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ABSTRACT

International Migration and the Distribution of Income in New Zealand Metropolitan and Non-Metropolitan Areas*

Since the 1980s, income inequality in New Zealand has been a growing concern - particularly in metropolitan areas. At the same time, the encouragement of permanent and temporary immigration has led to the foreign-born accounting for a growing share of the population; this is disproportionally so in metropolitan areas. This paper investigates the impact of immigration, by skill level and length of stay, on the distribution of income in metropolitan and non-metropolitan areas. We apply decomposition methodologies to data obtained from the 1986, 1991, 1996, 2001, 2006 and 2013 Censuses of Population and Dwellings. We find that increases in the immigrant share of population in an area have an inequality-increasing and area-specific effect. Changes in immigrant-group-specific distributions of income are inequality reducing in non-metropolitan areas but inequality increasing in metropolitan areas. Inequality increased in metropolitan areas because the overall inequality-increasing effect of immigration is larger than the inequality-reducing changes for the New Zealand-born. The opposite is the case in non-metropolitan areas: the overall inequality-reducing change in the income distribution of the New Zealand born there is larger than the inequality-increasing effect of immigration. The methodologies adopted here can also benefit the study of income distribution changes in countries with similar immigration policies, such as Australia and Canada.

JEL Classification: D63, F22, J15, R23

Keywords: international migration, income inequality, New Zealand, metropolitan areas, decomposition methods

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* Access to the data used in this study was provided by Statistics New Zealand (SNZ) under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. All frequency counts using Census data were subject to base three rounding in accordance with SNZ's release policy for census data.

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1. Introduction

Immigration has a major impact on population size, composition and distribution in New Zealand. Data from the 2013 Census of Population and Dwellings show that nationally, around 1 in 4 persons in New Zealand is foreign-born (Statistics New Zealand, 2014). Sub-nationally, international migration is even more significant in metropolitan areas, like the Auckland region where almost 4 out of 10 people are foreign-born. Accompanying the rising rate of immigration is a growing public debate on the appropriate levels of immigration and the perceived or actual societal impacts of immigrants. In addition to social concerns, there are also concerns about the effect of immigrants on the labour market[1] through their impact on wages and employment. These concerns are voiced both in the popular media (see Fyers, 2017) and among professional economists (Fry & Wilson, 2017).

There is already considerable New Zealand evidence on the impact of immigration on economic variables like wages and house prices (see Stillman & Maré, 2008; Maré & Stillman, 2009; and the review by Hodgson & Poot, 2011). However, the impact of immigration on the distribution of labour income has not previously been investigated explicitly at national or sub-national levels in New Zealand. To do so is the objective of the present paper. Additionally, the methodologies applied here may be useful in the context of countries like Australia and Canada, which have similar immigration policies.

International migration may affect the overall distribution of income in a destination area through three specific channels: 1) the compositional channel – due to differences between the aggregate income distributions of migrants and locals, and the changing relative proportions of these groups in the population; 2) the immigrant-specific income distribution channel whereby income distributions of migrants change differentially from those of locals; and 3) the general equilibrium effect of immigration on the income distribution of locals.

Through decomposition methodologies, we focus on six different groups of international migrants and compare them with two groups of New Zealand-born.

[1] New Zealand has the fifth highest proportion of immigrants in the population among OECD countries (after Luxembourg, Switzerland, Australia and Israel), see e.g. https://data.oecd.org/migration/foreign-born-population.htm

We calculate how each of these groups contributes to changes in the overall distribution of income between 1986 and 2013 in metropolitan and non-metropolitan areas. The 1986 to 2013 period represents a period of rising immigration as well as diversification in the type of immigrants coming to New Zealand. Phillips (2005) notes that "for over 130 years, from 1840 to the 1970s, New Zealand sought to people itself with 'kith and kin' from the United Kingdom. In the years since then, immigration from new countries has transformed the nation's culture and values". As well as examining the overall effect of these changes, we account for the fact that migrants are disproportionally attracted to metropolitan areas. Recent events like the Brexit vote in the UK have shown that space matters when considering changes in the income distribution. Focusing on national effects may be misleading or hide significant differences.

The analysis examines the composition effect (or the migrant-share effect) and changes in the distribution of income of migrant and non-migrant groups (migrant-specific income distribution effect). For both effects, we consider changes over time and differences across areas. We focus our analysis on the urban population of New Zealand aged 25 to 64 and earning positive income.[2] This way, we aim to capture labour market effects.[3]

We find evidence of an income inequality-reducing effect of increasing duration of stay in New Zealand among international migrants. Inequality is higher among newly arrived immigrant groups than among earlier immigrant groups regardless of skill level.

With respect to changes in the distribution of income between 1986 and 2013 across areas, we find that inequality rose slightly by about 1% in all urban areas combined but this masks the spatial difference. Inequality fell in non-metropolitan areas by 11% and rose in metropolitan areas by 4%.

We find that the proportion of immigrants in metropolitan areas is almost double that in non-metropolitan areas in all periods. This has a major impact on overall

[2] The population aged 25 to 64 earning positive income living in urban areas (both non-metropolitan and metropolitan) accounted for more than three quarters of all people aged 25 to 64 in New Zealand in each census period.

[3] Strictly speaking, income captured for the 25-64 age group in Censuses includes other non-labour income, like investment income, but Statistics New Zealand estimates that wages and salaries contribute more than two-thirds of overall income in general and even more so for those aged 25-64 (Statistics New Zealand, 1999). Other data sources like the Household Economic Surveys may provide better information on labour market incomes; but the Census remains the most comprehensive dataset for analysis at the sub-national level where surveys typically suffer from relatively large sampling errors and bias.

change in inequality. For the New Zealand-born (excluding New Zealand-born who have returned from living abroad), we find that changes in their population share and in their within-group income distribution are inequality-reducing across all areas. For all immigrant groups, increases in their population share have a universal inequality-increasing effect in both metropolitan and non-metropolitan areas but the effect of changes in the immigrant-specific distribution of income differs by area: it is inequality-reducing in non-metropolitan areas but inequality-increasing in metropolitan areas.

How do immigrants affect the distribution of personal incomes in destination areas? International migrants typically have a different income distribution when compared to locals. For example, immigrants may have a skill distribution that differs from the one for locals. Also, immigrants' skills may be rewarded differently in the labour market compared with those of locals. Furthermore, an increase in the number of immigrants effectively serves as an increase in labour supply and, depending on whether immigrants serve as substitutes or complements to locals, immigration may increase or decrease the labour market income of locals. All these effects imply that an increase in immigration may widen or narrow the distribution of income (or leave it unchanged). The impact of immigration on the earnings of locals is one of the most actively researched areas in the labour economics literature (see, e.g., Card, 1990, Borjas, 2003, Borjas et al., 1997, D'Amuri et al., 2010). In addition, international migrants are not a homogenous group. They may represent different age groups, skills, languages, and ethnicities. International migration may then impact on the overall distribution of income through changes in the distribution of income among migrants themselves, i.e. a "within the migrant group" effect. For example, certain classes of migrants may have skills that are relatively scarce and therefore rewarded highly. An increasing proportion of such migrants among the immigrants may widen the migrant and overall distributions of income.

Empirically, the evidence suggests that immigration has small effects on the individual earnings of locals (see Maré & Stillman, 2009 for New Zealand evidence; Card, 2009, for US evidence; Productivity Commission, 2006, for Australian evidence; and Longhi et al., 2005 for a meta-analysis of the international evidence). This extensive evidence justifies why we choose to focus on the other two channels through which migration can affect the overall income

distribution: the population composition effect and migrant-specific distribution effect. Both effects can be quite important. For example, Card (2009) finds that immigration in the US has very small impacts on wage inequality among locals, but when immigrants themselves are counted in the overall population; their presence can explain around 5% of the increase in overall wage inequality in the US between 1980 and 2000.

There are two important considerations when evaluating the role of international migration on the distribution of income in New Zealand: firstly, it is expected that the impact of international migration on the distribution of income will depend on the type of migrant (including New Zealand-born returning from abroad). Secondly, the length of stay of migrants in New Zealand is another important factor to account for when analysing the effect of international migration on inequality. There is existing evidence of convergence in incomes of migrants and locals the longer migrants stay in host countries (see Stillman & Maré, 2009 for New Zealand evidence). Hence, we expect the impact of international migration on the distribution of income to be dependent on the type of migrant as well as on their length of stay. We therefore classify migrants by skill level (into two groups: *High* and *Medium/Low Skilled*) and by their length of stay (also into two groups: *Newly Arrived* and *Earlier* migrants). Apart from these groups, there is also a stock of returning New Zealand-born people who were previously residing overseas. It is expected that these groups may have a different impact on the distribution of income than other immigrants and we therefore include them separately.[4]

The rest of the study proceeds as follows: Section 2 provides a brief review of the literature on the relationship between migration and the distribution of income. Section 3 introduces the decomposition methodologies. Section 4 describes the data and provides a description of the changes in immigration as well as of the distribution of income in New Zealand between 1986 and 2013. Section 5 presents the results and section 6 concludes.

[4] Selective emigration by the New Zealand born may influence the distribution of income in New Zealand too. However, there are no data on the incomes of emigrants before they left New Zealand. Some research suggests that the propensity to emigrate is similar across all skill groups, at least in trans-Tasman migration (e.g., Bushnell and Choy, 2001). Other research shows that the New Zealand-born have the highest rate, among the OECD countries, of highly skilled living abroad (Dumont and Lemaitre, 2005).

2. Literature Review

Blau and Kahn (2012) and Card (2009) have provided an extensive review of the theoretical and empirical evidence on the relationship between immigration and the distribution of income. Here we will therefore remain brief and focus only on three channels through which international migration affects the distribution of income in destination countries:

- The composition, or shares, effect;
- The effect on incomes of locals;
- The migrant-specific distribution effect.

2.1. The composition/shares effect

Immigrants typically possess characteristics that differ from the locally-born and these differences may influence local inequality. Immigrants typically have a different skill composition as well as different returns for skills. Both factors can influence inequality. Card (2009) found that immigrants are clustered at the high and low ends of the educational distribution and tend to have higher residual inequality than natives (p.19). Immigrants are typically self-selected, and the compositional difference could have implications for the overall distribution of income in their destination countries. Lumpe and Weigert (2010) present a theoretical framework that shows that the effect of immigration on between-skill group inequality is ambiguous and depends on the educational attainment level of the host country. In New Zealand's case, the compositional effect may be important as a key objective of past and present migration policy is to attract migrants to address skill shortages.[5] The impact of this selectivity on local inequality will depend on where most immigrants fall in the distribution of income in the destination areas – which is dependent on the skill distribution of this area and how migrants are rewarded. There is existing empirical evidence that New Zealand migrants are different from the locally-born and are rewarded differently in the labour market (Stillman &Maré, 2009; Poot & Stillman, 2016; Poot & Roskruge, 2013). Although there is evidence of some convergence over time, some persistent differences remain. For example, using data from 1997 to 2007, Stillman and Maré (2009) provide evidence that around 15 years after

[5] There is also a considerable flow of temporary migrants which consists predominantly of people taking up unskilled or semiskilled work in agriculture and tourism.

arrival, the income difference between immigrants and native-born New Zealanders has halved for men and disappears entirely for women. Thus, given the pattern of difference between migrants and locals in skill distribution as well as in returns for skills, it is expected that the compositional effect might be particularly relevant for New Zealand. The compositional effect may vary spatially, given the selectivity in terms of places immigrants choose to locate in. Most immigrants prefer the bigger metropolitan areas. Moore and Pacey (2003) examined the differences between metropolitan and non-metropolitan areas in the role of immigration with respect to the level of income inequality in Canada between 1980 and 1995.They found that the effects of immigrants on inequality were greater in the metropolitan cities, with the impact in the two cities of Toronto and Vancouver almost twice the rate of impact in any other city in the early 1990s.

2.2. Migration and distribution of income of locals

This is perhaps one of the most actively researched areas in the labour migration literature. There has been a lot of effort put into understanding the effect of immigration on labour market outcomes of locals in destination countries. This area of research is very important because migrants are typically an addition to the labour supply and a big part of the debate on the impact of immigration on locals is typically framed around the effect of immigration on wages and employment. Two main methodological approaches have dominated the literature measuring the effect of migrants on the income of locals[6]: the first approach compares the distribution of income in places with high immigration to those with low immigration, while controlling for other factors; and the second approach estimates the parameters of an assumed aggregate production function and uses these parameters to simulate the impact of any type of migration change. Some studies have also used natural experiments in the form of exogenous large shocks to migration, such as the Mariel Boatlift (see Card, 1990), to explore the impact of migration on the earnings of locals. LaLonde and Topel (1991), Altonji and Card (1991), Card (2001) and Borjas (2003) reported that immigrants lower the wages of natives.[7] In contrast, Dustmann, Fabbri and Preston (2005), Cortés (2008), Manacorda, Manning and Wadsworth (2012), and Card (2005) found that immigrants do not have statistically significant effects on the wages of locals, and

[6] See Blau and Kahn (2012) for a review of the empirical and methodological literature.
[7] In some studies, immigrants' lower wages of certain types of locals. For example, Card (2001) finds that immigrants lower wages of skilled locals.

Card (2009), Winter-Ebmer and Zweimüller (1996), and Foged and Peri (2016) showed that immigrants increased the wages of locals. New Zealand evidence from Maré and Stillman (2009) finds little evidence that immigrants negatively affect either the wages or employment opportunities of the average New Zealand-born worker. They find some evidence that increases in the number of high-skilled recent migrants have small negative impacts on the wages of high-skilled New Zealand-born workers, which are offset by small positive impacts on the wages of medium-skilled New Zealanders.

The literature appears inconclusive regarding the wage impact of immigration, given the abundance of positive, negative and insignificant results in the literature, but the evidence points towards the effects being quantitatively small in most cases. A meta-analysis of the literature on the labour market impacts of immigration on native workers in terms of wages and employment reveals small effects (Longhi et al. 2008).[8] We conclude that we expect the effect of immigration on the overall distribution of income through its impact on the income of locals to be quantitatively small. This study therefore excludes this channel and focuses on the composition and migrant-specific distribution channels.

2.3.Migrant-specific distribution effect

Immigrants are not a homogenous group and any income differences between migrants themselves may affect the overall distribution of income in destination areas. In New Zealand, besides the targeted "Skilled Migrant" category, there is a whole range of other migrant streams. Many of these are not selective on skills (e.g. family reunification and refugee admission schemes). Indeed, it is highly likely that the distribution of income within the migrant community is wider than among locals (see Card, 2009 for US evidence). Furthermore, there is evidence that the effect of recent immigration on the labour market is mostly felt by earlier migrants, with recent and earlier migrants acting as substitutes in the labour market. For example, Cortés (2008) shows that the negative impact of low skill immigration is felt mostly by earlier immigrants, with immigration lowering their wages (also confirmed by the meta-analysis by Longhi et al. (2005). Thus, depending on the size of the migrant group, immigration may affect the overall

[8] Evidence from studies like LaLonde and Topel (1991). Altonji and Card (1991) and Card (2001, 2005, 2009) also find small effect of immigration on the distribution of income of locals.

distribution of income through the distribution of income among migrants being different from that among the local-born. Consequently, this study examines the role of changes in the migrant-specific distribution of income on the overall distribution of income.

Apart from the mechanisms described above, international migration has also been linked to the distribution of income through other mechanisms. For example, Blau and Kahn (2012) note that immigration may change relative factor supplies, affect returns to capital investment, or influence the child care availability and female labour force participation of higher-earning women. All these factors may also have implications for the distribution of overall income but are they are beyond the scope of the present study.

The next section presents the decomposition methodologies used in this study.

3. Methodology

The study decomposes both levels and changes in inequality. The levels decomposition is the between- and within-group decomposition of the MLD and a regression based on between- and within-group decomposition[9]. Changes in inequality are decomposed using the population decomposition by sub-group approach of Mookherjee and Shorrocks (1982), and the regression-based decomposition approach. The method of Mookherjee and Shorrocks (1982) is described in Alimi, Maré and Poot (2017) but we provide a brief recap here.

Our measure of inequality is the Mean Log Deviation (MLD). The MLD is part of the family of generalised entropy indices (Bourguignon, 1979). These measures have the advantage of being additively decomposable (i.e. inequality among people in a group can be expressed as the weighted sum of inequalities between and within the sub-groups).We use the MLD instead of the slightly more popular Theil measure because our focus is on how changes in the demographic shares of migration in population have affected the distribution of income and, unlike the Theil measure (which weights by income share), the MLD weights by population share. Since we are concerned about the effect of changes in population shares, this makes the MLD a natural choice and fit for purpose. Additionally, it has been shown that MLD is less sensitive to uncertainty about incomes at the upper end of the distribution (Cowell and Flachaire, 2007).

Introducing some notation, let the aggregate income of all those in a migration-status group m be Y_m. For simplicity we will refer to the population group representing those who have never migrated as one of the groups. N_m is the population of migrant group m. N is the overall population, i.e. $N = \sum_{m=1}^{M} N_m$. Total income in the economy is $Y = \sum_{m=1}^{M} Y_m$. Finally, we denote average income in the economy by $\mu = Y/N$, average income of migrant group m by $\mu_m = Y_m/N_m$, relative income of migrant group m by $r_m = \mu_m/\mu$ and the fraction of the population that belongs to migrant group m as $\pi_m = \frac{N_m}{N}$. If everyone in group m has the same income (i.e. each person's income is μ_m), we need not be concerned about intra-group inequality and overall inequality can then simply be expressed as the weighted average of the (natural) logarithms of group-relative incomes, i.e.

