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# Non-response in the context of the New Zealand Census

A thesis  
submitted in fulfilment  
of the requirements for the degree  
of  
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at  
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by  
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## Abstract

The New Zealand Census provides an invaluable source of information on the estimated resident population of the country and its demographic, social and economic characteristics. The data derived from the census finds wide usage in research and analyses which inform numerous government policy decisions, including resource and funding allocation. Consequently, missing data caused by non-response to the census, whether unit (not returning completed census forms) or item (not providing a valid response to questions in the census forms) can cause a range of practical, methodological and ethical issues. Users of census datasets need to understand the implications of including or excluding the non-responding sub-population from their analyses.

This study looked at the residual non-response category 'Not Stated' or 'Not Elsewhere Included' (NS/NEI) for the 2006 and 2013 Censuses. NS/NEI is an aggregate of two different population groups. The majority are substitute records created by Statistics New Zealand as an estimate of the population not responding to the census at all, and the remaining are people who did not provide a valid response to the question on the census form, the item non-respondents. Detailed analyses were conducted on the variable that has one of the highest rates of item non-response: the question on personal income. The aim was to examine the demographic and socio-economic characteristics of the non-respondents and therefore identify any patterns or over-representation of certain population groups, likely to have an impact on any analysis carried out using these data. This study therefore enables analysts to have a more evidence based approach towards dealing with this residual category.

The analysis of the demographic and available key socio-economic characteristics of the item non-respondents (NS/NEI group excluding substitutes) to the income question showed patterned behavior with certain population groups over-represented - females, youth, those aged 65+ years, Pacific Islanders and Māori, people born overseas, people receiving government benefits, those not in the labour force or

unemployed and people working as labourers and machinery operators and drivers. Consequently, the exclusion or inclusion (by say, pro-rata apportioning or imputation) of the NS/NEI count from the analysis of the income variable will adversely affect these groups in terms of representativeness.

The users of census data need to take into account that the NS/NEI is not a homogeneous grouping. The imputed age-sex and spatial distribution of the majority of the substitutes is modelled on the population enumerated on census night and consequently, the demographic profile of the substitutes is more representative of census respondents. The substitutes included in the NS/NEI category can therefore substantially alter the demographic profile of the actual item non-respondents. To achieve an accurate profile, it is important to first exclude the substitutes from analyses. Decisions around the inclusion or exclusion of the NS/NEI count from any analysis can then be taken by ascertaining whether any particular population groups are over-represented among the item non-respondents and how the exclusion is likely to impact on the conclusion(s) reached from the analysis of that particular variable. Alternatively, for inclusion in the analysis, this will provide a more informed base for modelling the probable responses for the item non-respondents.

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# CHAPTER 1: INTRODUCTION

An accurate enumeration of the population of a country, as well as reliable information on the social and economic characteristics of that population, is vital for policy planning and service delivery. The related importance and potential of a census for a country cannot be disputed as it gives much more reliable measures of population size and characteristics than non-censal counts like surveys or administrative data sources. Periodic census data collection are the best means of collecting and collating comprehensive data about the size, composition and social and economic characteristics of the population and analysing changes over time.

This basic information is essential for the purposes of planning and development of services which are heavily reliant on availability of reliable, up-to-date, accurate and detailed data about the population; not only at the national, but more importantly at a local level (Green & Milligan, 2010; Davies, 2011). For example, when planning a school in an area, it is essential to have a reliable forecast of the number and type of potential students (for example, overseas born children may have language barriers which need to be taken into account) as well as the number of teaching staff that will be required. Or when planning the budget for the health system, apart from the necessary clinical data around prevalence and treatment, the planners also need to consider the number (quantity) and type (for example, age group) of people likely to use the system; as well as take into account one or more socio-economic indicators of this population, like income and ethnicity. Only a national census can provide such detailed information of the population down to the smallest geographical area across a wide range of variables such as age, ethnicity, employment, qualifications, spoken language, etc.

By definition, a census is the complete process of collecting, collating, analysing, publishing and distributing demographic, social and economic data at a given date on all residents of the country at a smallest possible geographical area level (United Nations, 1998). The New Zealand Census aims at providing a complete and accurate coverage of the country's resident population at a given point of time. However, it is inevitable that

some people are missed either because of collection error, people not filling in the census forms or people not answering all the relevant questions in the forms. The quality of the census data is affected by these uncollected and partially or completely unanswered forms referred to as non-response.

Residents are required by law to respond to the census, so coverage is typically high. However, non-response is a significant issue for any census and how it is dealt with has important implications for the accuracy and robustness of all analysis utilising census data. This non-response, which can be to the census as a whole or to individual questions within the census form, is the central topic of this thesis, the main objectives of which are to:

- i. Explore the issue of non-response, both, to the census as a whole and to specific questions asked in the census forms;
- ii. Examine the differences in the demographic profile of these two different types of non-respondents;
- iii. Analyse whether non-response, in context of the New Zealand census, is a random or a patterned phenomenon. That is, whether non-respondents typically differ from respondents in terms of their demographic and socio-economic characteristics.
- iv. Consider the possible implications of the findings from the above analyses.

Census data are not only used for commercial purposes but also widely used by policy makers for evidence based decision making. Therefore, it is essential that users have a thorough understanding of the population that is enumerated within the various census datasets as well as those who are missing or not included because of various reasons. Missing data means a loss of information which in turn may have implications on research results or policy decisions which are based on them. In context of the New Zealand Census, understanding how non-response is coded within various census datasets and examining the socio-demographic profile of the non-respondents to ascertain if and how they differ from people who do respond will provide an evidence base for analysts to more robustly deal

with missing data. Additionally, it will also help to develop targeted strategies to reduce the rate of non-response.

Non-response which results in missing data can be broadly categorised into two types: Unit non-response (people not filling in the census forms) and Item non-response (people not answering one or more relevant questions in the forms). Both affect the quality of the census data.

Within the various New Zealand census datasets related to each derived variable, the unit non-respondents as well as the item non-respondents are grouped together under the residual category 'Not Stated (NS)' or 'Not Elsewhere Included (NEI)'.

## **1.1 Unit non-response**

The actual census taking process broadly comprises of two steps:

1. Delivery of census forms (Dwelling and Individual forms, including an internet access code for completion online) to every person and occupied dwelling in New Zealand before census night.
2. Collection of census forms from every person and occupied dwelling that has not completed forms online.

Fully trained and supported team of census collectors, each allocated specific areas, deliver to and collect census forms from individuals and households across New Zealand.

Unit non-respondents include that sub-group of the population who, for various reasons, are not enumerated on census night. A unit non-response is recorded when a census form (either the Dwelling Form or the Individual Form or both) is not returned for a dwelling which is believed to be occupied on census night. Similarly, if an empty dwelling is deemed to be otherwise usually occupied, unit non-response is recorded for an estimated number of occupants for that dwelling (estimated by imputation methods discussed further on).

The Statistics Act of 1975 dictates that every person living in New Zealand on Census Night is obliged to participate in the census. While filling in a census form is compulsory by law, the penalty for not complying is minor – if ever applied – and as a result the unit non-response is not insignificant. Given the complexity and magnitude of the census process, it is inevitable that some people are missed or not enumerated and some counted more than once (Dunstan, Heyen, & Paice, 1999). Unit non-response can occur due to a variety of reasons – people may forget to mail back the census form(s) or complete it online in spite of having the desire or intention to participate in the census; some may have left the dwelling before the form is collected; and many a times people simply refuse to complete the census form(s) or actively avoid doing so. Also, people are now more mobile and some live in more than one residence (for example, children in shared custody arrangements), which can result in people being counted more than once. Sometimes a dwelling may be missed by the collector or possibly an occupied dwelling may be marked as unoccupied. Some very remote areas are intrinsically difficult to enumerate (Statistics New Zealand, 2014). Usually more people are missed than over-counted, so the census count of the population would be less than the true population (called net under-count). Moreover, rates of undercount can vary significantly for different population groups depending on factors such as sex, age, ethnicity and geographic location (Dunstan, Heyen, & Paice, 1999).

Quality of the census data, which is essential for research and policy decisions, is heavily dependent on the accuracy and completeness of coverage of the country's resident population. Coverage can be defined as the proportion of the total resident population of the country counted by the census (Dunstan, Heyen, & Paice, 1999). Perfect coverage means that the census counts every person who should be counted and no one that should not (Savage & Bycroft, 2014). It is very important that, for the purposes of obtaining reasonably accurate population estimates and projections, the accuracy and coverage of a census enumeration is evaluated and the census results are 'corrected' accordingly.

At the processing stage, the total unit non-response to the census is estimated from the following two components:

- People who are listed as occupants on the census Dwelling form (or the number of individual forms indicated on the dwelling form) but fail to return a completed census Individual form.
- Dwellings where no forms are returned but which are assessed as otherwise usually occupied by the collector.

Based on these estimates of the unit non-response to the census, '**substitute or dummy**' forms or records are created by Statistics New Zealand mainly to improve the coverage of the census and enhance the data quality of the four most important variables, namely, age, sex, usual residence mesh-block and the work and labour force status (Statistics New Zealand, 2014). Substitute records are created only when there is sufficient evidence that a person existed and was present in New Zealand on census night or that a dwelling is occupied on census night (Statistics New Zealand, 2016). As noted earlier, the substitutes created are coded to the residual 'NS/NEI' category of each variable derived from the census.

There are typically four types of substitute records created (Statistics New Zealand, 2014):

Partial Substitute Individual or Dwelling Forms	1. A substitute record for people listed on the census Dwelling form with no census Individual form returned (number of occupants stated on the Dwelling form is greater than the number of individual forms received). These are referred to as <b>partial substitute Individual forms</b> .
	2. A substitute Dwelling form when Individual form(s) related to that dwelling are returned but no Dwelling form is collected/returned. These are referred to as <b>partial substitute Dwelling forms</b>

Whole or Full Substitute Individual and Dwelling Forms	3. A substitute Dwelling form for dwellings with no forms received but are occupied as per the assessment of the census collector. These are referred to as <b>whole or full substitute Dwelling forms</b> .
	4. A substitute record for the estimated number of occupants for each full substitute Dwelling form created. An estimate of the number of occupants in these full substitute Dwelling forms is stochastically imputed using a nearest neighbour 'donor' household (one privately occupied dwelling or household is chosen randomly from responding households in the same mesh-block). These are referred to as <b>whole or full substitute Individual forms</b> .

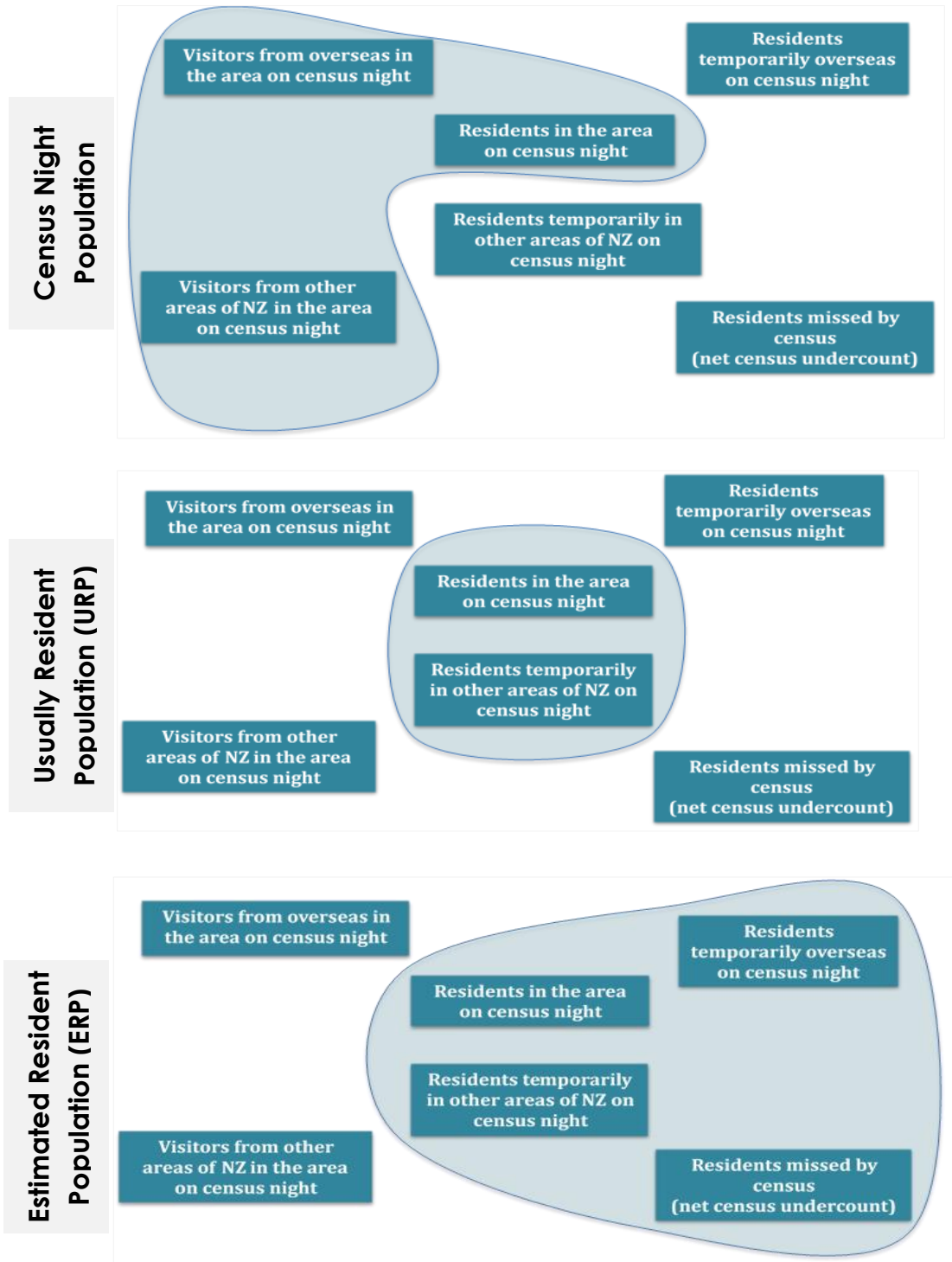
The first two types of substitute forms or records created can be termed as 'real' as the existence of the dwelling or individual is corroborated by a returned Individual or Dwelling form. The other two types are estimates based mostly on collector assessment (for creation of a substitute Dwelling form) and imputation (for creation of substitute Individual forms related to each substitute Dwelling form) and therefore need to be assessed for validity (whether too many or too few substitute records were created). In 2013, as reported by Statistics New Zealand, two-thirds of all substitute Individual Forms created were for whole or all substitute households or dwellings (Statistics New Zealand, 2014). These substitute Individual forms in all-substitute or whole substitute dwellings are imputed from 'donor' households and are prone to errors – the imputed number of occupants may not be equal to the actual number of people living in that dwelling. Or alternatively, an all-substitute private dwelling may be erroneously marked as occupied, in which case the substitute individual forms are created unnecessarily leading to an over-count. The 2013 Post Enumeration Survey (PES) found that the 2013 Census raised approximately 15,000 too many substitute records, suggesting that the number of individual substitute records was around 11 percent too high (Statistics New Zealand, 2014). Previous to 2013, there was no assessment of the validity of the number of substitutes created.

The Census Night Population count and the Usually Resident Population (URP) count, therefore are both inclusive of the substitute individual records created by Statistics New Zealand. The URP count is used as the base for all population estimates (Estimated Resident Population or ERP count)<sup>1</sup>, which in turn are used for population projections. Therefore, the accuracy of the ERP count as well as the population projections is heavily dependent on the accuracy of the URP count. See Figure 1.1 for the definitions of the three different population counts from the census.

---

<sup>1</sup> The ERP count includes the URP count, the residents who are temporarily overseas and therefore not included in the census, and an adjustment for residents missed or counted more than once by the census, that is, the net census undercount as measured by the PES (Savage & Bycroft, 2014).

Figure 1.1 Population counts derived from the New Zealand census



Source: Statistics New Zealand

As noted earlier, substitutes or 'dummies' are created by Statistics New Zealand for the 'known' number of unit non-respondents to the census specifically to achieve high coverage rates and then provide reasonably accurate population estimates and projections (Statistics New Zealand, 2014).<sup>2</sup> However, there is also an unknown component to this unit non-response which is estimated by the Post Enumeration Survey (PES<sup>3</sup>) which is carried out by Statistics New Zealand to measure the completeness of the census coverage achieved. It estimates the population that was not enumerated by the census, either in terms of completed census forms or substitute records created, and therefore not included in the URP count of the census.<sup>4</sup> The census net undercount, which is calculated after the PES, gives the proportion of the resident population of the country that was not included in the URP count. The census net undercount is the gross undercount minus the gross overcount and is a measure of the difference between the number of people counted by census and the number estimated by the survey as eligible to be counted. It is a measure of the difference between people missed by census and those counted more than once.

The PES is conducted as independently from the census as possible to minimise factors which might compromise the integrity of the PES sample. Despite these efforts to maintain independence, the census results and PES results may have correlation bias - the reasons which contribute to a person being missed in the census may also cause them to be missed in the PES (Dunstan, Heyen, & Paice, 1999).

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<sup>2</sup> The coverage rate is usually expressed as a percentage of the resident population of the country, as estimated by a post enumeration survey (PES), which should have been counted.

<sup>3</sup> Estimates of under-count, over-count, and net under-count produced from the PES are all subject to both sampling and non-sampling errors.

<sup>4</sup> The substitute forms are created before the PES is carried out.

Table 1.1 gives the coverage rate and the total non-response rate to the 2006 and 2013 censuses. The PES of 2013 estimates that 97.6 per cent of New Zealand's population was included in the URP count of the census, which gives a net under-count rate of 2.4 per cent, which is only marginally greater than that recorded in 2006 (2.0 per cent). The total non-response rate to the census (which includes the unit non-respondents as measured by the number of substitute records created, as well as those the PES estimates were not counted by the census process), on the other hand, increased from 5.2 per cent in 2006 to 7.1 per cent in 2013, which indicates a growing proportion of the population which is not covered by the census (Statistics New Zealand, 2014).

**Table 1.1 Coverage rate and total non-response rate, Census 2006 and 2013**

	<b>Census 2006</b>	<b>Census 2013</b>
Census count (forms received)	3,895,002	4,038,999
Unit non-respondents (no. of individual substitute records created)	132,945	203,049
Census Usually Resident Population (URP) count (including substitutes)	4,027,947	4,242,048
PES estimate of total population	4,109,000	4,346,000
Net Undercount	81,053	103,952
Estimated Coverage Rate	98.0%	97.6%
<b>Total non-response rate to the census **</b>	<b>5.2%</b>	<b>7.1%</b>

Source: Statistics New Zealand,

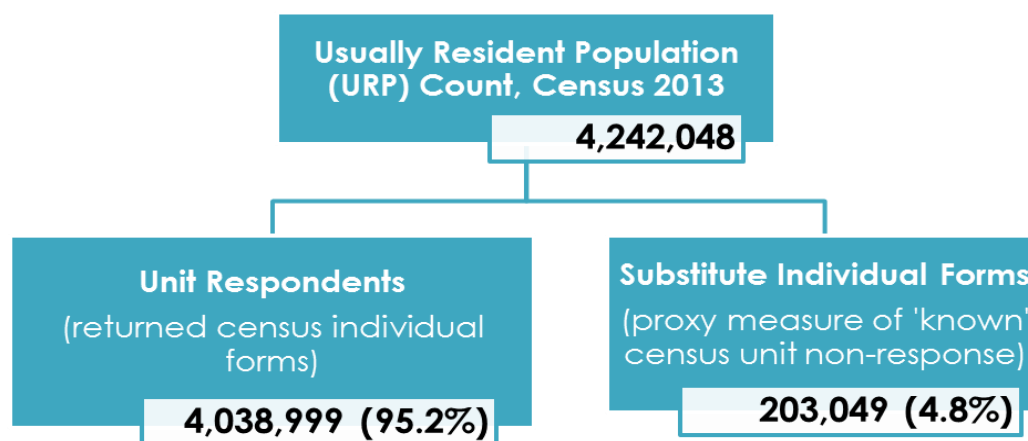
[http://www.stats.govt.nz/browse\\_for\\_stats/population/census\\_counts/report-on-2013-post-enumeration-survey.aspx](http://www.stats.govt.nz/browse_for_stats/population/census_counts/report-on-2013-post-enumeration-survey.aspx)

\*\* Total non-response includes the estimated number of unit non-respondents for whom a substitute individual form was created plus the net undercount as estimated by the post enumeration survey.

The URP at the 2013 Census was 4,242,048, which is an aggregate count of the 4,038,999 respondents who returned the completed Individual Forms (95.2 per cent) and the 'known' unit non-respondents for whom a substituted form was imputed (203,049 or 4.8 per cent) (see Figure 1.2 and Table 1.2). The number of individual substitute records as a proportion of the total number of census individual forms (or the total estimated URP) has increased notably over time (2.9 per cent in Census 2001, 3.3 per cent in Census 2006 and 4.8 per cent in Census 2013). This increase is seen in each of the broad age groupings shown in Table 1.1 (Source: Statistics New Zealand). If the **substitute records created are considered as a proxy measure of the number of unit non-respondents at the census**, then it is estimated that there has been an increase of approximately 45 per cent in the rate of unit non-response in 2013 compared to the previous 2006 Census.

However, it should be kept in mind that, as estimated by the PES, the number of individual substitute records was around 11 percent too high in 2013 (approximately 15,000 too many substitute individual records created). Moreover, no similar assessment was carried out for the 2006 Census. So, although there has been a noticeable increase since the last two censuses in the rate of unit not-response as indicated by the number of substitutes, it is difficult to accurately measure the magnitude of this increase.

**Figure 1.2 Disaggregation of the usually resident population (URP) count at the 2013 Census**



Source: Statistics New Zealand

**Table 1.2 Usually resident population, number of individual substitute records created (proxy measure of the number of unit non-respondents) and rate of unit non-response by age group, 2006 and 2013**

	<b>Age Group</b>	<b>Usually Resident Population (URP) count</b>	<b>No. of Individual Substitute Forms Created</b>	<b>Rate on unit non-response</b>
<b>Census 2006</b>	0-14	867,573	26,634	3.1
	15-24	571,173	21,978	3.8
	25-39	820,557	31,731	3.9
	40-64	1,273,029	40,113	3.2
	65+	495,603	12,471	2.5
	Total	4,027,950	132,945	3.3
<b>Census 2013</b>	0-14	865,629	38,946	4.5
	15-24	586,446	34,548	5.9
	25-39	782,208	43,902	5.6
	40-64	1,400,733	64,314	4.6
	65+	607,038	21,339	3.5
	Total	4,242,051	203,049	4.8

## **1.2 Item non-response**

Item non-response occurs where only a subset of information is missing from an otherwise responding individual; that is, when a census form has been returned for a person or dwelling but one or more applicable questions have not been answered, for example, questions on ethnicity, personal income, religion, smoking behaviour, etc. In other words, item non-response constitutes the total non-response or invalid response to a census variable that is applicable to the person filling the form.

Item non-response can also occur during processing of census forms when a response is lost while coding; for example, an unrecognisable response should be coded as 'unidentified' but due to human error is not

recoded at all. However, this occurs only rarely (Statistics New Zealand, 2014); and for the purpose of this dissertation it is assumed that all item non-responses are due to census respondents not providing any or a valid response.

In context of the New Zealand census datasets for the different variables, the item non-respondents are coded to the NS or NEI category along with the substitute records. For example, the residual NS/NEI category for the variable 'Ethnicity' includes both, the substitute records (that is, the unit non-respondents) as well as people who returned the forms but either chose not to answer the question or gave an invalid response to the same (the item non-respondents).

While there is a body of literature around unit and item non-response to survey questionnaires (Craig & McCann, 1978; Division of Behavioral and Social Sciences and Education, 2013; Hedengren & Stratmann, 2013; Tourangeau, Rips, & Rasinski, 2000), research around census item non-response is sparse. With a survey and a census being similar in a broader sense and the paucity of detailed research around census item non-response, this thesis draws upon the existing literature around survey non-response.

Being a self-administered questionnaire, the quality of census data is affected when respondents, either intentionally or unintentionally, fail to answer specific questions. Item non-responses leave gaps in the data that can pose a range of practical, methodological and ethical questions for the researcher (Denscombe, 2009). Of specific concern is establishing whether there is any significant inherent bias in the distribution of the missing data. In terms of quality, accuracy and completeness, the main question is whether the item non-responses should be excluded or included in some way in the analysis, for example, via pro-rata distribution. If excluded, will it have any significant implications on say, the resulting allocation of resources? These questions are of particular importance when dealing with variables which elicit a high rate of item non-response, for example, personal income.

Within the census datasets, information is available for other variables which facilitates at least the partial analysis of the item non-respondents themselves. For example, one or more socio-demographic characteristics like age, sex, location, qualifications, birthplace, etc. of a census respondent not answering the personal income question can be carried out to examine whether any particular population group is over-represented among the item non-respondents.

Quality issues like non-response bias caused by high rates of item non-response may not be as significant and problematic for census data where large numbers are involved, as they are for survey data where only a small subset of the population is included and the weighted results from a survey are expected to be representative of the total population. However, in census data some variables elicit a high rate of item non-response. Further, the census is the basis for a wide range of policy decisions and resource allocations in health, education, transportation, welfare and other major sectors of the country's economy. Statistics derived from census data are used in several contexts for the allocation/distribution of resources from the central government to local bodies (Simpson & Dorling, 1994). As highlighted by Turrel (2000), research suggests that low socio-economic groups are likely to be over-represented among unit non-respondents in surveys and when they do participate, they are more likely to have higher rates of item non-response. In a study of the non-response to the 1991 Census in Britain, Simpson & Dorling (1994) highlighted the implications of incomplete coverage on a spectrum of social statistics. Item non-response to census variables, like income and ethnicity for example, which play a significant role in policy and decision making, can potentially reduce the observed variation between areas or different population groups, with consequences for the distribution of resources for local services. Therefore, high non-response rates can adversely and disproportionately affect certain social, demographic and economic groups especially at the sub-national level.

A logistic regression model run by Rahman and Goldring (Rahman & Goldring, 2006) used to assess the probability of a household not responding to the 2001 Census in the United Kingdom found that non-

response is associated with a number of factors including socio-economic deprivation, ethnicity, migrant status, accommodation type (example single or multiple person households) and age group. A similar study in 1997 by Simpson and Middleton highlighted single and divorced males, recent migrants, the unemployed, minority ethnic groups, private renters, and those who share a dwelling with other households or with a business, as population groups who are all associated with higher non-response in a census (Simpson & Middleton, 1997).

It is important to learn about the determinants of non-response behaviour if strategies are to be developed to minimise non-response rates. The reasons for people either not answering or not giving a valid response to one or more relevant questions on a census form is varied. Several causes for non-response are mentioned in the literature. These range from the ethnic or country of birth diversity of the population leading to language and cultural barriers to accurately completing the census forms and answering particular questions; to people simply refusing to complete a census form (Tourangeau, Rips, & Rasinski, 2000). Grooves et al (2009) suggest that item non-response may be due to three causes: a) intent of the question not completely or clearly understood, b)'recall' failure, that is, judged failure to retrieve adequate information (the answer is not known), and c) the lack of willingness or motivation to disclose the information.

The first cause, not having a clear understanding of the question being asked, may be least likely to result in an item non-response and will probably invoke a perfectly valid but incorrect response (the respondent will answer, but without completely understanding the question is likely to give an incorrect one). This incidence of error is most 'invisible' of all errors within the census dataset (Tourangeau, Rips, & Rasinski, 2000).

The third listed cause, lack of willingness or motivation to disclose the information, could be mainly attributed to the respondent's unwillingness to answer questions that they perceive as highly sensitive or in violation of confidentiality and privacy (for example, personal income). A study by Singer, Hoewyk and Neugebauer (2003) on participation in the 2000 U.S Census found that there is a small but statistically significant impact of

privacy and confidentiality concerns on participation rates. Additionally, one or a combination of respondent fatigue, uncertainty, oversight, misunderstanding, or a perception that the particular question is not relevant to that person play a role (Loosveldt, Pickery, & Billiet, 2002). Hedengren and Stratmann (2013) propose that item non-response, and its equivalent inverse, the item response rate, is a measure of non-cognitive skills (example, personality traits, such as conscientiousness), and cognitive skills, such as intelligence.

The loss of information due to item non-response can be as substantive and problematic as the lack of complete census coverage of the population. Studies show that respondent characteristics like age and education level and factors such as mode of data collection (online versus paper and face to face versus mailed out questionnaires) affect the rate of item non-response (Chesnut, 2004). There is very little research on the effect online questionnaires may have on a respondent's willingness to answer individual questions and the existing research suggests that online questionnaires result in lower item non-responses than paper based ones (Boyer, Olson, Calantone, & Jackson, 2002; Haraldsen, Dale, Dalheim, & Stromme, 2002; Kwak & Radler, 2002; Tourangeau, Rips, & Rasinski, 2000; Denscombe, 2006)

A further study by Descombe (2009) concluded that use of online surveys did not have a negative impact on item non-response rates and that online questionnaires might possibly result in lower item non-response rates than their paper counterparts. On the contrary, other research suggests that rates of item non-response are in fact higher in questionnaire answered online (Lozar Manfreda, Bosnjak, Haas, & Vehovar, 2005). People using computer technology and the internet tend to be more affluent, better educated and younger (Atkin, Jeffres, & Neuendorf, 1998; Dickerson & Gentry, 1983), which affects the demographic profile of online respondents and this in turn introduces a bias in the item non-response rates for people completing their census forms online.

### 1.3 Imputation of variables

Data quality is the most important aspect of any census and the variables derived from the New Zealand census forms are ranked by three quality levels (Source: Statistics New Zealand):

1. **Foremost or Level 1** are the core variables which are the main reason for carrying out the census. They include data on age, sex, ethnicity and geographic location. These are given the utmost priority in terms of data quality.
2. **Defining or Level 2** variables are important for policy development, evaluation and monitoring and are used mostly in cross-tabulation with foremost variables. They represent measures that are of high public interest, for example, birthplace and labour force status. These variables are closely linked to the main purpose of the census.
3. **Supplementary or Level 3** variables do not fit directly with the primary purpose of the census but are important for certain users; for example, occupation, language, and religious affiliation. These have last priority in terms of effort (required in deriving and processing) and quality.

Data on the level 1 and 2 variables are collected in each census although the exact wording of the question(s) related to these variable may undergo change. One or more of the questions related to level 3 variables may be dropped at a particular census and replaced with other question(s). These changes are made post approval from the Government Statistician, after thorough research and a consultation process with the main users of the census information (Statistics New Zealand, 2014).

Key variables which are missing from the census individual forms are filled by Statistics New Zealand by statistical techniques called imputation. In simple terms, item imputation is the filling of missing information with a best estimate of what the true value might be and is mostly based on the available non-missing data/information about the individual (in other words, based on the available data from responding individuals). Imputation is carried out for the returned individual forms where the information is missing, as well as for the substitute individual forms.

Therefore, there are two types of imputations:

- Imputation of variables *for item non-responses*.
- Imputation of variables *for the full or partial substitute individual records* created by Statistics New Zealand for uncollected forms or unit non-responses in cases where there is sufficient evidence that a person or dwelling exists.

If age, sex, usual mesh-block of residence and work and labour force status cannot be derived due to unit non-response (completed individual form not returned or collected) or item non-response (individual form returned but respondent has not answered one or more questions), then the missing value(s) are imputed using the following three main methods of imputation, either alone or in combination (Statistics New Zealand, 2014):

**Deterministic imputation** involves using information from other responses on the census form to determine a missing response. For example, the age information of individuals listed on the dwelling form can be used to impute the missing age on an individual form or examining first name of individual and relationship to the reference person and making a decision. For example, females are typically three years younger than their male partners.

**Stochastic imputation** involves imputing missing values according to an existing distribution, for example using the national sex distribution to impute a missing value for a person who has not responded to the sex question.

**Donor imputation** involves matching the non-respondent (recipient) to a respondent (donor) for a particular question, based on a set of matching variables that are closely related to the missing variable. For example, if the work and labour force status information is missing for a 35-year-old male, a male in the same age group is found at random as a donor of this information.

The three level one variables, age, sex and mesh-block of residence, form the base for detailed national and subnational population estimates and

projections (which are based on the URP count) and it is therefore essential that this information is available for each and every person that comprises the usually resident population count of New Zealand. Essentially, the imputation of sex, age and mesh-block of usual residence is carried out to ensure that there are no gaps in the URP dataset related to these three most important variables.<sup>5</sup>

Work and labour force status is imputed because of its relation to other important socio-economic indicators like occupation and employment, in the development of the New Zealand deprivation index and for labour force projections. This variable is only imputed for returned census forms where information is missing but not for substitute records.

For returned census Individual forms, only three foremost (or level one) variables - **age**, **sex** and **usual residence mesh-block**, and one defining (or level two) variable, **work and labour force status** if missing are imputed using a combination of deterministic, stochastic and donor imputation methods. All other variables (example ethnicity, occupation, birthplace, income, qualifications, etc.) where information is missing (or invalid or unidentifiable) are coded to the residual NS or NEI category (Statistics New Zealand, 2014).

For the individual substitute records only the three level one variables, **age**, **sex** and **mesh-block of usual residence** are imputed. All other variables for these substitute records, including the work and labour force status, are coded to the residual NS or NEI category (Statistics New Zealand, 2014).

Details on the four imputed variables – age, sex, mesh-block of residence and work and labour force status is included for reference in Appendix A: Imputed Variables.

Note: For whole substitute individual records created, only age (not sex) was imputed from the age of the occupants of the donor household. For the 2001 Census, age of the occupants on the substitute form was

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<sup>5</sup> To be noted again that the work and labour force status is not imputed for substitute records.

imputed stochastically from a known joint age-sex distribution. In 2006 and 2013, however, the age of the occupants was taken from the dwelling form of the chosen donor household. The sex of the occupants on the substitute records was imputed independent of age in 2006 and 2013, which was not the case in 2001 when the age and sex was imputed together based on a known age-sex distribution (Statistics New Zealand, 2016).

## CHAPTER 2: OBJECTIVES AND SCOPE OF STUDY

The New Zealand Census aims at giving us not only a complete and accurate enumeration of the country's resident population at a given point in time, but also provides vital information on the demographic and socio-economic characteristics of the resident population. The quality of the census data is affected by non-response; whether unit non-response which affects coverage, or item non-response which leaves gaps in the dataset of different variables derived from the census questions.

In case of unit non-responses, Statistics New Zealand create 'substitute or dummy records' for non-responding individuals (estimated from the input of the census field workers/collectors as well as other statistical techniques like donor households) and attribute to them a narrow range of characteristics (only level one variables, age, sex and mesh-block of residence) using various imputation techniques. The three core level one variables, age, sex and mesh-block of residence, along with one defining (level two) variable, work and labour force status, are also imputed in cases of gaps created in the census data by item non-responses.

For the rest of the non-imputed variables (ethnicity, qualifications, income, etc.), the non-responses, whether arising from the substitute records created or actual item non-response from an otherwise responding individual, are grouped within the residual category 'Not Stated or 'Not Elsewhere Included' (NS/NEI). Therefore, this NS/NEI group in the datasets of all census derived variables is essentially an aggregate of the substitute records created and the item non-respondents.

The cause(s) of item non-response and consequently the demographic characteristics of the item non-respondents to various census variables may not be similar to that of the unit non-respondents. Therefore, within the different census datasets of socio-demographic variables like income, occupation, qualification, religious affiliation, etc., the residual NS/NEI category is an undifferentiated grouping of two potentially demographically and socially diverse groups – the unit non-respondents (substitutes) and

the item non-respondents. Consequently, the inclusion of the NS/NEI category in any analysis, using pro-rata or other imputation techniques, without taking into account this grouping of item and unit non-respondents is likely to adversely affect the results.

There are two commonly used approaches to dealing with the NS/NEI category in a population dataset like the census: one is to exclude them completely from the analysis except to note the rate of non-response; and second is to apportion them on a pro-rata basis as per the distribution of the respondents who do provide a valid response to the question(s). A third, less commonly used technique is to impute the missing responses statistically. Exclusion of the item non-responses, particularly in the case of variables with typically high non-response rates like income, is the most common approach (Rässler & Riphahn, 2006), but as noted earlier can adversely and disproportionately affect certain population groups, especially in research involving policy decisions and resource allocation.

On the other hand, inherent in techniques like pro-rata apportioning based on distribution of item respondents, and imputation, is the assumption that item non-response is a random phenomenon. The underlying assumption is that item non-respondents are randomly distributed through the population, and therefore their responses are likely to be similarly distributed as that of respondents. However, if non-respondents are typically different from respondents, as is indicated in the literature, any analysis carried out on the data while not taking these differences into account is likely to be biased. There is an extensive body of research that suggests that rate of item non-response not only depends on the kind of question asked, but is significantly higher among the elderly, the unmarried, persons of low socio-economic status and the physically, cognitively and psychologically impaired (Craig & McCann, 1978; Messmer & Seymour, 1982; Davis, Yee, Chetwynd, & McMillan, 1993; Slymen, Drew, Wright, Elder, & Williams, 1994). Therefore, item non-response is highly non-random and the pro-rata apportioning or imputing missing responses based on the distribution of the item respondents is also likely to have the same end result as the first approach of excluding

the item non-response data. In both cases, the outcomes are the same because the assumption made is zero bias due to item non-response.

The third approach of imputing item non-responses does attempt to account for some of the known biases. However, in the context of the New Zealand Census, the picture is muddled when the imputed substitute records for unit non-respondents are included with the item non-respondents in the NS/NEI category because the process of creation of the substitute records is almost entirely independent of the item non-response process (see Section 1.1: Unit non-response for the process of creating substitute records for unit non-respondents). The appropriateness or otherwise of pro-rata and imputation approaches for including the NS/NEI category in the analysis or to exclude it completely is therefore an important question.

Item non-response rates are known from the literature to vary for different questions/variables and also to depend on the demographic characteristics of the census respondents, such as age, sex, country of birth, cultural background; as well as socio-economic characteristics like qualifications, income, migrant status and so on. Analysing these demographic and socio-economic characteristics would seem an important step towards understanding the determinants of non-response behaviour, which in turn may enable the development of techniques to reduce non-response and substantially increase the quality of census data. Such knowledge would also improve data users' ability to rigorously deal with the non-response component in their analysis of census variables like ethnicity and income. Thirdly, such knowledge may provide important insights into improving imputation procedures for missing data (Riphahn & Serffing, 2005), and fourthly, contribute to understanding of the possible policy implications of non-response.

As briefly outlined in Chapter one, the primary objectives of this research are to:

- 1 Examine whether the imputed demographic profile (age, sex and geographical location) of substitute records (which are a proxy measure of unit non-response to the census) differs from that of the item non-respondents;
- 2 Study the impact of grouping individual substitute records with the item non-respondents within the residual category NS/NEI for all non-imputed variables from the census;
- 3 Conduct a detailed case study on the personal income variable from the census to:
  - find whether the item non-response rates have changed for the inter-censal period, 2006 – 2013, and ascertain the possible reasons contributing to this change;
  - test the hypothesis that, in the context of the New Zealand Census, and as far as the data will permit, item non-response to question on personal income is not a random phenomenon but a patterned one;
  - examine some key socio-demographic characteristics of item non-respondents to the personal income variable for the 2006 and 2013 censuses and compare them to that of respondents in order to identify differences if any; and
  - identify if there is over-representation of particular socio-demographic (sub-population) groups among the item non-respondents.
- 4 Consider the possible policy implications of any socio-demographic patterning in item-non responses.

The underlying causes for the item non-response/s which may contribute to any differing socio-demographic patterns found will be briefly discussed, but analysis of these is beyond the scope of this dissertation.

Because the objective of this study is to understand missing data in the recorded information, questions involving over count are not within the scope of the study. Over count occurs when people may be counted more

than once or overseas visitors are recorded as resident in New Zealand. While small, this component is of concern to coverage surveys such as the Census Post-Enumeration Survey.

The outline of the dissertation is as follows:

- The first chapter gives an overview of the issue which this study explores and summarises the available literature around unit and item non responses. It briefly describes the process of creation of substitute records or dummies and imputation of key variables carried out by Statistics New Zealand to fill gaps in the data caused by unit and item non-responses;
- Chapter two outlines the key aims and scope of this study;
- Chapter three will provide some background information with a brief history of the New Zealand Census along with some uses of the census data along with their limitations;
- Chapter four will describe the methodology and the data used in the analysis carried out;
- Chapter five looks at the imputed demographic profile (age, sex and geographical location) of the census unit non-respondents (as measured by the individual substitute records created by Statistics New Zealand) at the 2006 and 2013 Censuses;
- Chapter six will explore the issue of item non-response at the 2006 and 2013 censuses for the variables derived from the census Individual Form and look at the effect of inclusion of substitute records within the NS/NEI category on the demographic profile of the item non-respondents;
- Chapter seven will present a detailed case study of the item non-response to the question on personal income, comparing some key socio-demographic characteristics of the item non-respondents at the 2006 and 2013 censuses with that of the respondents to identify patterns; and
- Chapter eight will provide a summary and discussion of the key findings from this research.

## **CHAPTER 3: THE NEW ZEALAND CENSUS – BRIEF HISTORY, USES AND LIMITATIONS**

A census involves the collection of data on a specified day from the entire population of the country as opposed to surveys in which information is collected from only a proportion of the population and inferences are made for the entire population based on these data. Administrative data is collected by government agencies or private organisations in the course of conducting their business or services. It is data that is not collected primarily for statistical purposes. Rather it is collected for operations such as delivering a service or legal requirements to register events like births, deaths, marriages, people arriving into or leaving the country, etc. The organisation collecting these data have primary control over who is included in the data source, what information is recorded and the methods by which the administrative data are collected and processed (Statistics New Zealand, 2014a). As a result, administrative data has its limitations as a replacement for the census.

A census can be defined as the procedure of systematically acquiring and recording data/information about a population (Alterman, 1969). 'Population' is not necessarily only a human population and most of the earlier known censuses counted not only people, but also livestock as well as crops, butter, honey, milk and wool. The oldest existing census in the world, also considered to be fairly accurate, was carried out in China by the Han Dynasty in the year 2 A.D. (Hymes, 2000). In the current context, censuses are typically conducted by governments to determine the numbers of residents and housing in their country and to compile an accurate socio-demographic profile of the population. The periodicity of census taking varies across countries and is recommended by the United Nations to be taken at least every ten years (United Nations, 1998).

### 3.1 A brief history of the New Zealand Census

This section draws information from the various documents on the history of the New Zealand Census provided by Statistics New Zealand (Statistics New Zealand, n.d). The earliest official counting of the New Zealand population took place during the colonial period 1840-1855, wherein the New Zealand Governor provided a 'blue book' of population statistics to the British Government. These books, produced annually, contained handwritten records of the people (mostly European, and less consistently, Māori<sup>6</sup>) counted in each settlement by the magistrate. The books also contained other important information required for decision making by the British government, like revenue, military, public works, trade, shipping, civil servants, land transactions, agricultural produce, churches, schools and prisons. These counts were by no means comprehensive as they were mostly compiled from larger population centres, and smaller remote settlements were often left out. New Zealand's first official national census using printed schedules (now referred to as Individual and Dwelling forms) took place in 1851 and excluded the Māori population. These European censuses were carried out every three years. The 1851 Census, apart from the basic demographic information on age, sex and place of residence, also asked each household about other social aspects like disability, income and education.

