points). Comparing males and females on mean income, years of education, and age for each minor group occupation revealed that it was the lower mean income reported by females that likely resulted in lower sex-specific NZSEI-06 scores. However, male and female scores correlated strongly (r = 0.96), suggesting that the socio-economic structure of occupations is similar for the two sexes. This also suggests that NZSEI-06 scale is applicable to both males and females.

NZSEI-06 scores were also constructed separately and compared for four ethnic groups – European and Other (including New Zealander), Māori, Pacific, and Asian. Asian workers had ethnic-specific NZSEI-06 scores that were, on average, approximately 5 points higher than European and Other workers, and 13–14 points higher than either Māori or Pacific workers.

Comparing ethnicities on mean income, years of education, and age for each minor group occupation revealed that the higher mean years of education for Asian workers relative to other ethnic groups was the likely reason for their higher ethnic-specific NZSEI-06 scores. These differences notwithstanding, the ethnic-specific NZSEI-06 scores of each ethnic group correlated strongly with every other group (all pairwise r >= 0.90). This suggests that the socio-economic structure of occupations is similar across ethnic groups, and that NZSEI-06 can be applied to these ethnic groups.

Validation with health and socio-economic correlates

Assessing NZSEI-06 against 2006 Census data on smoking, housing tenure, motor vehicle access, and residential deprivation revealed socio-economic patterning for each of these outcomes. Moreover, these patterns were apparent for both males and females of each major ethnic group.

Results were clearest for smoking and residential deprivation. NZSEI-06 exhibited a ‘dose-response’ relationship with both of these indicators: the higher the NZSEI-06 score (or socio-economic group), the lower the likelihood of smoking, and the lower the score on the NZDep2006 index of deprivation.

5 Imputing NZSEI-06 scores in the absence of occupational data

This section describes and evaluates two methods for imputing NZSEI-06 scores for those with no occupational data. Both methods are based on the notion of 'occupational potential' (Jones and McMillan, 2001), whereby, in the absence of information on occupation, scores can be assigned using available data on age and education. These two methods were trialled for NZSEI-96 and were found to correspond well with actual NZSEI-96 scores and to have reasonable construct validity. A third method was also trialled for NZSEI-96 but found to have poorer correspondence and construct validity, so it will not be tested for NZSEI-06.

The two methods are compared as suitable methods for the classification of those without occupational data. This is done by assessing their correspondence with actual NZSEI-06 scores, and their ability to predict socio-economic patterns in smoking prevalence, housing tenure, motor vehicle access, and deprivation (NZDep2006 index).

5.1 Imputing NZSEI-06 scores: results of two alternative methods

For the earlier NZSEI-96, imputations were based on a simplified measure of educational qualifications containing just six levels: none, school certificate, higher school qualifications, vocational qualifications, bachelor's degree, and higher degree. The rationale for this approach was that some qualification levels – specifically those relating to vocational qualifications – are often difficult to classify to the detail required of, for example, the 15-level educational qualification measure used in the 2006 Census and in the construction of NZSEI-06.

However, for the imputation for NZSEI-06 described here, the approach taken will be to classify educational qualifications at the greatest (15-group) level of detail. The reasons for this are that, first, simplifying educational qualification levels risks grouping together individuals with quite different socio-economic standing. Second, with the standardisation of New Zealand qualifications to a 'levels' system through the New Zealand Qualifications Authority (NZQA), classification of qualifications has become easier – though it should not be assumed that no difficulties remain. Third, by showing the results of imputations with educational qualifications classified to the greatest level of detail, it is possible to determine where misclassifications might make large differences to an imputed score and where they have little impact. This will help those charged with classification of qualification data to determine the distinctions that are important for the accurate classification of socio-economic status.

For the purposes of imputing NZSEI-06 scores, 10-year age bands were used. Table 27 shows a classification of highest qualification by 10-year age band for those reporting an occupation as part of the 2006 Census. As the years of education corresponding to each qualification level are used in one of the imputation methods, these are also shown in the table (note, these are repeated from table 5).

For the two methods compared, the impact of sex will be investigated. Given the known differences between the occupational roles held by men and women (see section 2.1 and appendix I), it may be that sex-modified or sex-specific imputed scores may differ substantially from unmodified/unadjusted scores. This will be tested here. Where sex-modified or sex-specific scores do differ from unmodified/unadjusted scores, both sets of imputed scores will be assessed and compared in their correspondence with actual NZSEI-06 scores and in their ability to replicate known patterns for the health and socio-

economic correlates: smoking, housing tenure, motor vehicle access, and residential deprivation.

Table 27

Distribution of people with an occupation
By age-band and qualification
2006 Census

Highest qualification	Years of education	People with an occupation						
		Age (years)						
		15–24	25–34	35–44	45–54	55–64	65–74	75+
Doctorate degree	20	21	1,533	4,014	3,990	3,036	705	102
Master's degree	18	801	11,178	14,166	12,735	6,837	1,053	156
Post-graduate and honours degree	17	2,922	13,629	12,942	10,467	4,788	708	126
Bachelor's degree and level 7 qualification	16	27,801	78,642	66,339	50,235	22,434	4,323	816
Level 6 diploma	14.5	5,241	16,527	27,117	33,084	22,281	4,854	534
Level 5 diploma	13.5	9,726	19,104	22,749	20,217	11,160	2,193	258
Level 4 certificate gained post-school	12.5	17,583	41,448	61,386	56,304	31,896	7,002	870
Level 3 certificate gained post-school	11.5	11,967	13,977	11,013	8,514	4,395	711	117
Level 2 certificate gained post-school	11.5	6,000	6,747	6,582	5,526	3,564	753	117
Level 1 certificate gained post-school	11.5	1,863	1,863	1,659	1,386	801	156	33
Overseas secondary school qualification	12	8,004	16,566	24,591	20,301	12,999	2,940	390

Table 27 continued next page

Table 27 continued

Highest qualification	Years of education	People with an occupation						
		Age (years)						
		15–24	25–34	35–44	45–54	55–64	65–74	75+
Level 3 or 4 certificate gained at school	13	48,558	26,307	13,926	10,365	5,958	1,230	312
Level 2 certificate gained at school	12	49,182	37,092	49,665	35,736	11,901	2,433	483
Level 1 certificate gained at school	11	52,155	36,219	61,569	59,142	34,644	6,303	837
No school qualifications	10	47,733	37,995	68,529	79,608	76,098	17,235	2,337

Source: Statistics NZ, 1996 and 2006 Censuses

Method I – Simple averages

Method I involves calculating the average NZSEI-06 scores by highest educational qualification and age band. These are shown in table 28. The mean NZSEI-06 scores obtained ranged from 30, for those aged 15–24 years with no qualifications, to 75, for those aged 35–54 years with doctoral degrees. This range of scores is substantially narrower than the potential range of 10–90 for the 97 minor group occupations.

Scores increased with age, irrespective of education, and also increased with education, irrespective of age. Both these effects were reported with previous imputations of NZSEI (eg, Davis et al, 2003). However, both similarities and differences between adjacent educational qualification levels were apparent. For example, while those with a doctoral degree had NZSEI-06 scores that were, on average, around 8 points higher than those with a master's degree, only around a point separated those with a master's degree from those with a post-graduate or honours degree.

Consistent 4–5 point gaps separated the next four educational qualifications on the hierarchy, but there was little to separate those with a Level 4, Level 3, Level 2, or Level 1 Certificate gained post-school. For those with school qualifications, the difference in average NZSEI-06 scores between obtaining a Level 3 or 4 certificate and a Level 2 certificate was slight (1–3 points); a greater difference (2–5 points) was apparent between obtaining these and obtaining a Level 1 or overseas school qualification, and between gaining a Level 1 and obtaining none (3–7 points).

These similarities and differences have implications for coding educational qualifications for the classification of socio-economic status. In particular, if this method of simple averages is used, it may not be important to distinguish:

(i) between those with a master's degree and those with a post graduate or honours degree
(ii) between those with a Level 1, 2, 3, or 4 qualification obtained post-school
(iii) between those with a Level 3 or 4 and a Level 2 school qualification.

All other distinctions appear important.

Table 28

Imputed mean NZSEI-06 scores
For each age/qualification category
Method I

Highest qualification	Age (years)						
	15–24	25–34	35–44	45–54	55–64	65–74	75+
	Imputed mean NZSEI-06 score						
Doctorate degree	58	71	75	75	74	72	64
Master's degree	56	61	63	64	65	64	58
Post-graduate and honours degree	58	63	64	66	65	63	63
Bachelor's degree and level 7 qualification	55	59	61	61	61	60	60
Level 6 diploma	46	55	58	59	58	54	52
Level 5 diploma	42	48	51	51	51	49	47
Level 4 certificate gained post-school	39	42	44	45	45	43	43
Level 3 certificate gained post-school	37	42	44	43	43	43	45
Level 2 certificate gained post-school	36	40	42	42	43	42	47
Level 1 certificate gained post-school	36	41	42	43	43	48	47
Overseas secondary school qualification	34	40	41	41	42	42	43
Level 3 or 4 certificate gained at school	38	46	49	48	48	46	46
Level 2 certificate gained at school	36	43	46	46	46	45	45
Level 1 certificate gained at school	33	38	41	42	42	41	40
No school qualifications	30	33	34	35	36	36	37

Table 29 shows the influence of sex on mean NZSEI-06 scores by age and highest education. The imputed scores of males and females correlated at $r = 0.99$ and in general there were only small differences between them: females scores were on average 0.6 points higher than male scores (median = 0). Only for level 5 and 6 diplomas were there any consistent differences: females had scores that were 0–10 points higher across ages (mean difference = 3.8).

Given these small differences, and the strong correlation between scores, there appears to be little evidence that sex-specific scores will improve the validity of the imputed scores, so only the overall scores (as shown in table 28) will be validated in sections 5.2 and 5.3.