[9] We provide an extension to the regression decomposition methodology that allows us to express the contributions of each migrant group in terms of between and within-group contributions

$$MLD = \sum_{\mathrm{m}=1}^{M} \frac{N_m}{N} \ln\left(\frac{Y/N}{Y_m/N_m}\right) = \sum_{\mathrm{m}=1}^{M} \pi_m \ln\left(\frac{1}{r_m}\right) \quad (1)$$

More generally, the individuals within group *m* will have different incomes and the overall MLD level can then be decomposed into the weighted sum of within-migrant-group inequalities and the value of between-migrant-group inequality (which is the weighted sum of logged between-group inverse relative incomes):

$$MLD = \sum_{m=1}^{M} \pi_m MLD_m + \sum_{m=1}^{M} \pi_m \ln\left(\frac{1}{r_m}\right) \qquad (2)$$

in which $MLD_m = \sum_{\mathrm{i}=1}^{N_m} \frac{1}{N_m} \ln\left(\frac{\mu_m}{y_i}\right)$ is a measure of within-migrant-group inequality, y_i is the income of individual *i*,

$\sum_{m=1}^{M} \pi_m MLD_m$ is the migrant-share-weighted sum of within-migrant-group inequality and $\sum_{m=1}^{M} \pi_m \ln\left(\frac{1}{r_m}\right)$ the migrant-share-weighted sum of the logarithm of the inverse of migrant-group relative income (i.e., between-migrant-group inequality).

3.1. Population sub-group decomposition of inequality change of Mookherjee and Shorrocks (1982)

With some simple algebra, it can be shown that the change in the MLD between two periods can be expressed exactly as follows:

$$\Delta MLD = \underbrace{\sum_{m=1}^{M} \overline{\pi_m} \Delta MLD_m}_{\substack{aggregate\ change\ in\ within-migrant\ group\ inequality\ for\ given\ migrant\ shares \\ C1}} + \underbrace{\sum_{m=1}^{M} \overline{MLD_m} \Delta \pi_m}_{\substack{aggregate\ change\ in\ within-migrant\ group\ inequality\ due\ to\ changing\ migrant\ shares \\ C2}} + \underbrace{\sum_{m=1}^{M} \overline{\ln\left(\frac{1}{r_m}\right)} \Delta \pi_m}_{\substack{aggregate\ change\ in\ between-migrant\ group\ inequality\ due\ to\ changing\ migrant\ shares \\ C3}} + \underbrace{\sum_{m=1}^{M} \overline{\pi_m} \Delta \ln\left(\frac{1}{r_m}\right)}_{\substack{aggregate\ growth\ in\ migrant\ group\ relative\ income\ for\ given\ migrant\ shares \\ C4}} \qquad (3)$$

where a bar over an expression represents the simple arithmetic average of the variable over the two periods, i.e. $\bar{x} = \frac{1}{2}(x_{t-1} + x_t)$. Mookherjee and Shorrocks' (1982) methodological contribution was to suggest an approximate decomposition of ΔMLD, which will explicitly include group-specific mean income growth.[10] We

[10] Mookherjee & Shorrocks (1982) note that this approximation appears sufficient for computational purposes (p.897). It is clear that C3' − C3 = $\sum_{m=1}^{M} \overline{r_m} \Delta \pi_m$. Experimentation with a range of changing income distributions shows that the sign of *C*3 can be sometimes different from that of *C*3' and, similarly, the sign of *C*4 can be different from that of *C*4*'*. This may lead to slightly different interpretations. In this paper, we

use this approximate change decomposition, such that the change in overall inequality can be expressed as:

$$\Delta MLD \approx \underbrace{\sum_{m=1}^{M} \overline{\pi_m} \Delta MLD_m}_{C1} + \underbrace{\sum_{m=1}^{M} \overline{MLD_m} \Delta \pi_m}_{C2} + \underbrace{\sum_{m=1}^{M} (\overline{r_m} - \overline{\ln r_m}) \Delta \pi_m}_{C3'} + \underbrace{\sum_{m=1}^{M} (\overline{\pi_m r_m} - \overline{\pi_m}) \Delta \ln \mu_m}_{C4'} \quad (4)$$

Where:

- $C1$ is the aggregate change in within-migrant group inequality for given migrant-shares
- $C2$ is the aggregate change in within-migrant group inequality due to changing migrant-shares
- $C3'$ is the aggregate change in between-migrant group inequality due to changing migrant-shares
- $C4'$ is the aggregate growth in migrant-group mean income for given migrant-shares

The sum of $C2$ and $C3'$ thus represents the migrant-shares or composition effect and the sum of $C1$ and $C4'$ represents the migrant group-specific distribution effect.

3.2. Regression Decomposition Method

The regression decomposition method is an extension of Shorrocks' (1982) work on decomposition of income by additive factor components. Fields and Yoo (2000) extended this analysis and showed that Shorrocks' (1982) theorem is applicable when using an additive income generating function. An income generating function has the same additive form as any equation expressing total income as the sum of income from various components.

Using the income-generating function of the form:

$$lnY_{it} = \alpha_t + \sum_{k=1}^{K} \beta_{kt} X_{ikt} + \varepsilon_{it} \quad (6)$$

X_{ikt} is the value of the k^{th} covariate that determines the income of an individual i at time t and lnY_{it} is the logarithm of individual income i at time t. Fields and Yoo (2000) showed that the proportion of level of earnings inequality accounted for by factor k (relative factor inequality weight) S_{kt} is:

$$S_{kt} = \frac{\widehat{\beta_{kt}} * Cov(X_{kt}, lnY_t)}{Var(lnY_t)} \; or \; \frac{\widehat{\beta_{kt}} * SD(X_{kt}) * corr(X_{kt}, lnY_t)}{SD(lnY_t)} \quad (7)$$

follow Mookherjee & Shorrocks (1982) and use the approximate decomposition. Results for the exact decomposition are available upon request.

Where:

- $Cov(X_{kt}, lnY_t)$ is the covariance between factor X_k and lnY at time t
- $Var(lnY_t)$ is the variance of the logarithm of income
- $SD(lnY_t)$ and $SD(X_{kt})$ are the standard deviations of lnY and X_k at time t respectively
- $Corr(X_{kt}, lnY_t)$ is the correlation between factor X_k and lnY

S_{kt} represents the marginal contribution of the explanatory variable to the variance of the dependent variable and can be interpreted as the group-mean contribution of each factor at time t. If the regression has one explanatory variable then, in the terminology of sub-group decomposition methodology, S_{kt} represents the between-group contribution of that variable (X_k) to overall inequality[11].

Just as in Shorrocks (1982), with respect to additive contributions to overall income, the relative contribution of a factor to overall inequality S_{kt} is invariant to the choice of inequality measure I_t (if the measure satisfies Shorrock's six axioms). The contribution of an individual factor to earnings inequality is therefore simply:

$$S_{kt} * I_t \quad (8)$$

The estimated contributions of each factor to the level of inequality can then be used to estimate the contributions to inequality change. The contribution of each factor to change[12] in inequality between time t and t+1 is simply calculated as:

$$\delta_k = S_{k,t+1} * I_{t+1} - S_{k,t} * I_t \quad (9)$$

One of the advantages of the regression decomposition framework is the possibility of accounting for multiple explanatory variables. The sub-group decomposition approach quickly becomes unwieldy if we account for multiple explanatory factors[13]. Fields and Yoo (2000) demonstrate the strength of the regression decomposition approach to account for multiple explanatory variables in their examination of earnings inequality in Korea.

[11] X_k is either a continuous variable or a set of dummy variables for a classification of factors such as ethnicity, education, etc.

[12] Unlike the contribution of each factor to level S_{kt}, the contribution of each factor to change δ_k in equation (9) is dependent on the choice of inequality measure (Fields and Yoo, 2000)

[13] For example, in our research accounting for sex and migrant status alone means there would be 16 groups (8 migration status categories * 2 sex categories).

However, there are several limitations of the Fields and Yoo approach[14]. Most notably, with multiple explanatory variables, the standard Fields and Yoo approach relies on the assumption of mutually orthogonal explanatory variables. This assumption is very restrictive since income-determining explanatory variables are often correlated. In the regression framework, the marginal effect of a particular variable is then not unique and is dependent on the order in which the factor is included in the regression. The standard Fields and Yoo approach capture the contribution of each variable as if it was added last. Basically, the contribution of a variable (continuous or set of dummies for a classification) is the increment to R^2 from including the variable in the regression divided by the overall R^2.

Subsequent studies have adopted a Shapley value regression decomposition approach[15]. With its origin in game theory research, this approach uses a regression framework and calculates the average marginal effects of each explanatory variable (e.g. age, sex, migration status) from all possible orderings of the variance in the dependent variable (income). The marginal effects are calculated by introducing the variable into a regression model and measuring the contribution of that variable to the variance of the dependent variable. Since the marginal effect of a particular variable is not unique and is dependent on the order in which the factor is included in the regression, the average of all marginal effects of each variable in all possible orderings is treated as the contribution of that explanatory variable to inequality in the dependent variable. With K number of explanatory variables, the total possible numbers of orderings are K!. Israeli (2007) show that the basic Fields and Yoo approach is a stylised version/approximation of the Shapley value decomposition that assumes no correlation between the explanatory variables.

In this study, we use the Shapley value regression decomposition approach in a framework with age, sex and employment status as other explanatory variables alongside migration status (which already differentiates between skills). We examine the contribution of each migrant group to the level of inequality accounting for age, sex and migration status by comparing the group-mean

[14] See Wan (2002,2004) for a discussion of the limitations of the Fields and Yoo approach.
[15] This approach has its origins in Shorrocks (1999), later published in Shorrocks (2013) and has been used in empirical studies such as those of Wan (2004) and Gunatilaka and Chotikapanich (2009).

contributions of migrant groups in a regression on only migration dummies with another regression where we include age, sex and employment status.

Migrant categories are represented by a group of eight dummy variables representing each migrant group, as described in Section 4.4.1. For our Shapley regression, we treat them as a block and they are introduced into the regression together. Our full adjusted regression model is:

$$Y_{it} = \sum_{k=1}^{8} \beta_{kt} X_{ikt} + \beta_{at} Age_{it} + \beta_{st} Sex_{it} + \beta_{et} Empstatus_{it} + \varepsilon_{it} \quad (10)$$

X_k are the migration category dummies

To ensure that we had results for the conditional-contribution of each migrant group, we ran our regressions without an intercept because dummy variables were included for all migrant groups. Our marginal contributions are not affected by the exclusion of the intercept, given the way in which the average or marginal effects are calculated:

$$S_{kt=} \frac{\beta_{kt} * Cov(X_{kt}, Y_t)}{Var(Y_t)} \quad (11)$$

S_{kt} does not depend on the addition or removal of a constant i.e. the intercept is incorporated in the set of migration dummies.

Besides calculating the contribution of each migrant-group to between-group inequality using the regression framework, we provide an extension to the regression decomposition method that calculates the within-group contributions by migrant group to the level of inequality as well. To illustrate our extension, we assume an income-generating function with migration status as the only independent variable and three migrant categories represented by dummy variables D_{Hm} for High Skilled migrants, D_{Om} for Other Skilled migrants, and D_{Lm} for Low skilled migrants

$$Y_i = \beta_{Hm} D_{iHm} + \beta_{Om} D_{iOm} + \beta_{Lm} D_{iLm} + e_i \quad (12)^{16}$$

In factor component terminology, $\beta_{Hm} D_{iHm}$ can be interpreted as mean income from source - High Skilled migrant, $\beta_{Om} D_{iOm}$ is mean income from source - Other Skilled migrant, and $\beta_{Lm} D_{iLm}$ is mean income from source - Low Skilled

[16] There is no constant term in Equation 12 in order to allow us to calculate the contribution of each group.

migrant. Using Fields' initial approach, the contribution of High Skilled migrants (S_{Hm}), Other Skilled migrants (S_{Om})and Low Skilled migrants (S_{Lm}) are[17]:

$$S_{Hm} = \frac{\widehat{\beta_{Hm}} Cov(D_{Hm,} Y)}{Var(Y)} ; S_{Om} = \frac{\widehat{\beta_{Om}} Cov(D_{Om,} Y)}{Var(Y)} ; S_{Lm} = \frac{\widehat{\beta_{Lm}} Cov(D_{Lm,} Y)}{Var(Y)}$$

S_{Hm} , S_{Om} and S_{Lm} are the mean-group contributions of High Skilled migrants, Other Skilled migrants, and Low skilled migrants respectively to overall inequality in Y such that:

$$S_{Hm} + S_{Om} + S_{Lm} = R^2 \ (13)$$ [18]

Alternatively, we can arrive at $S_{Hm}, S_{Om}\ and\ S_{Lm}$ by regressing each of the estimated income sources ($\widehat{\beta_{Hm}} D_{Hm}$, $\widehat{\beta_{Om}} D_{Om} and\ \widehat{\beta_{Lm}} D_{Lm}$) on Y[19]:

$$\widehat{\beta_{Hm}} D_{Hm} = \alpha + \rho_{Hm} Y_i + u_i \qquad (14)$$

where $\widehat{\beta_{Hm}}$ is the estimated mean for group Hm etc.

S_{Hm} is calculated by:

$$\hat{\rho}_{Hm} = \frac{Cov(\widehat{\beta_{Hm}} D_{Hm}, Y_i)}{Var(Y_i)} = S_{Hm} \quad (15)$$

For S_{Om}, we regress:

$$\widehat{\beta_{Om}} D_{Om} = \alpha + \rho_{Om} Y_i + u_i \quad (16)$$

Such that $S_{Om}$is calculated by:

$$\hat{\rho}_{Om} = S_{Om} = \frac{Cov(\widehat{\beta_{Om}} D_{Om}, Y_i)}{Var(Y_i)} = S_{Om} \quad (17)$$

For S_{Lm}, we regress:

$$\widehat{\beta_{Lm}} D_{Lm} = \alpha + \rho_{Lm} Y_i + u_i \quad (18)$$

Such that $S_{Lm}$is calculated by:

$$\hat{\rho}_{Lm} = \frac{Cov(\widehat{\beta_{Lm}} D_{Lm}, Y_i)}{Var(Y_i)} = S_{Lm} \quad (19)$$

[17] The βs are estimated by OLS regression of equation (12)

[18] The R^2 in equation (13) is the R^2 of regression estimation of equation (12) with a constant in which one of the dummies is omitted.

[19] This follows from how regressions are calculated. For an equation: $Y = \alpha + \beta X + \in$, $\hat{\beta} = \frac{Cov(X,Y)}{Var(X)}$ and Cov(cX,Y) = cCov(X,Y)

The residual e_i in Equation (12) represents the unexplained variation in inequality not accounted for by the differences in the by-group mean for the migrant categories. This represents the sum of within-group contributions from all migration categories. We now estimate the within-group contributions of each migration category to the level of inequality by assigning this residual to each migrant category. We do this by multiplying the estimated residual ($\widehat{e_i}$) by the migration dummies($D_{Hm}, D_{Om}\ and\ D_{Lm}$). By allocating the residuals, it is possible to calculate the contribution to inequality levels from each factor arising from differences in group-mean incomes (between-group) as well as within-group inequality.

In this illustration, by allocating the residual, we can write income as the sum of six components:

$$Y_i = \beta_{Hm}D_{Hm} + \beta_{Om}D_{Om} + \beta_{Lm}D_{Lm} + e_iD_{Hm} + e_iD_{Om} + e_iD_{Lm} \quad (20)$$

The between-migrant group contributions are:

$$S_{Hm} = \frac{\hat{\beta}_{Hm}Cov(D_{Hm,}Y)}{Var(Y)} \quad (21)$$

$$S_{Om} = \frac{\hat{\beta}_{Om}Cov(D_{Om,}Y)}{Var(Y)} \quad (22)$$

$$S_{Lm} = \frac{\hat{\beta}_{Lm}Cov(D_{Lm,}Y)}{Var(Y)} \quad (23)$$

Within-migrant group contributions are:

$$W_{Hm} = \frac{Cov(\widehat{e_i}D_{Hm,}Y)}{Var(Y)} \quad (24)$$

$$W_{Om} = \frac{Cov(\widehat{e_i}D_{Om,}Y)}{Var(Y)} \quad (25)$$

$$W_{Lm} = \frac{Cov(\widehat{e_i}D_{Lm,}Y)}{Var(Y)} \quad (26)$$

The overall level of inequality is now the sum of contributions from within and between-group inequality

$$\underbrace{S_{Hm} + S_{Om} + S_{Lm}}_{\substack{Overall\ between-group\ inequality \\ or \\ Overall\ between-group\ inequality \\ or \\ R^2}} + \underbrace{W_{Hm} + W_{Om} + W_{Lm}}_{\substack{Allocated\ unexplained\ variation \\ or \\ Overall\ within-group\ inequality \\ 1-R^2}} = 1 \quad (27)$$

This method can be extended to a regression with multiple co-variates and will yield estimates of the conditional-contributions of each group to the level of inequality. In the multiple covariates case, unlike the mean-group contributions, the within-group contributions do not depend on the order in which they are introduced into the regression, so we used the method described above in Equations (24)-(26) to calculate the within-group contributions of each group while the mean-group contributions were calculated using the Shapley value decomposition approach (as the average of the marginal contributions from all possible orderings).

Similarities and differences between the regression and sub-group decomposition approaches.

