

Alimi, Omoniyi B; Maré, David C; Poot, Jacques

**Working Paper**

## The effects of immigration and skills on urban income inequality in New Zealand: two decomposition approaches

CRAM Discussion Paper Series, No. 23/20

**Provided in Cooperation with:**

Rockwool Foundation Berlin (RF Berlin)

*Suggested Citation:* Alimi, Omoniyi B; Maré, David C; Poot, Jacques (2020) : The effects of immigration and skills on urban income inequality in New Zealand: two decomposition approaches, CRAM Discussion Paper Series, No. 23/20, Centre for Research & Analysis of Migration (CRAM), Department of Economics, University College London, London

This Version is available at:

<https://hdl.handle.net/10419/295632>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



# CREAM

Centre for Research &  
Analysis of Migration

## Discussion Paper Series

CDP 23/20

- ▶ **The effects of immigration and skills on urban income inequality in New Zealand: two decomposition approaches**
- ▶ Omoniyi B Alimi, David C Maré, and Jacques Poot

Centre for Research and Analysis of Migration  
Department of Economics, University College London  
Drayton House, 30 Gordon Street, London WC1H 0AX  
[www.cream-migration.org](http://www.cream-migration.org)

# **The effects of immigration and skills on urban income inequality in New Zealand: two decomposition approaches**

Omoniyi B Alimi<sup>1</sup>, David C Maré<sup>2</sup>, and Jacques Poot<sup>3</sup>

<sup>1</sup> (Corresponding Author)

School of Accounting, Finance and Economics (SAFE), University of Waikato, Private Bag  
3105, Hamilton 3240, New Zealand

Email: [omoniyi.alimi@waikato.ac.nz](mailto:omoniyi.alimi@waikato.ac.nz)

<sup>2</sup> Motu Economic and Public Policy Research, PO Box 24390, Wellington 6142, New Zealand

Email: [dave.mare@motu.org.nz](mailto:dave.mare@motu.org.nz)

<sup>3</sup> National Institute of Demographic and Economic Analysis (NIDEA) and SAFE, University  
of Waikato, Private Bag 3105, Hamilton 3240, New Zealand

Email: [jacques.poot@waikato.ac.nz](mailto:jacques.poot@waikato.ac.nz)

## **Abstract**

Income inequality in New Zealand has been a growing concern since the 1980s. Inequality did indeed increase since then, particularly in metropolitan areas. At the same time, policies of encouraging permanent and temporary immigration led to the foreign born accounting for a growing share of the population, again particularly in metropolitan areas. This paper investigates the impact of immigration, by skill level and length of stay, on the distribution of income in urban areas. We apply, and reconcile, sub-group and Shapley-value regression decomposition methodologies to census microdata. We find that over the 1986-2013 period the inequality-increasing effects of immigration size and composition are together somewhat larger than the inequality-reducing effects of changes in the size and composition of the New Zealand born population. Additionally, changes in the skill distribution of the work force in New Zealand have been very important for changes in the distribution of income, regardless of migration status. While the sub-group decomposition of inequality change yields qualitatively similar contributions to 1986-2013 change as regression decomposition, the numerical effects differ markedly between the two methodologies.

**Keywords:** Decomposition; Immigration; Income inequality; Shapley-value; Urban areas; New Zealand

## **Disclaimer**

Access to the data used in this study was provided by Statistics New Zealand 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 Statistics New Zealand's release policy for census data. The views, opinions, findings and conclusions or recommendations expressed in this paper are strictly those of the authors and do not necessarily represent, and should not be reported as, those of the organisations at which the authors are employed.

# 1 Introduction

Immigration has had a major impact on population size, composition and distribution in New Zealand. Among OECD countries, New Zealand has the fifth highest proportion of immigrants in the population – after Luxembourg, Switzerland, Australia and Israel (OECD, 2019). Data from the 2013 Census of Population and Dwellings show that around one in four persons in New Zealand is foreign-born (Statistics New Zealand, 2014).<sup>1</sup> As in Europe and North America, the rising rate of immigration has been accompanied by a growing public debate on the appropriate level and the societal impacts of immigrants. In addition to social concerns, there are also concerns about the labour market impacts of immigrants. These concerns are voiced both in the popular media (see, e.g., Fyers, 2017) and among professional economists (e.g., Fry & Wilson, 2017).

The economic consequences of immigration have been well researched and there is already considerable New Zealand evidence on the impact of immigration on economic variables like wages and house prices (see Cochrane & Poot, 2020; Hyslop et al., 2019; Tse & Maani, 2017; Maani & Chen, 2012; Maré & Stillman, 2009; and the review by Hodgson & Poot, 2011). However, the impact of immigration on the distribution of income in New Zealand has not been previously investigated.

This paper makes two important contributions. Firstly, we use two decomposition methodologies (sub-group decomposition and regression decomposition) to explicitly examine the impact of immigration on the distribution of income. Secondly, we propose a variant of the regression decomposition approach that reconciles the regression methodology (e.g., Fields & Yoo, 2000) with the sub-group decomposition approach (e.g., Mookherjee &

---

<sup>1</sup> The most recent population census in New Zealand was held on 6 March 2018. The response rate of this census was lower than expected and led to a period of review and adjustment of the data, with much greater reliance on response imputation. Based on 2018 census data, it is estimated that the share of the foreign born in the usually resident population was 27.4% in 2018, as compared with 25.2% in 2013.

Shorrocks, 1982). Both decomposition methodologies are popular in the extant literature as they seek to address the same issue, namely the contribution of a particular income determinant or a particular group of the population to the level and/or change in inequality. In an earlier reconciliation of both strands of decomposition, Cowell & Fiorio (2011) estimate separate regressions for each sub-group/partition (pp. 522-525). This approach can quickly become unwieldy when allowing for heterogeneity across many sub-groups/partitions, such as those possible when considering income regressions by age group or employment status. Previous studies have avoided this limitation by focusing on mean-group (between-group) contributions only (see Brewer & Wren-Lewis, 2016; Gunatilaka & Chotikapanich, 2009). Our approach overcomes the limitation of high dimensionality by allocating the “residual inequality” in a multivariate regression framework to arrive at the conditional between-group and within-group contributions of each factor rather than through separate regressions for each sub-group/partition.

Using available individual-level Census data, we apply both the sub-group decomposition method and our extended regression method to New Zealand data to determine the contribution of various immigrant groups (classified by length of stay and skill level) to the level and change in inequality between 1986 and 2013. Our focus is the population aged 25 to 64 in main and secondary urban areas.<sup>2</sup> The population of main and secondary urban areas represents almost 80% of the total population in each census. We classify the urban areas into metropolitan and non-metropolitan urban areas.<sup>3</sup> Previous results in New Zealand have shown greater growth in inequality in metropolitan areas than in other urban areas (see

---

<sup>2</sup> Urban area boundaries are those as defined by Statistics New Zealand (SNZ) based on 2013 Census data. SNZ considers an urban area to be generally an area with a population of 1000 or more but other factors such as remoteness and location of employment of the majority of the population are also used to further differentiate between the types of urban area.

<sup>3</sup> There are 40 main and secondary urban areas. Metropolitan areas are the six largest cities of New Zealand: Auckland, Christchurch, Wellington, Hamilton, Tauranga and Dunedin. These metropolitan areas account for about three quarters of the population in all main and secondary urban areas.

Alimi et al., 2016). We focus on four types of migration status (viz. newly arrived immigrants; earlier immigrants; New Zealand born returning from residing abroad five years previously; all other New Zealand born). For each type of migration status we consider two skill levels (high skilled versus medium & low skilled). We use the decomposition approaches to calculate how much each of the resulting eight groups contributes to the level and changes in the overall distribution of income between 1986 and 2013.

Our research fits within the body of work that has focused on examining the contributions of various demographic, social, and economic factors to the changes in the distribution of income using decomposition procedures,<sup>4</sup> as well as within the wider literature focusing on the distributional effects of immigration.<sup>5</sup>

Personal income inequality – measured by Mean Log Deviation (MLD) – rose slightly in New Zealand from 0.3538 in 1986 to 0.3563 in 2013, i.e. an increase of about 1%, across all main and secondary urban areas but this masks notable spatial differences. Inequality fell in non-metropolitan areas by 11% and rose in metropolitan areas by 4%.

The proportion of immigrants in the urban population increased by about 10 percentage points from 24.9% in 1986 to 35.3% in 2013. This had a major impact on overall change in inequality. Our analysis shows that in a decomposition of level of inequality, the contribution of immigrant groups<sup>6</sup> to overall MLD increased from 20.0% in 1986 to 41.8% in 2013.

By skill level, there is a difference in the contribution of high-skilled and medium/low-skilled groups to inequality, whether they are immigrants or New Zealand born. The increasing share of high-skilled groups in the population had an inequality-increasing effect

---

<sup>4</sup> See Fields & Yoo (2000), Mookherjee & Shorrocks (1982) and Shorrocks (1982) for methodological backgrounds to these procedures. Applications can be found in: Kimhi & Hanuk-Tafia, 2019; Mussida & Parisi, 2018; Brewer & Wren-Lewis, 2016; and Gunatilaka & Chotikapanich, 2009.

<sup>5</sup> This is a broad area in the migration literature. See for example: Altonji & Card, 1991; Blau & Kahn, 2015; Borjas, 2003, 2005; Borjas et al., 1997; Card, 1990, 2005, 2009; D'Amuri et al., 2010; Dustmann et al., 2005; Foged & Peri, 2016; Longhi et al., 2005, 2008; and Manacorda et al., 2012.

<sup>6</sup> All foreign-born groups

because, firstly, there was a relatively strong increase in income inequality within these groups and, secondly, the average income of these groups increased faster than that of the medium and low-skill groups (thereby bringing the overall mean income closer to the mean income of high-skill groups).

Together, these changes in migration and in the skill composition of the population led to a slightly increasing contribution of between-group inequality between 1986 and 2013 with both the regression and sub-group decomposition approaches.

The rest of the paper proceeds as follows: Section 2 discusses the data and introduces the two decomposition methodologies and shows how they can be reconciled. Section 3 describes the results and Section 4 concludes.

## **2 Data and Methodology**

### **2.1 Data**

The data used are from the unit records of the usually resident New Zealand population enumerated in each Census of Population and Dwelling from 1986 to 2013.<sup>7</sup> New Zealand Census data capture *inter alia* information on current location of residence, place of residence at the last Census, country of birth and qualifications. We use this information to first classify the population by country of birth: New Zealand or abroad. We identify international migrants in each Census as people who are usually resident of New Zealand but whose country of birth is outside of New Zealand (i.e., the foreign born). We split this group by their length of stay into newly-arrived migrants (who arrived during the last five years before the census) and earlier migrants. Given the information on place of residence five years ago, we can also

---

<sup>7</sup> New Zealand Censuses were held in 1986, 1991, 1996, 2001, 2006, 2013 and 2018. As noted in footnote 1, the required data from the 2018 census are of lower quality than previous censuses. As a consequence, we have not included 2018 in our study.



identify a group of “Returning New Zealand born” migrants – they 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 because 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.<sup>8</sup> As well as classifying migrants by duration of residence, 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. Altogether, we divide the total population into eight categories: (1) Non-Migrant New Zealand born High Skilled; (2) Non-Migrant New Zealand born Medium/Low Skilled; (3) Returning New Zealand born High Skilled; (4) Returning New Zealand born Medium/Low Skilled; (5) Earlier Migrants High Skilled; (6) Earlier Migrants Medium/Low Skilled; (7) Newly-Arrived Migrants High Skilled; and (8) Newly-Arrived Migrants Medium/Low Skilled.