Table 29

Imputed mean NZSEI-06 scores by sex
For each age/qualification category
Method I

Highest qualification	Age (years)													
	15–24		25–34		35–44		45–54		55–64		65–74		75+	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
	Imputed mean NZSEI-06 score													
Doctorate degree	50	76	71	70	75	74	75	75	74	74	72	73	63	67
Master's degree	56	57	61	61	62	63	63	66	65	67	64	63	59	57
Post-graduate and honours degree	59	58	63	63	64	64	66	66	66	64	65	60	64	60
Bachelor's degree and level 7 qualification	54	55	58	60	60	61	61	62	62	61	62	57	60	57
Level 6 diploma	45	47	52	57	55	60	55	61	55	59	52	55	52	52
Level 5 diploma	41	42	48	48	50	52	50	53	49	54	47	54	45	55
Level 4 certificate gained post-school	39	39	42	43	44	45	44	46	44	47	43	46	43	45
Level 3 certificate gained post-school	36	38	41	43	44	44	45	42	45	41	44	42	48	40
Level 2 certificate gained post-school	35	36	39	42	42	42	43	42	43	42	42	42	48	45
Level 1 certificate gained post-school	36	35	39	42	42	42	42	43	44	43	49	46	47	47
Overseas secondary school qualification	34	35	40	40	42	41	42	41	43	41	43	41	43	41
Level 3 or 4 certificate gained at school	38	38	46	46	49	48	49	47	49	47	47	45	46	46
Level 2 certificate gained at school	35	36	41	44	46	46	46	45	47	45	46	44	46	42
Level 1 certificate gained at school	33	33	37	40	39	42	41	42	42	42	41	41	40	41
No school qualifications	30	31	32	34	34	34	34	35	36	36	36	35	37	36

Note: M – Male F – Female

Method II – Regression equation

For method II, NZSEI-06 scores were regressed against age and qualification level (as measured by years of education) for individuals reporting an occupation as part of the 2006 Census. This produced the following equation:

(1) NZSEI-06 = -14.422 + 4.191*education(years) + 0.163*age

To take account of the possible influence of sex, three further equations were calculated (shown below). Equation (2) is the result of regressing NZSEI-06 score against sex, age, and qualification level. Equation (3) is the result of regressing NZSEI-06 score against age and qualification level for males only. Equation (4) is the result of regressing NZSEI-06 score against age and qualification level for females only:

(2) NZSEI-06 = -13.481 - 1.507*sex(male) + 4.174*education(years) + 0.164*age

(3) NZSEI-06 = -13.510 + 4.085*education(years) + 0.156*age [*males*]

(4) NZSEI-06 = -15.283 + 4.277*education(years) + 0.176*age [*females*]

These regression equations were used to predict NZSEI-06 for each age and qualification level. The resulting scores were then averaged for each age band and qualification level. Table 30 shows the imputed mean NZSEI-06 scores for the sex-unadjusted and sex-adjusted regression equations (1) and (2), while table 31 shows the imputed mean NZSEI-06 scores for males and females using the regression models (3) and (4).

Table 30 shows very little difference between unadjusted and adjusted scores – 0 to 1 point across age and qualification level. Unadjusted and adjusted scores correlated at $r > 0.99$.

Table 30

Imputed mean NZSEI-06 scores
For each age/qualification category, both unadjusted and adjusted for sex
Method II

Highest qualification	Age (years)													
	21–30		31–40		41–50		51–60		61–69		65–74		75+	
	Un	Adj	Un	Adj	Un	Adj	Un	Adj	Un	Adj	Un	Adj	Un	Adj
	Imputed mean NZSEI-06 score													
Doctorate degree	73	72	75	74	76	76	77	77	79	79	80	80	82	82
Master's degree	65	65	66	66	67	67	69	69	71	70	72	72	74	74
Post-graduate and honours degree	61	61	62	62	63	63	65	65	66	66	68	68	70	70
Bachelor's degree and level 7 qualification	56	56	57	57	59	59	61	61	62	62	64	63	65	65

Table 30 continued next page

Table 30 continued

Highest qualification	Age (years)													
	21–30		31–40		41–50		51–60		61–69		65–74		75+	
	Un	Adj	Un	Adj	Un	Adj	Un	Adj	Un	Adj	Un	Adj	Un	Adj
	Imputed mean NZSEI-06 score													
Level 6 diploma	50	50	51	51	53	53	54	55	56	56	57	58	59	59
Level 5 diploma	46	46	47	47	49	49	50	50	52	51	53	53	55	55
Level 4 certificate gained post-school	41	41	43	43	44	44	46	46	48	47	49	49	51	50
Level 3 certificate gained post-school	37	37	39	39	40	40	42	42	43	43	45	45	47	47
Level 2 certificate gained post-school	37	37	39	39	40	40	42	42	43	43	45	45	47	47
Level 1 certificate gained post-school	37	37	39	39	40	40	42	42	43	43	45	45	47	47
Overseas secondary school qualification	39	39	41	41	42	42	44	44	45	46	47	47	49	49
Level 3 or 4 certificate gained at school	43	43	45	45	46	46	48	48	50	49	51	51	53	53
Level 2 certificate gained at school	39	39	41	41	42	42	44	44	45	45	47	47	49	49
Level 1 certificate gained at school	35	35	37	37	38	38	40	40	41	41	43	43	45	44
No school qualifications	31	30	32	32	34	34	36	36	37	37	39	38	40	40

Note: Un – unadjusted Adj – adjusted

Table 31 also shows very little difference between male and female scores – 1 to 4 points across age and qualification level, with slightly larger differences for older ages and higher qualification levels. Male and female scores also correlated at r > 0.99. Given these small differences and the strong correlation between scores, there appears little evidence that sex-adjusted or sex-specific scores will improve the validity of the imputed scores, so only the unadjusted scores (ie, model (1)) will be validated in sections 5.2 and 5.3. These are repeated in table 32.

Table 31

Imputed mean NZSEI-06 scores by sex
For each age/qualification category
Method II

Highest qualification	Age (years)													
	21–30		31–40		41–50		51–60		61–69		65–74		75+	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
	Imputed mean NZSEI-06 scores													
Doctorate degree	72	74	73	76	74	77	76	79	77	81	79	82	80	84
Master's degree	64	66	65	67	66	69	68	70	69	72	71	74	72	76
Post-graduate and honours degree	59	61	61	63	62	64	64	66	65	68	66	69	68	72
Bachelor's degree and level 7 qualification	55	57	56	58	58	60	59	62	61	63	62	65	64	67
Level 6 diploma	49	51	50	52	52	54	53	55	55	57	56	59	58	61
Level 5 diploma	45	46	46	48	48	49	49	51	51	53	52	54	54	56
Level 4 certificate gained post-school	41	42	42	43	44	45	45	47	47	48	48	50	50	52
Level 3 certificate gained post-school	37	38	38	39	40	41	41	43	43	44	44	46	46	48
Level 2 certificate gained post-school	37	38	38	39	40	41	41	43	43	44	44	46	46	48
Level 1 certificate gained post-school	37	37	38	39	40	41	41	43	43	44	44	46	46	48
Overseas secondary school qualification	39	40	40	41	42	43	43	45	45	46	46	48	48	50
Level 3 or 4 certificate gained at school	43	44	44	45	46	47	47	49	49	51	50	52	52	54
Level 2 certificate gained at school	39	39	40	41	42	43	43	45	45	46	46	48	48	50
Level 1 certificate gained at school	34	35	36	37	38	39	39	40	41	42	42	44	44	46
No school qualifications	30	31	32	33	34	35	35	36	37	38	38	39	40	41

Note: M=Male F=Female

Table 32 shows that the regression-model-based approach to imputing scores yielded consistent differences between qualification levels and ages. This was a direct result of

using the regression model in (1) in that differences between qualification level categories were simply 4.174 multiplied by the difference in years of education assigned each qualification level (assignment of years of education is shown in table 27). The mean imputed scores using method II ranged from 31, for those aged 15–24 years with no qualifications, to 82, for those aged 75+ years with doctoral degrees. As with method I, this range of scores is substantially narrower than the potential range of 10–90 for the 97 minor group occupations.

Table 32

Imputed mean NZSEI-06 scores
For each age/qualification category
Method II

Highest qualification	Age (years)						
	21–30	31–40	41–50	51–60	61–69	65–74	75+
	Imputed mean NZSEI-06 score						
Doctorate degree	73	75	76	77	79	80	82
Master's degree	65	66	67	69	71	72	74
Post-graduate and honours degree	61	62	63	65	66	68	70
Bachelor's degree and level 7 qualification	56	57	59	61	62	64	65
Level 6 diploma	50	51	53	54	56	57	59
Level 5 diploma	46	47	49	50	52	53	55
Level 4 certificate gained post-school	41	43	44	46	48	49	51
Level 3 certificate gained post-school	37	39	40	42	43	45	47
Level 2 certificate gained post-school	37	39	40	42	43	45	47
Level 1 certificate gained post-school	37	39	40	42	43	45	47
Overseas secondary school qualification	39	41	42	44	45	47	49
Level 3 or 4 certificate gained at school	43	45	46	48	50	51	53
Level 2 certificate gained at school	39	41	42	44	45	47	49
Level 1 certificate gained at school	35	37	38	40	41	43	45
No school qualifications	31	32	34	36	37	39	40

5.2 Comparison of actual and imputed scores

The Pearson correlation coefficients between actual NZSEI-06 scores and imputed scores using methods I and II for all workers aged at least 15 years are shown in table 33. These show that both imputed scores correlated similarly with actual NZSEI-06

scores, with method I (simple averages) performing marginally better. Results of the two methods correlated strongly with each other (r = 0.97).

Table 33

Correlations between actual and imputed NZSEI-06 scores
Workers aged 15+ years
2006 Census

Correlations	Actual NZSEI-06 score	Imputed NZSEI-06 score – method I	Imputed NZSEI-06 score – method II
Actual NZSEI-06	1	0.58	0.56
Imputed NZSEI-06 – I		1	0.97
Imputed NZSEI-06 – II			1

To gain a greater insight into the performance of the two methods, the mean error between imputed scores and actual scores by age and qualification level is shown in table 34. This shows that the mean difference between imputed scores and actual scores ranged from 8 points, for those aged 15–24 with no school qualifications, to 23 points, for those aged 15–24 holding a doctoral degree. Mean error between imputed and actual scores increased both with increasing qualification level and with increasing age. Method I and method II performed similarly: the mean difference between imputed and actual scores averaged across age and qualification level was 12.18 for method I and 12.54 for method II.

Table 34

Mean error (absolute difference) between imputed and actual NZSEI-06 scores
Method I (simple averages) and method II (regression equation)

Highest qualification	Age (years)													
	15–24		25–34		35–44		45–54		55–64		65–74		75+	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II
	Mean error													
Doctorate degree	23	22	11	11	11	11	12	12	12	12	14	14	15	21
Master's degree	15	14	12	11	11	11	11	10	11	11	12	13	14	18
Post-graduate and honours degree	15	15	12	12	11	11	11	11	12	11	16	15	17	17
Bachelor's degree and level 7 qualification	15	15	13	14	12	12	12	12	13	13	14	13	14	14
Level 6 diploma	14	14	14	14	13	14	13	14	14	15	16	16	16	16
Level 5 diploma	12	12	12	12	12	12	13	13	13	13	14	15	15	16

Table 34 continued next page

Table 34 continued

Highest qualification	Age (years)													
	15–24		25–34		35–44		45–54		55–64		65–74		75+	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II
	Mean error													
Level 4 certificate gained post-school	9	9	10	10	10	10	11	11	11	12	11	13	12	14
Level 3 certificate gained post-school	10	10	11	11	12	13	12	12	12	12	12	13	12	13
Level 2 certificate gained post-school	9	10	11	11	12	12	11	11	11	11	11	12	13	13
Level 1 certificate gained post-school	9	10	12	11	13	13	12	12	12	12	14	14	13	13
Overseas secondary school qualification	10	11	12	13	13	13	13	13	12	13	12	13	13	15
Level 3 or 4 certificate gained at school	10	12	12	12	12	13	13	13	13	13	14	15	14	15
Level 2 certificate gained at school	9	10	11	11	11	12	11	11	12	12	13	14	13	14
Level 1 certificate gained at school	9	9	11	11	11	11	11	11	11	11	11	11	12	13
No school qualifications	8	8	10	10	11	11	11	11	11	11	10	11	9	10

Note: I – method 1 II – method 2

5.3 Validation against health and socio-economic correlates

As a final assessment of the imputation methods, the performance of the two methods at predicting health and socio-economic correlates was assessed for those aged 21–69 years and not in the workforce, using data from the 2006 Census. The assessment involved regressing each of four health and socio-economic correlates – smoking prevalence, housing tenure, access to a motor vehicle, and deprivation – against the imputed scores, controlling for age, sex, and ethnicity.