The regression decomposition and sub-group decomposition techniques try to answer similar questions, such as what proportion of the inequality level is explained by some factor/characteristics (e.g. age, sex, etc.). In this paper, we provide an extension to the regression decomposition methodology that allows us to express the contribution to the level of inequality in terms of within and between-group inequality as in the sub-group decomposition. We compare the results from our extension of the regression method by decomposing overall inequality into the between and within contributions of each migrant group and compare it with the results of sub-group decomposition of the MLD into within- and between-group inequality. While the methods are similar, there is a major difference between the subgroup decomposition of the MLD and the regression decomposition approach:

- The regression decomposition approach can be interpreted as the decomposition of the variance. While Shorrocks' (1982) work has shown that the magnitude of the contributions calculated is invariant to the inequality measure (as long as the measure satisfies six axioms), this property does not apply to the signs or direction of change of the contributions from each group. To illustrate this, consider the mean-group contribution to overall inequality of a migrant group with high relative mean incomes. Using the sub-group decomposition approach with MLD as a measure of inequality, this group will make a negative mean-group contribution i.e.

- $Overall\ MLD = \underbrace{\sum_{m=1}^{M} \pi_m MLD_m}_{Within-group\ inequality} +$

  $\underbrace{\sum_{m=1}^{M} \pi_m \ln\left(\frac{1}{r_m}\right)}_{\substack{Between-group\ inequality \\ or \\ Mean-group\ contribution}}$ (28)

- If $r_m > 1$ for a group with high relative mean incomes, the contribution of that group to overall mean-group contributions (between-group inequality) will be negative i.e. $r_m = \mu_m/\mu$. If $\mu_m > \mu$ then $\ln\left(\frac{1}{r_m}\right) < 0$

However, the opposite will be the case in the regression decomposition approach. Groups with higher relative mean incomes will have a positive signed contribution in the regression decomposition approach. The regression decomposition approach is based on the variance as the measure of inequality:

- $Y = \beta_{Hm} D_{Hm} + \beta_{Om} D_{Om} + \beta_{Lm} D_{Lm} + e_i D_{Hm} + e_i D_{Om} + e_i D_{Lm}$ (29)

- $Var(Y) = Cov(Y, Y) = Cov\left(Y, \beta_{Hm} D_{Hm} + \beta_{Om} D_{Om} + \beta_{Lm} D_{Lm} + e_i D_{Hm} + e_i D_{Om} + e_i D_{Lm}\right)$ (30)

- $Var(Y) = \beta_{Hm} Cov(Y, D_{Hm}) + \beta_{Om} Cov(Y, D_{Om}) + \beta_{Lm} Cov(Y, D_{Lm}) + Cov(Y, e_i D_{Hm}) + Cov(Y, e_i D_{Om}) + Cov(Y, e_i D_{Lm})$ (31)

By the definition of variance, groups with higher mean income will make a positive signed contribution while groups with lower mean incomes will have a negative signed contribution. Notwithstanding the difference in this pattern for both decomposition approaches, Shorrocks' (1982) theorem implies that the magnitude of the contributions from both approaches should be similar. Understanding this key difference is important in interpreting and comparing the results from the regression approach and the sub-group decomposition of the MLD which we discuss in the next section.

By calculating the by-group between and within-group contribution using the regression framework, we aim to reconcile two different strands of the regression decomposition literature. Both techniques evolved separately in the literature and there have been few attempts to reconcile them (i.e. Cowell and Fiorio, 2011).

It is important to note that our analysis here is at the individual level but our income data from censuses are in income bands. We assign an individual the midpoint of the income band he or she belongs to. The availability of income data in bands poses no problem for neither the sub-group decomposition nor the regression method.[20]

Before presenting the results from our various methodologies, the next section provides descriptive information on the changes in inequality and immigration in New Zealand between 1986 and 2013.

[20] We note that the availability of income in bands may have implications for our measure of inequality. Not accounting for within-band variation may lead to under-estimation of actual inequality. Future work will investigate accounting for within-band variation using techniques like interval-regression (see Hansen and Kneale, 2013).

4. Data and Descriptive Analysis

4.1. Data

The data used are from the unit records of the usually resident New Zealand population from each Census of Population and Dwelling from 1986 to 2013.[21] Our target population consists of the residents of the 40 Main and Secondary urban areas.[22] New Zealand Census data capture information on current area of residence, place of residence at last Census, place of birth and qualifications. We use this information to classify the population by country of birth: New Zealand and abroad. We identify international migrants in each Census as people who are usually resident in New Zealand but whose country of birth is outside of New Zealand (i.e., the foreign-born). We divide the latter group, by their length of stay, into newly arrived and earlier migrants. Newly Arrived are migrants who arrived during the last inter-censal period. Given the information on place of residence five years ago, we can also identify a group of "Returning New Zealand-born"- these are New Zealand-born people who had been overseas five years before the census date and were resident in New Zealand at the time of the census. We consider this group separately as we expect that their effect on the distribution of income might be different from that of New Zealanders who lived in New Zealand continuously between two censuses. As well as classifying migrants by length of stay, we also divide each migrant category into high skilled and medium/low skilled based on qualifications. High Skilled are those who have at minimum a Bachelor's degree qualification while all other qualifications below Bachelor's degrees are in the Medium/Low Skilled category. Thus, the total population is divided into eight categories:

- New Zealand-born – High Skilled and Medium/Low Skilled
- Returning New Zealand-born – High Skilled and Medium/Low Skilled
- Earlier Migrants – High Skilled and Medium/Low Skilled
- Newly Arrived – High Skilled and Medium/Low Skilled

[21] New Zealand Censuses were held in 1986, 1991, 1996, 2001, 2006, 2013 and 2018. The data from the 2018 census were not yet available at the time this study was conducted.

[22] The 40 urban areas were grouped into metropolitan and non-metropolitan areas. Metropolitan areas are the urban areas in the six largest cities of Auckland, Christchurch, Wellington, Hamilton, Tauranga and Dunedin. We use the 2013 Statistics New Zealand definition of urban areas for all periods. The metropolitan areas account for about three quarters of all urban population. The rural population, which is excluded from the data, accounts for only about 14 percent of New Zealand's population.

We restrict our analysis to the population aged 25-64 years and focus on those who reported positive incomes to make our analysis reflect labour market incomes. Although Census data are available for the population 15+, we restrict our analysis to those aged 25-64 earning positive incomes because many of the population aged 15-24 and 65+ are likely to earn most of their income from non-labour market sources[23], while negative incomes are likely to be reported by those who are self-employed and those incomes are therefore not an outcome of the labour market. While there are other data sources, such as Household Economic Surveys, that may provide better information on labour incomes, the Census remains the most comprehensive dataset for analysis at the sub-national level – in contrast, surveys typically suffer from sampling errors and biases. The income data represent total personal income before tax of people earning positive income in the 12 months before census night. It consists of income from all sources such as wages and salaries, self-employment, investments, and superannuation. It excludes social transfers in kind, such as public education or government-subsidised health care services. Instead of recording actual incomes, total personal incomes are captured in income bands in each census with the top and bottom income bands open-ended. For example, the top band in the 2013 census data captures everybody earning $150,000 and over. An important issue with the open-ended upper band is the calculation of mean income in the open-ended band. At the national level, this is not a problem, as Statistics New Zealand publishes an estimate of the midpoint of the top band for the country based on Household Economic Survey (HES) estimates. However, HES top-band mean incomes for sub-national areas are not reliable due to sampling errors. To resolve this problem, Pareto distributions have been fitted to the upper tail of the area-specific distributions.[24] The midpoints of these distributions have been calculated by means of the Stata RPME command developed by von Hippel et al. (2016).

[23] Superannuation for 65+ and student allowances, loans and parental support for those aged 15 to 24 years.
[24] The proportion of the population in the top open-ended band is between 1 and 3% in non-metropolitan areas and between 2 and 7% in metropolitan areas in all census periods.

4.2.Descriptive Analysis

This sub-section provides a descriptive summary of the changes in immigration and income distribution between 1986 and 2013. We start the analysis by comparing all immigrant groups against the New Zealand-born. Table 4.1 presents the MLD, relative mean income and population share of New Zealand-born and immigrants by area.

Table 4-1: *Comparison of New Zealand-born and International migrants on relative incomes, population share and inequality by area*

		1986	1991	1996	2001	2006	2013
Non-metropolitan areas							
NZ-born	MLD	0.3579	0.3235	0.3258	0.3254	0.2961	0.3047
	Rel. mean	0.99	0.99	0.99	0.99	0.99	0.99
	Mean (real)	32,697	34,762	37,245	40,044	44,071	45,797
	Pop share	83.1%	84.5%	84.1%	84.6%	81.5%	79.3%
Immigrants	MLD	0.3607	0.3482	0.3768	0.3891	0.3516	0.3671
	Rel. mean	1.07	1.05	1.04	1.04	1.02	1.02
	Mean (real)	35,518	36,923	38,906	42,183	45,421	47,168
	Pop share	16.9%	15.5%	15.9%	15.4%	18.5%	20.7%
Combined	MLD	0.3589	0.3275	0.334	0.3354	0.3065	0.3177
	Rel. mean	1.00	1.00	1.00	1.00	1.00	1.00
	Mean (real)	33,173	35,096	37,510	40,374	44,321	46,080
	Pop share	100.0%	100.0 %	100.0 %	100.0 %	100.0 %	100.0%
Metropolitan areas							
NZ-born	MLD	0.3561	0.3389	0.3465	0.3474	0.3220	0.3427
	Rel. mean	1.00	1.01	1.03	1.03	1.04	1.05
	Mean (real)	36,940	42,011	46,421	51,750	56,353	58,539
	Pop share	71.7%	71.7%	69.8%	69.0%	63.5%	59.7%
Immigrants	MLD	0.3346	0.3475	0.4049	0.4227	0.3851	0.3943
	Rel. mean	1.00	0.97	0.94	0.93	0.92	0.92
	Mean (real)	36,775	40,531	42,256	46,533	49,876	51,244
	Pop share	28.3%	28.3%	30.2%	31.0%	36.5%	40.3%
Combined	MLD	0.3500	0.3415	0.3651	0.3719	0.3468	0.3656
	Rel. mean	1.00	1.00	1.00	1.00	1.00	1.00
	Mean (real)	36,893	41,592	45,165	50,133	53,987	55,602
	Pop share	100%	100%	100%	100%	100%	100%

Note: 1) The Returning New Zealand-born categories are excluded from the New Zealand-born category and counted with the international migrant category.
2) Rel. Mean is relative mean income calculated as group-mean income divided by overall mean income for that area
3) Real mean is in 2013 dollars

Table 4.1 continued: Comparison of New Zealand-born and International migrants on relative incomes, population share and inequality by area

		1986	1991	1996	2001	2006	2013
All urban areas							
NZ-born	MLD	0.3583	0.3376	0.3450	0.3473	0.3200	0.3370
	Rel. mean	0.99	1.00	1.01	1.01	1.02	1.03
	Mean (real)	35,533	39,609	43,460	48,115	52,516	54,579
	Pop share	75.1%	75.5%	73.9%	73.2%	68.2%	64.7%
Immigrants	MLD	0.3400	0.3481	0.4004	0.4177	0.3798	0.3904
	Rel. mean	1.02	1.00	0.97	0.96	0.96	0.95
	Mean (real)	36,518	39,847	41,669	45,836	49,156	50,622
	Pop share	24.9%	24.5%	26.1%	26.8%	31.8%	35.3%
Combined	MLD	0.3538	0.3402	0.3596	0.3664	0.3395	0.3565
	Rel. mean	1.00	1.00	1.00	1.00	1.00	1.00
	Mean (real)	35,778	39,668	42,992	47,504	51,446	53,182
	Pop share	100%	100%	100%	100%	100%	100%
Total population 25-64		1,029,201	1,121,880	1,209,630	1,212,711	1,372,773	1,415,343
Proportion of all urban population in metropolitan areas		70.0%	70.4%	71.6%	73.2%	74.0%	74.7%
MLD - Total urban population 15+ [25]		0.3509	0.3490	0.3916	0.4091	0.3971	0.4153
Note: 1) The Returning New Zealand-born categories are excluded from the New Zealand-born category and counted with the international migrant category. 2) Rel. Mean is relative mean income calculated as group-mean income divided by overall mean income for that area 3) Real mean is in 2013 dollars 4) All counts have been rounded to base 3 as per Statistics New Zealand policy for unit record data							

Notes: Results are the by-group MLD, by-group real (2013 $) mean income, relative mean income and population share of New Zealand-born and immigrant groups in metropolitan, non-metropolitan, and all urban areas combined

It is important to reiterate that the target population in this analysis is the population aged 25 to 64 years earning positive income in each Census period between 1986 and 2013. Nonetheless, Table 4.1 shows that the overall intercensal changes in inequality are in the same direction as those for the total urban population 15+ reported in Alimi et al. (2017), which have been reproduced in the bottom row. However, in level terms, inequality growth between 1986 and 2013 is relatively small (from 0.3538 to 0.3565) for those aged 25-64 and much larger (from 0.3509 to 0.4153) for all people aged 15+.

From Table 4.1, we can see that immigrants have become an increasingly important component of the total population. In all areas combined, in 1986 immigrants represented about 25% of the total population under consideration but by 2013 this had increased to about 35%. Spatially, immigrants are a bigger

[25] MLD calculations for the whole urban population aged 15+ earning positive incomes are reported in Alimi et al. (2017) – see for example Table 2 in Alimi et al. (2017).

proportion of the population in metropolitan areas: the proportion of immigrants in metropolitan areas is almost double that in non-metropolitan areas in each census period.

In all periods, immigrants have higher average incomes than New Zealand-born in non-metropolitan areas but the downward trend in the relative mean for immigrants indicates an increase in immigrants with lower incomes – reflecting the growth in temporary worker migration in agriculture and tourism. Although starting with parity with the New Zealand-born in 1986, the relative income of immigrants also exhibits a downward trend in metropolitan areas, reflecting for example the growth in foreign students who are also working part-time. This implies that the New Zealand-born in the studied population have higher average incomes in all periods but 1986. Besides the growth of temporary migration, particularly affecting the tourism, construction and caring sectors[26], this is also the result of differences in employment rates. Compared to the New Zealand-born, immigrants generally have lower employment rates in metropolitan areas[27] .

With respect to the distribution of income, apart from metropolitan areas in 1986, inequality is higher among immigrants than locals in both metropolitan and non-metropolitan areas in all other periods. This is as expected as immigrants typically have a wider distribution of income because of selectivity in migration. Immigrants are disproportionally recruited from the upper end of the distribution (professionals and other high skilled workers) and from the lower end of the distribution (dependent relatives and unskilled temporary workers). A similar finding has been reported for the US (see Reed, 2001).

Our earlier work (Alimi et al., 2016, 2017) signalled a strong increase in income inequality between 1986 and 2013, which is consistent with much of the earlier literature. However, we see in Table 4.1 that the trends differ across locations (metropolitan versus non-metropolitan) and migration status. While for everyone in all areas combined, inequality rose by only about 1% between 1986 and 2013, inequality rose in metropolitan areas by 4% while it fell in non-metropolitan areas

[26] See McLeod and Maré (2013)

[27] In metropolitan areas immigrants had lower total employment rates (Full time + Part time) compared to the New Zealand-born in all years considered except in 1986. See Appendix 4.A.1. Besides foreign students working part-time, another contributing factor is the presence of spouses and partners of labour migrants, who are not in the labour force.

by 11%. Similarly, inequality increased more for immigrants in metropolitan areas (18%) than in non-metropolitan areas (2%). For the New Zealand-born, inequality fell more in non-metropolitan areas (-15%) than in metropolitan areas (-4%). Thus, the 1986-2013 rise (fall) in inequality in metropolitan (non-metropolitan) areas is due to the large (small) increase in inequality for immigrants and the smaller (larger) fall in inequality for New Zealand-born.

One of the channels through which immigration affects the destination distribution of income is through the skill composition effect. One way to present descriptive evidence on the size of the composition effect of immigration is to examine the skill distribution of immigrants and New Zealand-born. If immigrants have a different skill distribution to New Zealand-born, we expect that the difference in composition will influence the overall distribution of income depending on the relative size of the immigrant group. For example, if immigrants represent a large group who are mostly low-skilled; i.e. have mostly low earnings, then an increase in immigration is simply adding a lot of people to the bottom of the income distribution. This may then lead to an increase in inequality. Table 4.2 compares the skills composition of the New Zealand-born and the immigrants across metropolitan and non-metropolitan areas.

