More older people, less inequality? The effect of local age structure on income inequality within and between urban areas

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Abstract

Like in most of the developed world, New Zealand's population is ageing. The patterns of ageing have been well documented at both the national and sub-national levels but few studies have examined the effect of spatial differences in the population's age composition on the distribution of personal income within and between urban areas. There are various avenues by which the age structure may affect the distribution of income: the life-cycle profile of earnings plays an important role, but also the spatial-temporal distribution of income within the various age groups. By decomposing New Zealand census data from 1986 to 2013 by age and urban area, this paper examines the effects of population ageing on spatial-temporal changes in income distributions to better understand urban area-level income inequality (measured by the Mean Log Deviation index). We assess the role of demographic change in changing income inequality by means of two popular decomposition methodologies. We find that population ageing in New Zealand generally lowers income inequality while population re-distribution towards the largest, and most youthful, urban areas increases income inequality.

1 Introduction

This study examines the impact of spatial-temporal changes in age structure on sub-national income inequality in New Zealand from 1986 to 2013. The spatial unit of analysis is the urban area, which captures about 85 percent of the population. Using the Mean Log Deviation (MLD) measure, we compare results from two popular approaches- the population decomposition by sub-group approach used in Mookherjee and Shorrocks (1982) and the density decomposition approach of DiNardo, Fortin and Lemieux (1996). We exploit micro-level data from six successive censuses. This study differs from previous inequality decomposition studies in New Zealand. Firstly, the latter were conducted at the national level only.[3] The main reason for the national focus in previous work is the relatively small number of observations, and hence relatively large sampling errors at sub-national levels, in New Zealand sample surveys. We overcome this limitation in the present study by using data for urban areas from pooling the previous six Censuses of Population and Dwellings. Secondly, we focus specifically the role of changes in age structure on the distribution of income. This is an important topic because the ageing of the population is expected to accelerate in the decades to come.

While the international literature has pointed to economic factors are the biggest drivers of growing income inequality,[4] demographic factors have played a role as well.[5] In this analysis, we examine two different ways in which age structure could affect the distribution of income. Specifically, we focus on the:

- Age-composition effect (i.e. the age-shares)
- Age-specific income distribution effect.

2 Methodology

2.1 The Decomposition by population sub groups approach

Mookherjee and Shorrocks (1982) showed that changes in the class of the Generalised Entropy (GE) measures of income distribution can be decomposed into components which reflect: changes in sub-group inequality, shifts in the sub-group population shares and

[3] Hyslop and Maré (2005) , Ball and Creedy (2015)

[4] See for example Castells-Quintana, Ramos and Royuela (2015) for a review of the literature of the trends and determinants of income inequality in Europe.

[5] See e.g. Cameron (2000), Zhong (2011) and Piechl, Pestel and Schneider (2012).

relative variations in the sub-group mean incomes. The approximate decomposition of the MLD can be written as[6]:

$$\Delta MLD \approx$$

$$\underbrace{\sum_{j=1}^{J} \overline{\pi}_j \Delta \mathrm{MLD}_j}_{\substack{within-group\ inequality\ change\ A}} + \underbrace{\sum_{j=1}^{J} \overline{MLD_j} \Delta \pi_j}_{\substack{age\ share\ effect\ on\ within-group\ inequality\ B}} + \underbrace{\sum_{j=1}^{J} \left(\overline{R_j} - \overline{LogR_j}\right) \Delta \pi_j}_{\substack{Age\ share\ effect\ on\ Between-group\ inequality\ C}} + \underbrace{\sum_{j=1}^{J} (\overline{\pi_j R_j} - \overline{\pi_j}) \Delta \log \mu_j}_{\substack{Relative\ change\ in\ sub-group\ mean\ effect\ D}}$$

The components with the bar above represent an average over two periods.[7] The sum of B and C gives us the contribution of changes in age structure while the sum of A and D represents the contribution of changes in the age-specific income distribution.

2.2 Density Decomposition Approach

This approach uses a re-weighting procedure to create counterfactual densities based on holding the age-composition or the age-specific distribution constant. Let $f_Y(y;x) = \int f_{Y|X}\, dF_X$ represent the general distribution of income with respect to age in an urban area.[8] The impact of age structure on the overall distribution of income could be through either a composition effect i.e. changes in dF_X^A or changes in the age-specific conditional distribution of income $f_{y|x}^A$.