The first attempt at counting the Māori population took place over 1857-1858, although the accuracy of these early counts is debatable. The next Māori Census took place in 1874, the delay attributed to the New Zealand Wars. From 1874, separate Māori censuses were carried out in the same year as the European censuses (although not on the same day until 1926). The accuracy of these early census counts for Māori also remains debatable. Unlike the European censuses which were conducted by the Registrar General's Office, Māori censuses were carried out under the authority of the Native Secretary. Not all Māori dwellings were visited and instances were noted of Māori being suspicious and not willing to

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<sup>6</sup> Māori counts were often in relation to the purchase of Māori land.

participate in the census. Additionally, the Māori census schedules (forms) were less comprehensive than the European census.

The three-yearly censuses were changed to five yearly intervals after the Census Act of 1877. From 1881 onwards, the national census (separate for Māori and Europeans) was carried out every five years with the exception of the following years: 1931 (cancelled because the New Zealand economy was at the height of the Depression), 1941 (cancelled due to World War II), 1946 (brought forward to September 1945 in order to redefine electorates in time for the 1946 elections) and 2011 (cancelled and undertaken in 2013 due to the Canterbury earthquakes which occurred just two weeks before census day).

In the earlier censuses, population statistics were based on a single household or dwelling form which was expected to be filled by the 'head of the household' who was responsible for providing details of all members in the household on census night. The Census and Statistics Act of 1926 changed this with all occupants in European dwellings given Individual schedules/forms in addition to the Household/Dwelling form, although the 'head of the household', usually male, continued to fill out the Dwelling form. From 1926, the census day was changed from Sunday to Tuesday. From the same year onwards until 1951, the Māori census was carried out on the same day as the European census after the responsibility for the Māori census was taken over from the Native Department by the Census and Statistics Office.

A separate census for Māori stopped and integrated into the general national census in 1951. Therefore, it is not until 1951 that all Māori received the same Individual and Dwelling form as the rest of the population. The Statistics Act of 1955 strengthened rules around confidentiality with all Department of Statistics employees required to take a confidentiality oath and stringent requirements put in place to ensure that it was impossible to identify individuals from published data. The Statistics Act of 1975, which continues to guide the work of Statistics New

Zealand today, laid down the strict requirement of using the census data for statistical purposes only.

Computers were first used in sorting and processing data for the 1966 Census. The 1981 Census was the last census which involved the New Zealand Post Office for distribution and collection of census forms (which started with the 1916 Census). Statistics New Zealand took over this process with the aim of reducing cost and increasing efficiency. Since 1981, there have been continuous improvements made to the census process and the data collected via the Dwelling and Individual census forms. Online census forms were first introduced at the 2006 Census resulting in seven per cent of the census forms completed and submitted online. This increased in the 2013 Census with one-third of the population filling forms online (Statistics New Zealand, 2014). The three main goals of online forms as set out by Statistics New Zealand, are to improve participation, improve data quality and most importantly, reduce the cost of the census (Statistics New Zealand, 2014).

Currently selected census data (current and past) are made available on the Statistics New Zealand website via the NZ.Stat portal and more detailed cross-tabulations of the various census variables can be purchased via customised data requests.

### **3.2 Uses and limitations of the census data**

In the New Zealand context, the census population estimates and projections (which are based on the estimates) are used for a wide range of purposes which include (Statistics New Zealand, 1998):

- Allocation of national funding to organisations operating at a sub-national level (example District Health Boards);
- Deriving fertility, mortality and other demographic indices as well as per capita time series;
- Determination of population weights for various surveys;
- Policy making, planning, administration; and
- Demographic, social and economic studies.

A census is not and unlikely to ever be one hundred per cent accurate for determining the size and characteristics of a country's resident population. It is, however, a very good estimate. Keeping this in mind, it is therefore extremely important to understand the sources of errors in any census. Only by the identification of the causes of these errors can we determine any changes needed in terms of revising census procedures or redesigning the census questionnaires. Understanding of these errors and gaps in the dataset also allows for appropriate inferences and adjustments to be made by researchers / analysts / statisticians using the census data.

There are four potential sources of error in the New Zealand Census data which affect its quality: coverage errors; non-response errors; response errors and processing errors (Statistics New Zealand, 2014).

**Coverage or Enumeration Errors:** A list of dwellings within each collection unit is compiled and the New Zealand Census Questionnaires (one 'Dwelling form' and one 'Individual form' per person living in the dwelling) are manually delivered by the collector. While every effort is taken to ensure that every resident is enumerated, it is inevitable that some are missed due to a variety of reasons – people are now more mobile, people live in more than one residence (example children in shared custody arrangements), a dwelling may be missed by the collector/enumerator or possibly an occupied dwelling may be marked as unoccupied (Statistics New Zealand, 2010). The scenario of people living at multiple addresses can also lead to the possibility of people being counted more than once (over-counting or duplication). In most censuses the possibility of people being missed is more likely than being over-counted, which results in a net undercount. This discrepancy is measured via a post-enumeration survey (Statistics New Zealand, 2014).

**Non-Response Errors:** The census is self-enumerated, and respondents sometimes do not return a census form or fail to answer every applicable question. There are two types of non-response errors in any census (or surveys):

- **Unit non-response** occurs where a Census form (either the Dwelling form or Individual form or both) is not returned for a dwelling which is believed to be occupied on Census Night.
- **Item non-response** occurs when a Census form has been returned for a person or dwelling but one or more applicable questions have not been answered.

**Response Errors:** A respondent may give a partially or completely inaccurate answer to one or more questions in the census forms. These errors are more common in census forms completed manually. To minimise these errors, census forms are designed so that questions are as easy to understand and as simple to answer as possible. Electronic forms completed online now have data quality checks in place which effectively minimise potential response errors. These were not possible for manually completed forms (Statistics New Zealand, 2014).

**Processing Errors:** Data entry and coding mistakes can occur during the processing stage mostly from census forms completed manually as opposed to online census forms where the potential for such errors is greatly minimised (Statistics New Zealand, 2014). Examples of these include incorrectly classifying responses and misrecognition of responses.

## CHAPTER 4: METHODOLOGY AND DATA SOURCES

The primary aims of this dissertation are to analyse the socio-demographic characteristics of item non-respondents; to examine how these differ from that for people who do respond, and to identify particular population groups that might be over-represented among non-respondents. It also looks at the impact of including the individual substitute records created by Statistics New Zealand in the residual NS/NEI category along with the actual item non-respondents for all non-imputed variables derived from the census.

### 4.1 Methodology

The following methodology was used for the various analyses:

#### **Chapter 5: Imputed demographic profile of unit non-respondents**

The number of individual substitute records created by Statistics New Zealand were taken as a proxy measure for the number of unit non-respondents to the census. Customised datasets for the 2006 and 2013 censuses were requested for the substitute individual records, disaggregated by broad age groups (0-14, 15-24, 25-39, 40-64 and 65+ years), sex (male, female, total) and geographical location (16 regions and 67 Territorial Authority areas across New Zealand).

The unit non-response rates in 2006 and 2013, disaggregated by age, sex and Regional Council (RC) or Territorial Authority (TA) area were calculated as follows:

Unit non-response rate (%) =

$$\frac{\text{Number of substitute records (for age } x, \text{ sex } y \text{ and RC or TA } z)}{\text{Total URP count of target population}} \times 100$$

The age-sex profile of the unit non-respondents (substitute forms) was also analysed for both censuses for comparison with similar profiles for item non-respondents.

### **Chapter 6: Item non-responses and the effect of inclusion of substitute records in the NS/NEI category**

The aim is to ascertain the impact of inclusion of the substitute records in the NS/NEI category along with the actual item non-respondents. The item non-response rates, including and excluding the individual substitute records, were calculated for 24 variables derived from the census Individual form for the 2006 and 2013 censuses via datasets sourced from the NZ.Stat portal of Statistics New Zealand:

Item non-response rate (%) for variable  $x$  including substitute records =

$$\frac{\text{Total NS or NEI count for variable } x}{\text{Total URP count of target population}} \times 100$$

Item non-response rate (%) for variable  $x$  excluding substitute records =

$$\frac{(\text{NS or NEI count for variable } x) - \text{Individual substitute records}}{(\text{Total URP count of target population} - \text{Individual substitute records})} \times 100$$

The above rates were also disaggregated by broad age groups (0-14, 15-24, 25-44, 45-64 and 65+ years) and geographical location (67 Territorial Authority or TA areas) for two selected variables – Highest Qualification and Ethnicity, to examine the effect of inclusion of substitute records in the NS/NEI category on the demographic profile of the item non-respondents.

### **Chapter 7: A detailed case study on the item non-response to the personal income question**

This thesis also tests the hypothesis that, in the context of the New Zealand Census, item non-response is not a random phenomenon. If it were random, it would be expected that the socio-demographic profile of the item non-respondents (in terms of the case study, the people not

answering the personal income question on the census form) is similar, if not identical, to that of the respondents (people answering the question).

The following steps were taken to develop and compare these two profiles for the personal income variable:

**Step 1:** Datasets for the personal income variable disaggregated by the four key demographic variables – age (15-24, 25-34, 35-44, 45-54, 55-64, 65-74 and 75+ years), sex (male, female, total), ethnic group (Māori, Pacific Islanders, Europeans/Others, Asian and Middle Eastern/Latin American/African) and area of residence (RC or TA) were sourced (some from NZ.Stat portal and others customised data requests).

The individual substitute records included in the NS/NEI category were removed from these datasets.

**Step 2:** The actual rates of item non-response to the personal income question at the 2006 and 2013 Censuses were imputed as follows:

Rate (%) of item non response to personal income

$$\frac{\text{NS or NEI count (excluding individual substitute records)}}{\text{URP count of target population (excluding substitute records)}} \times 100$$

The imputed item non-response rates were then compared across age groups, sex, geographical location and ethnic groups for the two census years, 2006 and 2013 to identify patterns of non-response and changes in item non-response rates to the personal income question over the intercensal period.

The age-sex profile of the item non-respondents was also analysed for both censuses for comparison with similar profiles for unit non-respondents.

**Step 3:** Cross tabulated datasets for the personal income variable, disaggregated by broad age groups and sex were sourced (some from NZ.Stat portal and others customised data requests) for the following variables:

- Birth place
- Sources of personal income
- Highest Qualification
- Work and Labour Force Status
- Status in employment
- Occupation

The individual substitute records included in the NS/NEI category were removed from each of these cross tabulated datasets.

The profile (related to each of the six variables listed) of item non-respondents was compared to that of the people who provided a valid response to the personal income question to assess the randomness of the non-response and to highlight the population groups which were over-represented among the item non-respondents at the 2013 Census. For example: for the birthplace variable, the distribution (proportion) of people born in New Zealand and those born overseas among the population not providing a valid response to the personal income question was compared to that for those who did respond.

The item non-response rates (to personal income), disaggregated by age and sex, were imputed for each of these six variables to identify whether any particular population group was over-represented among the item non-respondents.

Comparative data from 2006 was also analysed where feasible to assess whether there have been any changes to any patterns seen. All analysis for the case study was carried out only at the national level.

### **Correlation**

The Pearson Correlation Coefficient is a measure of the linear correlation between two variables giving a value between +1 and -1, where 1 is total positive correlation, 0 is no correlation, and -1 is total negative correlation. It is widely used in the sciences as a measure of the degree of linear dependence between two variables. The Pearson Correlation Coefficient was calculated to examine whether there was any correlation between the

item non-response rates to the personal income question and various socio-demographic characteristics like ethnicity and deprivation.

### **Quartiles**

The item non-response rates including and excluding substitute records was compared across the 16 regions for the two variables, Highest Qualifications and Ethnicity, using quartiles (Chapter 6: Item non-response and the effect of inclusion of substitute records in the NS/NEI category).

The quartiles of a ranked data set (in this case the non-response rates sorted in ascending order) are the three points that divide the data set into four equal groups, each group comprising a quarter of the data. Therefore, the 1st quartile will hold the lowest 25 percentile of the rates, the 2nd quartile is the median (50th percentile) and so on. For example: if the non-response rates were sorted in ascending order (smallest to largest), the lower half of a data set is the set of all values that are to the left of the median value and the upper half of a data set is the set of all values that are to the right of the median value. The first quartile, denoted by Q1, is the median of the lower half of the data set. This means that about 25 per cent of the non-response rates lie below Q1 and about 75 per cent lie above Q1. The third quartile, denoted by Q3, is the median of the upper half of the data set. This means that about 75 per cent of the non-response rates lie below Q3 and about 25 per cent lie above Q3.

### **New Zealand Deprivation Index**

The NZ Deprivation Index is a measure of the relative socio-economic deprivation of an area. The index combines nine variables from the 2013 census which reflect eight dimensions of deprivation (income, communication, employment, qualifications, home ownership, support, living space and transport) and provides a score for each mesh-block. In its ordinal form the index ranges from 1 to 10, where 1 represents areas of lowest socio-economic deprivation and 10 the areas of highest. Thus a score of 10 indicates that the area is in the most deprived 10 per cent

areas in New Zealand. It should be noted that NZDep scores apply to areas and not individual people (Atkinson, Salmond, & Crampton, 2014).

All spatial analysis in this study is presented at the TA and/or RC area level and therefore a population weighted average of the NZDep2013 at the Area Unit (AU) level has been used to get an indication of the socio-economic deprivation levels of each of the 67 TAs and 16 regions across the country. The data on the NZDep2013 Index of Deprivation at the area unit level was sourced from the Department of Public Health, University of Otago, Wellington, online resources:

(<http://www.otago.ac.nz/wellington/departments/publichealth/research/hirp/otago020194.html>).

It is acknowledged that the personal income variable analysed in the case study is one of the eight variables used to derive the index and therefore this is likely to have some impact (correlation bias) on any correlation analysis carried out for item non-response rates to personal income and NZDep2013.

## **4.2 Data Sources**

The customised datasets used to generate the information for the item non-respondents were all sourced from Statistics New Zealand and extracted using the 'Substitute Individual Form Indicator', which flags each individual record within the census data based on whether the input was from an imputed substitute form or not. The Substitute Individual Form Indicator is not a standard output variable and therefore Statistics New Zealand advises that these data should be used with caution. Some additional datasets were directly sourced and extracted from the NZ.Stats portal of the Statistics New Zealand website.

**General:**

1. Area of usual residence (2013) and ethnic group (total responses)<sup>7</sup> by age - five year groups and sex for the census usually resident population count, Census 2001, 2006 and 2013
2. Area of usual residence (2013), age group and sex by Eform (Internet) indicator – (Individual Census Forms) for the census usually resident population count aged 15 years and over, Census 2013
3. Area of usual residence (2013) by Substitute Individual Form indicator for the census usually resident population count

**Item non-response to the question on personal income:**

4. Area of usual residence (2013), total personal income and ethnic group (total responses) by age groups and sex for the census usually resident population count aged 15 years and over who completed an Individual Census Form, Census 2006 and 2013
5. Area of usual residence (2013), total personal income and birthplace by age group and sex for the census usually resident population count aged 15 years and over who completed an Individual Census Form, Census 2006 and 2013
6. Area of usual residence (2013), total personal income and highest qualification by age group and sex for the census usually resident population count aged 15 years and over who completed an Individual Census Form, Census 2006 and 2013
7. Area of usual residence (2013), ethnic group (New Zealand Responses) and sources of personal income (number on government benefits) by age groups and sex for the census usually resident population count aged 15 years and over, Census 2013
8. Area of usual residence (2013), personal income and sources of personal income (New Zealand Responses) by age groups and Sex for

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<sup>7</sup> Includes all people who stated each ethnic group, whether as their only ethnic group or as one of several ethnic groups. Where a person reported more than one ethnic group, they are counted in each applicable group. Therefore, the total number of responses in the table are greater than the total number of people (multiple ethnicity counting).

the census usually resident population count aged 15 years and over, Census 2006 and 2013

9. Area of usual residence (2013), total personal income and Work and Labour Force Status by Ethnic Group (Grouped Total Responses) and Sex, for the Census Usually Resident Population Count Aged 15 Years and Over, Census 2006 and 2013
10. Area of usual residence (2013), total personal income and status in employment by age group and sex, for the employed census usually resident population count aged 15 years and over, Census 2006 and 2013
11. Total personal income (grouped) by occupation (ANZSCO major group), for the employed census usually resident population count aged 15 years and over, Census 2006 and 2013

An important matter to note when using census data is that confidentiality rules have been applied to all dataset, including random rounding to base three. Individual figures therefore may not add up to totals, and values for the same data may vary in different tables. This rounding introduces an element of 'error' when undertaking analysis at high levels of disaggregation. However, this error is minor in comparison to the potential for error if unit as well as item non-response errors are (also) incorrectly coded.

## **CHAPTER 5: IMPUTED DEMOGRAPHIC PROFILE OF UNIT NON-RESPONDENTS**

Individual substitute records are created by Statistics New Zealand for an estimated number of census unit non-respondents. The age, sex and mesh-block of residence are imputed using various techniques for these substitute records. For all other non-imputed variables, these substitutes or dummies are coded to the residual NS or NEI category along with the item non-responses. This grouping essentially raises two issues:

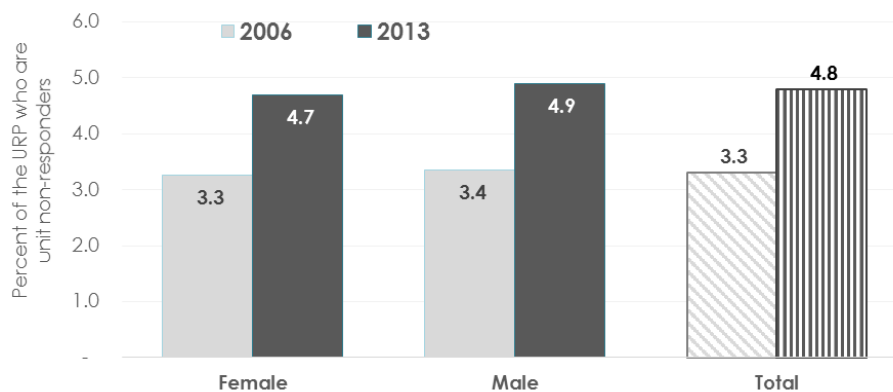
- 1) it increases the item non-response rates; and
- 2) the NS or NEI category within each non-imputed variable is not homogeneous and is comprised of two distinctly different counts – the actual item non-respondents or people who did not answer the question (or provided an invalid or unidentifiable response), and the substitute records which are proxies for the estimated number of unit non-respondents.

At the 2013 Census, a total of 203,049 individual substitute records were created (132,945 in 2006). It is assumed that the number of these records created and the imputed age, sex and mesh-block of residence characteristics allocated to them are a fair representation of the population who, for various reasons, were not enumerated in Census 2006 and 2013. This section looks at the demographic profile of these 'unit non-respondents' so that a comparison can be made with the profile of the item non-respondents to the personal income question in the case study.

Figure 5.1 shows the proportion of the usually resident population in 2006 and 2013 who did not respond to the census, disaggregated by sex (refer to Appendix Table 5 for underlying data). Measured in terms of the proportion of substitute records or dummies created, there has been a substantial increase in the proportion of the usually resident population of the country not responding or unable to respond to the census: 4.8 per cent in 2013 compared to only 3.3 per cent in 2006. This increase is noted for males as well as females. Both sexes have similar rates of unit non-

response, with males only marginally more likely to not return a completed census form than females; and this is true for both censuses.

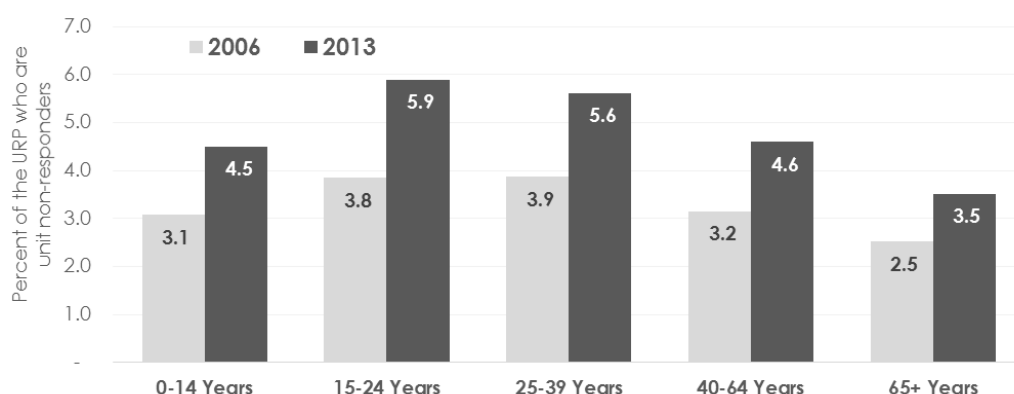
**Figure 5.1 Proportion of male and female unit non-respondents in the usually resident population, Census 2006 and 2013**



The data are now disaggregated by age, with Figure 5.2 showing age specific rates for the major age groupings (0-14, 15-24, 25-39, 40-64 and 65+ years). The proportion of the population not responding to the census has increased across all age groups. The rates are highest among youth aged 15-24 years, with six in every hundred not responding. This age group has also seen the greatest increase in non-response over the intercensal period, with the proportion of unit non-respondents increasing by more than two percentage points (an increase of 53.1 per cent in the non-response rate). The second highest rate of non-response is among young adults aged 25-39, very similar to that noted for the 15-24 year group. These two age groups disproportionately include students who are typically reluctant to participate in official surveys, especially those that entail form filling, and the young working population, which is much more mobile and more likely to be missed by the census (Simpson & Dorling, 1994).

The oldest age group, 65+ years, is the most likely to respond to the census, with the lowest unit non-response rates. However, even among this group, the proportion of people not responding has increased notably since 2006. The difference in non-response rates across the different age groups is consistent with the finding by Rahman and Goldring (2006) that age group is one of the dependent factors of unit non-response.

**Figure 5.2 Age-specific rates for unit non-respondents, Census 2006 and 2013**



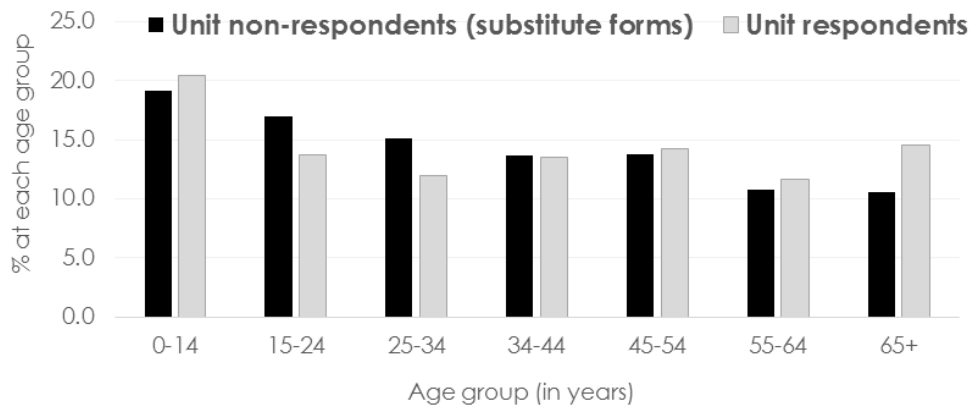
As seen in Figure 5.3, the youth and the young working age population (15-24 and 25-39 years) who are more likely to not complete a census form are slightly over-represented in the substitute records, and the oldest (65+) under-represented.

Figure 5.4 compares the age-sex profile of the census respondents (people who returned completed Individual forms) and with the imputed age-sex profile of the unit non-respondents as measured by the substitute records created. This two profiles are fairly similar which is to be expected as the imputed variables (age, sex and mesh-block of residence) for whole or full substitute records<sup>8</sup>, which make up two-thirds of all individual substitutes created (Statistics New Zealand, 2014), are based on the recorded age, sex and mesh-block of residence distribution of the respondents. When disaggregated at the regional level, the two age-sex profiles are even more similar (see Appendix Figure 1 for the two age-sex profiles for each of the sixteen regions across New Zealand).

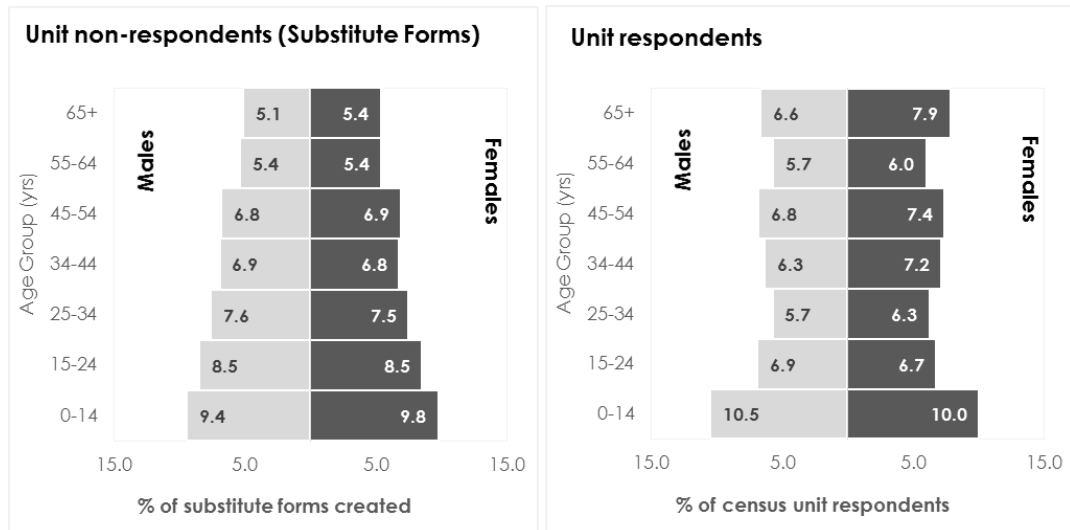
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<sup>8</sup> See section 1.2 Unit non-response for the difference between Partial Substitute Individual Forms and Whole or Full Substitute Individual Forms.

**Figure 5.3 Imputed age distribution of the unit non-respondents (substitute records) compared to the unit respondents, Census 2013**



**Figure 5.4 Imputed age-sex profile of the unit non-respondents (substitute records) compared to the unit respondents, Census 2013**



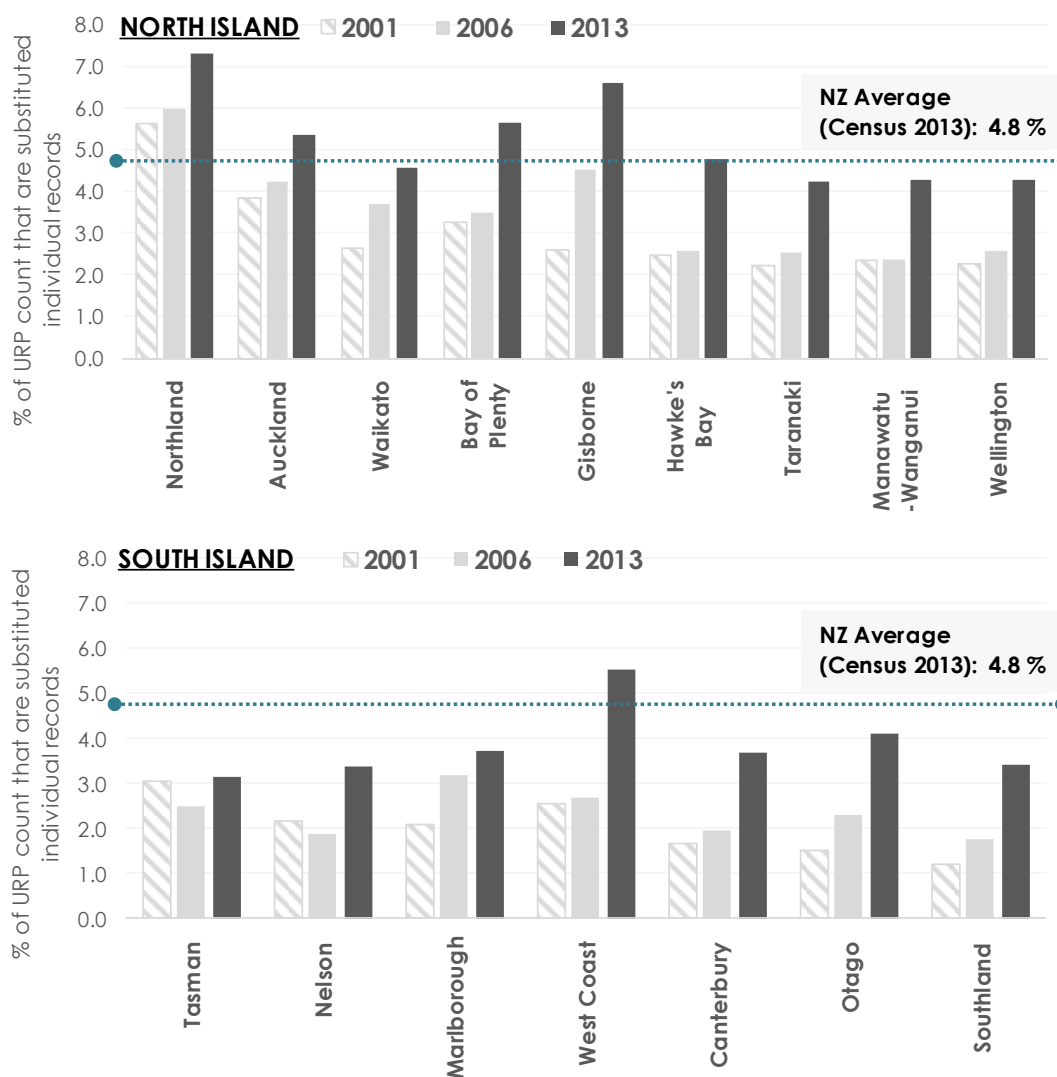
To identify possible spatial patterns, Figure 5.5 shows the proportion of the usually resident population of each of the sixteen regions across New Zealand who either refused to complete a census form, were unable to do so for various reasons or the census form was not collected, and were therefore could be termed as unit non-respondents at the last three censuses (measured in terms of the number of substitute records created). The same data is mapped spatially in Figure 5.6. Underlying data is given in Appendix Table 6.

The number as well as the proportion of substitute records created has increased significantly over the last three censuses across all regional council areas. This rapid increase is clearly visible in Figure 5.6 (the gradual 'darkening' in the shading of the regions reflecting a greater increase in the proportion of people not responding). In 2001, only four of the total 16 regions of New Zealand had more than 3.0 per cent of their usually resident population not responding. This increased to six regions in 2006, and at the 2013 Census included all sixteen regions (having more than 3.0 per cent of the URP not responding). The reasons for these growing rates of non-response can be varied. People are becoming more mobile and therefore more likely to be missed being counted on census night. It is also possible that a growing proportion of the population do not see any benefit in completing a census form or have concerns over the perceived intrusion on their time and privacy (Division of Behavioral and Social Sciences and Education, 2013).

The greatest increase over the 2006-2013 inter-censal period is noted for the West Coast Region with the number of substitute records created more than doubling (843 unit non-respondents in 2006 compared to 1,770 in 2013; an increase of 110.0 per cent). The other two regions with a significant increase, also from the South Island, are Southland (97.8 per cent increase from 1,614 in 2006 to 3,192 in 2013) and Canterbury (96.5 per cent increase from 10,137 in 2006 to 19,920 in 2013). The Christchurch earthquakes in 2011 may be one contributing factor to this increase in non-response in the Canterbury region. In the North Island, the biggest increase is noted in the Hawke's Bay region (3,819 in 2006 to 7,227 in 2013, an 89.2 per cent increase).

In comparison, very small increases in the proportion of substitute records created over this inter-censal period was seen in Marlborough (+19.5 per cent), Northland (+24.5 per cent) and Waikato (+30.1 per cent).

**Figure 5.5 Proportion of the usually resident population count who are unit non-respondents (as measured by number of substitute records created) by region, Census 2001, 2006 and 2013**



Source: Statistics NZ

In the most recent (2013) Census, the rate of unit non-respondents (number of substitutes created per 100 URP count) is higher than the national average of 4.8 per cent in five regions – Northland (7.3 per cent), Gisborne (6.6 per cent), Bay of Plenty (5.6 per cent), West Coast (5.5 per cent) and Auckland (5.4 per cent). The lowest rates (all regions with less than 4.8 per cent unit non-respondents) were noted in five regions, all in the South Island - Tasman, Nelson, Southland, Canterbury and Marlborough.

**Figure 5.6 Regional variation in the rate of unit non-response at the 2001, 2006 and 2013 Censuses as measured by the proportion of substitute records created**

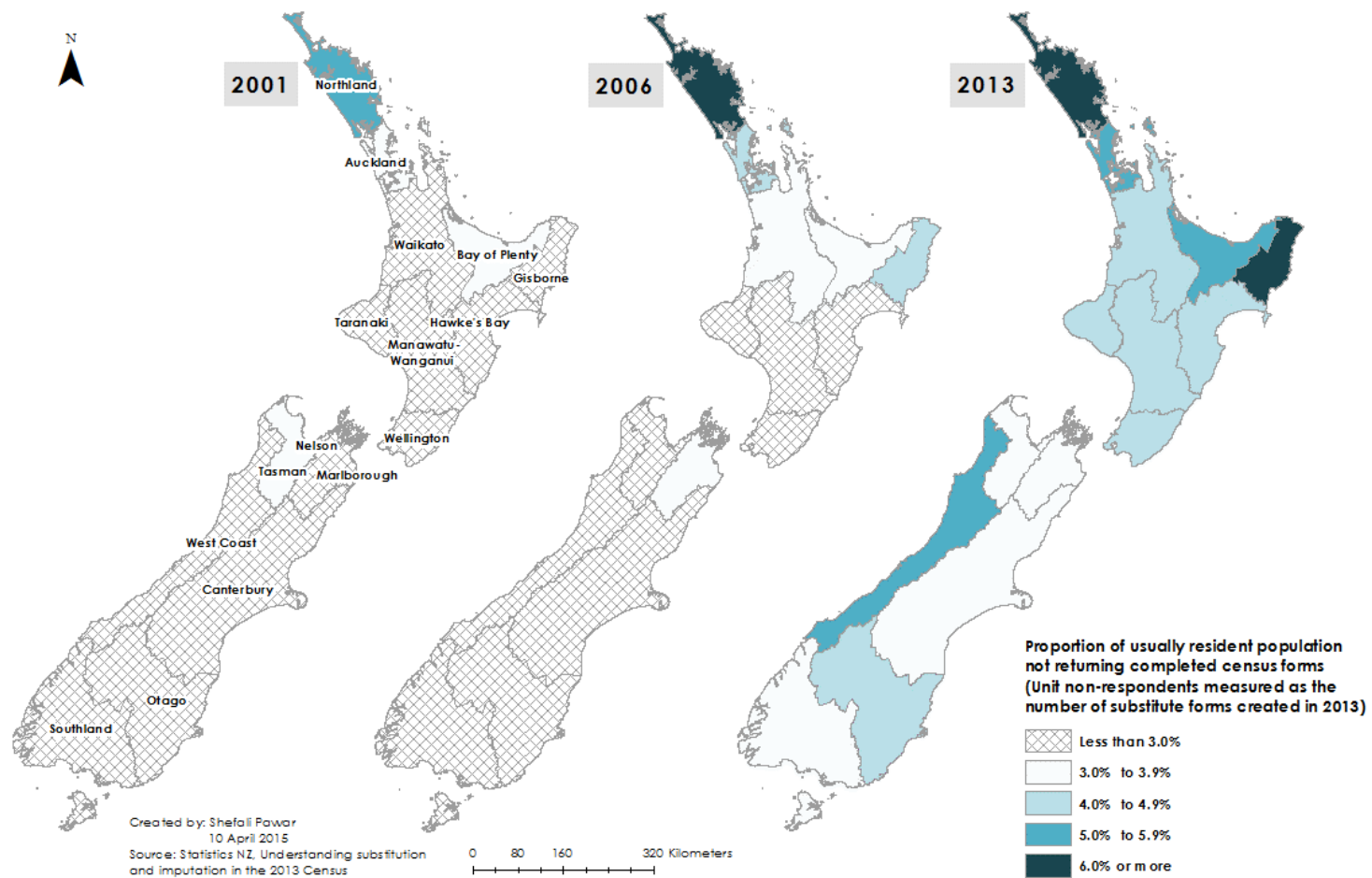
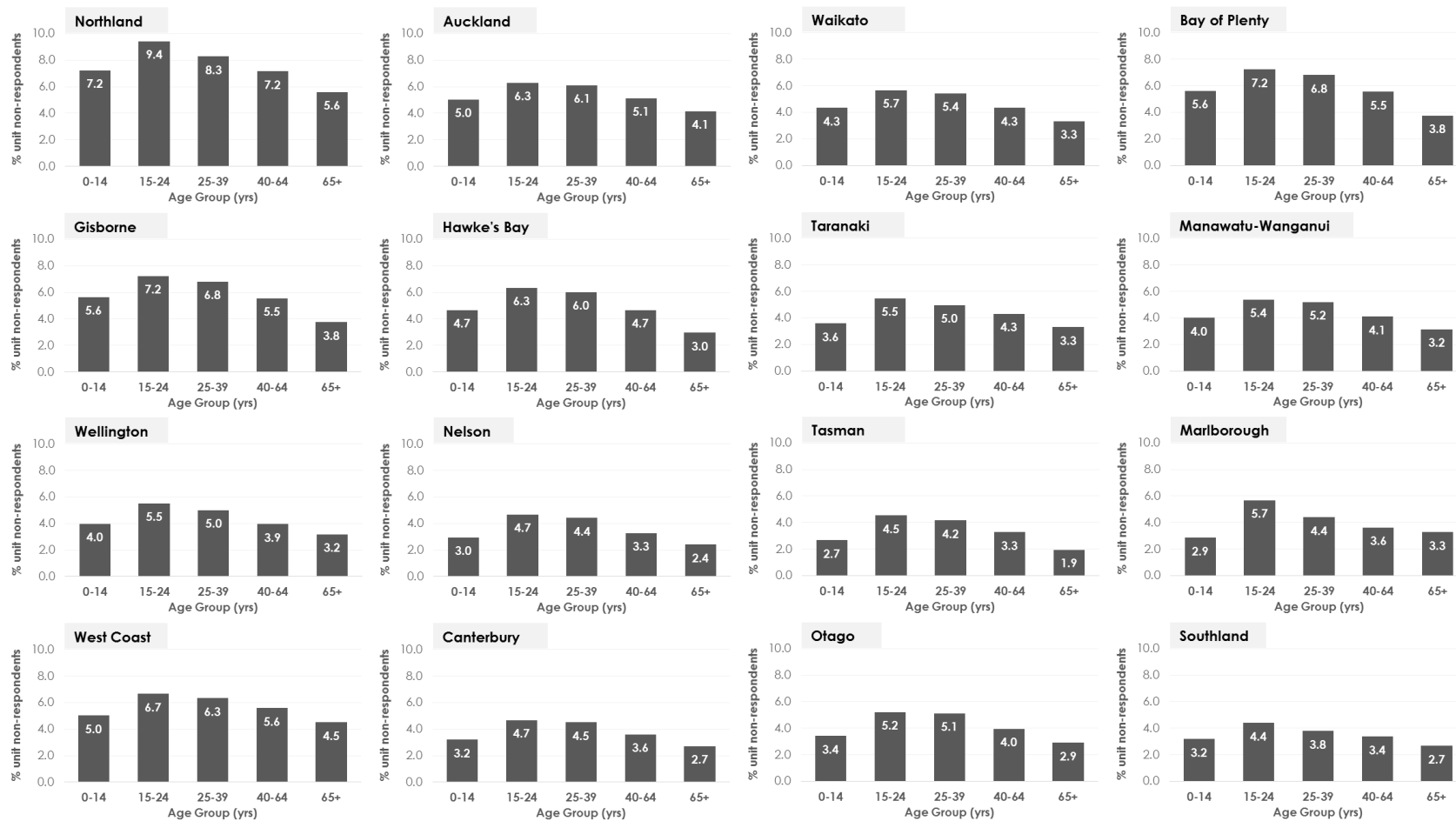


Figure 5.7 disaggregates the unit non-response rates (number of substitutes created per 100 URP count) for each region by broad age groups. The age specific pattern of higher rates among youth aged 15-24 and young adults aged 25-39, and low rates among the older population aged 65+ years, is seen across all the regional council areas.

Northland has the highest rate of unit non-response among youth (15-24 years) with almost 10 of every 100 (9.4 per cent) not returning completed census forms in 2013. The other regions where the rate of non-response at these ages is higher than the national average of 5.9 per cent are: Bay of Plenty and Gisborne (each 7.2 per cent), West Coast (6.7 per cent), Auckland and Hawke's Bay (each 6.3 per cent). The lowest rates among the 15-24 year age group are in Southland (4.4 per cent), Tasman (4.5 per cent), Nelson and Canterbury (4.7 per cent), all in the South Island.

Among the oldest age group, non-response rates above the national average of 3.5 per cent are found only in Northland (5.6 per cent), West Coast (4.5 per cent) and Auckland (4.1 per cent), while rates lower than the national average are found only in Tasman (1.9 per cent), Nelson (2.4 per cent), Canterbury and Southland (each 2.7 per cent).

**Figure 5.7 Age-specific rates of unit non-response for each region, Census 2013**



In summary, the URP counts which include the substitute records are the best possible estimate of the usually resident population of the country and are the base for population estimates and projections. Therefore, these substitute records, with their imputed age, sex and geographical location data fields are the only available estimates provided by Statistics New Zealand of the unit non-response to the census. The imputed age-sex profile of these substitute records is very similar to that of the census unit respondents and therefore their inclusion within the residual NS/NEI category along with the actual item non-respondents is very likely to result in a non-homogeneous grouping.

The next chapter looks at the other aspect of non-response, item non-response, and the effect of inclusion of the substitute records within the URP counts of different census datasets on the demographic profile of that sub-population who do not provide valid responses to one or more census questions, and consequently on our understanding of this sub-population, the item non-respondents.

## **CHAPTER 6: ITEM NON-RESPONSES AND EFFECT OF INCLUSION OF SUBSTITUTE RECORDS IN THE NS/NEI CATEGORY**

Item non-response occurs when a census respondent does not provide a valid response to a question on the census form. It can also occur during processing of the census forms when a response is lost during coding. However, the magnitude of this error is very small and therefore it is assumed that all item non-response is a result of census respondents not answering a particular question.

The gap in the census dataset resulting from item non-response (which is the residual NS/NEI category) is likely to raise a range of practical, methodological and ethical questions for the researcher, especially in the case of variables where the item non-response rates are relatively high (for example, income) or where the usage of data related to a particular variable is prolific (for example, ethnicity). The exclusion of the NS/NEI category from analysis is likely to affect the results (for example, allocation of resources based on the analysis) especially in cases where it makes up a relatively high proportion of the URP count. On the other hand, if the researcher decides to include the NS/NEI group in the analysis by using some computational method, for example, pro-rata distribution, it is based mainly on two assumptions:

1. Item non-response is a random phenomenon and the item non-respondents are likely to have a similar distribution or profile as that of the population who do respond. Therefore, it is reasonable to allocate to the NS/NEI group, characteristics that are similar to that of the respondents.
2. The NS/NEI category is a homogeneous sub-section of the population who are all item non-respondents to the particular census question(s) from which the variable is derived.

