National Institute of Demographic and Economic Analysis
Te Rūnanga Tātari Tatauranga

Motu

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

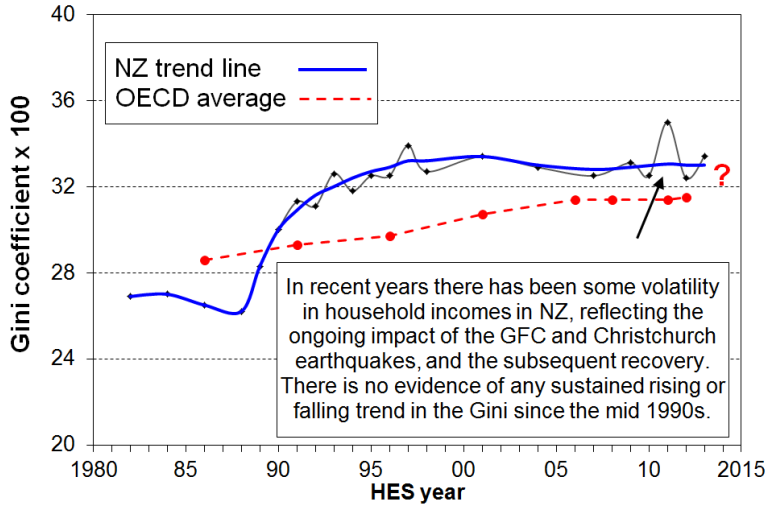
Nga Tangata Oho Mairangi

Tai Timu Tangata

CaDDANZ
Capturing the Diversity Dividend of Aotearoa/New Zealand

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
  - Eaqub (2013) *Growing apart*; Johnson (2015) *Mixed fortunes*
- 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

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

where $\lambda_k = income\ share = \frac{Y_k}{Y}$; $R_k = log\ relative\ mean\ income = \ln(\frac{\overline{y_k}}{\bar{y}})$

- T is decomposable: for groups *j=1, .. , J:*

$$T = 100 * \left(\underbrace{\sum_{j=1}^{J} \lambda_j T_j}_{W=within-group} + \underbrace{\sum_{j=1}^{J} \lambda_j R_j}_{B=between-group} \right)$$

- Change is decomposable

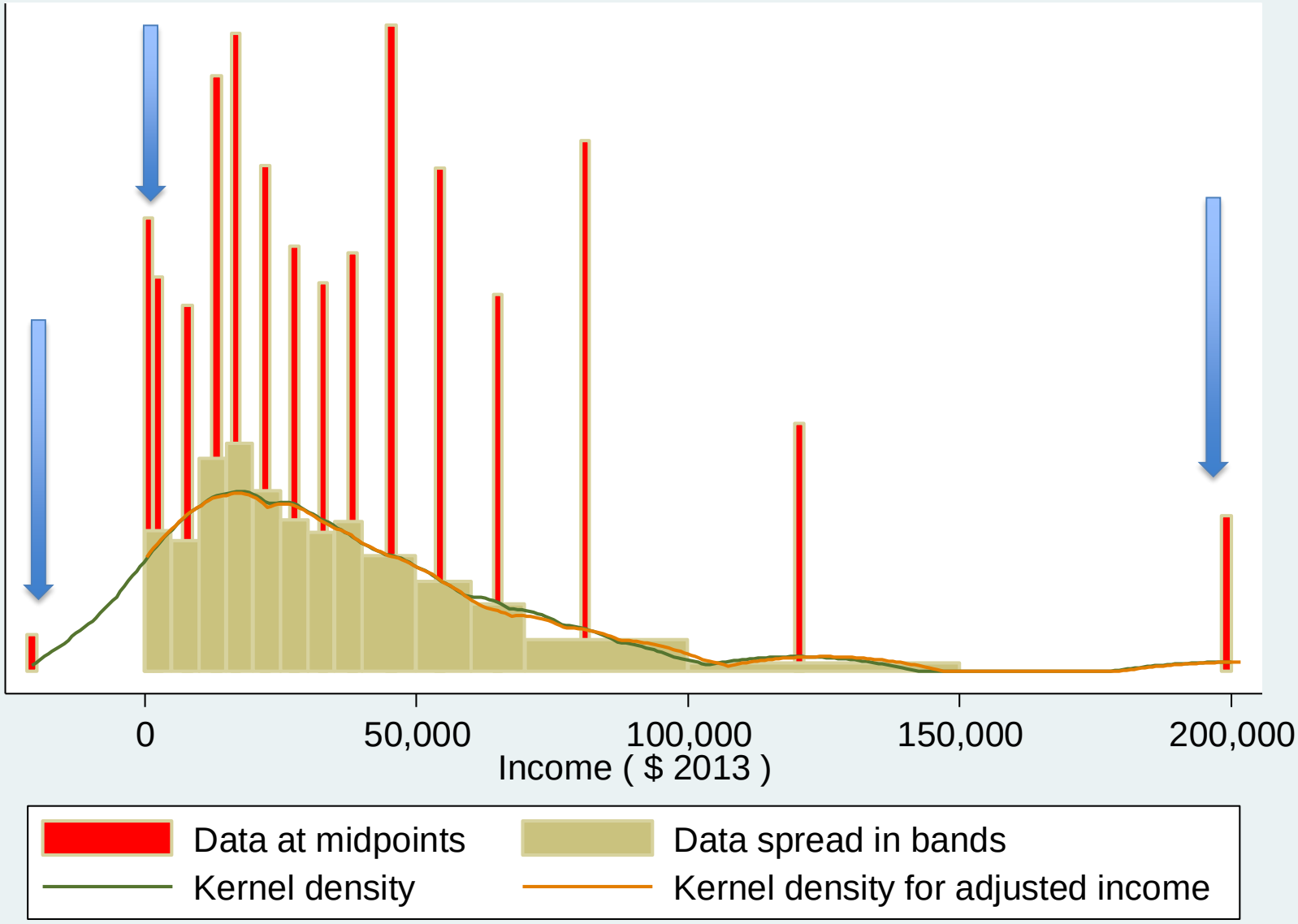
$$\Delta T = \underbrace{\sum_{j=1}^{J} \bar{\lambda}_j \Delta T_j}_{\substack{within-group \\ inequality \\ change}} + \underbrace{\sum_{j=1}^{J} \bar{\lambda}_j \Delta R_j}_{\substack{between-group \\ relative\ income \\ change}} + \underbrace{\sum_{j=1}^{J} \Delta\lambda_j (\bar{T}_j - \bar{T})}_{\substack{composition\ change \\ (inequality)}} + \underbrace{\sum_{j=1}^{J} \Delta\lambda_j (\bar{R}_j - \bar{R})}_{\substack{composition\ change \\ (relative\ income)}}$$

