Immigration, skills and changing urban income inequality in New Zealand

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Abstract

Policies have been implemented in New Zealand since the early 1990s that encourage long-term immigration of skilled workers and greater temporary immigration of unskilled workers. This paper investigates the contribution of immigration to change in income inequality of New Zealand's urban population and compares that with the contribution of the changing skill composition of the population. We apply sub-group and Shapley-value-regression decompositions of inequality to calculate contributions of eight population groups, defined by skill level and migration status, to inequality. We use microdata from six consecutive population censuses between 1986 and 2013. We find with both methodologies that: (1) more than 90 per cent of income inequality in each census can be attributed to within-group inequality; (2) the growth in the share of the population that is highly skilled and the growth in the share of foreign born in the population both had inequality-increasing effects; (3) the skill effect exceeded the migration effect. The findings suggest that changes to the level and skill composition of future immigration – triggered by the anticipated 'reset' of New Zealand immigration policies when the border re-opens after the subsiding of the COVID-19 pandemic – will impact on future income inequality. Hence our decomposition approaches ought to be revisited after the 2023 census data become available to measure early effects of any new policies.

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1. Introduction

Immigration has had a major impact on the population of Aotearoa 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). More than 27 per cent of the population is foreign born (NZPC 2021a). Policies implemented since the early 1990s encouraged greater permanent and long-term immigration of skilled workers and greater temporary migration of unskilled workers (NZPC 2021b).

New Zealand has a broad range of working-age immigration programs that enable immigrants to work, invest, or operate a business in the country. These policies allow foreign citizens to enter on a range of visas including temporary work visas, residence visas, student visas, investor and entrepreneur visas (NZPC 2021c). Bedford *et al*. (2002) provide a historical review of immigration policies in New Zealand while studies like Spoonley (2006) and Simon-Kumar (2015) provide more contemporary reviews. In the last three decades, immigrants have become an increasingly important contributor to New Zealand's workforce and have played a significant role in supporting population growth. The rise in immigration has led to a growing concern about the implications of immigration for wellbeing and welfare of the New Zealand born, as well as of immigrants themselves (Fry and Wilson, 2017). Two main areas that are often highlighted are the impact of immigration on the labour market (NZPC 2021b) and the impact on housing and public infrastructure (NZPC 2021d).

At the same time, New Zealand has witnessed growing concern about rising urban income inequality – with income inequality in large cities having increased notably since the 1980s (e.g., Alimi *et al*. 2016). There is already considerable New Zealand evidence on the impact of immigration on economic variables like wages and employment (NZPC 2021b, Tse and Maani 2017, Maani and Chen 2012, Maré and Stillman 2009). There is also evidence on the impact of immigration on the housing market (Cochrane and Poot, 2021; Hyslop *et al*. 2019), with potential implications for wealth inequality (NZPC 2021d). However, the contribution of immigration to changes in the distribution of income has, surprisingly, not been previously investigated. This paper therefore aims to quantify the effect of immigration on income inequality. Because immigration contributes to change in the skill composition of the work force, we also consider the effect of the changing skill composition of the work force on income inequality. Furthermore, because most immigrants live in urban areas, we focus on income inequality in New Zealand urban areas.

International migration may affect the distribution of income in destination countries through three channels. The first is the *compositional channel*. On average, immigrants possess characteristics that differ from the locally born and may also be rewarded differently – as has been confirmed by previous New Zealand research (Poot and Stillman 2016, Poot and Roskruge 2013, Stillman and Maré 2009). Second, the distribution of income within immigrant groups themselves can also affect the overall distribution of income in destination areas (this is the *immigrant-specific income distribution channel*). The distribution of income within the migrant community is often wider than among locals (see Card 2009 for US evidence). Furthermore, there

is evidence that the effect of recent immigration on the labour market is mostly felt by earlier migrants when recent and earlier migrants act as substitutes in the labour market (Longhi *et al*. 2005). The third and final channel through which immigrants affect the income distribution of locals is the general equilibrium effect. This is one of the most actively researched areas in the labour migration literature in recent decades (see e.g. Borjas 2003, 2005, Card 1990, 2005, 2009, D'Amuri *et al*. 2010, Foged and Peri 2016, Manacorda *et al*. 2012). Evidence on the wage effects of immigration appears inconclusive, with an abundance of positive, negative and insignificant results. However, the international evidence points towards the effects being quantitatively small in most cases (Longhi *et al*. 2010). This tends to be also the conclusion of New Zealand research by Maani and Chen (2012), Maré and Stillman (2009), MBIE (2018) and Tse and Maani (2017). Generally, immigration has had small, but mostly positive, effects on the wages and employment of New Zealand born workers over the last 25 years (NZPC 2021b).

Hence, given that general equilibrium effects have been shown to be minor, we focus in this study exclusively on the composition and immigrant-specific distribution channels. We examine contributions to inequality of groups defined by skill level and migration status by two decomposition approaches: the sub-group decomposition methodology (e.g., Mookherjee and Shorrocks 1982) and the Shapley-value-regression decomposition of inequality (e.g., Fields and Yoo 2000). Both decomposition methodologies allow the examination of the contribution of a particular income determinant, or of a particular group of the population, to the level and/or change in inequality. 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. For a general survey of all drivers of income inequality in developed countries, see e.g. Nolan *et al*. (2019).

We find with both decomposition methodologies that: (1) more than 90 per cent of income inequality can be attributed to within-group inequality; (2) the growth in the share of the population that is highly skilled and the growth in the share of foreign born in the population had both inequality-increasing effects between 1986 and 2013; (3) the skill effect exceeded the migration effect. Within-group contributions to inequality levels and change have generally the same sign and magnitude with the regression approach as contributions calculated with the sub-group approach. However, the two methodologies yield often opposite signs for contributions of specific groups to between-group inequality levels and change.