Table 4-2 : Skill Composition of New Zealand-born and immigrants by area

	1986	1991	1996	2001	2006	2013
Non-metropolitan						
	New Zealand-born					
High Skilled NZ-born	4.6%	4.9%	6.1%	8.4%	11.7%	15.8%
Medium/Low Skilled NZ-born	95.4%	95.1%	93.9%	91.6%	88.3%	84.2%
Total pop NZ-born	256,251	280,359	288,270	275,073	291,261	283,929
	Immigrants					
High Skilled Immigrants	9.9%	11.5%	15.4%	19.9%	26.0%	32.6%
Medium/Low Skilled Immigrants	90.1%	88.5%	84.6%	80.1%	74.0%	67.4%
Total pop Immigrants	52,071	51,300	54,639	50,187	66,249	73,953
	Combined					
High skilled in area	5.5%	5.9%	7.6%	10.2%	14.3%	19.3%
Medium/Low Skilled in area	94.5%	94.1%	92.4%	89.8%	85.7%	80.7%
Total pop (area)	308,322	31,659	342,909	325,260	357,510	357,882
Metropolitan areas						
	New Zealand-born					
High Skilled NZ-born	8.8%	10.2%	12.6%	16.6%	21.3%	27.2%
Medium/Low Skilled NZ-born	91.2%	89.8%	87.4%	83.4%	78.7%	72.8%
Total pop NZ-born	516,786	566,541	605,334	612,264	644,346	631,746
	Immigrants					
High Skilled Immigrants	11.0%	13.9%	19.2%	25.2%	33.6%	39.6%
Medium/Low Skilled Immigrants	89.0%	86.1%	80.8%	74.8%	66.4%	60.4%
Total pop Immigrants	204,102	223,683	261,354	275,199	370,908	425,724
	Combined					
High Skilled in area	9.5%	11.3%	14.6%	19.2%	25.8%	32.2%
Medium/Low Skilled in area	90.5%	88.7%	85.4%	80.8%	74.2%	67.8%
Total pop (area)	720,888	790,224	866,688	887,463	1,015,254	1,057,470
All urban areas						
	New Zealand-born					
High Skilled NZ-born	7.4%	8.4%	10.5%	14.0%	18.3%	23.7%
Medium/Low Skilled NZ-born	92.6%	91.6%	89.5%	86.0%	81.7%	76.3%
Total pop NZ-born	773,037	846,900	893,604	887,337	935,607	915,675
	Immigrants					
High Skilled Immigrants	10.8%	13.5%	18.5%	24.4%	32.5%	38.5%
Medium/Low Skilled Immigrants	89.2%	86.5%	81.5%	75.6%	67.5%	61.5%
Total pop Immigrants	256,173	274,983	315,993	325,386	437,157	499,677
	Combined					
High Skilled in area	8.3%	9.7%	12.6%	16.8%	22.8%	28.9%
Medium/Low Skilled in area	91.7%	90.3%	87.4%	83.2%	77.2%	71.1%
Total pop (area)	1,029,210	1,121,883	1,209,597	1,212,723	1,372,764	1,415,352
Note: as in Table 4.1, NZ-born return migrants are included in the immigrant group						

Notes: Results are the skill composition of New Zealand-born and immigrants in each census period for each area. High skilled are defined as those with a Bachelor's degree or higher and Medium/Low skilled are those with other qualifications below a Bachelor's degree or no qualifications. The population consists of those aged 25-64 years in receipt of positive income.

Table 4.2 shows that, for all groups considered, the high-skilled are a sharply growing proportion of the population. Combining this with the high-skilled being a larger proportion of immigrants than of New Zealand-born, immigration being a growing share of the workforce, and the highly skilled having the highest incomes, these trends contribute to increases in inequality.[28]

Between 1986 and 2013, the proportion of New Zealand-born who were high skilled increased from about 7.4% to 23.7% while the corresponding proportion for immigrants increased from 10.8% to 38.5%. This is not surprising given that New Zealand has a migration policy that aims to attract highly skilled migrants. Reflecting this skill-biased recruitment and the preference of migrants to stay in metropolitan areas, the proportion of high-skilled immigrants increased by about 29 percentage points in metropolitan areas between 1986 and 2013, compared to a 23 percentage points increase for the same group in non-metropolitan areas and an 18 percentage points increase for the New Zealand-born in metropolitan areas.

In all urban areas combined, the total proportion of highly skilled people was around 8.3% in 1986, compared with 7.4% for the New Zealand-born and 10.8% of immigrants. By 2013, the growing share of immigrants in the population and their more rapid increase in the share of high-skilled individuals led to an increase in the total proportion of high-skilled individuals in urban areas to 28.9%.

We compared New Zealand-born with international migrants and treated international migrants as a homogenous group, but immigrants to New Zealand are heterogeneous and apart from skill level, differences also exist within this group by length of stay in New Zealand. As discussed in Section 4.1, we categorise international migrants by skill level and length of stay and compare them to the New Zealand-born (classified by skill level) in terms of within-group inequality, relative mean incomes and population share. Table 4.3 presents, for all urban areas combined, relative mean income and population share for the six international migrant groups (Returning New Zealand-born – High Skilled and Medium/Low Skilled, Earlier migrants - High Skilled and Medium/Low Skilled,

[28] Or during a period in which inequality declines, the growing presence of high-skilled immigrant may slow down the decline of inequality.

and Newly Arrived migrants – High skilled and Medium/Low Skilled) and two categories of New Zealand-born (High skilled and Medium/Low Skilled)[29].

[29] Appendix A.2 and Appendix A.3 presents the same information for metropolitan and non-metropolitan areas respectively.

Table 4-3: Comparison of MLD, relative mean income, and population share for all international migrant groups and New Zealand-born by area

		NZ-born		Immigrants						
		HS NZ-born	M/LS NZ-born	HS Returning NZ-born	M/LS Returning NZ-born	HS Earlier	HS Newly Arrived	M/LS Earlier	M/LS Newly Arrived	Total
		All urban areas								
1986	MLD	0.3094	0.3466	0.3454	0.3353	0.3191	0.4286	0.3075	0.4164	0.3538
	Rel.inc	1.70	0.94	1.54	0.96	1.66	1.56	0.95	0.91	1.00
	Pop share	5.6%	69.5%	0.5%	2.5%	1.6%	0.6%	17.6%	2.2%	100.0%
1991	MLD	0.3127	0.319	0.3543	0.313	0.3223	0.3843	0.3098	0.3767	0.3402
	Rel.inc	1.77	0.93	1.67	0.95	1.72	1.53	0.90	0.86	1.00
	Pop share	6.4%	69.1%	0.5%	2.1%	1.9%	1.0%	16.2%	2.9%	100.0%
1996	MLD	0.3354	0.3195	0.3499	0.2997	0.3632	0.6172	0.3333	0.499	0.3596
	Rel.inc	1.77	0.92	1.65	0.92	1.66	1.09	0.87	0.75	1.00
	Pop share	7.7%	66.1%	0.6%	2.4%	2.5%	1.8%	15.7%	3.1%	100.0%
2001	MLD	0.3251	0.3215	0.3574	0.3308	0.3797	0.5085	0.3544	0.4798	0.3664
	Rel.inc	1.66	0.91	1.59	0.92	1.51	1.14	0.84	0.72	1.00
	Pop share	10.3%	62.9%	0.7%	1.7%	3.7%	2.2%	14.9%	3.6%	100.0%
2006	MLD	0.2997	0.2983	0.3261	0.3008	0.3509	0.4144	0.338	0.3926	0.3395
	Rel.inc	1.51	0.91	1.50	0.95	1.33	1.06	0.81	0.75	1.00
	Pop share	12.5%	55.7%	1.2%	2.0%	5.7%	3.5%	14.9%	4.6%	100.0%
2013	MLD	0.3248	0.3093	0.3701	0.3504	0.3465	0.4393	0.3462	0.4299	0.3565
	Rel.inc	1.46	0.89	1.44	0.91	1.26	1.05	0.78	0.71	1.00
	Pop share	15.3%	49.4%	1.1%	1.4%	9.4%	3.0%	17.0%	3.3%	100.0%
Abs pop share change (%pts)		9.7%	-20.1%	0.7%	-1.1%	7.8%	2.5%	-0.6%	1.2%	0.0%
Act pop change		276.8%	-2.3%	218.5%	-23.5%	694.2%	641.3%	33.1%	111.5%	37.5%

Note: Absolute and Actual pop (population) changes reported are changes between 1986 and 2013. Absolute change is the percentage point difference in the proportion of each group between 1986 and 2013 (prop2013-prop1986). Actual pop change is the percentage change in the population of each group between 1986 and 2013 calculated as: (Population 2013-population 1986)/population 1986 for each group. HS NZ-born and M/LS NZ-born represent High Skilled and Medium/Low Skilled New Zealand-born respectively; HS Ret. NZ-born and M/LS Ret. NZ-born represent High Skilled and Medium/Low Skilled Returning New Zealand-born; HS Earlier and LS Earlier represent High Skilled and Medium/Low Skilled Earlier migrants;

Notes: Results are the by-group MLD, relative mean income and population share of the different categories of migrant groups in all urban areas combined. HS (High skilled) are defined as those with a Bachelor's degree or higher and M/LS (Medium/Low skilled) are those with other qualifications below a Bachelor's degree or no qualifications. Newly Arrived are those who arrived in the last inter-censal period and earlier migrant are arrivals prior to the last inter-censal period.

Medium/Low Skilled earlier immigrants are the largest migrant group, representing between 15% and 17% of the total population in all census periods. Apart from Medium/Low Skilled Returning New Zealand-born and Medium/Low Skilled Earlier migrants, all international migrant groups increased as a proportion of the population between 1986 and 2013. The trend in the Medium/Low Skilled Returning New Zealand-born group was mostly driven by events in Australia. More than half of the Returning New Zealand-born groups were returnees from Australia, thus the size of this group is very sensitive to economic changes in Australia. The 2006 to 2013 period coincided with buoyant economic conditions in Australia, particularly the growth in the mining sector, and higher real wages in Australia meant lower inflows of Medium/Low Skilled New Zealand-born individuals from Australia.[30]

To show the scale of immigration changes in New Zealand, we examine the relative population increase of immigrant groups (relative to their 1986 population) in all areas combined. We find that High Skilled Returning New Zealand-born increased by almost 219%, High Skilled Earlier migrants increased by around 694%, High Skilled Newly Arrived migrants increased by 641% while Medium/Low Skilled Earlier and Medium/Low Skilled Newly Arrived increased by around 33% and 112% respectively. Only Low Skilled Returning New Zealand-born declined by about 24% relative to the 1986 population. The relative changes are important as research from the US has shown that the impact of immigration is most likely felt by earlier migrants who are close substitutes for recent arrivals in the labour market (see LaLonde & Topel, 1991; Cortés, 2008). The changes may have implications for the between-group distribution of income and by extension the overall distribution of income.

We find that inequality is, in each year, highest among newly arrived immigrants, regardless of skill level. This provides some evidence of a narrowing of the income distribution by duration of stay of immigrants. With respect to by-group inequality changes between 1986 and 2013, inequality rose for all immigrant groups between 1986 and 2013. Out of all groups (New Zealand-born and Immigrants), only the Medium/Low Skilled New Zealand-born group saw a decline in inequality over this period. Another interesting observation is that

[30] Return migration from Australia increased sharply after the end of our observation period, March 2013. See Statistics New Zealand (2015).

inequality is higher among High Skilled New Zealand-born returning migrants than High Skilled New Zealand-born who were in the country 5 years earlier. This suggests that return migration is selective of both the most highly successful (in terms of the achieved earnings level) and those who were the least successful in the foreign labour market.

Finally, given the differences between immigrants and New Zealand-born and the likely diversity between and within immigrant groups, we decompose the MLD level into within and between components using Equation (2) and examine the contribution of each migrant category to overall inequality in each period by area. Table 4.4 presents the results for all urban areas combined.

Table 4-4: Between-group and within-group contributions to MLD level by area from 1986 to 2013

Between and Within-group contributions to the level of inequality for all urban areas						
Between-group contributions						
	1986	1991	1996	2001	2006	2013
HS NZ-born	-0.0296	-0.0363	-0.0443	-0.0519	-0.0518	-0.0582
M/LS NZ-born	0.0456	0.0518	0.0538	0.0611	0.0524	0.0570
HS Ret. NZ-born	-0.0022	-0.0024	-0.0031	-0.0031	-0.0049	-0.0042
M/LS Ret. NZ-born	0.0010	0.0011	0.0020	0.0014	0.0010	0.0014
HS Earlier Migrants	-0.0083	-0.0101	-0.0124	-0.0153	-0.0162	-0.0215
HS Newly Arrived Migrant	-0.0025	-0.0041	-0.0016	-0.0029	-0.0020	-0.0015
M/LS Earlier Migrant	0.0089	0.0162	0.0215	0.0259	0.0315	0.0413
M/LS Newly Arrived Migrant	0.0020	0.0044	0.0091	0.0121	0.0134	0.0115
Sum of Between	0.0149	0.0206	0.0250	0.0273	0.0234	0.0258
Prop-Between	4%	6%	7%	7%	7%	7%
Within-group contributions						
	1986	1991	1996	2001	2006	2013
HS NZ-born	0.0173	0.0199	0.0260	0.0334	0.0374	0.0497
M/LS NZ-born	0.2410	0.2205	0.2113	0.2022	0.1661	0.1527
HS Ret. NZ-born	0.0017	0.0017	0.0022	0.0024	0.0039	0.0042
M/LS Ret. NZ-born	0.0083	0.0065	0.0073	0.0058	0.0060	0.0048
HS Earlier Migrants	0.0052	0.0060	0.0089	0.0140	0.0199	0.0327
HS Newly Arrived Migrant	0.0024	0.0037	0.0109	0.0111	0.0143	0.0133
M/LS Earlier Migrant	0.0540	0.0502	0.0523	0.0528	0.0503	0.0588
M/LS Newly Arrived Migrant	0.0090	0.0110	0.0157	0.0175	0.0181	0.0143
Sum of Within	0.3389	0.3195	0.3346	0.3392	0.3160	0.3305
Prop-Within	96%	94%	93%	93%	93%	93%
Total inequality	0.3538	0.3401	0.3596	0.3665	0.3394	0.3563
Total inequality here is slightly different from the last column in Table 4.3 in some years due to base 3 rounding						

Note: Results are the between- and within-group contributions to overall inequality (as measured by the MLD) for the migrant group categories in all urban areas combined in each census period from 1986 to 2013

Table 4.4 shows that, in all urban areas combined, between-group inequality accounted for around only 4% of MLD inequality in 1986. This share then increases to 7% by 1996 and remains constant thereafter until 2013. Between-migration group inequality calculated here is higher than the between-age group inequality reported by Alimi et al. (2017), indicating bigger differences (at least in average income) across migrant groups than age groups. Spatially, between-group inequality is lower in non-metropolitan areas than in metropolitan areas.[31] This suggests that migrant groups are "closer" in non-metropolitan areas (at least in terms of average incomes). Examining the contribution of each migrant category indicates that Medium/Low Skilled New Zealand-born and Medium/Low Skilled Earlier migrants have the biggest and second biggest contribution respectively to aggregate within-group inequality. This is not surprising as these groups are the biggest and second biggest in terms of population share.

Decomposing the level of MLD into the sum of between- and within-group contributions shows that most of the change in inequality is driven by what is happening within each migrant group, with big differences in the trends in the within-group contributions across the migrant groups. In the next section, we focus on changes between 1986 and 2013 and employ change-decomposition strategies to decompose overall inequality change between years and to understand the role of changes within each migrant group.

[31] See the Appendix A.4

5. Decomposition of Inequality Change Results

Up to this point, we have considered how the overall level of income inequality is the result of inequality within migrant groups, the relative importance of these groups, and their average incomes. Income inequality has been quantified by just a single index, the MLD. In this section, we quantify how changes in each of the migrant groups have contributed to overall change in inequality between 1986 and 2013. We focus on the between- and within-group inequality contributions of each group using the two different change decomposition of inequality change approaches (Mookherjee and Shorrocks' sub-group decomposition and regression-based approach).

5.1.Mookherjee and Shorrocks decomposition of inequality change by sub-groups

Table 5-1: Contribution to changes in Mean Log Deviation (MLD) index of inequality between 1986 and 2013 by migrant group when using the Mookherjee and Shorrocks approach

	Components of change (see Eq. 4)				Total change (approx) 1986-2013	Composition effect C2+C3'	Group specific distribution effect C1+C4'	Contribution to within-group inequality C1+C2	Contribution to between-group inequality C3'+C4'
Non-metropolitan									
Migrant Status	C1	C2	C3'	C4'					
HS NZ-born	-0.0005	0.0264	0.0997	0.0050	0.1306	0.1261	0.0045	0.0259	0.1046
M/LS NZ-born	-0.0454	-0.0398	-0.1255	-0.0148	-0.2254	-0.1653	-0.0602	-0.0852	-0.1402
HS Ret. NZ-born	0.0002	0.0016	0.0050	0.0002	0.0069	0.0066	0.0004	0.0018	0.0051
M/LS Ret. NZ-born	-0.0005	-0.0022	-0.0067	-0.0003	-0.0097	-0.0089	-0.0008	-0.0027	-0.0070
HS Earlier	0.0006	0.0109	0.0374	0.0012	0.0501	0.0483	0.0018	0.0115	0.0387
HS Newly Arrived	-0.0002	0.0064	0.0149	-0.0004	0.0206	0.0212	-0.0006	0.0061	0.0145
M/LS Earlier	-0.0015	-0.0050	-0.0160	-0.0012	-0.0237	-0.0210	-0.0027	-0.0065	-0.0172
M/LS Newly Arrived	-0.0014	0.0042	0.0099	-0.0002	0.0125	0.0141	-0.0016	0.0028	0.0096
Sum	**-0.0487**	**0.0024**	**0.0187**	**-0.0104**	**-0.0381**	**0.0211**	**-0.0592**	**-0.0463**	**0.0082**
Metropolitan									
Migrant Status	C1	C2	C3'	C4'					
HS NZ-born	0.0020	0.0316	0.1105	0.0161	0.1602	0.1421	0.0181	0.0336	0.1265
M/LS NZ-born	-0.0155	-0.0720	-0.2192	-0.0155	-0.3221	-0.2912	-0.0310	-0.0875	-0.2347
HS Ret. NZ-born	0.0002	0.0025	0.0076	0.0016	0.0118	0.0101	0.0017	0.0026	0.0092
M/LS Ret.NZ-born	0.0004	-0.0043	-0.0127	-0.0004	-0.0169	-0.0170	0.0000	-0.0039	-0.0131
HS Earlier	0.0019	0.0309	0.0998	0.0020	0.1346	0.1307	0.0039	0.0328	0.1019
HS Newly Arrived	0.0005	0.0120	0.0295	0.0001	0.0420	0.0415	0.0005	0.0124	0.0296
M/LS Earlier	0.0097	-0.0025	-0.0077	-0.0062	-0.0066	-0.0101	0.0035	0.0073	-0.0139
M/LS Newly Arrived	0.0011	0.0049	0.0121	-0.0012	0.0169	0.0170	-0.0001	0.0059	0.0109
Sum	**0.0002**	**0.0031**	**0.0199**	**-0.0035**	**0.0197**	**0.0230**	**-0.0032**	**0.0033**	**0.0164**