Census income data

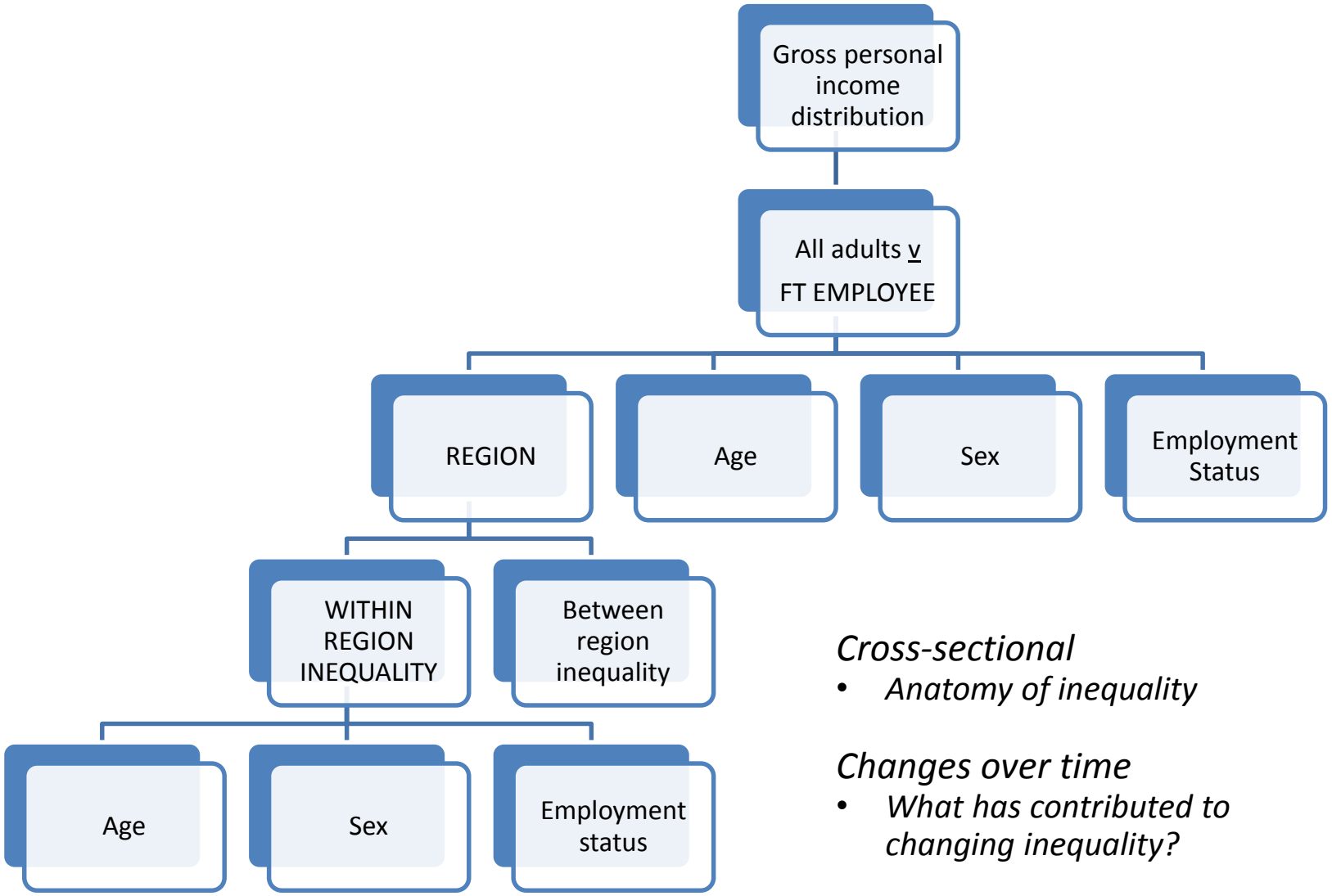
- Gross personal income from all sources
- We use data for broad cross-classifications of:
  - 16 regions, 4 age groups (15-24; 25-54; 55-64; 65+), sex, employment status (FT employee, Other FT, Other employed, Unemp, NILF)
  - Non-standard tabulations of census data from 1986, 1991, 1996, 2001, 2006, 2013