The rest of the paper proceeds as follows. Section 2 discusses the data. We also introduce and compare the two decomposition methodologies in this section. Section 3 describes the results. 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.[1] New Zealand Census data capture *inter alia* information on current location of residence, place of residence at the last census date, 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 information on place of residence five years ago, we can also identify a group of 'Returning New Zealand born migrants' – they are New Zealand born people who were 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.[2] As well as classifying the population by duration of residence in New Zealand, we also divide each group 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) High Skilled Non-Migrant New Zealand Born; (2) Medium/Low Skilled Non-Migrant New Zealand Born; (3) High Skilled Returning New Zealand Born; (4) Medium/Low Skilled Returning New Zealand Born; (5) High Skilled Earlier Migrants; (6) Medium/Low Skilled Earlier Migrants; (7) High Skilled Newly-Arrived Migrants; and (8) Medium/Low Skilled Newly-Arrived Migrants.

Given our focus on the contribution of migration and skills to inequality, an ideal measure of income would be gross labour earnings, but income reported in the census refers to annual income from all sources. Hence we restrict our analysis to the population aged 25-64 who are earning positive incomes, given that for this population group income consists mostly of labour earnings.

Instead of providing a dollar amount of actual income, the census respondent selects one of a set of income bands. All income bands were converted by means of

1 New Zealand Censuses were held in 1986, 1991, 1996, 2001, 2006, 2013 and 2018. The 2018 census did not collect data about location '5-years ago' – an important variable we use to identify migrants. Furthermore, the required data on income from the 2018 census are of lower quality than data from previous censuses. Consequently, we have not included 2018 in our study.

2 Selective emigration by the New Zealand born may influence the distribution of income in New Zealand too. However, there are no data on the incomes of emigrants before they left New Zealand. Some research suggests that the propensity to emigrate is similar across all skill groups, at least in trans-Tasman migration (e.g., Bushnell and Choy, 2001). Other research shows that the New Zealand born have the highest rate, among the OECD countries, of highly skilled population living abroad (NZPC 2021b, Dumont and Lemaître 2005).

the CPI to 2013 real incomes. The top and bottom income bands are open ended.[3] The bottom income band captures those who reported a negative income. They are not included in the analysis. An important issue with the open-ended upper band is the calculation of median income in this band (about one per cent – three per cent of the population in non-metropolitan areas and two per cent – seven per cent in metropolitan areas are within this band). Pareto distributions have been fitted to the upper tail of the area-specific distributions to estimate median income of the top income groups by means of the Stata RPME command developed by von Hippel *et al*. (2016). For all other income bands, the income of the individual is assumed to be the midpoint of the income band he or she belongs to. The availability of income data in bands poses no problem for the sub-group and regression decomposition methods used in this paper, although not accounting for within-band income variation clearly leads to underestimation of actual overall inequality.

2.2 Methodology

2.2.1 Population sub-group decomposition of the level and change in inequality

Level of inequality

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, while the more commonly used Gini coefficient is not. Because our focus is on how changes in the population shares by migration status and skill level have affected the distribution of income, the MLD is a natural choice and fit-for-purpose index. Additionally, it has also been shown that MLD is less sensitive to uncertainty about incomes at the upper end of the distribution (Cowell and Flachaire, 2007). For a population of N persons indexed by $i = 1,2,\ldots,N$ and each having personal income y_i,

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

in which the bar above a variable refers to the arithmetic average. Eq. (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.

The overall MLD level of inequality in any year t can then be written as the weighted sum of within-group inequality and between-group inequality:

$$MLD_t = \frac{1}{N_t}\sum_{i=1}^{N_t} \ln\left(\frac{\bar{y}_t}{y_{it}}\right) = \underbrace{\sum_{m=1}^{M} \pi_{mt} MLD_{mt}}_{Within-group\ inequality} + \underbrace{\sum_{m=1}^{M} \pi_{mt} \ln\left(\frac{1}{r_{mt}}\right)}_{\substack{Between-group\ inequality \\ or \\ Mean-group\ contribution}} \qquad (2)$$

3 For example, the top band in the 2013 census data captures everybody earning $150,000 and over.

where:

- π_{mt} is population share of group m, i.e. $\pi_{mt} = \frac{N_{mt}}{N_t}$; and N_{mt} is the population of all those in the group m at census t. Hence the total population $N_t = \sum_{m=1}^{M} N_{mt}$;

- r_{mt} is the relative income of group m, i.e. $r_{mt} = \bar{y}_{mt}/\bar{y}_t$, where $\bar{y}_{mt} = \frac{1}{N_{mt}} \sum_{j=1}^{N_{mt}} y_{jt}$ is average income of all those in group m in census t;

- $MLD_{mt} = \frac{1}{N_{mt}} \sum_{j=1}^{N_{mt}} \ln\left(\frac{\bar{y}_{mt}}{y_{jt}}\right)$ is the MLD measure of within-group inequality.

Change in inequality

We decompose the change in inequality, as measured by MLD, by means of the approximate change decomposition introduced by Mookherjee and Shorrocks (1982).[4] The change (Δ) in overall inequality for a population of N people (indexed by i) can be decomposed into the contributions from each of M groups (indexed by m) as follows:

$$\Delta MLD \approx \underbrace{\sum_{m=1}^{M} \overline{\pi_m} \Delta MLD_m}_{C1} + \underbrace{\sum_{m=1}^{M} \overline{MLD_m} \Delta \pi_m}_{C2} + \underbrace{\sum_{m=1}^{M} (\overline{r_m} - \overline{\ln r_m}) \Delta \pi_m}_{C3'} + \underbrace{\sum_{m=1}^{M} (\overline{\pi_m r_m} - \overline{\pi_m}) \Delta \ln \bar{y}_m}_{C4'} \quad (3)$$

This decomposition identifies four components of inequality change. First, the contribution of changing within-group inequality, holding shares constant ($C1$); second, the within-group contribution of changing shares ($C2$); third, the between-group contribution due to changing shares ($C3'$); and fourth, the contribution of changing relative incomes, holding shares constant ($C4'$).