We use the density decomposition approach to assess the effect of inter-temporal changes in the age structure as well as the effect of spatial differences in the age structure. Let:

- $f_{(y)}^A = \int f_{y|x}^A\, dF_X^A$ represents the actual distribution of income in A based on A's conditional age-specific distribution ($f_{y|x}^A$) and A's shares of people in each age group (dF_X^A);

[6] In another working paper, Alimi et al. (forthcoming) we test the sensitivity of the approach to the choice of inequality measure.

[7] π_i refer to the share of group *i* in the population, R_i refer to the natural logarithm of the income of group *i* relative to the overall mean income μ. $\overline{\pi_j} = \frac{1}{2}(\pi_{jt} + \pi_{jt+1})$ and $\overline{MLD_j}$ and $\overline{Log(R_j)}$ also similarly defined.

[8] For a specific urban area in New Zealand, for example Ashburton (A), the income distribution is given by: $\mathrm{f_Y^A(y;x)} = \underbrace{\int \mathrm{f_{y|x}^A}}_{\substack{age-specific\ conditional\ distibution}} \underbrace{\mathrm{dF_X^A}}_{\substack{Compositional\ or\ shares\ effect}}$ which represent the overall distribution of income with respect to X such that X could be a vector of all the age groups in Ashburton from youngest to oldest. The integral sign is used to depict aggregate income with respect to the attributes X. When X is a discrete variable, this can be represented as $\sum \mathrm{f_{Y|X}}\ \phi_{\mathrm{X}}$ where $\phi = \mathrm{Prob(X = x)}$. X is a factor such as age, Y represents total income and y and x represent individual incomes and individual attributes respectively.

- $f_{(y)}^{N} = \int f_{y|x}^{N}\, dF_X^N$ represents the actual national distribution of income based on national age-specific conditional distribution of income ($f_{y|x}^{N}$) and national shares of people in each age group (dF_X^N);
- $\check{f}_{(y)}^{N|A} = \int f_{y|x}^{N}\, dF_X^A = \int f_{y|x}^{N}\, dF_X^N . \frac{dF_X^A}{dF_X^N}$ represents a counterfactual distribution of income in A based on national age-specific conditional distribution of income($f_{y|x}^{N}$) but A's shares of people in each age group (dF_X^A);
- $\check{f}_{(y)}^{A|N} = \int f_{y|x}^{A}\, dF_X^N = \int f_{y|x}^{A}\, dF_X^A . \frac{dF_X^N}{dF_X^A}$ represents a counterfactual distribution of income in A based on A's age-specific conditional distribution of income ($f_{y|x}^{A}$) but national shares of people in each age group (dF_X^N).
- $f_{(y)}^{N86|N86} = \int f_{y|x}^{N86}\, dF_X^{N86}$ represents the actual 1986 distribution of incomes and $f_{(y)}^{N13|N13} = \int f_{y|x}^{N13}\, dF_X^{N13}$ represents the actual 2013 distribution of income
- $\check{f}_{(y)}^{N13|N86} = \int f_{y|x}^{N13}\, dF_X^{N86}$ represents a 1986 counterfactual distribution, based on 1986 shares of people in each age group but 2013 age-specific conditional distribution of incomes.

2.2.1 Inter temporal changes –age composition and age-specific distribution effect

To examine the effect of inter-temporal changes in the age structure, we compare $\mathrm{f}_{(y)}^{N13}$ to its counterfactual distribution $\check{f}_{(y)}^{N13|N86}$. This estimates the effect of the changes in the population composition between 1986 and 2013 while holding the age-specific conditional distribution constant. Conversely, to estimate the effect of changes in the age-specific conditional distribution, we compare the counter factual distribution $\check{f}_{(y)}^{N13|N86}$ to the 1986 original distribution $\mathrm{f}_{(y)}^{N86}$. The difference in these distributions can be displayed graphically or alternatively through the calculation of inequality measures. We can write changes in MLD between 1986 and 2013 as

$$\Delta MLD = MLD\left(f_{(y)}^{N86}\right) - MLD\left(f_{(y)}^{N13}\right)$$

$$= \left[\underbrace{MLD\left(f_{(y)}^{N86}\right) - MLD\left(\check{f}_{(y)}^{N86|N13}\right)}_{AC}\right] + \left[\underbrace{MLD\left(\check{f}_{(y)}^{N86|N13}\right) - MLD\left(f_{(y)}^{N13}\right)}_{ASD}\right]$$

Where: the first component AC represents the age composition effect while the second component ASD shows how, contribution of changes in age-specific distribution.