Table 5.1 continued: Contribution to changes in Mean Log Deviation (MLD) between 1986 and 2013 by migrant group when using the Mookherjee and Shorrocks approach

	Components of change (see Eq. 4)				Total change (approx)	Composition effect C2+C3’	Group specific distribution effect C1+C4’	Contribution to within-group inequality C1+C2	Contribution to between-group inequality C3’+C4’
All urban areas									
Migrant Status	C1	C2	C3’	C4’					
HS NZ-born	0.0016	0.0308	0.1094	0.0136	0.1554	0.1402	0.0152	0.0324	0.1230
M/LS NZ-born	-0.0222	-0.0660	-0.2022	-0.0170	-0.3074	-0.2682	-0.0392	-0.0882	-0.2192
HS Ret NZ-born	0.0002	0.0023	0.0071	0.0013	0.0109	0.0095	0.0015	0.0025	0.0084
M/LS Ret NZ-born	0.0003	-0.0038	-0.0110	-0.0004	-0.0148	-0.0148	-0.0001	-0.0035	-0.0114
HS Earlier	0.0015	0.0259	0.0851	0.0020	0.1146	0.1111	0.0035	0.0275	0.0871
HS Newly Arrived	0.0002	0.0107	0.0260	0.0000	0.0369	0.0367	0.0002	0.0109	0.0260
M/LS Earlier	0.0067	-0.0018	-0.0057	-0.0046	-0.0055	-0.0076	0.0021	0.0049	-0.0104
M/LS Newly Arrived	0.0004	0.0049	0.0120	-0.0008	0.0165	0.0169	-0.0005	0.0053	0.0112
Sum	**-0.0113**	**0.0031**	**0.0207**	**-0.0060**	**0.0066**	**0.0238**	**-0.0173**	**-0.0082**	**0.0148**

Notes: Results are the contributions to change in overall inequality (as measured by the MLD) between 1986 and 2013 in all urban areas combined. C1 is the aggregate change in within-migrant group inequality for given migrant-shares; C2 is the aggregate change in within-migrant group inequality due to changing migrant-shares; C3' is aggregate change in between-migrant group inequality due to changing migrant-shares; C4' is aggregate growth in migrant-group mean income for given migrant-shares

Table 5.1 presents the by-migrant group contributions to the changes in MLD between 1986 and 2013. This is further split into the composition and within-migrant-group specific distribution effects. Section 3.1 showed that the calculated components of change C3' and C4' are approximations. The calculated total change is therefore not exactly equal to the total 1986-2013 change in the MLD that can be obtained from Table 4.1. However, the approximation is very good. Table 5.1 reports an approximate change in the MLD in non-metropolitan areas of -0.0381, whereas the actual change was -0.0412 (see Table 4.1). For metropolitan areas the approximate 1986-2013 increase in MLD is 0.0197 and the actual increase is 0.0156. Finally, for all areas combined the approximate increase is 0.0066 and the actual increase is 0.0027.

Spatially, there are some distinctions in the changes between metropolitan and non-metropolitan areas. Inequality fell in non-metropolitan areas while it rose in metropolitan areas. The advantage of the Mookherjee and Shorrocks approach is that we can split the total change into the overall contribution of each group to within-group contributions (C1+C2) and between-group contributions (C3 and C4), or into a composition effect (C2+C3') and a group-specific distribution effect (C1+C4'). Before we discuss the by-migrant group contributions, we describe below what determines the type of contribution each migrant group will make (i.e. whether these will be inequality-increasing or inequality-decreasing contributions).

The changes in each of C1 to C4' will determine whether a group will make an inequality-increasing or inequality-decreasing contribution. What determines the direction of each term? Considering each of C1 to C4' below:

- $C1 = \sum_{m=1}^{M} \overline{\pi_m} \Delta MLD_m$. This is the aggregate change in within-migrant group inequality for given migrant shares.

Given that migrant shares π_m will always be positive, changes from this component are dependent on the changes in within-group inequality (ΔMLD_m). If within-group inequality increases (decreases) for a group, then the contribution from C1 for that group will be inequality-increasing (inequality-decreasing).

- $C2 = \sum_{m=1}^{M} \overline{MLD_m} \Delta \pi_m$. It is the aggregate change in within-migrant group due to changing migrant shares.

Given that MLD_m is always positive, the changes from this component are dependent on the changes in the population share ($\Delta\pi_m$). If the share of a group increases (decreases) then C2 will make an inequality-increasing (inequality-decreasing) contribution.

- $C3' = \sum_{m=1}^{M}(\overline{r_m} - \overline{\ln r_m})\Delta\pi_m$. It is the aggregate change in between-migrant group due to changing migrant shares.

As for C2, the direction of change (whether inequality-increasing or inequality decreasing) from this component is dependent on the changes in the population share ($\Delta\pi_m$). r_m is a positive number and lnr_m will always be smaller than r_m, thus the direction of change from $C3'$ will be dependent on whether the population share (π_m) of a group increases or decreases. The contribution from $C3'$ for groups that increase (decrease) in share will be inequality-increasing (inequality-reducing).

- $C4' = \sum_{m=1}^{M}(\overline{\pi_m r_m} - \overline{\pi_m})\Delta\ln\mu_m$. It is the aggregate growth in migrant-group mean income for given migrant-shares

In terms of the direction of change, $C4'$ is slightly more complex and the direction of change is dependent on changes in group-mean income (μ_m) as well as the relative mean income(r_m). If for a group:

  - $\overline{r_m} > 1$ and group-mean income increases i.e. $\Delta\ln\mu_m > 0$, the direction of change of $C4'$ will be inequality-increasing. Intuitively for this group, this change represents an increase in average income for a group that is above the overall average(μ). This change will be inequality-increasing as it widens the overall distribution i.e. the top moves further away;
  - $\overline{r_m} < 1$ and group-mean income increases i.e. $\Delta\ln\mu_m > 0$, the direction of change of $C4'$ will be inequality-decreasing. Intuitively for this group, this change represents an increase in average income for a group that is below the overall average(μ). This change will be inequality-decreasing as it narrows the overall distribution of income;
  - $\overline{r_m} > 1$ and group-mean income decreases i.e. $\Delta\ln\mu_m < 0$, the direction of change of $C4'$ will be inequality-decreasing. Intuitively for this group, this change represents a decrease in average income

for a group that is above the overall average(μ). This change will be inequality-decreasing;

- $\overline{r_m} < 1$ and group-mean income decreases i.e. $\Delta \ln \mu_m < 0$, the direction of change of $C4'$ will be inequality-increasing. Intuitively for this group, this change represents a decrease in average income for a group that is below the overall average(μ). This change will be inequality-increasing as it widens the overall distribution; i.e. the bottom becomes further apart

By knowing what determines the direction of each of C1-C4, we now examine the overall contribution, along with the between-group inequality contribution (C3'+C4') and the within-group inequality contributions (C1+C2) of each group. We begin the analysis with all urban areas combined. The direction of change of within-group contributions will be determined by within-group inequality changes (ΔMLD_m) and change in group population share($\Delta \pi_m$) and between-group contributions will be determined by relative mean income ($\overline{r_m}$) and changes in mean income ($\Delta \ln \mu_m$).

The total contribution to inequality from all high skilled groups i.e. High Skilled New Zealand-born, High Skilled Returning New Zealand-born, High Skilled Earlier Migrants and High Skilled Newly Arrived Migrants was inequality-increasing while Medium/Low skilled groups made inequality-reducing total contributions except for Medium/Low Newly Arrived. The inequality-increasing contributions of high skilled groups occurred because in these groups, relative mean income was high (greater than 1) and within-group inequality, population share, and mean incomes increased. Thus, groups at the top of the distribution experienced greater within-group inequality and an increase in average income; this can be described as a widening of the income distribution at the top.

For medium/low skilled groups, there was more variation in the patterns but apart from Medium/Low Newly Arrived, all other low skilled groups had inequality-reducing total contributions. For these groups even though group-mean income increased, their relative income was low (relative mean less than 1) and their population share also fell. This led to inequality-reducing between-group contributions for these groups, except for Medium/Low Newly Arrived, which had an inequality-increasing between-group contribution. The Medium/Low Newly Arrived group was different because it was the only low skilled group to

experience an increase in population share; thus, their inequality-increasing contribution was driven by the composition effect. Within-group inequality contributions also varied in the low skilled groups. Except for Medium/Low New Zealand-born and Medium/Low Returning New Zealand-born, all low skilled groups had inequality-increasing within-inequality contributions. The Medium/Low New Zealand-born group was an exception because both within-group inequality and population share fell for this group while Medium/Low Returning New Zealand-born had a fall in population share.

Spatially, the trends in metro and non-metro areas mirrored each other - changes in population share for each migrant group across both areas were in the same direction although the magnitude differed[32]. In both areas, all high skilled groups had in increase in population share while low skilled groups had a decrease in population share (except for M/LS Newly arrived). This implies that the composition effect (C2+C3') is inequality-increasing for high skilled groups but inequality-reducing for low skilled groups. Overall, the composition effect is inequality-increasing, with a slightly larger magnitude in metropolitan areas. Notwithstanding these similarities, across areas, there are some differences due to the differences in the within-group specific distribution changes (C1+C4'). For example, in non-metropolitan areas, within-group inequality fell for the High Skilled New Zealand-born, High Skilled New Zealand Newly Arrived, Medium/Low Skilled Earlier and Medium/Low Skilled Newly Arrived, in contrast to metropolitan areas. Hence, aggregate change in within-migrant group inequality for given migrant-shares (C1) made an inequality-reducing contribution for these groups in non-metropolitan areas compared to metropolitan areas[33]. Also, the High Skilled Newly Arrived group had an inequality-reducing contribution from the aggregate growth in migrant-group mean income for given migrant-shares (C4') in non-metropolitan areas in contrast to metropolitan areas. The reason for this difference is that the average income for this group fell slightly

[32] This implies that the direction of change of C2 and C3' is the same for each migrant group in both non-metropolitan and metropolitan areas.

[33] Except for M/LS Earlier, although within-group inequality fell for these groups in non-metropolitan areas, the within-group contributions to inequality for these groups were inequality-increasing because of the stronger inequality-increasing aggregate change in within-migrant group inequality due to changing migrant-shares (i.e. although C1 was negative, C4' was positive and larger than C1).

in metropolitan areas. This group was the only group to experience a fall in average incomes.

Focusing on the role of immigrant groups (foreign-born and Returning New Zealand-born groups)[34], we can now answer the questions: what role have specific immigrant groups played in the changes in the distribution of income between 1986 and 2013, and what role has the skill-biased immigration policy had on the distribution of income? Our results show that in all urban areas combined, high skilled immigrant groups (High Skilled Returning. New Zealand-born, High Skilled Earlier migrants and High Skilled Newly Arrived) display inequality-increasing between- and within-group contributions. This is because for these groups, their relative group mean was above the overall mean in all periods, and between 1986 and 2013, within-group inequality increased, population share increased, and mean income increased. These changes led to inequality-increasing between- and within-group contributions.

Of all immigrant groups, High Skilled Earlier Migrants and High Skilled Newly Arrived Migrants made the highest and second-highest inequality-increasing total contributions, respectively. In terms of magnitude, the inequality-increasing total contribution was larger for earlier immigrants compared to newly arrived immigrants and this is unsurprising given that earlier high skilled immigrants experienced a larger change in population share, a higher growth in within-group inequality and had a higher relative mean income.

For the Medium and Low skilled immigrants (Medium/Low Skilled Returning New Zealand-born, Medium/Low Skilled Earlier Migrants and Medium/Low Skilled Newly Arrived), except for Medium/Low Skilled Newly Arrived, these groups had an inequality-reducing between-inequality contribution. This is because for these groups, although mean-group income increased between 1986 and 2013, mean-group income was less than overall mean income, and their population share also declined. These changes combined to narrow between-group inequality. Medium/Low Skilled Newly Arrived was an exception to this case because even though it had similar changes and patterns in relative income and mean income and within-group inequality as with other Medium/Low Skilled

[34] We have classified the Returning New Zealand-born group as one of the immigrant groups. Hence immigrant groups are all other groups except the High Skilled New Zealand-born and Medium/Low Skilled New Zealand-born

groups, it differed in one key aspect: its population share increased. This difference ensured that Medium/Low Skilled Newly Arrived had inequality-increasing between-group contributions[35].

Within-group contributions for the low skilled immigrant groups were inequality-increasing except for the Medium/Low Skilled Returning New Zealand-born. For Medium/Low Skilled Earlier migrants, the inequality-increasing within-group contribution was driven by the increase in within-group inequality. Although the population share of this group fell, the inequality-reducing change in within-migrant group inequality due to falling migrant-shares (C2) was not large enough to offset the inequality-increasing contribution from the increase in within-migrant group inequality for given migrant-shares (C1). For Medium/Low Skilled Newly Arrived, both within-group inequality and population share increased, hence this group had an inequality-increasing within-group contribution (C1 and C2 are both positive).

If we combine all immigrant groups, the total change in immigrant groups is inequality-increasing across areas[36]. Unsurprisingly, the effect is larger in metropolitan areas, which have seen greater levels of immigration and larger widening of the income distribution of immigrants. The inequality-increasing change in inequality due to immigration is smaller in non-metropolitan areas and combined with a larger inequality-reducing change from the New Zealand-born group (sum of High Skilled New Zealand-born and Medium/Low Skilled New Zealand-born), has led to a fall in overall inequality in these areas. This is in contrast to metropolitan areas, where overall inequality rose because the inequality-increasing effect of changes in immigration was larger than the inequality-reducing change from the New Zealand-born group (sum of total change for High Skilled New Zealand-born and Medium/Low Skilled New Zealand-born).

Similarly, the inequality-increasing compositional effect of immigration (C2+C3) is slightly higher in metropolitan areas while the inequality-reducing group-specific distributional changes are slightly higher in non-metropolitan areas. This is not surprising as metropolitan areas have had greater increases in the shares of

[35] The inequality-increasing effect from C3' dominated the inequality-reducing effect from C4' and ensured that M/LS Newly Arrived had an inequality-increasing between-group contribution.
[36] Summing the total change of all immigrant groups in each of metropolitan and non-metropolitan areas.

immigrants while non-metropolitan areas have had falls for most immigrant groups in within-group inequality[37]. However, the magnitude of the composition effect is similar across all areas, whereas the migrant-group-specific distribution effect (C1+C4) is almost negligible in metropolitan areas, but strongly inequality-reducing in non-metropolitan areas.

Next, we present the between- and within-group contributions of migration groups to the level of inequality using the regression decomposition approach. We begin by comparing the regression results with the within- and between-group contributions from the sub-group decomposition of the MLD level, then we proceed to present the conditional contribution of migration status accounting for age, sex and employment status[38]. These contributions are then used to estimate the contribution of different migrant groups to the change in income inequality between 1986 and 2013.

5.2. Regression decomposition approach

This section presents results from the regression decomposition approach.
We check the performance of our extension to the regression approach by comparing the between- and within-group contributions to the level of inequality from this method to the within- and between-group contributions from the sub-group decomposition of the MLD level (Table 4.4). As usual we focus on our three sets of geographical areas: non-metropolitan areas, metropolitan areas, and all urban areas combined. The results for all urban areas are presented in Table 5.2 and the results for metropolitan and non-metropolitan areas are separately presented in the appendix.

[37] Except High Skilled Returning New Zealand-born and High Skilled Earlier immigrants
[38] Instead of accounting for multiple factors, as most studies that use regression decomposition do, we focus exclusively on "explaining" overall income inequality in terms of the composition of the population across the eight migrant groups.