A regression approach was favoured over comparing rates of each correlate across the six socio-economic groups, in part because the restricted range of imputed scores resulted in no imputed cases in socio-economic group 6 and very few in socio-economic groups 1 and 5. These validation analyses are equivalent to those conducted in tables 23–26 in section 4.3, describing the validation of actual NZSEI-06 scores among those in the workforce. Thus, the performance of the imputed NZSEI-06 scores – using both method I and method II – was able to be directly compared with the performance of the

actual NZSEI-06 at predicting each of the four health and socio-economic correlates. The result of these comparisons is described below.

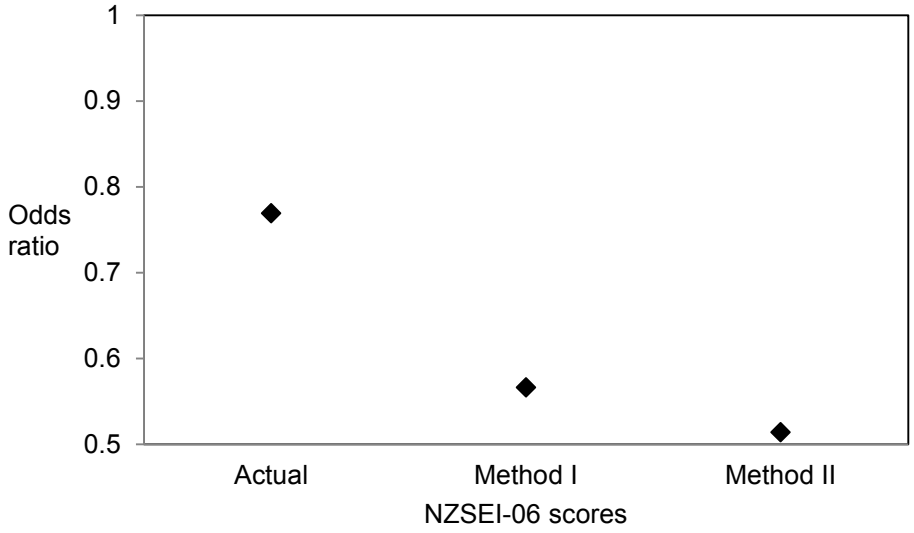
Smoking prevalence

Figure 26 shows the odds ratios for smoking per 10-unit increase in NZSEI-06 scores, comparing actual scores for those in the workforce versus imputed scores for those not in the workforce, using the two methods described above. The effects of age, sex, and ethnicity were controlled.

The figure indicates that the odds of smoking were lower for both method I (odds ratio = 0.57) and for method II (odds ratio = 0.51) than for actual scores (odds ratio = 0.77). Thus, socio-economic scores based on age and education (ie, the imputed NZSEI-06 scores) were found to be a strong predictor of smoking among those not in the workforce. In fact, the imputed NZSEI-06 scores were stronger predictors of smoking among those not in the workforce than the actual NZSEI-06 scores were among those in the workforce.

Figure 26

Odds ratios for smoking
Comparison between actual and imputed NZSEI-06 scores (per 10 units)



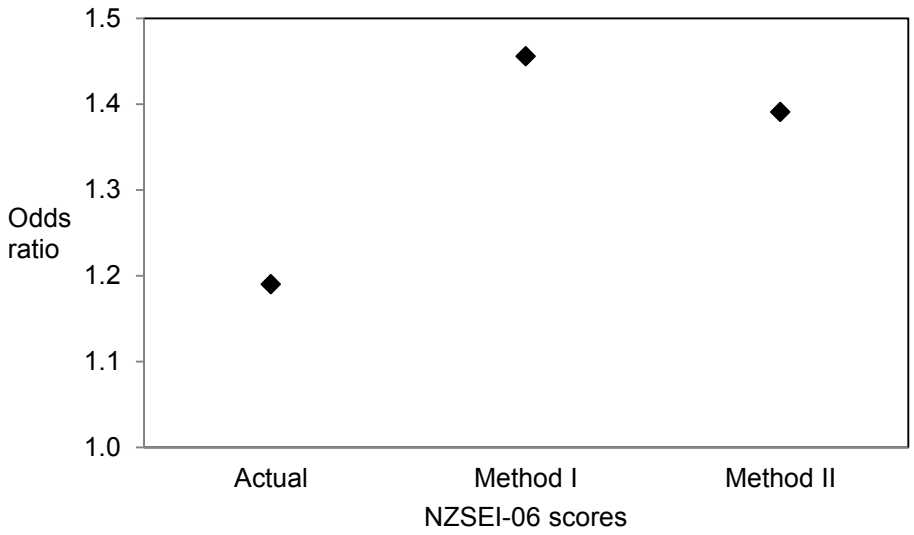
Housing tenure

Figure 27 shows the odds ratios of living in an owned home per 10-unit increase in actual and imputed NZSEI-06 scores, controlling for age, sex, and ethnicity.

The figure indicates that the odds of living in an owned home were stronger for the imputed scores (odds ratio = 1.46 for method I and 1.39 for method II) than for the actual scores (odds ratio = 1.19).

Figure 27

Odds ratios for housing tenure
Comparison between actual and imputed NZSEI-06 scores (per 10 units)



Note: because of the large sample analysed, the confidence intervals for the odds ratios are so narrow that they do not appear on the graph above.

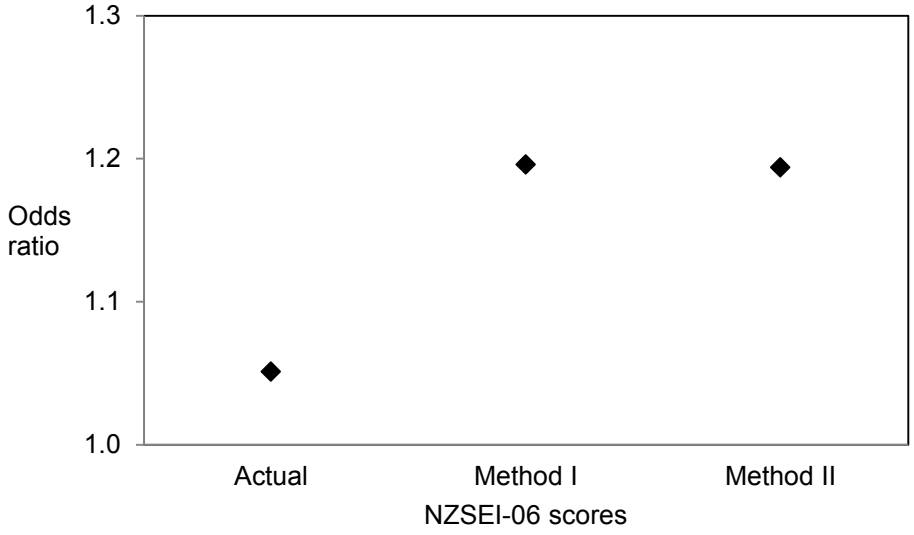
Access to a motor vehicle

Figure 28 shows the odds ratios of having access to two or more motor vehicles per 10-unit increase in actual and imputed NZSEI-06 scores, controlling for age, sex, and ethnicity.

The figure indicates that the odds of living in an owned home were stronger for the imputed scores (odds ratio = 1.20 for method I and 1.19 for method II) than for the actual scores (odds ratio = 1.05).

Figure 28

Odds ratios for access to two or more vehicles
Comparison between actual and imputed NZSEI-06 scores (per 10 units)



Note: because of the large sample, the confidence intervals for the odds ratios are so narrow that they do not appear on the graph above.

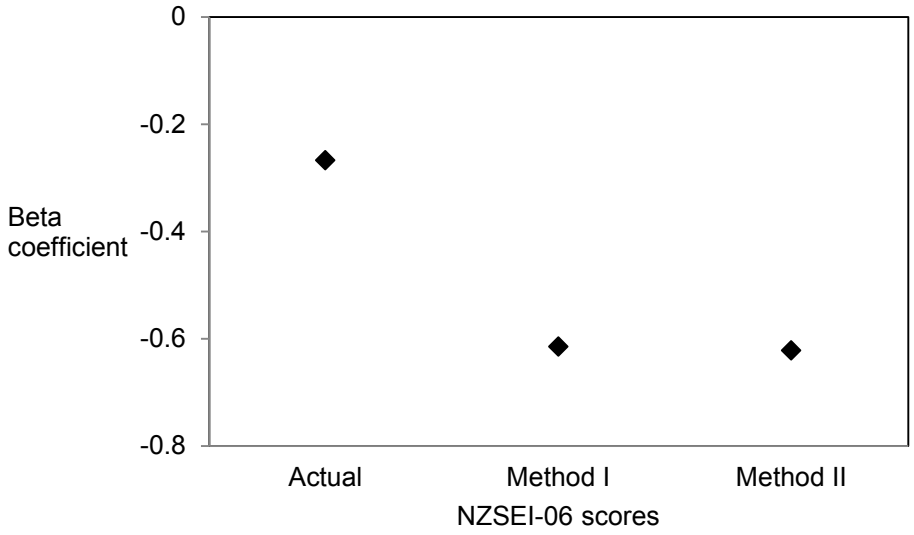
Deprivation

Figure 29 shows the effect on the NZDep2006 scale per 10-unit increase in actual and imputed NZSEI-06 scores, controlling for age, sex, and ethnicity.

The figure indicates that, for those not in the workforce, NZDep2006 scores were approximately 0.6 points lower for every 10-unit increase in imputed NZSEI-06 scores (β = 0.61 for method I and β = 0.62 for method II). This was a stronger effect than the effect of actual NZSEI-06 scores among those in the workforce (β = 0.27).

Figure 29

Beta coefficients for scores on the NZDep2006 scale
Comparison between actual and imputed NZSEI-06 scores (per 10 units)



Note: because of the large sample analysed, the confidence intervals for the beta coefficients are so narrow that they do not appear on the graph above.