Our ideal income measure is that of gross labour earnings, but income reported in the Census refers to income from all sources. Hence we restrict our analysis to the population aged 25-64 who are earning positive incomes.<sup>9</sup>

---

<sup>8</sup> 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 & Choy, 2001). Other research shows that the New Zealand-born have the highest rate, among the OECD countries, of highly-skilled population living abroad (Dumont & Lemaitre, 2005).

<sup>9</sup> Income information is recorded in the Census for any New Zealand resident aged 15 and over. Those who report a negative income are likely to be owning a business or farm that operates at a loss. We cannot impute their labour earnings. Among those aged 15 to 24 years there are many who receive student allowances or parental support. Superannuation is an important source of income for those aged 65 and over. We assume that Census income is a good proxy for gross labour earnings among the population aged 25 to 64 who are earning positive income. The proportion earning positive income is above 90% of the target population in each Census period. Experimental estimates of gross taxable income from linked administrative data show that wages and salaries of those in the 25 to 64 age range account for 99% of their total income. See <https://www.stats.govt.nz/experimental/experimental-estimates-of-income-from-linked-administrative-data> accessed 12 May 2020.

Instead of recording actual incomes, the census uses income bands with the top and bottom income bands open ended.<sup>10</sup> An important issue with the open-ended upper band is the calculation of mean income in the open-ended band.<sup>11</sup> To resolve this problem, Pareto distributions have been fitted to the upper tail of the area-specific distributions.<sup>12</sup> The midpoints of these distributions have been calculated by means of the Stata RPME command developed by von Hippel et al. (2016).

## 2.2 Methodology

We decompose levels of income inequality and changes in inequality using the sub-group approach and a variant of the Shapley-value regression-based approach. We briefly describe both approaches here. As noted in the introductory section, our measure of inequality is the Mean Log Deviation (MLD). The MLD is a member of the family of generalised entropy indices (see Bourguignon, 1979). All entropy measures have the advantage of being additively decomposable. We use the MLD instead of the more popular Theil measure because our focus is on how changes in the population shares through immigration have affected the distribution of income. Unlike the Theil measure (which weights by income share), the MLD weights by population share and is therefore a natural choice and fit-for-purpose index when the focus is on income inequality impacts of changes in population composition.<sup>13</sup> For a population of  $N$  persons indexed by  $i=1,2,\dots,N$  and each having personal income  $y_i$ ,

---

<sup>10</sup> For example, the top band in the 2013 census data captures everybody earning \$150,000 and over.

<sup>11</sup> 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.

<sup>12</sup> 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.

<sup>13</sup> Additionally, it has also been shown that MLD is less sensitive to uncertainty about incomes at the upper end of the distribution (Cowell & Flachaire, 2007).

$$MLD = \frac{1}{N} \sum_{i=1}^N \ln\left(\frac{\bar{y}}{y_i}\right) = \ln(\bar{y}) - \overline{\ln(y)} \quad (1)$$

in which the bar above a variable refers to the arithmetic average. Equation (1) shows that MLD is the difference between the natural logarithm of mean income and the mean of the natural logarithm of individual incomes. MLD is nonnegative due to Jensen's inequality.

For a population that is partitioned by migration status into  $m$  groups ( $m=1,2,\dots,M$ ;  $M=8$  in our application), the overall MLD level of inequality can then be written as the weighted sum of within-migrant-group inequality and between-migrant-group inequality:

$$Overall\ MLD = \underbrace{\sum_{m=1}^M \pi_m MLD_m}_{\text{Within-group inequality}} + \underbrace{\sum_{m=1}^M \pi_m \ln\left(\frac{1}{r_m}\right)}_{\substack{\text{Between-group inequality} \\ \text{or} \\ \text{Mean-group contribution}}} \quad (2)$$

where:

- $\pi_m$  is the population share of migrant group  $m$ , i.e.  $\pi_m = \frac{N_m}{N}$ , in which  $N_m$  is the population of all those belonging to migrant group  $m$  and  $N = \sum_{m=1}^M N_m$ .
- $r_m$  is the relative income of migrant group  $m$ , i.e.  $r_m = \mu_m/\mu$ , where  $\mu_m$  is average income of migrant group  $m$ , i.e.  $\mu_m = Y_m/N_m$ , and  $Y_m$  is aggregate income of all those in group  $m$ , while  $\mu$  is the average income in the economy:  $\mu = Y/N = \bar{y}$ ;
- $MLD_m = \frac{1}{N_m} \sum_{i=1}^{N_m} \ln\left(\frac{\mu_m}{y_i}\right)$  is a measure of within-migrant-group inequality.

### 2.2.1 Population sub-group decomposition of inequality change

With some algebra, it can be shown that the change in the MLD ( $\Delta MLD$ ) between two periods can be expressed exactly as follows (Mookherjee & Shorrocks, 1982) :

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

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 & Shorrocks' (1982) methodological contribution was to suggest an approximate decomposition of  $\Delta MLD$ , which will explicitly include group-specific mean income growth. We use this approximate change decomposition. The change in overall inequality can then be expressed as:

$$\begin{aligned}
\Delta MLD \approx & \underbrace{\sum_{m=1}^M \bar{\pi}_m \Delta MLD_m}_{C1} + \underbrace{\sum_{m=1}^M \overline{MLD}_m \Delta \pi_m}_{C2} + \underbrace{\sum_{m=1}^M (\bar{r}_m - \overline{\ln r_m}) \Delta \pi_m}_{C3'} \\
& + \underbrace{\sum_{m=1}^M (\bar{\pi}_m \bar{r}_m - \bar{\pi}_m) \Delta \ln \mu_m}_{C4'}
\end{aligned} \tag{4}$$

where:

- $C1$  is the aggregate change in within-migrant group inequality for given migrant group shares;
- $C2$  is the aggregate change in within-migrant group inequality due to changing migrant group shares;

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

The sum of  $C2$  and  $C3'$  represents the migrant-group shares or composition effect and the sum of  $C1$  and  $C4'$  represents the migrant group-specific distribution effect.<sup>14</sup>

## 2.2.2 Shapley-value regression decomposition of level and changes in inequality

The regression decomposition method is an extension of Shorrocks' (1982) work on decomposition of income by additive factor components. We start with the following income generating function (IGF):

$$y_{it} = \sum_{m=1}^M \beta_{mt} D_{imt} + \sum_{j=1}^J \gamma_{jt} Z_{ijt} + \varepsilon_{it} \quad (5)$$

Where the  $D_{mt}$  are a full set of dummy variables denoting membership of each of the  $M$  migrant groups  $m$  ( $M=8$  in our application), and  $Z_{jt}$  are vectors of other covariates that affect income.  $\beta_{mt}$  and  $\gamma_{jt}$  are sets of IGF parameters, and  $\varepsilon_{it}$  is random variation in income that is not related to the included covariates. By construction, the  $D_{mt}$  are mutually orthogonal but the  $Z_{jt}$  can be arbitrarily correlated with each other and with the  $D_{mt}$  dummies.

Decomposing the contributions of the  $m$  migrant groups to income inequality is straightforward in the case where there are no correlated covariates ( $J=0$ ). In this case, Shorrocks (1982) shows that the proportion of the level of earnings inequality accounted for

---

<sup>14</sup> Mookherjee & Shorrocks (1982) note that this approximation appears sufficient for computational purposes (p.897). It is clear that  $C3' - C3 = \sum_{m=1}^M \bar{\gamma}_m \Delta \pi_m$ . Experimentation with a range of changing income distributions shows that the sign of  $C3$  can be sometimes different from that of  $C3'$  and, similarly, the sign of  $C4$  can be different from that of  $C4'$ . This may lead to slightly different interpretations. In this paper, we follow Mookherjee & Shorrocks (1982) and use the approximate decomposition. Results for the exact decomposition are available upon request.

by group  $m$ , also referred to as the relative factor inequality weight  $S_{mt}$ , can then be calculated as:

$$S_{mt} = \frac{\hat{\beta}_{mt} * Cov(D_{mt}, Y_t)}{Var(Y_t)} \quad (6)$$

where  $\hat{\beta}_{mt}$  is the OLS coefficient on dummy variable  $D_{mt}$  in a regression of equation (5) with  $J=0$ . By construction,  $\hat{\beta}_{mt}$  equals average income of the members of group  $m$ .  $S_{mt} > 0$  ( $< 0$ ) for groups that have an average income that is greater (less) than the overall mean.

Hence  $S_{mt}$  can be interpreted as the group-mean contribution, or the between-group contribution, of group  $m$  to overall inequality at time  $t$ .<sup>15</sup>

The relative between-group contribution of a group to overall inequality,  $S_{mt}$ , is invariant to the choice of inequality measure  $I_t$ .<sup>16</sup> The between-group contribution of a group  $m$  to income inequality at time  $t$  is simply:

$$\theta_{mt} = S_{mt} * I_t \quad (7)$$

Additionally, the between-group contribution of all groups considered jointly can be shown to be the  $R$ -square of the OLS regression from which the  $\beta_{mt}$  are estimated, while the aggregate of the within-group contributions is equal to the unexplained variance in  $Y_t$ , i.e. total within-group inequality is  $1 - R^2$  (Israeli, 2007).<sup>17</sup>

The between-group contribution of group  $k$  to *change* in inequality between time  $t$  and  $t+1$  is given by:<sup>18</sup>

$$\delta_m = S_{m,t+1} * I_{t+1} - S_{m,t} * I_t \quad (8)$$

---

<sup>15</sup> Note that these contributions are likely to be jointly small, because they do not account for within group inequality. However, they can be individually greater than one or less than minus one.

<sup>16</sup> If the measure satisfies the six axioms listed in Shorrocks (1982).

<sup>17</sup> Note that  $R^2$  equals the  $R$  square as calculated conventionally in the regression with a constant term, in which one of the  $m$  groups is the omitted group.

<sup>18</sup> Unlike the contribution of each factor to level  $S_{mt}$ , the contribution of each factor to change  $\delta_m$  in equation (8) is dependent on the choice of inequality measure (Fields & Yoo, 2000).

One of the advantages of the regression decomposition framework is the possibility of accounting for multiple explanatory variables ( $Z_{jt}$ )<sup>19</sup> although their inclusion makes decomposition more challenging, and has limitations.<sup>20</sup> Most notably, with multiple explanatory variables, the standard Fields & Yoo (2000) approach relies on the assumption of mutually orthogonal explanatory variables (Israeli, 2007), in which case the between-group contribution of each variable to overall inequality is simply the increase in  $R^2$  when that variable is added to the regression. When correlated covariates are included, the marginal contribution of a particular variable on the  $R^2$  of the regression is not unique, since the increase in  $R^2$  is dependent on the order in which factors are included in the regression.<sup>21</sup>

Subsequent studies have therefore adopted a Shapley-value regression decomposition approach.<sup>22</sup> This approach calculates the average marginal effect of each explanatory variable (e.g. age, sex, migration status) from all possible orderings. The contribution of each explanatory variable to income inequality is calculated as the average of its marginal effects in all possible orderings. With  $J$  explanatory variables, the total number of possible orderings is  $J!$ .

