Revisiting income inequality within and between New Zealand’s regions:

Analysis of 1986-2013 Census data

David C. Maré; Omoniyi Alimi; Jacques Poot

Pathways conference, Wellington, 24 July 2015
Income-inequality trends

- By most measures, income and earnings inequality in NZ increased markedly from mid-1980s to mid-1990s
  - Perry (2014); OECD (2011); Gould (2008); Hyslop & Yanapath (2006); Hyslop & Maré (2005); Easton (1996)

- Since then, inequality has been relatively stable, remaining high

- Currently (2010), NZ inequality is above OECD average (13th highest of 34)

- Public debate has focused on 1986-2006
  - Rashbrooke (2013) Inequality: A NZ Crisis
  - Concerns about poverty in particular

Source: Perry (2014, p. 187) [Equiv disp hh inc]
Spatial income-inequality

• Until recently, relatively little attention to NZ regional variation

• This study updates and extends previous work: Karagedikli *et al* (2000, 2003); Smith (2000)
  – Examined 1981-1996 regional incomes
    • By gender; FT employed v all adults
  – Between regions: Mean income by region
    • Stronger real income growth in Auckland and Wellington
    • Convergence among ‘heartland’ regions
  – Within regions: Inequality within regions
    • Increased 1986-1996

• Dual interest:
  – distributional patterns, *and*
  – regional labour market adjustment
Measuring inequality

- No unique best measure. We focus on the Theil index

\[ T = 100 \times \frac{1}{N} \sum_{i=1}^{N} \frac{y_i}{\bar{y}} \ln \left( \frac{y_i}{\bar{y}} \right) = 100 \times \sum_{i=1}^{N} \lambda_i R_i \]

where \( \lambda_k = \text{income share} = \frac{y_k}{\bar{y}}\); \( R_k = \text{log relative mean income} = \ln(\frac{\bar{y}_k}{\bar{y}})\)

- \( T \) is decomposable: for groups \( j=1, \ldots, J \):

\[ T = 100 \times \left( \sum_{j=1}^{J} \lambda_j T_j + \sum_{j=1}^{J} \lambda_j R_j \right) \]

\( W=\text{within-group} \quad B=\text{between-group} \)

- Change is decomposable

\[ \Delta T = \sum_{j=1}^{J} \lambda_j \Delta T_j + \sum_{j=1}^{J} \lambda_j \Delta R_j + \sum_{j=1}^{J} \Delta \lambda_j (T_j - \bar{T}) + \sum_{j=1}^{J} \Delta \lambda_j (R_j - \bar{R}) \]

\( W=\text{within-group inequality change} \quad B=\text{between-group relative income change} \quad \text{composition change (inequality)} \quad \text{composition change (relative income)} \)
Census income data

- Gross personal income from all sources
- We use data for broad cross-classifications of:
  - 16 regions, 4 age groups (15-24; 25-54; 55-64; 65+), sex, employment status (FT employee, Other FT, Other employed, Unemp, NILF)

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. The results presented in this study are the work of the author, not Statistics NZ.

- Income data are reported in bands
  - Band definitions are census-specific
  - We convert band boundaries from nominal to real ($2013), using CPI for the prior September quarter

- Three challenges
  - Zero and negative incomes
  - Within-band variation
  - Top-coding
Census income data

- Data at midpoints
- Data spread in bands
- Kernel density
- Kernel density for adjusted income
A map of the analysis

Cross-sectional
- Anatomy of inequality

Changes over time
- What has contributed to changing inequality?
## Income patterns by year

<table>
<thead>
<tr>
<th>Year</th>
<th>Population 15+</th>
<th>Mean income ($2013)</th>
<th>Inequality (Theil)</th>
<th>Inequality (Gini)</th>
<th>% with income &lt;$1</th>
<th>% in top bracket</th>
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<td>2006</td>
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<td>2013</td>
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<td>Total</td>
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<td>38.1</td>
<td>46.4</td>
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![Graph showing income trends](image-url)
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<td>12.6</td>
<td>13.6</td>
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<td>87.4</td>
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<td>Sex (2) between</td>
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<td>31</td>
<td>31.6</td>
<td>30.1</td>
<td>32.3</td>
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</table>
Convergence of relative income and of inequality (All adults)
Labour force status contributions to regional inequality change (All adults)