5.4 Summary and discussion

This section described two methods for imputing NZSEI-06 scores when data on occupation are unavailable. Both involved analysing data from the 2006 Census for those in an occupation and with an NZSEI-06 score assigned. Method I involved calculating the average NZSEI-06 scores by highest educational qualification and age band, whereas method II involved regressing NZSEI-06 scores against age and highest educational qualification. The impact of adjusting for sex and stratifying by sex on these two methods was investigated, but revealed little impact, so only sex-unadjusted scores were evaluated.

Three evaluations of these methods were undertaken:

(i) assessing the extent to which each correlated with actual NZSEI-06 scores
(ii) assessing the mean error between each and the actual NZSEI-06 scores
(iii) validating the imputed scores against health and socio-economic correlates.

These evaluations revealed that there was little to separate the two methods. The two methods correlated similarly with actual NZSEI-06 scores, had similar mean errors, and each validated well against health and socio-economic correlates – at least as well (if not better) than actual NZSEI-06 scores. However, both methods produced a restricted range of scores compared with the actual NZSEI-06, suggesting that neither was suitable for the assignment of socio-economic groups.

In the absence of other evidence to choose between them, and in the absence of other 'proxy'-information, such as previous occupation, the simplicity of method I (simple averages) makes it the preferred approach.

6 Conclusion

This report detailed the construction of NZSEI-06, an occupation-based measure of socio-economic status, derived using data from the 2006 Census. NZSEI-06 assigned scores from 10 (lowest) to 90 (highest) for each minor group (three-digit) occupation in New Zealand according to ANZSCO.

The algorithm used to derive NZSEI-06 scores was based on a path-analytic representation of the 'returns to human capital' model of stratification, in which occupation is viewed as the means by which human capital (education) is converted into material rewards (income).

NZSEI-06 produced similar scores to the previous NZSEI-96. NZSEI-06 also produced very similar scores to AUSEI06, a socio-economic scale for the Australian workforce which was derived in a similar way to NZSEI-06 and classified occupations using the same classification system (ANZSCO) as New Zealand. NZSEI-06 validated well against a number of health and socio-economic correlates for both sexes and also for four major ethnic groups: European and Other (including New Zealander), Māori, Pacific, and Asian.

Like previous versions of NZSEI (eg, NZSEI-96), the scale was first developed for the full-time workforce, and part-time workers were added after 'equivalising' their income to a full-time equivalent. The full scale (including part-time workers) was very similar to the scale including the full-time workforce only, with no large rank-order changes among occupations.

Also like previous versions, a method was suggested for imputing NZSEI-06 scores for those not in the workforce. The favoured method involved assigning scores based on the mean NZSEI-06 scores for each age and educational qualification group. Factoring sex into the imputation was found to have little impact on imputed scores, so the imputed scores suggested for use were unadjusted for sex. It was also suggested that categorisation should not be used for imputed scores (eg for those not in the workforce) because the restricted range of the imputed scores results in some categories having few or no cases.

A number of differences between NZSEI-06 and its predecessors should be noted. First, unlike previous versions of NZSEI (eg, NZSEI-96), an attempt was made to 'centre' the scale, so that the mean of scores was around 50 (ie half-way between 10 and 90). This was achieved with some degree of success by applying a square-root transformation of the original scores (mean of the final NZSEI-06 scale = 46.5).

Second, unlike previous versions of NZSEI (eg, NZSEI-96) and similar international scales (eg AUSEI06), the incomes of self-employed workers were not adjusted to account for under-estimation, as there was little evidence for any under-estimation. In fact, self-employed workers reported higher incomes for the majority of occupation groups.

Third, the path coefficients relating education to occupational socio-economic status (SES) and occupational SES to income were quite different for NZSEI-06 compared with the previous NZSEI-96 and NZSEI-91. Indeed, while for NZSEI-96 and NZSEI-91 the path coefficient relating education to occupational SES was about one third the magnitude of the path coefficient relating occupational SES to income, for NZSEI-06 the magnitudes were reversed: the path coefficient relating education to occupational SES was nearly double the magnitude of the path coefficient relating occupational SES to income. While the reason for the differences in path coefficients between NZSEI-06 and the previous scales is unclear, it is notable that the relative magnitude of the path coefficients for NZSEI-06 are more in line with international scales (eg, AUSEI06 and the ISEI-88, see McMillan et al, 2009).

Fourth, NZSEI-06 was validated for a wider range of ethnic groups than the Māori versus non-Māori comparison that previous NZSEI versions had undertaken. In general, NZSEI-06 validated well for each of the four ethnic groups studied: European and Other (including New Zealander), Māori, Pacific, and Asian.

An interesting finding from part of this validation was the anomalous association between education and income for those identifying as Asian. That is, while Asian workers were twice as likely to hold a degree compared with every other ethnic group, nearly two-thirds reported incomes less than the median. This warrants further investigation, perhaps testing the extent to which this is a migrant effect (many of the qualifications attained by Asian workers may have been attained outside of New Zealand) or to what extent language and cultural barriers have a role to play. It would also be interesting to see whether this pattern persists in 2013, when the next census was held.

A more detailed breakdown of ethnicity might also be warranted in 2013, particularly if numbers are sufficient to analyse the 'Middle Eastern, Latin American and African' category, and if there are sufficient numbers in the 'Other' category who do not identify 'New Zealander' as their ethnicity. Note that the 'New Zealander' ethnic group formed the vast majority (>95 percent) of the 'Other' ethnic category among 21–69-year-old workers in the 2006 Census, which was the primary reason for combining this ethnic group with the 'New Zealand European' ethnic group to form the 'European and Other (including New Zealander)' ethnic group.

Fifth, cluster and discriminant function analysis were not used to determine cut-points for dividing the continuous NZSEI-06 scale into categories, as had been used in the previous NZSEI-96. Instead, 'convenience' cut-points were chosen so that a reasonable proportion of the population was in each category. This approach was taken because NZSEI-06 was constructed to be a uni-dimensional scale (from 10–90), so there was no good reason to suspect that there would be discreet groupings of occupations. Three groupings were suggested:

- a six-group classification, in line with the historic Elley and Irving scale (eg, Elley and Irving, 1972; 1976; 1985; 2003; Irving and Elley, 1977)
- a four-group classification representing quartiles
- a 10-group classification representing deciles, to enable direct comparisons with the NZDep deciles.

6.1 Advantages of NZSEI-06 as a measure of socio-economic status

There are several advantages of NZSEI-06. First, occupation is readily and accurately recalled. It is not subject to stigma with reporting, or a tendency to misreport (as, for example, income may be in some instances (Davis and Smith, 1994)).

Second, occupation can be retrospectively recalled with some accuracy (Hauser and Warren, 1997). Thus, it may be possible (and preferable) to assess the socio-economic status of individuals in late-aged or retired samples by asking about their main occupation during their working years.

Third, occupation is often recorded in survey datasets, especially in the socio-economic and sociological fields, and also on administrative datasets (eg, birth and death records). Against this, recent health surveys in New Zealand have tended to neglect the collection of occupation data.

Fourth, as the validation exercise showed, NZSEI-06 is a robust measure of socio-economic status in that it produces expected stratification patterns across smoking prevalence and across three socio-economic correlates.

Fifth, NZSEI-06 has a sound theoretical basis – the 'returns to human capital model' – that has been used and validated previously in New Zealand and elsewhere (Davis et al, 1997; 2003; Ganzeboom et al, 1992; McMillan et al, 2009).

Sixth, because NZSEI-06 uses a similar methodology to other scales developed internationally, this provides opportunities for international comparisons.

Seventh, New Zealand has a long history of occupation-based socio-economic measures that have been frequently updated, and an even longer history of collecting information on occupation. This enables socio-economic comparisons over time to be undertaken, and for cohort samples to have socio-economic status to be assessed at different life-stages using the 'current' occupation-based socio-economic measure.

6.2 Limitations of NZSEI-06

NZSEI-06 has its limitations. First, it requires occupational information. A significant proportion of the population is not currently employed, and unless further steps are taken to collect such information – for example, previous occupation – NZSEI-06 cannot be directly estimated. An 'imputed' score, based on the age and education of respondents, has been suggested as a way to assign scores to those without any information on occupation, but previous occupation or 'main' occupation during working life may be preferable for some individuals (eg, retirees). Note that in some cases it may be justified to use the occupation of a proxy person to assess socio-economic status (eg, for children).

Second, even if occupational information is available, it is often difficult to classify with accuracy to the minor group (three-digit) level of ANZSCO, which is required for NZSEI-06. Steps can be taken to help with the collection and classification of occupations (see appendix V), but if insufficient detail is provided to the coder there is little that can be done. Where there is insufficient detail to code to the minor group level, it may sometimes be possible to classify to the major (one-digit) or sub-major (two-digit) group level, and NZSEI-06 scores can be assigned for these classifications (see appendix III).

Third, NZSEI-06 only classifies occupations to the minor group level of ANZSCO, and it is likely that there is a great deal of socio-economic heterogeneity among occupations grouped at this level. Thus, while it would make the task of occupational coding more difficult, it is possible that more accurate socio-economic scores could be obtained if NZSEI-06 was developed for occupations coded at the unit group (four-digit) or group (six-digit) level.

Fourth, there is likely to be socio-economic heterogeneity among individuals who have the same occupation, regardless of the level of categorisation. Unfortunately, this cannot be captured by NZSEI-06, which groups individuals according to their occupation.

6.3 Future work

Further work still remains to be done with NZSEI-06. First, the validation work, while promising, only encompasses one health indicator and three socio-economic indicators. An assessment of NZSEI-06 against a wider range of indicators is required, though a different data source – other than the census – would be needed.

Second, given the interest in the socio-economic patterning of children's outcomes – particularly in the area of health (eg, Mortensen, Helweg-Larsen, & Andersen, 2011) – the validity of NZSEI-06 as it applies to children also needs to be explored. As suggested above, the scores assigned to children will necessarily have to be derived from a proxy (eg, a parent, or perhaps the combined scores of two parents or the household).

Third, since the basic unit of socio-economic structure is often the household rather than the individual, a framework for placing the household at the centre of socio-economic index construction needs to be developed.

Finally, given that researchers have a number of different options for assessing socio-economic status in New Zealand (eg, New Zealand deprivation index (NZDep), New Zealand index of socio-economic deprivation for individuals (NZiDep), education, income, living standards, as well as NZSEI-06) it would be worthwhile to assess the extent to which these different measures have independent, as opposed to shared, influences on outcomes of interest.

7 References

Australian Bureau of Statistics & Statistics NZ (2006). *ANZSCO – Australian and New Zealand Standard Classification of Occupations, first edition*. Canberra: Australian Bureau of Statistics. Available from www.abs.gov.au.

Baker, PS (1993). *Taxpayer compliance of the self-employed: estimates from household spending data*. *Working Paper 93/14* London: Institute for Fiscal Studies.

Bradbury, B (1997). The living standards of the low income self-employed. *Australian Economic Review 30*(4), 374–389.