The validity of the first assumption (in context of the New Zealand Census), will be examined via the detailed case study on item non-response to the personal income question in the next chapter.

The second assumption does not hold true in context of the New Zealand census datasets because for each non-imputed variable<sup>9</sup>, the substitute records created by Statistics New Zealand to improve census coverage are also coded to the NS/NEI category along with the actual item non-respondents or the people who did not provide a valid response to the particular question(s). Therefore, this residual NS/NEI category is not homogeneous but an aggregation of two different sub-population groups.

This chapter looks at the impact of inclusion of the substitute records in the NS/NEI category on the item non-response rates and the age and spatial distribution of the population that makes up the NS/NEI count.

Table 6.1 gives the usually resident population count, the number of substitute records created, the NS or NEI count and the item non-response rates (NS/NEI count expressed as a proportion of the URP count) including and excluding the substitute records for twenty four census variables in 2006 and 2013 which were derived from questions asked in the census Individual Form. These variables are listed in the order in which the corresponding question (from which these variables are derived) are listed on the census form. The actual item non-response rates in 2006 and 2013 (which exclude the substitute records created by Statistics New Zealand), sorted in ascending order for the 2013 Census, are shown graphically in Figure 6.1.

Compared to the 2006 Census, the item non-response rates have either remained similar or declined at the 2013 Census for almost all variables with the exception of 'Usual residence 5 years ago' where the rate has increased slightly. However, this increase is more likely to be a result of coding issues for this variable at the 2006 Census because of which the

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<sup>9</sup> Imputed census variables for non-substitute forms are age, sex, mesh-block of residence and work and labour force status (see Section 1.3 on Imputation of variables).

residual NS/NEI category in 2006 is skewed.<sup>10</sup> The most significant decline in non-response, two percentage points or more, is noted for – ‘Hours worked in employment per week’, ‘Tenure holder’ and ‘Personal income’. One of the factors contributing to the decline in item non-response rates is likely be the increase in the number of census forms completed online in 2013 (34.0 per cent) as compared to 2006 (7.0 per cent) (Statistics New Zealand, 2014) with research showing that non-response rates are lower for online questionnaires (Denscombe, 2009).

Comparing the item non-response rates in 2013 across the key variables listed in Table 6.1, relatively very low non-response rates are recorded for ‘Tenure holder’ and ‘Ethnicity’ whereas the highest rates are seen for the three variables – ‘Highest qualification’ (derived from the responses to three questions, Q26-28), ‘Unpaid activities’ (Q46) and ‘Study participation’ (Q29). At the previous 2006 Census, along with ‘Highest qualification’, the variables ‘Hours worked’ and ‘Personal income’ had the highest item non-response rates (see Table 6.1). There has been a significant decline in the non-response rates for these two variables (hours worked and personal income) over the inter-censal period. The possible reasons for this decline along with the socio-demographic profile of the item non-respondents to one of these two variables, personal income, will be examined in detail in the next chapter.

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<sup>10</sup> Source: Tom Lynskey, Statistics New Zealand, Wellington; email correspondence, 18 July 2016.

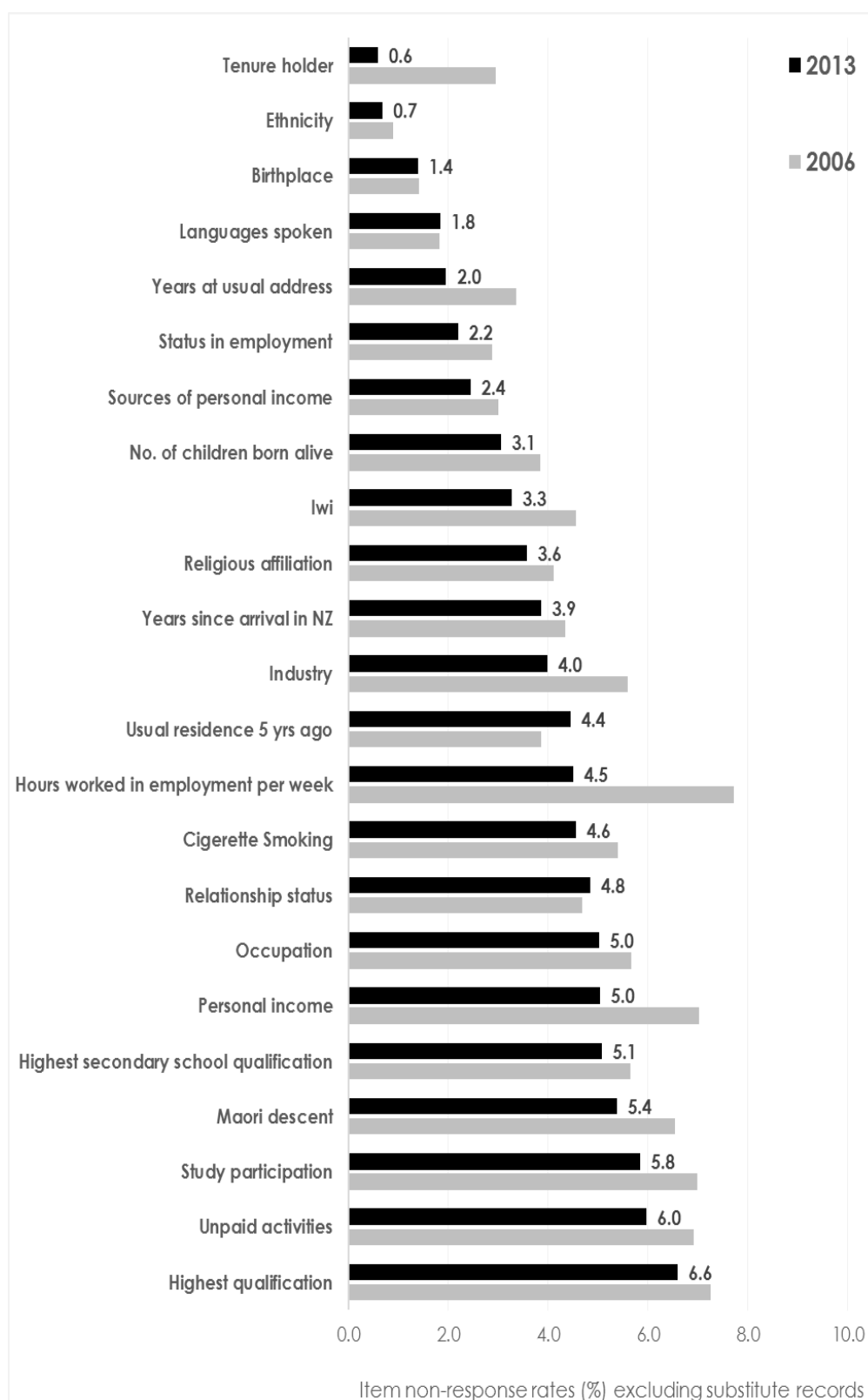
**Table 6.1 Usually resident population, substitute records and item non-response rates (including and excluding substitute records), Census 2006 and 2013**

Census Variable	Question(s) number on 2013 Census Individual Form	Census 2006					Census 2013				
		Total URP	Number of Substitute records	Not Stated/Not Elsewhere Included	Item non-response rate (%): Including substitute records	Item non-response rate (%): Excluding substitute records	Total URP	Number of Substitute records	Not Stated/Not Elsewhere Included	Item non-response rate (%): Including substitute records	Item non-response rate (%): Excluding substitute records
Years of usual address	Q6	4,027,947	132,948	264,177	6.6	<b>3.4</b>	4,242,051	203,049	282,096	6.6	<b>2.0</b>
Usual residence 5 yrs ago*	Q7	4,027,947	132,948	283,215	7.0	<b>3.9</b>	4,242,051	203,049	382,623	9.0	<b>4.4</b>
Birthplace	Q9	4,027,947	132,948	188,187	4.7	<b>1.4</b>	4,242,051	203,049	259,437	6.1	<b>1.4</b>
Years since arrival in New Zealand	Q10	879,546	-	38,178	4.3	<b>4.3</b>	1,001,787	-	38,745	3.9	<b>3.9</b>
Ethnicity	Q11	4,027,947	132,948	167,784	4.2	<b>0.89</b>	4,242,051	203,049	230,649	5.4	<b>0.68</b>
Languages spoken	Q13	4,027,947	132,948	204,180	5.1	<b>1.8</b>	4,242,051	203,049	277,614	6.5	<b>1.8</b>
Maori descent	Q14	4,027,947	132,948	387,885	9.6	<b>6.5</b>	4,242,051	203,049	420,603	9.9	<b>5.4</b>
Iwi	Q15	643,977	-	29,328	4.6	<b>4.6</b>	668,724	-	21,852	3.3	<b>3.3</b>
Religious affiliation	Q18	4,027,947	132,948	292,971	7.3	<b>4.1</b>	4,242,051	203,049	347,298	8.2	<b>3.6</b>
Cigarette Smoking	Q21-22	3,160,371	106,311	271,365	8.6	<b>5.4</b>	3,376,419	164,103	310,593	9.2	<b>4.6</b>
Relationship status	Q23	3,160,371	106,311	249,336	7.9	<b>4.7</b>	3,376,419	164,103	319,656	9.5	<b>4.8</b>
Tenure holder	Q24	3,160,371	106,311	196,434	6.2	<b>3.0</b>	3,376,419	164,103	182,862	5.4	<b>0.6</b>
Number of children born alive	Q25	1,638,783	53,517	114,396	7.0	<b>3.8</b>	1,754,571	82,203	133,245	7.6	<b>3.1</b>
Highest secondary school qualification	Q26	3,160,371	106,311	278,778	8.8	<b>5.6</b>	3,376,419	164,103	327,027	9.7	<b>5.1</b>
Highest qualification	Q26-28	3,160,371	106,311	328,014	10.4	<b>7.3</b>	3,376,419	164,103	375,783	11.1	<b>6.6</b>
Study participation	Q29	3,160,371	106,311	319,665	10.1	<b>7.0</b>	3,376,419	164,103	351,870	10.4	<b>5.8</b>
Sources of personal income	Q30	3,160,371	106,311	198,138	6.3	<b>3.0</b>	3,376,419	164,103	242,697	7.2	<b>2.4</b>
Personal income	Q31	3,160,371	106,311	320,889	10.2	<b>7.0</b>	3,376,419	164,103	325,929	9.7	<b>5.0</b>
Work and labour force status**	Q32, 40, 43, 44, 45	3,160,371	106,311	106,311	3.4	<b>0.0</b>	3,376,419	164,103	164,103	4.9	<b>0.0</b>
Status in employment	Q34	1,985,775	-	57,126	2.9	<b>2.9</b>	2,001,006	-	43,992	2.2	<b>2.2</b>
Occupation	Q35	1,985,775	-	112,404	5.7	<b>5.7</b>	2,001,006	-	100,407	5.0	<b>5.0</b>
Industry	Q37-39	1,985,775	-	111,111	5.6	<b>5.6</b>	2,001,006	-	79,614	4.0	<b>4.0</b>
Hours worked in employment per week	Q32, 40, 43, 44, 45	1,985,775	-	153,303	7.7	<b>7.7</b>	2,001,006	-	90,207	4.5	<b>4.5</b>
Unpaid activities	Q46	3,160,371	106,311	317,322	10.0	<b>6.9</b>	3,376,419	164,103	355,611	10.5	<b>6.0</b>

\*NS/NEI category includes 'Not Stated', 'Response unidentifiable' and 'New Zealand not further defined'.

\*\* Work and labour force status is the only variable aside from age, sex and mesh-block of residence which is imputed for the non-substitute census individual forms in case of item non-responses.

**Figure 6.1 Item non-response rates (excluding substitute records), Census 2006 and 2013**



Note: Variables sorted in descending order of item non-response rates recorded at the 2013 census.

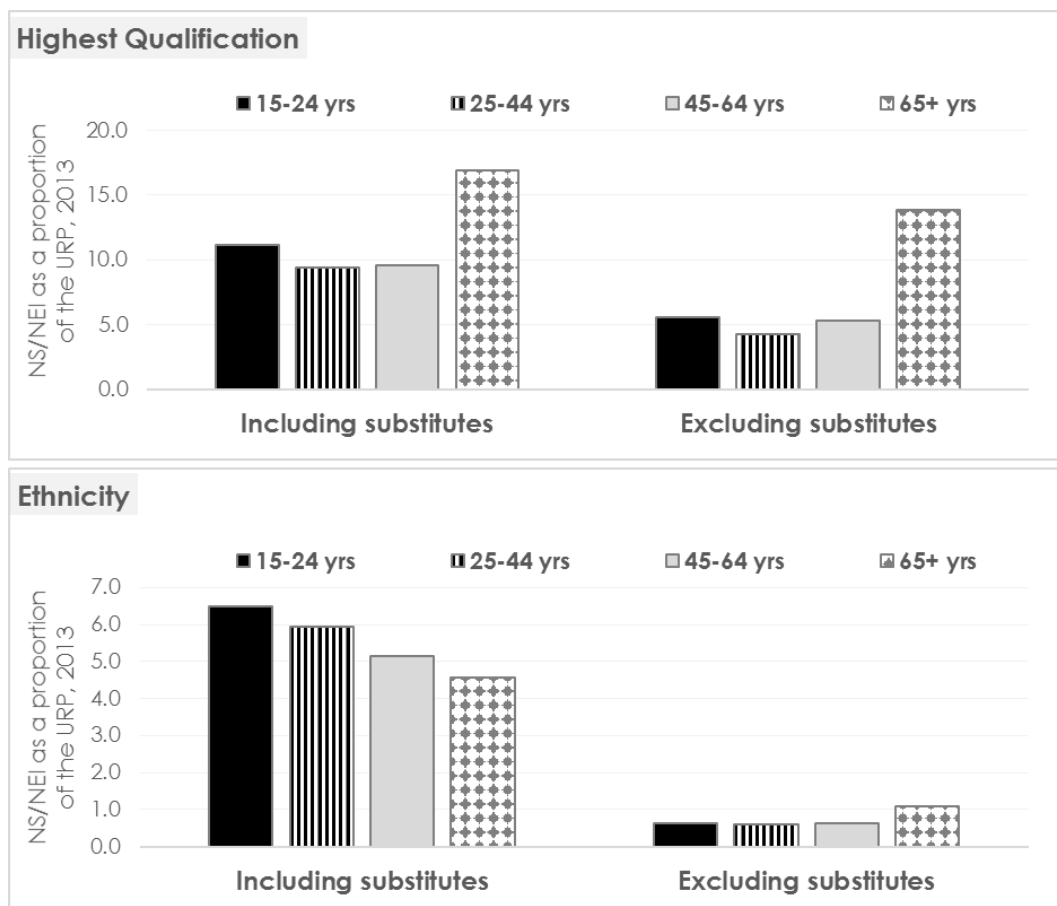
As cited in literature, the cause(s) and motivation(s) for people not responding to the census and responding but not answering a particular question can be very different. Therefore, the two sub-population groups that make up the NS/NEI count (item non-respondents and the unit non-respondents as measured by the number of substitute records created) are likely to be dissimilar in terms of demographic and social characteristics. Moreover, as detailed in the previous chapter, two-thirds of all individual substitute records are whole or full substitutes for which the age, sex and mesh-block of residence are imputed based on the recorded age, sex and mesh-block of residence distribution of the population who do respond to the census. Therefore, the age, sex and geographical location distribution of the NS/NEI group (which is likely to be assumed by users of the data to only include the item non-respondents to the particular variable) is affected by the corresponding profile of the census unit respondents. The extent to which this happens depends on what proportion of the NS/NEI category is made up of substitute records – higher the proportion of substitute records in the NS/NEI count, the more likely that its demographic profile is representative of the census unit respondents rather than that of item non-respondents.

The proportion of substitute records included in the NS/NEI category varies between variables, ranging from a maximum of 89.7 per cent for 'Tenure holder' and 88.0 per cent for 'Ethnicity'; to minimum of 43.7 per cent in the case of 'Highest qualification' and 46.1 per cent for 'Unpaid activities'. This means that the imputed age, sex and spatial profile of the substitute records can slightly or substantially alter the profile of the NS/NEI category. Therefore, any analysis of the NS/NEI category, for example, pro-rata distribution for inclusion in the overall analysis of the variable or studying the profile of item non-respondents (not providing a valid response to a census question), needs to be carried out by separating these two demographically and socially different components.

This point is illustrated in Figure 6.2 which compares the Census 2013 non-response rates (the NS/NEI count as a proportion of the URP) including and excluding the substitute records for the two variables, 'Highest qualification' which has one of the lowest, and 'Ethnicity' one of

the highest proportion of substitute records, in the NS/NEI category. The inclusion of the substitute records in the NS/NEI category marginally changes the profile of non-response disaggregated by age in the case of 'Highest qualification' where the proportion of substitutes is relatively small (43.7 per cent). However, in the case of the other variable 'Ethnicity' where substitutes make up close to nine-tenths (88.0 per cent) of the NS/NEI category, the profile is dramatically altered. Looking at the non-response including the substitute records, the rates decline with age – highest rate of non-response noted for the 15-24 age group and the lowest among those aged 65+ years. When the substitute records are excluded from the analysis, the actual item non-response rates are the highest for the 65+ year age group with no notable difference among the other younger age groups.

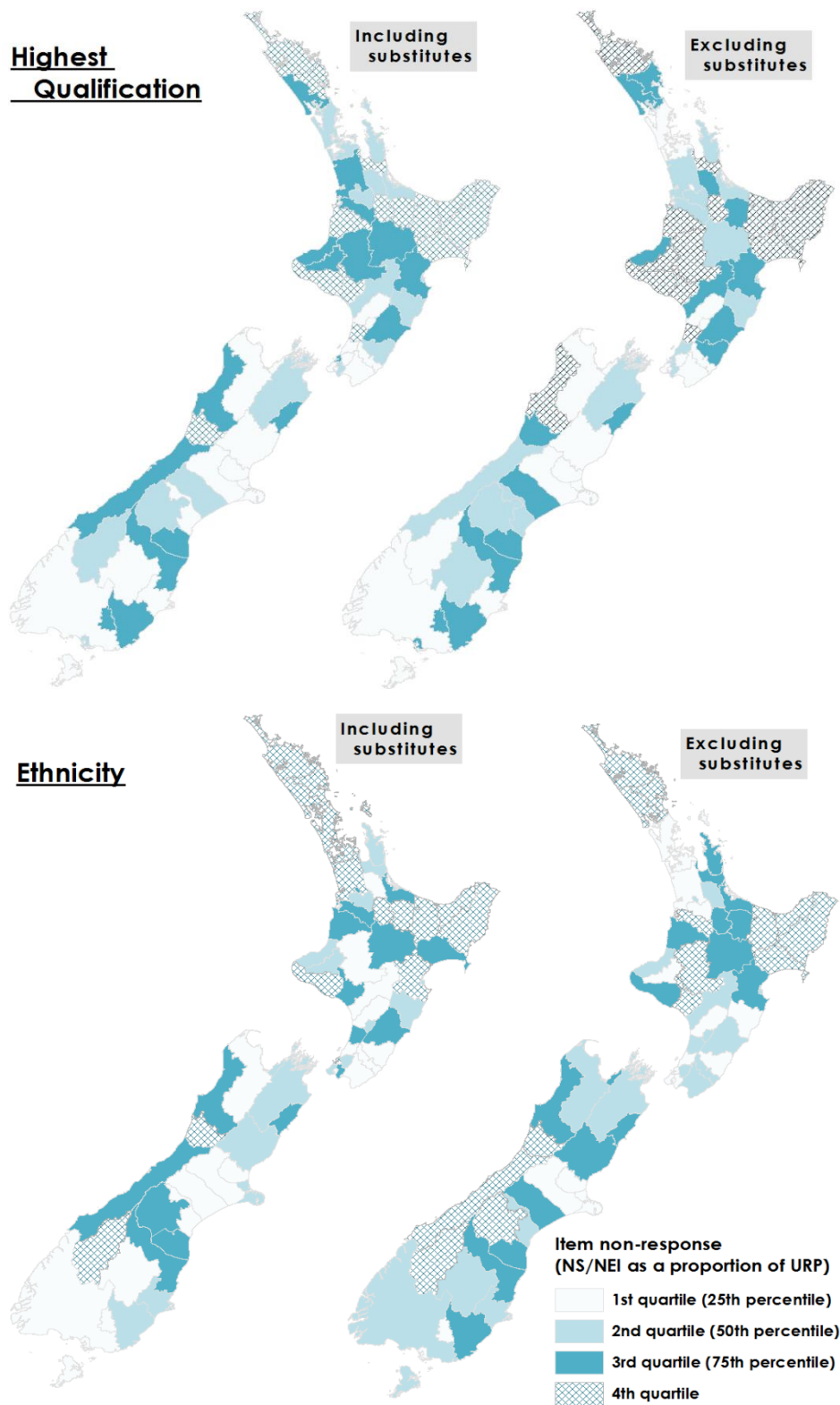
**Figure 6.2 Non-response rates (NS/NEI as a proportion of the URP) including and excluding substitute records for selected variables, Census 2013**



Similarly, when disaggregated by geographical location, the inclusion or exclusion of substitute records from the NS/NEI category changes the pattern of non-response. Figure 6.3 shows the spatial distribution (by TA) of the non-response rates (NS/NEI category as a proportion of the URP) including and excluding substitute records for the same two variables, 'Highest qualification' and 'Ethnicity' as recorded for the 2013 Census. For each scenario, the non-response rates have been divided into quartiles. See Chapter 4: Methodology and Data Sources, for the information on quartiles.

Including the substitutes in the NS/NEI category alters the non-response spatial pattern, especially in the case of 'Ethnicity'. For example, with substitutes included, TAs with high rate of non-response to 'Ethnicity' seem to be mostly located in the North Island with only two from the South Island included in the 4<sup>th</sup> quartile – Grey and Queenstown-Lakes. However, looking at the actual item not response by excluding the substitutes, five TAs from the South Island have rates which fall in the highest quartile - Chatham Islands, Mackenzie, Westland, Grey and Queenstown-Lakes.

**Figure 6.3 Non-response rates (NS/NEI category as a proportion of the URP) for selected variables including and excluding substitute records, Census 2013**



As noted earlier, it is important to learn about the determinants of non-response behaviour if strategies are to be developed to minimise non-response rates and this can only be achieved by studying the profile of the item non-respondents. Not only does the pattern of item non-response vary when disaggregated by key demographic characteristics like age, sex and geographical location, the profile also varies between different variables given that the reasons for and motivation behind people not answering one or more relevant questions on a census form can be varied. Analysing the NS/NEI category to study the patterns of item non-response and the profile of these non-respondents without excluding the substitute records, a proxy measure of the unit non-response to the census, can be misleading.

The next chapter presents a detailed case study on the item non-response to one of the most important variables within the census dataset, 'Personal income'. It looks at the non-response rates disaggregated by four key demographic characteristics (age, sex, ethnicity and geographical location) over two censuses, 2006 and 2013. It also analyses the socio-demographic profile of these item non-respondents to the question on personal income for the two censuses and compares it with that for the respondents, that is, the people who did provide a valid response.

## **CHAPTER 7: A DETAILED CASE STUDY ON THE ITEM NON-RESPONSE TO THE PERSONAL INCOME QUESTION**

Income is a vital measure of the economic status of a population. It can be used to determine poverty levels, measure the economic well-being and gauge need for economic assistance. Central and local government bodies use the information to allocate funds for healthcare, education, housing, etc. In the New Zealand Census, total personal income is the before-tax income of a person aged 15 years or more, in the preceding 12 months ending 31 March. The information is collected in income bands rather than actual dollar value and includes income sourced from wages and salaries, self-employed income, property and rental income, dividends and investments, social insurance, superannuation, government assistance schemes and private transfers such as child support (Statistics New Zealand, 2013).

### **7.1 Background**

While completing a census form, a respondent has the following alternatives (Barnes, 1992; Groves & Couper, Nonresponse in household interview surveys, 2012; Tourangeau, Rips, & Rasinski, The psychology of survey response, 2000):

1. respond and answer the question as truthfully as possible;
2. respond with a false answer which is deemed to be more socially desirable;
3. wants to respond but doesn't know the answer; and
4. refuse to respond at all.

Options three and four result in an item non-response. The question on the personal income of an individual is a sensitive one and widely seen as very intrusive. As a result, the non-response rates are relatively higher than for other variables (see Table 6.1 for comparison of item non-response rates). There are a number of factors that possibly affect a

person's reluctance and refusal to provide a valid response on the census form (Tourangeau & Yan, Sensitive questions in surveys, 2007). Three aspects particularly highlighted by Tourangeau et al. (2000) to people's reluctance towards answering sensitive questions are:

- Privacy invasion – respondents thinking that this is a private matter and out of bounds for the government to ask.
- Threat of disclosure – concerns about the possibility of the information being known to a third party. Respondents don't always believe the assurances of confidentiality.
- Perceived social (un)desirability of the response - for example, admitting to having low (or no) income thought to be a socially undesirable response.

The causes of non-response to the income question can be broadly categorised as cognitive (not understanding the question, wanting to answer but lack of knowledge, judgement of perceived accuracy requested) and/or motivational (willingness to respond) (Sousa-Poza & Henneberger, 2000). Incorrect reporting of income is the most invisible error in the income dataset. Cognitive factors like knowledge and memory can underpin a person's ability to provide an accurate response to the personal income question (Turrell, 2000). In addition to increasing the item non-response rate, sensitive questions like that on personal income, which are widely seen as very intrusive, can also affect the accuracy of the response (that is, the percentage of the census unit respondents answering the question truthfully). Findings from Heeringa et al. (1995) and Juster & Smith (1997) both show that asking of the income data in income bands or brackets rather than actual dollar value effectively reduces the missing data or non-response by 50 per cent or more. This effect is described as a response to reducing the cognitive burden on respondents and also reduces the perceived sensitivity of the question.

Typically, high rates of item non-response are recorded on questions related to sensitive issues such as income and these in turn can lead to data bias. This data or non-response bias refers to the mistake one expects to make in estimating a population characteristic based on (in this

instance) the census data in which, due to non-response, certain types of respondents are under-represented (Berg, 2005). This can potentially lead to misdirected policy actions.

A report by Moore, Stinson and Welniak shows that more than a quarter of the wage and salary data in the U.S. Current Population Survey is missing or incomplete because respondents are reluctant to answer or uncertain over how to answer (Stinson, Moore, & Welniak, Jr, 2000). The average and median income statistics as well as derived variables like household income, combined parental income, etc., will be biased due to undercount of people in very low and very high income bands. High non-response rates affect data quality of the income variable, while disparities in income at regional or ethnic group levels might be understated for regions or ethnic groups with high non-response rates. Population-based funding models that use income as a variable and analysis at a smaller geographical level like territorial authority areas, will also be affected by the bias (Statistics New Zealand, 2013). For example, income is one of the important variables used in deriving the NZDep index, which is primarily developed for the purpose of planning and resource allocation, research and advocacy. The quality of these data are therefore of utmost importance.

At the 2013 New Zealand Census, personal income was derived from question 31 on the census Individual form.

**Question 31: From all sources of income you marked in question 30, what will the total income be**

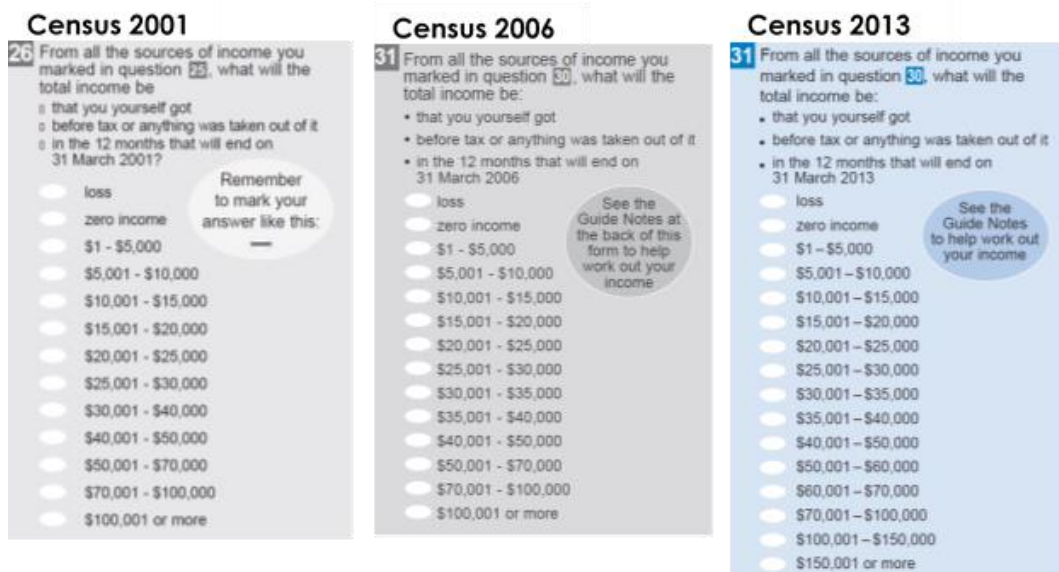
- that you yourself got
- before tax or anything was taken out of it
- in the 12 months that will end on 31 March 2013?

Loss	\$30,001-\$35,000
Zero income	\$35,001-\$40,000
\$1-\$5,000	\$40,001-\$50,000
\$5,001-\$10,000	\$50,001-\$60,000
\$10,001-\$15,000	\$60,001-\$70,000
\$15,001-\$20,000	\$70,001-\$100,000
\$20,001-\$25,000	\$100,001-\$150,000
\$25,001-\$30,000	\$150,001 or more

The data obtained is used to derive other income related variables such as total household income, total family income, combined parental income for couple with children and total extended family income.

Since 2001, the question on total personal income has remained consistent (see Figure 7.1); however changes have been made to the income bands listed. As compared to the 2006 Census, two new bands were added in the 2013 Census with the \$50,001-\$70,000 band split into two income brackets: \$50,001-\$60,000 and \$60,001-\$70,000; and \$100,001 or more split into: \$100,001-\$150,000 and \$150,001 or more. Thus, the 2013 census data on personal income is highly comparable with 2006 and broadly comparable to the 2001 census data. In addition to changes in the income bands, guide notes to answering the question were not provided in the 2001 census.

**Figure 7.1 Question on total personal income, Census 2001, 2006 and 2013**



Source: Statistics New Zealand

The item non-responses (including invalid responses such as selecting more than one income band) to the income question are coded as 'Not Stated (NS)' in the census database. The NS category for the personal income variable also includes the individual substitute records or 'dummies' created by Statistics New Zealand. Table 7.1 gives the total usually resident population (URP) count aged 15 years or more at the

2006 and 2013 censuses along with the NS count for the personal income variable, the number of substitute records created (for imputed ages 15 years and over) and the non-response rate to the personal income question (NS count expressed as a proportion of the URP count), both actual (excluding substitute records) and overall (including substitute records).

In 2013, personal income was not recorded for 325,929 people aged 15+ years among the total usually resident population of 3,376,416, which equates to an overall non-response rate of 9.7 per cent (10.2 per cent in 2006). However, the actual rate of item non-response (excluding substitute records created) is much lower at 5.0 per cent in 2013 (7.0 per cent in 2006).

**The case study focuses the analysis of only those people who returned their completed census individual forms and either answered the question on personal income (item respondents) or did not provide a valid response (item non-respondents).** The individual substitute records are excluded from all analyses. This equates to 161,829 item non-respondents at the 2013 Census and 214,581 at Census 2006. All non-response rates have been calculated using the non-substitute URP (aged 15 years or more) of 3,212,319 at the 2013 Census (3,054,063 for 2006); that is, only the census respondents.

**Table 7.1 Usually resident population, substitute records and non-response to question on personal income; Census 2006 and 2013**

	Usually Resident Population (15+ yrs)			Personal Income not recorded			Item non-response rate to Personal Income	
	2006	2013		2006	2013		2006	2013
Census non-respondents (individual substitute records)	106,311	164,097	Census non-respondents (individual substitute records)	106,311	164,097			
<b>Census unit respondents</b>	<b>3,054,063</b>	<b>3,212,319</b>	<b>Item non-respondents</b>	<b>214,581</b>	<b>161,829</b>	<b>Actual (excluding substitute records)</b>	<b>7.0%</b>	<b>5.0%</b>
Total URP	3,160,374	3,376,416	Total non-response	320,889	325,929	Overall (including substitute records)	10.2%	9.7%

Source: Statistics New Zealand

## **7.2 Rates of item non-response to income question**

Across New Zealand between 2006 and 2013, the population has aged and the migrant mix has changed, and these demographic changes are likely to have affected the rates of item non-response, especially to 'sensitive' questions like personal income. This section looks at the item non-response rates to the personal income question disaggregated by the four key demographic characteristics – age, sex, location and ethnicity, with rates from the previous census also included for comparison.

As outlined in the methodology section, all item non-response rates presented in the case study are based on the data for census unit respondents only, with all substitute records or 'dummies' excluded. Therefore, to calculate the non-response rates, the substitute records are excluded from the numerator (number of people not providing a valid response to the question on personal income) as well as the denominator (the usually resident population aged 15+ years).

It should also be noted that the age and sex of a very small proportion (0.4 per cent) of census unit respondents has been imputed by Statistics New Zealand due to missing item responses (see Section 1.3).

### **7.2.1 Age and sex of item non-respondents to income**

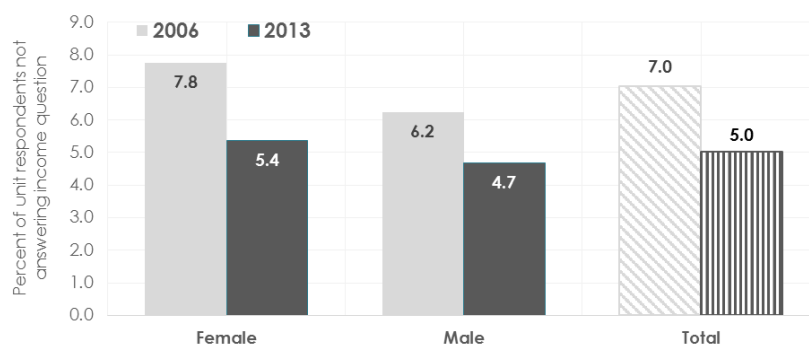
The item non-response rates for the 2006 and 2013 censuses disaggregated by sex are shown in Figure 7.2 (underlying data in Appendix Table 7). Overall, the rate of item non-response to the question on personal income has declined over the inter-censal period by 28.3 per cent or two percentage points (7.0 per cent in 2006 to 5.0 per cent in 2013).

The first factor that has contributed to this decline has been a change in coding practice by Statistics New Zealand. For the 2013 Census dataset, all the item non-respondents to the personal income question who answered 'No Source of Income' to the previous question on source of

income<sup>11</sup> were coded to the 'Zero Income' category instead of 'Not Stated'. This edit was not carried out in previous years (Statistics New Zealand, 2013). Effectively around 35,000 item non-respondents (17.8 per cent of the total actual 196,829 item non-respondents to the personal income question), were recoded to 'Zero Income' (based on their response 'No Source of income' to the previous question).<sup>12</sup> This reduced the number of item non-respondents among the 3,212,319 census unit respondents aged 15+ years from around 196,829 to the recorded 161,829 (see Table 7.1); thereby decreasing the item non-response rate from 6.1 per cent to 5.0 per cent for the 2013 Census.

The second factor likely to have contributed to the decline in item non-response is the substantial increase in the uptake of online forms in 2013 (compared to the previous census), resulting in a diminishing possibility of inaccurate or invalid responses. The total online response rate at Census 2006 was only 7.0 per cent, substantially lower than that recorded at the 2013 Census of 34.0 per cent (Statistics New Zealand, 2014). Findings from research on the comparison of item non-response rates of online and paper questionnaires (Denscombe, 2009) show that rates are lower for responses received online. At the New Zealand census, the selection of only one income band was allowed in the online form whereas multiple responses were possible on paper based forms completed.

**Figure 7.2 Rate of non-response to the question on personal income, males, females and total; Census 2006 and 2013**



<sup>11</sup> Question 30: 'Mark as many spaces as you need to show all the ways you yourself got income in the 12 months ending today'

<sup>12</sup> Source: T. Morant, Customised Data Analyst, Customised Data Services, Statistics New Zealand, Christchurch, email correspondence, 2 Oct 2015.

Females are slightly less likely to respond to the income question: a non-response rate of 5.4 per cent compared to 4.7 per cent recorded for males in 2013. This is consistent with the finding from Sousa-Poza & Henneberger (2000) and Bell (1984), who reported a slightly higher rate of item non-response to the income question among women. Socio-economic factors like workforce status, source of income, etc. which might explain the higher non-response rates to the question on personal income among women, is examined later on in this chapter.

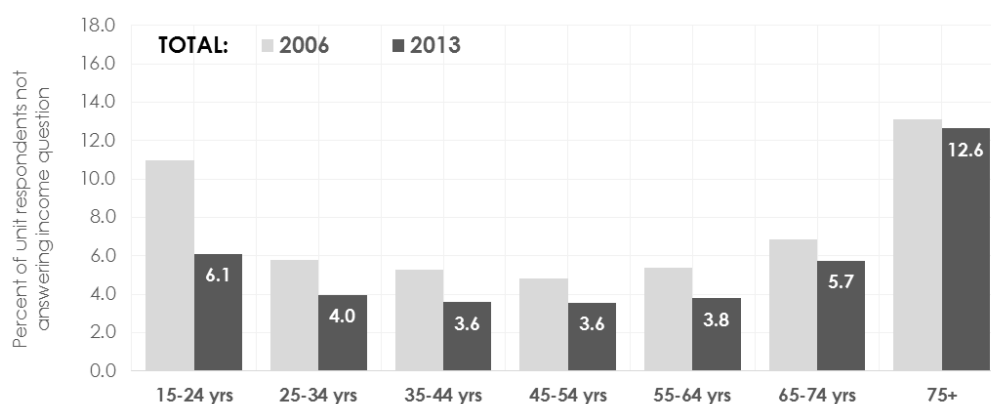
The gap in the non-response rates between the sexes has reduced since 2006 with the rate for females declining much more significantly over the inter-censal period (decline of 2.4 percentage points or 30.9 per cent) than for males (decline of 1.5 percentage points or 24.9 per cent). The impact of completing the census form online is unlikely to have contributed to this disparity as there is very little difference in online response rates by sex, with males only marginally more likely to complete their forms online (Statistics New Zealand, 2014).

The change in coding practice adopted by Statistics New Zealand for the 2013 Census dataset noted previously is more likely to be the major contributing factor to this more significant decline in item non-response rates for female respondents. A higher proportion of women reported 'no source of income' at the 2013 Census: 8.6 percent compared to 6.3 per cent among men (see Appendix Figure 2 for the proportion of the 15+ year population reporting 'No Source of income' at the 2013 Census disaggregated by age and sex). Consequently, it is likely that more female item non-respondents to income who reported 'no source of income' to the previous question, were re-coded to 'Zero Income' instead of 'Not Stated'. This recoding was not carried out for the 2006 Census dataset, therefore resulting in the more substantial decline in non-response rates over this inter-censal period for females shown in Figure 7.2.

Figure 7.3 shows the age-specific rates of item non-response to the question on personal income, and Figure 7.4 disaggregates these age-specific rates by sex. Appendix Table 7 has the underlying data. Item non-response is highest among the youngest (15-24 years) and oldest (65+

years) age groups, and this pattern is consistent for both males and females. It is likely that these two groups, people aged 15-24, a majority of whom are likely to be students, and the elderly (65+ years), perceive the income question to be either too difficult to answer or irrelevant to themselves. In comparison, non-response is much lower among the prime working age population aged 25-64 years, with rates by age group varying only slightly over the 3.6 – 4.0 per cent range.

**Figure 7.3 Age specific rate of non-response to the personal income question, Census 2006 and 2013**

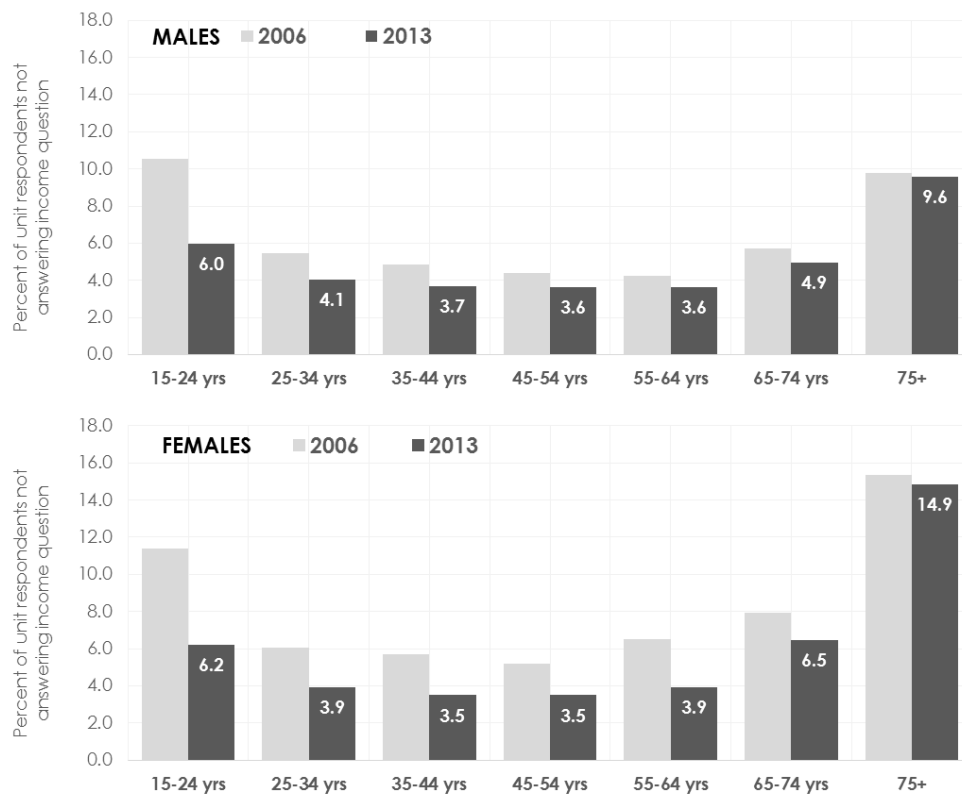


Approximately one in every 10 census respondents aged 65 years or more failed to provide a valid response to the question on personal income (8.7 per cent in 2013 and 9.8 per cent in 2006, not shown in above figure). When disaggregated further, the non-response rate among 75+ year olds (12.6 per cent) is more than double that for the 65-74 year age group (5.7 per cent). A possible contributing factor to these high rates of non-response among the older population is that a substantial proportion of them reside in residential care facilities and it is likely that they have other people, who have insufficient knowledge of their income status, completing their form for them.

The rate of item non-response at the two oldest age groups is more pronounced among women, especially those aged 75 years or more. Overall, in the broader 65+ year group of census respondents (not shown

in Figure 7.4), 10.3 per cent women did not provide a valid response to the income question compared to only 6.8 per cent of men. Similarly, at both census years, females aged 15-24 years were marginally more likely than their male counterparts to not provide a valid response to the question. It is interesting to note that women have a higher rate of non-response than men only at the youngest (15-24 years) and oldest (55+ years) age groups. Among the young working age population aged 25-54 years, women are in fact marginally more likely to answer the income question than men. The possible reasons for this are examined further along.