We use the Shapley-value regression decomposition approach to examine the contribution of each migrant group ( $m$ ) to the level of inequality when accounting for age, sex and employment status.<sup>23</sup> For our Shapley regressions, we treat the migrant group dummy variables ( $D_{mt}$ ) as a block and they are introduced into the regression together.

---

<sup>19</sup> The sub-group decomposition approach quickly becomes unwieldy if we account for multiple explanatory factors. For example, accounting for sex and migration status in our research together means there would be 16 groups (eight migration status categories times two genders).

<sup>20</sup> See Wan (2002, 2004) for a discussion of the limitations of the Fields & Yoo approach.

<sup>21</sup> The standard Fields & Yoo approach captures the contribution of each variable as if it was added last.

<sup>22</sup> 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).

<sup>23</sup> The definition of variables used in the regression decomposition method are given in the online Appendix, Table A.1.

Of the other variables, age is included as an integer. There are three employment status dummies (part-time, unemployment, and not in the labour force, with full-time employed as the omitted group). To ensure that we can account for the conditional contribution of each migrant group, we run our regressions without an intercept because dummy variables are included for all migrant groups.

In addition to calculating the mean-group (“between”) contribution of each migrant-group, we extend the analysis to calculate the within-group contributions to the level of inequality by migrant group. Most studies using the regression approach ignore the group-specific within-group contributions to “residual” inequality. We allocate this residual to the individual groups and interpret the result as providing the conditional within-group contributions:<sup>24</sup>

$$Cov(\hat{\epsilon}_t, Y_t) = \sum_{m=1}^M Cov(\hat{\epsilon}_{mt} D_{mt}, Y_t) \quad (9)$$

### **2.2.3 Differences between the regression and sub-group decomposition approaches.**

The regression decomposition approach can be interpreted as a decomposition of the variance. While Shorrocks (1982) has shown that the magnitude of the contributions calculated using factor decomposition 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. Recalling that

---

<sup>24</sup> Because our focus is on the role of migrant groups, we calculate the conditional within-group contribution of each migrant group accounting for age, sex and employment status.



$$\begin{aligned}
\text{Overall MLD} = & \underbrace{\sum_{m=1}^M \pi_m \text{MLD}_m}_{\text{Within-group inequality}} + \underbrace{\sum_{m=1}^M \pi_m \ln\left(\frac{1}{r_m}\right)}_{\substack{\text{Between-group inequality} \\ \text{or} \\ \text{Mean-group contribution}}} \quad (10)
\end{aligned}$$

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

However, the regression decomposition approach is based on the variance as the measure of inequality and the sign for each group is dependent on how far the group is on average from the overall mean. Given equation (6), it is easy to see that 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 the sign from both decomposition approaches, Shorrocks' (1982) theorem implies that the magnitude of the contributions from both approaches should be similar. Understanding the difference in how the contributions are calculated is important in interpreting and comparing the results from the regression approach and the sub-group decomposition of the MLD, which we do in the next section.

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. The availability of income data in bands poses no problem for neither the sub-group decomposition nor the regression method.<sup>25</sup>

---

<sup>25</sup> 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).

## 3 Results

### 3.1 Trends and patterns in the distribution of income of immigrants and New Zealand born between 1986 and 2013

Table 1 presents the MLD by type of urban area for all censuses between 1986 and 2013. For all areas combined, inequality rose by only about 1% between 1986 and 2013. However, this overall trend masks a large difference between metropolitan and non-metropolitan areas.

Inequality rose in metropolitan areas by 4% while it fell in non-metropolitan areas by 11%.

**Insert Table 1 here**

Figure 1 shows that migrants have become an increasingly important component of the total population (aged 25-64). In all main and secondary urban areas combined, immigrants represented about 25% of the total population under consideration in 1986 but by 2013 this had increased to about 35%. Spatially, immigrants are a bigger proportion of the population in metropolitan areas: the proportion of immigrants in metropolitan areas is around double that in non-metropolitan areas in each census period.

**Insert Figure 1 here**

We compare the distribution of income of immigrants and New Zealand (NZ) born using average incomes and the MLD. Average real incomes of immigrants and NZ born across areas are presented in Figure 2. Overall, real income of the urban population aged between 25 and 64 increased by about 50% between 1986 and 2013. In 1986, average income of immigrants was about 3% higher than of the NZ born, but by 2013 immigrants earned on average about 7% less than the NZ born. The main driver of this shift has been huge growth in temporary migration, attracting relatively lower skilled workers. This reflects growth in low-paid temporary worker migration in the agriculture, caring and tourism sectors, leading to

a downward trend in the relative mean incomes for immigrants in all main and secondary urban areas.<sup>26</sup>

### **Insert Figure 2 here**

There is also a big contrast between metropolitan and non-metropolitan areas: in the metropolitan areas, real income of the NZ born exceeded in 2013 that of immigrants by 14%, while in 1986 there was virtually no difference in average income between these two groups. A contributing factor is that, compared to the NZ born, immigrants generally have lower employment rates in metropolitan areas.<sup>27</sup> The downward trend in relative incomes for immigrants also reflects for example the growth in foreign students who are also working part-time (see Poot and Roskrug, 2013), although many of these would be below the age threshold of 25 in our data. In non-metropolitan areas, immigrants earned on average 9% more than the NZ born in 1986, but this dropped to 3% by 2013.

In Figure 3 we compare inequality (measured by MLD) in the distribution of income within immigrant groups and among the NZ born in metropolitan and non-metropolitan areas. Inequality is higher among immigrants than NZ born in both metropolitan and non-metropolitan areas in all years, except in metropolitan areas in 1986. The higher inequality among immigrants is as expected, given strong 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).

---

<sup>26</sup> See also McLeod & Maré (2013) and MBIE (2018).

<sup>27</sup> Immigrants in metropolitan areas had lower total (full-time plus part-time) employment rates compared to the New Zealand born in all years considered, except in 1986. See Appendix Table A.2. Besides foreign students working part-time (who are largely excluded from our data), another contributing factor to lower employment rates is the presence of spouses and partners of labour migrants who are not employed.

Inequality declined between 1986 and 1991, except for immigrants in the metro areas. The 1986-1991 period heralded a change in New Zealand's immigration policy away from recruiting from traditional source countries (United Kingdom, Western Europe and Pacific Islands) to global recruitment, particularly of skilled workers.<sup>28</sup> Post 1991, inequality increased in all intercensal periods, except for a sharp drop in inequality between 2001 and 2006. The period between 2001 and 2006 was characterized by high economic growth and increasing labour force participation and hours worked.

**Insert Figure 3 here**

Taking a longer term perspective, income inequality among immigrants increased by 13% between 1991 and 2013 in metropolitan areas but by only 5% in non-metropolitan areas. For the New Zealand born, inequality increased by 1% in metropolitan areas over the 1991-2013 period, but declined by 6% for this group in non-metropolitan areas.

By comparing all New Zealand born with all international migrants in main and secondary urban areas we essentially treat international migrants as a homogeneous group. However, immigrants are a heterogeneous group in terms of skill level and length of stay in New Zealand. We categorise therefore international migrants by skill level and length of stay and compare them to the New Zealand born (classified by skill level and migration status) in terms of within-group inequality and population share. Figure 4 presents the population share by migration status in 1986 and 2013.

**Insert Figure 4 here**

Between 1986 and 2013, the share of High Skilled Earlier immigrants and High Skilled Newly Arrived immigrants in the population increased by 7.8 and 2.5 percentage points respectively. However, the corresponding increase in the size of these groups was

---

<sup>28</sup> It should be noted that migration from and to Australia falls outside immigration policy. Under the so-called Trans-Tasman Travel Agreement (TTTA) Australians and New Zealand citizens have the right to live and work indefinitely in each other's country.

much more dramatic: a population increase of around 694% for High Skilled Earlier immigrants and 641% for High Skilled Newly Arrived immigrants. In contrast, the share of the Medium/Low Skilled Earlier migrants in the population declined from 17.6% to 17.0% (in number terms; this still represents a 33% increase in the size of this group). The number of Medium/Low Skilled Newly Arrived increased around 112% (with its share increasing from 2.2% to 3.3%). The number of Low Skilled Returning NZ born in 2013 declined by about 24% relative to the 1986 population (with the population share declining from 2.5% to 1.4%) but the number of High Skilled Returning NZ born increased by 219% (corresponding to a population share increase from 0.5% to 1.1%), reflecting a high level of cross-border mobility of NZ professionals.

The relative changes are important, as evidence 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 e.g. LaLonde & Topel, 1991; Cortés, 2008). The growth in immigration has implications for the distribution of income of immigrants but also for the overall distribution of income.

Table 2 presents the by-group inequality of each migrant group in 1986 and 2013 in all main and secondary urban areas. Over this period, the income distribution has had a large increase in density at the upper tail of the distribution, leading to a sharp increase in average income but a decline in group-average income relative to the overall mean for all eight groups considered. We find that inequality is, in each year, highest among newly arrived immigrants, regardless of skill level. The much lower inequality among earlier migrants suggests a process of economic integration in terms of a narrowing of the income distribution by duration of stay. At this level, inequality increased between 1986 and 2013 for all groups, except the Medium/Low Skilled New Zealand born. The decline in income inequality among the latter

group could be driven by significant increases in the minimum wage over this period (see e.g. Maloney & Pacheco, 2012).

Another interesting observation is that inequality is higher among High Skilled NZ-born Returning migrants than among High Skilled NZ born who were in the country five 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.

**Insert Table 2 here**

Given the differences between immigrants and New Zealand born and the likely diversity between and within immigrant groups, we decompose MLD inequality 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 3 presents the results for all main and secondary urban areas combined.

**Insert Table 3 here**

Table 3 shows that, in all urban areas combined, between-group inequality accounted for 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. (2018a), indicating bigger differences (at least in average income) across migrant groups than age groups. Table 3 also clearly shows that the between-group contribution of high-skilled workers is negative, irrespective of migration status. This is due to the average income of groups of high skilled exceeding overall average income, thereby leading to a negative contribution to overall MLD (see equation (2)). The 1986-1996 increase in between group inequality is due to the growing negative contributions of the high skilled being offset by even faster growing positive contributions of the low and medium skilled.

Decomposing the level of MLD into the sum of between-group 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 between the trends in the within-group contributions across the migrant groups. In the next sub-section, we focus on changes between 1986 and 2013 and employ change-decomposition procedures to decompose overall inequality change between these years and to understand the role of changes within each migrant group.