The sum of $C2$ and $C3'$ quantifies the contribution of the changing population composition to the change in income inequality. The sum of $C1$ and $C4'$ represents the contribution of change in the group-specific income distributions to the change in income inequality.

4 The approximation was introduced to give the individual components clear economic interpretation. Mookherjee and Shorrocks (1982) note that this approximation is sufficient for computational purposes (p.897). For more details, see Alimi *et al*. (2020).

2.2.2 Shapley-value regression decomposition of the level and change in inequality

Level of 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):

$$y_t = \sum_{m=1}^{M} \beta_{mt} d_{mt} + \sum_{j=1}^{J} \gamma_{jt} z_{jt} + \varepsilon_t, \quad (4)$$

where y_t is a $N\times1$ vector of income of individuals i (i = 1,2,…,N) at time t. The d_{mt} are a set of m dummy variable vectors denoting membership of each of the M groups (M = 8 in our application; d_{mt} = 1 when an individual belongs to group m and 0 otherwise), and z_{jt} are vectors of j covariates that affect income. β_{mt} and z_{jt} are sets of IGF parameters, and ε_t is a vector of random variation in income that is not related to the included variables. By construction, the d_{mt} vectors are orthogonal but the z_{jt} can be correlated with each other and with the d_{mt} vectors.

Decomposing the contributions of the m 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 contribution to earnings inequality accounted for by group m, also referred to as the relative factor inequality weight S_{mt}, can then be calculated as:

$$S_{mt} = \frac{\hat{\beta}_{mt} * Cov(d_{mt}, y_t)}{Var(y_t)} \quad (5)$$

where $\hat{\beta}_{mt}$ are the OLS coefficients in a regression of Eq. (4) 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. S_{mt} can be interpreted as the group-mean contribution, or the between-group contribution, of group m to overall inequality at time t. Following Shorrocks (1982), we calculate the between-group contribution of a group m to income inequality at time t by $\theta_{mt} = S_{mt} * MLD_t$.

In addition to calculating the between-group contribution of each group, we also calculate within-group contributions to the level of inequality with the regression approach. Most studies using the regression approach ignore the group-specific within-group contributions and consider these part of 'residual' inequality. We allocate this residual to the individual groups and interpret the result as providing the conditional within-group contributions:

$$Cov(\hat{\varepsilon}_t, y_t) = \sum_{m=1}^{M} Cov(\hat{\varepsilon}_{mt} d_{mt}, y_t) \quad (6)$$

We calculate these conditional within-group contribution of each migrant group both without and with accounting for age, sex and employment status. Alimi

et al. (2020) provide technical details on similarities and differences between the regression decomposition and sub-group decomposition approaches.

Change in inequality

The between-group contribution of group m to *change* in inequality between time t and t+1 is given by Eq. (7) below. Unlike the contribution of each factor to the level of inequality, S_{mt}, the contribution of each factor to change in inequality, δ_m, is here dependent on the choice of inequality measure (Fields and Yoo 2000).

$$\delta_m = \theta_{m,t+1} - \theta_{mt} = S_{m,t+1} * MLD_{t+1} - S_{m,t} * MLD_t \qquad (7)$$

One of the advantages of the regression decomposition framework is the possibility of accounting for multiple explanatory variables (z_{jt}). In contrast, the sub-group decomposition approach quickly becomes unwieldy if we account for multiple explanatory factors. For example, accounting for sex and migration and skills status in our research together means there would be 16 groups (eight migration and skills status categories times two genders). However, the regression decomposition framework has limitations too (Wan 2002, 2004). Most notably, the standard Fields and Yoo (2000) approach with multiple explanatory variables relies on the assumption of uncorrelated 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.[5]

Subsequent studies have therefore adopted a Shapley-value regression decomposition approach.[6] This approach calculates the marginal effect of each explanatory variable in all possible orderings of these variables. The contribution of each explanatory variable to income inequality is then 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 and skills group (m) to the level of inequality when accounting for age, sex, and employment status. For our Shapley regressions, we treat the group dummy variables (d_{mt}) as a block and they are entered into the regressions together.

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;

5 The standard Fields and Yoo (2000) approach captures the contribution of each variable as if it were added last.

6 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).

with full-time employed as the omitted group). To ensure that we can account for the conditional contribution of each group, we run our regressions without an intercept because dummy variables are included for all migrant and skill groups.

3. Results

3.1 Trends and patterns in income inequality by migration status and skill level

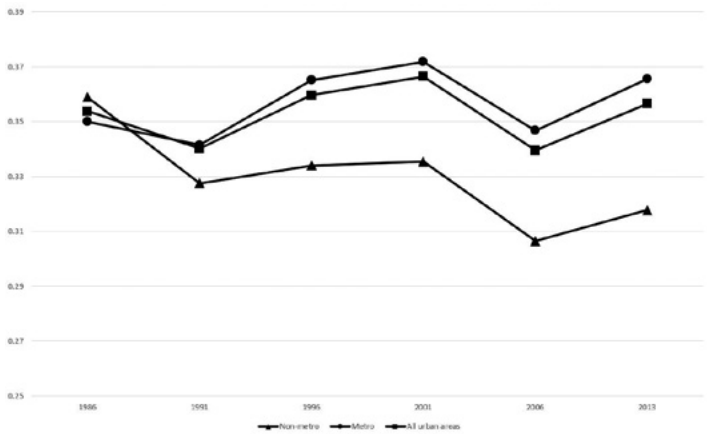
Real income of New Zealand's urban population aged between 25 and 64 in receipt of positive income increased by about half between 1986 and 2013, which implies real income growth of about 1.5 per cent per year. In 1986, average income of immigrants was about 3 per cent higher than of the New Zealand born, but by 2013 immigrants earned on average about 7 per cent less than the New Zealand born. One of the drivers 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 (NZPC 2021b, MBIE 2018, McLeod and Maré 2013).