  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



A map of the analysis



Cross-sectional

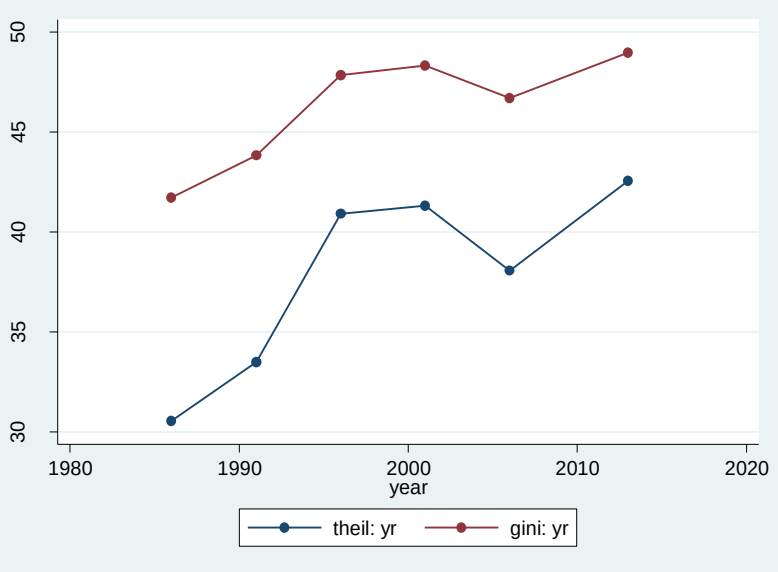
- *Anatomy of inequality*

Changes over time

- *What has contributed to changing inequality?*

Income patterns by year

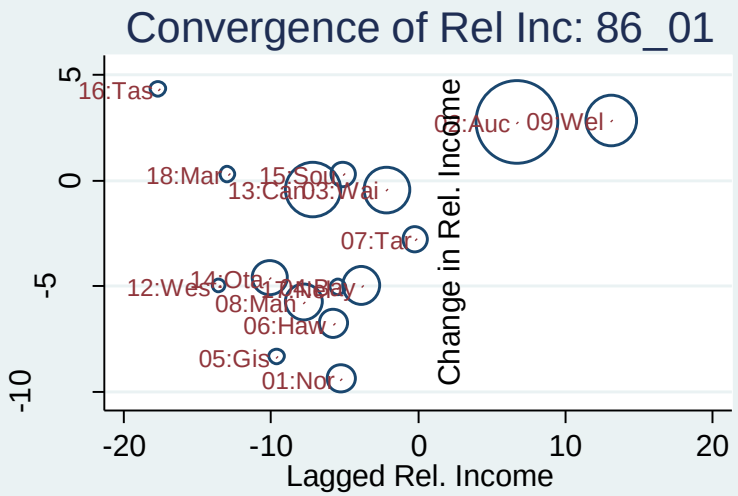
Year	Population 15+	Mean income ($2013)	Inequality (Theil)	Inequality (Gini)	% with income <$1	% in top bracket
1986	2,280,441	$33,000	30.5	41.7	3%	1%
1991	2,410,923	$31,000	33.5	43.8	4%	2%
1996	2,483,394	$33,000	40.9	47.8	5%	2%
2001	2,526,552	$35,000	41.3	48.3	5%	2%
2006	2,791,989	$39,000	38.1	46.7	5%	4%
2013	3,000,777	$39,000	42.6	49.0	7%	2%
Total	2,605,095	$35,000	38.1	46.4	5%	2%