**Figure 7.4 Age specific rate of non-response to the personal income question for males and females, Census 2006 and 2013**



The item non-response rate to the income question has declined across all age groups over the 2006-2013 inter-censal period. However, the most substantial decline is recorded for 15-24 year olds with the non-response rate falling by almost five percentage points or 44.3 per cent. This may be due, at least in part, to the higher rate of online response among youth at the 2013 Census (just above 30 per cent) as compared to the previous

census (see Appendix Figure 3 for age group specific online response rates in 2013). One other contributing factor is likely to be the much higher proportion of people aged 15-24 years selecting 'no source of income' (compared to other age groups) who were coded as 'zero income' in the 2013 Census dataset. In 2013, one in four respondents (25.3 per cent) aged 15-24 years reported 'No source of income' (see Appendix Figure 2).

Conversely, those aged 65+ years had the lowest uptake of online forms, with the substantial majority more likely to complete the census forms manually. At Census 2013, less than two fifths (19.8 per cent) of the respondents aged 65 years or more completed their census individual forms online (see Appendix Figure 3) which is much lower than the proportion of online responses among those aged 15-64 years (37.1 per cent). Additionally, people in this age group are also less likely (compared to other age groups, particularly the 15-24 year population) to have 'no source of income'. Only 1.1 per cent of the 65+ year usually resident population reported 'No source of income' (see Appendix Figure 2). Consequently, as seen in Figure 7.3 and Figure 7.4, the two oldest age groups (65-74 and 75+ years) have the least decline in the non-response rate over the inter-censal period.

### **7.2.2 Comparison of the demographic profile of item respondents and non-respondents**

The demographic profile of the people who chose to not answer the personal income question is very different to that of the people who do respond (see Figure 7.5), and this holds true for both census years. People in the youngest age group (15-24 years), and those in the oldest (75+ years) are over-represented among item non-respondents and this discrepancy is more pronounced for older people, especially women. Over the inter-censal period, the proportion of 65+ year olds among item non-respondents increased quite substantially, from 21.9 to 31.6 per cent. In 2013, two out of every 10 non-respondents (19.8 per cent) are from the oldest age 75+ age group, and with the imminent ageing of the population, this proportion is likely to grow. In comparison, the 75+ year population

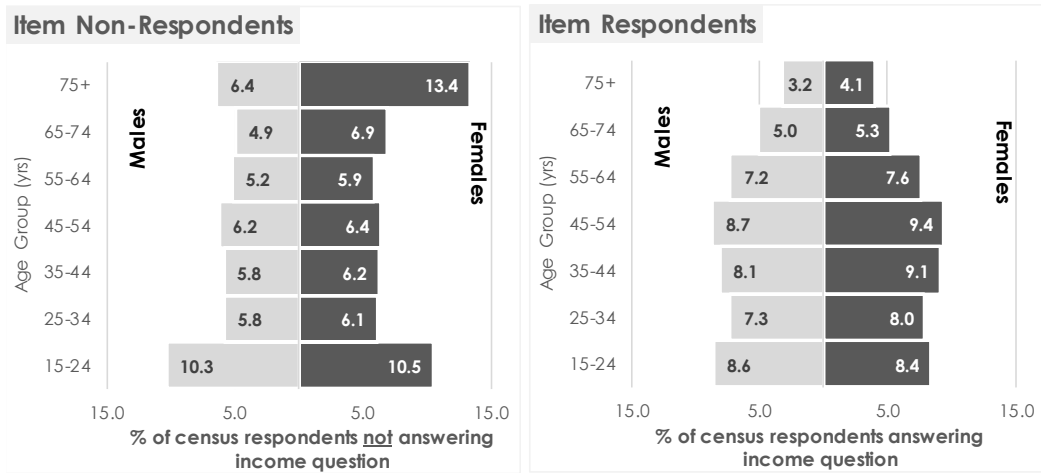
accounts for only 7.3 per cent of the item respondents. Conversely, the proportion of the population aged 15-24 among item non-respondents has declined from 28.1 per cent in 2006 to 20.8 per cent in 2013. However, they are still over represented among non-respondents.

These differences suggest that any pro-rata apportioning of the NS category (excluding the substitute records) of the personal income variable in the census dataset is likely to disproportionately affect the older population, particularly women, and those aged 15-24 years.

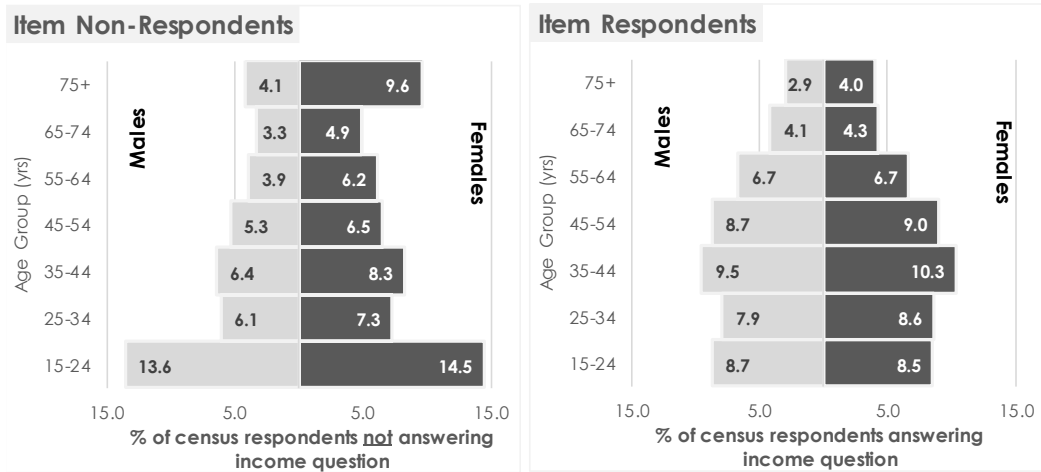
Compounding this issue is the inclusion of substitute records for the unit non-respondents in the NS count. The allocated or imputed age-sex structure of the substitute records or dummies (refer Chapter 5, Figure 5.3 and Figure 5.4) is very different to that of the item non-respondents to the income question (Figure 7.5). This imputed age-sex structure is likely to be more representative of the overall population responding to the census. Therefore, these two different sub-population groups that comprise the NS count should be ideally treated differently in terms of research which uses the data for related to the personal income variable.

**Figure 7.5 Age-sex profiles of the item non-respondents and item respondents to the personal income question; Census 2006 and 2013**

**CENSUS 2013**



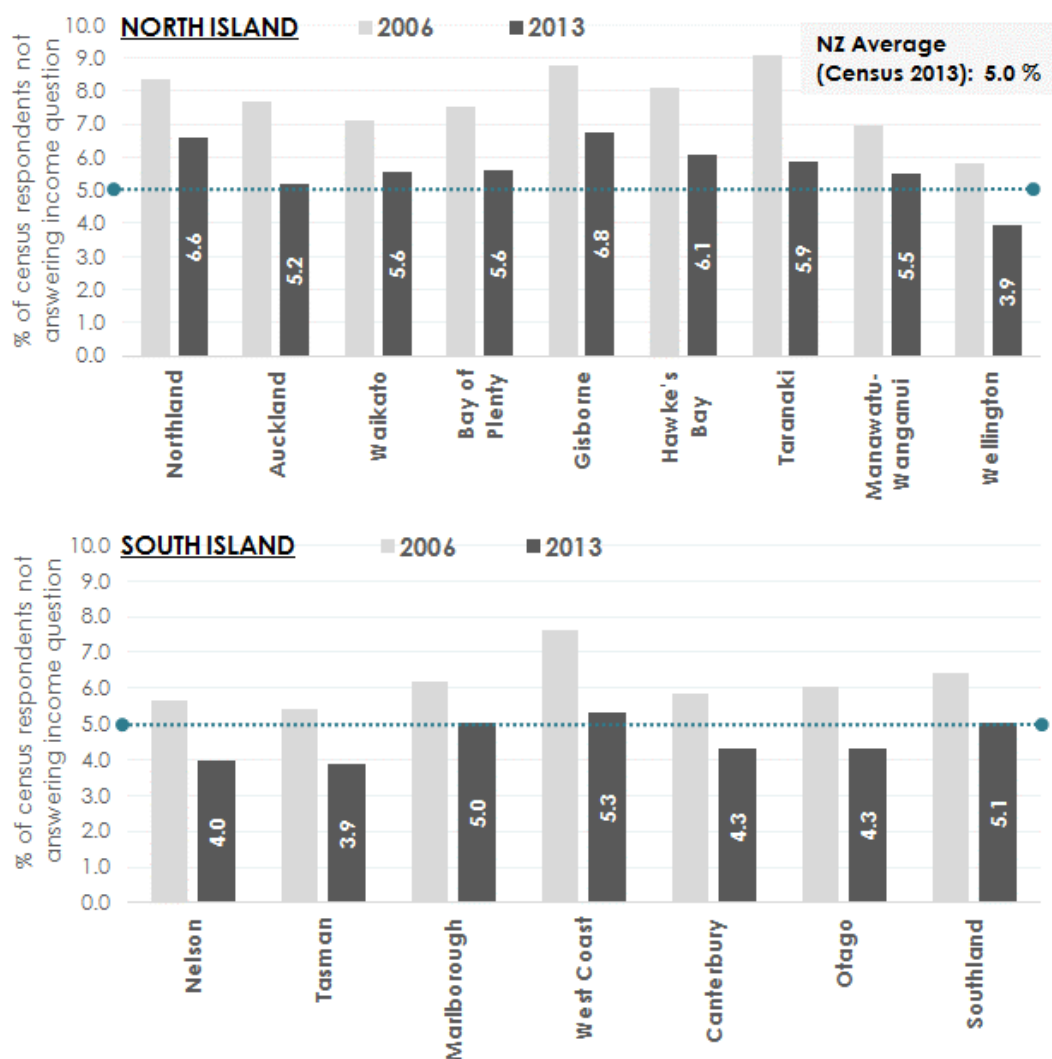
**CENSUS 2006**



### 7.2.3 Geographical location of item non-respondents to income

The regional variation in the rate of item non-response at Census 2006 and Census 2013 is shown in Figure 7.6. The same data is mapped in Figure 7.7. The underlying data can be found in Appendix Table 8. In 2013, only five regions, four of which are in the South Island, had item-non-response rates lower than the national average of 5.0 per cent: Tasman, Wellington, Nelson, Canterbury and Otago. All of these regions had a high uptake on online forms which could partly contribute to their low rates of item non-response. By comparison, the highest rates of item non-response are seen for Gisborne, Northland, Hawke's Bay, Taranaki and the Bay of Plenty, all located in the North Island.

**Figure 7.6 Item non-response rate to personal income question by regions in the North and South Island, Census 2006 and 2013**

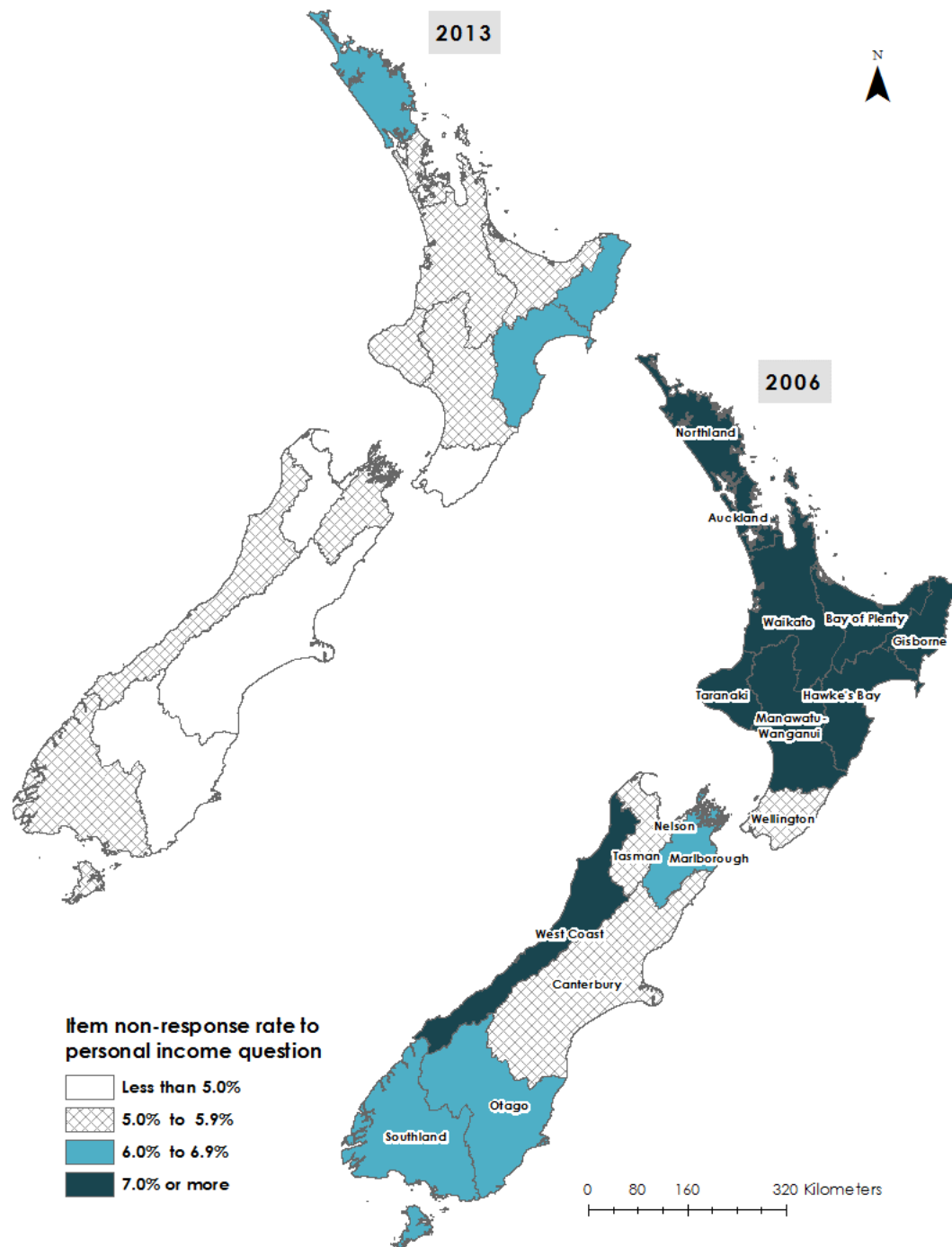


Across all 16 regions, item non-response to income has declined over the inter-censal period, with the most substantial declines noted for Taranaki (9.1 to 5.9 per cent in 2013, a decline of 35.5 per cent), Auckland (7.7 to 5.2 per cent, decline of 32.8 per cent) and West Coast (7.6 to 5.3 per cent, decline of 30.1 per cent).

Appendix Figure 4 gives the online response rates in 2013 for each of the 16 regions across the country. Auckland had the highest proportion of individual forms completed online, 38.7 per cent. The region also had a substantially high proportion, 10.0 per cent, of respondents with 'No sources of income' (see Appendix Figure 7 for the proportion of census respondents in each region with no sources of income in 2013). These two factors probably contributed substantially to the decline in the item non-response rates in Auckland over the inter-censal period 2006-2013.

However, this was not the case for Taranaki and West Coast, where the uptake of online forms was among the lowest in the country. The other factor – recoding of 'No source of Income' to 'Zero income' for item non-respondents to the personal income question, is also unlikely to have made any major contribution towards the declining non-response rates in these two regions, as comparatively much smaller proportions of the usually resident populations aged 15+ years reported 'No source of income', 6.2 and 5.2 per cent respectively (see Appendix Figure 7). This would suggest that there are other factors (outside the scope of this thesis) involved in the decline in the item non-response rates to the personal income question in these two regions.

**Figure 7.7 Item non-response rate to the personal income question by region, Census 2006 and 2013**



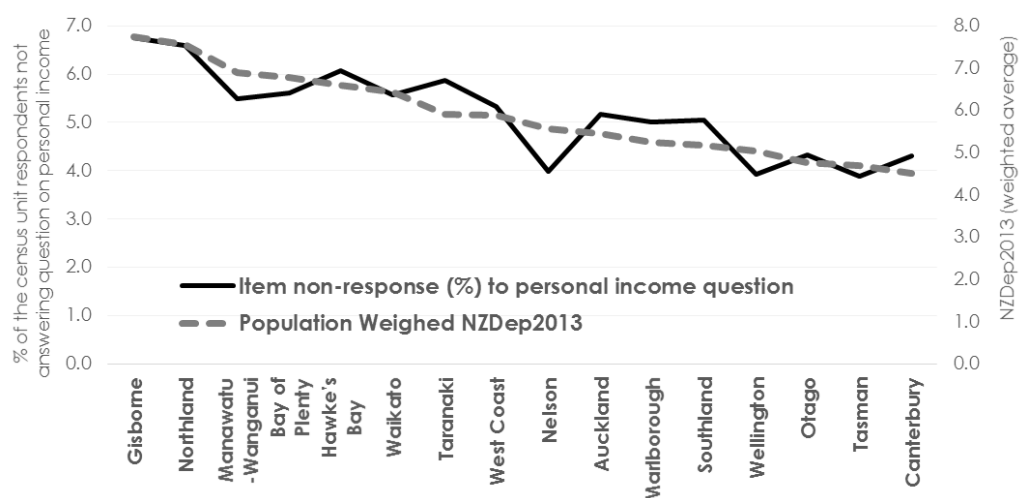
The regions with the highest rates of item non-response also have the highest proportions of the usually resident population living in areas coded as NZDep2013 deciles 9 and 10; that is, areas of high socio-economic deprivation. The same pattern can be seen when the data is disaggregated at the TA level. Refer to Appendix Table 9 and Appendix

Table 10 for the population weighted average NZDep2013 index for each region and TA, along with the number and proportion of the usually resident population living in areas coded as NZDep2013 indexes 9 and 10.

This is further illustrated in Figure 7.8 and Table 7.2. It should be noted here that income is one of eight variables from the census used to calculate the NZ Deprivation Index. As per the methodology used to calculate the index, the NS count within the income variable dataset is excluded from the analysis (Atkinson, Salmond, & Crampton, 2014).

As Figure 7.8 shows, at the regional level, there is a strong positive correlation between the rate of item non-response to the question on personal income in the Census and the population weighted NZDep2013 index (a correlation coefficient of 0.88). Similarly, as shown in Table 7.2, when disaggregated by TA there is a similar pattern with a strong positive correlation between the rate of item non-response and the population weighted NZDep2013 index of the TA, as well as the proportion of TA's population living in areas categorised as NZDep 9 & 10 (correlation coefficient of 0.85). Therefore, the higher the socio-economic deprivation level of an area, the greater is the likelihood of respondents not answering the income question and vice-versa.

**Figure 7.8 Item non-response rate to the income question in 2013 and the population weighted NZDep2013 index in each region**



Note: Regions listed in descending order of rate of item non-response to personal income question.

**Table 7.2 Correlation between item non-response to income and socio-economic deprivation as defined by the NZ Deprivation Index; Census 2013**

TA	Item non-response rate to income	Population weighted NZDep2013	% URP living in NZDep 9 & 10 areas
Far North District	7.4	8.4	61.1
Whangarei District	6.2	6.9	33.8
Kaipara District	6.1	7.5	30.2
Auckland	5.2	5.4	24.5
Thames-Coromandel District	5.4	7.5	15.0
Hauraki District	7.2	8.3	49.6
Waikato District	6.1	5.5	27.1
Matamata-Piako District	5.5	6.6	10.6
Hamilton City	5.1	6.6	27.7
Waipa District	4.6	4.6	1.0
Otorohanga District	5.8	6.5	31.3
South Waikato District	7.6	8.2	64.1
Waitomo District	7.5	8.4	47.9
Taupo District	5.7	6.5	38.6
Western Bay of Plenty District	4.7	6.0	22.2
Tauranga City	4.5	6.1	11.0
Rotorua District	6.9	7.2	44.8
Whakatane District	7.1	7.8	57.9
Kawerau District	8.9	10.0	100.0
Opotiki District	8.8	9.4	67.6
Gisborne District	6.7	7.7	60.4
Wairoa District	8.7	9.3	83.8
Hastings District	6.7	6.3	42.8
Napier City	5.1	6.6	25.5
Central Hawke's Bay District	5.4	6.4	4.1
New Plymouth District	5.5	5.5	16.0
Stratford District	6.1	6.6	0.0
South Taranaki District	7.0	6.9	24.2
Ruapehu District	7.8	8.6	47.6
Wanganui District	7.1	7.5	43.9
Rangitikei District	5.3	7.0	37.8
Manawatu District	4.0	5.6	12.2
Palmerston North City	4.4	6.1	23.6
Tararua District	5.3	7.3	42.7
Horowhenua District	6.7	8.4	70.7
Kapiti Coast District	4.2	5.6	11.8
Porirua City	6.3	5.6	44.3
Upper Hutt City	4.0	5.1	0.8
Lower Hutt City	4.8	5.8	22.9
Wellington City	2.7	4.1	2.9
Masterton District	5.3	6.9	19.0
Carterton District	3.8	5.0	0.0
South Wairarapa District	3.9	5.0	23.6
Tasman District	3.9	4.7	0.8
Nelson City	4.0	5.6	7.8
Marlborough District	5.0	5.2	7.5
Kaikoura District	5.0	5.7	0.0
Buller District	6.0	6.6	5.8
Grey District	4.8	5.6	14.5
Westland District	5.3	5.3	0.0
Hurunui District	4.0	4.1	0.0
Waimakariri District	3.8	3.3	0.0
Christchurch City	4.4	4.9	8.7
Selwyn District	2.7	1.8	0.0
Ashburton District	5.4	4.5	0.0
Timaru District	4.5	5.2	0.0
Mackenzie District	4.9	3.3	0.0
Waimate District	5.0	5.9	36.8
Waitaki District	5.4	5.6	0.0
Central Otago District	4.2	3.9	0.0
Queenstown-Lakes District	3.8	2.3	0.0
Dunedin City	4.2	5.3	13.2
Clutha District	5.2	4.9	0.0
Southland District	4.1	3.6	2.0
Gore District	6.5	5.1	12.5
Invercargill City	5.2	6.1	30.5
<b>Correlation coefficient</b>		<b>0.85</b>	<b>0.82</b>

The highest non-response rates at the 2013 Census are recorded for Gisborne (6.8 per cent), Northland (6.6 per cent) and Hawke's Bay (6.1 per cent), all three regions with very high levels of socio-economic deprivation as defined by the NZDep index. A substantially high proportion, more than 60 per cent, of Gisborne's resident population lives in areas coded as NZDep2013 deciles 9 and 10. This is similarly the case for Northland (43.4 per cent) and Hawke's Bay (35.1 per cent). High levels of socio-economic deprivation in a population can possibly aggravate factors which are likely to influence people's reluctance towards answering sensitive questions such as personal income, like social desirability or threat of disclosure noted earlier. This aspect affects not only the rate of non-response, but also the accuracy of the responses which are actually obtained. As mentioned previously, inaccurate responses given by respondents are the most invisible of all errors in the census dataset. The three regions listed above (Gisborne, Northland and Hawke's Bay) with larger proportions of resident population living in areas coded as high deprivation were also noted for their comparatively lower levels of online census form filling as seen in Appendix Figure 4.

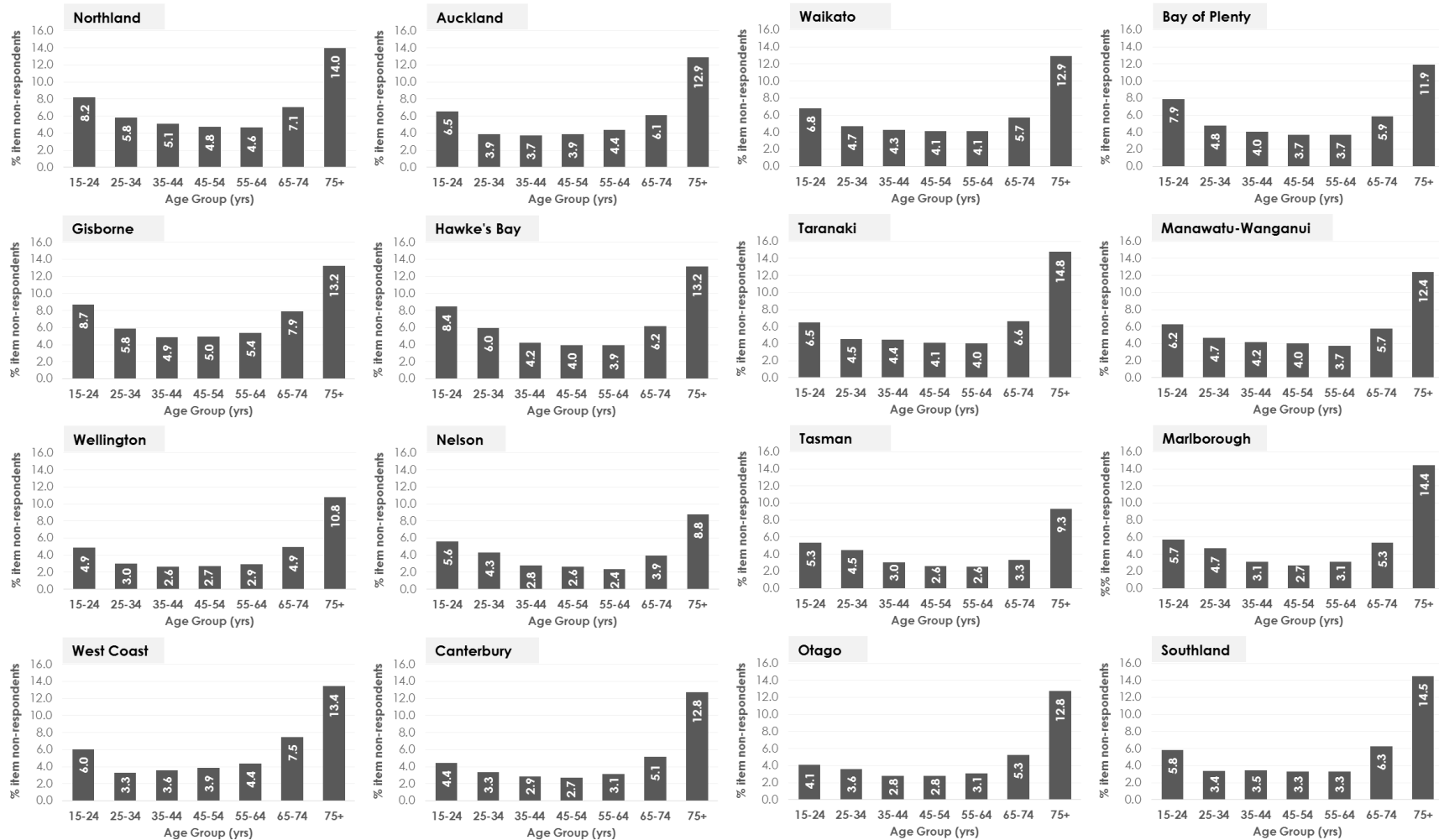
Interestingly, Manawatu-Wanganui seems to be somewhat of an exception to the rule. The region has the third highest proportion of residents living in areas coded with high deprivation scores (36.0 per cent) but ranks seventh in terms of item non-response to the income variable. The opposite is true for Taranaki which has relatively lower levels of deprivation (only 16.7 per cent of the population living in areas coded as NZDep2013 deciles 9 and 10, ranked) but high non-response rates (ranked fourth in terms of item non-response in 2013). In terms of socio-economic deprivation (proportion of the population living in areas coded as NZDep 9 or 10) Taranaki is ranked third lowest in the North Island, followed by Auckland and Wellington which both have comparatively lower non-response rates. Therefore, the 'rurality' of a region is also likely to have an impact on the rate of non-response. Taranaki being mostly rural with less than half of its resident population living in New Plymouth city and the remaining living like in rural areas like Waitara, Inglewood, Stratford, Opunake, Okato, Kaponga, Eltham, Hawera, Patea and

Waverley. By comparison, Auckland and Wellington have much higher proportions of the population living in urban areas. Variables that define the urbanity or rurality of an area like transport, communication and support are included in the derivation of the NZDep index. However, this apparent discrepancy in the non-response rates between a predominantly rural region like Taranaki and a predominantly urban region like Wellington, with somewhat similar levels of socio-economic deprivation, suggests the role of accessibility and isolation of an area in people's decision to not respond.

### **Age-specific item non-response rates by location**

The age-specific non-response rates to the question on income for each of the 16 regions in New Zealand are presented in Figure 7.9. The overall pattern remains similar across all regions with higher rates of item non-response seen among the youngest (15-24 years) and the two oldest (65-74 and 75+ years) age groups as was the case nationally. Generally, the regions in the South Island have lower non-response rates than those in the North Island. However, there are a few exceptions as can be seen from Table 7.3, which shows the top three regions with the highest and lowest item non-response rates recorded at Census 2006 and Census 2013, disaggregated by age group and sex.

**Figure 7.9 Age-specific rates of item non-response to the question on personal income for each region, Census 2013**



Overall, at both census years, the three regions with the highest item non-response rates to the income question have been in the North Island while the three with lowest rates have been in the South Island. Looking at the non-response rates by region in 2006 and 2013, the pattern is similar at both censuses with the exception of Hawkes Bay region which replaced Taranaki region as one of the three regions with highest non-response rates in 2013. When disaggregated by sex, the pattern is consistent.

When disaggregated by the three broad age groupings, some deviations to this overall pattern are seen for the 65+ age group. Although the item non-response rates have declined for both sexes and all younger age groups, the rates for 65+ year olds in the Taranaki region remain among the highest in the country at 10.4 per cent. Taranaki had one of the lowest rates of online response in 2013, particularly among the 65+ population with only 13.3 per cent in this oldest age group completing their forms online (see Appendix Figure 5), and this may partly contribute to the high non-response rates. Similar is the case for the Gisborne region.

Southland, with an overall item non-response rate of only 5.1 per cent in 2013, had the third highest rate among its 65+ year population (10.0 per cent). West Coast in the South Island also had one of the highest non-response rates among 65+ year olds in 2006 (10.0 per cent) dropping slightly to 9.8 per cent in 2013 (compared to a much lower overall rate of 5.3 per cent for the 15+ year population). It should be noted that both of these regions had the lowest levels of internet access in 2013 (well below the national average) (Statistics New Zealand, 2014) and consequently, the lowest online response rates in the South Island (West Coast 27.2 per cent and Southland 29.8 per cent, see Appendix Figure 4). This disparity is even more pronounced for respondents aged 65 years or more, with West Coast having the lowest rate of online response (only 12.2 per cent) and Southland not far ahead at 13.9 per cent (see Appendix Figure 5). One of the factors contributing to the higher item non-response rates recorded for these two regions of the South Island could therefore be online access. Additionally, the overlapping issues of accessibility and isolation which characterise these two predominantly rural regions could also be contributing factors.

Among the 15-24 year age group, the lowest rates of non-response are seen for Otago, Canterbury and Wellington. Otago and Canterbury have substantial student populations and both regions, along with Wellington, have comparatively higher rates of online response among their 15-24 year populations (see Appendix Figure 6).

**Table 7.3 Regions (top three) with the highest and lowest item non-response rates to the income question at the 2006 and 2013 censuses, disaggregated by sex and broad age group**

	CENSUS 2006						CENSUS 2013					
	Total 15+ years	Sex		Age Group			Total 15+ years	Sex		Age Group		
		Males	Females	15-24 years	25-64 years	65+ years		Males	Females	15-24 years	25-64 years	65+ years
Northland	8.4%	7.8%	8.9%	14.5%	6.4%		6.6%	6.3%	6.9%	8.2%	5.0%	
Auckland												
Waikato												
Bay of Plenty												
Gisborne	8.8%	8.1%	9.4%	14.8%	6.5%	11.5%	6.8%	6.5%	7.0%	8.7%	5.2%	10.2%
Hawke's Bay				13.8%			6.1%	5.8%	6.3%	8.4%	4.4%	
Taranaki	9.1%	8.4%	9.7%		7.1%	12.9%						10.4%
Manawatu-Wanganui												
Wellington	5.8%		6.4%		4.2%	8.5%	3.9%	3.6%	4.2%	4.9%	2.8%	7.5%
Nelson	5.6%	4.9%	6.3%		4.2%	8.1%	4.0%	3.5%	4.5%		2.9%	6.2%
Tasman	5.4%	4.8%	6.0%	8.5%	4.2%	7.7%	3.9%	3.6%	4.2%		3.0%	5.7%
Marlborough												
West Coast						11.3%						
Canterbury		5.0%		8.0%						4.4%		
Otago				6.7%						4.1%		
Southland												10.0%

 Highest item non-response rates

 Lowest item non-response rates

#### **7.2.4 Ethnicity of item non-respondents to income**

Among census respondents aged 15+ years, a very small proportion (0.3 per cent in both 2006 and 2013) were 'double' item non-respondents; that is, people who did not answer both, the personal income and the ethnicity questions. These people have been excluded. The analysis presented in this section is therefore based only on those item non-respondents to the income question whose ethnic group is known (153,000 in 2013 and 203,979 in 2006).

The ethnicity variable includes all people who stated an ethnic group, whether as their only ethnic group or as one of several ethnic groups. Where a person reported more than one ethnic group, they are counted in each applicable group. Therefore, the total number of responses in an ethnicity based dataset from the census are always greater than the total number of people.

The Census 2006 and Census 2013 ethnicity data is internally consistent and therefore directly comparable. In 2013 however, there was a substantial decline in the number of people identifying with the 'New Zealander' group compared to the previous census; 347,970 aged 15+ years in 2006 compared to only 53,634 in 2013 (a decline of 84.6 per cent). In the months leading up to the 2006 Census, a media campaign encouraged people to select the New Zealander response, which resulted in a sharp increase in 'New Zealander' responses (2.4 per cent in 2001 to 11.1 per cent in 2006). The majority of these 'new' New Zealanders, as found by a subsequent review, were people who previously identified with the 'NZ European' ethnic group (Statistics New Zealand, 2009; Kukutai & Didham, 2012). The European grouping, as a result, declined from 80.0 per cent of the population in 2001 to 67.6 percent in 2006. In 2013, there was very little prior public discussion over the 'New Zealander' term, with the result that only 1.6 per cent of the population selected this response to the ethnicity question, and consequently the European grouping returned to around 74 per cent (Statistics New Zealand, 2013).

In 2006 and 2013, unlike previous censuses, the 'New Zealander' responses were no longer coded as 'NZ European' but were classified

under 'Other ethnicity' at Level 1 of the classification. Therefore, the substantial response change over the 2006-2013 inter-censal period noted earlier, directly affects the Level 1 groupings of 'European' and 'Other ethnicity'. Moreover, 'New Zealander' makes up more than 97 per cent of the Level 1 'Other ethnicity' grouping (Statistics New Zealand, 2013); and therefore the two groups 'European' and 'Other ethnicity' are combined for the analysis presented in this section.

The item non-response rates to the income question in 2006 and 2013 for the five broad ethnic groups, Māori, Pacific Islanders or Pasifika, Europeans & Other, Asians and Middle Eastern/Latin American/African or MELAA, are presented in Figure 7.10. Underlying data is in Appendix Table 11. At the 2013 Census, Pacific Islanders had the highest rate of non-response (11.3 per cent) and European & Other the lowest (3.7 per cent). The rate among Māori is also very high (8.2 per cent), second only to the Pasifika population.

The income item non-response rates have declined across all ethnic groups. The biggest declines are noted for Asian (decline by 4.2 percentage points or 47.6 per cent), MELAA (4.5 percentage points or 37.3 per cent) and Pacific Islanders (5.6 percentage points or 33.1 per cent between 2006 and 2013) ethnic groups. People identifying with the Asian and MELAA ethnic groups were most likely to complete their forms online with the highest online response rates (compared to other ethnic groups) in 2013 (Statistics New Zealand, 2014), and this may have partly contributed towards the decline in item non-response. These two ethnic groups also had among the highest proportions of their 15+ population with 'No source of income' – 16.6 per cent for Asians and 13.1 per cent for MELAA (see Appendix Figure 8). This plausibly resulted in higher proportions (compared to other ethnic groups) of item non-respondents to question 31 (personal income) being coded to 'Zero income' rather than 'Not Stated', if they selected 'No source of income' for the previous question.

Pacific Islanders however, had the lowest online response rates in 2013, which suggests that there are other contributing factors to the decline in

non-response rates for this group. The coding of 'No source of income' to 'Zero income' in the 2013 census dataset for the item non-respondents to the question on personal income may be one major contributing factor. The proportion of the 15+ year population which selected 'No source of income' to the question on income source in 2013 is very high among Pacific Islanders (14.5 per cent, see Appendix Figure 8), second only to the Asian ethnic group.

**Figure 7.10 Rate of item non-response to the question on personal income for major ethnic groups; Census 2006 and 2013**

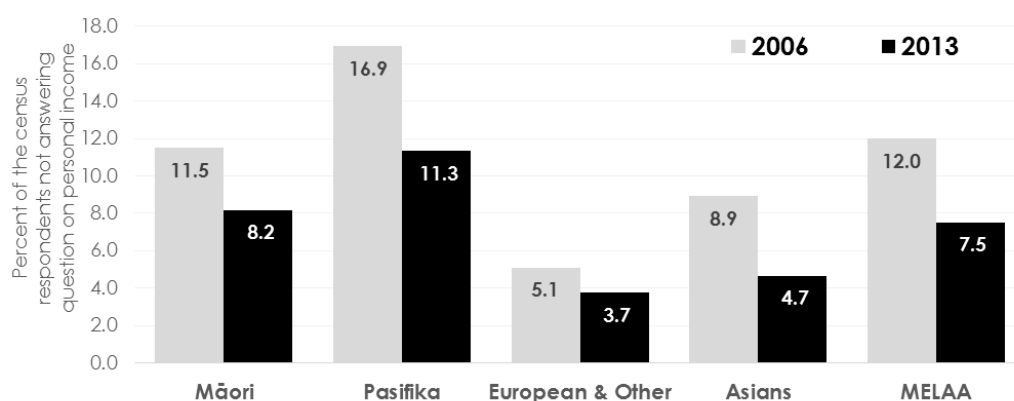


Table 7.4 shows the correlation between item non-response rates and the proportion of Māori, Pacific Islanders and MELAA in the population aged 15+ years across the regions in 2013. While there is a strong positive correlation (Pearson correlation coefficient of 0.83) between proportion of census respondents not answering the question on personal income and the proportion of Māori in the region (population aged 15+ years), this is not the case with the other two ethnic groups who also have relatively higher non-response rates, Pacific Islanders (correlation coefficient of -0.03) and MELAA (correlation coefficient of -0.31). The proportion of the 15+ year population identifying with these two ethnic groups is very small, which is likely to affect the correlation analysis.

**Table 7.4 Correlation between item non-response to income and the proportion of Māori, Pacific Islanders and MELAA in the population aged 15+ years; Census 2013**

Region	Item non-response rate to Income	% Māori in the 15+ Population	% Pasifika in the 15+ Population	% MELAA in the 15+ population
Northland	6.6	25.1	2.0	0.3
Auckland	5.2	8.5	11.4	1.7
Waikato	5.6	17.4	2.8	0.8
Bay of Plenty	5.6	21.8	2.1	0.4
Gisborne	6.8	40.3	2.6	0.3
Hawke's Bay	6.1	19.1	3.2	0.4
Taranaki	5.9	13.5	1.1	0.4
Manawatu-Wanganui	5.5	16.2	2.5	0.6
Wellington	3.9	10.4	6.4	1.3
Nelson	4.0	7.1	1.3	0.4
Tasman	3.9	5.8	0.8	0.2
Marlborough	5.0	9.0	1.7	0.5
West Coast	5.3	8.2	0.8	0.4
Canterbury	4.3	6.3	1.9	0.7
Otago	4.3	5.8	1.6	1.0
Southland	5.1	10.1	1.5	0.3
<b>Correlation coefficient:</b>		<b>0.83</b>	<b>-0.03</b>	<b>-0.31</b>

Figure 7.11 disaggregates the ethnicity specific item non-response rates by sex. Irrespective of which ethnic group they identify with, women were more likely than men to not provide a valid response to the question on personal income at the 2013 Census; and this pattern is consistent with the previous census.

The difference between the sexes in the rate of non-response to the income question has declined over the inter-censal period. Despite the closing of this gap, in 2013, Māori, Pacific Islanders and European & Other women were more likely than their male counterparts to not respond, whereas among Asians and the MELAA population the disparity was minimal.