Figure 1 shows MLD inequality by type of urban area for all censuses between 1986 and 2013 (for the population who are aged between 25 and 64 and residing in urban areas). For all urban areas combined, MLD income inequality dropped from 0.3538 in 1986 to 0.3402 in 1991. This was a period of substantial economic deregulation and reform in New Zealand that affected private and public sectors (e.g., Evans *et al*. 1996) and may have increased density at the lower end of the real wage distribution. Additionally, 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.[7] A sharp reduction in social security payments and extensive liberalisation of labour contracting regulations in 1991 contributed to an increase in the MLD measure of inequality to 0.3596 in 1996 before peaking at 0.3664 in 2001. Subsequently, MLD inequality declined again sharply (to 0.3395 in 2006) before increasing to 0.3565 in 2013. The period between 2001 and 2006 was characterised by high economic growth and increasing labour force participation and hours worked. Overall, inequality of the urban population aged between 25 and 64 rose by only 0.0027 MLD points between 1986 and 2013, which is less than 1 per cent.

These macro fluctuations mask large differences between metropolitan and non-metropolitan areas. Inequality rose in metropolitan areas between 1986 and 2013 by 4 per cent while it fell in non-metropolitan areas by 11 per cent. In this paper we focus on the roles of immigration and skills at the national urban level and we do not consider the distinction between metropolitan and non-metropolitan income inequality trends here any further (but see e.g. Alimi *et al*. 2018 on that issue).

7 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.

Figure 1. New Zealand income inequality from 1986 to 2013 by type of urban area



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

Table 1 reports within-group income inequality, group relative income and the population share for each of the six censuses between 1986 and 2013. The share of High Skilled Earlier Migrants and High Skilled Newly Arrived Migrants in the population increased by 7.8 and 2.4 percentage points respectively between 1986 and 2013. Given strong population growth over these 27 years, it can be easily calculated that the corresponding increase in the size of these groups was even more dramatic: the High Skilled Earlier Migrants group in 2013 was about eight times as large as in 1986 and the High Skilled Newly Arrived Migrants group was about seven times as large. In contrast, the share of the Medium/Low Skilled Earlier Migrants in the population declined from 17.6 per cent to 17.0 per cent (this still equates to a 33 per cent increase in the size of this group). The share of Medium/Low Skilled Newly Arrived Migrants increased from 2.2 per cent to 3.3 per cent (equivalent to a roughly doubling of the number). The number of Medium and Low Skilled Returning New Zealand born Migrants in 2013 declined by about 24 per cent relative to the 1986 size of this group (with the population share declining from 2.5 per cent to 1.4 per cent). The number of High Skilled Returning New Zealand born increased by 219 per cent (a population share increase from 0.5 per cent to 1.1 per cent), reflecting an increasing level of cross-border mobility of New Zealand young professionals.

Table 1. Income inequality (Mean Log Deviation), relative mean income and population share by migration/skill group, 1986-2013

		HS Non-Migrant NZ-born	*M/LS Non-Migrant NZ-born*	*HS Returning NZ-born*	*M/LS Returning NZ-born*	*HS Earlier Migrants*	*M/LS Earlier Migrants*	*HS Newly Arrived Migrants*	*M/LS Newly Arrived Migrants*	*Total*
1986	MLD	0.3094	0.3466	0.3454	0.3353	0.3191	0.3075	0.4286	0.4164	0.3538
	Rel.inc.	1.70	0.94	1.54	0.96	1.66	0.95	1.56	0.91	1.00
	Pop. share	5.6%	69.5%	0.5%	2.5%	1.6%	17.6%	0.6%	2.2%	100.0%
1991	MLD	0.3127	0.3190	0.3543	0.3130	0.3223	0.3090	0.3843	0.3767	0.3402
	Rel.inc.	1.77	0.93	1.67	0.95	1.72	0.90	1.53	0.86	1.00
	Pop. share	6.4%	69.1%	0.5%	2.1%	1.9%	16.2%	1.0%	2.9%	100.0%
1996	MLD	0.3354	0.3195	0.3499	0.2997	0.3632	0.3333	0.6172	0.499	0.3596
	Rel.inc.	1.77	0.92	1.65	0.92	1.66	0.87	1.09	0.75	1.00
	Pop. share	7.7%	66.1%	0.6%	2.4%	2.5%	15.7%	1.8%	3.1%	100.0%
2001	MLD	0.3251	0.3215	0.3574	0.3308	0.3797	0.3544	0.5085	0.4798	0.3664
	Rel.inc.	1.66	0.91	1.59	0.92	1.51	0.84	1.14	0.72	1.00
	Pop. share	10.3%	62.9%	0.7%	1.7%	3.7%	14.9%	2.2%	3.6%	100.0%
2006	MLD	0.2997	0.2983	0.3261	0.3008	0.3509	0.338	0.4144	0.3926	0.3395
	Rel.inc.	1.51	0.91	1.50	0.95	1.33	0.81	1.06	0.75	1.00
	Pop. share	12.5%	55.7%	1.2%	2.0%	5.7%	14.9%	3.5%	4.6%	100.0%
2013	MLD	0.3248	0.3093	0.3701	0.3504	0.3465	0.3462	0.4393	0.4299	0.3565
	Rel.inc.	1.46	0.89	1.44	0.91	1.26	0.78	1.05	0.71	1.00
	Pop. share	15.3%	49.4%	1.1%	1.4%	9.4%	17.0%	3.0%	3.3%	100.0%
1986-2013 Population share change (%pts)		9.7%	-20.1%	0.7%	-1.1%	7.8%	-0.6%	2.4%	1.2%	0.0%
1986-2013 Population change (%)		277%	-2%	219%	-24%	694%	33%	641%	112%	38%
1986-2013 change in MLD points		0.0154	-0.0373	0.0247	0.0151	0.0274	0.0387	0.0107	0.0135	0.0027