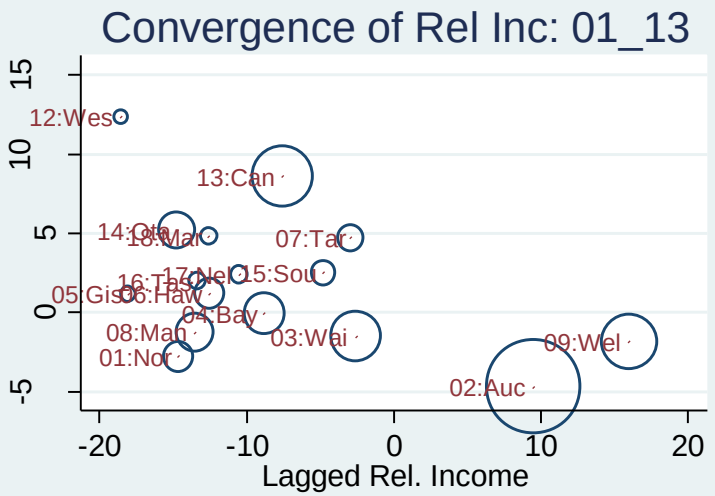


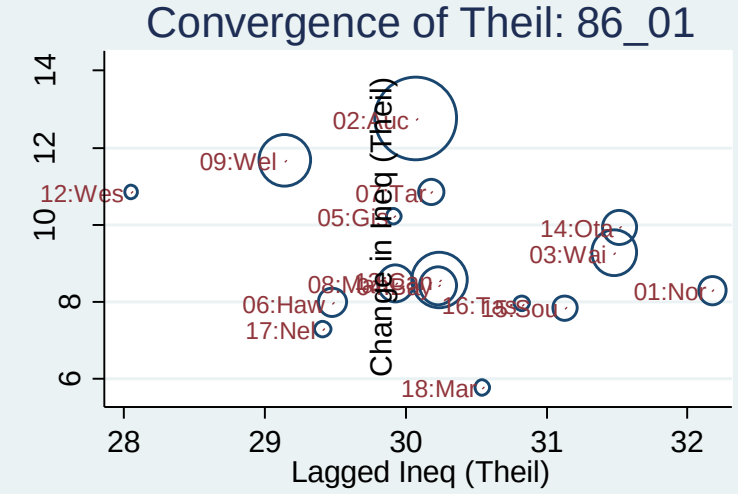
Inequality within & between regions

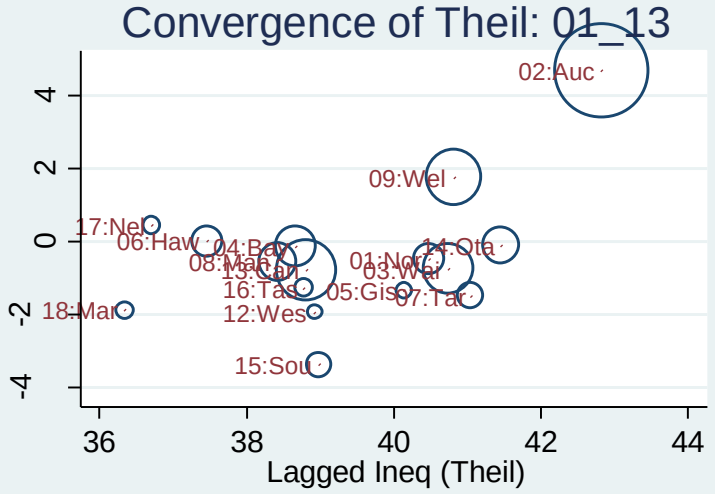
		1986	1991	1996	2001	2006	2013
Theil (NZ)		30.5	33.5	40.9	41.3	38.1	42.6
Region (16)	within	98.9	98.4	98.7	98.6	98.8	99.1
	between	1.1	1.6	1.3	1.4	1.2	0.9
Age Group (4)	within	91.5	88.2	87.4	86.4	85.7	85.4
	between	8.5	11.8	12.6	13.6	14.3	14.6
Sex (2)	within	84.4	90.8	91.4	93.4	93.5	95
	between	15.6	9.2	8.6	6.6	6.5	5
LF status (5)	within	68.7	66.8	69	68.4	69.9	67.7
	between	31.3	33.2	31	31.6	30.1	32.3

Convergence of relative income and of inequality (All adults)









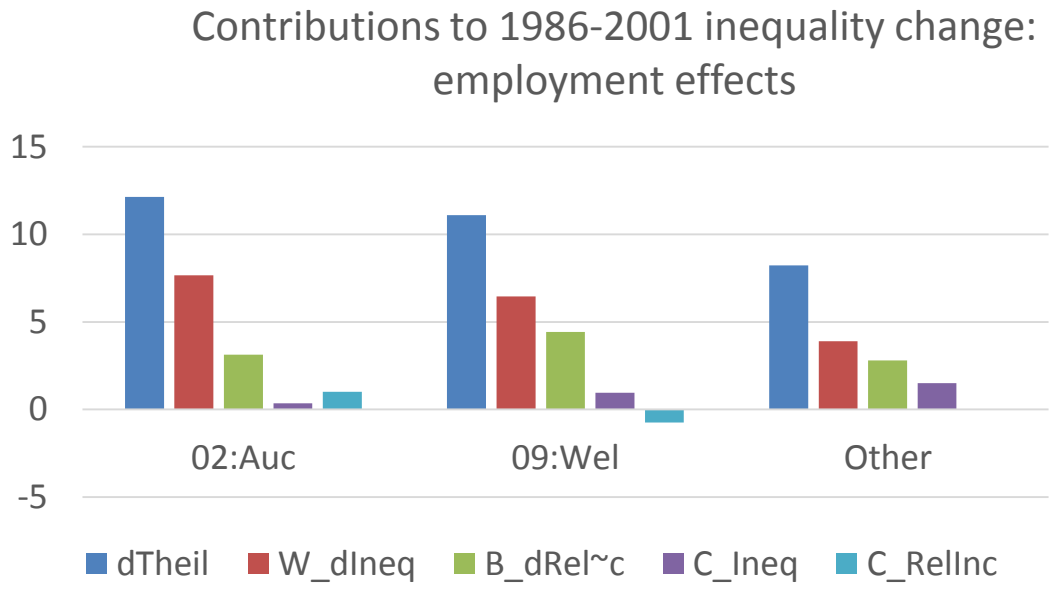
Labour force status contributions to regional inequality change (All adults)