Table 5-2: Comparison of between- and within-group contributions to the level of inequality (MLD) from the regression and sub-group decomposition approach

All urban areas combined												
	Regression decomposition of inequality level						**Sub-group decomposition of inequality level**					
Migrant status	1986	1991	1996	2001	2006	2013	1986	1991	1996	2001	2006	2013
	Between-group contribution						**Between-group contribution**					
HS NZ-born	12%	14%	13%	14%	14%	14%	-8%	-11%	-12%	-14%	-15%	-16%
M/LS NZ-born	-7%	-7%	-6%	-6%	-7%	-7%	13%	15%	15%	17%	15%	16%
HS Ret. NZ-born	1%	1%	1%	1%	1%	1%	-1%	-1%	-1%	-1%	-1%	-1%
M/LS Ret. NZ-born	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%
HS Earlier Migrants	3%	4%	3%	4%	4%	4%	-2%	-3%	-3%	-4%	-5%	-6%
HS Newly Arrived Migrant	1%	1%	0%	0%	0%	0%	-1%	-1%	0%	-1%	-1%	0%
M/LS Earlier Migrant	-1%	-2%	-2%	-2%	-3%	-4%	3%	5%	6%	7%	9%	12%
M/LS Newly Arrived Migrant	0%	-1%	-1%	-1%	-1%	-1%	1%	1%	3%	3%	4%	3%
Overall between-inequality proportion	**7%**	**9%**	**8%**	**9%**	**8%**	**8%**	**4%**	**6%**	**7%**	**7%**	**7%**	**7%**
	Within-group contribution						**Within-group contribution**					
HS NZ-born	12%	13%	18%	20%	21%	26%	5%	6%	7%	9%	11%	14%
M/LS NZ-born	58%	54%	49%	46%	42%	35%	68%	65%	59%	55%	49%	43%
HS Ret. NZ-born	1%	1%	1%	1%	2%	2%	0%	0%	1%	1%	1%	1%
M/LS Ret. NZ-born	2%	2%	2%	1%	2%	1%	2%	2%	2%	2%	2%	1%
HS Earlier Migrants	3%	4%	5%	7%	9%	13%	1%	2%	2%	4%	6%	9%
HS Newly Arrived Migrant	1%	2%	3%	3%	4%	4%	1%	1%	3%	3%	4%	4%
M/LS Earlier Migrant	13%	12%	11%	10%	10%	10%	15%	15%	15%	14%	15%	17%
M/LS Newly Arrived Migrant	2%	2%	3%	3%	3%	2%	3%	3%	4%	5%	5%	4%
Overall within-inequality proportion	**93%**	**91%**	**92%**	**91%**	**92%**	**92%**	**96%**	**94%**	**93%**	**93%**	**93%**	**93%**

Note: Results are the between- and within-group contributions in all urban areas combined from the regression and sub-group decomposition approaches. The sub-group decomposition contributions are based on converting the contributions in Table 4.4 to percentages($\frac{by-group\ contribution}{overall\ inequality} * 100$). The regression approach contributions are based on the formulae presented in Section 3.2

The results in Table 5.2 show some similarities, but also some differences between the results from the sub-group decomposition of the MLD level and our extension of the Fields and Yoo approach. The overall between- and within-group contributions from both approaches are similar. From each method, the between-group effects contribute little to the overall level of income inequality in urban areas in New Zealand. The within-group contribution of each migrant-group from the regression approach is also consistent with the sub-group decomposition approach. While the overall between- and within-group inequality contributions (expressed in percentages) from both approaches are directly comparable, the signs of the by-migrant mean group contributions from the sub-group approach are opposite to those obtained in the regression approach. As noted earlier, this is because the two approaches are based on different measures of inequality. The regression approach is a variance decomposition. The mean-group contribution in the regression approach is the proportion of the variance in income explained by a specific migrant group[39]. The MLD sub-group approach is based on the MLD level decomposition. The key difference in the way in which these two measures calculate inequality is that they assign opposing signs to migrant groups above and below the overall mean. With the regression approach, groups with higher mean income than the overall mean will have a positive by-migrant group contribution[40] while with the MLD, these groups will have a negative between-group contribution[41].

Figure 5.1 presents a comparison of the between- and within-group contributions from both approaches. We see that the MLD method shows an upward trend until 2001 in the contribution of between-group inequality to overall inequality. With the regression method, there is also an increase in between-group inequality between 1986 and 1991, but this is followed by a decline between 1991 and 1996 and little variation thereafter.

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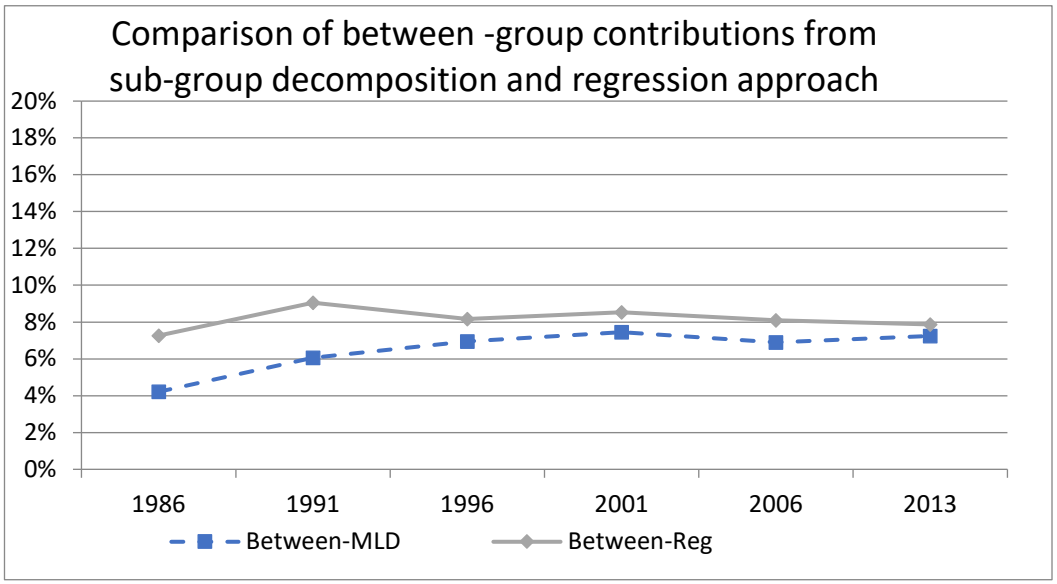
[39] The contribution (S_k) from the regression approach is from a decomposition of variance. Shorrocks showed that the contributions calculated from these are applicable to other measures of inequality such as the MLD, which satisfies a set of six axioms (see Shorrocks, 1982).

[40] In our regression model, the sign of the contribution depends on the covariance of the group income with the overall income. Groups that have high average incomes such as High Skilled NZ-born will have positive co-variances with total income and thus positive contribution.

[41] If $r_m > 1$ for a group with high relative mean incomes, the contributions of that group to overall mean-group contributions (between-group inequality) will be negative i.e. $r_m = \mu_m/\mu$. If $\mu_m > \mu$ then $\ln\left(\frac{1}{r_m}\right) < 0$

Figure 5-1 : Between- and within-group contributions from the regression and sub-group decomposition approaches



Notes: Figure 5.1 compares the between-group MLD contributions from the regression and sub-group decomposition approaches

We have shown that the results from our extension of the regression approach and the sub-group level decomposition approach are similar. Given that one of the advantages of the regression approach is the ease of accounting for multiple factors, we report the contribution of each migrant group to inequality accounting for age, sex and employment status. We compare the results from this adjusted decomposition with the basic approach (with migration indicators as the only covariates). We present the results for all urban areas combined[42] in Table 5.3 It is important to remember that for the multivariate regression[43], the between-group contributions are calculated using a Shapley value approach and are the average of the marginal contributions of each factor from all possible orderings while the within-group contributions do not depend on the order in which they are included and are calculated using the standard Fields and Yoo approach. In the multivariate regression, we report only the conditional between-group and conditional within-group contributions for migration. The sum of conditional between-group and conditional within-group contributions will not add up to overall inequality because instead of explaining the contributions of all factors, as most studies that use regression decomposition do, we focus exclusively on "explaining" overall

[42] Results for Non-metropolitan and Metropolitan areas are available in Appendix A.5 and Appendix A.6.

income inequality in terms of the contribution of the eight migrant groups and how accounting for age, sex, and employment status changes the contributions.

Table 5-3: Mean-group contribution of migrant groups to inequality with and without accounting for age, sex and employment status in all urban areas combined

	Basic regression-based decomposition of inequality level and change							**Adjusted regression-based decomposition of inequality level and change**						
Migrant status	1986	1991	1996	2001	2006	2013	Contri to change (δ_k)MLD points	1986	1991	1996	2001	2006	2013	Contri to change (δ_k)MLD points
	Between-group contribution							**Conditional between-group contribution**						
HS NZ-born	11.7%	13.5%	12.6%	13.8%	14.2%	14.0%	0.0086	12.9%	15.1%	13.8%	15.1%	15.5%	15.0%	0.0079
M/LS NZ-born	-7.3%	-7.3%	-5.7%	-6.5%	-6.7%	-6.5%	0.0027	-9.3%	-9.5%	-7.1%	-8.0%	-7.8%	-7.3%	0.0070
HS Ret. NZ-born	0.7%	0.8%	0.8%	0.8%	1.3%	1.0%	0.0009	0.8%	0.9%	0.9%	0.9%	1.5%	1.1%	0.0009
M/LS Ret. NZ-born	-0.2%	-0.2%	-0.2%	-0.2%	-0.1%	-0.2%	0.0000	-0.2%	-0.2%	-0.3%	-0.2%	-0.2%	-0.2%	0.0001
HS Earlier	3.2%	3.6%	3.2%	3.5%	3.6%	4.1%	0.0034	3.5%	4.0%	3.5%	3.9%	4.0%	4.4%	0.0034
HS New	0.9%	1.2%	0.2%	0.4%	0.3%	0.2%	-0.0023	1.0%	1.4%	0.3%	0.5%	0.4%	0.2%	-0.0025
M/LS Earlier	-1.5%	-2.2%	-2.1%	-2.4%	-3.3%	-3.9%	-0.0087	-1.8%	-2.9%	-2.6%	-3.1%	-4.0%	-4.5%	-0.0095
M/LS New	-0.3%	-0.6%	-0.7%	-0.9%	-1.3%	-0.9%	-0.0022	-0.4%	-0.7%	-1.0%	-1.2%	-1.6%	-1.1%	-0.0026
Overall between	**7.3%**	**9.0%**	**8.2%**	**8.5%**	**8.1%**	**7.9%**	**0.0024**	**6.5%**	**8.2%**	**7.4%**	**8.0%**	**7.8%**	**7.7%**	**0.0047**
	Within-group contribution							**Conditional within-group contribution**						
HS NZ-born	12.2%	13.5%	18.1%	20.1%	20.9%	25.8%	0.0485	9.9%	11.0%	15.8%	17.4%	17.6%	21.5%	0.0416
M/LS NZ-born	57.6%	54.4%	49.1%	45.6%	41.7%	34.9%	-0.0795	35.2%	35.7%	36.4%	34.5%	31.7%	25.9%	-0.0324
HS Ret. NZ-born	0.9%	1.0%	1.3%	1.3%	2.1%	2.0%	0.0037	0.7%	0.9%	1.1%	1.1%	1.8%	1.6%	0.0033
M/LS Ret. NZ-born	1.8%	1.6%	1.6%	1.3%	1.6%	1.1%	-0.0024	1.2%	1.1%	1.2%	1.1%	1.3%	0.9%	-0.0009
HS Earlier	3.5%	3.9%	5.3%	6.9%	8.7%	12.7%	0.0331	2.8%	3.1%	4.6%	5.9%	7.3%	10.6%	0.0280
HS New	1.4%	2.0%	3.1%	3.3%	4.1%	3.6%	0.0080	1.1%	1.6%	2.5%	2.8%	3.4%	2.9%	0.0066
M/LS Earlier	13.3%	12.2%	10.9%	10.3%	10.0%	10.1%	-0.0111	8.2%	8.1%	8.0%	7.8%	7.5%	7.5%	-0.0021
M/LS New	2.0%	2.5%	2.5%	2.6%	2.8%	2.0%	0.0001	1.4%	1.8%	2.0%	2.0%	2.2%	1.6%	0.0007
Overall Within	**92.7%**	**91.0%**	**91.8%**	**91.5%**	**91.9%**	**92.1%**	**0.0003**	**60.4%**	**63.3%**	**71.6%**	**72.5%**	**72.8%**	**72.5%**	**0.0448**
MLD	0.3538	0.3402	0.3596	0.3664	0.3395	0.3565		0.3538	0.3402	0.3596	0.3664	0.3395	0.3565	

Note: Results are the between- and within-group contribution of migrant groups to inequality with and without accounting for age, sex and employment status in all urban areas combined. Contri to change(δ_k) is the contribution to change in MLD between 1986 and 2013 and is calculated using $\delta_k = S_{k,t+1} * I_{t+1} - S_{k,t} * I_t$

Table 5.3 reports the contribution to inequality in all urban areas combined for each migrant group using the regression-based decomposition approach. As explained earlier, we consider two variations. The first variation (hereafter referred to as the basic decomposition) reported in the first panel of Table 5.3 uses only migrant groups as explanatory variables. Because we treat all migrant groups as a block (as if they are one single explanatory variable), the Shapley value decomposition procedure coincides with the standard Fields and Yoo approach i.e. with only one block of explanatory variable; the marginal contribution does not depend on the order in which it is introduced in the regression.

In the second panel in Table 5.3 (hereafter referred to as the adjusted decomposition), we account for age, sex and employment status, in our regression framework and examine what effect these characteristics have on the contributions of each migrant group to inequality. Here, the between-group contributions depend on the ordering and the reported contributions are the average of the marginal contributions from all possible orderings. The within-group contributions do not depend on the orderings and are calculated using the Fields and Yoo approach.

Although the results from the regression decompositions represent a decomposition of the variance of income, Shorrocks (1982) shows that the calculated contributions are invariant to the choice of inequality measure as long as the inequality measure satisfies a set of six axioms[44]. Thus, it is possible to apply the calculated level contributions to the MLD to derive the contribution to change in MLD between 1986 and 2013. The contribution to change (δ_k) is calculated using the formula:

$$\delta_k = S_{k,t+1} * I_{t+1} - S_{k,t} * I_t$$

We compare the within- and between-group contribution to change from the basic regression approach to the within- and between-group contribution to change from the Mookherjee and Shorrocks change decomposition approach.

In the basic regression decomposition, all groups except the High Skilled Newly Arrived, Medium/Low Skilled Earlier and Medium/Low Skilled Newly Arrived make inequality-increasing between-group contributions to inequality change between 1986 and 2013. This is in contrast to the results using the Mookherjee

[44] Popular measures like MLD, Gini, and Theil satisfies these six axioms.

and Shorrocks approach, where all low skilled groups (except for Medium/Low Skilled Newly Arrived) make inequality-reducing between-group contributions to inequality change. For within-group inequality change contributions, the patterns in the regression-based decomposition and Mookherjee and Shorrocks sub-group change decomposition are the same in terms of direction of change except for the Medium/Low Skilled Earlier group. In the Mookherjee and Shorrocks approach, Medium/Low Skilled Earlier made an inequality-increasing contribution but in the regression approach, its contribution to change is inequality-reducing.

Focusing on the immigrant groups (all other groups except High Skilled New Zealand-born and Medium/Low Skilled New Zealand-born), High Skilled Earlier, High Skilled Returning New Zealand-born and Medium/Low Skilled Returning New Zealand-born make inequality-increasing between- and within-group contributions to change in contrast to Medium/low Skilled groups, which make inequality-reducing within-group contributions except for the Medium/Low Skilled Newly Arrived.

Accounting for age, sex and employment status, in the adjusted regressions, the overall between- and within-group contributions to the level of inequality decrease. This implies that accounting for these factors, migrant groups are closer together in terms of average incomes while within-group contributions are lower because some of the within-group inequality is accounted for by differences in age, sex and employment status across groups. With respect to the contribution to change, the basic decomposition results imply that most of the change between 1986 and 2013 is from between-group contributions. However, when age, sex and employment status are accounted for as in the adjusted regressions, the results show that changes in within-group inequality make a greater contribution to overall change in inequality between 1986 and 2013.

Finally, to end this section, we summarise the results from all the decomposition approaches. Table 5.4 summarises the results of the contributions to inequality in levels in 1986 and 2013 from the decomposition techniques. Table 5.5 presents the by-group contribution to changes from the Mookherjee and Shorrocks sub-group decomposition and the basic regression decomposition approaches for all urban areas. Table 5.6 summarises the overall within- and between-group contributions from each method by area.

Summary of decomposition results

Table 5-4: Summary of the contributions to the LEVEL of inequality

		1986		2013	
Table	Decomposition Method	Sum of between-group prop.	Sum of within-group	Sum of Between-group prop.	Sum of within-group prop.
All urban areas combined					
4.6	Sub-group decomposition	4%	96%	7%	93%
4.6	Regression-based	7%	93%	8%	92%
4.7	Regression-based with covariates	6%	60%	8%	73%
Non-metropolitan					
Appendix 5	Sub-group decomposition	3%	97%	6%	94%
Appendix 5	Regression-based	7%	93%	6%	94%
Appendix 7	Regression-based with covariates	6%	58%	6%	71%
Metropolitan					
Appendix 6	Sub-group decomposition	4%	96%	8%	92%
Appendix 6	Regression-based	7%	93%	8%	92%
Appendix 8	Regression-based with covariates	7%	61%	8%	73%

Note: Results are the overall between- and within-group contributions in 1986 and 2013 using sub-group decomposition and regression decomposition

Table 5-5: By-migrant group contribution to CHANGE in inequality between 1986 to 2013

All urban areas						
	Sub-group change decomposition (approx)			**Regression decomposition of inequality change**		
	Contribution to between	Contribution to within	Total change (approx.)	Contribution to between	Contribution to within	Total change
HS NZ-born	0.1230	0.0324	0.1554	0.0086	0.0485	0.0571
M/LS NZ-born	-0.2192	-0.0882	-0.3074	0.0027	-0.0795	-0.0768
HS Ret. NZ-born	0.0084	0.0025	0.0109	0.0009	0.0037	0.0046
M/LS Ret. NZ-born	-0.0114	-0.0035	-0.0149	0.0000	-0.0024	-0.0024
HS Earlier	0.0871	0.0275	0.1146	0.0034	0.0331	0.0365
HS Newly Arrived	0.0260	0.0109	0.0369	-0.0023	0.0080	0.0057
M/LS Earlier	-0.0104	0.0049	-0.0055	-0.0087	-0.0111	-0.0198
M/LS Newly Arrived	0.0112	0.0053	0.0165	-0.0022	0.0001	-0.0021
Overall	**0.0148**	**-0.0082**	**0.0066**	**0.0024**	**0.0003**	**0.0027**

Note: Results are the overall between- and within-group contributions to change between 1986 and 2013 in all urban areas combined using the sub-group decomposition and regression decomposition

Table 5-6: Summary of the group contributions to CHANGE in inequality between 1986 and 2013: Sub-group decomposition and regression approach

		1986-2013				
Table		Overall contribution from within-group inequality	Overall contribution from between-group inequality	Approx. total contribution	Actual change	Decomposition error
	Sub-group change decomposition (Mookherjee & Shorrocks)					
4.5	All urban areas	-0.0082	0.0148	0.0066	0.0027	0.0043
4.5	Non-metropolitan	-0.0463	0.0082	-0.0381	-0.0412	0.0032
4.5	Metropolitan	0.0033	0.0164	0.0197	0.0156	0.0044
	Change contribution based on Regression decomposition					
4.7	All urban areas	0.0003	0.0024		0.0027	
Appx 7	Non-metropolitan	-0.0380	-0.0032		-0.0412	
Appx 8	Metropolitan	0.0117	0.0039		0.0156	
	Change contribution based on Regression based decomposition with covariates					
4.7	All urban areas	0.0448	0.0047		0.0027	
Appx 7	Non-metropolitan	0.0163	-0.0006		-0.0412	
Appx 8	Metropolitan	0.0517	0.0059		0.0156	

Note: Results are the overall between- and within-group contributions to change between 1986 and 2013 across areas using the sub-group decomposition and regression decomposition approaches

6. Conclusion

Debates on the various socio-economic impacts of immigration in destination countries continue to take centre stage in most western countries. There is a lot of evidence on the impact of immigration on several social and economic outcomes, but the implications for the distribution of personal incomes remain relatively under-researched, particularly in New Zealand, where the emphasis is more commonly on mean income differences between groups of migrants and the local-born. Using New Zealand data, we focus in this paper on the distributional impact of migration on incomes at the sub-national level[45]. A large part of the immigration flow into New Zealand is meant to address skill shortages and while there is evidence of its minimal impact on average incomes, there has previously been little evidence relating to the impact of skilled immigration on income inequality. Using multiple decomposition methodologies, we contribute to the literature by examining two channels through which migration status may affect the distribution of income in New Zealand (namely the group size and within-group distribution effects) and provide evidence on the role of migration on changes in the distribution of income between 1986 and 2013 – a period of relatively high immigration and diversification of the type of immigrants in New Zealand.