Notes: Derived from census microdata on reported gross income of respondents aged 25 to 64 in main and secondary urban areas. HS NZ-born and M/LS NZ-born represent High Skilled and Medium/Low Skilled New Zealand born respectively; HS Ret. NZ-born and M/LS Ret. NZ-born represent High Skilled and Medium/Low Skilled Returning New Zealand born; HS Earlier and LS Earlier represent High Skilled and Medium/Low Skilled Earlier migrants; HS (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. Earlier migrant are arrivals prior to the last inter-censal period. MLD is calculated as in Eq. (1). Rel.inc. refers to relative income, which is defined as the ratio of the average income of the population sub-group over the average income of the national urban population. Pop. share refers to the share of group in the urban population. The data refer to the population in all urban areas combined.

The relative changes are important. 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 and Topel 1991; Cortés 2008). The growth in the number and share of migrants at various skill levels has implications for the distribution of income of migrant groups but also for the overall distribution of income.

Table 1 also presents the within-group inequality of each population group between 1986 and 2013. Over this quarter century, 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. At the same time, group-average income declined relative to the overall mean for all eight groups considered due to higher income growth for high income groups – as can be seen in Table 1. 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 the level of disaggregation used in Table 1, inequality increased between 1986 and 2013 for all groups, except the Medium/Low Skilled New Zealand born. Note that this is the largest population sub-group, although its population share declined from 69.5 per cent to 49.4 per cent. The decline in income inequality within this group could have been driven by increases in the real minimum wage over this period (see e.g., Maloney and Pacheco, 2012).

3.2 Decomposition of the level of inequality – Results

3.2.1 Sub-group decomposition of the level of Inequality

Given the differences between immigrants and New Zealand born and the likely diversity between and within immigrant/skill groups, we decompose MLD inequality into 'within' and 'between' components, using Eq. (2), and examine the contribution of each group to overall inequality in each census year. The results are shown in Table 2.

Table 2. Sub-group decomposition of urban income inequality (MLD) from 1986 to 2013

	1986	*1991*	*1996*	*2001*	*2006*	*2013*
Between-group contributions						
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 Migrants	0.0089	0.0162	0.0215	0.0259	0.0315	0.0413
HS Newly Arrived Migrants	-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%
Within-group contributions						
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 Migrants	0.0540	0.0502	0.0523	0.0528	0.0503	0.0588
HS Newly Arrived Migrants	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 MLD 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 and skills status categories in all urban areas combined in each census from 1986 to 2013, using Eq. (2). For definitions of the groups, see the notes below Table 1.

Table 2 shows that between-group inequality accounted for only 4 per cent of MLD inequality in 1986. This share increases to 7 per cent by 1996 and remains constant thereafter until 2013. Between-migrant/skill group inequality calculated here is higher than the between-age group inequality reported by Alimi *et al*. (2018), indicating bigger differences in average income across migrant and skill groups than age groups.

Table 2 also clearly shows that the between-group contribution of high skilled workers to inequality is negative, irrespective of migration status. This perhaps counterintuitive result is due to the average income of groups of high skilled workers

exceeding overall average income, thereby leading to a negative contribution to overall MLD (see Eq. (2)). The 1986-1996 increase in between-group inequality is due to the increasingly 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 group, with big differences between the time trends in the within-group contributions across sub groups. In Section 3.3, we employ change-decomposition procedures to provide a decomposition of overall inequality change between 1986 and 2013 and to understand the role of changes within each migrant/skill group.

3.2.2 Regression decomposition of the level of Inequality

We start with comparing the results of the regression approach to decomposing the variance in personal income (Eqs. (4) and (5)) with those of the sub-group decomposition of MLD (Eq. (2)). The results are presented in Table 3.

Table 3. Comparison of between- and within-group contributions to the level of urban income inequality (MLD) with the regression and sub-group decomposition approaches

	Regression decomposition of inequality level						*Sub-group decomposition of inequality level*					
	1986	*1991*	*1996*	*2001*	*2006*	*2013*	*1986*	*1991*	*1996*	*2001*	*2006*	*2013*
Between-group contribution												
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%
M/LS Earlier Migrants	-1%	-2%	-2%	-2%	-3%	-4%	3%	5%	6%	7%	9%	12%
HS Newly Arrived Migrants	1%	1%	0%	0%	0%	0%	-1%	-1%	0%	-1%	-1%	0%
M/LS Newly Arrived Migrants	0%	-1%	-1%	-1%	-1%	-1%	1%	1%	3%	3%	4%	3%
Overall between-inequality	**7%**	**9%**	**8%**	**9%**	**8%**	**8%**	**4%**	**6%**	**7%**	**7%**	**7%**	**7%**
Within-group contributions												
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%
M/LS Earlier Migrants	13%	12%	11%	10%	10%	10%	15%	15%	15%	14%	15%	17%
HS Newly Arrived Migrants	1%	2%	3%	3%	4%	4%	1%	1%	3%	3%	4%	4%
M/LS Newly Arrived Migrants	2%	2%	3%	3%	3%	2%	3%	3%	4%	5%	5%	4%
Overall within-inequality	**93%**	**91%**	**92%**	**91%**	**92%**	**92%**	**96%**	**94%**	**93%**	**93%**	**93%**	**93%**

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 2. The regression approach contributions are calculated as described in Section 2.2.2. For definitions of the groups, see the notes below Table 1.