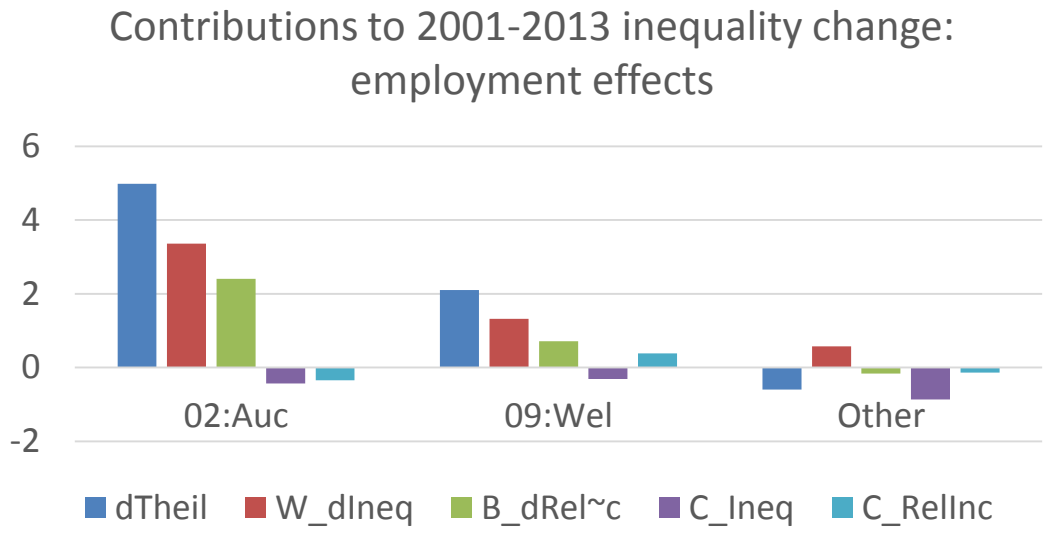
1986-2001

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

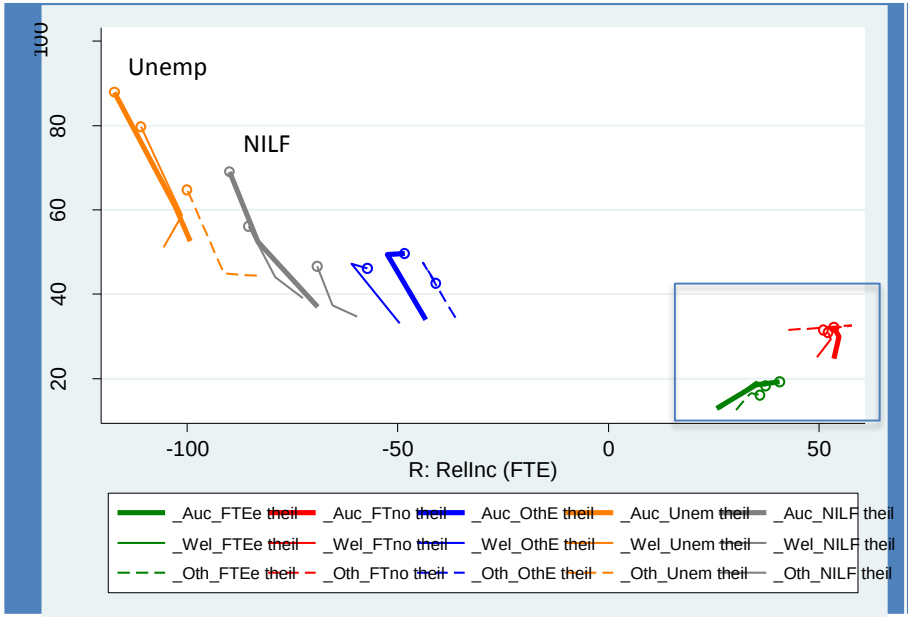
2001-2013

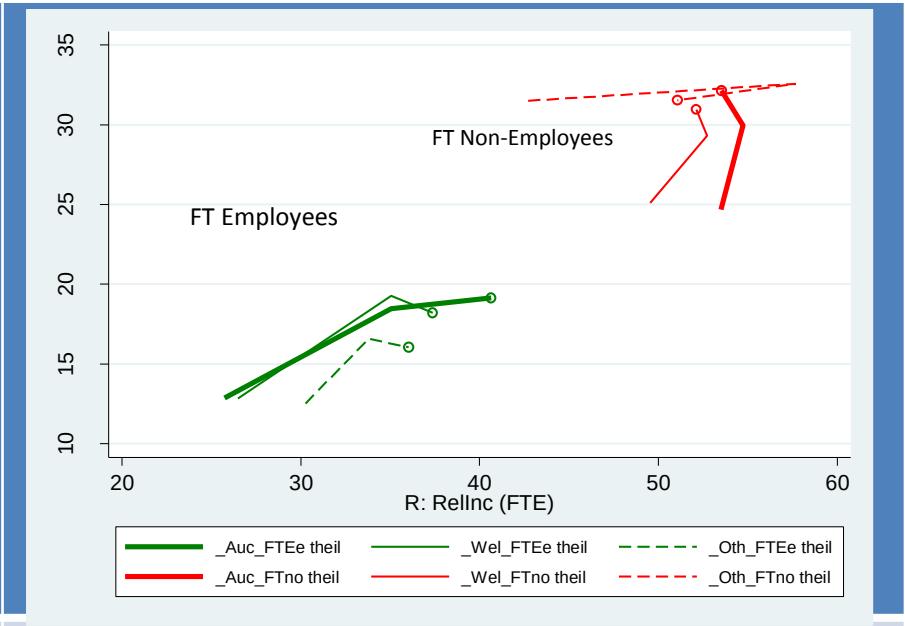
- Within group
  - Stronger inequality rise for FT employees in Auckland