2.2.2 Spatial differences - age composition and age-specific distribution effect

We estimate the role variations in age composition and age-specific distribution effect play in the differences across areas. All urban areas are benchmarked to the national distribution. The age composition effect for each area can be calculated by comparing the actual distribution of that area to the counterfactual distribution i.e. $f_{(y)}^{A} - \check{f}_{(y)}^{A|N}$. While the age-specific distributional effect is the difference between the area counterfactual distribution and the national distribution. i.e.$\check{f}_{(y)}^{N|A} - f_{(y)}^{N}$, it should be noted that the calculation of the effect of the changing age composition on inequality can be done separately for every urban area. Of particular interest is then the extent to which the age composition effects plays a greater or lesser role in explaining inequality change in certain areas and whether the sign of the effect (positive or negative) is the same in all areas.

3 Findings

3.1 The effect of inter-temporal changes in age structure using the population decomposition by sub group approach

The results of the decomposition of the changes in the MLD between 1986 and 2013 are reported in Table 1 below:

	Contribution to changes in MLD between 1986 and 2013				Total change	Age share effect = B+C
Age group	A	B	C	D		
15-24	0.0232	-0.0327	-0.0874	-0.0433		
25-44	-0.0135	-0.0138	-0.0400	0.0676		
45-64	0.0143	0.0280	0.0862	0.0748		
65+	0.0172	0.0060	0.0313	-0.0577		
Sum	0.0412	-0.0125	-0.0099	0.0414	0.0603	-0.0223

Table 1: Contribution to changes in Mean Log Deviation between 1986 and 2013 by age group

We find a negative effect for the role of changes in the age structure. Had everything else been the same, the MLD would have decreased by 0.0223 MLD points due to the changes in the population composition from 1986 and 2013.

3.2 Density Decomposition- DFL

3.2.1 The effect of inter-temporal changes in age structure on the distribution of income

DFL	2013OD	2013CF	1986OD	Age share effect = 2013OD-2013CF	Age specific distribution effect= 2013CF-1986OD	Total change= 2013OD-1986OD
MLD	0.4153	0.4448	0.3509	-0.0295	0.0939	0.0644

Table 2: Estimates of age share and age- specific distributional effect using MLD

In line with the population decomposition by sub-group approach, we find that the age composition has contributed negatively to the overall change in inequality. Specifically, had everything else remained the same, the changes in the age structure (ageing of the population) from 1986 to 2013 would have led to lower income inequality. If the age structure had remained at the younger 1986 levels, the MLD would have been 0.03 MLD points higher.

New Zealand has a universal non-means tested superannuation policy which may be the primary factor responsible for this result. This social welfare policy seems to have an inequality-reducing effect as the proportion of the older population increases. However, recent trends of increases in the labour force participation of the 65+ may widen the distribution of income in the older age groups and reverse this effect.

3.2.2 The effect of spatial differences in age structure on observed local level distribution of income

We focus on the 1986 (initial year) and 2013 (final year) to examine the role of spatial differences.[9] Figures 1 and 2 present a scatter plot of the age composition effect and age-specific distribution effect for each of the 40 urban areas in 1986 and 2013.[10] We find that spatial differences in age composition do not account for a significant proportion of the observed differences in inequality between each urban area and the national level. As indicated in previous studies such as Alimi et al. (2016), there is a contrast in the experience of metropolitan and non-metropolitan areas, with inequality rising faster in the large metropolitan areas. We investigate what role age structure of these areas has to play. Large

[9] Full results for each urban area in each Census period are available in the forthcoming working paper.
[10] The 45 degrees line represents national inequality.

metropolitan areas have a youthful population and if lower inequality is associated with the ageing of the population then the presence of a high proportion of youth people may be contributing the rise of inequality in the metropolitan areas.