We find that the overall between-group contributions in the regression method contribute less than 10 per cent to the overall level of urban income inequality in New Zealand. Hence that is very similar to what we found above with the sub-group decomposition of the MLD. 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 individual between-group contributions from the sub-group approach are opposite to those obtained in the regression approach. The main reason is that the two approaches use 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-group contribution (because the covariance in Eq. (5) is then positive) while with the MLD, these groups have a negative between-group contribution (as noted earlier).

Table 3 shows that the within-group contributions of each group are very similar across the two methods. The population shares play an important role here. The Medium/Low Skilled Non-Migrant New Zealand born group makes the largest within-group contribution, but also represents the largest group share of the population (see Table 1). The group shares act explicitly as weights in the formula for sub-group decomposition (see Eq.(2)) and do so implicitly in the calculation of the covariances in Eq. (6).

3.3 Decomposition of the change in inequality – Results

3.3.1 Decomposition of inequality change by sub-groups

Table 4 presents the group contributions to the change in MLD of urban income inequality between 1986 and 2013. Recall from Eq. (3) 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. However, the approximation is quite close relative to the magnitude of the individual contributions. The sign of the sum of $C1$ to $C4'$ determines whether a group makes an inequality-increasing or inequality-decreasing contribution to the 1986-2013 (slight) growth in inequality.

Table 4. Contributions to change in the Mean Log Deviation (MLD) index of inequality between 1986 and 2013 when using the sub-group decomposition approach

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

Notes: Results are the contributions to change in overall inequality (as measured by the MLD) between 1986 and 2013 in all main and secondary urban areas combined. C1 is the aggregate change in within- group inequality for given group-shares; C2 is the aggregate change in within-group inequality due to changing group shares; C3′ is aggregate change in between-group inequality due to changing group shares; C4′ is aggregate growth in group mean income for given group shares. See Eq. (3). For definitions of the groups, see the notes below Table 1.

One of the advantages of the Mookherjee and Shorrocks (1982) 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 alternatively into a compositional change contribution ($C2$+$C3'$) and a group-specific distribution change contribution ($C1$+$C4'$).

Focusing on the role of immigrant groups (both foreign-born and returning New Zealand born), our results show that high skilled (High Skilled Returning New Zealand 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. Of all immigrant groups, the positive contribution to growing inequality among high skilled workers is the least for the Returning New Zealand born. If we combine all immigrant groups regardless of skill (i.e., simply exclude the non-migrant New Zealand born), the 1986-2013 increase in migration has been inequality-increasing in terms of both composition and group-specific distribution contributions 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 New Zealand born, High Skilled Returning New Zealand born, High Skilled Earlier migrants and High Skilled Newly Arrived migrants was inequality-increasing while Medium/Low Skilled groups made inequality-reducing total contributions (except for the Medium/Low Skilled Newly Arrived).

The inequality-increasing contributions of high skilled groups occurred because relative mean income of these groups was high (greater than 1), and within-group inequality, population share, and mean incomes increased. Thus, groups at the top of the income distribution experienced greater within-group inequality and an increase in relative average income. This widens 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 Skilled Newly Arrived. The Medium/Low Skilled 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 contribution ($C2$+$C3'$).

3.2.2 Decomposition of inequality change by the regression method

Given that one of the advantages of the regression approach is the ease of accounting for multiple factors, we also report the contribution of each migration status group to inequality levels and change when we account for age, sex and employment status. We compare the results from this extended decomposition with the basic one (with migration/skill status as the only covariate of income). First we show the estimated extended income generating functions (Eq. (4)) in 1986 and 2013 in Table 5.

Table 5. Estimated income generating functions, 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)
M/LS Earlier Migrant	24218.14	29869.02
	(51.52)	(81.81)
HS New Migrant	43998.54	47201.35
	(276.48)	(191.44)
M/LS New Migrant	23921.83	28818.69
	(141.06)	(181.38)
Fulltime employed	0	0
	[0]	[0]
Part-time employed	-4560.03	-11108.72
	(53.01)	(72.54)
Unemployed	-11502.97	-17635.42
	(118.67)	(162.33)
Not in the Labour Force	-10726.83	-16174.88
	(37.05)	(71.76)
Male	0	0
	[0]	[0]
Female	-5256.64	-5045.79
	(16.01)	(22.39)
Constant	0	0
Observations	1,029,201	1,415,343
R-squared	0.40	0.27

Notes: The coefficients are obtained by regression of the level of real income on migration status, age, sex and employment status. Standard errors in parentheses. 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/skill groups are evaluated at overall means of the other covariates. For definitions of the groups, see the notes below Table 1. Fulltime employed and males are reference groups. All coefficients are statistically significant at the 0.1 per cent level.

The covariates are defined in the two regressions as deviation contrasts, so that the coefficients represent differences relative to 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 the excluded group (in our case, full-time employed and men) for the categorical variables.

It should be noted that the dependent variable in these regressions is the dollar value 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 in Table 5 all have the expected signs and levels. Using contrasts for the 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 New Zealand born in 1986, but by 2013 their average income is exceeded by that of the high skilled returning New Zealand born, consistent with the analysis of survey data by Poot and Roskruge (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-squared declining from 0.40 to 0.27.

Table 6 compares the regression-based decomposition with and without accounting for covariates in 1986 and in 2013. The left panel of Table 6 (basic regression) reports the results when only migrant/skill groups are considered as explanatory variables. In the right panel (extended regression), we report the between and within-group contributions 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) when calculating Shapley-value marginal effects. These are the average of the marginal contributions of each factor from all possible orderings. However, the within-group contributions do not depend on the order in which they are included and are calculated using the Fields and Yoo (2000) approach.