We find that in all urban areas combined, income inequality rose by about 1% for the population aged 25 to 64 years earning positive incomes. This small increase masks notable spatial differences. In metropolitan areas, the inequality of this population rose by about 5% while in non-metropolitan areas, inequality fell by 11%.

In all urban areas combined, immigrants increased from around 25% of the population aged 25 to 64 years in 1996 to 35% in 2013. The national figures mask the spatial selectivity in the location of immigrants. The immigrant share of the population in metropolitan areas is almost double that in non-metropolitan areas. Also, across areas there are big differences in the patterns of change among immigrants with respect to length of stay and skill level. For example, in all urban areas the number of High Skilled Earlier immigrants in 2013 had increased by

[45] We use the positive income of people between the ages of 25 to 64 as a proxy for labour income.

around 694% relative to the 1986 number while the number of Low/Medium Skilled Earlier immigrants increased by only around 33% relative to the 1986 number.

We used two decomposition approaches to analyse the effect of these changes on the distribution of income between 1986 and 2013. Using the Mookherjee and Shorrocks sub-group decomposition of inequality change, we examine two channels through which changes in immigration may affect the distribution of income – the composition effect and the migrant-specific distribution effect. In all urban areas, changes from migration have had an inequality-increasing composition effect and an inequality-reducing migrant-specific distribution effect. This composition effect slightly dominated the migrant-specific distribution effect; this is why inequality increased by around 1%. Spatially, the pattern is different with the inequality-reducing migrant-specific distribution effect dominating the inequality-increasing composition effect in non-metropolitan areas, which is why inequality declined in non-metropolitan areas.

We provide an extension to the standard regression decomposition methodology that allows us to express the contributions of migration groups into within- and between-group contributions to the level of inequality, and thus to estimate the contributions to inequality change. This allows us to reconcile the regression decomposition approach with the sub-group decomposition method. We show that the results from both methods are comparable but the difference in the way the MLD and Variance treat groups above/below the mean imply that they give opposing signs for the year-specific mean-group contributions to the level of inequality. In the MLD change decomposition, migrant groups above the overall mean will make inequality-reducing mean group contributions to the level of inequality, contrary to the regression decomposition.

Examining the data by migrant group, we find that excluding the New Zealand-born group (i.e High Skilled New Zealand-born and Low Skilled New Zealand-born), the High Skilled Earlier Migrants group makes the biggest income inequality-increasing contribution to inequality change. Overall, there seems to be a difference in the contribution of high skilled and medium/low skilled groups (immigrants and New Zealand-born). High Skilled groups generally tend to make inequality-increasing contributions while medium/low skilled groups tend to be inequality-decreasing. This is because high skilled groups have high levels of

within-group inequality, increased as a share of the total population, as well as having high relative incomes. Medium/low skilled groups had a reduction in population share, lower within-group inequality and lower relative incomes, leading to their inequality-reducing contributions. New Arrivals (high skilled and medium/low skilled) are interestingly different: within-group inequality is high for this group and the population share increased for this group regardless of skill level. Thus, the Newly Arrived group made inequality-increasing contributions regardless of skill level.

Spatially, we show that metropolitan and non-metropolitan areas have a different skill mix, with a greater proportion of high-skilled New Zealand-born and immigrants preferring metropolitan areas. In non-metropolitan areas, the inequality-reducing contribution of the medium/low skilled groups dominated the inequality-increasing contributions of the high-skilled groups, so inequality fell in these areas. The opposite is true in metropolitan areas, with the inequality-increasing contributions of the high-skilled groups dominating the inequality-reducing contributions of the low-skilled group in these areas.

In this research we examined the distributional implications of immigration. The approach provided here can be easily replicated in countries such as Australia and Canada, which operate a similar migration policy to New Zealand, or in countries of the European Union that have experienced large scale immigration in recent times and have high quality disaggregated data on individual incomes.

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Appendix

Table A.1: Employment status of New Zealand-born compared to Immigrants

	NZ-born					Immigrants				
	FT Employed	PT Employed	All employed	Unemployed	NILF	FT Employed	PT Employed	All employed	Unemployed	NILF
Non-metropolitan										
1986	61.8%	13.2%	75.0%	3.1%	21.9%	65.4%	11.6%	77.0%	3.0%	20.0%
1991	55.9%	12.9%	68.8%	5.7%	25.5%	57.6%	12.0%	69.6%	5.6%	24.8%
1996	59.0%	15.9%	75.0%	4.4%	20.7%	59.0%	14.7%	73.7%	4.9%	21.4%
2001	62.3%	16.8%	79.2%	4.0%	16.8%	61.4%	16.0%	77.4%	4.1%	18.5%
2006	66.1%	16.6%	82.6%	2.6%	14.8%	67.1%	15.8%	82.9%	2.6%	14.5%
2013	65.2%	16.1%	81.3%	4.1%	14.6%	67.7%	15.7%	83.3%	3.2%	13.4%
Metropolitan										
1986	65.9%	11.7%	77.6%	2.7%	19.7%	69.7%	10.3%	79.9%	2.8%	17.2%
1991	61.5%	11.9%	73.4%	5.0%	21.6%	61.8%	10.2%	72.0%	5.6%	22.3%
1996	64.9%	14.2%	79.1%	3.5%	17.4%	60.6%	12.2%	72.8%	5.8%	21.4%
2001	68.1%	14.5%	82.6%	3.4%	14.0%	63.3%	12.7%	76.0%	4.9%	19.1%
2006	70.1%	14.5%	84.6%	2.2%	13.2%	67.5%	13.1%	80.6%	2.9%	16.5%
2013	69.5%	13.9%	83.4%	3.6%	13.1%	68.3%	12.7%	81.0%	3.8%	15.2%
All urban areas										
1986	64.5%	12.2%	76.7%	2.9%	20.4%	68.8%	10.6%	79.3%	2.9%	17.8%
1991	59.6%	12.3%	71.9%	5.3%	22.8%	61.0%	10.6%	71.6%	5.6%	22.8%
1996	63.0%	14.8%	77.8%	3.8%	18.4%	60.3%	12.6%	72.9%	5.7%	21.4%
2001	66.3%	15.2%	81.6%	3.6%	14.8%	63.0%	13.3%	76.2%	4.8%	19.0%
2006	68.9%	15.1%	84.0%	2.3%	13.7%	67.4%	13.5%	80.9%	2.9%	16.2%
2013	68.1%	14.6%	82.7%	3.7%	13.5%	68.2%	13.1%	81.3%	3.7%	15.0%

Table A.2: Comparison of MLD, relative mean income, and population share for all international migrant groups and New Zealand-born for non-metropolitan area

		NZ-born		Immigrants						
		HS NZ-born	M/LS NZ-born	HS Ret. NZ-born	M/LS Ret. NZ-born	HS Earlier	HS Newly Arrived	M/LS Earlier	M/LS Newly Arrived	Total
		Non-metropolitan								
1986	MLD	0.3054	0.3492	0.3366	0.3462	0.3216	0.4886	0.3235	0.4740	0.3589
	Rel.inc	1.79	0.95	1.64	0.96	1.81	1.81	1.00	1.00	1.00
	Pop Shr	3.8%	79.3%	0.3%	2.2%	1.0%	0.4%	11.6%	1.4%	100.0%
1991	MLD	0.3040	0.3092	0.3369	0.3023	0.3186	0.4124	0.3092	0.4129	0.3275
	Rel.inc	1.91	0.94	1.68	0.90	1.91	1.74	0.97	0.89	1.00
	Pop Shr	4.2%	80.4%	0.2%	1.7%	1.1%	0.5%	10.6%	1.3%	100.0%
1996	MLD	0.3178	0.3078	0.3409	0.2930	0.3643	0.5600	0.3275	0.4556	0.3340
	Rel.inc	1.88	0.94	1.56	0.91	1.83	1.46	0.93	0.86	1.00
	Pop Shr	5.1%	78.9%	0.3%	2.2%	1.4%	0.8%	9.9%	1.4%	100.0%
2001	MLD	0.3093	0.3079	0.3494	0.3095	0.3577	0.4727	0.3398	0.4325	0.3354
	Rel.inc	1.71	0.93	1.50	0.88	1.73	1.46	0.92	0.81	1.00
	Pop Shr	7.1%	77.5%	0.3%	1.5%	1.9%	0.9%	9.2%	1.6%	100.0%
2006	MLD	0.2809	0.2821	0.3223	0.2790	0.3420	0.3999	0.3146	0.3545	0.3065
	Rel.inc	1.51	0.93	1.33	0.91	1.53	1.27	0.89	0.85	1.00
	Pop Shr	9.5%	72.0%	0.7%	2.1%	2.5%	1.6%	8.8%	2.8%	100.0%
2013	MLD	0.2993	0.2870	0.3724	0.3225	0.3436	0.4647	0.3100	0.3986	0.3177
	Rel.inc	1.44	0.91	1.30	0.86	1.43	1.15	0.89	0.78	1.00
	Pop Shr	12.6%	66.8%	0.7%	1.6%	4.3%	1.7%	10.0%	2.4%	100.0%
Abs pop share change (%pts)		8.7%	-12.5%	0.5%	-0.7%	3.3%	1.3%	-1.6%	1.0%	0.0%
Act pop change		281.2%	-2.2%	203.8%	-18.4%	391.3%	431.0%	0.1%	95.7%	16.1%

Note: Absolute and Actual pop (population) changes reported are changes between 1986 and 2013. Absolute change is the percentage point difference in the proportion of each group between 1986 and 2013 (prop2013-prop1986). Actual pop change is the percentage change in the population of each group between 1986 and 2013 calculated as: (Population 2013-population 1986)/population 1986 for each group. HS NZ-born and M/LS NZ-born represent High Skilled and Medium/Low Skilled New Zealand-born respectively; HS Ret. NZ-born and M/LS Ret. NZ-born represent High Skilled and Medium/Low Skilled Returning New Zealand-born; HS Earlier and LS Earlier represent High Skilled and Medium/Low Skilled Earlier migrants; HS N.A and M/LS N.A represent High Skilled and Medium/Low Skilled Newly Arrived

Notes: Results are the by-group MLD, relative mean income and population share of the different categories of migrant groups in Non-metropolitan areas. HS (High skilled) are defined as those with Bachelor's degree or higher and M/LS (Medium/Low skilled) are those with other qualifications below a Bachelor's degree or no qualifications. Newly Arrived are those who arrived in the last inter-censal period and earlier migrant are arrivals prior to the last inter-censal period

Table A.3: Comparison of MLD, relative mean income, and population share for all international migrant groups and New Zealand-born for non-metropolitan area

		NZ-born		Immigrants						
		HS NZ-born	M/LS NZ-born	HS Ret. NZ-born	M/LS Ret. NZ-born	HS Earlier	HS Newly Arrived	M/LS Earlier	M/LS Newly Arrived	Total
		Metropolitan								
1986	MLD	0.3104	0.3437	0.3473	0.3300	0.3186	0.4125	0.3034	0.4023	0.3500
	Rel.inc	1.66	0.94	1.50	0.96	1.61	1.48	0.93	0.88	1.00
	Pop Shr	6.3%	65.3%	0.6%	2.6%	1.9%	0.6%	20.1%	2.5%	100.0%
1991	MLD	0.3148	0.3199	0.3566	0.3105	0.3233	0.3801	0.3096	0.3706	0.3415
	Rel.inc	1.70	0.93	1.63	0.95	1.64	1.46	0.87	0.83	1.00
	Pop Shr	7.3%	64.4%	0.6%	2.2%	2.2%	1.2%	18.5%	3.6%	100.0%
1996	MLD	0.3389	0.3201	0.3488	0.2971	0.3631	0.6235	0.3341	0.5054	0.3651
	Rel.inc	1.72	0.93	1.61	0.92	1.59	1.02	0.84	0.71	1.00
	Pop Shr	8.8%	61.1%	0.7%	2.5%	2.9%	2.1%	18.0%	3.8%	100.0%
2001	MLD	0.3271	0.3212	0.3560	0.3300	0.3838	0.5129	0.3570	0.4866	0.3719
	Rel.inc	1.62	0.92	1.56	0.93	1.44	1.07	0.81	0.68	1.00
	Pop Shr	11.4%	57.6%	0.8%	1.8%	4.4%	2.7%	17.0%	4.4%	100.0%
2006	MLD	0.3021	0.3002	0.3223	0.3005	0.3531	0.4170	0.3426	0.4001	0.3468
	Rel.inc	1.50	0.92	1.49	0.97	1.27	1.01	0.78	0.72	1.00
	Pop Shr	13.5%	49.9%	1.4%	1.9%	6.8%	4.1%	17.0%	5.3%	100.0%
2013	MLD	0.3283	0.3152	0.3643	0.3527	0.3473	0.4349	0.3528	0.4366	0.3656
	Rel.inc	1.45	0.90	1.44	0.93	1.20	1.01	0.75	0.68	1.00
	Pop Shr	16.2%	43.5%	1.3%	1.3%	11.2%	3.5%	19.4%	3.7%	100.0%
Abs pop share change (%pts)		9.9%	-21.8%	0.7%	-1.3%	9.3%	2.8%	-0.8%	1.2%	0.0%
Act pop		275.7%	-2.3%	221.5%	-25.4%	763.3%	693.8%	41.2%	115.4%	46.7%

Note: Absolute and Actual pop (population) changes reported are changes between 1986 and 2013. Absolute change is the percentage point difference in the proportion of each group between 1986 and 2013 (prop2013-prop1986). Actual pop change is the percentage change in the population of each group between 1986 and 2013 calculated as: (Population 2013-population 1986)/population 1986 for each group. HS NZ-born and M/LS NZ-born represent High Skilled and Medium/Low Skilled New Zealand-born respectively; HS Ret. NZ-born and M/LS Ret. NZ-born represent High Skilled and Medium/Low Skilled Returning New Zealand-born; HS Earlier and LS Earlier represent High Skilled and Medium/Low Skilled Earlier migrants; HS N.A and M/LS N.A represent High Skilled and Medium/Low Skilled Newly Arrived

Notes: Results are the by-group MLD, relative mean income and population share of the different categories of migrant groups in Metropolitan areas. HS (High skilled) are defined as those with Bachelor's degree or higher and M/LS (Medium/Low skilled) are those with other qualifications below a Bachelor's degree or no qualifications. Newly Arrived are those who arrived in the last inter-censal period and earlier migrant are arrivals prior to the last inter-censal period

Table A.4: Between-group and within-group contributions to MLD by area from 1986 to 2013