## **3.2 Decomposition of Inequality Change – Results**

### **3.2.1 Mookherjee and Shorrocks decomposition of inequality change by sub-groups**

Table 4 presents the by-migrant group contributions to the changes in MLD between 1986 and 2013 for all main and secondary urban areas combined. Recall from Equation (4) in Section 2.2.1 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 1. However, the approximation is quite good. Table 4 reports an approximate change in the MLD of 0.0066 while the actual increase is 0.0027.

**Insert Table 4 here**

One of the advantages 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 to change ( $C1+C2$ ) and between-group contributions ( $C3'+C4'$ ), or into a compositional change effect ( $C2+C3'$ ) and a group-specific distribution effect ( $C1+C4'$ ). The changes in each of  $C1$  to  $C4'$  will determine whether a group makes an inequality-increasing or inequality-

decreasing contribution. Appendix 1 describes what determines the direction of change of each of C1 to C4'.

Focusing on the role of immigrant groups (foreign-born and returning New Zealand born groups),<sup>29</sup> our results show that high skilled immigrant groups (High Skilled Returning NZ born, High Skilled Earlier migrants and High Skilled Newly Arrived migrants) 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, the positive contribution to growing inequality among high skilled workers is the least for the returning NZ born. If we combine all immigrant groups regardless of skill (i.e. simply exclude the non-migrant NZ born), it can be easily calculated that the 1986-2013 increase in migration has been inequality-increasing in terms of both composition and group-specific distribution effects or, alternatively, in terms of both within-group inequality and between-group inequality.

Focusing on the skill distribution, we find that changes in the skill distribution of the workforce in New Zealand are very important for changes in the distribution of income, regardless of migration status. The total contribution to inequality from all high skilled groups i.e. High Skilled Non-Migrant NZ born, High Skilled Returning NZ-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.

---

<sup>29</sup> We have classified the Returning New Zealand-born group as one of the immigrant groups. Hence immigrant groups are all groups except the High Skilled Non-Migrant New Zealand born and Medium/Low Skilled Non-Migrant New Zealand born.



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 relative average income; this represents as a widening of the income distribution at the top. For medium/low skilled 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. The Medium/Low Newly Arrived group is different because it is the only low skilled group to experience an increase in population share; thus, their inequality-increasing contribution was driven by the composition effect.

In the next sub-section we present the between- and within-group contributions of migration groups to the level of inequality using the regression decomposition approach. We then compare the results of the regression decomposition with the within and between-group contributions from the sub-group decomposition of the MLD level that we discussed above. Finally, we will show the difference in between-group and within-group contributions with the regression method when we compare the basic regression (migration status as the only determinant) with a regression in which the variance in income has already been adjusted for the effects of age, sex and employment status.

### **3.2.2 Regression decomposition approach**

We begin by comparing the results of the regression approach to decomposing the variance in personal income (equations (5) to (9)) with those of the sub-group decomposition of MLD (equation (10)). The results are presented in Table 5.

**Insert Table 5**

Apart from the opposite signs of the between-group contributions, the magnitudes of the between- and within-group contributions from both approaches are similar. As with the sub-group decomposition of the MLD, we find that the overall between-migrant group effects in the regression method contribute little to the overall level of income inequality in main and secondary urban areas in New Zealand. Despite the fundamental differences between the two approaches, the magnitudes of the overall between-group contributions (and therefore also the overall within-group contributions) are strikingly similar. Both methods show also a notable increase in the share of overall between-group inequality from 1986 to 1991, followed by a roughly stationary share.

Although 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 (MLD versus Variance). With the regression approach, groups with higher mean income than the overall mean will have a positive by-migrant group contribution<sup>30</sup> while with the MLD, these groups will have a negative between-group contribution.<sup>31</sup> Our results are consistent with Shorrocks' (1982) conclusion that the contribution of a factor to inequality, in our case migration status, should be invariant to the choice of inequality measure.

Given that one of the advantages of the regression approach is the ease of accounting for multiple factors, we report the contribution of each migration status group to inequality

---

<sup>30</sup> 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 covariances with total income and thus a positive contribution.

<sup>31</sup> For a group with a high relative mean income,  $\mu_m > \mu$  and  $r_m = \mu_m/\mu > 1$ . Hence the contribution of that group to overall mean-group contributions (between-group inequality), which is  $\pi_m \ln\left(\frac{1}{r_m}\right)$ , will be negative.

accounting for age, sex and employment status. We compare the results from this adjusted decomposition with the basic one (with migration status as the only covariate of income). We present the results for 1986 and 2013 in all urban areas combined in Table 6. It is important to remember that for the multivariate regression approach, the between-group contributions are calculated using a Shapley-value approach. They 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 Fields and Yoo approach.

In the multivariate regression, we focus on the conditional between-group and conditional within-group contributions of the migration status groups. The sum of conditional between-group and conditional within-group contributions will not add up to overall inequality in our case because we focus on “explaining” overall income inequality in terms of exclusively the within and between-group contribution of the eight migrant groups while controlling for age, sex, and employment status.<sup>32</sup> This is unlike earlier studies that use regression decomposition to explain the mean-group contributions of several factors and ignore the within-group contributions, which are classified as “residual” inequality. The proportion of inequality not explained by the between-group and conditional within-group contributions reflects the contribution of between-group differences in observable characteristics included in the regression.

### **Insert Table 6**

Table 6 reports the contribution to inequality in all main and secondary urban areas combined for each migrant group using the regression-based decomposition approach. The left panel of Table 6 (basic regression) reports the results when only migrant groups are

---

<sup>32</sup> In the basic regression, the sum of within and between-migrant group contributions add up to total inequality. However, in the adjusted regressions, we show the conditional-between and conditional-within group contributions of each migration status group after controlling for age, sex and employment status. Because some of the overall inequality is accounted for by between-age/between-sex/between-employment status contributions, the sum of the conditional-migration status group contributions will not add up to overall inequality.

considered as explanatory variables. In the right panel (adjusted regression), we report the between and within-group contributions by means of Shapley-value marginal effects when also accounting for age, sex and employment status. We treat all migration status groups as a block (as if they are one single explanatory variable).

Table 7 shows the regression coefficients of the model that is the equivalent of Equation (5). Other co-variables are defined as deviation contrasts, so the coefficients represent differences relative to the overall mean income. Categorical covariates such as employment status and sex are defined as mean-deviation contrasts and age is measured as a deviation from its mean. Using deviation contrasts for the categorical variables ensures that the conditional-between mean contributions reported are not sensitive to the choice of excluded group (in our case, full-time employed and men) for the categorical variables. The dependent variable in these regressions is the level of real income and not the natural logarithm of real income. We note that the latter is commonly used in earnings regressions but the reason for using the level of income here is that the level of income is also used in the sub-group approach which we compare with the regression approach. The income determinants of the regressions in Table 7 have all the expected signs and levels. Using contrasts for the other covariates means that coefficients on migrant groups are evaluated at overall means of the other covariates. The highest incomes are found among the high-skilled non-migrant NZ born in 1986, but by 2013 their average income is exceeded by that of the high-skilled returning NZ born, consistent with the analysis of survey data by Poot and Roskrug (2013). Income increases with age. Females have a considerably lower average income. With respect to employment status, the average income of the unemployed is the lowest. The variation in income that can be attributed to factors other than those taken into account increased notably between 1986 and 2013, with  $R^2$  declining from 0.40 to 0.27.

**Insert Table 7**

As expected, the overall between and within-group contributions of migration status to the level of inequality decrease in the adjusted regression. Most of the differences arise from within-group contributions. The results imply that migration status groups are closer together in terms of average incomes once differences between these groups in terms of age, sex and employment status are taken into account. Even more importantly, a considerable proportion of within-group inequality among migrant groups is, as expected, due to within-group inequality that can be attributed to age, sex and employment status.

Table 8 summarises the by-migration status group change decomposition results from the sub-group and regression decomposition approaches. The calculations of the sub-group change decomposition have been copied from Table 4, while those for the basic and adjusted regression decompositions have been copied from Table 6. Recall that the sub-group decomposition of change approach proposed by Mookherjee and Shorrocks (1982) is an approximate decomposition and as such will not equal the exact change in inequality. For the regression decompositions, the extended regressions show the conditional-between and conditional-within migrant contributions of each migrant groups after adjusting for age, sex and employment status. Because some of the overall inequality is accounted for by between-age/between-sex/between-employment status contributions, the sum of the conditional-migrant group contributions will not add up to overall inequality. Only in the basic regressions will the change from the decomposition equal the actual MLD change in inequality. The overall within-migration status group contribution in the adjusted regression is 0.0448, which is much larger the corresponding overall contribution in the basic regression (0.0003), and suggesting a total change of 0.0496. Hence we can conclude that the contribution to change from age, sex and employment status is  $0.027 - 0.0496 = -0.0469$ .

### **Insert Table 8**

In general we see that the two methods lead to different quantifications of the effects of migrant groups to the increase in inequality between 1986 and 2013, but the qualitative interpretations are similar. Both high skilled non-migrant NZ born and high skilled earlier migrants made relatively large positive contributions to the increase in inequality in New Zealand. The growth in within-migration status group inequality has clearly played a major role. The magnitudes and signs of the numbers in the within-migration status group columns of sub-group change and basic regression decomposition are quite different although the signs of the contributions to total change are mostly the same. Both methods also pick up the downward effect on inequality of the medium and low-skilled non-migrant NZ born group, whose income is likely to have been affected by minimum wage increases, as noted earlier.

## **4 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 differences in mean income between groups of migrants and the locally born. Using New Zealand data, we focus in this paper on the distributional impact of migration on incomes. 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 the within-group distribution effects. We provide evidence on the role of migration on the level and changes in the distribution of income between 1986 and 2013 – a period of relatively high immigration and changes in the type of immigrants in New Zealand. We find

that differences across migrant groups in terms of average incomes (between-group inequality) account for around 4-7% of overall inequality. Most of the observed level of inequality is due to within-migrant group inequality (93-96% of overall-inequality).

In all main and secondary urban areas combined, immigrants increased from around 25% of the population aged 25 to 64 years in 1986 to 35% in 2013. The national shares 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. In addition, there are big differences across areas in the patterns of change with respect to the immigrants' length of stay and skill level. For example, the number of High Skilled Earlier immigrants in 2013 in all urban areas combined had increased by 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 find that income inequality rose by about 1% for the population aged 25 to 64 years earning positive incomes in all main and secondary urban areas combined. This small increase masks notable spatial differences. In metropolitan areas, the inequality of this population rose by about 4% while in non-metropolitan areas, inequality fell by 11%. We used two decomposition approaches to 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, migration status changes between 1986 and 2013 had an inequality-increasing composition effect and an inequality-reducing migrant-specific distribution effect. The composition effect slightly dominated the migrant-specific distribution effect; this is why inequality increased by around 1% overall.

Regardless of migration status, we find that changes in the skill distribution of the workforce in New Zealand are very important for changes in the distribution of income. 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 were broadly inequality-reducing.

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.

The approach provided here can be easily replicated in countries such as Australia and Canada, which operate skills-oriented migration policies that are similar to those in New Zealand. Additionally, the decomposition approaches may also be fruitfully investigated for countries of the European Union that have experienced large-scale immigration in recent times and have high-quality disaggregated data on individual incomes.