1986-2001
- Differences of degree
- Within-group
  - Stronger Akld/Wgtn rises in inequality within FT non-employees

2001-2013
- Within group
  - Stronger inequality rise for FT employees in Auckland
- Between group
  - Auckland: Stronger rises in relative income for FT employees
Changes by labour force group

Unemp
NILF

FT Employees
NILF

FT Non-Employees

FT Employees

FT Non-Employees

Unemp
NILF

FT Employees
NILF

FT Non-Employees

Unemp
NILF
# Income patterns by year (FT employee)

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Mean income ($2013)</th>
<th>Inequality (Theil)</th>
<th>Inequality (Gini)</th>
<th>% with income &lt;$1</th>
<th>% in top bracket</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>1,017,432</td>
<td>$44,000</td>
<td>12.8</td>
<td>27.4</td>
<td>0%</td>
<td>1%</td>
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<tr>
<td>1991</td>
<td>889,155</td>
<td>$45,000</td>
<td>14.0</td>
<td>28.6</td>
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<td>1996</td>
<td>913,296</td>
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<td>17.5</td>
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<td>1%</td>
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<tr>
<td>2001</td>
<td>969,336</td>
<td>$49,000</td>
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<td>32.1</td>
<td>0%</td>
<td>3%</td>
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<td>2006</td>
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<td>2013</td>
<td>1,199,109</td>
<td>$57,000</td>
<td>17.8</td>
<td>32.1</td>
<td>0%</td>
<td>3%</td>
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<tr>
<td>Total</td>
<td>1,036,341</td>
<td>$50,000</td>
<td>16.2</td>
<td>30.5</td>
<td>0%</td>
<td>3%</td>
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![Graph showing income patterns from 1980 to 2020](image)
## Inequality within & between regions (FT Employee)

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<tbody>
<tr>
<td>Theil</td>
<td>12.8</td>
<td>14.0</td>
<td>17.5</td>
<td>18.2</td>
<td>16.7</td>
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<td>Region (16)</td>
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<td>within</td>
<td>98.5</td>
<td>96.9</td>
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<td>97.4</td>
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<tr>
<td>between</td>
<td>1.5</td>
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<td>Sex (2)</td>
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<tr>
<td>within</td>
<td>89.6</td>
<td>92.9</td>
<td>94.2</td>
<td>95.9</td>
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<tr>
<td>between</td>
<td>10.4</td>
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<td>Age Group (4)</td>
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<tr>
<td>within</td>
<td>83.5</td>
<td>85.8</td>
<td>86.6</td>
<td>88.4</td>
<td>87.8</td>
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<td>11.6</td>
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</tbody>
</table>
Convergence of relative income and of inequality (FT Employee)
Age contributions to inequality (FT Employee)

1986-2001
- (small) differences of degree

2001-2013
- Within group
  - Auckland: Stronger inequality rise within 25-54 and 15-24
  - Auckland: Stronger inequality rise for 55-64 in Auckland and Wellington
- Between group
  - Relative income gains for 55-64 and 65+ groups
- Composition
  - Auckland had relatively strong FT employment growth for 25-54 and 15-24, consistent with population growth

Contributions to 1986-2001 inequality change: age effects

Contributions to 2001-2013 inequality change: age effects
Changes by age group
Summary

• Inequality rose between 1986-2001 and has remained high and relatively stable since then
• Between region differences contribute little
  – Overall income convergence between regions since 2001
  – Inequality divergence since 2001
    • Auckland high and increasing;
    • relatively stable regional differences for FT employees
      – In balance?
• Auckland (and Wellington) look different
  – Most of difference is ‘within-group’ (age, sex, LF status)
  – Highest relative income
  – High inequality (since 2001)
• Age effects are evident
  – Relative income gains for 55+ groups – for ‘all adults’, as well as for ‘FT employees’
  – 25-54: declining FT inequality only in Wgtn.
  – 55-64: rising ‘all 55-64’ inequality only in Akld; rising FT inequality in Auckland & Wellington
Sump

• Below here:
  – Extra slides
  – Slides probably to be discarded
Challenges using banded data

• Challenge 1: within-bracket income variation
  – Assign people to bracket midpoint