**Figure 7.11 Rate of item non-response to the question on personal income for major ethnic groups disaggregated by sex; Census 2006 and 2013**

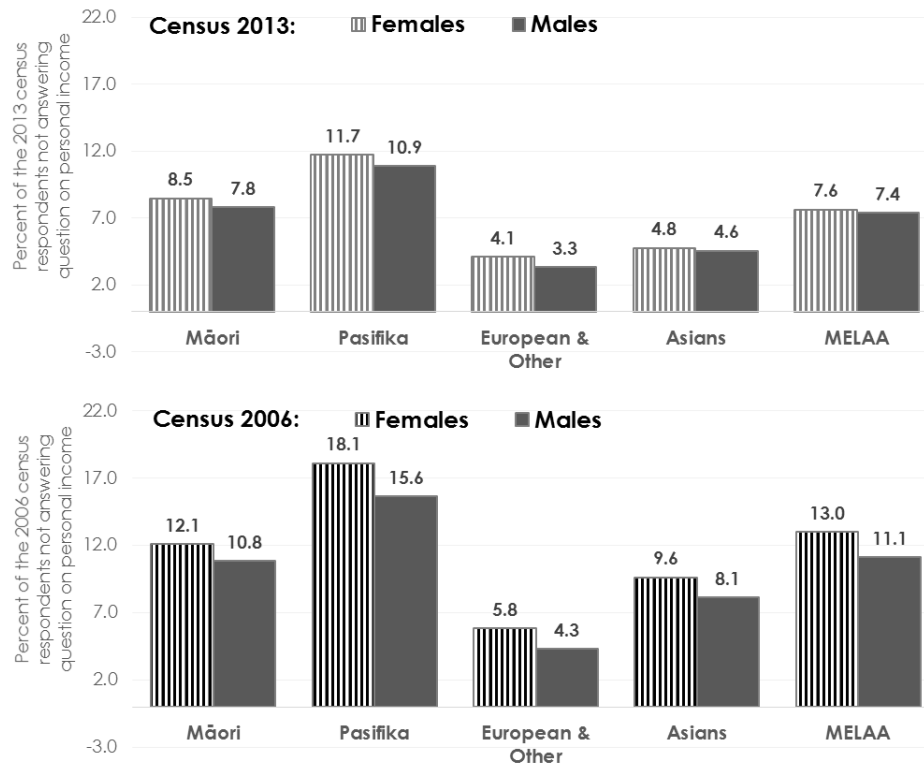


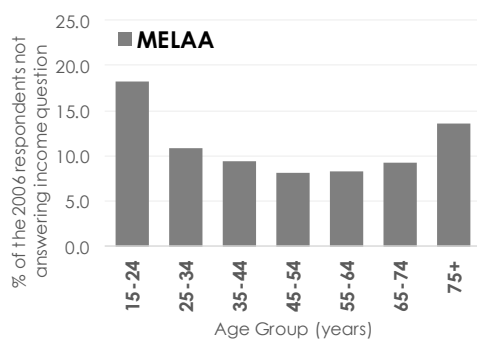
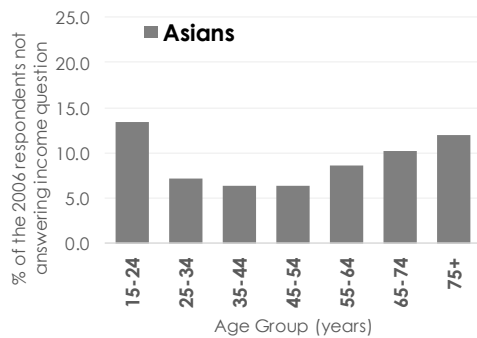
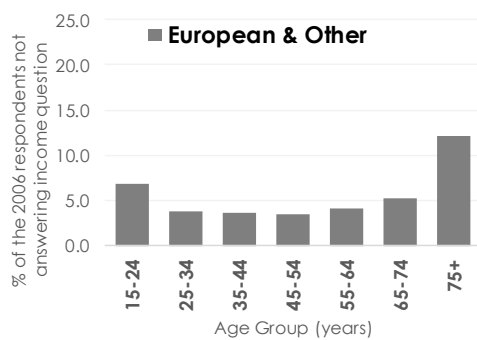
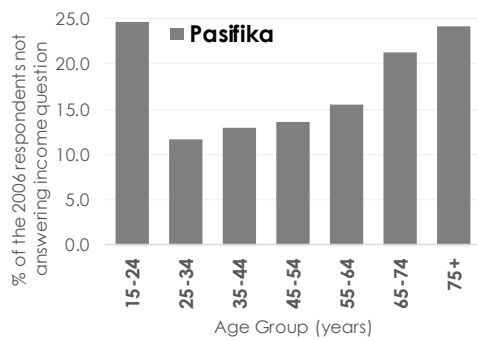
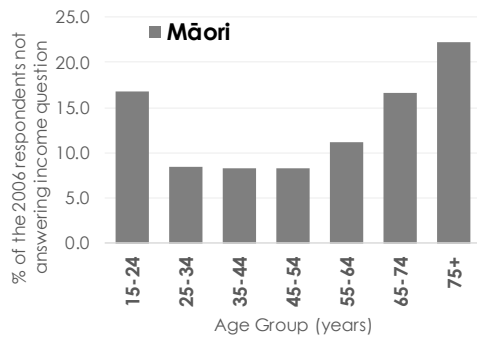
Figure 7.12 disaggregate the ethnicity specific item non-response rates at the 2013 and 2006 censuses by major age groups. At the 2013 Census, the pattern of non-response is similar across all ethnic groups with higher rates among the two oldest (65-74 and 75+ years) and youngest (15-24 years) age groups. Pacific Islander and Māori respondents aged 65-74 and 75+ years had substantially higher (double or more) item non-response rates than other ethnicities, with two out of every 10 census respondents aged 75+ years not answering the income question.

Among the youngest 15-24 year age group, rate of item non-response is highest among the Pacific Islanders and MELAA population groups with over one in every 10 not answering the income question. Non-response rates in this youngest age group have declined substantially over the intercensal period across all ethnic groups. The decline is not as remarkable for the other age groups and this is probably an artefact of the change in

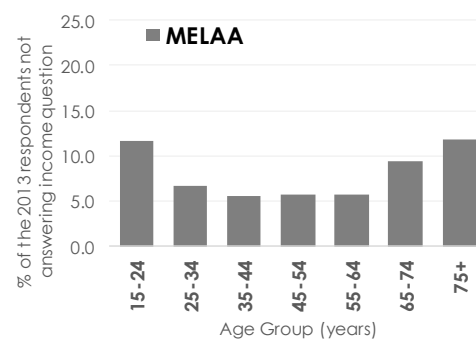
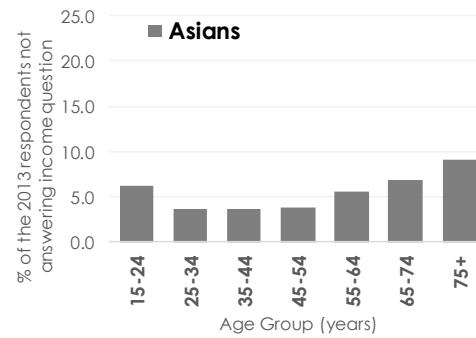
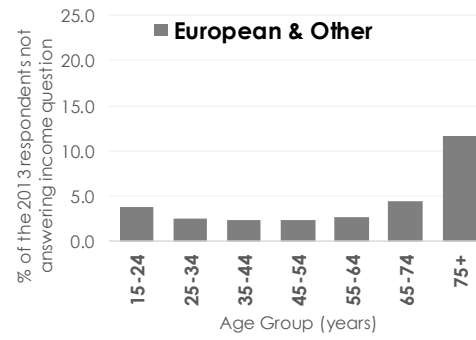
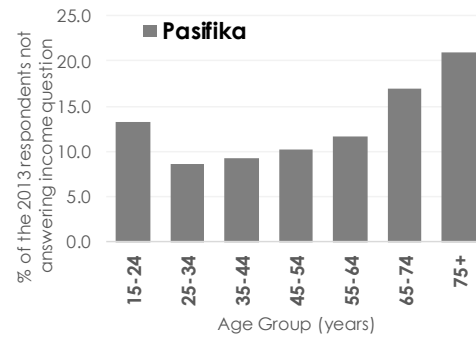
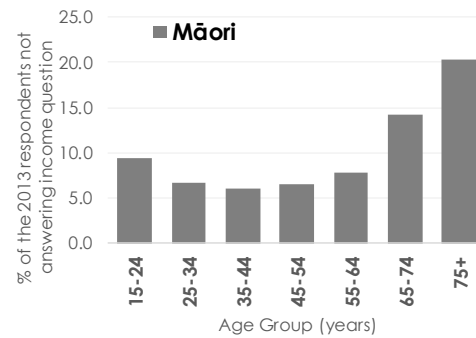
coding practice adopted in 2013 – a substantially higher proportion of 15-24 year olds (compared to other age groups) have no source of income (one in four at the 2013 Census (see Appendix Figure 2) and as a result, a much higher proportion of non-respondents to the income question were likely to be recoded to 'Zero Income' instead of 'Not Stated'.

**Figure 7.12 Rate of item non-response to the question on personal income for major ethnic groups disaggregated by age; Census 2006 and 2013**

**Census 2006**



**Census 2013**



### **7.3 Socio-economic profile of item non-respondents to income question**

This section compares the socio-economic characteristics, namely, birthplace, source of income, qualifications, work & labour force status and occupation, of the item non-respondents with that of the item respondents, to identify any differences in the characteristics of these two groups.

It should be noted that the time reference periods are different for income variables and for other variables that may be cross-tabulated with income variables. For example, 'Work and labour force status' relates to the week prior to census day, while personal income relates to the preceding 12 months ending 31 March. It cannot therefore be assumed that someone employed in the previous week was employed all year (Statistics New Zealand, 2013).

#### **7.3.1 Birthplace of item non-respondents to income**

The question on birthplace<sup>13</sup> underwent a change between the 2006 and 2013 Censuses. As a response option, at the 2013 Census, India replaced Scotland, and China was moved up in the response option list, with India listed below China (Statistics New Zealand, 2010) (Refer to Appendix Table 12 for the change in the two census years). With the exception of the Cook Islands, which is included for reasons of data quality, the countries listed as response options on the census form are derived from the seven most common responses at the previous census. For the purposes of this thesis, the birthplace responses have been broadly grouped as New Zealand and Overseas (United Kingdom, Ireland & Rest of Europe, Asia, Pacific Islands, Africa and the Middle East and Australia, Northern America & Other).

Figure 7.13 shows the profile of the item respondents and non-respondents to the income question disaggregated by the broad birthplace grouping – New Zealand and Overseas. Underlying data is in Appendix

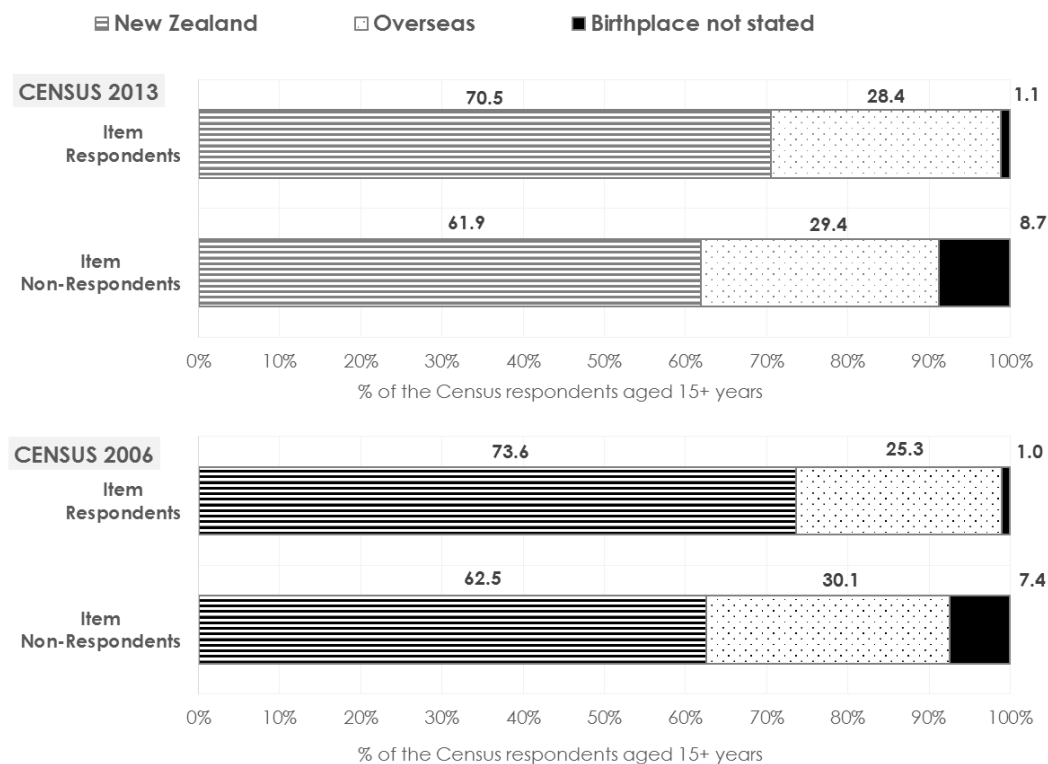
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<sup>13</sup> Question 9 on the Census Individual form "Which country were you born in?"

Table 13. People born overseas are over-represented among the non-respondents, that is, they are less likely to answer the income question. This pattern holds true for both census years. It is interesting to note that people who answer the question on birthplace (question 9 on the census individual form in 2013) are more likely to go on to answer the income question (question 31). Of the 161,826 people who did not answer the income question at the 2013 Census, 8.7 per cent also did not answer the question on birthplace. The proportion of these 'double item non-respondents' has increased slightly from the 7.4 per cent recorded at the previous census.

For all subsequent analysis on non-response rates in this section, the people who did not answer the birthplace question are excluded.

**Figure 7.13 Birthplace profile of the item non-respondents and item respondents to the income question, Census 2006 and 2013**



For respondents born in both New Zealand and overseas, the item non-response rates to the income question in 2013 are higher among women than men as seen in Figure 7.14 (see Appendix Table 14 for underlying data). This disparity is slightly more pronounced among New Zealand born compared to the residents born overseas.

**Figure 7.14 Rate of item non-response to income disaggregated by sex and birth place, Census 2013**

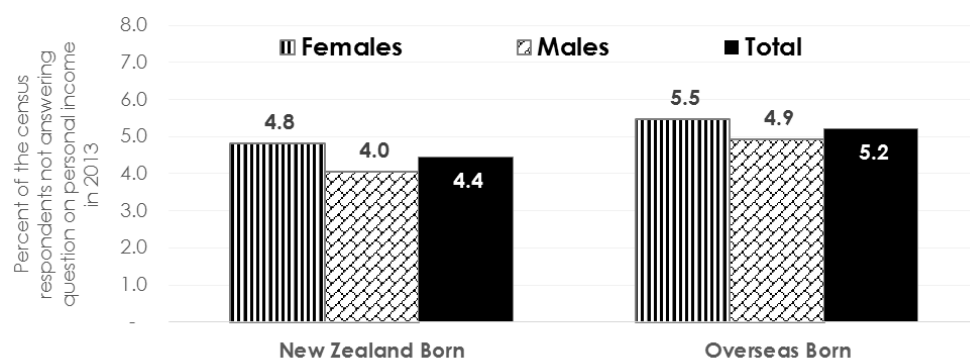
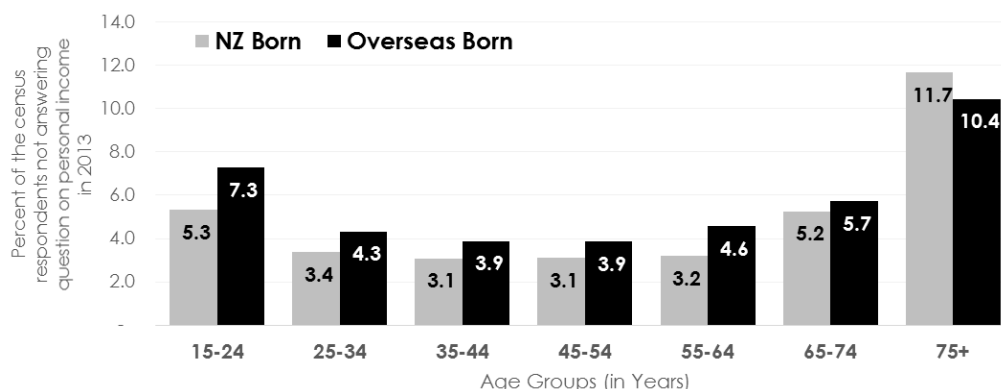


Figure 7.15 disaggregates the non-response rates in 2013 for New Zealand and overseas born census respondents by age (the underlying data are in Appendix Table 15). The overall age specific pattern is similar for both groups with higher non-response rates at the youngest and oldest age groups as was the case nationally. At all age groups except the oldest, 75+ years, overseas born residents are more likely to provide a valid response to the income question and this disparity is most in the 15-24 and 55-64 year the groups. Close to half (46.2 per cent, Source: Statistics New Zealand) of the overseas born residents aged 15-24 years are not in the labour force and therefore most likely to be students who are in the country for education purposes and could possibly perceive the income question to be either too hard or irrelevant to themselves.

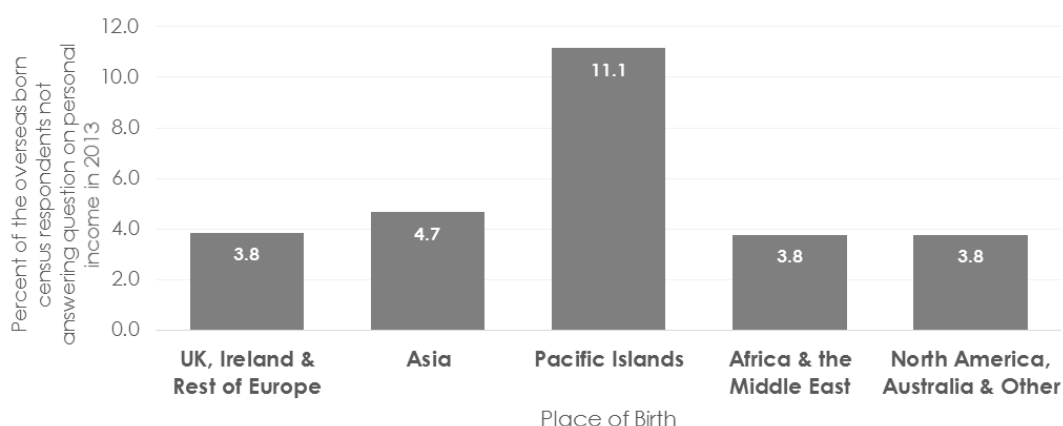
It is only in the oldest group of 75+ year olds that the likelihood of not answering the income question is more prevalent among New Zealand born residents compared to those born overseas.

**Figure 7.15 Rate of item non-response to income disaggregated by age group and birth place, Census 2013**



Looking at the census respondents born overseas, Figure 7.16 disaggregates the item non-response rates in 2013 by the five broad birthplace groupings: United Kingdom (UK), Ireland & Rest of Europe; Asia; Pacific Islands; Africa and the Middle East; and Australia, Northern America & Other. People coming from the Pacific Islands have notably higher rates of non-response to the income question, with over one in 10 (11.1 per cent) not answering in 2013. This finding is consistent with the high rates of non-response found among people identifying with the Pasifika ethnic grouping noted earlier. The item non-response rate among people born in the Pacific Islands (which is the third biggest overseas born group after those born in UK & Ireland and Asia), is around 2.5 times that of the four other groups of overseas born residents. Respondents born in Asia have the second highest rate of item non-response, 4.7 per cent.

**Figure 7.16 Rate of item non-response to income disaggregated by place of birth for the overseas born respondents, Census 2013**



### 7.3.2 Sources of personal income of item non-respondents to income

Sources of personal income identifies the various sources from which a person aged 15 years and over received income in the 12 months ending 5 March 2013 (at Census 2013).<sup>14</sup> The sources are categorised as:

- No source of income during that time
- Wages, salaries, commissions, bonuses etc
- Self-employment or business
- Interest, dividends, rent, other investments
- Payments from a work accident insurer
- NZ superannuation or veterans pension
- Other superannuation, pensions, annuities
- Unemployment benefit
- Sickness benefit
- Domestic purposes benefit
- Invalids benefit
- Student allowance
- Other government benefits, payments or pensions,
- Other sources of income

Sources of personal income is a multiple response question and when more than one source of income is reported, each source is counted for that individual. This means that in sources of personal income tables, the sum of people will exceed the total number of people or families (Statistics New Zealand, 2013). Additionally, the cross-tabulation of sources of income with total personal income needs to be treated with caution as people may obtain income from more than one source and for different periods of time.

Figure 7.17 shows the profile of the item respondents and non-respondents to the income question disaggregated by the sources of income. Underlying data are in Appendix Table 16. As noted earlier, a change in coding practice adopted by Statistics New Zealand for the 2013 Census dataset resulted in all the item non-respondents to income who

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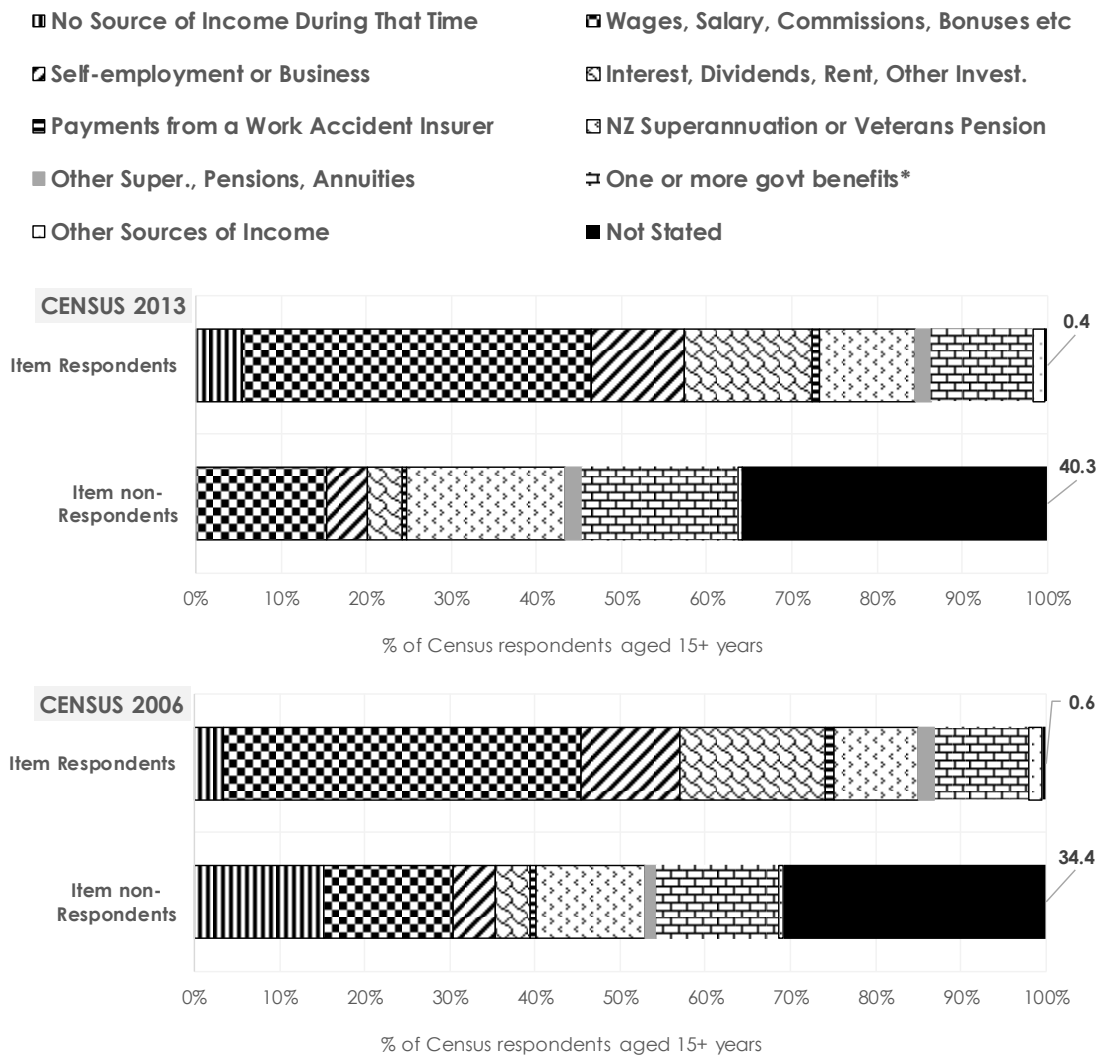
<sup>14</sup> Derived from question 30 on the Census 2013 Individual Form, 'Mark as many spaces as you need to show all the ways you yourself got income in the 12 months ending today'

selected 'No Source of Income' to the previous question being recoded to 'Zero Income' rather than 'Not Stated'. Consequently, the sources of income profiles of item non-respondents at the two censuses are not comparable. However, a similar pattern of certain groups over-represented among non-respondents can be seen at both censuses. People on NZ Superannuation or Veterans Pension and/or one or more government benefits (Unemployment, Sickness Domestic Purposes, Invalids, Student Allowance and Other Govt Benefits, Payments or Pension) are over-represented among census respondents who do not provide a valid response to the personal income question.

Two out of every five (40.3 per cent of the 161,826) census respondents who did not answer the income question at the 2013 Census also did not provide a valid response to the question on sources of income. This proportion has increased from the 34.4 per cent recorded at the 2006 Census. Therefore, a person not answering the question on sources of income is very likely to also not answer the subsequent question on personal income. Only 0.4 per cent of the people who answered the sources of income question in 2013 did not answer the personal income one and this proportion is similarly low in 2006.

For all subsequent analysis on non-response rates in this section, the 'double' item non-respondents are excluded, which means that the calculated rates are only partially representative of the population of item non-respondents who did not answer the personal income question.

**Figure 7.17 Sources of income profile of the item non-respondents and item respondents to the income question, Census 2006 and 2013**



\* Unemployment Benefit, Sickness Benefit, Domestic Purposes Benefit, Invalids Benefit, Student Allowance, Other Govt Benefits, Payments or Pension

Figure 7.18 shows the Census 2013 item non-response rates disaggregated by sex and sources of income. Underlying data, including data for Census 2006, can be found in Appendix Table 17. In the 2013 Census dataset, all item non-respondents to personal income self-identifying as having no source of income have been re-coded by Statistics New Zealand to 'Zero income'. However, looking at the 2006 data set, where this recoding was not carried out, the non-response rates were highest among respondents with no sources of income, with one in

five (20.6 per cent, see Appendix Table 17) not answering the personal income question.

Item non-response to income is notably higher among census respondents who categorise themselves as recipients of one or more government benefits; namely, unemployment, sickness, domestic purposes and/or Invalids. The other group with comparatively higher rate of item non-response are those who receive NZ Superannuation or Veterans Pension.

**Figure 7.18 Rate of item non-response to income disaggregated by sex and sources of income, Census 2013**

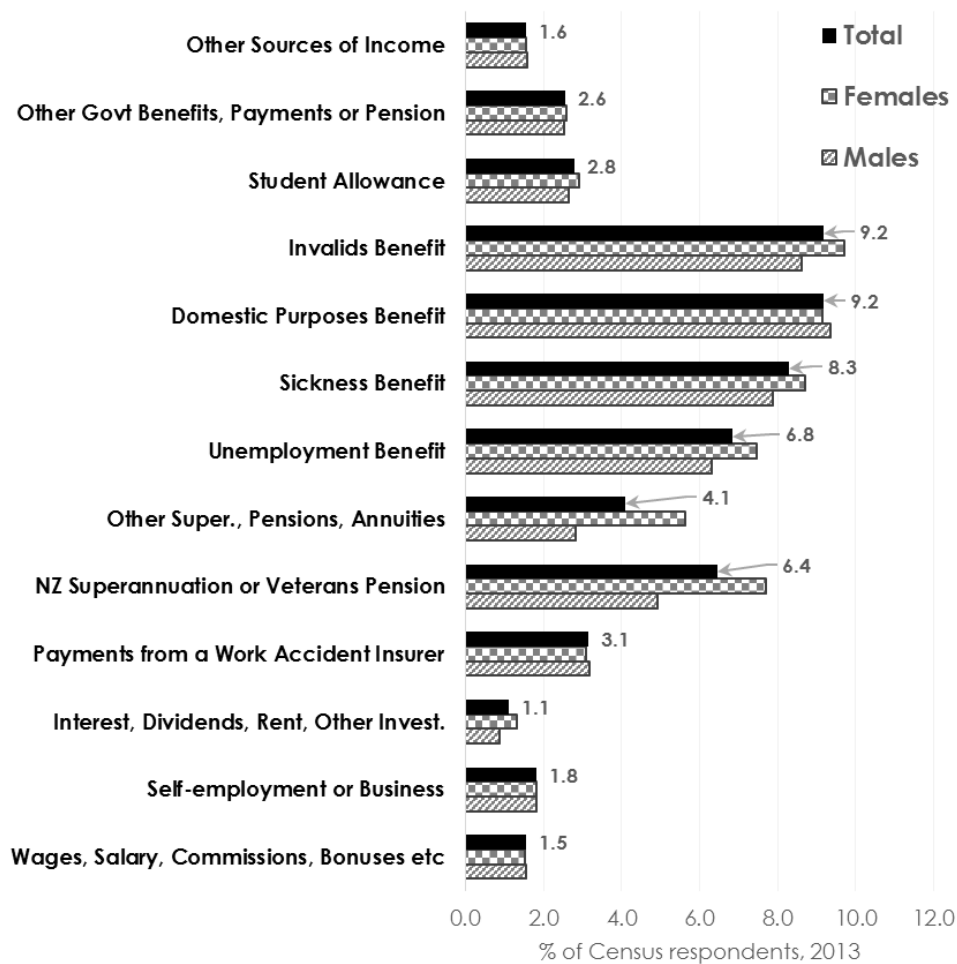


Figure 7.19 disaggregates the item non-response rates by age group and sources of income (underlying data in Appendix Table 18). A substantial majority of New Zealand residents receiving NZ Superannuation or Veteran's Pension are aged 65 or more. However, people aged less than 65 years can be eligible for either of these two benefits.<sup>15</sup> In 2013, around 13,752 people aged less than 65 years (0.4 per cent of the total 3,212,316 census respondents aged 15+ years) selected 'NZ Superannuation or Veterans Pension' when answering the question on sources of income. As per the data held by the Ministry of Social Development, in March 2013, the number of residents aged 65+ years receiving either superannuation or Veteran's Pension is very similar to the number recorded by the Census.<sup>16</sup> This means that the self-reported data on sources of income is likely to be fairly accurate and representative of the true picture.

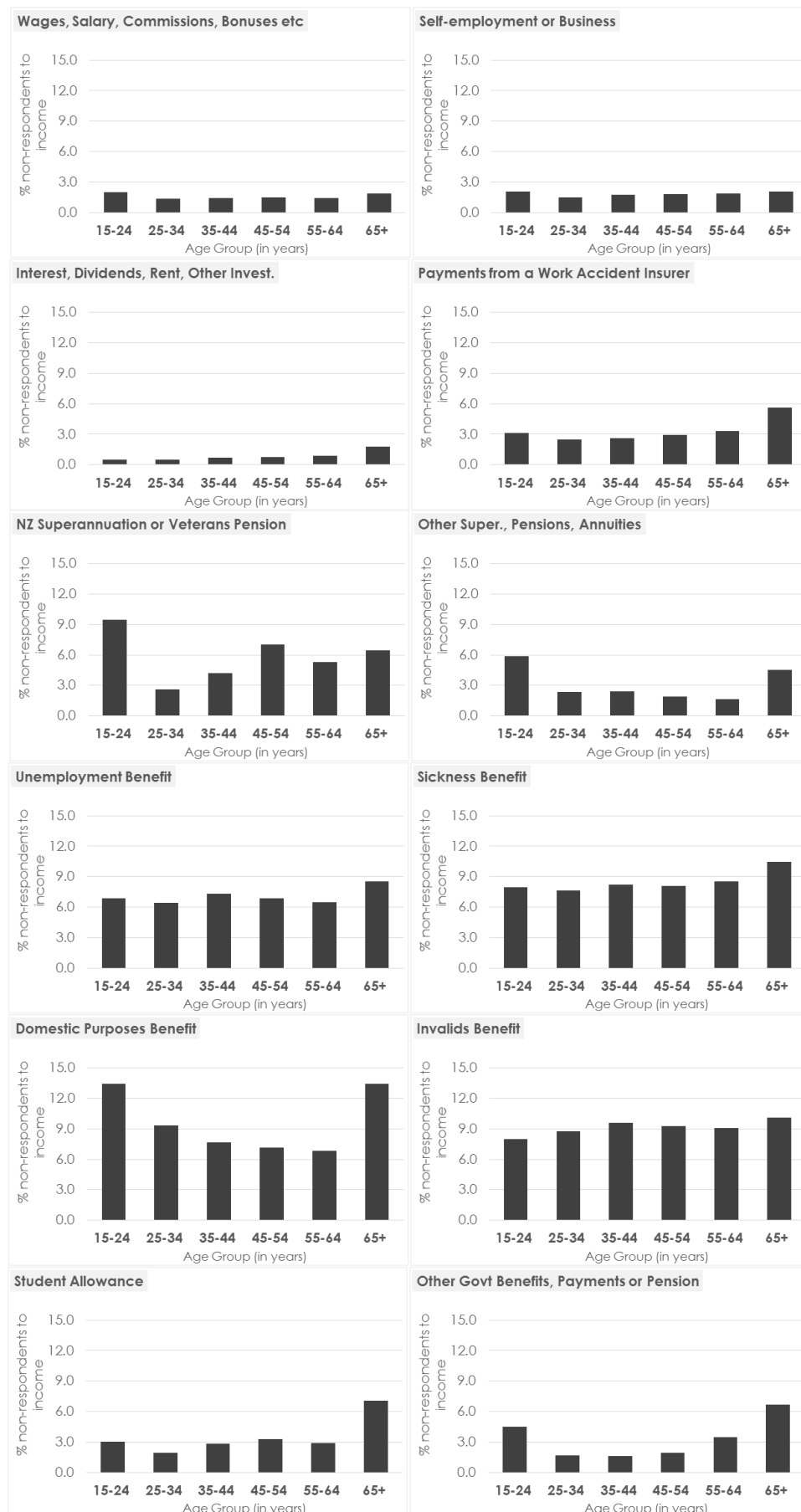
Irrespective of age, non-response to the personal income question was highest among respondents receiving one or more government benefits, namely NZ Superannuation or Veteran's Pension, Unemployment, Sickness, Domestic Purpose and/or Invalids. Factors that affect response rates to sensitive questions like personal income, such as threat of disclosure and/or the perceived social (un)desirability of the response, are more likely to affect respondents whose source(s) of income is government funded benefits. It is also likely that people receiving these benefits find it difficult to accurately assess their annual personal income and therefore are unable to provide a response.

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<sup>15</sup> <http://www.msd.govt.nz/what-we-can-do/seniorcitizens/entitlements/nz-superannuation/index.html#IncludingyourpartnerinyourNZSuper4>

<sup>16</sup> Source: David Conwell, Senior Analyst, Business Reporting Team, Insights MSD Group, Ministry of Social Development, Wellington; email correspondence, 4 November 2015.

**Figure 7.19 Rate of item non-response to income disaggregated by age group and sources of income, Census 2013**



### 7.3.3 Highest qualification of item non-respondents to income

This section looks at the highest qualifications of the item non-respondents in 2013. A qualification is defined as requiring full-time equivalent study of three months or greater. 'Highest qualification' is derived for people aged 15 years and over, and combines highest secondary school qualification and post-school qualification to obtain a single highest qualification by category of attainment.<sup>17</sup> The Census 2013 qualification data is fully comparable with 2006 Census data, but has limited comparability with 2001 and 1996 due to changes in the classifications used for each of the variables and changes in the way the data has been collected (Statistics New Zealand, 2013). For the purposes of this thesis, the Highest Qualification responses have been collapsed into four categories: No qualifications, School qualifications, Vocational qualifications (including certificates and diplomas gained post school) and Bachelor degree & higher.

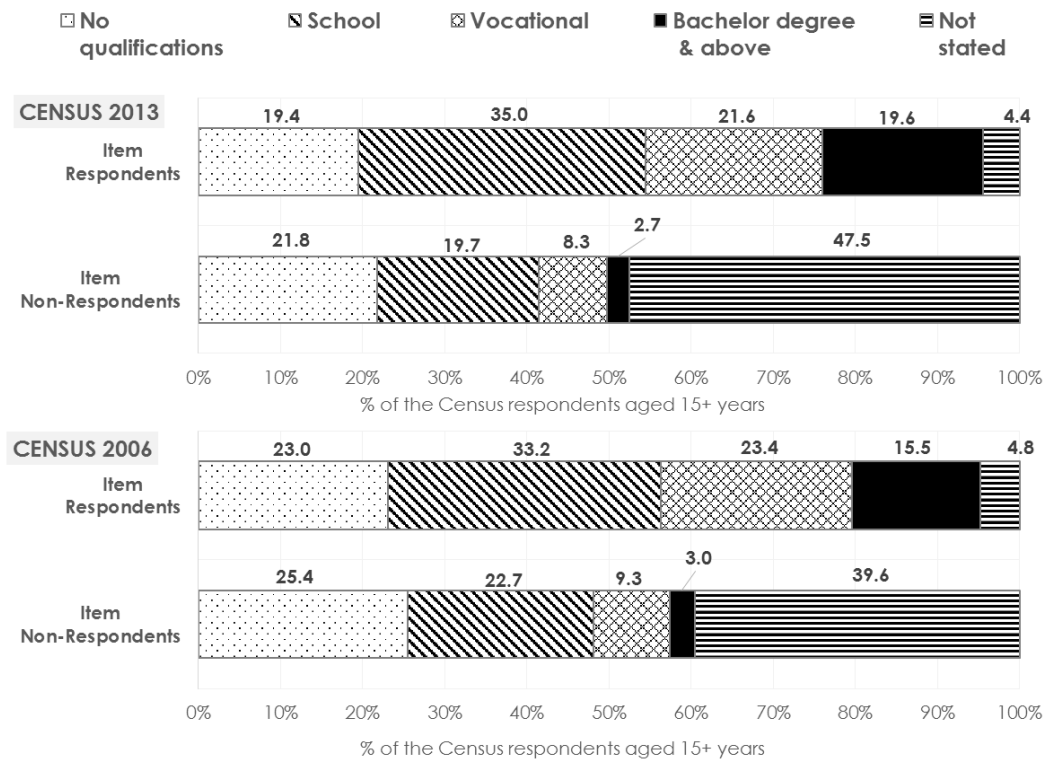
Figure 7.20 shows the highest qualification profile of the item respondents and non-respondents to the income question in 2006 and 2013 (underlying data in Appendix Table 19). The overall pattern is similar at both census years with people with no qualifications over-represented among item non-respondents and those with at least a Bachelor's degree or higher notably under-represented.

Of the 161,826 people who did not answer the income question at the 2013 Census, almost half (47.8 per cent) also did not provide a valid response to the qualification questions. The proportion of these 'double item non-respondents' has increased from 39.6 per cent recorded in 2006. Due to this high rate of non-response to the qualification questions among the item non-responders to income, the rates presented in Figure 7.21 and Figure 7.22 are representative of only around half of this population.

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<sup>17</sup> Derived from questions 26 (What is your highest secondary school qualification?), 27 (Apart from secondary school qualifications, do you another completed qualification?) and 28 (Print your highest qualification, and the main subject) on the 2013 Census individual form.

**Figure 7.20 Highest qualification profile of the item non-respondents and item respondents to the income question, Census 2006 and 2013**

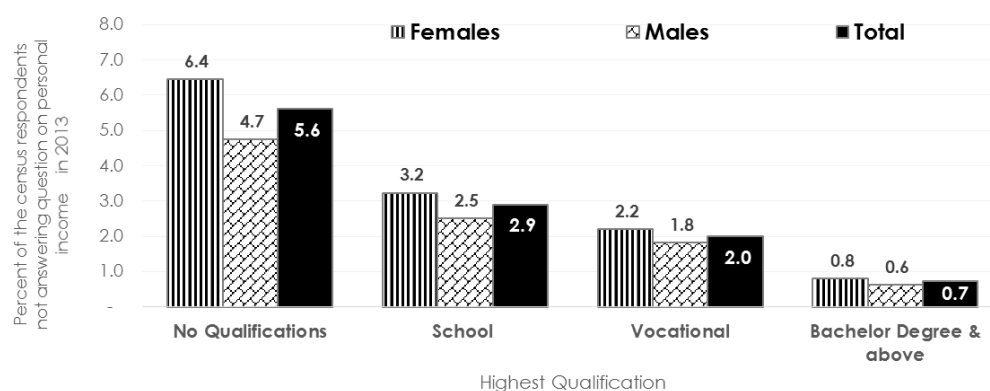


As indicated, the 2013 Census item non-response rates presented in Figure 7.21 and Figure 7.22 are based on only just over half of the item non-respondents and therefore may not be fully representative of the total group of people not answering the question on personal income. The underlying data for these figures can be found in Appendix Table 21.

The item non-response rates decline rapidly with increasing level of qualification. This is consistent with findings by Sousa-Poza & Henneberger (2000) that non-response probabilities are significantly higher for respondents with low education. On the other hand, the non-response rates are extremely low among respondents with a University qualification, with less than one in 10 not responding (0.7 per cent).

Conforming to the overall non-response pattern, irrespective of their levels of qualification, women are more likely than men to not answer the income question. This disparity is, however, much more marked among those with no qualifications.

**Figure 7.21 Rate of item non-response to income disaggregated by sex and highest qualification, Census 2013**



The age-specific rates of item non-response to income at the 2013 Census for the four qualification groups are presented in Figure 7.22. The overall age-specific pattern of higher non-response among the youngest (15-24 years) and two oldest (65-74 and 75+) age groups is mirrored by the groups whose respondents have at minimum a school qualification. However, the pattern is very different for respondents with no formal qualifications, with non-response rates highest over the prime working age population of 25-44 year olds and oldest 75+ year group.

The unemployment rate<sup>18</sup> (as recorded at the 2013 Census) is the highest among respondents aged between 25-44 years who have no qualifications, ranging from 11.6 to 16.2 per cent compared to only 3.1 – 7.6 per cent among those in the same age group but having some formal qualifications.<sup>19</sup> Respondents aged 25-44 years who have no qualifications and are unemployed are likely to be on no or very low incomes, and consequently factors highlighted by Tourangeau et al. (2000) such as the perceived social (un)desirability of the response could therefore result in the very high non-response to a sensitive question like personal income.

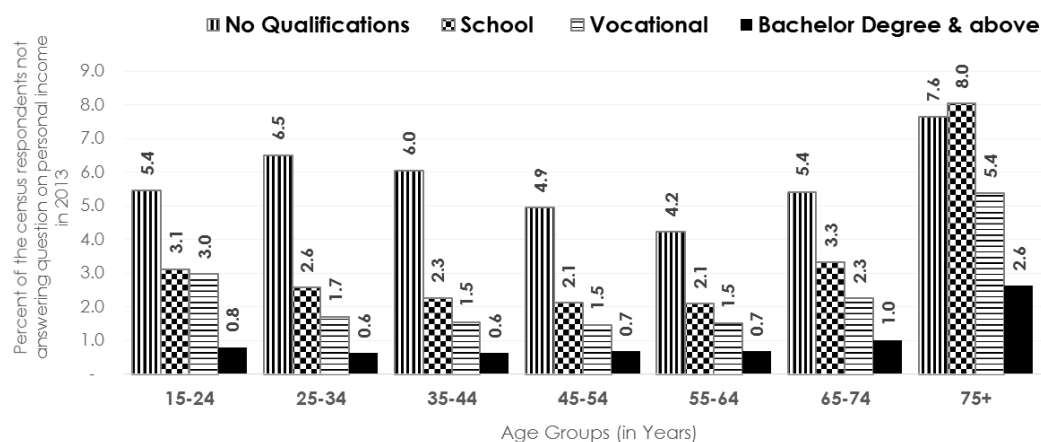
<sup>18</sup> Unemployment rate = (Number unemployed ÷ Number in the Labour Force)\*100. The force includes the people who are employed and those who are unemployed and actively seeking work.

<sup>19</sup> Source: Statistics New Zealand/NZ.Stat Dataset: Work and labour force status and highest qualification by age group, for the census usually resident population count aged 15 years and over, 2013 Census (RC, TA)

Another factor to be taken into consideration is the very high proportion of the respondents aged 25-34 and 35-44 years who reported receiving one or more government benefits<sup>20</sup> as a source of income at the 2013 Census: 20.5 and 18.1 per cent respectively, compared to a range of 4.3 to 13.8 per cent rates recorded for other age groups (see Appendix Figure 9 for the proportion of 15+ year respondents in 2013 who reported receiving one or more government funded benefits as a source of income disaggregated by age and sex). Therefore, the perceived threat of disclosure can plausibly be a factor partially responsible for the high non-response rates among 25-44 year olds.

The unemployment rate is also the highest for the youngest (15-24 years) age group of respondents with no qualifications (30.6 per cent), as compared to those with some formal qualifications (8.7 to 18.2 per cent). These unemployed youths are likely to be receiving one or more government benefits and consequently, as noted above, their response to a question on their personal income could probably be affected by factors such as the threat of disclosure or the perceived social (un)desirability of the response. This possibly explains the much higher rate of item non-response of 5.4 per cent among 15-24 year olds with no qualifications (compared to 0.8 to 3.1 per cent among those with qualifications).