## References

- Alimi, O., Maré, D. C. & Poot, J. (2016). Income inequality in New Zealand regions. In P. Spoonley (Ed.), *Rebooting the Regions* (pp. 177-212). Auckland, New Zealand: Massey University Press.
- Alimi, O., Maré, D. C., & Poot, J. (2018a). More pensioners, less income inequality? The impact of changing age composition on inequality in big cities and elsewhere. In U. Blien, K. Kourtit, P. Nijkamp & R. Stough (eds.) *Modelling Aging and Migration Effects on Spatial Labor Markets* (pp. 133-159). New York & Berlin: Springer Verlag.
- Alimi O.B., Maré, D. C., & Poot, J. (2018b). *International Migration and the Distribution of Income in New Zealand Metropolitan and Non-metropolitan Areas*. Discussion Paper IZA DP No. 11959, IZA Institute of Labor Economics, Bonn, Germany.
- Alimi, O., Maré, D.C., Poot, J. & Oxley, L. (2018c). How does immigration impact on metropolitan and non-metropolitan income distributions? Some New Zealand findings. In P. Dalziel (Ed.), *Proceeding of the 2017 Conference of the Australian and New Zealand Section of the Regional Science Association International (ANZRSAI)* (pp. 54-71). Lincoln University: Agricultural Economics Research Unit (AERU).
- Altonji, J. G., & Card, D. (1991). The effects of immigration on the labor market outcomes of less-skilled natives. In J. M. Abowd & R. B. Freeman (Eds.), *Immigration, Trade, and the Labor Market* (pp. 201-234). Chicago, IL: University of Chicago Press.
- Blau, F. D., & Kahn, L. M. (2015). Immigration and the distribution of incomes. In B. R. Chiswick & P. W. Miller (eds.) *Handbook of the Economics of International Migration*, Volume 1b (pp. 793-843). Elsevier.

- Borjas, G. J. (2003). The labor demand curve is downward sloping: Re-examining the impact of immigration on the labor market. *The Quarterly Journal of Economics*, 118(4), 1335-1374.
- Borjas, G.J. (2005). The labor-market impact of high-skill immigration. *American Economic Review*, 95(2), 56-60.
- Borjas, G. J., Freeman, R. B., Katz, L. F., DiNardo, J., & Abowd, J. M. (1997). How much do immigration and trade affect labor market outcomes? *Brookings Papers on Economic Activity*, 1997(1), 1-90.
- Bourguignon, F. (1979). Decomposable income inequality measures. *Econometrica*, 47(4), 901-920.
- Brewer, M., & Wren-Lewis, L. (2016). Accounting for changes in income inequality: decomposition analyses for the UK, 1978–2008. *Oxford Bulletin of Economics and Statistics*, 78(3), 289-322.
- Bushnell, P., & Choy, W. K. (2001). Go west, young man, go west! *People and Place*, 9(3), 66-83.
- Card, D. (1990). The impact of the Mariel boatlift on the Miami labor market. *ILR Review*, 43(2), 245-257.
- Card, D. (2005). Is the new immigration really so bad? *The Economic Journal*, 115(507): F300-F323.
- Card, D. (2009). Immigration and inequality. *American Economic Review*, 99(2): 1-21.
- Cochrane, W., & Poot, J. (2020). Effects of immigration on local housing markets. In K. Kourtit, B. Newbold, P. Nijkamp, & M. Partridge (eds.) *The Economic Geography of Cross-border Migration*. Springer Nature Switzerland AG.
- Cortés, P. (2008). The effect of low-skilled immigration on US prices: evidence from CPI data. *Journal of Political Economy*, 116(3), 381-422.

- Cowell, F. A., & Fiorio, C. V. (2011). Inequality decompositions: A reconciliation. *The Journal of Economic Inequality*, 9(4), 509-528.
- Cowell, F.A. & Flachiare, E. (2007). Income distribution and inequality measurement: The problem of extreme values. *Journal of Econometrics*, 141(2), 1044-1072.
- D'Amuri, F., Ottaviano, G. I., & Peri, G. (2010). The labor market impact of immigration in Western Germany in the 1990s. *European Economic Review*, 54(4), 550-570.
- Dumont, J. & Lemaître, G. (2005). *Counting immigrants and expatriates in OECD Countries: a new perspective* (OECD Social, Employment and Migration Working Papers, No. 25) Paris, France: OECD Publishing.
- Dustmann, C., Fabbri, F., & Preston, I. (2005). The impact of immigration on the British labour market. *The Economic Journal*, 115(507), F324-F341.
- Fields, G. S., & Yoo, G. (2000). Falling labor income inequality in Korea's economic growth: Patterns and underlying causes. *Review of Income and Wealth*, 46(2), 139-159.
- Foged, M., & Peri, G. (2016). Immigrants' effect on native workers: New analysis on longitudinal data. *American Economic Journal: Applied Economics*, 8(2), 1-34.
- Fry, J., & Wilson, P (2017). Immigration policies that would enhance the wellbeing of New Zealanders. *Policy Quarterly*, 13(3), 22-26.
- Fyers, A. (2017). How record migration affects traffic, schools, housing and the economy in New Zealand. *Stuff News*. Retrieved on 28 April 2017 from <https://www.stuff.co.nz/business/91925666/this-is-what-we-know-about-how-record-migration-affects-traffic-schools-housing-and-the-economy-in-new-zealand>
- Gunatilaka, R., & Chotikapanich, D. (2009). Accounting for Sri Lanka's expenditure inequality 1980–2002: regression-based decomposition approaches. *Review of Income and Wealth*, 55(4), 882-906.

- Hansen, K., & Kneale, D. (2013). Does how you measure income make a difference to measuring poverty? Evidence from the UK. *Social Indicators Research*, 110(3), 1119-1140.
- Hodgson, R. & Poot, J. (2011). *New Zealand Research on the Economic Impacts of Immigration 2005-2010: Synthesis and Research Agenda* (CReAM Discussion Paper Series CDP No. 04/11). London, UK: Centre for Research and Analysis of Migration.
- Hyslop, D., Le, T., Maré, D. C., & Stillman, S. (2019). *Housing Markets and Migration – Evidence from New Zealand*. Motu Working Paper 19-14. Wellington: Motu Economic and Public Policy Research.
- Israeli, O. (2007). A Shapley-based decomposition of the R-square of a linear regression. *The Journal of Economic Inequality*, 5(2), 199-212.
- Kimhi, A., & Hanuka-Taflia, N. (2019). What drives the convergence in male and female wage distributions in Israel? A Shapley decomposition approach. *The Journal of Economic Inequality*, 17(3), 379-399.
- LaLonde, R. J., & Topel, R. H. (1991). Labor market adjustments to increased immigration. In J.M. Abowd and R.B. Freeman (Eds.), *Immigration, Trade, and the Labor Market* (pp. 167-199). Chicago, IL: University of Chicago Press.
- Longhi, S., Nijkamp, P., & Poot, J. (2005) A meta-analytic assessment of the effect of immigration on wages. *Journal of Economic Surveys*, 19(3), 451-477.
- Longhi, S., Nijkamp, P., & Poot, J. (2008). *Meta-analysis of Empirical Evidence on the Labour Market Impacts of Immigration*. (IZA Working Paper No. 3418). Bonn, Germany: IZA Institute for the Study of Labor.
- Maani, S., & Chen, Y. (2012). Impacts of a high-skilled immigration policy and immigrant occupational attainment on domestic wages. *Australian Journal of Labour Economics*, 15(2), 101.

- Maloney, T., & Pacheco, G. (2012). Assessing the possible antipoverty effects of recent rises in age-specific minimum wages in New Zealand. *The Review of Income and Wealth*, 58(4), 648-674.
- Manacorda, M., Manning, A., & Wadsworth, J. (2012). The impact of immigration on the structure of wages: Theory and evidence from Britain. *Journal of the European Economic Association*, 10(1), 120-151.
- Maré, D. C., & Stillman, S. (2009). *The Impact of Immigration on the Labour Market Outcomes of New Zealanders*. (Working Paper No. 09-11). Wellington, New Zealand: Motu Economic and Public Policy Research.
- MBIE. (2018). *Impacts of Temporary Migration on Employment and Earnings of New Zealanders*. Wellington, New Zealand: Ministry of Business, Innovation and Employment
- McLeod, K., & Maré, D. (2013). *The Rise of Temporary Migration in New Zealand and its Impact on the Labour Market*. Wellington, New Zealand: Ministry of Business, Innovation and Employment.
- Mookherjee, D., & Shorrocks, A. (1982). A decomposition analysis of the trend in UK income inequality. *The Economic Journal*, 92(368), 886-902.
- Mussida, C., & Parisi, M. L. (2018). Immigrant groups' income inequality within and across Italian regions. *The Journal of Economic Inequality*, 16(4), 655-671.
- OECD (2019). Foreign-born population (indicator). doi: 10.1787/5a368e1b-en (Accessed on 29 April 2019). Available at <https://data.oecd.org/migration/foreign-born-population.htm>
- Poot, J., & Roskrige, M. (2013). Internationalisation of education and returns in the labour market. *Studies in Regional Science*, 43(1), 61-78.

- Reed, D. (2001). Immigration and males' earnings inequality in the regions of the United States. *Demography*, 38(3), 363-373.
- Shorrocks, A. F. (1982). Inequality decomposition by factor components. *Econometrica*, 50(1), 193-211.
- Shorrocks, A. F. (1999). *Decomposition Procedures for Distributional Analysis: A Unified Framework Based on the Shapley Value*. Unpublished manuscript, Department of Economics, University of Essex, Essex, UK. Retrieved from <https://www.komkon.org/~tacik/science/shapley.pdf>
- Shorrocks, A. F. (2013). Decomposition procedures for distributional analysis: a unified framework based on the Shapley value. *The Journal of Economic Inequality*, 11(1), 99-126.
- Statistics New Zealand (2014). *2013 Census QuickStats about Culture and Identity*. Wellington, New Zealand: Statistics New Zealand. Retrieved from <http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-culture-identity.aspx>
- Tse, M. M., & Maani, S. A. (2017). The impacts of immigration on earnings and employment: Accounting for effective immigrant work experience. *Australian Journal of Labour Economics*, 20(1), 291.
- von Hippel, P.T., Scarpino, S.V., & Holas, I. (2016). Robust estimation of inequality from binned incomes. *Sociological Methodology*, 46(1), 212-251.
- Wan, G. (2004). Accounting for income inequality in rural China: A regression-based approach. *Journal of Comparative Economics*, 32(2), 348-363.
- Wan, G. H. (2002). *Regression-based Inequality Decomposition: Pitfalls and a Solution Procedure* (WIDER Discussion Papers No. 2002/101). Helsinki, Finland: World Institute for Development Economics.