Crampton, P, Salmond, C, & Sutton, F (1997). *Research report no 5: NZDep91 index of deprivation*. Wellington: Health Services Research Centre.

Davis, JA, & Smith, TW (1994). *General Social Surveys 1972–1994; cumulative codebook*. Chicago: National Opinion Research Centre.

Davis, P, McLeod, K, Ransom, M, & Ongley, P (1997). *The New Zealand socio-economic index of occupational status (NZSEI).* (Research report no. 2). Wellington: Statistics NZ.

Davis, P, Jenkin, G, & Coope, P (2003). *The New Zealand socio-economic index 1996. An update and revision of the New Zealand socio-economic index of occupational status.* Wellington: Statistics NZ.

De-Leeuw, J (1989). Multivariate analysis with linearizable regressions. *Psychometrika 53*(4), 437–454.

Department of Statistics (1992). *New Zealand Standard Classification of Occupations 1990*. Wellington: Department of Statistics.

Elley, WB, & Irving, JC (1972). A socio-economic index for New Zealand based on levels of education and income from the 1966 Census. *New Zealand Journal of Educational Studies 2*(2), 153–157.

Elley, WB, & Irving, JC (1976). Revised socio-economic index for New Zealand. *New Zealand Journal of Educational Studies 11*(1), 25–36.

Elley, WB, & Irving, JC (1985). The Elley-Irving socio-economic index 1981 Census revision. *New Zealand Journal of Educational Studies 20*(2), 115–128.

Elley, WB, & Irving, JC (2003). The Elley-Irving socio-economic index: 2001 Census revision. *New Zealand Journal of Educational Studies 38*(1), 3–17.

Galbraith, C, Jenkin, G, Davis, P, & Coope, P (2003). *New Zealand socio-economic index 1996 users' guide*. Wellington: Statistics NZ.

Ganzeboom, H, De-Graaf, P, Treiman, D, & De-Leeuw, J (1992). A standard international socioeconomic index of occupational status. *Social Science Research 21*(1), 1–56.

Ganzeboom, H, & Treiman, D (1996). Internationally comparable measures of occupational status for the 1988 International Standard Classification of Occupations. *Social Science Research 25*(3), 201–239.

Hauser, RM, & Warren, JR (1997). Socioeconomic indices for occupation: A review, update, and critique. *Sociological Methodology 27*, 177–298.

Irving, JC, & Elley, WB (1977). A socioeconomic index for the female labour force in New Zealand. *New Zealand Journal of Educational Studies 34*, 86–98.

Jones, F & McMillan, J (2001). Scoring occupational categories for social research: A review of current practice, with Australian examples. *Work, Employment and Society 15*(3): 539–564.

McMillan, J, Beavis, A, & Jones, FL (2009). The AUSEI06. A new socioeconomic index for Australia. *Journal of Sociology 45*, 123–49.

Metcalf, PA, Scragg, RRK, Schaaf, D, Dyall, L, Black, PN, & Jackson, RT (2008). Comparison of different markers of socioeconomic status with cardiovascular disease and diabetes risk factors in the Diabetes, Heart and Health Survey. *New Zealand Medical Journal, 121*(1269), 45–56.

Ministry of Health. (2008). *A portrait of health: Key results of the 2006/07 New Zealand Health Survey*. Wellington: Ministry of Health.

Mortensen, LH, Helweg-Larsen, K, & Andersen, AM (2011). Socioeconomic differences in perinatal health and disease. *Scandinavian Journal of Public Health 39*(7 Suppl),110–4.

Parker, SC (1997). The distribution of self-employment income in the United Kingdom, 1976–1991. *The Economic Journal 107*(441), 455–466.

Pissarides, CA, & Weber, G (1989). An expenditure-based estimate of Britain's black economy. *Journal of Public Economics 39*(1), 17–32.

Salmond, C, Crampton, P, & Sutton, F (1998). *Research report No 8, NZDep96 index of deprivation*. Wellington: Health Services Research Centre.

Salmond, C, & Crampton, P (2002). *NZDep2001 index of deprivation*. Wellington: Department of Public Health: School of Medicine and Health Sciences.

Salmond, C, Crampton, P, & Atkinson, J (2007). *NZDep2006 index of deprivation*. Wellington: Ministry of Health.

Statistics NZ (1995). *New Zealand Standard Classification of Occupations 1995*. Wellington: Statistics NZ.

Statistics NZ (2007). *Guidelines for using ethnicity data: 2006 Census*. Wellington: Statistics NZ.

Appendix I: Occupation by sex

Table A1

Occupation by sex
Full-time workers aged 21–69 years
2006 Census

Occupation (minor group)		Sex		Total
		Male	Female	
	Manager			
111	Chief Executives, General Managers and Legislators	43,170	13,680	56,850
121	Farmers and Farm Managers	35,748	10,491	46,239
131	Advertising, Public Relations and Sales Managers	15,771	8,241	24,012
132	Business Administration Managers	21,831	18,303	40,134
133	Construction, Distribution and Production Managers	37,530	2,925	40,455
134	Education, Health and Welfare Services Managers	2,697	5,106	7,803
135	ICT Managers	3,414	933	4,347
139	Miscellaneous Specialist Managers	3,153	2,061	5,214
141	Accommodation and Hospitality Managers	6,993	8,976	15,969
142	Retail Managers	13,959	13,437	27,396
149	Miscellaneous Hospitality, Retail and Service Managers	7,218	5,202	12,420
	Total	**191,484**	**89,355**	**280,839**
	Professional			
211	Arts Professionals	2,835	1,581	4,416
212	Media Professionals	4,047	3,225	7,272
221	Accountants, Auditors and Company Secretaries	10,758	9,456	20,214
222	Financial Brokers and Dealers, and Investment Advisers	5,529	3,138	8,667
223	Human Resource and Training Professionals	2,901	5,115	8,016
224	Information and Organisation Professionals	9,732	9,204	18,936
225	Sales, Marketing and Public Relations Professionals	6,900	6,006	12,906
231	Air and Marine Transport Professionals	4,296	282	4,578
232	Architects, Designers, Planners and Surveyors	8,820	5,181	14,001
233	Engineering Professionals	14,967	891	15,858
234	Natural and Physical Science Professionals	6,039	3,126	9,165

Table continued next page

Table continued

Occupation (minor group)		Sex		Total
		Male	Female	
241	School Teachers	11,691	37,317	49,008
242	Tertiary Education Teachers	5,856	4,929	10,785
249	Miscellaneous Education Professionals	1,362	2,643	4,005
251	Health Diagnostic and Promotion Professionals	2,259	4,173	6,432
252	Health Therapy Professionals	2,184	3,708	5,892
253	Medical Practitioners	5,598	3,045	8,643
254	Midwifery and Nursing Professionals	2,262	22,626	24,888
261	Business and Systems Analysts, and Programmers	14,856	3,396	18,252
262	Database and Systems Administrators, and ICT Security Specialists	2,316	1,635	3,951
263	ICT Network and Support Professionals	3,144	678	3,822
271	Legal Professionals	5,433	3,990	9,423
272	Social and Welfare Professionals	6,333	10,317	16,650
	Total	**140,118**	**145,662**	**285,780**
Technician and Trades Workers				
311	Agricultural, Medical and Science Technicians	4,260	4,524	8,784
312	Building and Engineering Technicians	11,391	1,326	12,717
313	ICT and Telecommunications Technicians	4,866	1,728	6,594
321	Automotive Electricians and Mechanics	14,361	123	14,484
322	Fabrication Engineering Trades Workers	9,153	201	9,354
323	Mechanical Engineering Trades Workers	15,711	513	16,224
324	Panelbeaters, and Vehicle Body Builders, Trimmers and Painters	4,560	72	4,632
331	Bricklayers, Carpenters and Joiners	14,454	120	14,574
332	Floor Finishers and Painting Trades Workers	8,631	453	9,084
333	Glaziers, Plasterers and Tilers	7,809	132	7,941
334	Plumbers	6,960	36	6,996
341	Electricians	10,995	153	11,148
342	Electronics and Telecommunications Trades Workers	5,778	264	6,042
351	Food Trades Workers	12,138	6,321	18,459
361	Animal Attendants and Trainers, and Shearers	2,199	1,476	3,675
362	Horticultural Trades Workers	7,299	2,493	9,792

Table continued next page

Table continued

Occupation (minor group)		Sex		Total
		Male	Female	
391	Hairdressers	810	3,993	4,803
392	Printing Trades Workers	5,511	1,152	6,663
393	Textile, Clothing and Footwear Trades Workers	1,701	873	2,574
394	Wood Trades Workers	3,321	288	3,609
399	Miscellaneous Technicians and Trades Workers	6,666	1,410	8,076
	Total	**158,574**	**27,651**	**186,225**
Community and Personal Service Workers				
411	Health and Welfare Support Workers	2,922	6,462	9,384
421	Child Carers	90	2,706	2,796
422	Education Aides	255	2,319	2,574
423	Personal Carers and Assistants	2,268	15,630	17,898
431	Hospitality Workers	4,806	8,805	13,611
441	Defence Force Members, Fire Fighters and Police	10,728	2,067	12,795
442	Prison and Security Officers	5,709	1,464	7,173
451	Personal Service and Travel Workers	3,030	6,717	9,747
452	Sports and Fitness Workers	3,207	1,908	5,115
	Total	**33,015**	**48,078**	**81,093**
Clerical and Administrative Workers				
511	Contract, Program and Project Administrators	3,816	6,318	10,134
512	Office and Practice Managers	2,391	11,649	14,040
521	Personal Assistants and Secretaries	501	14,772	15,273
531	General Clerks	6,075	26,604	32,679
532	Keyboard Operators	627	3,474	4,101
541	Call or Contact Centre Information Clerks	936	2,214	3,150
542	Receptionists	774	14,040	14,814
551	Accounting Clerks and Bookkeepers	2,607	13,509	16,116
552	Financial and Insurance Clerks	3,360	8,628	11,988
561	Clerical and Office Support Workers	5,445	5,082	10,527
591	Logistics Clerks	9,591	5,166	14,757
599	Miscellaneous Clerical and Administrative Workers	4,518	6,051	10,569
	Total	**40,641**	**117,507**	**158,148**