**Figure 7.22 Rate of item non-response to income disaggregated by age group and highest qualification, Census 2013**



<sup>20</sup> Unemployment benefit, Domestic purposes benefit, Sickness benefit, Invalids benefit and Other government benefits, payments, pensions

The age specific rates of non-response to income at the 2013 Census presented in Figure 7.22 are further disaggregated by sex in Table 7.5. The highest rate of item non-response is among females with no qualifications aged between 15-44 and 65+ years (6.0 to 8.6 per cent). The noticeably higher rates of item non-response of residents aged 25-34 and 35-44 years having no qualifications (noted above in Figure 7.22) are a result of the much higher contribution to the non-response by women in these age groups, especially those aged 25-34 years. As Appendix Figure 9 shows, a very high proportion of women aged 25-34 and 35-44 reported receiving some form of government benefit, 28.0 and 23.3 percent respectively at the 2013 Census, which in turn is likely to affect the response to the income question. In comparison, among men in the same age groups, only 12.3 and 12.1 were recorded in 2013 as recipients of one or more government benefits.

**Table 7.5 Age specific rate of non-response to the personal income question disaggregated by highest qualification and sex, Census 2013**

		15-24	25-34	35-44	45-54	55-64	65-74	75+
<b>No Qualifications</b>	Female	6.7	8.6	7.1	5.4	4.5	6.0	8.5
	Male	4.4	4.8	5.2	4.5	4.0	4.7	6.3
<b>School Qualifications</b>	Female	3.5	2.9	2.4	2.2	2.2	3.8	9.6
	Male	2.7	2.3	2.1	2.1	1.9	2.7	5.7
<b>Vocational Qualifications</b>	Female	3.7	2.0	1.6	1.5	1.5	2.3	6.3
	Male	2.3	1.4	1.5	1.5	1.5	2.2	4.6
<b>Bachelor Degree &amp; above</b>	Female	0.8	0.6	0.7	0.8	0.8	1.4	3.9
	Male	0.7	0.6	0.5	0.6	0.6	0.7	1.8



**LOW**  
(< 4.0%)



**MEDIUM**  
(4.0% - 5.9%)



**HIGH**  
(6.0% or more)

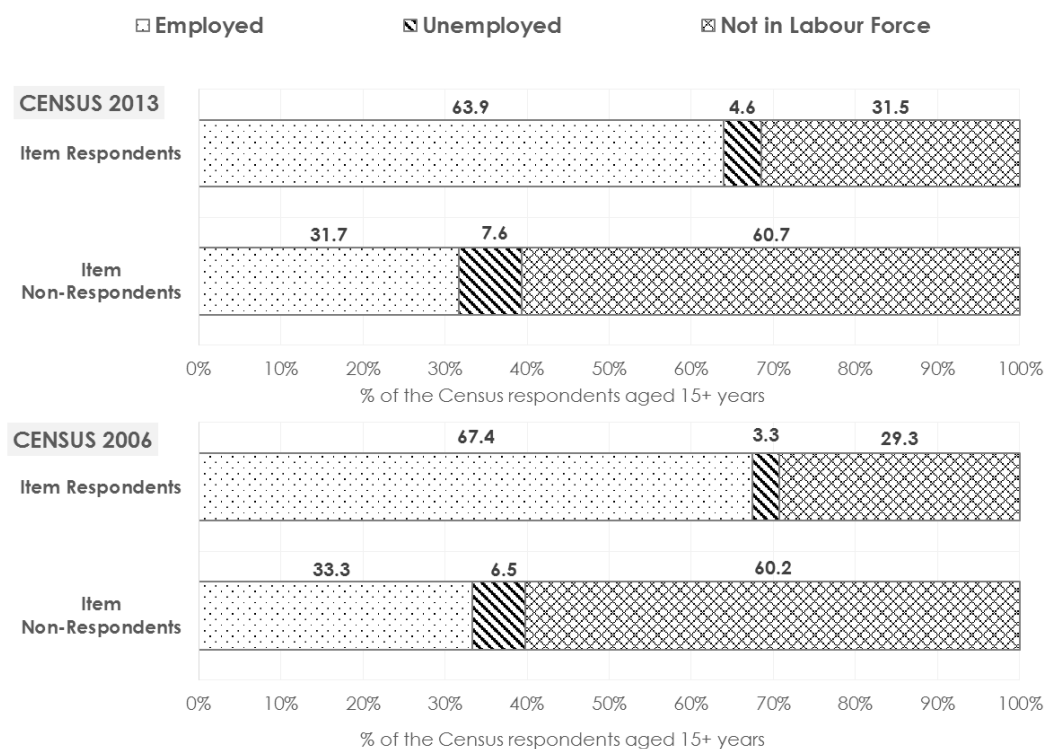
### **7.3.4 Work and labour force status of item non-respondents to income**

This section looks at the Work & Labour Force (LF) status of the item non-respondents in 2013. Work & LF status classifies a person aged 15 years and over as Employed (part time and full time), Unemployed (and actively seeking work) and Not in the Labour Force. This variable was derived from question 32 (job indicator), question 40 (hours worked), question 43 (seeking paid work), question 44 (job search methods) and question 45 (availability for work) on the individual form in 2013.

As noted earlier in Section 1.3 *Imputation of variables*, the Work & LF status is the only variable, apart from age, sex and mesh-block, for which the item non-responses are imputed for the census respondents who returned completed forms but did not provide a valid response to the particular questions from which this variable is derived. In cases where the respondent (aged 15+ years) either does not answer or gives an invalid answer to one or more of the five questions from which the Work & LF status is derived, or does not return an Individual Form but a Dwelling Form is completed and returned, their Work & LF status is imputed by looking at related questions that have been answered. In 2013, the Work & LF status was imputed for 5.5 per cent of the census respondents. The 'Not Stated' or the 'Work & LF status unidentifiable' category for this variable only pertains to the substitute records which were created, and are therefore excluded from the analysis presented below.

Figure 7.23 shows the Work & LF profile of the item respondents and non-respondents to the income question in 2006 and 2013 (underlying data in Appendix Table 22). In both 2006 and 2013, the people who are not in the labour force are notably over-represented among the item non-respondents to the income question. Although much smaller in magnitude, the same is the case with people who are unemployed.

**Figure 7.23 Work and labour force status of the item non-respondents and item respondents to the income question, Census 2006 and 2013**



The item non-response rates to the income question in 2013 disaggregated by sex and Work & LF status is shown in Figure 7.24. Underlying data can be found in Appendix Table 23. Non-response is lowest among people who are employed, with men marginally less likely to answer the personal income question than women. Not shown here but this pattern was also seen at the 2006 Census. The rate of item non-response is two to three times higher for the two other groups (Unemployed and Not in the Labour Force), with very less or no disparity between the sexes. Perceived social (un)desirability of the response may be a contributing factor, or in the case of people not in the labour force, a big proportion of whom are likely to be students, it is plausible that the question on personal income is perceived to be either too hard or irrelevant to themselves.

**Figure 7.24 Rate of item non-response to income disaggregated by sex and Work & LF status, Census 2013**

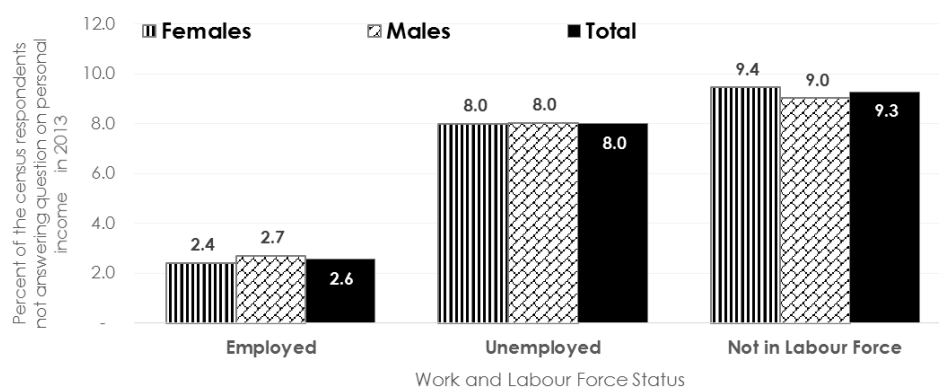


Figure 7.25 shows the income non-response rates in 2013 for the broad age groupings along with the Work & LF status (underlying data in Appendix Table 23). When disaggregated by age, differences in the pattern of non-response across the three Work & LF groups can be seen. Among the employed population and those not in the labour force, non-response is highest at the oldest 65+ year age group, whereas this trend is reversed for the unemployed, with 65+ year olds having the lowest rates of item non-response (plausibly because they have very few unemployed).

One out of every 10 census respondents aged 65+ years who are not in the labour force are likely to not answer the income question. A big proportion of this population, particularly the 75+ age group, is likely to find the income question difficult to understand and/or may have other people, who have insufficient knowledge of their income status, complete their form for them.

One of the other factor contributing to the higher rate of non-response among the employed population aged 65+ years (compared to the other age groups), might be the issue of perceived threat of disclosure (Tourangeau, Rips, & Rasinski, 2000), wherein the respondents feels there could be an adverse effect on their superannuation payment if their personal income is disclosed. The assurances of confidentiality are not always believed.

**Figure 7.25 Rate of item non-response to income disaggregated by age group and Work & LF status, Census 2013**



### 7.3.5 Status in employment of item non-respondents to income

This section looks at only the employed population to see what the employment status of the item non-respondents to income is, that is, whether they are Paid employees, Employers, Self-employed & without employees or Unpaid family workers.<sup>21</sup>

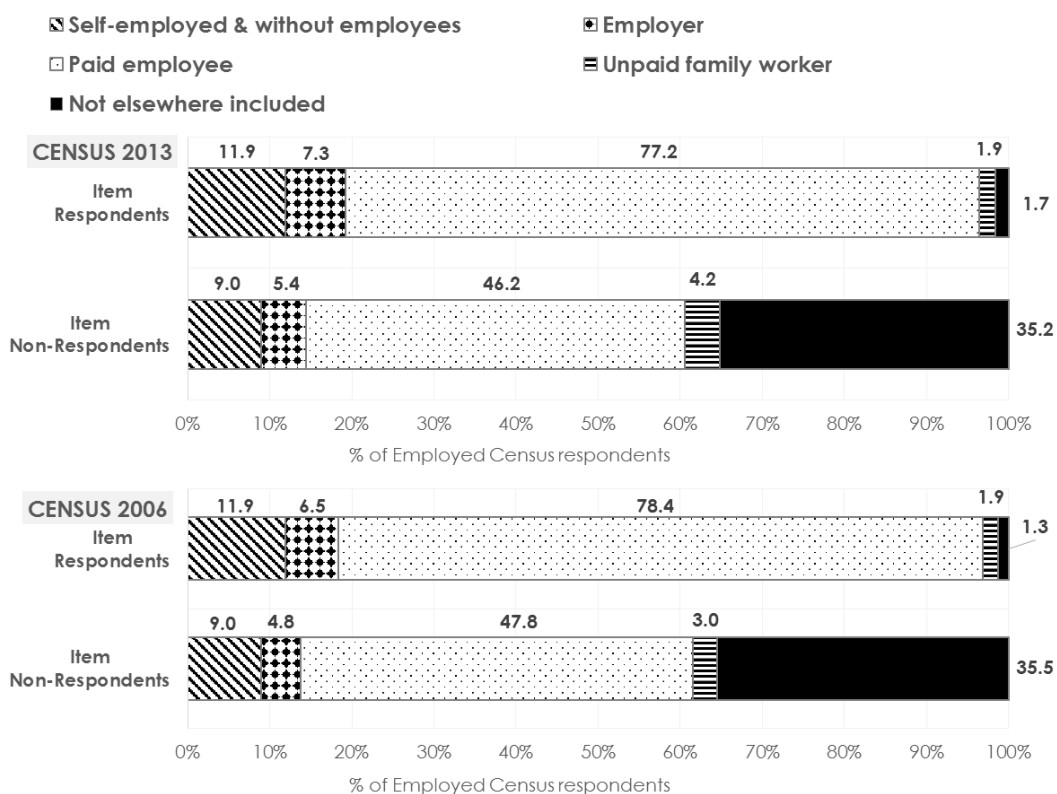
Figure 7.26 shows the status in employment profile of the item respondents and non-respondents to the income question in 2006 and 2013. Underlying data can be found in Appendix Table 25.

The profile is very similar at both census years, with respondents who are unpaid family workers over-represented among the item non-respondents. More than one-third (35.2 per cent) of the people who do not answer the personal income question (question 31 in 2013), also go on to not provide a valid response to the question on their status in employment (question 34). This pattern is mirrored at the previous census. Therefore, the item non-response rates presented in Figure 7.27 and Figure 7.28 are representative of only two-thirds the population of item non-respondents to the question on personal income. It should also be recalled that for the 2013 Census, the Work & LF status for 5.5 per cent of the total census

<sup>21</sup> Derived from question 34 on the Individual Form in 2013.

respondents is a value imputed by Statistics New Zealand, which further affects the rates.

**Figure 7.26 Employment status of the item non-respondents and item respondents to the income question, Census 2006 and 2013**



The item non-response rates in 2013 are disaggregated by sex and status in employment in Figure 7.27 (underlying data in Appendix Table 26). Rates are highest among the unpaid family workers; twice those for the other three groups. This group has also had the steepest decline in the item non-response rates (7.6 per cent in 2006 to 4.0 per cent in 2013, not shown here). One contributing factor to this will be the change in coding practice adopted in 2013. Unpaid family workers are more likely to have 'No source of income' and therefore a bigger proportion of item non-respondents to income, compared to the other three groups, will have been coded as 'Zero Income' instead of 'Not Stated'.

Overall, people who are self-employed are slightly less likely to answer the income question than those who work as paid employees (also seen in

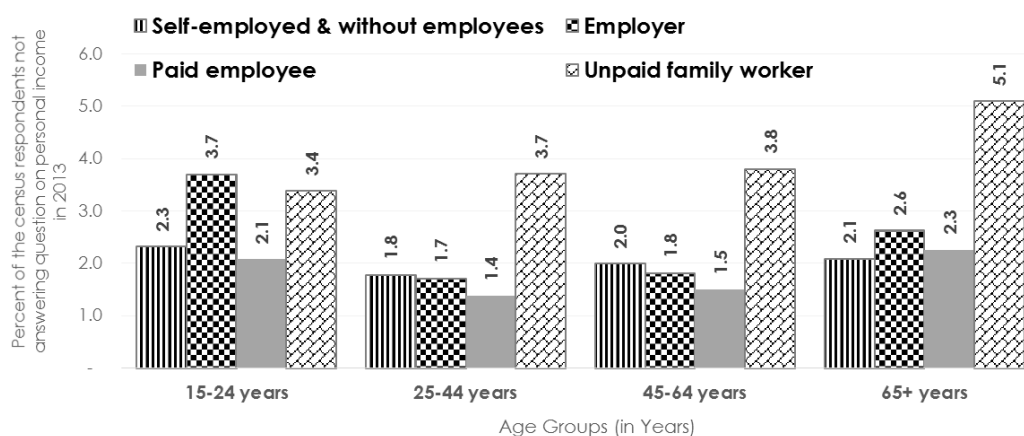
2006). One of the reasons for this may be the concern about the possible reporting of their income information to taxation authorities (Turrell, 2000; Tourangeau, Rips, & Rasinski, 2000). The propensity to not answer the income question is similar among men and women, whether they are self-employed or paid employees. On the other hand, among unpaid family workers, rates of item non-response are higher for women. This pattern is also seen for the 2006 Census (not shown).

**Figure 7.27 Rate of item non-response to income disaggregated by sex and employment status, Census 2013**



Figure 7.28 disaggregates the item non-response rates by broad age groups and employment status (underlying data in Appendix Table 27). The overall pattern of higher rates of non-response among the youngest (15-24 years) and oldest (65+ years) age groups is mirrored by those who are either self-employed or paid employees. To the contrary, the rate increases by age for people who are unpaid family workers. Among the self-employed and paid employee population who did not answer the income question, the rate of item non-response is disproportionately high for those who are aged 15-24 years and categorise themselves as self-employed with hired employees, 3.7 per cent). This pattern was noted at the 2006 Census as well.

**Figure 7.28 Rate of item non-response to income disaggregated by age group and employment status, Census 2013**



### 7.3.6 Occupation of item non-respondents to income

An occupation is a set of jobs that require the performance of similar or identical sets of tasks by employed people. This section looks at the level one grouping of the Australian and New Zealand Standard Classification of Occupations (ANZSCO) classification of occupations for the item non-respondents to the income question to see if the propensity to not answer varies across different occupations. The ANZSCO classification used in the New Zealand census datasets is:

- Level 1: Managers
- Level 2: Professionals
- Level 3: Technicians and trades workers
- Level 4: Community and personal service workers
- Level 5: Clerical and administrative workers
- Level 6: Sales workers
- Level 7: Machinery operators and drivers
- Level 8: Labourers

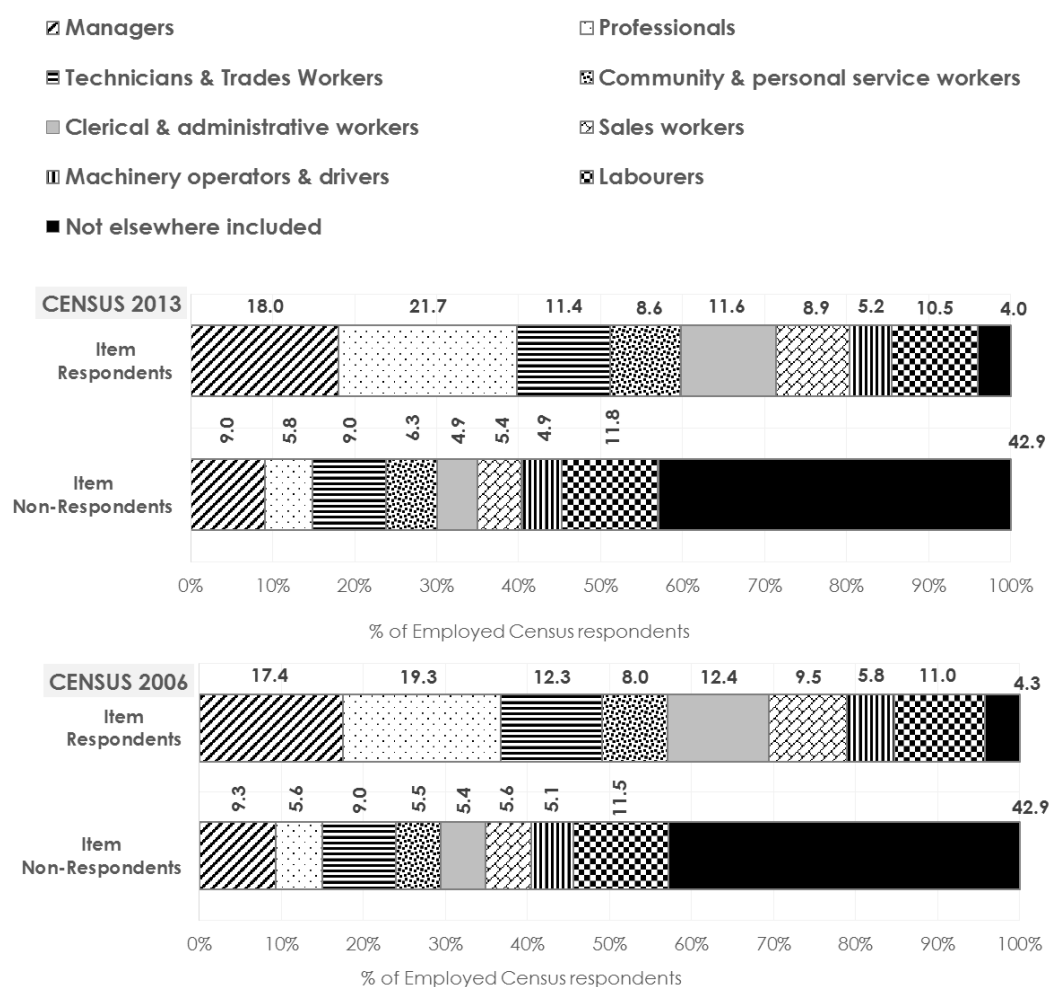
This variable is derived from question 35 on the Individual Form in 2013.<sup>22</sup> Where occupation could not be determined from the response to question 35, the response to question 36 (tasks and duties) was used.

The occupation profiles of the item non-respondents and respondents to the personal income question as recorded at the 2006 and 2013 Censuses are presented in Figure 7.29 (underlying data in Appendix Table 28). The profile is very similar at both census years with only people working as labourers slightly over-represented among the item non-respondents. Over two in every five employed people (42.9 per cent) who did not answer the question on income, also did not provide a valid response to the question on occupation. Consequently, the item non-response rates presented in Figure 7.30 and Figure 7.31 may not be very representative of the total sub-population of item non-respondents to income.

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<sup>22</sup> Question 35 on the Census Individual Form: In that job, what was your occupation, for example PRIMARY SCHOOL TEACHER, CLOTHING MACHINIST, MOTEL MANAGER, RECEPTIONIST?

**Figure 7.29 Occupation profile of the item non-respondents and item respondents to the income question, Census 2006 and 2013**



The item non-response rates in 2013 are disaggregated by sex and occupation in Figure 7.30 (underlying data in Appendix Table 29). Non response to the income question is lowest (ranging from 0.7 to 1.3 per cent) among professionals, clerical and administrative workers and people working as managers; occupations that rate higher on the scales of income and skill.<sup>23</sup> On the other hand, people working as machine operators, drivers and labourers, all lower income jobs, are twice as likely to not answer the income question (non-response rates ranging from 2.4 to 2.9 per cent).

<sup>23</sup> Occupations are 'skilled' if they are listed as skill levels one, two or three on the Australian and New Zealand Standard Classification of Occupations (ANZSCO).

Irrespective of their occupation, women are more likely than men to not respond to the question on personal income and this disparity is greatest among community and personal service workers.

**Figure 7.30 Rate of item non-response to income disaggregated by sex and occupation, Census 2013**

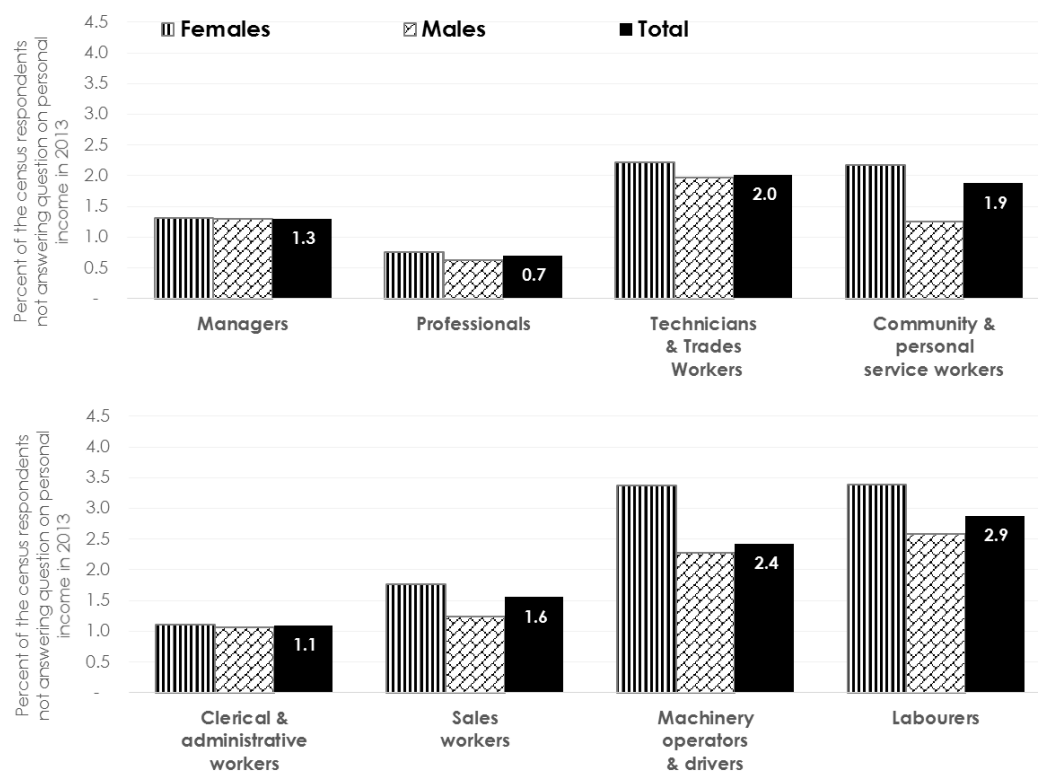
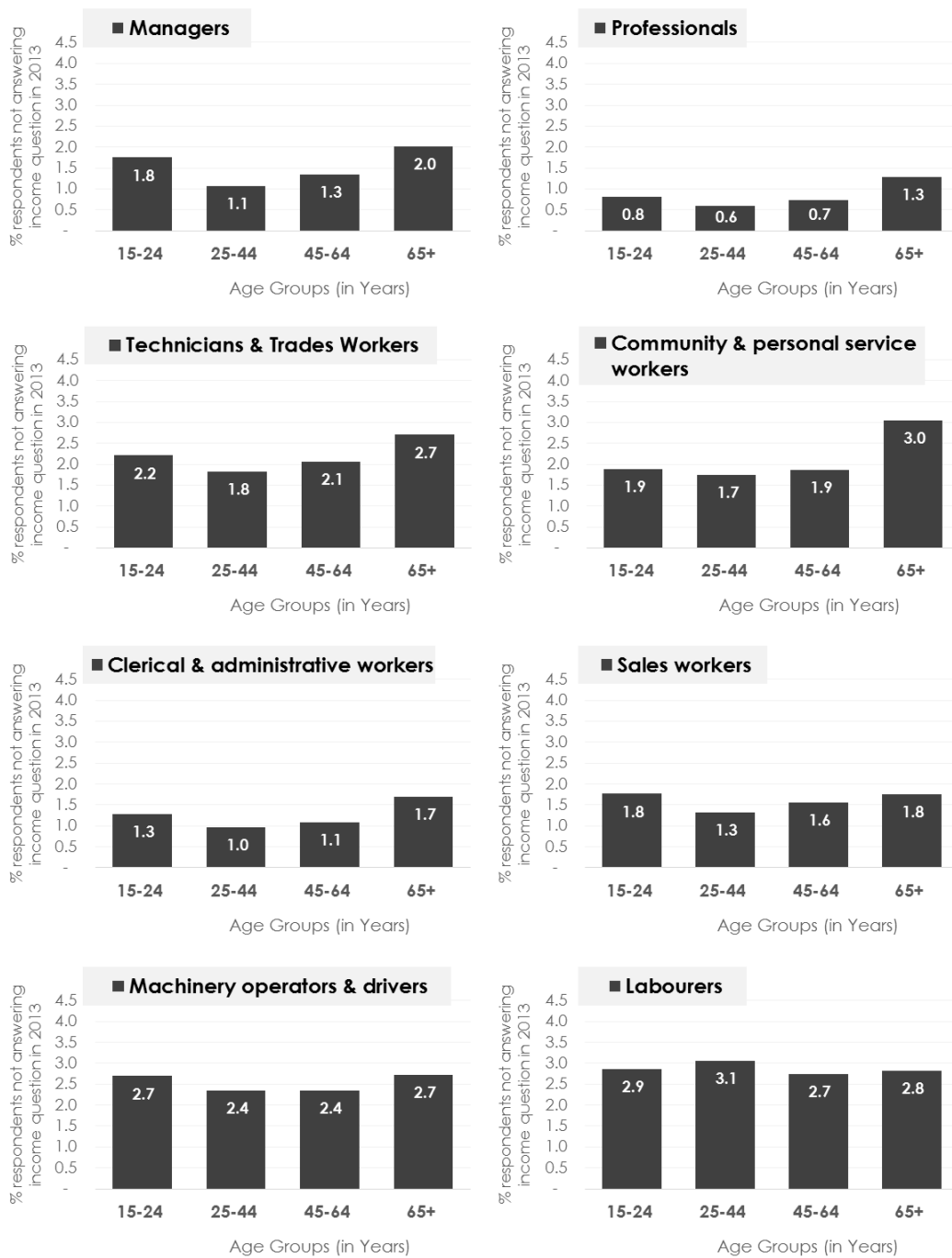


Figure 7.31 disaggregates the non-response rates by age group and occupation (underlying data in Appendix Table 30). The overall age related pattern of item non-response to income, higher rates among the youngest (15-24 years) and oldest (65+ years) age group; is mirrored by all occupations except the employed population working as labourers. The pattern is similar in 2006. Among respondents working as labourers, the highest rate of non-response (3.1 per cent) is for those in the prime working age of 25-44 years.

**Figure 7.31 Rate of item non-response to income disaggregated by age group and occupation, Census 2013**



## CHAPTER 8: SUMMARY AND DISCUSSION

The analysis and use of research outputs using census data are essential decision making tools for effective policy and planning. Within New Zealand, the census data find wide usage, for example, in the health sector for conducting need assessments for the resident population, planning of health services and funding and delivery of health initiatives. Statistics derived from a national census are vital to evaluate the progress in development and in making comparisons over time and between countries or different regions within a country. Census data can tell a powerful story about important aspects of demographic, social and economic change (Findlay, 2006).

Demographic questions are a crucial part of the census, or for that matter, any survey. They are designed to help researchers determine the factors that might influence or characterise the responses of a particular population group to a particular variable. For example, is there any specific age, sex, ethnicity or spatial pattern to the population people living in single parent families? Or is any particular population group over-represented among those living in areas of high socio-economic deprivation? Such analyses are essential for research initiatives which are aimed at looking at key issues like equity or policy decisions around service delivery and funding.

Similarly, it is of utmost importance to be able to evaluate these demographic patterns for the population who either do not respond to the census at all (unit non-responders) or who do not provide a valid response to one or more questions within the census form (item non-responders). Any analysis undertaken using the census data without also taking into account these non-respondents is likely to introduce a bias in the results which will in turn affect the 'action(s)' arising from the use of this derived information. For example, in the New Zealand context, if Māori are more likely than non-Māori to be non-respondents, then they are under-represented in the census data which will in turn adversely affect any policy decisions (resulting from the use of census data) that are based on

ethnicity as a variable. Additionally, there is the issue of imputation carried out by Statistics New Zealand to fill gaps in the data caused by unit and item non-response. Therefore, a thorough understanding of the census, the derived datasets and their limitations are essential for all users.

### **Strengths of this analysis**

This study undertakes a detailed examination of the issue of item non-response, and makes two important contributions to knowledge. It first provides researchers and analysts with an evidence base to make a more informed decision on how to deal with missing data caused by item non-response. The findings from this study give more insight into the possible impacts of excluding or including (using pro-rata apportioning or statistical techniques like imputing) the residual 'Not Stated/Not Elsewhere (NS/NEI)' category in any analysis of the different census variables, especially those with high item non-response rates. Thirdly it explores whether there are any particular socio-demographic population groups that are disproportionately represented among item non-respondents. This latter analysis is critical to consider any potential adverse impact on informed decision making: policy development, targeting and resource allocation which uses these census data. The use of routine datasets, including the Census (and related linked data sets such as those in the Integrated Data Infrastructure) are becoming of increasing importance in the drive for evidence-based practice across the sectors in New Zealand.

### **Limitations of this analysis**

This study looks at the item non-response issue related to only one variable, personal income. Testing the hypothesis that item non-response is a non-random phenomenon is one of the key objectives of this study and therefore all analyses are restricted to comparing rates and proportions to identify descriptive patterns and trends. These patterns are important to understand in order to consider further analyses of these variables, and of other aspects of the census data set. For example, using these findings as a guide, further statistical techniques such as multivariate analysis and significance testing can additionally be carried

out to ascertain the correlation of various socio-economic factors affecting item non-response to the personal income question (or to other census variables). However, such analyses were outside the scope of this study.

### **Summary of findings**

The findings from this study related to the objectives listed in Chapter two, are as follows:

#### **Objective 1: Examine whether the demographic profile (age, sex and geographical location) of unit non-respondents differs from that of item non-respondents.**

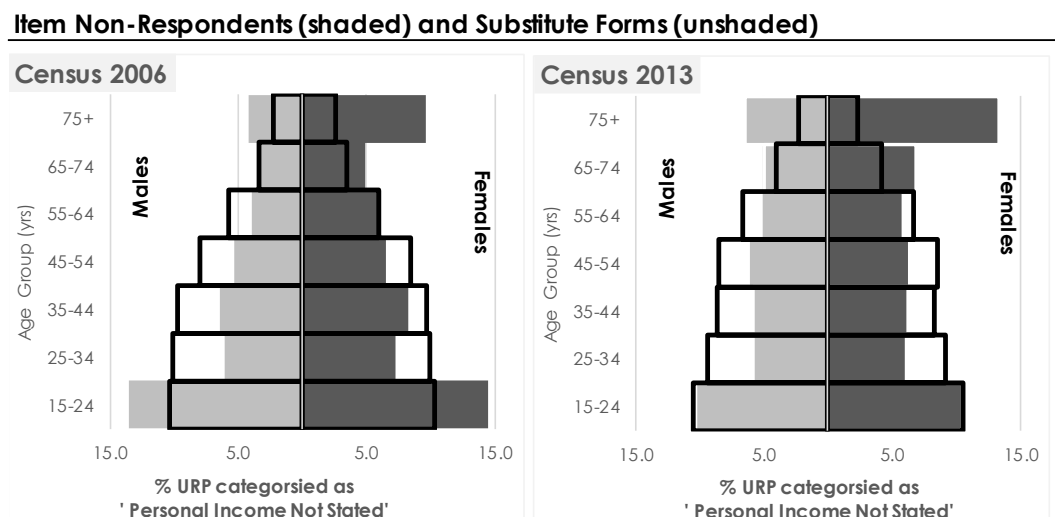
Using various techniques, for e.g. census collector's assessments, physical location of a dwelling, names on the electoral roll, etc., Statistics New Zealand estimates the number of people not counted on census night. Substitute records are then created for these estimated number of unit non-respondents to improve census coverage. These individual substitute records are the only available measure of the unit non-respondents to the census. The age, sex and mesh-block of residence are imputed for these substitutes and this study analysed these three imputed variables as a proxy measure of the age, sex and spatial characteristics of unit non-respondents.

Individual substitute records can be classified as partial or whole/full. Unlike partial substitute records where the age, sex and mesh-block of residence can be extracted from returned Dwelling Forms or other returned Individual Forms from the same dwelling using deterministic imputation techniques; these three variables for whole or full substitute records are based on collector's assessment of occupied dwellings and are imputed using stochastic or donor imputation techniques. Therefore, the age, sex and mesh-block of residence for whole substitute records are imputed using the recorded distribution of responding individuals (the census unit respondents).

The whole or full substitutes make up two-thirds of all records created. Consequently, the age, sex and spatial profile of the census unit non-

respondents (as measured by the total individual substitutes created) is skewed towards the corresponding profile of their counterparts, the census unit respondents. In view of this finding, it is not surprising that the imputed age and sex profile of unit non-respondents (substitute records) is very different to that of the item non-respondents to the income question as seen in Figure 8.1. People aged 65 years or more, particularly women aged 75+ years, are substantially over-represented among item non-respondents to income, whereas the rate of unit non-response is lower among this older population. Men are over-represented among unit non-respondents, while women are more likely to not respond to the income question.

**Figure 8.1 Age-sex profile of the item non-respondents to the personal income question and the unit respondents (substitute records), Census 2006 and 2013**



**Objective 2: Study the impact of grouping individual substitute records with the actual item non-respondents within the residual NS or NEI count for all non-imputed variables from the census.**

The NS or NEI category within any census dataset is a residual count of responses which cannot be coded or are missing altogether. The individual substitute records are therefore coded to this category for all non-imputed variables like ethnicity, income, qualification, etc. As found above, the allocated demographic profile of these substitutes is similar to that of census unit respondents and very different from that of item non-respondents who are included in the NS/NEI category. Consequently, the NS/NEI count is an aggregate of two demographically diverse population groups, the item and unit non-respondents.

Analysis of the NS/NEI category is sometimes required to be carried out by analysts for purposes such as studying the profile of item non-respondents to various census questions or to ascertain whether exclusion of this population is likely to have any significant implications, for example, the resulting allocation of resources. This is of particular importance in the case of analysis of census datasets where this residual NS/NEI category forms a significant proportion of the total URP count, for example, personal income. There are two data quality and validity issues that need to be taken into account by users of census data as each has important implications for research findings and policy development that draw from the analyses of these data:

1. Possibility of error in the creation of number of substitutes. Although not assessed for previous census years, it is estimated that 11 per cent (approximately 15,000) more than the required substitute individual records were created in 2013. This resulted in a small error in the URP estimated for 2013. The population estimates and projections, which are based on the URP count, were subsequently adjusted for this error by Statistics New Zealand (Statistics New Zealand, 2016).
2. The residual NS/NEI group is not homogeneous but an aggregate of actual item non-respondents and the substitute records. Therefore, to estimate the item non-response rates for a particular variable or to

study the characteristics of people not providing a valid response to a particular question on the census forms, it is essential to exclude the substitute records from the NS or NEI count. Analysing the NS/NEI category without excluding the substitutes will yield a higher (and inaccurate) rate of item non-response and distort the demographic profile of the item non-respondents.

Any analysis carried out without disaggregating the 'NS/NEI' count into actual item non-respondents and substitute records, it is likely to introduce bias into the dataset and affect the quality of the results.

The proportion of substitute records in the NS/NEI category differs across the census variables – the bigger the level of actual item non-response related to a particular variable, the smaller the proportion of substitute records in the NS/NEI category. For example, in 2013, 'Highest qualification' had one of the lowest proportion of substitute records in the NS/NEI category, and 'Ethnicity' one of the highest. Consequently, inclusion of the substitute records marginally changes the demographic profile of the item non-respondents (NS/NEI category as a proportion of the URP count of the target population) in the case of the 'Highest qualification' variable. However, this inclusion substantially alters the profile in the case of 'Ethnicity'. Analysis shows that not only does the pattern of item non-response vary when disaggregated by key demographic characteristics like age, sex and geographical location, the profile also varies between different variables given that the reasons for and motivation behind people not answering one or more relevant questions on a census form can be varied. Analysing the NS/NEI category for studying the patterns of item non-response and the profile of the non-respondents, without excluding the substitute records can be misleading.

Objectives three, four, five and six were explored via the detailed case study on the variable which has one of the highest rates of item non-response in the census and which finds major use in analysis related to policy development and resource allocation – personal income. Personal income is categorised as a defining variable within the census dataset and is important for policy development, evaluation, monitoring and targeting.

This variable is also used by central and local government bodies to allocate funds for healthcare, education, housing, etc. The data derived from the income question in the census forms is used, for example, to calculate the NZ Deprivation index of a mesh-block.

The NZ Deprivation index (NZDep) is in turn used by a wide range of government agencies as a measure of socio-economic deprivation. In the primary health sector, for example, the NZDep deciles are used as one of the variables to calculate and allocate funding to general practices – higher the proportion of enrolled patients living in areas coded as NZDep deciles 9 and 10, more the funding allocated to the practice. Health researchers also use the index to ascertain the relationship between health outcomes and socio-economic deprivation. Errors in income reporting therefore, including missing data, can have important implications for measures of poverty and inequality like the New Zealand Deprivation Index.

**Objective 3: Find whether the item non-response rates have changed for the inter-censal period, 2006 – 2013, and ascertain the possible reasons contributing to this change.**

The overall rate of item non-response to the personal income question has declined over 2006 – 2013 and this decline is noted for almost all variables derived from the census Individual Form. For the personal income variable in particular, the decline in non-response rates are partly due to a change in the coding practice adopted by Statistics New Zealand for the 2013 census. People selecting 'No source of income' to the previous question but not answering the question on personal income were all coded to the 'Zero income' category instead of NS/NEI. The second factor contributing to the decline is the substantial increase in the uptake of online forms in 2013 (compared to the previous census) – the possibility of missing or invalid responses is greatly diminished in forms completed online (Denscombe, 2009).

When disaggregated by age and ethnicity, the more substantial decline in item non-response rates were noted among particular groups – youth (15-

24 year olds) and the Asians and MELAA populations. All three of these groups have the highest uptake of online form filling and also the highest proportions of their population aged 15 years or more declared having 'No source of income'. When the item non-response rates were analysed spatially, the three regions with the greatest decline were Taranaki, Auckland and West Coast. Auckland had the highest proportion of its population filling census forms online as well as a relatively high proportion with 'No source of income' recorded. However, both these factors (which contributed to a decline in non-response rates to the income question) did not hold true for the other two regions, which suggests that there are likely to be other factors that have possibly resulted in the decline.

**Objective 4: Test the hypothesis that, in the context of the New Zealand Census, item non-response is not a random phenomenon but a patterned one.**

**Objective 5: Ascertain whether the socio-demographic characteristics of item non-respondents are typically different from those who do provide a valid response to the census question.**

**Objective 6: Identify if any particular sub-population groups are over-represented among item non-respondents.**

Aside from the four key demographic variables, age, sex, ethnicity and geographical location; five socio-economic characteristics, namely, birthplace, source of income, qualifications, work & labour force status and occupation of the item non-respondents to the question on personal income were analysed. The socio-economic characteristics of the people who do provide a valid response, the item respondents, was also compared to that of the item non-respondents to identify differences if any.

In context of the New Zealand census, the item non-response rates to the personal income question is higher among certain population groups and the socio-economic characteristics of non-respondents differs from that of people who do respond. This corroborates the findings from existing research on item non-response to surveys and other administrative questionnaires conducted elsewhere that item non-response is not

random but a patterned phenomenon. The study found that the item non-response rates were higher among certain sub-population groups (see Table 8.1) – women, youth, older people (65+ years) and people identifying with the Pasifika and Māori ethnic groups. At the regional level, the study found a positive correlation between the proportion of Māori among the resident population of the region and the rate of item non-response to the income question.

An association of item non-response to the income variable with the NZ Deprivation index was also found – higher the socio-economic deprivation of a region (as defined by NZDep 2013), higher the item non-response rates. Spatial analysis of the item non-response found highest rates in Gisborne, Northland and Hawke's Bay regions, all three in the North Island and all three with relatively higher proportion of the resident population living in areas of high socio-economic deprivation, as well as relatively higher proportion of the residents identifying with the Māori ethnic group.

When compared to the people who did answer the income question, people who were born overseas, were on one of more government benefits, had no qualifications, were not in the labour force or were unemployed, were unpaid workers or worked as labourers or machinery operators or drivers, were over-represented among non-respondents (see Table 8.1).

This patterning among the non-respondents when disaggregated by key characteristics is supported by the findings from existing research on item non-response to surveys and other administrative questionnaires conducted outside of New Zealand (Tourangeau, Rips, & Rasinski, 2000; Bell, 1984; Korinek, Mistiaen, & Ravallion, 2005; Schrapler, 2006; Rahman & Goldring, 2006).