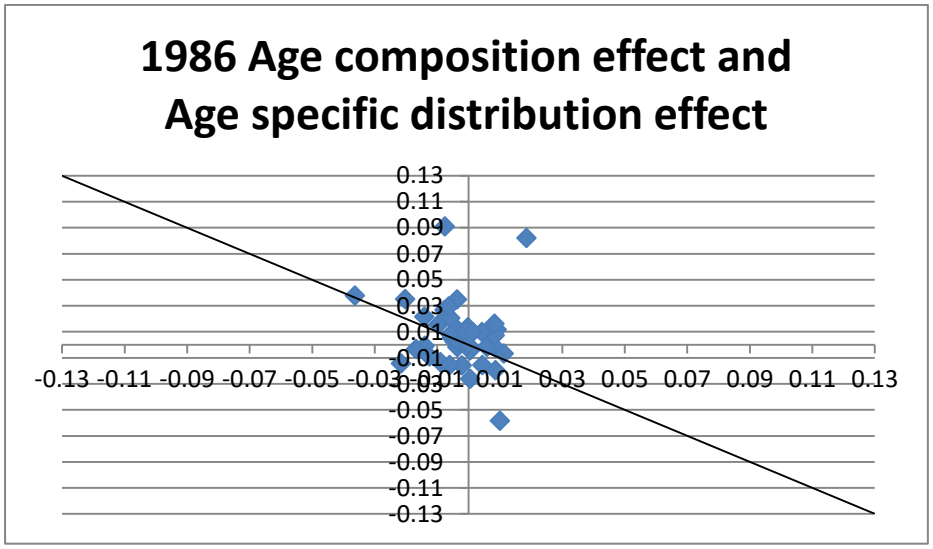

Figure 1: Age composition and Age Specific Distribution Effect for Urban Areas in 1986

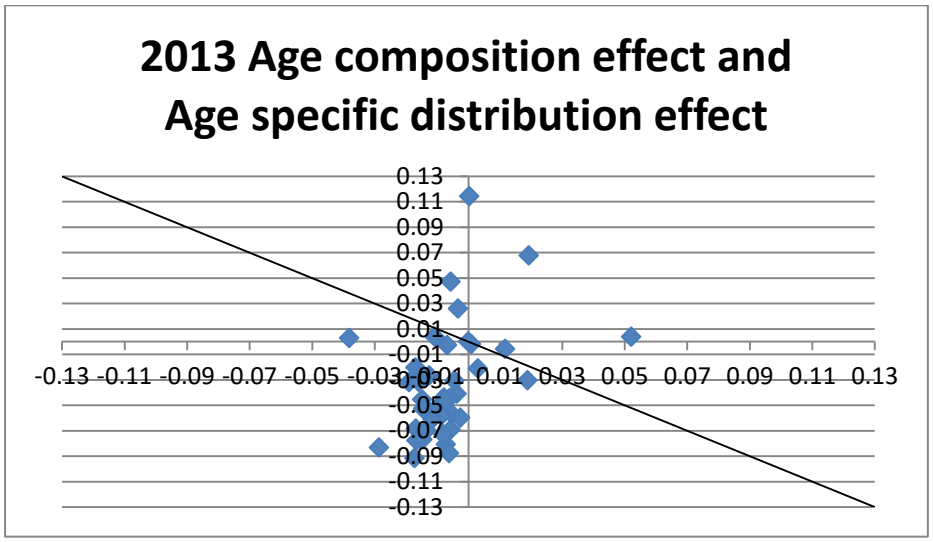

Figure 2: Age composition and Age Specific Distribution Effect for Urban Areas in 2013

If the effect of ageing is to lead to less inequality then in a cross-section we should find negative association between the level of ageing in an area and inequality. We use a self-defined measure to classify if an urban area is older or younger than the national. We use the following criteria to classify urban areas:

- An area is said to be 'older than national' if the proportion of people in the 45-64 and 65+ group are higher than national and the 15-24 are lower than national.

- An area is said to be 'younger than national' if the proportion of people in in the 45-64 and 65+ group are lower than national and the proportion 15-24 are higher than national.
- Any area that does not fall under any of these two conditions is defined as unclear

Table 3 presents information on the urban areas that have higher than national level inequality and their age classification for each Census period.

Year	No of UAs with higher than national	Number classified as younger than national	Number classified as older than national	Unclear from condition
1986	25	7	10	8
1991	14	4	5	5
1996	9	3	2	4
2001	7	4	0	3
2006	6	3	0	3
2013	6	4	1	1

Table 3: UA level of inequality and age structure classification

The table shows a positive association between areas with higher inequality and a younger age structure. It seems that the increase in income inequality in the largest urban areas are further accelerated by the redistribution of the younger population towards these areas

4 Conclusion

We examined the effect of changes in the age structure in New Zealand using two popular approaches in the literature. Our main finding is that, contrary to studies in other countries, the ageing of the population in New Zealand has slowed down inequality growth.[11] We envisage that the New Zealand result is driven by the relatively generous national superannuation (pension) which is not income or wealth tested.[12] At the sub-national level, we find a very small impact of spatial differences in local age structure on income inequality but find that changes in the age-structure towards being younger contributes to greater income inequality.

[11] For example, studies like Deaton and Paxson (1994) and Cameron (2000) found that population ageing increases inequality.

[12] To be eligible, New Zealand residents must have lived in New Zealand for at least 10 years since they turned 20. Five of those years must be since they turned 50. However, the residency rule does not apply to those countries with which New Zealand has a social security agreement.

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