Table continued next page

Table continued

Occupation (minor group)		Sex		Total
		Male	Female	
Sales Workers				
611	Insurance Agents and Sales Representatives	14,865	16,197	31,062
612	Real Estate Sales Agents	7,455	5,388	12,843
621	Sales Assistants and Salespersons	24,744	24,441	49,185
631	Checkout Operators and Office Cashiers	609	3,090	3,699
639	Miscellaneous Sales Support Workers	1,578	2,808	4,386
	Total	**49,251**	**51,924**	**101,175**
Machinery Operators and Drivers				
711	Machine Operators	13,317	7,320	20,637
712	Stationary Plant Operators	7,008	462	7,470
721	Mobile Plant Operators	13,707	624	14,331
731	Automobile, Bus and Rail Drivers	7,092	1,011	8,103
732	Delivery Drivers	2,094	273	2,367
733	Truck Drivers	23,109	687	23,796
741	Storepersons	11,820	2,142	13,962
	Total	**78,147**	**12,519**	**90,666**
Labourers				
811	Cleaners and Laundry Workers	6,504	8,034	14,538
821	Construction and Mining Labourers	11,712	450	12,162
831	Food Process Workers	12,435	5,247	17,682
832	Packers and Product Assemblers	4,272	5,655	9,927
839	Miscellaneous Factory Process Workers	4,878	858	5,736
841	Farm, Forestry and Garden Workers	20,652	8,037	28,689
851	Food Preparation Assistants	1,170	2,745	3,915
891	Freight Handlers and Shelf Fillers	2,406	531	2,937
899	Miscellaneous Labourers	23,820	5,760	29,580
	Total	**87,849**	**37,317**	**125,166**
All occupations				
Total		**779,079**	**530,013**	**1,309,092**

Note: Data randomly rounded to base three.
Source: Statistics New Zealand, 2006 Census

Appendix II: Occupations of waged and self-employed workers

Table A2

Occupations of waged and self-employed workers
Full- and part-time workers aged 21–69 years
2006 Census

Occupation (minor group)		Employment status		Percent self-employed
		Waged	Self-employed	
Manager				
111	Chief Executives, General Managers and Legislators	26,079	36,057	58.0
121	Farmers and Farm Managers	19,053	33,429	63.7
131	Advertising, Public Relations and Sales Managers	22,263	3,441	13.4
132	Business Administration Managers	39,594	4,977	11.2
133	Construction, Distribution and Production Managers	24,582	17,910	42.1
134	Education, Health and Welfare Services Managers	8,253	501	5.7
135	ICT Managers	4,140	492	10.6
139	Miscellaneous Specialist Managers	5,673	327	5.5
141	Accommodation and Hospitality Managers	9,519	9,465	49.9
142	Retail Managers	18,654	11,931	39.0
149	Miscellaneous Hospitality, Retail and Service Managers	11,868	1,731	12.7
	Total	**189,678**	**120,261**	**38.8**
Professional				
211	Arts Professionals	1,995	4,572	69.6
212	Media Professionals	5,835	3,060	34.4
221	Accountants, Auditors and Company Secretaries	18,573	5,070	21.4
222	Financial Brokers and Dealers, and Investment Advisers	6,384	3,324	34.2
223	Human Resource and Training Professionals	7,896	1,404	15.1
224	Information and Organisation Professionals	18,474	4,005	17.8
225	Sales, Marketing and Public Relations Professionals	12,285	2,439	16.6
231	Air and Marine Transport Professionals	4,107	924	18.4

Table A2 continued next page

Table A2 continued

Occupation		Employment status		Percent self-employed
		Waged	Self-employed	
232	Architects, Designers, Planners and Surveyors	9,939	6,510	39.6
233	Engineering Professionals	14,016	3,069	18.0
234	Natural and Physical Science Professionals	8,838	1,824	17.1
241	School Teachers	61,650	1,365	2.2
242	Tertiary Education Teachers	13,176	576	4.2
249	Miscellaneous Education Professionals	4,743	2,775	36.9
251	Health Diagnostic and Promotion Professionals	7,026	1,392	16.5
252	Health Therapy Professionals	4,323	3,732	46.3
253	Medical Practitioners	6,570	3,261	33.2
254	Midwifery and Nursing Professionals	33,372	1,248	3.6
261	Business and Systems Analysts, and Programmers	16,164	4,146	20.4
262	Database and Systems Administrators, and ICT Security Specialists	4,242	252	5.6
263	ICT Network and Support Professionals	3,816	447	10.5
271	Legal Professionals	6,597	4,137	38.5
272	Social and Welfare Professionals	18,624	3,045	14.1
	Total	**288,645**	**62,577**	**17.8**
Technician and Trades Workers				
311	Agricultural, Medical and Science Technicians	10,347	456	4.2
312	Building and Engineering Technicians	11,751	2,160	15.5
313	ICT and Telecommunications Technicians	6,495	1,083	14.3
321	Automotive Electricians and Mechanics	11,910	3,252	21.4
322	Fabrication Engineering Trades Workers	8,382	1,380	14.1
323	Mechanical Engineering Trades Workers	15,096	1,950	11.4
324	Panelbeaters, and Vehicle Body Builders, Trimmers and Painters	3,492	1,386	28.4
331	Bricklayers, Carpenters and Joiners	9,753	5,613	36.5
332	Floor Finishers and Painting Trades Workers	4,761	5,232	52.4
333	Glaziers, Plasterers and Tilers	4,377	4,122	48.5
334	Plumbers	4,476	2,844	38.9
341	Electricians	8,193	3,588	30.5
342	Electronics and Telecommunications Trades Workers	5,418	984	15.4
351	Food Trades Workers	19,452	3,162	14.0

Table A2 continues next page

Table A2 continued

Occupation		Employment status		Percent self-employed
		Waged	Self-employed	
361	Animal Attendants and Trainers, and Shearers	3,291	1,296	28.3
362	Horticultural Trades Workers	8,094	4,989	38.1
391	Hairdressers	3,708	3,162	46.0
392	Printing Trades Workers	6,147	1,161	15.9
393	Textile, Clothing and Footwear Trades Workers	1,896	1,113	37.0
394	Wood Trades Workers	2,763	1,227	30.8
399	Miscellaneous Technicians and Trades Workers	6,276	2,946	31.9
	Total	**156,078**	**53,106**	**25.4**
Community and Personal Service Workers				
411	Health and Welfare Support Workers	11,889	1,416	10.6
421	Child Carers	4,929	909	15.6
422	Education Aides	10,200	156	1.5
423	Personal Carers and Assistants	31,887	1,440	4.3
431	Hospitality Workers	21,102	1,191	5.3
441	Defence Force Members, Fire Fighters and Police	13,350	336	2.5
442	Prison and Security Officers	7,737	486	5.9
451	Personal Service and Travel Workers	9,444	3,345	26.2
452	Sports and Fitness Workers	5,241	2,466	32.0
	Total	**115,779**	**11,745**	**9.2**
Clerical and Administrative Workers				
511	Contract, Program and Project Administrators	11,169	1,203	9.7
512	Office and Practice Managers	14,919	2,778	15.7
521	Personal Assistants and Secretaries	18,783	1,947	9.4
531	General Clerks	43,563	4,743	9.8
532	Keyboard Operators	5,676	378	6.2
541	Call or Contact Centre Information Clerks	3,954	57	1.4
542	Receptionists	21,318	1,278	5.7
551	Accounting Clerks and Bookkeepers	19,740	2,589	11.6
552	Financial and Insurance Clerks	14,673	345	2.3
561	Clerical and Office Support Workers	12,228	2,994	19.7
591	Logistics Clerks	15,138	1,173	7.2
599	Miscellaneous Clerical and Administrative Workers	12,345	852	6.5
	Total	**193,506**	**20,337**	**9.5**

Table A2 continued next page

Table A2 continued

Occupation		Employment status		Percent self-employed
		Waged	Self-employed	
Sales Workers				
611	Insurance Agents and Sales Representatives	33,693	3,099	8.4
612	Real Estate Sales Agents	4,437	9,957	69.2
621	Sales Assistants and Salespersons	62,319	8,667	12.2
631	Checkout Operators and Office Cashiers	6,501	132	2.0
639	Miscellaneous Sales Support Workers	7,002	594	7.8
	Total	**113,952**	**22,449**	**16.5**
Machinery Operators and Drivers				
711	Machine Operators	20,637	2,529	10.9
712	Stationary Plant Operators	7,464	474	6.0
721	Mobile Plant Operators	12,141	3,117	20.4
731	Automobile, Bus and Rail Drivers	6,576	3,915	37.3
732	Delivery Drivers	2,691	555	17.1
733	Truck Drivers	22,380	3,075	12.1
741	Storepersons	15,195	156	1.0
	Total	**87,084**	**13,821**	**13.7**
Labourers				
811	Cleaners and Laundry Workers	27,579	4,638	14.4
821	Construction and Mining Labourers	9,498	3,918	29.2
831	Food Process Workers	18,456	696	3.6
832	Packers and Product Assemblers	11,163	462	4.0
839	Miscellaneous Factory Process Workers	5,622	576	9.3
841	Farm, Forestry and Garden Workers	27,858	8,016	22.3
851	Food Preparation Assistants	6,987	453	6.1
891	Freight Handlers and Shelf Fillers	4,461	87	1.9
899	Miscellaneous Labourers	32,154	3,726	10.4
	Total	**143,778**	**22,572**	**13.6**
All occupations				
Total		**1,288,500**	**326,868**	**20.2**

Note: Data randomly rounded to base three.
Source: Statistics New Zealand, 2006 Census

Appendix III: Final NZSEI-06 scores

Table A3

Final NZSEI-06 scores
ANZSCO major, sub-major, and minor group level

Occupation (ANZSCO major, sub-major, and minor groups)			NZSEI-06 score			Count
			Major group	Sub-major group	Minor group	
1	**Managers**		**52**			**324,582**
	11	*Chief Executives, General Managers and Legislators*		*59*		*66,153*
		111 Chief Executives, General Managers and Legislators			59	66,153
	12	*Farmers and Farm Managers*		*36*		*56,541*
		121 Farmers and Farm Managers			36	56,541
	13	*Specialist Managers*		*59*		*136,161*
		131 Advertising, Public Relations and Sales Managers			62	26,283
		132 Business Administration Managers			62	45,978
		133 Construction, Distribution and Production Managers			48	44,061
		134 Education, Health and Welfare Services Managers			74	8,952
		135 ICT Managers			71	4,704
		139 Miscellaneous Specialist Managers			64	6,183
	14	*Hospital, Retail and Service Managers*		*43*		*65,727*
		141 Accommodation and Hospitality Managers			40	20,139
		142 Retail Managers			40	31,638
		149 Miscellaneous Hospitality, Retail and Service Managers			56	13,950
2	**Professionals**		**70**			**364,389**
	21	*Arts and Media Professionals*		*59*		*16,386*
		211 Arts Professionals			49	7,122
		212 Media Professionals			66	9,264
	22	*Business, Human Resource and Marketing Professionals*		*68*		*82,659*