Between and Within-group contributions for non-metropolitan and metropolitan areas Between-group contributions												
	Between-group contributions											
	Non-metropolitan						**Metropolitan**					
	1986	1991	1996	2001	2006	2013	1986	1991	1996	2001	2006	2013
HS NZ-born	-0.0222	-0.0269	-0.0325	-0.0382	-0.0394	-0.0461	-0.0321	-0.0389	-0.0474	-0.0549	-0.0544	-0.0607
M/LS NZ-born	0.0431	0.0473	0.0529	0.0598	0.0555	0.0635	0.0421	0.0456	0.0449	0.0504	0.0408	0.0443
HS Ret. NZ-born	-0.0014	-0.0012	-0.0014	-0.0013	-0.0019	-0.0019	-0.0024	-0.0028	-0.0036	-0.0035	-0.0056	-0.0047
M/LS Ret. NZ-born	0.0008	0.0019	0.0021	0.0019	0.0021	0.0023	0.0011	0.0011	0.0021	0.0014	0.0006	0.0010
HS Earlier Migrants	-0.0060	-0.0071	-0.0083	-0.0103	-0.0108	-0.0153	-0.0091	-0.0109	-0.0134	-0.0159	-0.0162	-0.0208
HS New. Arr. Migrant	-0.0022	-0.0025	-0.0029	-0.0033	-0.0038	-0.0023	-0.0025	-0.0045	-0.0004	-0.0018	-0.0002	-0.0005
M/LS Earlier Migrant	0.0003	0.0036	0.0070	0.0080	0.0098	0.0113	0.0150	0.0249	0.0309	0.0361	0.0427	0.0552
M/LS New. Arr. Migrant	0.0000	0.0016	0.0021	0.0034	0.0045	0.0060	0.0032	0.0067	0.0130	0.0167	0.0175	0.0139
Sum of Between	0.0124	0.0167	0.0190	0.0200	0.0160	0.0175	0.0153	0.0212	0.0261	0.0285	0.0252	0.0277
Prop-Between	3%	5%	6%	6%	5%	6%	4%	6%	7%	8%	7%	8%
Within-group contributions												
	1986	1991	1996	2001	2006	2013	1986	1991	1996	2001	2006	2013
HS NZ-born	0.0117	0.0126	0.0163	0.0219	0.0267	0.0376	0.0197	0.0230	0.0298	0.0374	0.0409	0.0533
M/LS NZ-born	0.2769	0.2485	0.2429	0.2386	0.2031	0.1917	0.2246	0.2060	0.1955	0.1849	0.1499	0.1371
HS Ret. NZ-born	0.0009	0.0008	0.0011	0.0011	0.0021	0.0027	0.0020	0.0020	0.0026	0.0028	0.0045	0.0047
M/LS Ret. NZ-born	0.0077	0.0052	0.0065	0.0047	0.0060	0.0051	0.0085	0.0070	0.0076	0.0060	0.0058	0.0046
HS Earlier Migrants	0.0033	0.0035	0.0050	0.0067	0.0087	0.0147	0.0060	0.0071	0.0105	0.0168	0.0240	0.0388
HS New. Arr. Migrant	0.0018	0.0019	0.0043	0.0041	0.0064	0.0079	0.0026	0.0045	0.0134	0.0136	0.0171	0.0151
M/LS Earlier Migrant	0.0374	0.0329	0.0324	0.0313	0.0276	0.0309	0.0611	0.0574	0.0601	0.0606	0.0584	0.0683
M/LS New. Arr. Migrant	0.0067	0.0055	0.0064	0.0069	0.0099	0.0095	0.0100	0.0133	0.0193	0.0214	0.0211	0.0160
Sum of Within	0.3464	0.3109	0.3149	0.3153	0.2905	0.3001	0.3345	0.3203	0.3388	0.3435	0.3217	0.3379
Prop-Within	97%	95%	94%	94%	95%	94%	96%	94%	93%	92%	93%	92%
Total inequality	0.3588	0.3276	0.3339	0.3353	0.3065	0.3176	0.3498	0.3415	0.3649	0.3720	0.3469	0.3656
Total inequality here is slightly different from the last column in Table 3 in some years (around 0.0001pts difference) due to base 3 rounding												

Note: Results are the between and within-group contributions to overall inequality (as measured by the MLD) for the migrant group categories in Non-metropolitan and Metropolitan areas in each census period from 1986 to 2013

Table A.5: Comparison of between and within-group contributions in Non-metropolitan areas from the regression and sub-group decomposition approach

Non-metropolitan												
	Regression approach						**Sub-group decomposition**					
Migrant status	1986	1991	1996	2001	2006	2013	1986	1991	1996	2001	2006	2013
	Between-group contribution						**Between-group contribution**					
HS NZ-born	10%	12%	11%	12%	12%	12%	-6%	-8%	-10%	-11%	-13%	-15%
M/LS NZ-born	-7%	-7%	-6%	-7%	-8%	-8%	12%	14%	16%	18%	18%	20%
HS Ret. NZ-born	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-1%
M/LS Ret. NZ-born	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%
HS Earlier Migrants	3%	3%	3%	3%	3%	4%	-2%	-2%	-2%	-3%	-4%	-5%
HS Newly Arrived Migrant	1%	1%	1%	1%	1%	0%	-1%	-1%	-1%	-1%	-1%	-1%
M/LS Earlier Migrant	0%	-1%	-1%	-1%	-1%	-1%	0%	1%	2%	2%	3%	4%
M/LS Newly Arrived Migrant	0%	0%	0%	0%	-1%	-1%	0%	0%	1%	1%	1%	2%
Overall between-inequality proportion	7%	8%	7%	7%	6%	6%	3%	5%	6%	6%	5%	6%
	Within-group contribution						**Within-group contribution**					
HS NZ-born	66%	65%	61%	60%	57%	49%	3%	4%	5%	7%	9%	12%
M/LS NZ-born	1%	1%	1%	1%	1%	1%	77%	76%	73%	71%	66%	60%
HS Ret. NZ-born	2%	1%	1%	1%	2%	1%	0%	0%	0%	0%	1%	1%
M/LS Ret. NZ-born	3%	3%	4%	5%	5%	8%	2%	2%	2%	1%	2%	2%
HS Earlier Migrants	1%	1%	2%	2%	3%	3%	1%	1%	1%	2%	3%	5%
HS Newly Arrived Migrant	10%	9%	8%	8%	7%	7%	1%	1%	1%	1%	2%	2%
M/LS Earlier Migrant	2%	1%	1%	1%	2%	2%	10%	10%	10%	9%	9%	10%
M/LS Newly Arrived Migrant	93%	92%	93%	93%	94%	94%	2%	2%	2%	2%	3%	3%
Overall within-inequality proportion	66%	65%	61%	60%	57%	49%	97%	95%	94%	94%	95%	94%

Note: Results are the between- and within-group contributions in Non-metropolitan areas from the regression and sub-group decomposition approaches. The sub-group decomposition contributions are based on converting the contributions in Table 4.4 to percentages ((by-group contribution)/(overall inequality)*100). The regression approach contributions are based on the formulae presented in Section 3.2

Table A.6: Comparison of between and within-group contributions in Metropolitan areas from the regression and sub-group decomposition approach

Metropolitan												
	Regression approach						**Sub-group decomposition**					
Migrant status	1986	1991	1996	2001	2006	2013	1986	1991	1996	2001	2006	2013
	Between-group contribution						**Between-group contribution**					
HS NZ-born	12%	14%	13%	14%	15%	14%	-9%	-11%	-13%	-15%	-16%	-17%
M/LS NZ-born	-7%	-6%	-5%	-5%	-5%	-5%	12%	13%	12%	14%	12%	12%
HS Ret. NZ-born	1%	1%	1%	1%	1%	1%	-1%	-1%	-1%	-1%	-2%	-1%
M/LS Ret. NZ-born	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%
HS Earlier Migrants	3%	4%	3%	3%	3%	4%	-3%	-3%	-4%	-4%	-5%	-6%
HS Newly Arrived Migrant	1%	1%	0%	0%	0%	0%	-1%	-1%	0%	0%	0%	0%
M/LS Earlier Migrant	-2%	-3%	-3%	-3%	-4%	-5%	4%	7%	8%	10%	12%	15%
M/LS Newly Arrived Migrant	0%	-1%	-1%	-1%	-2%	-1%	1%	2%	4%	4%	5%	4%
Overall between-inequality proportion	7%	9%	8%	9%	8%	8%	4%	6%	7%	8%	7%	8%
	Within-group contribution						**Within-group contribution**					
HS NZ-born	13%	15%	19%	21%	22%	27%	6%	7%	8%	10%	12%	15%
M/LS NZ-born	55%	51%	46%	42%	38%	32%	64%	60%	54%	50%	43%	38%
HS Ret. NZ-born	1%	1%	1%	1%	2%	2%	1%	1%	1%	1%	1%	1%
M/LS Ret. NZ-born	2%	2%	2%	1%	2%	1%	2%	2%	2%	2%	2%	1%
HS Earlier Migrants	4%	4%	6%	8%	10%	14%	2%	2%	3%	5%	7%	11%
HS Newly Arrived Migrant	1%	2%	3%	4%	4%	4%	1%	1%	4%	4%	5%	4%
M/LS Earlier Migrant	15%	13%	12%	11%	11%	11%	17%	17%	16%	16%	17%	19%
M/LS Newly Arrived Migrant	2%	3%	3%	3%	3%	2%	3%	4%	5%	6%	6%	4%
Overall within-inequality proportion	93%	91%	92%	91%	92%	92%	96%	94%	93%	92%	93%	92%

Note: Results are the between- and within-group contributions in Metropolitan areas from the regression and sub-group decomposition approaches. The sub-group decomposition contributions are based on converting the contributions in Table 4.4 to percentages ((by-group contribution)/(overall inequality)*100). The regression approach contributions are based on the formulae presented in Section 3.2

Table A.7: *Mean-group contribution of migrant groups to inequality with and without accounting for age, sex and employment status in all non-metropolitan areas*

	Basic decomposition							**Adjusted decomposition**						
Migrant status	1986	1991	1996	2001	2006	2013	Contri to change (δ_k)MLD points	1986	1991	1996	2001	2006	2013	Contri to change (δ_k)MLD points
	Between-group contribution							**Between-group contribution**						
HS NZ-born	9.7%	11.8%	11.1%	11.7%	11.9%	12.2%	0.0041	10.7%	13.1%	12.2%	12.9%	13.4%	13.6%	0.0048
M/LS NZ-born	-7.2%	-7.1%	-6.2%	-7.2%	-8.0%	-8.4%	-0.0009	-9.3%	-9.4%	-8.0%	-9.0%	-9.7%	-9.9%	0.0019
HS Ret. NZ-born	0.5%	0.4%	0.3%	0.3%	0.5%	0.4%	-0.0005	0.6%	0.5%	0.4%	0.4%	0.6%	0.5%	-0.0006
M/LS Ret. NZ-born	-0.1%	-0.3%	-0.2%	-0.2%	-0.3%	-0.3%	-0.0004	-0.2%	-0.3%	-0.3%	-0.3%	-0.4%	-0.3%	-0.0002
HS Earlier	2.7%	3.1%	2.7%	3.2%	3.3%	4.0%	0.0031	2.9%	3.5%	3.0%	3.5%	3.7%	4.4%	0.0036
HS New	1.0%	1.0%	0.7%	0.8%	0.9%	0.4%	-0.0022	1.1%	1.1%	0.8%	0.9%	1.0%	0.5%	-0.0024
M/LS Earlier	-0.1%	-0.6%	-0.8%	-0.9%	-1.3%	-1.5%	-0.0044	-0.1%	-0.7%	-1.1%	-1.2%	-1.6%	-1.7%	-0.0050
M/LS New	0.0%	-0.2%	-0.2%	-0.3%	-0.6%	-0.6%	-0.0020	0.0%	-0.3%	-0.3%	-0.4%	-0.7%	-0.8%	-0.0025
Overall betweenine	6.5%	8.2%	7.3%	7.3%	6.4%	6.4%	-0.0032	5.8%	7.4%	6.7%	6.9%	6.3%	6.3%	-0.0008
	Within-group contribution							**Within-group contribution**						
HS NZ-born	9.2%	10.3%	14.2%	15.7%	17.0%	21.4%	0.0348	7.5%	8.5%	12.5%	13.4%	14.1%	17.5%	0.0287
M/LS NZ-born	66.4%	65.2%	60.9%	59.5%	56.8%	49.5%	-0.0810	38.9%	41.6%	43.6%	43.2%	41.6%	35.2%	-0.0278
HS Ret. NZ-born	0.6%	0.5%	0.6%	0.7%	1.0%	1.2%	0.0015	0.5%	0.4%	0.5%	0.6%	0.9%	0.9%	0.0011
M/LS Ret. NZ-born	1.7%	1.2%	1.4%	1.1%	1.5%	1.2%	-0.0022	1.0%	0.8%	1.0%	0.8%	1.1%	0.9%	-0.0007
HS Earlier	2.6%	2.8%	3.9%	4.5%	5.3%	8.1%	0.0167	2.1%	2.3%	3.4%	3.9%	4.5%	6.8%	0.0141
HS New	1.4%	1.3%	2.1%	2.0%	2.7%	2.9%	0.0045	1.1%	1.0%	1.8%	1.7%	2.3%	2.5%	0.0040
M/LS Earlier	9.8%	9.2%	8.0%	7.8%	7.2%	7.5%	-0.0114	5.8%	6.0%	5.8%	5.9%	5.4%	5.6%	-0.0030
M/LS New	1.8%	1.4%	1.5%	1.4%	2.1%	1.7%	-0.0009	1.2%	1.0%	1.2%	1.1%	1.6%	1.4%	0.0001
Overall Within	93.5%	91.8%	92.7%	92.7%	93.6%	93.6%	-0.0380	58.2%	61.7%	69.8%	70.6%	71.5%	70.9%	0.0164
MLD	0.3589	0.3275	0.334	0.3354	0.3065	0.3177		0.3589	0.3275	0.334	0.3354	0.3065	0.3177	

Note: Results are the between- and within-group contribution of migrant groups to inequality with and without accounting for age, sex and employment status in Non-metropolitan areas. Contri to change(δ_k) is the contribution to change in MLD between 1986 and 2013 and is calculated using $\delta_k = S_{k,t+1} * I_{t+1} - S_{k,t} * I_t$

Table A.8: *Mean-group contribution of migrant groups to inequality with and without accounting for age, sex and employment status in metropolitan areas*

	Basic decomposition							**Adjusted decomposition**						
Migrant status	1986	1991	1996	2001	2006	2013	Contri to change (δ_k)MLD points	1986	1991	1996	2001	2006	2013	Contri to change (δ_k)MLD points
	Between-group contribution							**Between-group contribution**						
HS NZ-born	12.2%	13.8%	12.8%	14.0%	14.6%	14.3%	0.0097	13.5%	15.4%	13.9%	15.3%	15.7%	15.1%	0.0080
M/LS NZ-born	-6.8%	-6.5%	-4.8%	-5.4%	-5.2%	-5.1%	0.0050	-8.6%	-8.4%	-5.9%	-6.5%	-6.0%	-5.6%	0.0096
HS Ret. NZ-born	0.8%	0.9%	0.9%	0.8%	1.5%	1.1%	0.0012	0.9%	1.0%	1.0%	0.9%	1.6%	1.2%	0.0012
M/LS Ret. NZ-born	-0.2%	-0.2%	-0.2%	-0.2%	-0.1%	-0.1%	0.0002	-0.2%	-0.2%	-0.3%	-0.2%	-0.1%	-0.1%	0.0003
HS Earlier	3.3%	3.7%	3.2%	3.4%	3.4%	3.7%	0.0019	3.6%	4.1%	3.5%	3.8%	3.7%	3.9%	0.0017
HS New	0.8%	1.3%	0.0%	0.2%	0.0%	0.1%	-0.0026	0.9%	1.4%	0.1%	0.3%	0.0%	0.1%	-0.0028
M/LS Earlier	-2.4%	-3.2%	-2.8%	-3.2%	-4.3%	-4.8%	-0.0094	-2.9%	-4.2%	-3.6%	-4.0%	-5.1%	-5.4%	-0.0096
M/LS New	-0.5%	-0.8%	-0.9%	-1.2%	-1.6%	-1.1%	-0.0022	-0.6%	-1.1%	-1.3%	-1.6%	-1.9%	-1.2%	-0.0023
Overall between	7.3%	9.0%	8.2%	8.5%	8.3%	8.1%	0.0039	6.6%	8.1%	7.4%	8.0%	8.0%	7.9%	0.0058
	Within-group contribution							**Within-group contribution**						
HS NZ-born	13.3%	14.5%	19.2%	21.2%	21.8%	26.6%	0.0507	10.7%	11.8%	16.7%	18.2%	18.3%	22.1%	0.0433
M/LS NZ-born	54.6%	51.2%	46.0%	42.5%	38.4%	31.8%	-0.0751	34.0%	34.0%	34.5%	32.5%	29.5%	23.9%	-0.0316
HS Ret. NZ-born	1.1%	1.2%	1.4%	1.5%	2.3%	2.1%	0.0040	0.8%	1.0%	1.2%	1.3%	1.9%	1.8%	0.0038
M/LS Ret. NZ-born	1.9%	1.7%	1.6%	1.4%	1.6%	1.1%	-0.0025	1.2%	1.2%	1.2%	1.1%	1.3%	0.9%	-0.0009
HS Earlier	3.8%	4.2%	5.7%	7.5%	9.5%	13.8%	0.0371	3.0%	3.4%	4.9%	6.4%	8.0%	11.4%	0.0312
HS New	1.4%	2.2%	3.3%	3.7%	4.4%	3.8%	0.0089	1.1%	1.8%	2.7%	3.0%	3.7%	3.0%	0.0071
M/LS Earlier	14.6%	13.2%	11.7%	10.9%	10.7%	10.7%	-0.0118	9.0%	8.6%	8.5%	8.2%	8.0%	7.9%	-0.0026
M/LS New	2.1%	2.8%	2.8%	2.9%	3.0%	2.1%	0.0004	1.4%	2.0%	2.2%	2.2%	2.3%	1.6%	0.0009
Overall Within	92.7%	91.0%	91.8%	91.5%	91.7%	91.9%	0.0117	61.2%	63.8%	72.0%	73.0%	73.0%	72.7%	0.0516
MLD	0.3500	0.3415	0.3651	0.3719	0.3468	0.3656		0.3500	0.3415	0.3651	0.3719	0.3468	0.3656	

Note: Results are the between- and within-group contribution of migrant groups to inequality with and without accounting for age, sex and employment status in Metropolitan areas. Contri to change(δ_k) is the contribution to change in MLD between 1986 and 2013 and is calculated using $\delta_k = S_{k,t+1} * I_{t+1} - S_{k,t} * I_t$