## 5 Tables

Table 1: New Zealand income inequality from 1986 to 2013

Type of urban area	1986	1991	1996	2001	2006	2013	Change between 1986 and 2013 in MLD points	Change between 1986 and 2013 in MLD as a percentage of 1986 MLD
Non-metro	0.3589	0.3275	0.3340	0.3354	0.3065	0.3177	-0.0412	-11%
Metro	0.3500	0.3415	0.3651	0.3719	0.3468	0.3656	0.0156	4%
All urban areas	0.3538	0.3402	0.3596	0.3664	0.3395	0.3565	0.0027	1%

*Notes:* Inequality is measured by Mean Log Deviation (MLD) of gross income, obtained from census microdata. The population is restricted to residents of main and secondary urban areas who are aged 25 to 64. The metro areas are the six largest urban areas in terms of population (Auckland, Christchurch, Wellington, Hamilton, Tauranga and Dunedin).

Table 2: Income inequality (Mean Log Deviation) and relative mean incomes in 1986 and 2013, by migration status

Migration Status		1986	2013	Change 1986-2013 (MLD points)
HS Non-Migrant NZ born	MLD	0.3094	0.3248	0.0154
	Relative Income	1.70	1.46	
M/LS Non-Migrant NZ born	MLD	0.3466	0.3093	-0.0373
	Relative Income	0.94	0.89	
HS Returning NZ born	MLD	0.3454	0.3701	0.0247
	Relative Income	1.54	1.44	
M/LS Returning NZ born	MLD	0.3353	0.3504	0.0151
	Relative Income	0.96	0.91	
HS Earlier Migrants	MLD	0.3191	0.3465	0.0274
	Relative Income	1.66	1.26	
M/LS Earlier Migrants	MLD	0.3075	0.3462	0.0387
	Relative Income	1.56	1.05	
HS Newly Arrived Migrants	MLD	0.4286	0.4393	0.0107
	Relative Income	0.95	0.78	
M/LS Newly Arrived Migrants	MLD	0.4164	0.4299	0.0135
	Relative Income	0.91	0.71	

*Notes:* Derived from census microdata on reported gross income of respondents aged 25 to 64 in main and secondary urban areas. “HS”: high skilled; “M/LS”: medium/low skilled. “Non-Migrant NZ born” refers to NZ born census respondents who were living in New Zealand at the time of the previous census. “Returning NZ-born” refers to NZ born census respondents who were living abroad at the time of the previous census. “Earlier Migrants” refers to immigrants who were already living in New Zealand at the time of the previous census. “Newly Arrived Migrants” refers to immigrants who were still living abroad at the time of the previous census.



Table 3: Between-group and within-group contributions to inequality (MLD) for all main and secondary urban areas from 1986 to 2013

<b>Between-group contributions</b>						
	1986	1991	1996	2001	2006	2013
HS Non-Migr. NZ-born	-0.0296	-0.0363	-0.0443	-0.0519	-0.0518	-0.0582
M/LS Non-Migr. 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
M/LS Earlier Migrant	0.0089	0.0162	0.0215	0.0259	0.0315	0.0413
HS Newly Arrived Migrant	-0.0025	-0.0041	-0.0016	-0.0029	-0.0020	-0.0015
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
Proportion Between	4%	6%	7%	7%	7%	7%
<b>Within-group contributions</b>						
	1986	1991	1996	2001	2006	2013
HS Non-Migr. NZ-born	0.0173	0.0199	0.0260	0.0334	0.0374	0.0497
M/LS Non-Migr. 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
M/LS Earlier Migrant	0.0540	0.0502	0.0523	0.0528	0.0503	0.0588
HS Newly Arrived Migrant	0.0024	0.0037	0.0109	0.0111	0.0143	0.0133
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
Proportion Within	96%	94%	93%	93%	93%	93%
Total inequality	0.3538	0.3401	0.3596	0.3665	0.3394	0.3563

*Notes:* Results are the between-group and within-group contributions to overall inequality (as measured by Mean Log Deviation) for the migration status categories in all main and secondary urban areas combined in each census from 1986 to 2013, using Equation (2). For definitions of the groups, see the notes below Table 2.

Table 4: Contribution to changes in the Mean Log Deviation (MLD) index of inequality between 1986 and 2013 by migrant group when using the sub-group decomposition 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'
<b>All main and secondary urban areas</b>									
Migration Status	C1	C2	C3'	C4'					
HS Non-Migr. NZ-	0.0016	0.0308	0.1094	0.0136	0.1554	0.1402	0.0152	0.0324	0.1230
M/LS Non Migr. NZ-	-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 Migr.	0.0015	0.0259	0.0851	0.0020	0.1146	0.1111	0.0035	0.0275	0.0871
M/LS Earlier Migr.	0.0067	-0.0018	-0.0057	-0.0046	-0.0055	-0.0076	0.0021	0.0049	-0.0104
HS Newly Arrived	0.0002	0.0107	0.0260	0.0000	0.0369	0.0367	0.0002	0.0109	0.0260
M/LS Newly Arrived Migr.	0.0004	0.0049	0.0120	-0.0008	0.0165	0.0169	-0.0005	0.0053	0.0112
<b>Sum</b>	<b>-0.0113</b>	<b>0.0031</b>	<b>0.0207</b>	<b>-0.0060</b>	<b>0.0066</b>	<b>0.0238</b>	<b>-0.0173</b>	<b>-0.0082</b>	<b>0.0148</b>

Notes: Results are the contributions to change in overall inequality (as measured by the MLD) between 1986 and 2013 in all main and secondary 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. See Equation (4). For definitions of the groups, see the notes below Table 2.

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

Migration status	Regression decomposition of inequality level						Sub-group decomposition of inequality level					
	1986	1991	1996	2001	2006	2013	1986	1991	1996	2001	2006	2013
	<b>Between-group contribution</b>						<b>Between-group contribution</b>					
HS Non Migr. NZ-born	12%	14%	13%	14%	14%	14%	-8%	-11%	-12%	-14%	-15%	-16%
M/LS Non Migr. 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%
<b>Overall between-inequality</b>	<b>7%</b>	<b>9%</b>	<b>8%</b>	<b>9%</b>	<b>8%</b>	<b>8%</b>	<b>4%</b>	<b>6%</b>	<b>7%</b>	<b>7%</b>	<b>7%</b>	<b>7%</b>
	<b>Within-group contribution</b>						<b>Within-group contribution</b>					
HS Non Migr. NZ-born	12%	13%	18%	20%	21%	26%	5%	6%	7%	9%	11%	14%
M/LS Non Migr. 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%
<b>Overall within-inequality</b>	<b>93%</b>	<b>91%</b>	<b>92%</b>	<b>91%</b>	<b>92%</b>	<b>92%</b>	<b>96%</b>	<b>94%</b>	<b>93%</b>	<b>93%</b>	<b>93%</b>	<b>93%</b>

Notes: Results are the between- and within-group contributions in all main and secondary urban areas combined, as obtained with the regression and sub-group decomposition approaches. The sub-group decomposition contributions are the “percentage of total inequality” equivalents of the contributions reported in Table 3. The regression approach contributions are calculated as described in Section 2.2.2. For definitions of the groups, see the notes below Table 2.

Table 6: Mean-group contribution of migration status groups to inequality with and without accounting for age, sex and employment status

Migration status	Basic regression			Adjusted regression		
	1986	2013	Contribution to change in MLD points ( $\delta_k$ )	1986	2013	Contribution to change in MLD points ( $\delta_k$ )
	<b>Between-group contribution</b>			<b>Conditional between-group contribution</b>		
HS NZ-born	11.7%	14.0%	0.0086	10.3%	12.8%	0.0094
M/LS NZ-born	-7.3%	-6.5%	0.0027	-6.4%	-5.6%	0.0025
HS Ret. NZ-born	0.7%	1.0%	0.0009	0.6%	0.9%	0.0010
M/LS Ret. NZ-born	-0.2%	-0.2%	0.0000	-0.1%	-0.1%	0.0000
HS Earlier	3.2%	4.1%	0.0034	2.8%	3.7%	0.0032
HS New	0.9%	0.2%	-0.0023	0.8%	0.2%	-0.0020
M/LS Earlier	-1.5%	-3.9%	-0.0087	-1.2%	-3.3%	-0.0074
M/LS New	-0.3%	-0.9%	-0.0022	-0.3%	-0.8%	-0.0020
Overall between	<b>7.3%</b>	<b>7.9%</b>	<b>0.0024</b>	<b>6.4%</b>	<b>7.7%</b>	<b>0.0048</b>
	<b>Within-group contribution</b>			<b>Conditional within-group contribution</b>		
HS NZ-born	12.2%	25.8%	0.0485	9.9%	21.5%	0.0416
M/LS NZ-born	57.6%	34.9%	-0.0795	35.2%	25.9%	-0.0324
HS Ret. NZ-born	0.9%	2.0%	0.0037	0.7%	1.6%	0.0033
M/LS Ret. NZ-born	1.8%	1.1%	-0.0024	1.2%	0.9%	-0.0009
HS Earlier	3.5%	12.7%	0.0331	2.8%	10.6%	0.0280
HS New	1.4%	3.6%	0.0080	1.1%	2.9%	0.0066
M/LS Earlier	13.3%	10.1%	-0.0111	8.2%	7.5%	-0.0021
M/LS New	2.0%	2.0%	0.0001	1.4%	1.6%	0.0007
Overall within	<b>92.7%</b>	<b>92.1%</b>	<b>0.0003</b>	<b>60.4%</b>	<b>72.5%</b>	<b>0.0448</b>
Remainder	0	0		<b>33.2%</b>	<b>19.8%</b>	
MLD	0.3538	0.3565		0.3538	0.3565	

Notes: 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 main and secondary urban areas combined. The contribution to change in MLD between 1986 and 2013 is calculated using  $\delta_k = S_{k,t+1} * I_{t+1} - S_{k,t} * I_t$ . For definitions of the groups, see the notes below Table 2.

Table 7: Regression results for all main and secondary urban areas, 1986 and 2013

VARIABLES	1986	2013
Age	216.68***	511.80***
	(1.92)	(3.04)
HS Non Migr. NZ-born	47687.36***	64931.59***
	(89.38)	(87.41)
M/LS Non Migr. NZ-born	25931.46***	35174.55***
	(26.94)	(50.65)
HS Ret. NZ-born	43717.12***	67481.47***
	(294.15)	(307.47)
M/LS Ret. NZ-born	27020.32***	38806.09***
	(132.64)	(280.39)
HS Earlier Migrant	46202.12***	53467.48***
	(162.59)	(109.46)
HS New Migrant	43998.54***	47201.35***
	(276.48)	(191.44)
M/LS Earlier Migrant	24218.14***	29869.02***
	(51.52)	(81.81)
M/LS New Migrant	23921.83***	28818.69***
	(141.06)	(181.38)
FT employed	0	0
	[0]	[0]
PT employed	-4560.03***	-11108.72***
	(53.01)	(72.54)
Unemployed	-11502.97***	-17635.42***
	(118.67)	(162.33)
NILF	-10726.83***	-16174.88***
	(37.05)	(71.76)
Male	0	0
	[0]	[0]
Female	-5256.64***	-5045.79***
	(16.01)	(22.39)
Constant		
Observations	1,029,201	1,415,343
R-squared	0.40	0.27

*Notes:* Regressions of the level of real income on migration status, age, sex and employment status. The data are for all main and secondary urban areas combined. Age is measured as a deviation from average age; employment status and sex are defined as deviation contrasts, so that the coefficients on migrant groups are evaluated at overall means of the other covariates. For definitions of the groups, see the notes below Table 2.