Table A3 continued next page

Table A3 continued

Occupation (ANZSCO major, sub-major, and minor groups)			NZSEI-06 score			Count
			Major group	Sub-major group	Minor group	
	221	Accountants, Auditors and Company Secretaries			73	24,498
	222	Financial Brokers and Dealers, and Investment Advisers			64	10,125
	223	Human Resource and Training Professionals			63	9,582
	224	Information and Organisation Professionals			71	23,256
	225	Sales, Marketing and Public Relations Professionals			63	15,198
23	*Design, Engineering, Science and Transport Professionals*			*67*		*50,790*
	231	Air and Marine Transport Professionals			60	5,310
	232	Architects, Designers, Planners and Surveyors			65	16,977
	233	Engineering Professionals			66	17,529
	234	Natural and Physical Science Professionals			76	10,974
24	*Education Professionals*			*74*		*88,098*
	241	School Teachers			72	65,586
	242	Tertiary Education Teachers			85	14,355
	249	Miscellaneous Education Professionals			68	8,157
25	*Health Professionals*			*74*		*62,970*
	251	Health Diagnostic and Promotion Professionals			70	8,718
	252	Health Therapy Professionals			74	8,472
	253	Medical Practitioners			90	10,275
	254	Midwifery and Nursing Professionals			70	35,505
26	*ICT Professionals*			*67*		*29,823*
	261	Business and Systems Analysts, and Programmers			70	20,835
	262	Database and Systems Administrators, and ICT Security Specialists			59	4,614

Table A3 continued next page

Table A3 continued

Occupation (ANZSCO major, sub-major, and minor groups)		NZSEI-06 score			Count
		Major group	Sub-major group	Minor group	
	263 ICT Network and Support Professionals			63	4,374
27	*Legal, Social and Welfare Professionals*		*72*		*33,663*
	271 Legal Professionals			80	11,118
	272 Social and Welfare Professionals			68	22,545
3	**Technicians and Trades Workers**	**40**			**217,605**
31	*Engineering, ICT and Science Technicians*		*55*		*33,207*
	311 Agricultural, Medical and Science Technicians			58	11,088
	312 Building and Engineering Technicians			52	14,322
	313 ICT and Telecommunications Technicians			56	7,797
32	*Automotive and Engineering Trades Workers*		*40*		*48,699*
	321 Automotive Electricians and Mechanics			40	15,795
	322 Fabrication Engineering Trades Workers			33	10,206
	323 Mechanical Engineering Trades Workers			45	17,622
	324 Panelbeaters, and Vehicle Body Builders, Trimmers and Painters			34	5,076
33	*Construction Trades Workers*		*36*		*42,963*
	331 Bricklayers, Carpenters and Joiners			39	15,957
	332 Floor Finishers and Painting Trades Workers			31	10,494
	333 Glaziers, Plasterers and Tilers			29	8,889
	334 Plumbers			43	7,623
34	*Electrotechnology and Telecommunication Trades Workers*		*48*		*18,711*

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Table A3 continued

Occupation (ANZSCO major, sub-major, and minor groups)			NZSEI-06 score			Count
			Major group	Sub-major group	Minor group	
	341	Electricians			49	12,132
	342	Electronics and Telecommunications Trades Workers			45	6,579
35	*Food Trades Workers*			*28*		*23,640*
	351	Food Trades Workers			28	23,640
36	*Skilled Animal and Horticultural Workers*			*35*		*18,699*
	361	Animal Attendants and Trainers, and Shearers			32	4,842
	362	Horticultural Trades Workers			36	13,857
39	*Other Technicians and Trades Workers*			*38*		*65,349*
	391	Hairdressers			34	7,278
	392	Printing Trades Workers			41	7,554
	393	Textile, Clothing and Footwear Trades Workers			31	3,138
	394	Wood Trades Workers			35	4,155
	399	Miscellaneous Technicians and Trades Workers			43	9,561
4	**Community and Personal Service Workers**		**38**			**133,821**
41	*Health and Welfare Support Workers*			*50*		*13,875*
	411	Health and Welfare Support Workers			50	13,875
42	*Carers and Aides*			*29*		*52,464*
	421	Child Carers			36	6,198
	422	Education Aides			36	10,851
	423	Personal Carers and Assistants			26	35,415
43	*Hospitality Workers*			*31*		*23,409*
	431	Hospitality Workers			31	23,409
44	*Protective Service Workers*			*47*		*22,497*
	441	Defence Force Members, Fire Fighters and Police			52	13,926
	442	Prison and Security Officers			38	8,571

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Table A3 continued

Occupation (ANZSCO major, sub-major, and minor groups)		NZSEI-06 score			Count
		Major group	Sub-major group	Minor group	
45	*Sports and Personal Service Workers*		*47*		*21,576*
451	Personal Service and Travel Workers			46	13,350
452	Sports and Fitness Workers			48	8,226
5	**Clerical and Administrative Workers**	**44**			**225,522**
51	*Office Managers and Program Administrators*		*50*		*31,467*
511	Contract, Program and Project Administrators			52	12,897
512	Office and Practice Managers			48	18,570
52	*Personal Assistants and Secretaries*		*44*		*21,999*
521	Personal Assistants and Secretaries			44	21,999
53	*General Clerical Workers*		*44*		*57,999*
531	General Clerks			44	51,657
532	Keyboard Operators			40	6,342
54	*Inquiry Clerks and Receptionists*		*37*		*27,987*
541	Call or Contact Centre Information Clerks			45	4,119
542	Receptionists			36	23,868
55	*Numerical Clerks*		*47*		*39,630*
551	Accounting Clerks and Bookkeepers			46	24,201
552	Financial and Insurance Clerks			49	15,429
56	*Clerical and Office Support Workers*		*38*		*15,957*
561	Clerical and Office Support Workers			38	15,957
59	*Other Clerical and Administrative Workers*		*47*		*30,483*
591	Logistics Clerks			43	16,845
599	Miscellaneous Clerical and Administrative Workers			52	13,638

Table A3 continued next page

Table A3 continued

Occupation (ANZSCO major, sub-major, and minor groups)			NZSEI-06 score			Count
			Major group	Sub-major group	Minor group	
6	**Sales Workers**		**39**			**142,047**
	61	*Sales Representatives and Agents*		*47*		*53,214*
		611 Insurance Agents and Sales Representatives			44	37,929
		612 Real Estate Sales Agents			55	15,285
	62	*Sales Assistants and Salespersons*		*34*		*73,980*
		621 Sales Assistants and Salespersons			34	73,980
	63	*Sales Support Workers*		*33*		*14,853*
		631 Checkout Operators and Office Cashiers			28	6,897
		639 Miscellaneous Sales Support Workers			38	7,956
7	**Machinery Operators and Drivers**		**26**			**105,711**
	71	*Machinery and Stationary Plant Operators*		*27*		*32,580*
		711 Machine Operators			24	24,315
		712 Stationary Plant Operators			37	8,265
	72	*Mobile Plant Operators*		*23*		*16,077*
		721 Mobile Plant Operators			23	16,077
	73	*Road and Rail Drivers*		*27*		*41,109*
		731 Automobile, Bus and Rail Drivers			34	11,034
		732 Delivery Drivers			27	3,417
		733 Truck Drivers			24	26,658
	74	*Storepersons*		*26*		*15,945*
		741 Storepersons			26	15,945
8	**Labourers**		**21**			**177,306**
	81	*Cleaners and Laundry Workers*		*14*		*35,304*
		811 Cleaners and Laundry Workers			14	35,304
	82	*Construction and Mining Labourers*		*30*		*14,073*
		821 Construction and Mining Labourers			30	14,073

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Table A3 continued

Occupation (ANZSCO major, sub-major, and minor groups)		NZSEI-06 score			Count
		Major group	Sub-major group	Minor group	
83	*Factory Process Workers*		*21*		*38,874*
	831 Food Process Workers			23	20,160
	832 Packers and Product Assemblers			17	12,234
	839 Miscellaneous Factory Process Workers			21	6,480
84	*Farm, Forestry and Garden Workers*		*25*		*38,226*
	841 Farm, Forestry and Garden Workers			25	38,226
85	*Food Preparation Assistants*		*10*		*7,923*
	851 Food Preparation Assistants			10	7,923
89	*Other Labourers*		*22*		*42,906*
	891 Freight Handlers and Shelf Fillers			26	4,770
	899 Miscellaneous Labourers			22	38,136
All occupations					
Total					**1,690,983**

Note: Data randomly rounded to base three.
Source: Statistics New Zealand, 2006 Census

Appendix IV: NZSEI-06 groups and final scores

Table A4

NZSEI-06 groups and final scores

Occupation (ANZSCO minor groups)		NZSEI-06 groups			NZSEI-06 score
		6–group	4–group	10–group	
Managers					
111	Chief Executives, General Managers and Legislators	3	2	3	59
121	Farmers and Farm Managers	4	3	7	36
131	Advertising, Public Relations and Sales Managers	2	1	3	62
132	Business Administration Managers	2	1	3	62
133	Construction, Distribution and Production Managers	3	2	5	48
134	Education, Health and Welfare Services Managers	1	1	1	74
135	ICT Managers	1	1	1	71
139	Miscellaneous Specialist Managers	2	1	2	64
141	Accommodation and Hospitality Managers	4	3	6	40
142	Retail Managers	4	3	6	40
149	Miscellaneous Hospitality, Retail and Service Managers	3	2	4	56
Professionals					
211	Arts Professionals	3	2	4	49
212	Media Professionals	2	1	2	66
221	Accountants, Auditors and Company Secretaries	1	1	1	73
222	Financial Brokers and Dealers, and Investment Advisers	2	1	2	64
223	Human Resource and Training Professionals	2	1	3	63
224	Information and Organisation Professionals	1	1	1	71
225	Sales, Marketing and Public Relations Professionals	2	1	3	63
231	Air and Marine Transport Professionals	3	2	3	60
232	Architects, Designers, Planners and Surveyors	2	1	2	65
233	Engineering Professionals	2	1	2	66
234	Natural and Physical Science Professionals	1	1	1	76
241	School Teachers	1	1	1	72
242	Tertiary Education Teachers	1	1	1	85
249	Miscellaneous Education Professionals	2	1	2	68

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Table A4 continued

Occupation (ANZSCO minor groups)		NZSEI-06 groups			NZSEI-06 score
		6– group	4– group	10– group	
251	Health Diagnostic and Promotion Professionals	2	1	2	70
252	Health Therapy Professionals	1	1	1	74
253	Medical Practitioners	1	1	1	90
254	Midwifery and Nursing Professionals	2	1	2	70
261	Business and Systems Analysts, and Programmers	2	1	2	70
262	Database and Systems Administrators, and ICT Security Specialists	3	2	3	59
263	ICT Network and Support Professionals	2	1	3	63
271	Legal Professionals	1	1	1	80
272	Social and Welfare Professionals	2	1	2	68
Technicians and Trades Workers					
311	Agricultural, Medical and Science Technicians	3	2	4	58
312	Building and Engineering Technicians	3	2	4	52
313	ICT and Telecommunications Technicians	3	2	4	56
321	Automotive Electricians and Mechanics	4	3	6	40
322	Fabrication Engineering Trades Workers	5	4	8	33
323	Mechanical Engineering Trades Workers	3	2	5	45
324	Panelbeaters, and Vehicle Body Builders, Trimmers and Painters	4	3	8	34
331	Bricklayers, Carpenters and Joiners	4	3	7	39
332	Floor Finishers and Painting Trades Workers	5	4	8	31
333	Glaziers, Plasterers and Tilers	5	4	9	29
334	Plumbers	4	3	6	43
341	Electricians	3	2	4	49
342	Electronics and Telecommunications Trades Workers	3	2	5	45
351	Food Trades Workers	5	4	9	28
361	Animal Attendants and Trainers, and Shearers	5	4	8	32
362	Horticultural Trades Workers	4	3	7	36
391	Hairdressers	4	3	8	34
392	Printing Trades Workers	4	3	6	41
393	Textile, Clothing and Footwear Trades Workers	5	4	8	31
394	Wood Trades Workers	4	3	8	35
399	Miscellaneous Technicians and Trades Workers	4	3	6	43