- Between group
  - Auckland: Stronger rises in relative income for FT employees

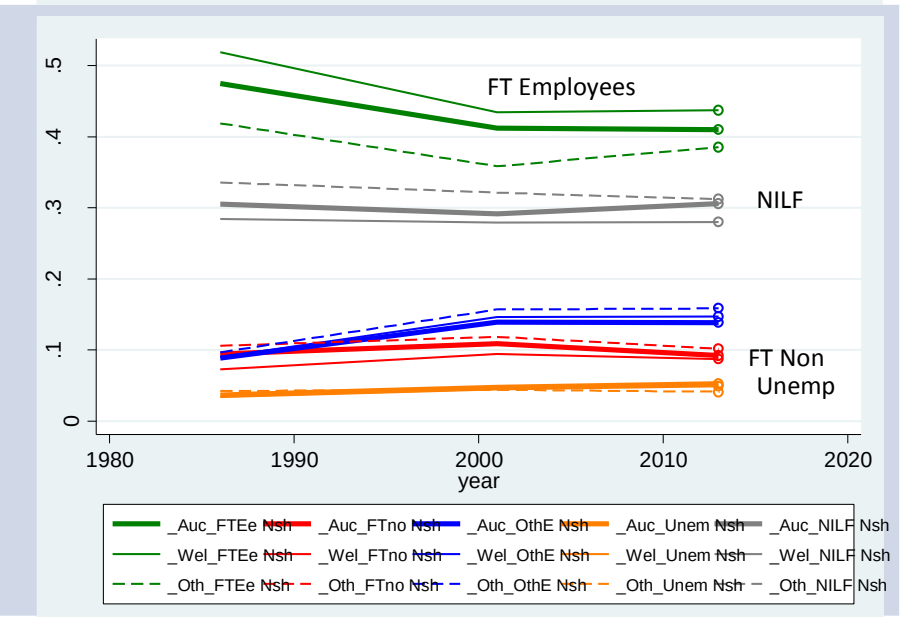




Changes by labour force group

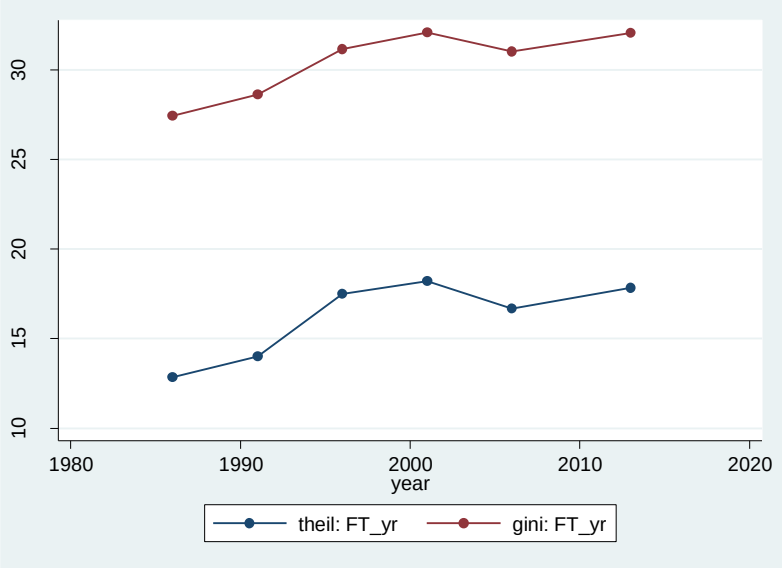






Income patterns by year (FT employee)