Table 8: Comparison of the by-migrant group contribution to change in inequality between 1986 and 2013 from the sub-group decomposition and regression decomposition approaches

Migration status	Sub-group decomposition of inequality change (approximation)			Basic regression decomposition of inequality change			Extended regression decomposition of inequality change		
	Contribution to between-migrant group	Contribution to within-migrant group	Total change (approx.)	Contribution to between-migrant group	Contribution to within-migrant group	Total change	Contribution to between-migrant group	Contribution to within-migrant group	Total change
HS NZ born	0.1230	0.0324	0.1554	0.0086	0.0485	0.0571	0.0094	0.0416	0.0510
M/LS NZ born	-0.2192	-0.0882	-0.3074	0.0027	-0.0795	-0.0768	0.0025	-0.0324	-0.0299
HS Ret. NZ	0.0084	0.0025	0.0109	0.0009	0.0037	0.0046	0.0010	0.0033	0.0043
M/LS Ret. NZ	-0.0114	-0.0035	-0.0148	0.0000	-0.0024	-0.0024	0.0000	-0.0009	-0.0009
HS Earlier Migrant	0.0871	0.0275	0.1146	0.0034	0.0331	0.0365	0.0032	0.0280	0.0312
HS Newly Arrived Migrant	0.0260	0.0109	0.0369	-0.0023	0.0080	0.0057	-0.0020	0.0066	0.0046
M/LS Earlier Migrant	-0.0104	0.0049	-0.0055	-0.0087	-0.0111	-0.0198	-0.0074	-0.0021	-0.0095
M/LS Newly Arrived Migrant	0.0112	0.0053	0.0165	-0.0022	0.0001	-0.0021	-0.0020	0.0007	-0.0013
Overall	<b>0.0148</b>	<b>-0.0082</b>	<b>0.0066</b>	<b>0.0024</b>	<b>0.0003</b>	<b>0.0027</b>	<b>0.0048</b>	<b>0.0448</b>	<b>0.0496</b>

*Notes:* The data are obtained from all main and secondary urban areas combined. In the basic regression, the sum of within and between-migrant group contributions add up to total inequality. In the extended regression, we show the conditional-between and conditional-within migrant contributions of each migrant groups after adjusting for age, sex and employment status. Because some of the overall inequality is accounted for by the between age, sex and employment status group contributions, the sum of the conditional-migrant group contributions will not add up to overall inequality. For definitions of the groups, see the notes below Table 2.

# 6 Figures

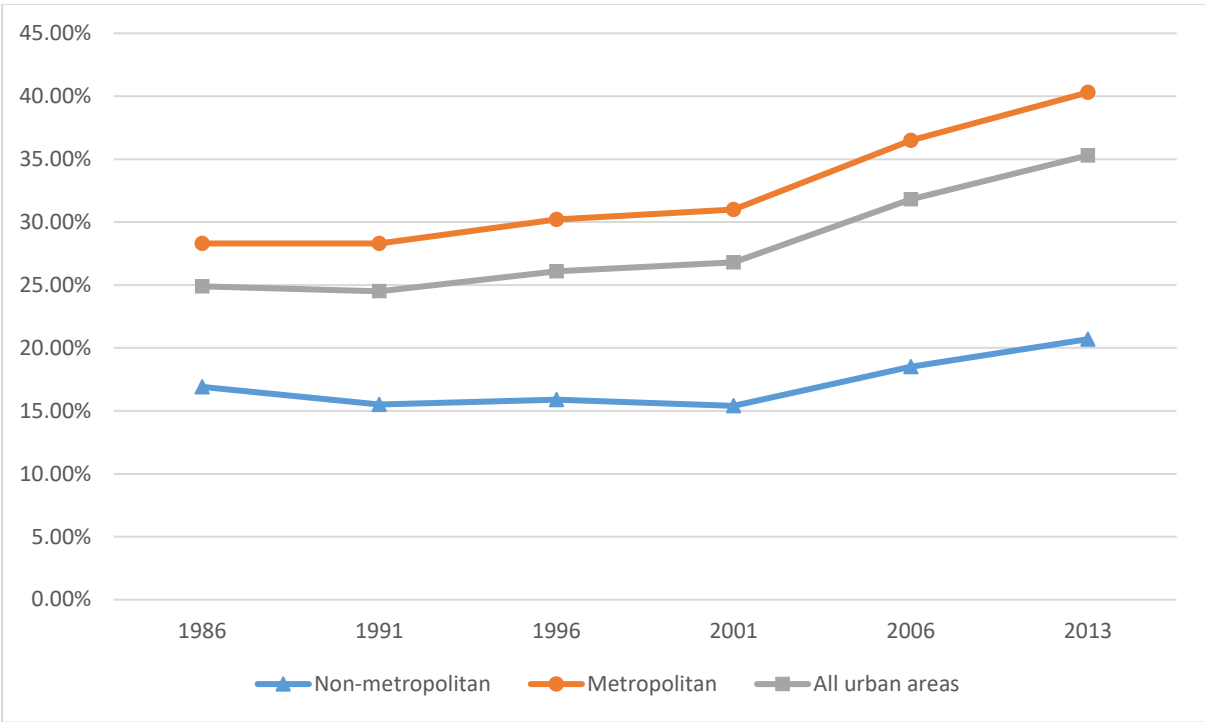


Figure 1: Immigrant share of the population in main and secondary urban areas

Notes: The sources are unit record data from the New Zealand Census of Population and Dwellings. The population is restricted to residents of main and secondary urban areas who are aged 25 to 64. Immigrants are the subset of this population who were born outside New Zealand. The metropolitan areas are the six largest urban areas in terms of population (Auckland, Christchurch, Wellington, Hamilton, Tauranga and Dunedin).

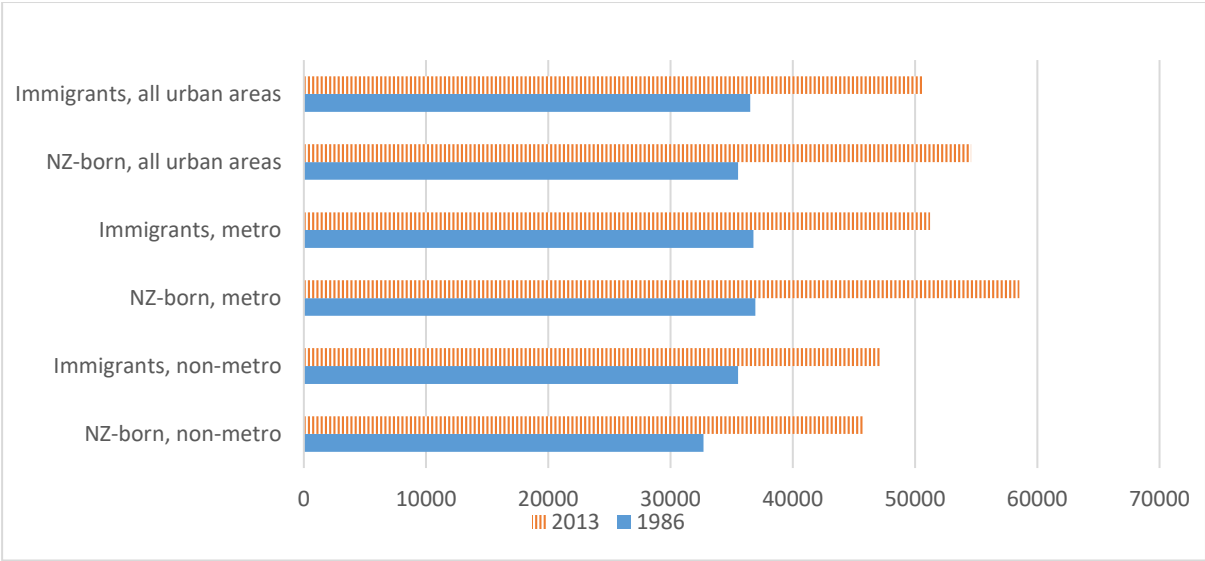


Figure 2: Real mean income (in 2013 dollars) of immigrants and NZ born in 1986 and 2013

Notes: The data refer to gross income from all sources, reported in the New Zealand Census of Population and Dwellings. The population is restricted to residents of main and secondary urban areas who are aged 25 to 64. Immigrants are the subset of this population who were born outside New Zealand. The metro areas are the six largest urban areas in terms of population (Auckland, Christchurch, Wellington, Hamilton, Tauranga and Dunedin).



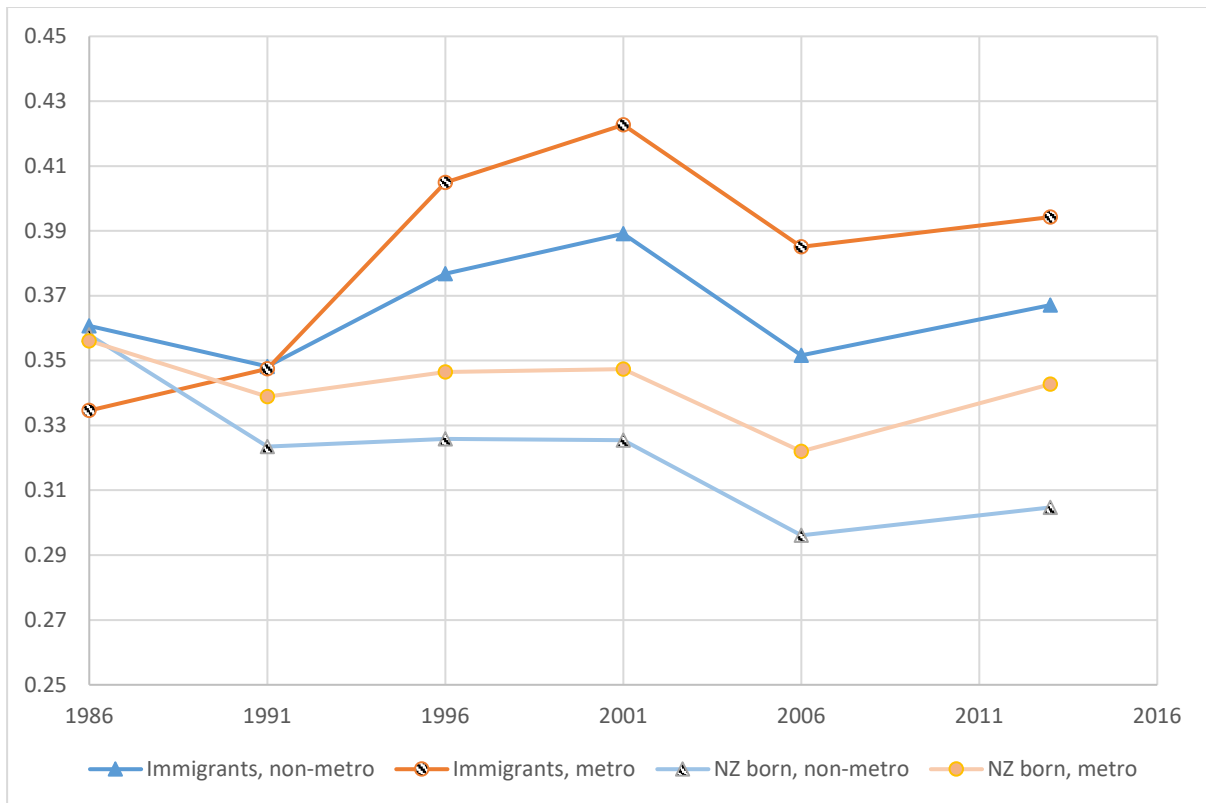


Figure 3: Income inequality among the New Zealand born and among immigrants in metropolitan and non-metropolitan areas

*Notes:* The Mean Log Deviation (MLD) measure of inequality has been calculated from microdata on gross income from all sources reported in the New Zealand Census of Population and Dwellings. The population is restricted to residents of main and secondary urban areas who are aged 25 to 64. Immigrants are the subset of this population who were born outside New Zealand. The metropolitan areas are the six largest urban areas in terms of population (Auckland, Christchurch, Wellington, Hamilton, Tauranga and Dunedin).