Table 6. Between and within group contributions to urban income inequality levels and change with the regression approach, with and without accounting for covariates

	Basic regression			*Extended regression*		
	1986	*2013*	*Contribution to change in MLD points (δ_k)*	*1986*	*2013*	*Contribution to change in MLD points (δ_k)*
	Between-group contribution			**Conditional between-group contribution**		
HS Non-Migr. NZ-born	11.7%	14.0%	0.0086	10.3%	12.8%	0.0094
M/LS Non-Migr. 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 Migrants	3.2%	4.1%	0.0034	2.8%	3.7%	0.0032
M/LS Earlier Migrants	-1.5%	-3.9%	-0.0087	-1.2%	-3.3%	-0.0074
HS Newly Arrived Migrants	0.9%	0.2%	-0.0023	0.8%	0.2%	-0.0020
M/LS Newly Arrived Migrants	-0.3%	-0.9%	-0.0022	-0.3%	-0.8%	-0.0020
Overall between	**7.3%**	**7.9%**	**0.0024**	**6.4%**	**7.7%**	**0.0048**
	Within-group contribution			**Conditional within-group contribution**		
HS Non-Migr. NZ-born	12.2%	25.8%	0.0485	9.9%	21.5%	0.0416
M/LS Non-Migr. 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 Migrants	3.5%	12.7%	0.0331	2.8%	10.6%	0.0280
M/LS Earlier Migrants	13.3%	10.1%	-0.0111	8.2%	7.5%	-0.0021
HS Newly Arrived Migrants	1.4%	3.6%	0.0080	1.1%	2.9%	0.0066
M/LS Newly Arrived Migrants	2.0%	2.0%	0.0001	1.4%	1.6%	0.0007
Overall within	**92.7%**	**92.1%**	**0.0003**	**60.4%**	**72.5%**	**0.0448**
Total	**100.0%**	**100.0%**	**0.0027**	**66.8%**	**80.2%**	**0.0496**
Covariates effect	**0.0%**	**0.0%**	**0.0000**	**33.2%**	**19.8%**	**-0.0469**
MLD levels and change	0.3538	0.3565	0.0027	0.3538	0.3565	0.0027

Notes: Results are the between- and within-group contribution of migrant/skill groups to inequality with and without accounting for age, sex and employment status in all main and secondary urban areas combined. The contributions to change in MLD between 1986 and 2013 are calculated using Eq. (6). For definitions of the groups, see the notes below Table 1.

In the basic regression, the sum of within and between-group contributions add up to total inequality. However, because in the adjusted regressions some of the overall inequality is accounted for by between-age/between-sex/between-employment status contributions, the conditional-migration/skill status group contributions do not add up to overall inequality. Hence the proportion of inequality not explained by the conditional within-group and conditional between-group contributions respectively reflects the contribution of between-group differences in other observable characteristics included in the regression.

Table 6 shows that the between-group contributions do not differ much between the basic and the extended regression. The high skilled groups contribute positively to overall between-group inequality and the medium-low skilled groups negatively. Taken together, the migrant groups (including returning New Zealanders) contribute positively to overall between-group inequality, but there is evidence that the joint contribution of the two non-migrant New Zealand born groups to between-group inequality is also positive and in fact much larger.

When we consider 1986-2013 change in inequality with the regression method (using Eq. (7)), the contributions of specific groups are again similar in magnitude and sign, both in the basic and in the extended regression. However, we see that the role of within-group inequality of age, sex and employment status groups has been declining (from 33.2 per cent in 1986 to 19.8 per cent in 2013), leading to a large negative contribution (-0.0469) of covariates to change in the MLD that mostly offsets the positive aggregate contribution of the migrant/skill groups. The overall within-migration status group contribution in the extended regression is 0.0448, which is much larger than the corresponding overall contribution in the basic regression (0.0003), and suggesting a total change of 0.0496. Again, the contribution to change from age, sex and employment status is $0.027 - 0.0496 = -0.0469$

As shown in Table 6, the between and within-group percentage contributions of migration/skill status to the level of inequality are lower in the extended regression than in the basic regression. The results imply that migration/skill 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/skill groups is, as expected, due to within-group inequality that can be attributed to age, sex and employment status.

Table 7 summarises the by-group decomposition of 1986-2013 inequality change from the sub-group and regression decomposition approaches. The calculations of the decomposition of inequality change by subgroup have been reproduced from Table 4, while those for the basic and extended regression decompositions have been copied from Table 6. Recall that the sub-group decomposition of change calculated with Eq. (3) is an approximate decomposition and therefore does 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* accounting for age, sex and employment status in the regression. Here the sum of the conditional group contributions to 1986-2013 inequality change greatly exceeds the total change in inequality. That is because, as noted above, changes in the population's composition in terms of age, employment status and gender had a downward effect on 1986-2013 inequality change. Ignoring this effect in the basic regression, the sum of the group contributions to change does equal the actual MLD change in inequality in the decomposition with the basic regression.