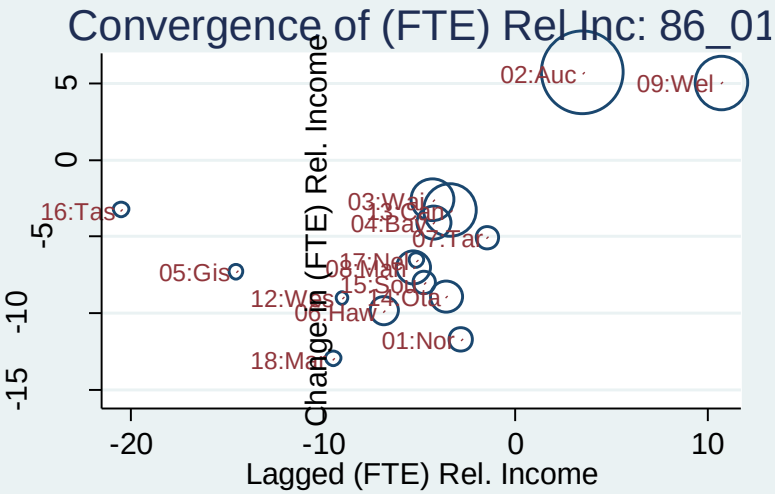
Year	Population	Mean income ($2013)	Inequality (Theil)	Inequality (Gini)	% with income <$1	% in top bracket
1986	1,017,432	$44,000	12.8	27.4	0%	1%
1991	889,155	$45,000	14.0	28.6	0%	2%
1996	913,296	$47,000	17.5	31.2	0%	1%
2001	969,336	$49,000	18.2	32.1	0%	3%
2006	1,151,226	$53,000	16.7	31.0	0%	4%
2013	1,199,109	$57,000	17.8	32.1	0%	3%
Total	1,036,341	$50,000	16.2	30.5	0%	3%

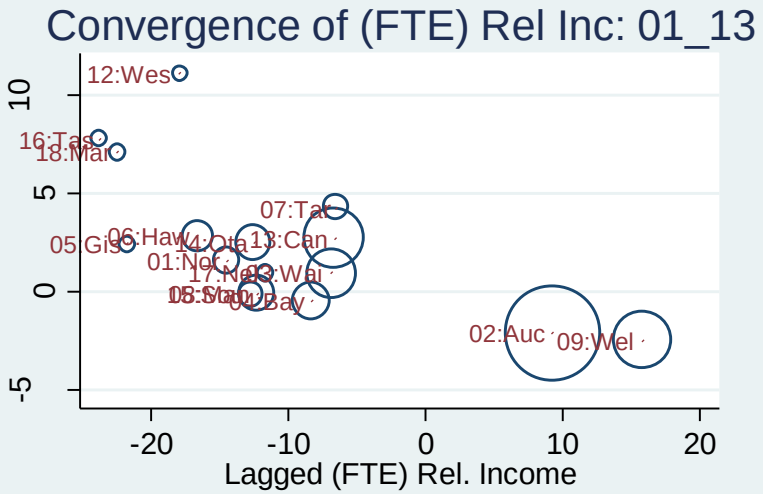


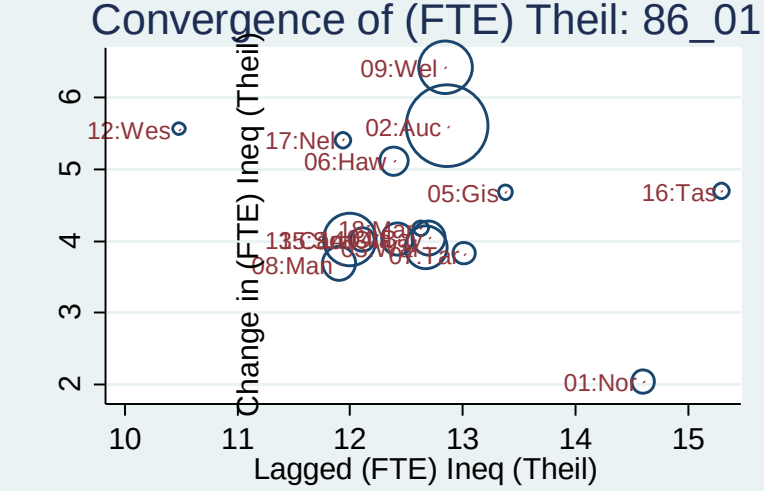
Inequality within & between regions (FT Employee)