• Challenge 2: zero/ negative incomes
  – Merge these into first positive bracket
    • and adjust lower bound so that implied midpoint matches independent estimates of the mean of the lower tail
      – Lower bound set to zero when looking only at FT employed because less than 0.2% of FT employed individuals report zero income
    • Previously, restrict attention to positive incomes
Challenges using banded data

- Challenge 3: Midpoint for top bracket
  - Fit a Pareto distribution to the upper tail (using two top uncensored brackets)
  - The proportion of people with incomes above $\tilde{Y}$ is a (relatively) simple function of $\tilde{Y}$ and an estimated parameter ($\alpha$)
    \[ 1 - F(\tilde{Y}) = A\tilde{Y}^{-\alpha} \]
  - Different $\alpha$ for each sub-distribution
    - Preferred approach but compromises exact decomposition

  - Use $\alpha$ to create a robust midpoint estimate [von Hippel et al (2014)] as a function of the lower bound (L) of top bracket
    \[ Med(L) = L \times 2^{1/\alpha} \]
  - Less volatile than commonly used $Mean(L) = L \times \frac{\alpha}{\alpha-1}$
  - Robustness important when analysing smaller subgroups
  - ‘Median’ estimate matches external estimates of the mean of the top bracket very well.
  - Estimated inequality is slightly higher if we use other methods
Age contributions to regional inequality change (All adults)

1986-2001
• Differences of degree

2001-2013
• Within group
  – Auckland: Stronger inequality rise within each age group except 65+
  – Inequality declines in Wgtn & other for 25-54 and 55-64
• Between group
  – Big relative income rises for 55-64 group across all 3 regions
  – Auckland: Rise in relative income of 25-54
• Composition
  – Auckland had relatively strong population growth for 25-54 (low inequality) and 15-24 (high inequality)
Changes by age group

Ineq: Theil

R: RelInc

_Auc_1524 theil
_Auc_2554 theil
_Auc_5564 theil
_Auc_6599 theil
_Wel_1524 theil
_Wel_2554 theil
_Wel_5564 theil
_Wel_6599 theil
_Oth_1524 theil
_Oth_2554 theil
_Oth_5564 theil
_Oth_6599 theil

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_Auc_1524 Nsh
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_Auc_5564 Nsh
_Auc_6599 Nsh
_Wel_1524 Nsh
_Wel_2554 Nsh
_Wel_5564 Nsh
_Wel_6599 Nsh
_Oth_1524 Nsh
_Oth_2554 Nsh
_Oth_5564 Nsh
_Oth_6599 Nsh
Sex contributions to inequality (All adults)

1986-2001
• Differences of degree

2001-2013
• Within group
  – Auckland: Stronger inequality rise for both men and women
  – Slight fall in within-group inequality outside Auckland and Wellington
• Composition
  – ‘Other’ regions maintained lower ratio of women to men
  – Wellington is most feminised

Contributions to 1986-2001 inequality change: Sex effects

Contributions to 2001-2013 inequality change: sex effects
Changes by sex

**Pop share**

<table>
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<th>Year</th>
<th>_Auc_M Nsh</th>
<th>_Auc_F Nsh</th>
<th>_Wel_M Nsh</th>
<th>_Wel_F Nsh</th>
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**Pop share (FTE)**

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**Ineq: Theil (FTE)**

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**R: RelInc (FTE)**

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</table>
A map of the analysis

- Gross personal income distribution
  - All adults
  - FT EMPLOYEE
    - REGION
      - WITHIN REGION INEQUALITY
        - Age
        - Sex
      - Between region inequality
        - Employment status

Cross-sectional
- Anatomy of inequality

Changes over time
- What has contributed to changing inequality?
Sex contributions to inequality (FT Employee)

1986-2001
- Differences of degree.
- Within group
  - Wellington had the strongest within-group inequality increase, for both men and women
- Composition
  - Convergence of sex ratio – still least balanced in ‘other’ regions

2001-2013
- Within group
  - Auckland is very different: Increased inequality within both men and women (for men only in Wellington
  - ‘Other’ regions had small declines in inequality for both
- Composition
  - Wellington and Auckland are closest to gender-balanced
Changes by sex

![Graphs showing changes by sex over time](image-url)
Inequality within & between regions
Inequality within & between regions (FT Employed)

Graphs by gph_code
Future work

• The Palma index
  – Ratio of income shares of [Top decile] v [bottom 4 deciles]

Other sources of population diversity