**Table 8.1 Population sub-groups characterised by selected demographic and socio-economic attributes having higher non-response rates to the personal income question in the census form**

<b>Demographic/Socio-Economic Variable</b>	<b>Sub-group(s) with highest non-response rate to personal income question</b>
Sex	Females
Age	65+ years 15-24 years
Ethnicity	Pacific Islanders Māori
Birthplace	Overseas born People born in the Pacific Islands
Sources of Income	One or more government benefits (Unemployment, Sickness, Domestic Purpose, Invalids) NZ Superannuation or Veteran's Pension
Highest Qualification	No qualifications
Work and Labour Force Status	Not in the Labour Force Unemployed
Status in employment	Unpaid Family workers
Occupation	Labourers Machinery operators & drivers

**Objective 6: Consider possible policy implications of any socio-demographic patterning in item non-respondents.**

Gaps in the data caused by item non-response (in context of the New Zealand census, the residual category NS or NEI), especially in the case of variables like income for which rates are relatively high, give rise to some methodological issues arise for the users of the census data:

1. Should the 'Not Stated' category be included in some way for the intended research analysis?
2. If included, either by pro-rata apportioning or imputation of missing values, will it introduce a bias in the data?
3. What are the likely implications of including or excluding this category on say, the resulting allocation of resources?

As this study has detailed, the NS/NEI count is an aggregate of two demographically different population groups and this needs to be taken into account. In order to pro-rata apportion the item non-respondents or to impute the missing values using statistical techniques without introducing bias in the income data, the assumption that the non-respondents are randomly distributed has to hold true. That is, the item non-respondents need to be randomly distributed through the population which will then mean that their responses to the question are also likely to be distributed similarly to that of the people who do provide a valid response. However, the analysis shows that item non-response to income is a highly non-random phenomenon and therefore, pro-rata apportioning or imputing missing responses based on the distribution of the item respondents will have exactly the same end result as the alternative approach of excluding the item non-response data from the analysis. Both options will introduce a bias in the dataset. Moreover, the inclusion of the substitute records within the NS/NEI count, will only add to the bias.

Certain population groups when disaggregated by key demographic variables like age, sex, ethnicity and geographical location, as well as socio-economic indicators like socio-economic deprivation, birthplace, sources of income, qualification, work and labour force status, employment status and occupation, are over-represented among the item non-respondents to the personal income question (see Table 8.1). Consequently, their exclusion or inclusion using pro-rata apportioning or statistical techniques like imputing, will adversely affect policies directed towards these sub-groups in the population.

A good example of usage of the census variables is in the construction of the New Zealand Deprivation Index (NZDep) which in turn is used for a number of research and funding and policy decisions including allocation of resources as mentioned earlier. The index combines nine variables from the census which reflect eight dimensions of deprivation (income, communication, employment, educational qualifications, home ownership, support, living space and transport) and provides a score for each mesh-block. The index in its ordinal form ranges from 1 to 10 and divides New Zealand into tenths (or deciles) of the distribution of the first principal

component scores<sup>24</sup> (Atkinson, Salmond, & Crampton, 2014). For example, a value of 10 indicates that the mesh-block is in the most deprived 10 percent of areas in New Zealand, according the NZDep2013 scores<sup>25</sup>.

As per the methodology used, the NS or NEI count for each of the nine variables used to calculate the index is not included in the principal components analysis. For variables derived from the census Individual Form (tenure holder, qualifications, income, source of income and work and labour force status), the excluded NS/NEI category including the substitute records account for 5 to 11 per cent of the URP in 2013. For variables like Qualifications and Income (overall non-response rates of 11.1 and 9.7 per cent respectively in 2013) the actual item non-respondents (excluding the substitute records) make up about half of the NS/NEI count (6.6 and 5.4 per cent respectively).

As this study has shown, exclusion of item non-respondents to the income variable means that some population groups (females, Māori, youth, people aged 65+ years, people with no qualifications, unemployed, etc.) are under-represented in the analysis used to generate the NZDep score. Consequently, any resource or funding allocation made is likely to adversely affect these population groups. When disaggregated spatially for example, areas like Kawerau and Opotiki where item non-response rates to the income question are relatively high (compared with other TAs), the exclusion of the item non-respondents is likely to have a bigger impact on the NZDep score calculation of the mesh-block areas within these TA boundaries.

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<sup>24</sup> Principal components analysis is a multivariate method that identifies linear combinations of variables that progressively account for the overall variation in the data. The first principal component accounts for the most variation, the second accounts for as much of the remaining variation as possible, and so on.

<sup>25</sup> NZDep is designed to measure relative socioeconomic deprivation, not absolute socioeconomic deprivation. Hence, ten per cent of areas will always fall into the most deprived decile of the NZDep.

## **Recommendations**

It is therefore recommended that decisions on the inclusion (by pro-rata apportioning or using statistical imputation techniques) or exclusion of the residual NS/NEI count for the different variables derived from the questions on the census forms should be taken only after:

- a) excluding the substitute records from the NS or NEI count of the variable (as well as from the URP count of the target population being studied);
- b) examining the demographic and socio-economic characteristics (where possible) of the item non-respondents and finding out how these differ from the responding population;
- c) ascertaining whether any sub-population groups are over-represented among those not responding to the particular question(s) from which the variable is derived; and
- d) considering what impact the decision of either including or excluding the NS/NEI count from the analyses will have on the results and the subsequent research or policy decisions or resource/funding allocations made based on these results.

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## Appendix A: Imputed Variables

### Sex

A foremost or level 1 variable, sex (male or female) is derived from question 3 on the individual form and is imputed for all New Zealand residents where a valid response is not found. Of the four variables, sex is the first variable to be imputed using deterministic or stochastic imputation methods. In 2013, sex was imputed for 5.2 percent of the usually resident population, of which 4.8 were substitute records (Statistics New Zealand, 2014). This means that only a very small proportion (0.4 per cent) of the usually resident population who returned the census form did not answer or incorrectly answered this question.

The unit non-response rate, having increased quite substantially from 2.1 per cent in 2001 to 4.8 per cent in 2013, is perhaps indicative of the growing reluctance of people towards filling census forms and also due to the growing mobility of the population. The item non-response to the question on sex, on the other hand, has declined quite notably from 2.0 per cent in 2001 to 0.4 per cent in 2013. This improvement would appear to be primarily due to the introduction of online forms (electronic submission) in 2013.

**Appendix Table 1: Number of imputations for the variable 'sex' as a percentage of the usually resident population**

Census Year	<i>Imputations as a percentage of the usually resident population</i>		
	Imputations for unit non-response (forms not returned or collected)	Imputations for item non-response (forms returned but question not answered/ response invalid)	Total imputations for variable 'Sex'
2013	4.8	0.4	5.2
2006	3.2	0.9	4.1
2001	2.1	2.0	4.1

Source: Statistics New Zealand, 2013 Census information by variable □

### Age

Age is the difference between the date of birth and 5 March 2013 and is defined as the length of time a person has been alive, measured in complete, elapsed years. It is a foremost or level 1 variable and is derived from question 4 on the individual form. If missing, it can be imputed deterministically from question 6 (information about people completing an individual form at the dwelling) on the dwelling form; and if not possible, then stochastically or by the donor method imputation.

The proportion of individuals who had their age imputed in the 2013 Census was 5.2% compared to 4.0% in 2006. The majority of imputed ages are attributed to unit non-response and a very small proportion (0.4 per cent) due to people returning a partially completed form without reporting age or giving an invalid response (age outside the expected range or inconsistency between age and relationship data). Again, as seen previously for sex, the item non-response rates for age have notably improved since 2001 as opposed to the unit non-response rates, which more than doubled from 2.1 per cent in 2001 to 4.8 per cent in 2013.

**Appendix Table 2: Number of imputations for the variable 'age' as a percentage of the usually resident population**

Census Year	<i>Imputations as a percentage of the usually resident population</i>		
	Imputations for unit non-response (forms not returned or collected)	Imputations for item non-response (forms returned but question not answered/ response invalid)	Total imputations for variable 'Age'
2013	4.8	0.4	5.2
2006	3.3	0.7	4.0
2001	2.1	1.6	3.7

Source: Statistics New Zealand, 2013 Census information by variable □

### Mesh-block of Usual Residence

For the URP count, residents are counted in the meshblock<sup>26</sup> of their usual residential address, that is, the residents who were temporarily elsewhere in New Zealand on census night are included in the meshblock they usually live in. For example a resident of Hamilton City who was temporarily in Auckland City on census night will be included in the Census Night Population count of Auckland City and in the URP count of Hamilton City. Where a usual address is not specified, a meshblock of usual residence is imputed.

The geographic location of usual residence of a person is a foremost or level 1 variable and is derived from question 8 on the individual form. Mesh-blocks are the smallest geographical unit which define the location of usual residence, and which are then aggregated to form statistically larger areas like Census Area Units (CAUs), Territorial Authorities (TAs) and Regional Councils (RCs).

<sup>26</sup> The smallest geographical units defined by Statistics New Zealand, containing a median of approximately 81 people in 2013.

When this variable is missing due to item or unit non-response, the information is taken from the mesh-block code supplied by the collector.

shows that the substitute rate has more than doubled in 2013 (4.7 per cent) compared to 2001 (2.3 per cent) for reasons noted earlier.

**Appendix Table 3: Number of imputations for the variable ‘mesh-block of usual residence’ as a percentage of the usually resident population**

Census Year	Total imputations for variable 'meshblock of usual residence' for missing data as a percentage of the usually resident population
2013	4.7
2006	3.2
2001	2.3

Source: Statistics New Zealand, 2013 Census information by variable □

### Work and Labour Force Status

Work and Labour Force status is a defining or Level 2 variable that classifies people aged 15 years or more based on whether they are employed (part or full time), unemployed and actively looking for work or not in the labour force. It is derived from questions 32 (job indicator), 40 (hours worked), 43 (seeking paid work), 44 (job search methods) and 45 (availability for work) on the Individual form.

In cases where the respondent (aged 15+ years) does not answer or gives an invalid answer to one or more of the five questions listed above, or does not return an individual form but a dwelling form is completed and returned; their work and labour force status is imputed by looking at related questions that have been answered. On the other hand, when neither the individual nor the dwelling form is returned by a household, the work and labour force status is classified as ‘unidentifiable’ in the substitute record created (see ‘substitution rate’ in ).

The increase in the substitution rate from 3.1 per cent in 2001 to 4.9 per cent in 2013 is a result of a growing proportion of people not filling their census forms. Conversely, the imputation rate has declined (7.9 per cent in 2001 to 5.5 per cent in 2013) which, as noted earlier, would appear to be primarily due to the increasing use of online census forms. The online forms have built-in editing functionality that directs respondents to the appropriate questions and ensures their responses are valid (Statistics New Zealand, 2014).

**Appendix Table 4: Imputations and substitutions for the variable 'work and labour force status' as a percentage of the usually resident population**

<b>Census Year</b>	<b>Imputation rate (%)</b>	<b>Substitution rate (%)</b>
<b>2013</b>	5.5	4.9
<b>2006</b>	6.7	3.4
<b>2001</b>	7.9	3.1

Source: Statistics New Zealand, 2013 Census information by variable □

## Appendix B: Tables and Figures

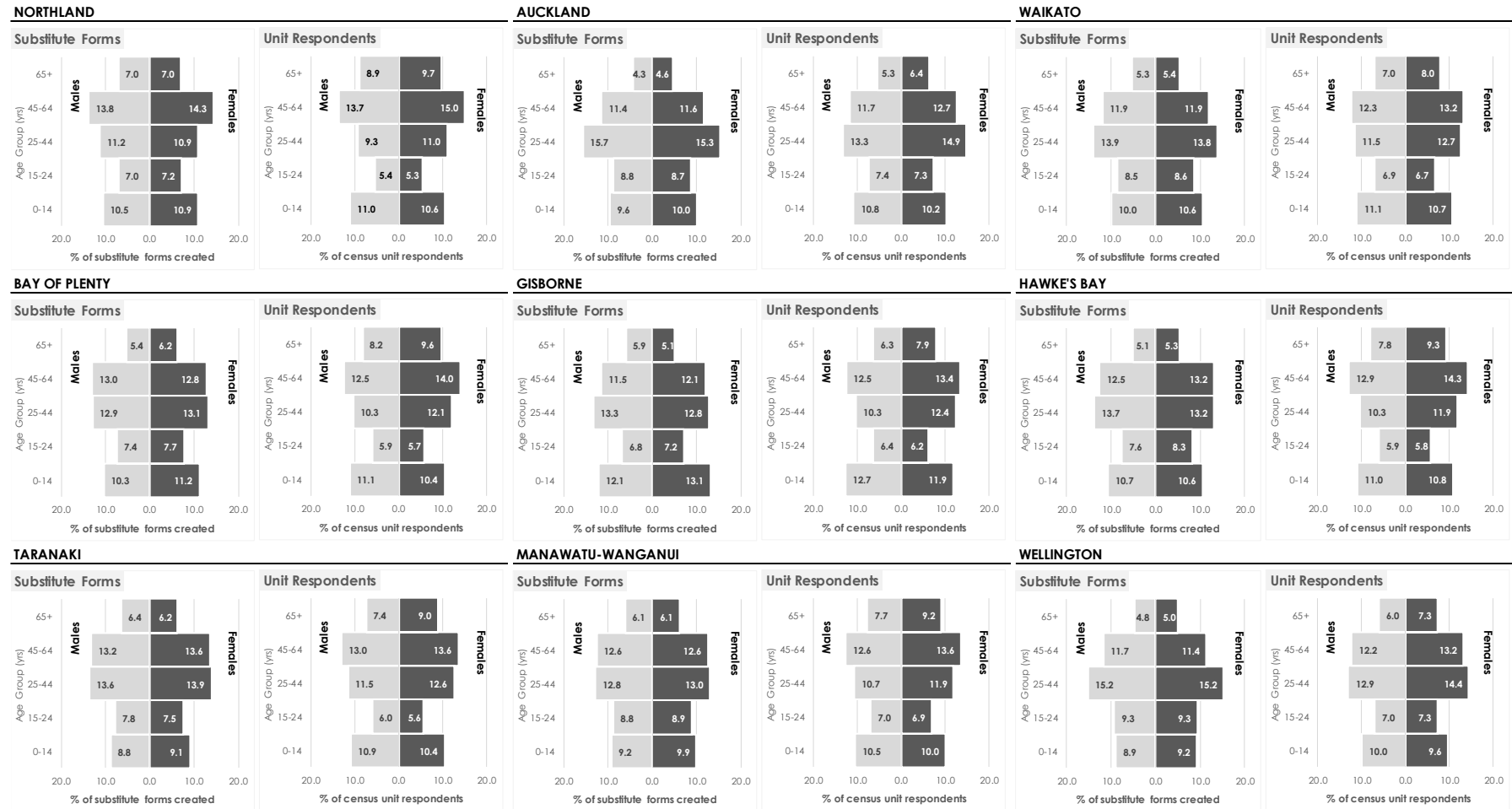
**Appendix Table 5: Usually resident population, number of unit non-respondents and rate of unit non-response to the census by age group and sex, 2006 and 2013**

	Age Group	Usually Resident Population			Unit Non-Respondents			Rate of unit non-response (%)		
		Males	Females	Total	Males	Females	Total	Males	Females	Total
Census 2006	0-14	444,027	423,546	867,573	13,098	13,536	26,634	2.9	3.2	3.1
	15-24	287,520	283,653	571,173	11,013	10,965	21,978	3.8	3.9	3.8
	25-39	391,104	429,453	820,557	15,963	15,768	31,731	4.1	3.7	3.9
	40-64	621,819	651,210	1,273,029	19,779	20,334	40,113	3.2	3.1	3.2
	65+	221,139	274,464	495,603	6,033	6,438	12,471	2.7	2.3	2.5
	Total	1,965,621	2,062,329	4,027,950	65,898	67,047	132,945	3.4	3.3	3.3
Census 2013	0-14	442,167	423,462	865,629	19,104	19,845	38,949	4.3	4.7	4.5
	15-24	296,505	289,941	586,446	17,229	17,322	34,551	5.8	6.0	5.9
	25-39	373,221	408,987	782,208	22,170	21,732	43,902	5.9	5.3	5.6
	40-64	673,245	727,488	1,400,733	32,058	32,259	64,317	4.8	4.4	4.6
	65+	278,880	328,158	607,038	10,446	10,893	21,339	3.7	3.3	3.5
	Total	2,064,018	2,178,033	4,242,051	101,007	102,048	203,055	4.9	4.7	4.8

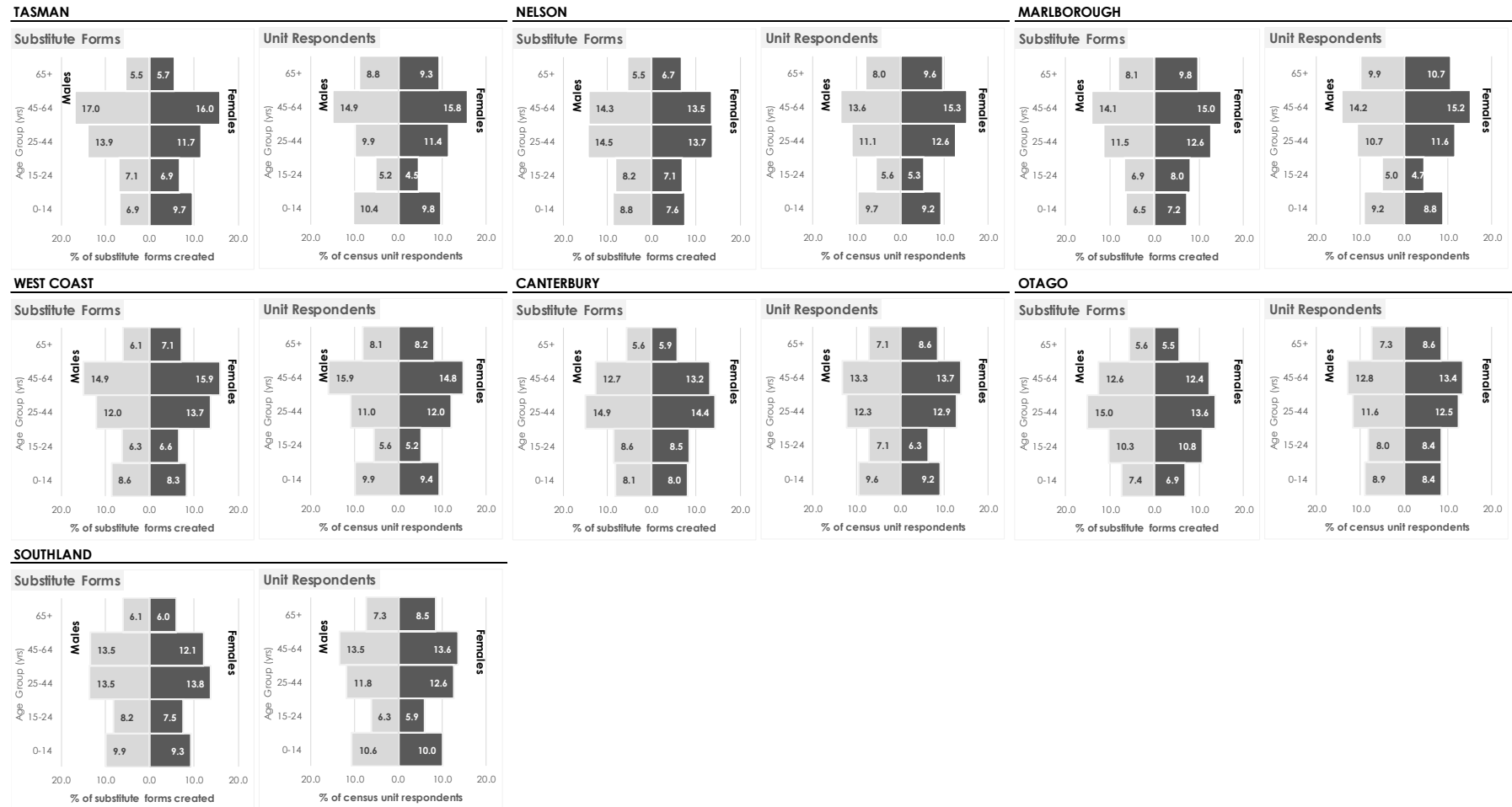
**Appendix Table 6: Number and proportion of individual substitute records created by region, Census 2001, 2006 and 2013**

	Total substitute individual records			Census URP count			% of URP count that are substituted individual records		
	2001	2006	2013	2001	2006	2013	2001	2006	2013
Northland	7,878	8,886	11,064	140,130	148,470	151,689	5.6	6.0	7.3
Auckland	44,379	55,293	76,098	1,160,271	1,304,961	1,415,550	3.8	4.2	5.4
Waikato	9,387	14,145	18,408	356,349	380,823	403,638	2.6	3.7	4.6
Bay of Plenty	7,779	9,030	15,126	239,415	257,379	267,744	3.2	3.5	5.6
Gisborne	1,134	2,019	2,877	43,974	44,499	43,653	2.6	4.5	6.6
Hawke's Bay	3,519	3,819	7,227	142,950	147,783	151,179	2.5	2.6	4.8
Taranaki	2,289	2,643	4,662	102,858	104,127	109,608	2.2	2.5	4.3
Manawatu-Wanganui	5,127	5,259	9,522	220,089	222,423	222,672	2.3	2.4	4.3
Wellington	9,648	11,502	20,193	423,765	448,956	471,315	2.3	2.6	4.3
Tasman	1,260	1,113	1,485	41,352	44,625	47,154	3.0	2.5	3.1
Nelson	897	810	1,572	41,568	42,888	46,437	2.2	1.9	3.4
Marlborough	828	1,356	1,620	39,558	42,558	43,416	2.1	3.2	3.7
West Coast	777	843	1,770	30,300	31,326	32,148	2.6	2.7	5.5
Canterbury	7,947	10,137	19,920	481,431	521,832	539,436	1.7	1.9	3.7
Otago	2,751	4,446	8,304	181,539	193,803	202,470	1.5	2.3	4.1
Southland	1,104	1,614	3,192	91,002	90,873	93,342	1.2	1.8	3.4
Area outside	39	30	15	726	621	603	5.4	4.8	2.5
<b>New Zealand</b>	<b>106,743</b>	<b>132,945</b>	<b>203,052</b>	<b>3,737,277</b>	<b>4,027,947</b>	<b>4,242,051</b>	<b>2.9</b>	<b>3.3</b>	<b>4.8</b>

**Appendix Figure 1: Imputed age-sex profile of the substitute records compared to the age-sex profile of the census unit respondents disaggregated by regions, Census 2013**



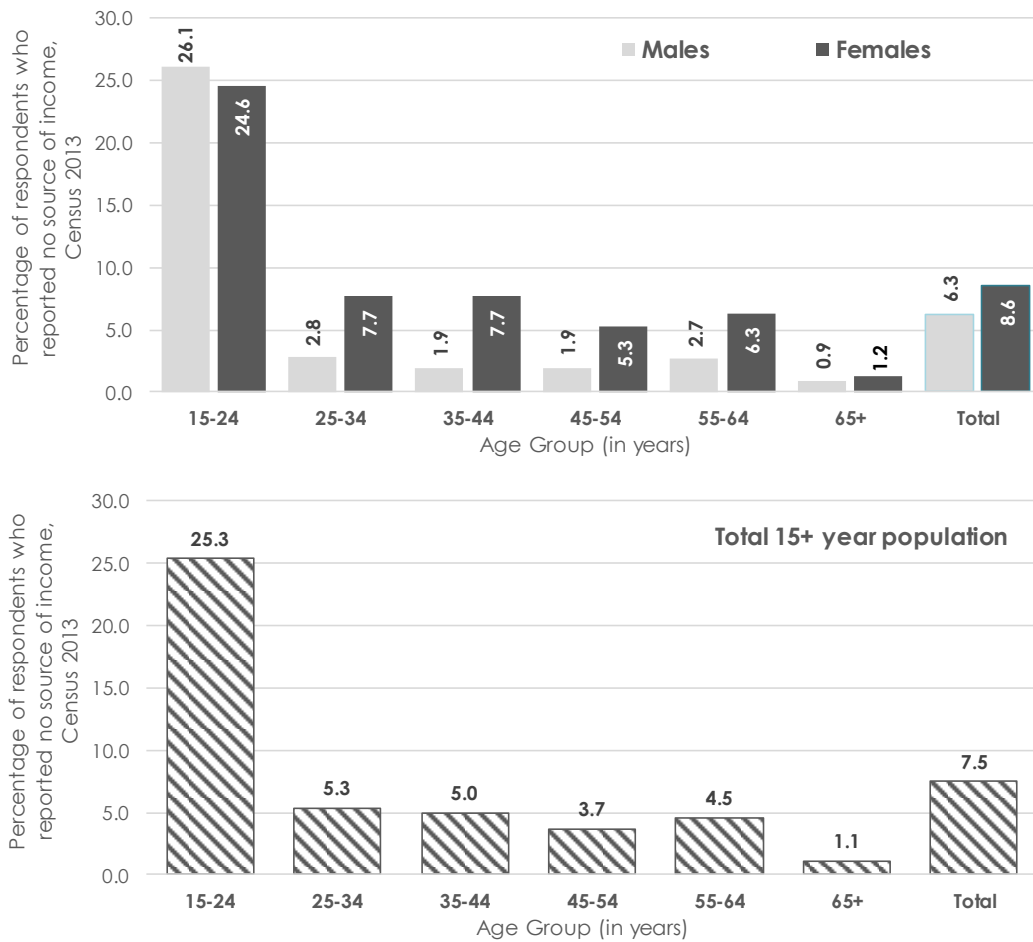
**Appendix Figure 1 (contd.): Imputed age-sex profile of the substitute records compared to the age-sex profile of the census unit respondents disaggregated by regions, Census 2013**



**Appendix Table 7: Number of item respondents and non-respondents to the question on personal income disaggregated by age group and sex, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Total 15+ URP (excluding substitute forms)	Item non-respondents to Income	Item Respondents	Total 15+ URP (excluding substitute forms)
<b>Male</b>	15-24 yrs	29,133	247,374	276,507	16,701	262,575	279,276
	25-34 yrs	13,002	224,391	237,393	9,378	222,075	231,453
	35-44 yrs	13,710	269,784	283,494	9,462	246,918	256,380
	45-54 yrs	11,403	247,443	258,846	9,999	265,050	275,049
	55-64 yrs	8,379	189,066	197,445	8,358	220,995	229,353
	65-74 yrs	7,116	117,288	124,404	7,962	152,928	160,890
	75+ yrs	8,874	81,825	90,699	10,311	97,233	107,544
	Total	91,620	1,377,171	1,468,791	72,165	1,467,783	1,539,948
<b>Female</b>	15-24 yrs	31,050	241,638	272,688	16,956	255,663	272,619
	25-34 yrs	15,723	244,644	260,367	9,897	242,736	252,633
	35-44 yrs	17,745	293,304	311,049	10,083	278,982	289,065
	45-54 yrs	13,995	255,816	269,811	10,437	288,210	298,647
	55-64 yrs	13,272	190,059	203,331	9,504	232,635	242,139
	65-74 yrs	10,587	123,174	133,761	11,121	160,425	171,546
	75+ yrs	20,586	113,676	134,262	21,660	124,059	145,719
	Total	122,958	1,462,314	1,585,272	89,664	1,582,704	1,672,368
<b>Total Sex</b>	15-24 yrs	60,183	489,012	549,195	33,657	518,235	551,892
	25-34 yrs	28,728	469,035	497,763	19,275	464,814	484,089
	35-44 yrs	31,458	563,085	594,543	19,545	525,900	545,445
	45-54 yrs	25,398	503,262	528,660	20,436	553,260	573,696
	55-64 yrs	21,648	379,131	400,779	17,862	453,630	471,492
	65-74 yrs	17,706	240,462	258,168	19,080	313,359	332,439
	75+ yrs	29,457	195,507	224,964	31,971	221,292	253,263
	Total	214,581	2,839,482	3,054,063	161,829	3,050,490	3,212,319

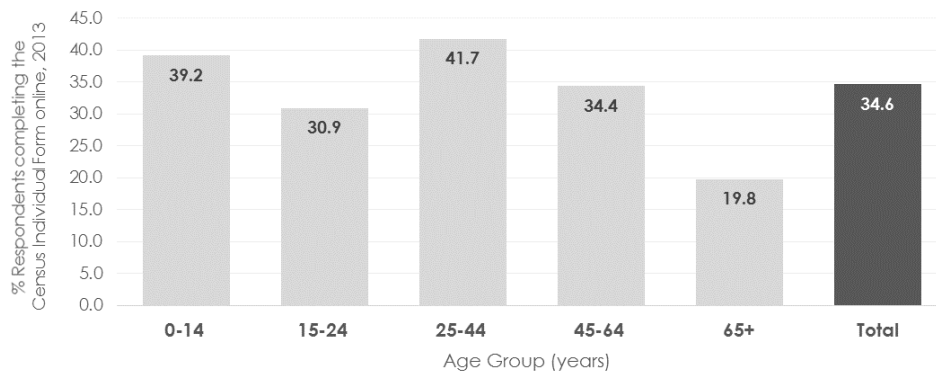
**Appendix Figure 2: Proportion (%) of the 15+ year population reporting 'No Source of income' at the 2013 Census disaggregated by age group and sex**



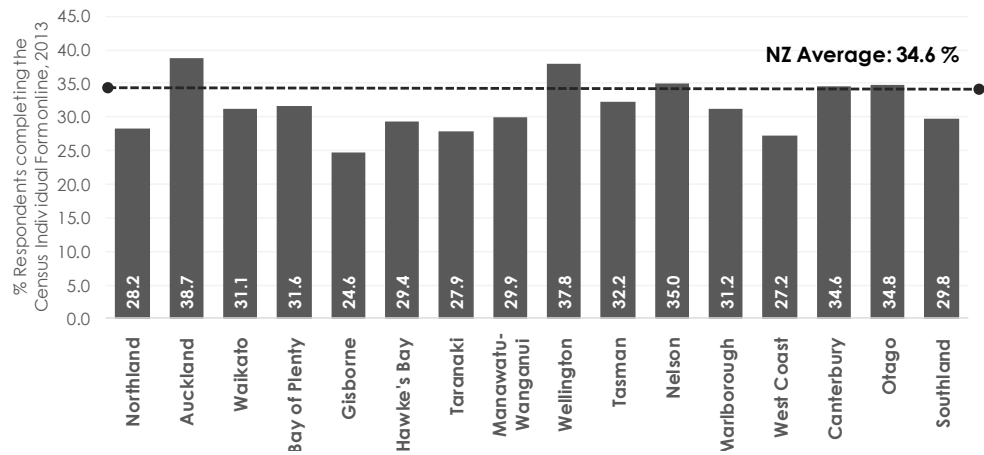
Source: Statistics NZ/NZ.Stat Dataset: Sources of personal income and work and labour force status by age group and sex, for the census usually resident population count aged 15 years and over, 2013 Census (RC, TA)

Note: Sources of personal income is a multiple response question and respondents can select more than one source. When a person reports more than one source, they are counted in each source they report. Therefore in sources of income tables, the sum of people/families exceeds total number of people/families. Any percentages calculated on the total population add up to more than 100 percent.

**Appendix Figure 3: Proportion of respondents (by age group) completing the Census Individual Form online, Census 2013**

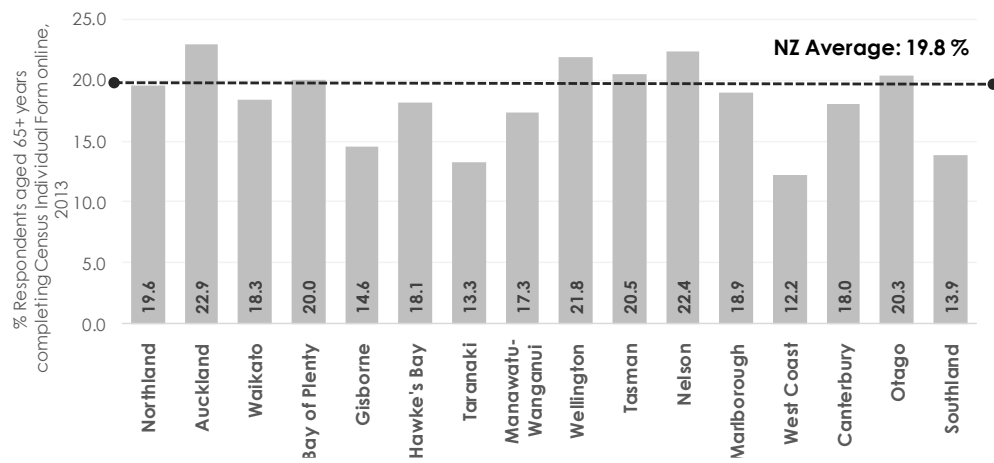


**Appendix Figure 4: Proportion of respondents completing the Census Individual Form online in each region and total New Zealand, Census 2013**



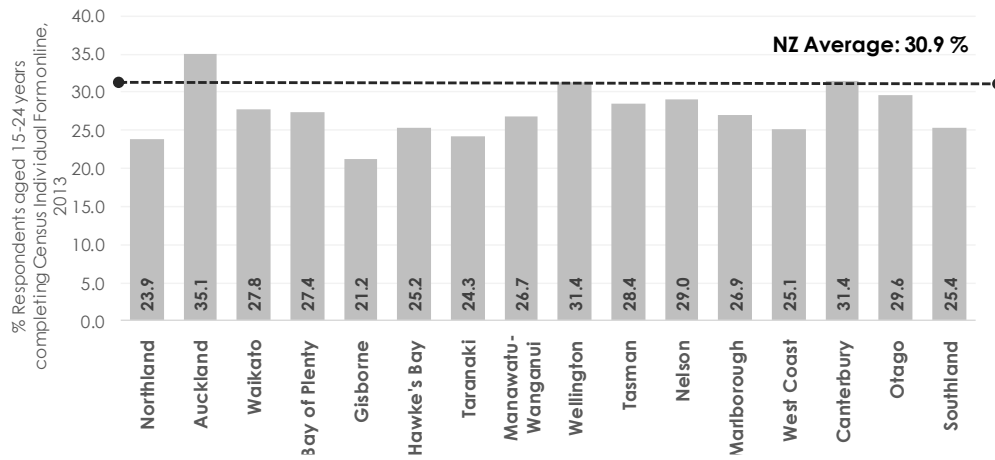
Note: Excludes data for overseas visitors

**Appendix Figure 5: Proportion of respondents aged 65+ years completing the Census Individual Form online in each region and total New Zealand, Census 2013**



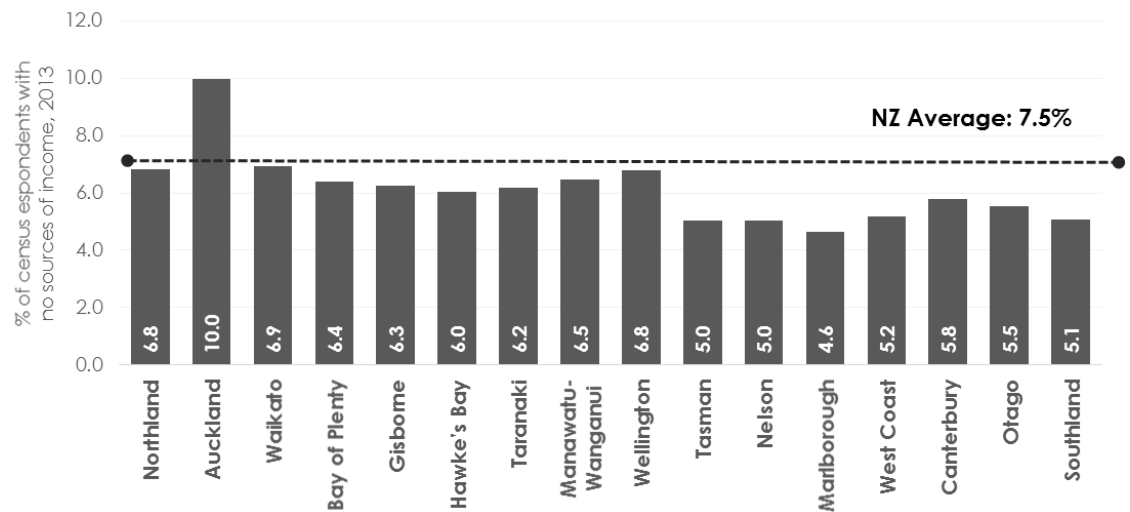
Note: Excludes data for overseas visitors

**Appendix Figure 6: Proportion of respondents aged 15-24 years completing the Census Individual Form online in each region and total New Zealand, Census 2013**



Note: Excludes data for overseas visitors

**Appendix Figure 7: Proportion of census respondents with no source of income in each region and total New Zealand, Census 2013**



**Appendix Table 8: Number of item respondents and non-respondents to the personal income question by region, Census 2006 and 2013**

	Census 2006			Census 2013		
	Item non-respondents to Income	Item Respondents	Total 15+ URP (excluding substitute forms)	Item non-respondents to Income	Item Respondents	Total 15+ URP (excluding substitute forms)
Northland	8,928	97,932	106,860	7,266	102,981	110,247
Auckland	74,700	896,814	971,514	54,672	1,003,344	1,058,016
Waikato	20,121	262,752	282,873	16,806	284,724	301,530
Bay of Plenty	14,379	176,766	191,145	11,112	187,032	198,144
Gisborne	2,745	28,584	31,329	2,079	28,695	30,774
Hawke's Bay	8,961	101,964	110,925	6,831	105,759	112,590
Taranaki	7,218	72,135	79,353	4,845	77,793	82,638
Manawatu-Wanganui	11,802	158,097	169,899	9,294	160,131	169,425
Wellington	20,127	326,970	347,097	14,274	348,498	362,772
Nelson	1,917	32,064	33,981	1,452	34,929	36,381
Tasman	1,839	32,217	34,056	1,419	35,067	36,486
Marlborough	2,067	31,419	33,486	1,719	32,550	34,269
West Coast	1,842	22,350	24,192	1,305	23,226	24,531
Canterbury	23,958	386,934	410,892	18,150	403,896	422,046
Otago	9,420	146,325	155,745	6,948	153,492	160,440
Southland	4,512	65,745	70,257	3,615	67,950	71,565
Area Outside Region	42	414	456	42	423	465
New Zealand	214,581	2,839,482	3,054,063	161,829	3,050,490	3,212,319

**Appendix Table 9: NZDep2013 indexes (weighted average) for each region and the proportion of the usually resident population living in areas coded as NZDep2013 indexes 9 and 10**

Region	URP 2013	No. of Area Units (AUs)	No. of AUs coded as NZDep2013 Indexes 9 & 10	Population Weighed NZDep13	Population living in areas coded as NZDep2013 Indexes 9 & 10	
					number	%
Northland	151,605	84	39	7.6	65,784	43.4
Auckland	1,415,043	405	90	5.4	346,821	24.5
Waikato	403,620	196	45	6.4	106,824	26.5
Bay of Plenty	267,621	115	47	6.8	82,554	30.8
Gisborne	43,662	23	12	7.7	26,361	60.4
Hawke's Bay	151,158	80	21	6.6	53,064	35.1
Taranaki	109,602	64	10	5.9	18,303	16.7
Manawatu-Wanganui	222,687	126	43	6.9	80,208	36.0
Wellington	471,180	204	25	5.0	63,675	13.5
Nelson	46,437	28	2	5.6	3,615	7.8
Tasman	47,136	24	1	4.7	396	0.8
Marlborough	43,380	24	2	5.2	3,243	7.5
West Coast	32,148	55	5	5.9	2,541	7.9
Canterbury	539,409	245	12	4.5	32,460	6.0
Otago	202,461	125	8	4.8	15,912	7.9
Southland	93,357	68	11	5.2	17,895	19.2
	4,088,901	1866	373	... ..	919,656	22.5

Note: In order to have at least 100 persons in each NZDep 2013 small area, the areas with individual input variables having denominators less than 20 were excluded. This equates to values of 82 NZDep2013 small areas involving 112 meshblocks being withheld from the index. Some Area Units are therefore not included in the table above.

**Appendix Table 10: NZDep2013 indexes (weighted average) for each TA and the proportion of the usually resident population living in areas coded as NZDep2013 indexes 9 and 10**

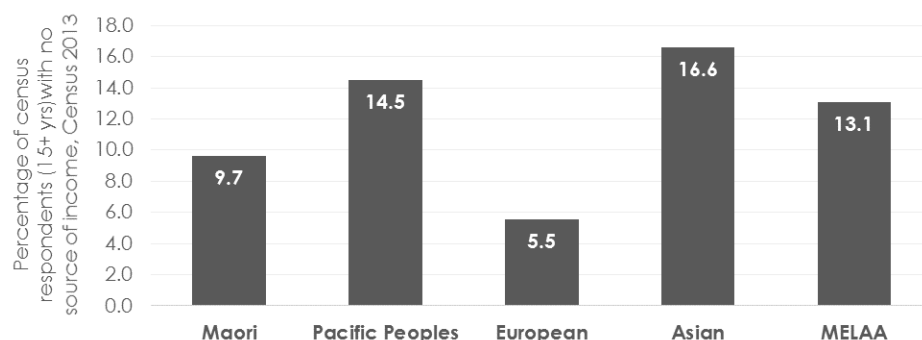
Region	URP 2013	No. of Area Units (AUs)	Population Weighed NZDep13	No. of AUs coded as NZDep2013 Indexes 9 & 10	Population living in areas coded as NZDep2013 Indexes 9 & 10	
					number	%
Far North	55,734	33	8.4	21	34,038	61.1
Whangarei	76,995	41	6.9	14	26,031	33.8
Kaipara	18,960	10	7.5	4	5,727	30.2
Auckland	1,415,550	405	5.4	90	346,839	24.5
Thames-Coromandel	26,181	10	7.5	2	3,927	15.0
Hauraki	17,811	8	8.3	3	8,841	49.6
Waikato	63,378	30	5.5	6	17,148	27.1
Matamata-Piako	31,536	13	6.6	3	3,333	10.6
Hamilton	141,612	46	6.6	12	39,225	27.7
Waipa	46,668	29	4.6	1	444	1.0
Otorohanga	9,138	5	6.5	2	2,856	31.3
South Waikato	22,071	16	8.2	7	14,142	64.1
Waitomo	8,907	8	8.4	2	4,266	47.9
Taupo	32,907	30	6.5	8	12,690	38.6
Western Bay of Plenty	43,692	19	6.0	5	9,702	22.2
Tauranga	114,789	35	6.1	7	12,621	11.0
Rotorua	65,280	39	7.2	18	29,232	44.8
Whakatane	32,691	19	7.8	12	18,933	57.9
Kawerau	6,363	1	10.0	1	6,363	100.0
Opotiki	8,436	5	9.4	4	5,706	67.6
Gisborne	43,656	23	7.7	12	26,370	60.4
Wairoa	7,890	9	9.3	6	6,612	83.8
Hastings	73,245	41	6.3	10	31,341	42.8
Napier	57,240	21	6.6	4	14,592	25.5
Central Hawke's Bay	12,717	7	6.4	1	525	4.1
New Plymouth	74,187	36	5.5	4	11,871	16.0
Stratford	8,988	7	6.6	-	-	0.0
South Taranaki	26,577	22	6.9	6	6,435	24.2
Ruapehu	11,844	14	8.6	6	5,634	47.6
Wanganui	42,150	29	7.5	13	18,516	43.9
Rangitikei	14,019	11	7.0	3	5,304	37.8
Manawatu	27,456	18	5.6	3	3,342	12.2
Palmerston North	80,079	27	6.1	5	18,906	23.6
Tararua	16,854	11	7.3	4	7,194	42.7
Horowhenua	30,096	16	8.4	8	21,267	70.7
Kapiti Coast	49,104	17	5.6	1	5,778	11.8
Porirua	51,717	24	5.6	9	22,932	44.3
Upper Hutt	40,179	22	5.1	1	309	0.8
Lower Hutt	98,238	42	5.8	8	22,452	22.9
Wellington	190,959	77	4.1	2	5,514	2.9
Masterton	23,352	12	6.9	3	4,437	19.0
Carterton	8,232	4	5.0	-	-	0.0
South Wairarapa	9,525	5	5.0	1	2,250	23.6
Tasman	47,154	24	4.7	1	396	0.8
Nelson	46,437	28	5.6	2	3,612	7.8
Marlborough	43,416	24	5.2	2	3,243	7.5
Kaikoura	3,552	2	5.7	-	-	0.0
Buller	10,473	15	6.6	3	603	5.8
Grey	13,371	21	5.6	2	1,944	14.5
Westland	8,307	19	5.3	-	-	0.0
Hurunui	11,529	9	4.1	-	-	0.0
Waimakariri	49,989	39	3.3	-	-	0.0
Christchurch	341,472	124	4.9	11	29,679	8.7
Selwyn	44,595	19	1.8	-	-	0.0
Ashburton	31,041	16	4.5	-	-	0.0
Timaru	43,929	23	5.2	-	-	0.0
Mackenzie	4,158	5	3.3	-	-	0.0
Waimate	7,536	3	5.9	1	2,775	36.8
Chatham Islands territory	600	1	7.0	-	-	0.0
Waitaki	20,826	19	5.6	-	-	0.0
Central Otago	17,895	9	3.9	-	-	0.0
Queenstown-Lakes	28,224	18	2.3	-	-	0.0
Dunedin	120,246	70	5.3	7	15,909	13.2
Clutha	16,890	13	4.9	-	-	0.0
Southland	29,613	32	3.6	2	600	2.0
Gore	12,033	9	5.1	1	1,509	12.5
Invercargill	51,693	27	6.1	8	15,780	30.5
	4,241,982	1866	.....	372	919,695	21.7

Note: In order to have at least 100 persons in each NZDep 2013 small area, the areas with individual input variables having denominators less than 20 were excluded. This equates to values of 82 NZDep2013 small areas involving 112 meshblocks being withheld from the index. Some Area Units are therefore not included in the table above.