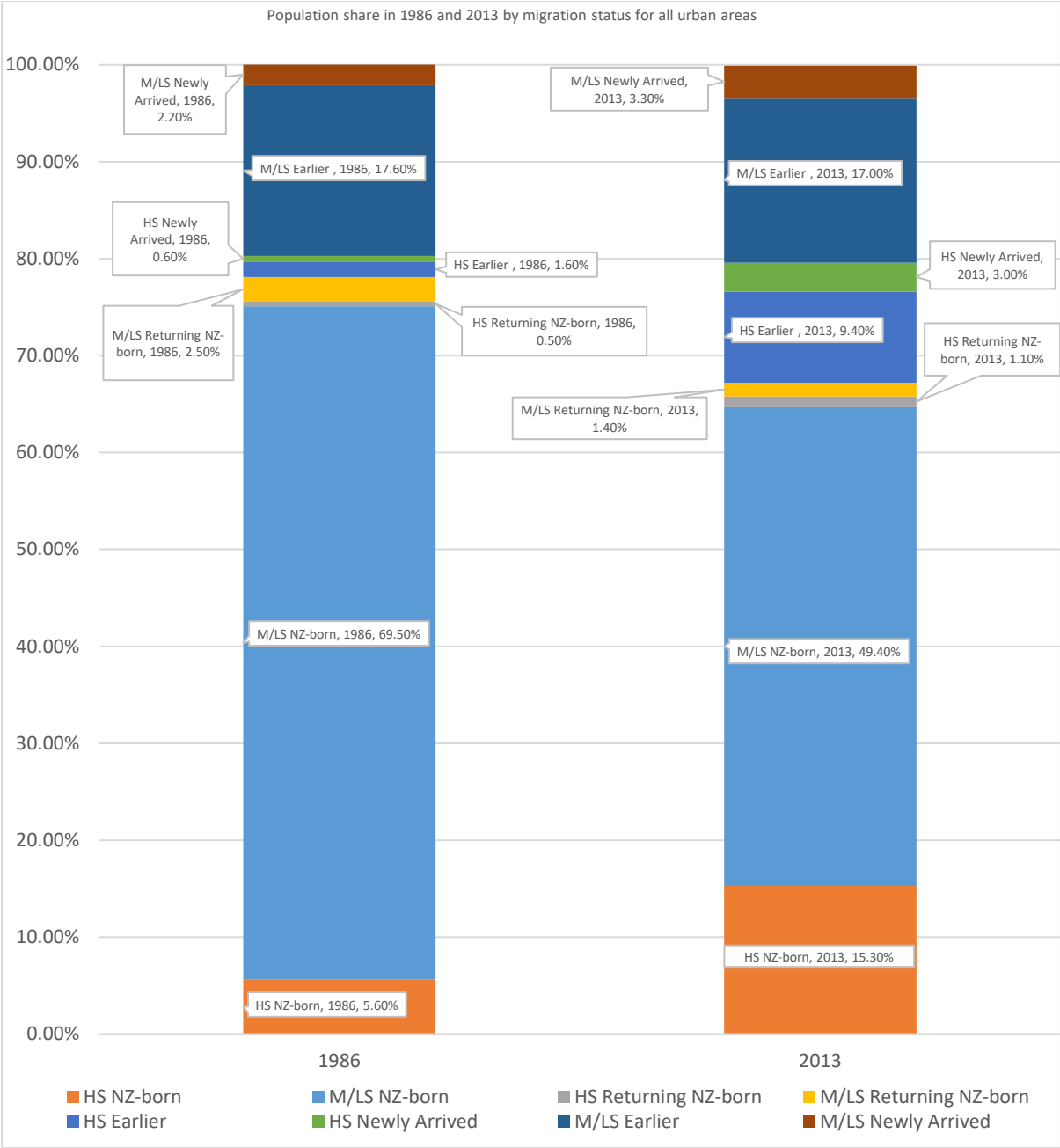


Figure 4: Population share by migration status in 1986 and 2013

Notes: The sources are unit record data from the New Zealand Census of Population and Dwellings. The population is restricted to residents of main and secondary urban areas who are aged 25 to 64. Newly arrived immigrants and returning NZ-born persons resided abroad five years before the census. “HS” (High Skilled) refers to those with a Bachelor’s or higher degree and “M/LS” refers to all levels of education below a Bachelor’s degree.

## 7 Acknowledgements

This study has been supported by the 2014–2020 *Capturing the Diversity Dividend of Aotearoa New Zealand* (CaDDANZ) programme, funded by Ministry of Business, Innovation and Employment grant UOWX1404; by National Science Challenge 11: *Building Better Homes, Towns and Cities*; and by a New Zealand National Institute of Demographic and Economic Analysis (NIDEA) PhD scholarship for the first author. An early version of this paper is available as a working paper (Alimi et al., 2018b) and as part of conference proceedings (Alimi et al., 2018c).

# 8 Appendix

## Appendix 1

Considering each of C1 to C4' below:

- $C1 = \sum_{m=1}^M \bar{\pi}_m \Delta MLD_m$ . This is the aggregate change in within-migrant group inequality for given migrant shares. Given that migrant shares  $\pi_m$  will always be positive, changes from this component are dependent on the changes in within-group inequality ( $\Delta MLD_m$ ).
- $C2 = \sum_{m=1}^M \overline{MLD}_m \Delta \pi_m$ . It is the aggregate change in within-migrant group due to changing migrant shares.  $MLD_m$  is always positive, the changes from this component are dependent on the changes in the population share ( $\Delta \pi_m$ ).
- $C3' = \sum_{m=1}^M (\bar{r}_m - \ln r_m) \Delta \pi_m$ . 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  $\ln r_m$  will always be smaller than  $r_m$ , thus the direction of change from C3' will be dependent on whether the population share ( $\pi_m$ ) of a group increases or decreases.
- $C4' = \sum_{m=1}^M (\bar{\pi}_m \bar{r}_m - \bar{\pi}_m) \Delta \ln \mu_m$ . It is the aggregate growth in migrant-group mean income for given migrant-shares. C4' is slightly more complex and the direction of change is dependent on changes in group-mean income ( $\mu_m$ ) as well as the relative mean income ( $r_m$ ). If for a group:
  - $\bar{r}_m > 1$  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( $\mu$ ). This change will be inequality-increasing as it widens the overall distribution i.e. the top moves further away;

- $\bar{r}_m < 1$  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( $\mu$ ). This change will be inequality-decreasing as it narrows the overall distribution of income;
- $\bar{r}_m > 1$  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( $\mu$ ). This change will be inequality-decreasing;
- $\bar{r}_m < 1$  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( $\mu$ ). This change will be inequality-increasing as it widens the overall distribution; i.e. the bottom becomes further apart

Table A.1: Definition of variables used in regression decomposition method

Variable	Definition
Income	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. Income is captured in bands.
Migration status	Country of birth is used to determine migration status. 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 this group, by their length of stay, into newly arrived and earlier migrants. Newly Arrived are migrants who arrived during the last inter-censal period. We use the information on place of residence five years ago to 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.
Sex	This represents the gender of the individual as male or female.
Employment Status	This represents the employment status of the individual, whether employed, unemployed or not in the labour force.
Age	This represent the age in years of the individual.

Table A.2: Employment status of New Zealand born compared to immigrants

NZ-born						Immigrants				
	FT	PT	All	Unempl	NILF	FT	PT	All	Unempl	NILF
Non-metropolitan areas										
19	61.8%	13.2%	75.0%	3.1%	21.9%	65.4%	11.6%	77.0%	3.0%	20.0
19	55.9%	12.9%	68.8%	5.7%	25.5%	57.6%	12.0%	69.6%	5.6%	24.8
19	59.0%	15.9%	75.0%	4.4%	20.7%	59.0%	14.7%	73.7%	4.9%	21.4
20	62.3%	16.8%	79.2%	4.0%	16.8%	61.4%	16.0%	77.4%	4.1%	18.5
20	66.1%	16.6%	82.6%	2.6%	14.8%	67.1%	15.8%	82.9%	2.6%	14.5
20	65.2%	16.1%	81.3%	4.1%	14.6%	67.7%	15.7%	83.3%	3.2%	13.4
Metropolitan areas										
19	65.9%	11.7%	77.6%	2.7%	19.7%	69.7%	10.3%	79.9%	2.8%	17.2
19	61.5%	11.9%	73.4%	5.0%	21.6%	61.8%	10.2%	72.0%	5.6%	22.3
19	64.9%	14.2%	79.1%	3.5%	17.4%	60.6%	12.2%	72.8%	5.8%	21.4
20	68.1%	14.5%	82.6%	3.4%	14.0%	63.3%	12.7%	76.0%	4.9%	19.1
20	70.1%	14.5%	84.6%	2.2%	13.2%	67.5%	13.1%	80.6%	2.9%	16.5
20	69.5%	13.9%	83.4%	3.6%	13.1%	68.3%	12.7%	81.0%	3.8%	15.2
All main and secondary urban areas										
19	64.5%	12.2%	76.7%	2.9%	20.4%	68.8%	10.6%	79.3%	2.9%	17.8
19	59.6%	12.3%	71.9%	5.3%	22.8%	61.0%	10.6%	71.6%	5.6%	22.8
19	63.0%	14.8%	77.8%	3.8%	18.4%	60.3%	12.6%	72.9%	5.7%	21.4
20	66.3%	15.2%	81.6%	3.6%	14.8%	63.0%	13.3%	76.2%	4.8%	19.0
20	68.9%	15.1%	84.0%	2.3%	13.7%	67.4%	13.5%	80.9%	2.9%	16.2
20	68.1%	14.6%	82.7%	3.7%	13.5%	68.2%	13.1%	81.3%	3.7%	15.0

Note: The data refer to the population aged 25-64.

Table A.3: Comparison of MLD, relative mean income, and population share for all international migrant groups and New Zealand born in all urban areas

		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
<b>All main and secondary urban areas</b>										
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%
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 main and secondary 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