Table 7. Comparison of the group contributions to change in urban income inequality between 1986 and 2013 with the sub-group decomposition and regression decomposition approaches

	Sub-group decomposition of inequality change (approximation)			*Basic regression decomposition of inequality change*			*Extended regression decomposition of inequality change*		
	Contribution to between-group change	*Contribution to within-group change*	*Contribution to total change (approx.)*	*Contribution to between-group change*	*Contribution to within-group change*	*Contribution to total change (approx.)*	*Contribution to between-group change*	*Contribution to within-group change*	*Contribution to total change (approx.)*
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
M/LS Earlier Migrant	-0.0104	0.0049	-0.0055	-0.0087	-0.0111	-0.0198	-0.0074	-0.0021	-0.0095
HS Newly Arrived Migrant	0.0260	0.0109	0.0369	-0.0023	0.0080	0.0057	-0.0020	0.0066	0.0046
M/LS Newly Arrived Migrant	0.0112	0.0053	0.0165	-0.0022	0.0001	-0.0021	-0.0020	0.0007	-0.0013
Total of all migrant/skill status group contributions	**0.0148**	**-0.0082**	**0.0066**	**0.0024**	**0.0003**	**0.0027**	**0.0048**	**0.0448**	**0.0496**
Actual 1986-2013 change in MLD			0.0027			0.0027			0.0027
All High Skilled (HS)	0.2445	0.0733	0.3178	0.0106	0.0933	0.1039	0.0116	0.0795	0.0911
All Medium/Low Skilled (M/LS)	-0.2298	-0.0815	-0.3112	-0.0082	-0.0929	-0.1011	-0.0069	-0.0347	-0.0416
All non-migrants	-0.0962	-0.0558	-0.1520	0.0113	-0.0310	-0.0197	0.0119	0.0092	0.0211
All migrants	0.1109	0.0476	0.1586	-0.0089	0.0314	0.0224	-0.0072	0.0356	0.0285

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 (which has made a negative contribution to overall inequality change), the sum of the conditional-migrant group contributions to inequality change will not add up to overall inequality change. For definitions of the groups, see the notes below Table 1.

In general we find that high skilled workers have had an upward effect on the 1986-2013 increase in income inequality, irrespective of the decomposition method used. Additionally, both the between-group and within-group contributions of high skilled workers have been inequality increasing. Conversely, the total contribution of medium and low skilled workers to 1986-2013 inequality growth has been negative, irrespective of the decomposition method used (with Medium and Low Skilled Newly Arrived migrants the only exception). When considering between-group and within-group contributions to change separately, the signs for Medium and Low Skilled workers vary across decomposition methods and migration status groups.

When we combine all high skill groups in Table 7, we get a positive contribution to change of 0.3178 with the sub-group decomposition, 0.1039 with the basic regression and 0.0911 with the extended regression. Similarly adding all migrant groups (including the returning New Zealand born), we get a positive contribution to change of 0.1586 with the sub-group decomposition, 0.0224 with the basic regression and 0.0285 with the extended regression. We conclude that migration and upskilling of the labour force have both contributed to an increase in inequality in New Zealand. However, it is clear that the skill effect has been larger than the migration effect irrespective of the method used.

4. Conclusion

Using New Zealand data, we focus in this paper on the contribution of changes in population composition to changes in the distribution of personal income. Using two distinct decomposition methodologies, we contribute to the literature by examining two channels through which a group may affect the distribution of income in New Zealand, namely (i) the group size and group-relative mean income effect; and (ii) the within-group income distribution effect. We provide evidence on the role of migration and skills on the level and change in the distribution of income between 1986 and 2013 – a period of strongly growing immigration of both high skill and low skill workers, together with a general upskilling of the labour force. We find that differences across groups (between-group inequality) account for less than 10 per cent of overall inequality. Most of the observed level of inequality is due to within-group inequality.

In terms of the 1986-2013 change in inequality 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 changes in income of medium/low skilled groups were broadly inequality reducing.

The approach provided here could be usefully 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 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.

Our findings regarding the importance of within-group inequality change have implications for ongoing policy debates about growing income inequality, equity and wellbeing in New Zealand. Since we find that changes within groups make large contributions to income inequality trends, the focus of policy should be directed at programmes that not only provide safety nets for those at the bottom end of the distribution but also address negative externalities and downward effects on wellbeing of growing inequality within groups with similar observable characteristics (e.g. Oishi *et al*. 2011).

Our findings have also implications for migration policy in New Zealand especially since COVID-19 has virtually suspended almost all forms of working age migration to New Zealand. The onset of the COVID-19 pandemic led to closure of the New Zealand border. The provisional net migration gain of only 800 people in the year ended September 2021 is consequently a huge contrast compared with the record net migration gain of 92,000 in the March 2020 year and the average net gain of 56,000 over the previous seven September years (Statistics New Zealand, 2021). While net migration will undoubtedly increase again once the border reopens, the pandemic has triggered a review of immigration policies (NZPC, 2021e).

The findings suggest that any changes to the level and skill composition of future immigration – triggered by the anticipated 'reset' of New Zealand immigration policies when the border re-opens after the subsiding of the COVID-19 pandemic – will impact on future income inequality. Hence our decomposition approaches ought to be revisited after the 2023 census data become available to measure early effects of the new policies.

However, it is important to note that our study does not provide a comprehensive examination of the role immigrants play in the New Zealand society. We have just examined the compositional and within-group migrant specific distribution effects. Any comprehensive evaluation of immigration needs to include other wider benefits and costs of immigration including the fiscal, social and cultural capital contributions as well as any macroeconomic impacts from immigration.

Immigration has historically tended to be used primarily as a tool to address skill shortages of both high skilled and low skilled workers (NZPC, 2021e). This, and a wide within-group distribution of income, has made the contributions of immigrant groups to be inequality-increasing. Of course, other high skill groups, either expatriate New Zealanders (Returning New Zealand born) or high skilled New Zealand born have also been shown to make inequality increasing contributions to the changes in the inequality trends, which highlights the role that within-skill group changes play in the changes in the distribution of income. Thus policies to address growing inequality in New Zealand should focus on avenues of support to improve the re-distribution of post-tax income within-groups (for example focusing on monopsony, gender gaps, discrimination, pay exploitation etc.), as well as providing safety nets for those at the bottom end of the distribution.

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