**Appendix Table 11: Number of unit respondents and non-respondents to the personal income question in each ethic group, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Total 15+ URP (excluding substitute forms)	Item non-respondents to Income	Item Respondents	Total 15+ URP (excluding substitute forms)
<b>Māori</b>	15-24 yrs	16,929	84,375	101,304	10,071	96,930	107,001
	25-34 yrs	6,486	71,079	77,565	4,758	66,639	71,394
	35-44 yrs	6,246	69,621	75,870	4,473	69,075	73,545
	45-54 yrs	4,596	51,504	56,097	4,413	63,462	67,875
	55-64 yrs	3,513	27,930	31,443	3,447	40,839	44,286
	65-74 yrs	2,775	13,887	16,665	3,162	19,026	22,188
	75+ yrs	1,437	5,025	6,459	2,025	7,968	9,996
	Total	41,982	323,427	365,406	32,346	363,939	396,285
<b>Pacific Peoples</b>	15-24 yrs	11,922	36,489	48,411	7,527	49,314	56,841
	25-34 yrs	4,320	32,727	37,050	3,249	34,677	37,923
	35-44 yrs	4,425	29,736	34,164	3,204	31,470	34,677
	45-54 yrs	3,084	19,650	22,737	2,961	26,112	29,070
	55-64 yrs	2,037	11,154	13,188	2,079	15,888	17,964
	65-74 yrs	1,485	5,523	7,005	1,587	7,824	9,411
	75+ yrs	744	2,331	3,075	951	3,582	4,533
	Total	28,017	137,613	165,630	21,555	168,873	190,425
<b>European &amp; Other</b>	15-24 yrs	26,073	353,475	379,551	14,028	364,215	378,243
	25-34 yrs	13,692	346,047	359,736	8,127	308,961	317,088
	35-44 yrs	16,533	434,460	450,996	9,399	391,935	401,334
	45-54 yrs	14,502	407,526	422,031	10,548	430,509	441,057
	55-64 yrs	13,719	327,534	341,256	9,870	372,765	382,638
	65-74 yrs	11,883	212,958	224,838	12,714	273,885	286,599
	75+ yrs	25,428	183,927	209,355	26,637	202,197	228,834
	Total	121,830	2,265,927	2,387,757	91,326	2,344,461	2,435,790
<b>Asian</b>	15-24 yrs	10,431	67,269	77,697	5,142	77,952	83,094
	25-34 yrs	4,329	55,782	60,111	3,387	92,250	95,637
	35-44 yrs	3,774	56,133	59,907	2,556	67,725	70,278
	45-54 yrs	2,715	40,167	42,885	2,208	57,315	59,520
	55-64 yrs	1,803	19,125	20,928	2,151	36,522	38,673
	65-74 yrs	1,179	10,410	11,589	1,230	16,980	18,210
	75+ yrs	534	3,951	4,482	831	8,268	9,099
	Total	24,765	252,834	277,596	17,499	357,012	374,511
<b>MELAA</b>	15-24 yrs	1,242	5,571	6,813	933	7,131	8,064
	25-34 yrs	717	5,850	6,567	672	9,339	10,005
	35-44 yrs	552	5,340	5,892	426	7,170	7,596
	45-54 yrs	285	3,198	3,483	294	4,860	5,154
	55-64 yrs	120	1,341	1,461	147	2,454	2,601
	65-74 yrs	60	582	645	96	924	1,017
	75+ yrs	45	291	333	63	468	531
	Total	3,021	22,170	25,194	2,628	32,343	34,971

**Appendix Figure 8: Proportion (%) of the 15+ year population reporting 'No Source of income' at the 2013 Census disaggregated by ethnic group**



**Appendix Table 12: Change in the census question on birthplace**

**Question 9 – Birthplace**

2006 Census question	2011 Census question
<p><b>9</b> Which country were you born in?</p> <ul style="list-style-type: none"> <li><input type="radio"/> New Zealand → go to <b>11</b></li> <li><input type="radio"/> Australia</li> <li><input type="radio"/> England</li> <li><input type="radio"/> Scotland</li> <li><input type="radio"/> China (People's Republic of)</li> <li><input type="radio"/> South Africa</li> <li><input type="radio"/> Samoa</li> <li><input type="radio"/> Cook Islands</li> <li><input type="radio"/> other. Please print the present name of the country:</li> </ul>	<p><b>9</b> Which country were you born in?</p> <ul style="list-style-type: none"> <li><input type="radio"/> New Zealand → go to <b>11</b></li> <li><input type="radio"/> Australia</li> <li><input type="radio"/> England</li> <li><input type="radio"/> China (People's Republic of)</li> <li><input type="radio"/> India</li> <li><input type="radio"/> South Africa</li> <li><input type="radio"/> Samoa</li> <li><input type="radio"/> Cook Islands</li> <li><input type="radio"/> other. Please print the present name of the country:</li> </ul>

**Appendix Table 13: Number of item non-respondents and respondents to the personal income question disaggregated by birthplace, Census 2006 and 2013**

Birthplace	CENSUS 2006			CENSUS 2013		
	Item non-respondents to Income	Item Respondents	Total 15+ URP	Item non-respondents to Income	Item Respondents	Total 15+ URP
New Zealand	134,139	2,090,328	2,224,467	100,134	2,150,649	2,250,783
UK, Ireland & Rest of Europe	15,843	279,246	295,089	12,015	300,126	312,141
Asia	20,454	204,381	224,835	13,659	279,477	293,136
Pacific Islands	18,927	103,656	122,583	15,510	123,663	139,173
Africa and the Middle East	4,368	58,347	62,715	3,042	77,562	80,604
North America, Australia & Other	4,899	73,878	78,777	3,327	85,062	88,389
Total Stated	198,627	2,809,836	3,008,463	147,678	3,016,533	3,164,211
Not Elsewhere Included	15,954	29,640	45,594	14,148	33,954	48,102
Total	214,581	2,839,476	3,054,057	161,826	3,050,490	3,212,316

**Appendix Table 14: Item non-response rates to income disaggregated by birthplace and sex, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
New Zealand Born	Females	77,919	1,078,044	6.7	56,544	1,117,086	4.8
	Males	56,223	1,012,287	5.3	43,590	1,033,563	4.0
	Total	134,139	2,090,328	6.0	100,134	2,150,649	4.4
Oversea Born	Females	37,071	369,063	9.1	25,917	448,086	5.5
	Males	27,417	350,436	7.3	21,633	417,804	4.9
	Total	64,491	719,508	8.2	47,553	865,890	5.2

**Appendix Table 15: Item non-response rates to income disaggregated by birthplace and age group, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
New Zealand Born	15-24 Years	39,531	375,714	9.5	21,999	391,626	5.3
	25-34 Years	16,485	345,042	4.6	10,398	298,293	3.4
	35-44 Years	18,615	404,706	4.4	11,505	360,723	3.1
	45-54 Years	15,633	373,545	4.0	12,432	388,320	3.1
	55-64 Years	13,461	279,612	4.6	10,956	332,184	3.2
	65-74 Years	10,932	170,868	6.0	12,447	225,057	5.2
	75+ Years	19,485	140,841	12.2	20,400	154,443	11.7
Oversea Born	15-24 Years	17,685	109,692	13.9	9,615	122,679	7.3
	25-34 Years	10,071	121,671	7.6	7,365	163,380	4.3
	35-44 Years	10,557	154,785	6.4	6,495	161,175	3.9
	45-54 Years	7,896	124,656	6.0	6,402	159,429	3.9
	55-64 Years	6,555	94,080	6.5	5,517	115,266	4.6
	65-74 Years	5,307	65,052	7.5	5,016	82,770	5.7
	75+ Years	6,426	49,560	11.5	7,137	61,182	10.4

**Appendix Table 16: Number of item non-respondents and respondents to the personal income question disaggregated by sources of income, Census 2006 and 2013**

Sources of Income	CENSUS 2006			CENSUS 2013		
	Item non-respondents to Income	Item Respondents	Total 15+ URP (excl substitute forms)	Item non-respondents to Income	Item Respondents	Total 15+ URP (excl substitute forms)
No Source of Income	36,162	139,518	175,680	-	233,628	233,625
Wages, Salary, Commissions, Bonuses etc	36,384	1,738,956	1,775,343	27,900	1,781,634	1,809,531
Self-employment or Business	12,237	479,787	492,024	8,793	474,693	483,486
Interest, Dividends, Rent, Other Invest.	9,522	705,210	714,729	7,260	647,802	655,062
Payments from a Work Accident Insurer	1,581	43,533	45,114	1,140	35,127	36,267
NZ Superannuation or Veterans Pension	30,717	408,969	439,683	33,951	492,489	526,437
Other Super., Pensions, Annuities	3,198	80,070	83,268	3,432	80,472	83,904
Unemployment Benefit	7,260	84,909	92,169	6,255	85,224	91,482
Sickness Benefit	6,348	64,206	70,554	6,504	71,904	78,411
Domestic Purposes Benefit	8,862	84,228	93,090	7,905	78,228	86,133
Invalids Benefit	6,678	68,676	75,357	6,828	67,671	74,499
Student Allowance	2,010	62,271	64,284	2,496	86,865	89,361
Other Govt Benefits, Payments or Pension	3,216	93,141	96,357	3,363	127,758	131,121
Other Sources of Income	1,566	64,845	66,411	939	59,226	60,165
Total Stated	140,829	2,821,404	2,962,236	96,600	3,037,122	3,133,722
Not Stated	73,749	18,075	91,824	65,226	13,368	78,594
Total (15+ years)	214,578	2,839,479	3,054,060	161,826	3,050,490	3,212,316

**Appendix Table 17: Item non-response rates to income disaggregated by sources of income and sex, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
No Source of Income	Females	23,847	87,006	21.5	-	139,593	0.0
	Males	12,315	52,515	19.0	-	94,032	0.0
	Total	36,162	139,518	20.6	-	233,628	0.0
Wages, Salary, Commissions, Bonuses	Females	18,477	874,497	2.1	14,085	902,781	1.5
	Males	17,910	864,459	2.0	13,812	878,853	1.5
	Total	36,384	1,738,956	2.0	27,900	1,781,634	1.5
Self-employment or Business	Females	4,857	181,413	2.6	3,456	184,827	1.8
	Males	7,383	298,368	2.4	5,340	289,866	1.8
	Total	12,237	479,787	2.5	8,793	474,693	1.8
Interest, Dividends, Rent, Other Invest.	Females	5,517	350,907	1.5	4,365	324,789	1.3
	Males	4,005	354,300	1.1	2,892	323,013	0.9
	Total	9,522	705,210	1.3	7,260	647,802	1.1
Payments from a Work Accident Insurer	Females	678	17,148	3.8	450	14,175	3.1
	Males	903	26,388	3.3	690	20,955	3.2
	Total	1,581	43,533	3.5	1,140	35,127	3.1
NZ Superannuation or Veterans Pension	Females	20,862	227,325	8.4	22,266	267,078	7.7
	Males	9,855	181,644	5.1	11,685	225,411	4.9
	Total	30,717	408,969	7.0	33,951	492,489	6.4
Other Super., Pensions, Annuities	Females	2,016	34,017	5.6	2,142	35,883	5.6
	Males	1,179	46,053	2.5	1,293	44,586	2.8
	Total	3,198	80,070	3.8	3,432	80,472	4.1
Unemployment Benefit	Females	3,951	40,611	8.9	3,096	38,442	7.5
	Males	3,312	44,301	7.0	3,159	46,782	6.3
	Total	7,260	84,909	7.9	6,255	85,224	6.8
Sickness Benefit	Females	3,597	32,721	9.9	3,432	35,931	8.7
	Males	2,751	31,485	8.0	3,072	35,973	7.9
	Total	6,348	64,206	9.0	6,504	71,904	8.3
Domestic Purposes Benefit	Females	8,145	76,575	9.6	7,086	70,305	9.2
	Males	717	7,653	8.6	819	7,926	9.4
	Total	8,862	84,228	9.5	7,905	78,228	9.2
Invalids Benefit	Females	3,696	35,082	9.5	3,645	33,936	9.7
	Males	2,985	33,594	8.2	3,186	33,735	8.6
	Total	6,678	68,676	8.9	6,828	67,671	9.2
Student Allowance	Females	1,236	34,251	3.5	1,440	47,838	2.9
	Males	774	28,023	2.7	1,056	39,024	2.6
	Total	2,010	62,271	3.1	2,496	86,865	2.8
Other Govt Benefits, Payments or Pension	Females	2,418	68,247	3.4	2,550	96,309	2.6
	Males	798	24,894	3.1	813	31,449	2.5
	Total	3,216	93,141	3.3	3,363	127,758	2.6
Other Sources of Income	Females	1,059	43,716	2.4	621	39,657	1.5
	Males	510	21,129	2.4	315	19,569	1.6
	Total	1,566	64,845	2.4	939	59,226	1.6

**Appendix Table 18: Item non-response rates to income disaggregated by sources of income and age group, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
<b>No Source of Income</b>	15-24 Years	19,185	74,898	<b>20.4</b>	-	133,731	<b>0.0</b>
	25-44 Years	8,433	38,091	<b>18.1</b>	-	51,933	<b>0.0</b>
	45-64 Years	7,275	23,454	<b>23.7</b>	-	41,757	<b>0.0</b>
	65+ Years	1,269	3,078	<b>29.2</b>	-	6,210	<b>0.0</b>
<b>Wages, Salary, Commissions, Bonuses etc</b>	15-24 Years	9,720	359,193	<b>2.6</b>	6,321	312,228	<b>2.0</b>
	25-44 Years	15,519	774,591	<b>2.0</b>	10,242	731,016	<b>1.4</b>
	45-64 Years	10,149	559,356	<b>1.8</b>	9,705	652,221	<b>1.5</b>
	65+ Years	993	45,819	<b>2.1</b>	1,632	86,169	<b>1.9</b>
<b>Self-employment or Business</b>	15-24 Years	369	15,585	<b>2.3</b>	297	14,076	<b>2.1</b>
	25-44 Years	4,914	192,852	<b>2.5</b>	2,685	158,874	<b>1.7</b>
	45-64 Years	6,081	236,922	<b>2.5</b>	4,629	245,637	<b>1.8</b>
	65+ Years	876	34,428	<b>2.5</b>	1,188	56,106	<b>2.1</b>
<b>Interest, Dividends, Rent, Other Invest.</b>	15-24 Years	312	37,359	<b>0.8</b>	126	24,147	<b>0.5</b>
	25-44 Years	1,977	196,902	<b>1.0</b>	810	134,424	<b>0.6</b>
	45-64 Years	3,402	281,904	<b>1.2</b>	2,220	265,575	<b>0.8</b>
	65+ Years	3,831	189,045	<b>2.0</b>	4,104	223,656	<b>1.8</b>
<b>Payments from a Work Accident Insurer</b>	15-24 Years	237	6,294	<b>3.6</b>	144	4,443	<b>3.1</b>
	25-44 Years	552	16,290	<b>3.3</b>	297	11,352	<b>2.5</b>
	45-64 Years	597	18,363	<b>3.1</b>	528	16,455	<b>3.1</b>
	65+ Years	195	2,583	<b>7.0</b>	171	2,877	<b>5.6</b>
<b>NZ Superannuati on or Veterans Pension</b>	15-24 Years	24	384	<b>5.9</b>	30	288	<b>9.4</b>
	25-44 Years	72	1,005	<b>6.7</b>	42	1,176	<b>3.4</b>
	45-64 Years	789	14,553	<b>5.1</b>	675	11,544	<b>5.5</b>
	65+ Years	29,832	393,030	<b>7.1</b>	33,207	479,481	<b>6.5</b>
<b>Other Super., Pensions, Annuities</b>	15-24 Years	27	420	<b>6.0</b>	15	240	<b>5.9</b>
	25-44 Years	48	2,361	<b>2.0</b>	33	1,371	<b>2.4</b>
	45-64 Years	291	16,314	<b>1.8</b>	198	11,607	<b>1.7</b>
	65+ Years	2,835	60,972	<b>4.4</b>	3,189	67,257	<b>4.5</b>

Continued.....

**Appendix Table 17: Item non-response rates to income disaggregated by sources of income and age group, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
<b>Unemployment Benefit</b>	15-24 Years	2,427	23,910	<b>9.2</b>	2,106	28,539	<b>6.9</b>
	25-44 Years	2,571	31,512	<b>7.5</b>	2,217	30,198	<b>6.8</b>
	45-64 Years	1,914	25,293	<b>7.0</b>	1,755	24,516	<b>6.7</b>
	65+ Years	345	4,194	<b>7.6</b>	183	1,968	<b>8.5</b>
<b>Sickness Benefit</b>	15-24 Years	1,044	10,074	<b>9.4</b>	951	11,031	<b>7.9</b>
	25-44 Years	2,085	22,743	<b>8.4</b>	1,944	22,536	<b>7.9</b>
	45-64 Years	2,742	27,852	<b>9.0</b>	3,078	33,828	<b>8.3</b>
	65+ Years	474	3,534	<b>11.8</b>	528	4,512	<b>10.5</b>
<b>Domestic Purposes Benefit</b>	15-24 Years	2,262	13,242	<b>14.6</b>	2,079	13,407	<b>13.4</b>
	25-44 Years	5,295	55,842	<b>8.7</b>	4,377	46,866	<b>8.5</b>
	45-64 Years	1,122	14,052	<b>7.4</b>	1,293	16,956	<b>7.1</b>
	65+ Years	186	1,095	<b>14.5</b>	156	1,002	<b>13.5</b>
<b>Invalids Benefit</b>	15-24 Years	516	5,226	<b>9.0</b>	483	5,556	<b>8.0</b>
	25-44 Years	2,037	20,763	<b>8.9</b>	1,785	17,460	<b>9.3</b>
	45-64 Years	3,645	38,499	<b>8.6</b>	4,005	39,750	<b>9.2</b>
	65+ Years	486	4,188	<b>10.4</b>	552	4,905	<b>10.1</b>
<b>Student Allowance</b>	15-24 Years	1,305	37,359	<b>3.4</b>	1,818	58,980	<b>3.0</b>
	25-44 Years	549	20,403	<b>2.6</b>	501	22,881	<b>2.1</b>
	45-64 Years	138	4,101	<b>3.3</b>	156	4,764	<b>3.2</b>
	65+ Years	18	414	<b>4.2</b>	18	237	<b>7.1</b>
<b>Other Govt Benefits, Payments or Pension</b>	15-24 Years	606	11,157	<b>5.2</b>	672	14,367	<b>4.5</b>
	25-44 Years	1,254	51,933	<b>2.4</b>	1,284	77,196	<b>1.6</b>
	45-64 Years	552	16,485	<b>3.2</b>	615	25,134	<b>2.4</b>
	65+ Years	801	13,563	<b>5.6</b>	792	11,055	<b>6.7</b>
<b>Other Sources of Income</b>	15-24 Years	582	22,044	<b>2.6</b>	315	17,625	<b>1.8</b>
	25-44 Years	534	27,162	<b>1.9</b>	276	23,127	<b>1.2</b>
	45-64 Years	303	11,991	<b>2.5</b>	198	14,025	<b>1.4</b>
	65+ Years	150	3,648	<b>3.9</b>	153	4,446	<b>3.3</b>

**Appendix Table 19: Number of item non-respondents and respondents to the personal income question disaggregated by highest qualification, Census 2006 and 2013**

Highest Qualification	CENSUS 2006			CENSUS 2013		
	Item non-respondents to Income	Item Respondents	Total 15+ URP	Item non-respondents to Income	Item Respondents	Total 15+ URP
No Qualifications	54,609	653,823	708,432	35,262	593,115	628,377
School	48,684	943,881	992,565	31,872	1,066,551	1,098,423
Vocational	19,962	663,621	683,583	13,416	659,106	672,522
Bachelor Degree & above	6,387	441,396	447,783	4,383	596,925	601,308
Total Stated	129,639	2,702,721	2,832,360	84,936	2,915,700	3,000,636
Not Elsewhere Included	84,942	136,761	221,703	76,893	134,790	211,683
Total	214,581	2,839,482	3,054,063	161,826	3,050,487	3,212,313

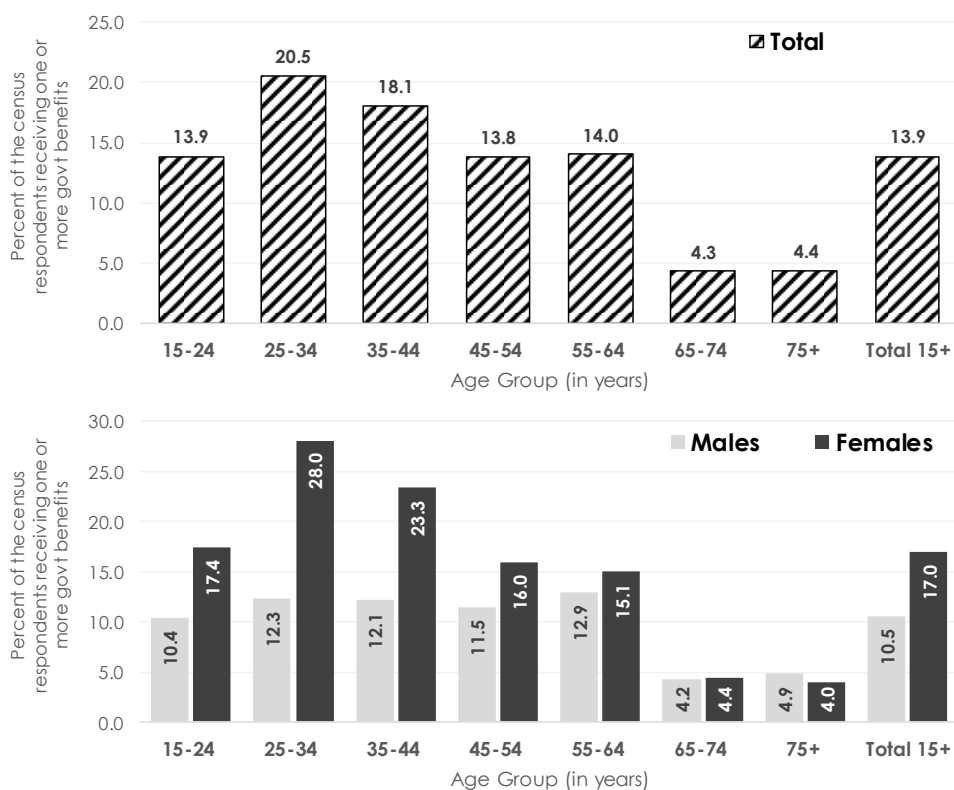
**Appendix Table 20: Item non-response rates to income disaggregated by highest qualification and sex, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
No Qualifications	Females	32,769	329,121	9.1	20,643	299,466	6.4
	Males	21,843	324,705	6.3	14,619	293,649	4.7
	Total	54,609	653,823	7.7	35,262	593,115	5.6
School	Females	30,468	517,167	5.6	19,290	577,731	3.2
	Males	18,219	426,717	4.1	12,582	488,820	2.5
	Total	48,684	943,881	4.9	31,872	1,066,551	2.9
Vocational	Females	10,893	307,308	3.4	6,744	299,421	2.2
	Males	9,066	356,316	2.5	6,675	359,691	1.8
	Total	19,962	663,621	2.9	13,416	659,106	2.0
Bachelor Degree & above	Females	4,245	234,996	1.8	2,739	336,966	0.8
	Males	2,142	206,400	1.0	1,644	259,959	0.6
	Total	6,387	441,396	1.4	4,383	596,925	0.7

**Appendix Table 21: Item non-response rates to income disaggregated by highest qualification and age group, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
<b>No Qualifications</b>	15-24 Years	16,227	101,973	<b>13.7</b>	4,971	86,286	<b>5.4</b>
	25-34 Years	5,685	60,372	<b>8.6</b>	3,750	54,006	<b>6.5</b>
	35-44 Years	7,119	96,600	<b>6.9</b>	4,254	66,168	<b>6.0</b>
	45-54 Years	6,681	106,485	<b>5.9</b>	4,962	95,424	<b>4.9</b>
	55-64 Years	6,996	122,112	<b>5.4</b>	4,713	106,623	<b>4.2</b>
	65-74 Years	5,322	90,711	<b>5.5</b>	5,949	104,010	<b>5.4</b>
	75+ Years	6,582	75,570	<b>8.0</b>	6,672	80,601	<b>7.6</b>
<b>School</b>	15-24 Years	18,987	264,072	<b>6.7</b>	9,732	302,577	<b>3.1</b>
	25-34 Years	6,639	150,546	<b>4.2</b>	3,567	134,928	<b>2.6</b>
	35-44 Years	7,167	184,794	<b>3.7</b>	3,948	170,148	<b>2.3</b>
	45-54 Years	5,118	150,618	<b>3.3</b>	3,945	182,007	<b>2.1</b>
	55-64 Years	3,528	94,140	<b>3.6</b>	2,922	137,217	<b>2.1</b>
	65-74 Years	2,697	55,713	<b>4.6</b>	2,877	83,667	<b>3.3</b>
	75+ Years	4,545	43,998	<b>9.4</b>	4,890	56,001	<b>8.0</b>
<b>Vocational</b>	15-24 Years	3,291	68,931	<b>4.6</b>	2,076	67,719	<b>3.0</b>
	25-34 Years	3,483	121,860	<b>2.8</b>	1,908	110,664	<b>1.7</b>
	35-44 Years	3,918	151,689	<b>2.5</b>	1,968	125,370	<b>1.5</b>
	45-54 Years	3,324	141,210	<b>2.3</b>	2,055	138,774	<b>1.5</b>
	55-64 Years	2,394	94,833	<b>2.5</b>	1,707	111,396	<b>1.5</b>
	65-74 Years	1,494	53,091	<b>2.7</b>	1,551	67,335	<b>2.3</b>
	75+ Years	2,064	32,004	<b>6.1</b>	2,151	37,848	<b>5.4</b>
<b>Bachelor Degree &amp; above</b>	15-24 Years	651	39,405	<b>1.6</b>	378	47,133	<b>0.8</b>
	25-34 Years	1,767	125,091	<b>1.4</b>	954	152,562	<b>0.6</b>
	35-44 Years	1,695	114,312	<b>1.5</b>	933	150,222	<b>0.6</b>
	45-54 Years	1,065	87,264	<b>1.2</b>	816	119,112	<b>0.7</b>
	55-64 Years	597	46,344	<b>1.3</b>	537	77,754	<b>0.7</b>
	65-74 Years	246	17,898	<b>1.4</b>	351	34,857	<b>1.0</b>
	75+ Years	360	11,082	<b>3.1</b>	411	15,285	<b>2.6</b>

**Appendix Figure 9: Proportion (%) of the 15+ year population who reported receiving one or more government benefits as a source of income at the 2013 Census disaggregated by age group and sex**



Government benefits include Unemployment, Domestic Purpose, Sickness, Invalids and Other Govt Benefits, Payments or Pension. It does not include NZ Superannuation or Veteran's Pension.

**Appendix Table 22: Number of item non-respondents and respondents to the personal income question disaggregated by work and labour force status, Census 2006 and 2013**

Work and Labour Force Status	CENSUS 2006			CENSUS 2013		
	Item non-respondents to Income	Item Respondents	Total 15+ URP	Item non-respondents to Income	Item Respondents	Total 15+ URP
Total Employed	71,502	1,914,276	1,985,778	51,303	1,949,703	2,001,006
Unemployed	13,932	92,568	106,500	12,282	140,928	153,210
Not in Labour Force	129,150	832,635	961,785	98,244	959,856	1,058,100
Total 15+ Popn	214,584	2,839,479	3,054,063	161,829	3,050,487	3,212,316

Note: Work and Labour Force status is imputed for the census respondents who do not answer one or more questions used to derive this variable.

**Appendix Table 23: Item non-response rates to income disaggregated by work and labour force status and sex, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
<b>Total Employed</b>	Females	32,469	903,540	<b>3.5</b>	23,025	931,425	<b>2.4</b>
	Males	39,033	1,010,733	<b>3.7</b>	28,281	1,018,278	<b>2.7</b>
	Total	71,502	1,914,276	<b>3.6</b>	51,303	1,949,703	<b>2.6</b>
<b>Unemployed</b>	Females	7,971	49,653	<b>13.8</b>	6,606	75,999	<b>8.0</b>
	Males	5,958	42,912	<b>12.2</b>	5,676	64,929	<b>8.0</b>
	Total	13,932	92,568	<b>13.1</b>	12,282	140,928	<b>8.0</b>
<b>Not in Labour Force</b>	Females	82,518	509,115	<b>13.9</b>	60,030	575,286	<b>9.4</b>
	Males	46,629	323,523	<b>12.6</b>	38,211	384,573	<b>9.0</b>
	Total	129,150	832,635	<b>13.4</b>	98,244	959,856	<b>9.3</b>

**Appendix Table 24: Item non-response rates to income disaggregated by work and labour force status and age group, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
<b>Total Employed</b>	15-24 Years	15,387	301,068	<b>4.9</b>	9,141	261,936	<b>3.4</b>
	25-44 Years	28,752	834,876	<b>3.3</b>	17,886	772,146	<b>2.3</b>
	45-64 Years	22,569	701,754	<b>3.1</b>	18,771	791,610	<b>2.3</b>
	65+ Years	4,791	76,578	<b>5.9</b>	5,502	124,011	<b>4.2</b>
<b>Unemployed</b>	15-24 Years	7,662	40,737	<b>15.8</b>	4,794	56,508	<b>7.8</b>
	25-44 Years	4,437	33,768	<b>11.6</b>	4,683	48,621	<b>8.8</b>
	45-64 Years	1,728	16,989	<b>9.2</b>	2,679	33,654	<b>7.4</b>
	65+ Years	99	1,074	<b>8.4</b>	126	2,145	<b>5.5</b>
<b>Not in Labour Force</b>	15-24 Years	37,137	147,201	<b>20.1</b>	19,719	199,794	<b>9.0</b>
	25-44 Years	26,991	163,479	<b>14.2</b>	16,248	169,947	<b>8.7</b>
	45-64 Years	22,749	163,647	<b>12.2</b>	16,848	181,626	<b>8.5</b>
	65+ Years	42,270	358,314	<b>10.6</b>	45,423	408,495	<b>10.0</b>

**Appendix Table 25: Number of item non-respondents and respondents to the personal income question disaggregated by employment status, Census 2006 and 2013**

Employment Status	CENSUS 2006			CENSUS 2013		
	Item non-respondents to Income	Item Respondents	Total 15+ URP	Item non-respondents to Income	Item Respondents	Total 15+ URP
Self-employed & without employees	6,435	228,519	234,954	4,602	231,318	235,920
Employer	3,870	139,014	142,884	2,442	127,428	129,870
Paid employee	33,027	1,478,223	1,511,250	24,510	1,528,998	1,553,508
Unpaid family worker	3,024	36,543	39,567	1,524	36,192	37,716
Total Stated	46,356	1,882,299	1,928,655	33,078	1,923,936	1,957,014
Not Elsewhere Included	25,146	31,980	57,126	18,228	25,767	43,995
Total Employed (15+ years)	71,502	1,914,276	1,985,778	51,303	1,949,703	2,001,006

**Appendix Table 26: Item non-response rates to income disaggregated by employment status and sex, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
Self-employed & without employees	Females	2,244	80,469	2.7	1,587	85,095	1.8
	Males	4,191	148,047	2.8	3,012	146,223	2.0
	Total	6,435	228,519	2.7	4,602	231,318	2.0
Employer	Females	1,413	43,260	3.2	852	40,410	2.1
	Males	2,460	95,748	2.5	1,590	87,015	1.8
	Total	3,870	139,014	2.7	2,442	127,428	1.9
Paid employee	Females	16,629	742,122	2.2	12,195	772,881	1.6
	Males	16,398	736,098	2.2	12,312	756,120	1.6
	Total	33,027	1,478,223	2.2	24,510	1,528,998	1.6
Unpaid family worker	Females	2,001	21,093	8.7	906	20,349	4.3
	Males	1,023	15,450	6.2	621	15,840	3.8
	Total	3,024	36,543	7.6	1,524	36,192	4.0

**Appendix Table 27: Item non-response rates to income disaggregated by employment status and age group, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
Self-employed & without employees	15-24 Years	237	6,192	3.7	138	5,814	2.3
	25-44 Years	2,439	88,233	2.7	1,353	74,424	1.8
	45-64 Years	3,165	114,336	2.7	2,448	120,042	2.0
	65+ Years	594	19,758	2.9	663	31,041	2.1
Employer	15-24 Years	72	1,449	4.7	45	1,170	3.7
	25-44 Years	1,521	54,978	2.7	729	41,766	1.7
	45-64 Years	2,004	75,144	2.6	1,344	72,705	1.8
	65+ Years	279	7,428	3.6	318	11,793	2.6
Paid employee	15-24 Years	8,631	283,911	3.0	5,253	246,513	2.1
	25-44 Years	13,794	670,773	2.0	8,934	640,419	1.4
	45-64 Years	9,558	488,259	1.9	8,787	575,868	1.5
	65+ Years	1,044	35,277	2.9	1,533	66,201	2.3
Unpaid family worker	15-24 Years	552	4,665	10.6	168	4,794	3.4
	25-44 Years	846	11,133	7.1	330	8,562	3.7
	45-64 Years	1,098	13,863	7.3	552	13,959	3.8
	65+ Years	525	6,888	7.1	477	8,874	5.1

**Appendix Table 28: Number of item non-respondents and respondents to the personal income question disaggregated by occupation, Census 2006 and 2013**

Occupation	CENSUS 2006			CENSUS 2013		
	Item non-respondents to Income	Item Respondents	Total 15+ URP	Item non-respondents to Income	Item Respondents	Total 15+ URP
Managers	6,672	333,858	340,530	4,635	351,441	356,076
Professionals	3,999	370,329	374,328	2,994	423,705	426,699
Technicians & Trades Workers	6,411	235,446	241,857	4,593	223,224	227,817
Community & personal service workers	3,951	152,517	156,468	3,216	167,817	171,033
Clerical & administrative workers	3,873	236,940	240,813	2,508	225,483	227,991
Sales workers	4,017	182,043	186,060	2,754	174,063	176,817
Machinery operators & drivers	3,678	110,646	114,324	2,514	101,061	103,575
Labourers	8,247	210,744	218,991	6,054	204,534	210,588
Total Stated	40,848	1,832,523	1,873,371	29,268	1,871,328	1,900,596
Not Elsewhere Included	30,651	81,753	112,404	22,026	78,381	100,407
Total Employed (15+ years)	71,502	1,914,273	1,985,775	51,303	1,949,703	2,001,006

**Appendix Table 29: Item non-response rates to income disaggregated by occupation and sex, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
<b>Managers</b>	Females	2,499	117,621	<b>2.1</b>	1,719	129,957	<b>1.3</b>
	Males	4,176	216,234	<b>1.9</b>	2,919	221,484	<b>1.3</b>
	Total	6,672	333,858	<b>2.0</b>	4,635	351,441	<b>1.3</b>
<b>Professionals</b>	Females	2,415	206,070	<b>1.2</b>	1,857	241,344	<b>0.8</b>
	Males	1,584	164,262	<b>1.0</b>	1,137	182,361	<b>0.6</b>
	Total	3,999	370,329	<b>1.1</b>	2,994	423,705	<b>0.7</b>
<b>Technicians &amp; Trades Workers</b>	Females	1,356	44,166	<b>3.0</b>	1,008	44,451	<b>2.2</b>
	Males	5,058	191,277	<b>2.6</b>	3,588	178,770	<b>2.0</b>
	Total	6,411	235,446	<b>2.7</b>	4,593	223,224	<b>2.0</b>
<b>Community &amp; personal service workers</b>	Females	3,141	106,503	<b>2.9</b>	2,550	115,128	<b>2.2</b>
	Males	807	46,020	<b>1.7</b>	672	52,686	<b>1.3</b>
	Total	3,951	152,517	<b>2.5</b>	3,216	167,817	<b>1.9</b>
<b>Clerical &amp; administrative workers</b>	Females	3,183	186,375	<b>1.7</b>	1,974	175,341	<b>1.1</b>
	Males	690	50,562	<b>1.3</b>	537	50,139	<b>1.1</b>
	Total	3,873	236,940	<b>1.6</b>	2,508	225,483	<b>1.1</b>
<b>Sales workers</b>	Females	2,778	108,771	<b>2.5</b>	1,878	104,475	<b>1.8</b>
	Males	1,239	73,272	<b>1.7</b>	873	69,594	<b>1.2</b>
	Total	4,017	182,043	<b>2.2</b>	2,754	174,063	<b>1.6</b>
<b>Machinery operators &amp; drivers</b>	Females	732	17,706	<b>4.0</b>	471	13,503	<b>3.4</b>
	Males	2,943	92,946	<b>3.1</b>	2,046	87,555	<b>2.3</b>
	Total	3,678	110,646	<b>3.2</b>	2,514	101,061	<b>2.4</b>
<b>Labourers</b>	Females	3,711	79,467	<b>4.5</b>	2,586	73,653	<b>3.4</b>
	Males	4,539	131,274	<b>3.3</b>	3,468	130,881	<b>2.6</b>
	Total	8,247	210,744	<b>3.8</b>	6,054	204,534	<b>2.9</b>

**Appendix Table 30: Item non-response rates to income disaggregated by occupation and age group, Census 2006 and 2013**

		Census 2006			Census 2013		
		Item non-respondents to Income	Item Respondents	Non-response rate (%)	Item non-respondents to Income	Item Respondents	Non-response rate (%)
<b>Managers</b>	15-24 Years	582	23,196	<b>2.4</b>	372	20,850	<b>1.8</b>
	25-44 Years	2,745	152,259	<b>1.8</b>	1,554	143,703	<b>1.1</b>
	45-64 Years	2,952	143,562	<b>2.0</b>	2,208	162,348	<b>1.3</b>
	65+ Years	393	14,844	<b>2.6</b>	504	24,537	<b>2.0</b>
<b>Professionals</b>	15-24 Years	375	27,957	<b>1.3</b>	231	28,236	<b>0.8</b>
	25-44 Years	1,878	187,737	<b>1.0</b>	1,182	199,590	<b>0.6</b>
	45-64 Years	1,533	142,632	<b>1.1</b>	1,290	173,277	<b>0.7</b>
	65+ Years	219	11,994	<b>1.8</b>	294	22,602	<b>1.3</b>
<b>Technicians &amp; Trades Workers</b>	15-24 Years	1,332	43,011	<b>3.0</b>	723	31,905	<b>2.2</b>
	25-44 Years	2,847	108,462	<b>2.6</b>	1,806	96,924	<b>1.8</b>
	45-64 Years	2,034	77,286	<b>2.6</b>	1,764	83,841	<b>2.1</b>
	65+ Years	204	6,672	<b>3.0</b>	294	10,566	<b>2.7</b>
<b>Community &amp; personal service workers</b>	15-24 Years	1,035	35,958	<b>2.8</b>	708	36,870	<b>1.9</b>
	25-44 Years	1,524	62,277	<b>2.4</b>	1,083	60,936	<b>1.7</b>
	45-64 Years	1,239	50,403	<b>2.4</b>	1,176	61,986	<b>1.9</b>
	65+ Years	138	3,894	<b>3.4</b>	252	8,019	<b>3.0</b>
<b>Clerical &amp; administrative workers</b>	15-24 Years	606	29,895	<b>2.0</b>	297	22,857	<b>1.3</b>
	25-44 Years	1,644	106,677	<b>1.5</b>	852	86,976	<b>1.0</b>
	45-64 Years	1,455	92,769	<b>1.5</b>	1,110	101,259	<b>1.1</b>
	65+ Years	156	7,623	<b>2.0</b>	249	14,385	<b>1.7</b>
<b>Sales workers</b>	15-24 Years	1,536	60,969	<b>2.5</b>	939	52,191	<b>1.8</b>
	25-44 Years	1,344	64,509	<b>2.0</b>	765	56,808	<b>1.3</b>
	45-64 Years	1,029	51,759	<b>1.9</b>	891	56,190	<b>1.6</b>
	65+ Years	105	4,803	<b>2.1</b>	159	8,874	<b>1.8</b>
<b>Machinery operators &amp; drivers</b>	15-24 Years	531	14,070	<b>3.6</b>	321	11,586	<b>2.7</b>
	25-44 Years	1,614	47,514	<b>3.3</b>	870	36,048	<b>2.4</b>
	45-64 Years	1,386	44,487	<b>3.0</b>	1,101	45,633	<b>2.4</b>
	65+ Years	147	4,578	<b>3.1</b>	219	7,797	<b>2.7</b>
<b>Labourers</b>	15-24 Years	2,442	53,985	<b>4.3</b>	1,398	47,310	<b>2.9</b>
	25-44 Years	3,207	77,688	<b>4.0</b>	2,082	65,979	<b>3.1</b>
	45-64 Years	2,283	70,179	<b>3.2</b>	2,175	77,079	<b>2.7</b>
	65+ Years	324	8,895	<b>3.5</b>	411	14,163	<b>2.8</b>