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Table A4 continued

Occupation (ANZSCO minor groups)		NZSEI-06 groups			NZSEI-06 score
		6– group	4– group	10– group	
Community and Personal Service Workers					
411	Health and Welfare Support Workers	3	2	4	50
421	Child Carers	4	3	7	36
422	Education Aides	4	3	7	36
423	Personal Carers and Assistants	5	4	9	26
431	Hospitality Workers	5	4	8	31
441	Defence Force Members, Fire Fighters and Police	3	2	4	52
442	Prison and Security Officers	4	3	7	38
451	Personal Service and Travel Workers	3	2	5	46
452	Sports and Fitness Workers	3	2	5	48
Clerical and Administrative Workers					
511	Contract, Program and Project Administrators	3	2	4	52
512	Office and Practice Managers	3	2	5	48
521	Personal Assistants and Secretaries	4	3	6	44
531	General Clerks	4	3	6	44
532	Keyboard Operators	4	3	6	40
541	Call or Contact Centre Information Clerks	3	2	5	45
542	Receptionists	4	3	7	36
551	Accounting Clerks and Bookkeepers	3	2	5	46
552	Financial and Insurance Clerks	3	2	4	49
561	Clerical and Office Support Workers	4	3	7	38
591	Logistics Clerks	4	3	6	43
599	Miscellaneous Clerical and Administrative Workers	3	2	4	52
Sales Workers					
611	Insurance Agents and Sales Representatives	4	3	6	44
612	Real Estate Sales Agents	3	2	4	55
621	Sales Assistants and Salespersons	4	3	8	34
631	Checkout Operators and Office Cashiers	5	4	9	28
639	Miscellaneous Sales Support Workers	4	3	7	38

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Table A4 continued

Occupation (ANZSCO minor groups)		NZSEI-06 groups			NZSEI-06 score
		6– group	4– group	10– group	
Machinery Operators and Drivers					
711	Machine Operators	6	4	10	24
712	Stationary Plant Operators	4	3	7	37
721	Mobile Plant Operators	6	4	10	23
731	Automobile, Bus and Rail Drivers	4	3	8	34
732	Delivery Drivers	5	4	9	27
733	Truck Drivers	6	4	10	24
741	Storepersons	5	4	9	26
Labourers					
811	Cleaners and Laundry Workers	6	4	10	14
821	Construction and Mining Labourers	5	4	9	30
831	Food Process Workers	6	4	10	23
832	Packers and Product Assemblers	6	4	10	17
839	Miscellaneous Factory Process Workers	6	4	10	21
841	Farm, Forestry and Garden Workers	5	4	9	25
851	Food Preparation Assistants	6	4	10	10
891	Freight Handlers and Shelf Fillers	5	4	9	26
899	Miscellaneous Labourers	6	4	10	22

Note: Data randomly rounded to base three.
Source: Statistics New Zealand, 2006 Census

Appendix V: Using NZSEI-06

This appendix is intended to provide brief notes on using NZSEI-06. For a fuller discussion of the issues discussed in this appendix, see the New Zealand socio-economic index 1996 users' guide (Galbraith, Jenkin, Davis, & Coope, 2003). Various websites mentioned in this section may also be a useful resource for those requiring more information.

Coding occupation

In order to assign NZSEI-06 scores or groups, occupation must first be coded using the Australian and New Zealand Standard Classification of Occupations (ANZSCO). At the time of writing, ANZSCO is the classification system suggested for occupational classification in New Zealand, and since 2006 it has been used in Statistics NZ censuses and surveys where occupation data are collected.

For the coding of NZSEI-06, coding to the minor group (three-digit) level of ANZSCO is required. This has 97 categories. However, if coding to the minor group level is not possible (eg, it is unavailable or if data on occupation lack the detail required), NZSEI-06 scores can be assigned to the sub-major group (two-digit, 43 categories) or major group (one-digit, 8 categories) level of ANZSCO. Coding to any greater detail than the minor group level is unnecessary.

Researchers with occupational data already pre-coded to the minor group level of ANZSCO can move to coding NZSEI-06 scores (see below).

For researchers with un-coded data on occupation in text form, a list of ANZSCO codes as well as guides for coding occupational data to ANZSCO can be found at Occupation. A classification code finder has also been developed.

Coders may find it useful to alphabetise their occupational data so that individuals with the same occupation can be coded at the same time (and with the same code). This is particularly useful if a large number of individuals need to be coded. If necessary, the reliability of coding can be checked by two or more coders coding a subset (or all) of the occupational data and comparing results, eg, by assessing the correlation or computing a kappa statistic.

Researchers who wish to collect occupational data to code to ANZSCO should take the following steps.

First, to enable accurate coding, it is helpful to obtain:

- the occupation title
- the main tasks or duties of that occupation
- the industry to which the occupation belongs.

Second, data collected face-to-face or via telephone are likely to be more accurate, as this allows for the researcher to probe for more information where insufficient detail has been supplied. In this regard, it is helpful for interviewers to be trained with the ANZSCO system or with occupational coding, to gain an understanding of the level of detail required to code occupations accurately.

Coding NZSEI-06

If ANZSCO-classified occupational data are available to the minor group (three-digit) level, researchers can assign NZSEI-06 scores and groups by referring to the 'Minor group' column in appendix III. If ANZSCO-classified occupational data are only available

to the sub-major (two-digit) or major (one-digit) group level, then NZSEI-06 scores can still be assigned by referring to the appropriate columns in appendix III. Note that NZSEI-06 scores are presented for sub-major group occupations in *italics* and for major group occupations in **bold**. Note also that if ANZSCO-classified occupational data are only available to the major or sub-major level, NZSEI-06 SES groups cannot be assigned.

Whether to assign individuals NZSEI-06 scores or assign them to NZSEI-06 SES groups is entirely up to the researcher. Greater sensitivity should be obtained by assigning scores, and scores may also be preferred for analytic reasons – eg, continuous data allow analyses such as linear regression to be undertaken.

However, there are circumstances under which one or other of the SES group classifications would be preferred. For example, for researchers wanting equal-sized groups representing different levels of socio-economic status, NZSEI-06 four-group or 10-group classification would be appropriate. NZSEI-06 10-group classification also allows for direct comparisons with NZDep scales (eg, NZDep2006, Salmond et al, 2007). Similarly, for comparisons with, or assessing continuity with, the previous Elley-Irving scales (eg, Elley and Irving, 1972; 1976; 1985; 2003; Irving and Elley, 1977), NZSEI-06 six-group classification may be preferred.

Coding those not in the workforce

One of the major disadvantages of an occupational-based measure of SES such as NZSEI-06 is that those without an occupation – or for whom occupational data are unavailable – cannot be coded. There are at least three alternatives to assigning NZSEI-06 scores in this situation.

First, NZSEI-06 scores can be assigned based on previous occupation, if such data are available. Moreover, those wishing to estimate the SES of those who have left the workforce (eg, retirees) might wish to consider collecting information on the main occupation held by respondents in their lifetime.

Second, in some cases it may be justifiable to use the occupation of a proxy person to assess socio-economic status (eg, for children or homemakers). Researchers using this method should carefully consider whether an individual's SES is best captured by the SES of their proxy.

Third, individuals can be assigned SES scores based on their 'occupational potential' (Jones and McMillan, 2001), whereby in the absence of information on occupation, scores are imputed using available data on age and education. Methods for imputing NZSEI-06 scores based on age and education were described in chapter 5, and were shown to provide reasonably robust measures of SES that validated well against health and socio-economic correlates.

The suggested imputed NZSEI-06 scores are shown in table A5, and are based on the mean NZSEI-06 scores by age and education for those with a current occupation. Scores are given for seven age bands (10-year blocks from 15–24 years to 75+ years) and 15 different highest qualification levels (from no qualification to doctoral degree). While no problem should be encountered classifying the age of individuals, in some cases there may be difficulties classifying the highest education of individuals to the level displayed in the table. Researchers are advised to classify individuals as accurately as possible, but should note that similar scores are often assigned to adjacent groups. Thus, some distinctions are more important than others. For example, similar scores are assigned to:

(i) those with a master's degree and those with a post-graduate or honours degree
(ii) those with either a Level 4, Level 3, Level 2, or Level 1 Certificate gained post-school
(iii) those with a Level 3 or 4 certificate gained at school and those with a Level 2 certificate gained at school.

Thus, failure to distinguish between these adjacent qualification levels is unlikely to cause large misclassification in imputed NZSEI-06 scores.

The major disadvantage of these imputed NZSEI-06 scores is their restricted range from 30 to 75 (the NZSEI-06 scale for those with occupational data ranges from 10 to 90). A consequence of the restricted range is that NZSEI-06 SES groups cut points do not sensibly assign those with imputed NZSEI-06 scores to SES groups (eg, individuals are concentrated in the middle groups, and groups at the upper and lower end often have no or few cases). Thus, it is suggested that SES groups are not used for those with imputed NZSEI-06 scores.

Table A5

Suggested imputed NZSEI-06 scores for those not in the workforce,
Based on age and highest qualification

Highest qualification	Age (years)						
	15–24	25–34	35–44	45–54	55–64	65–74	75+
	Suggested imputed NZSEI-06 score						
Doctorate degree	58	71	75	75	74	72	64
Master's degree	56	61	63	64	65	64	58
Post-graduate and honours degree	58	63	64	66	65	63	63
Bachelor's degree and level 7 qualification	55	59	61	61	61	60	60
Level 6 diploma	46	55	58	59	58	54	52
Level 5 diploma	42	48	51	51	51	49	47
Level 4 certificate gained post-school	39	42	44	45	45	43	43
Level 3 certificate gained post-school	37	42	44	43	43	43	45
Level 2 certificate gained post-school	36	40	42	42	43	42	47
Level 1 certificate gained post-school	36	41	42	43	43	48	47
Overseas secondary school qualification	34	40	41	41	42	42	43
Level 3 or 4 certificate gained at school	38	46	49	48	48	46	46
Level 2 certificate gained at school	36	43	46	46	46	45	45
Level 1 certificate gained at school	33	38	41	42	42	41	40
No school qualifications	30	33	34	35	36	36	37

Source: Statistics New Zealand, 2006 Census