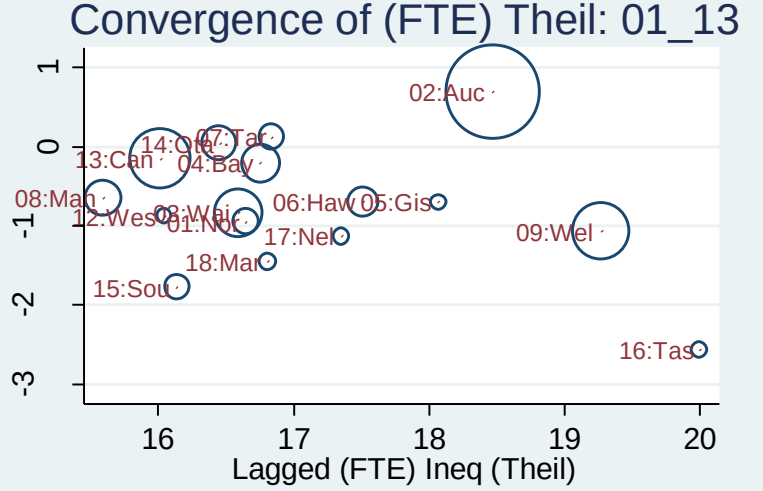
		1986	1991	1996	2001	2006	2013
Theil		12.8	14.0	17.5	18.2	16.7	17.8
Region (16)	within	98.5	96.9	97	96.1	96.4	97.4
	between	1.5	3.1	3	3.9	3.6	2.6
Sex (2)	within	89.6	92.9	94.2	95.9	95.8	96.7
	between	10.4	7.1	5.8	4.1	4.2	3.3
Age Group (4)	within	83.5	85.8	86.6	88.4	87.8	89.2
	between	16.5	14.2	13.4	11.6	12.2	10.8

Convergence of relative income and of inequality (FT Employee)









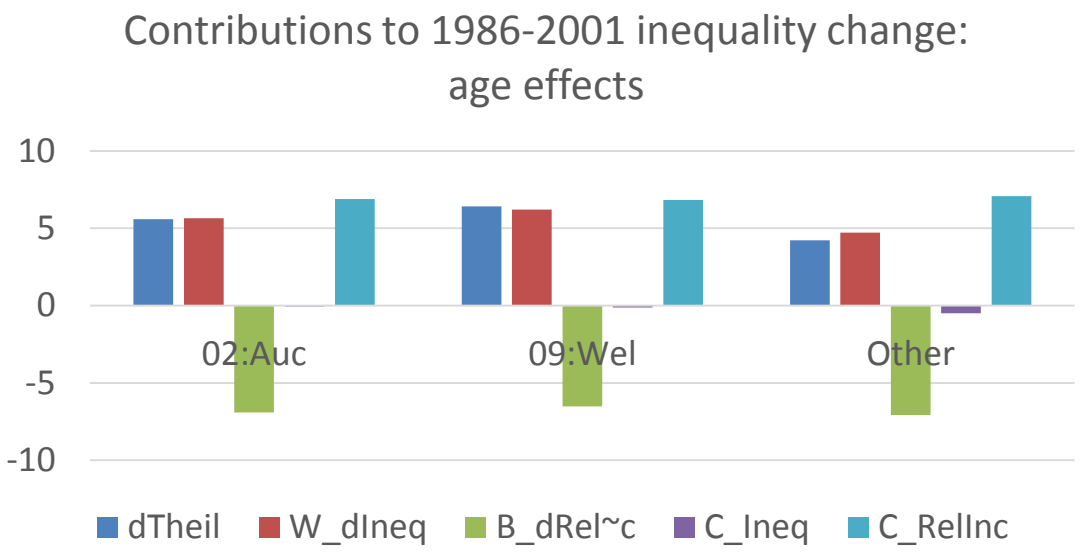
Age contributions to inequality (FT Employee)

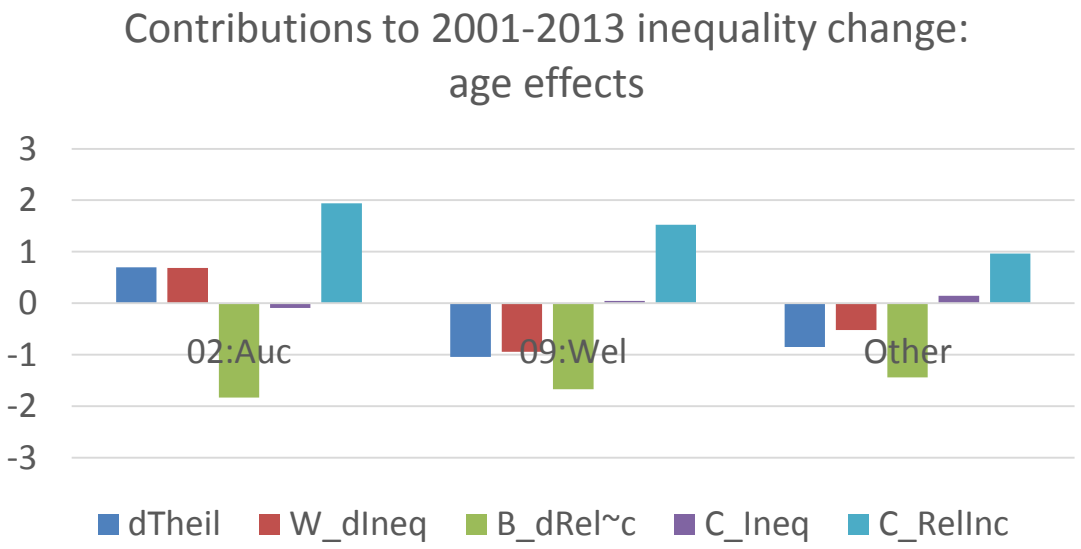
1986-2001

- (small) differences of degree

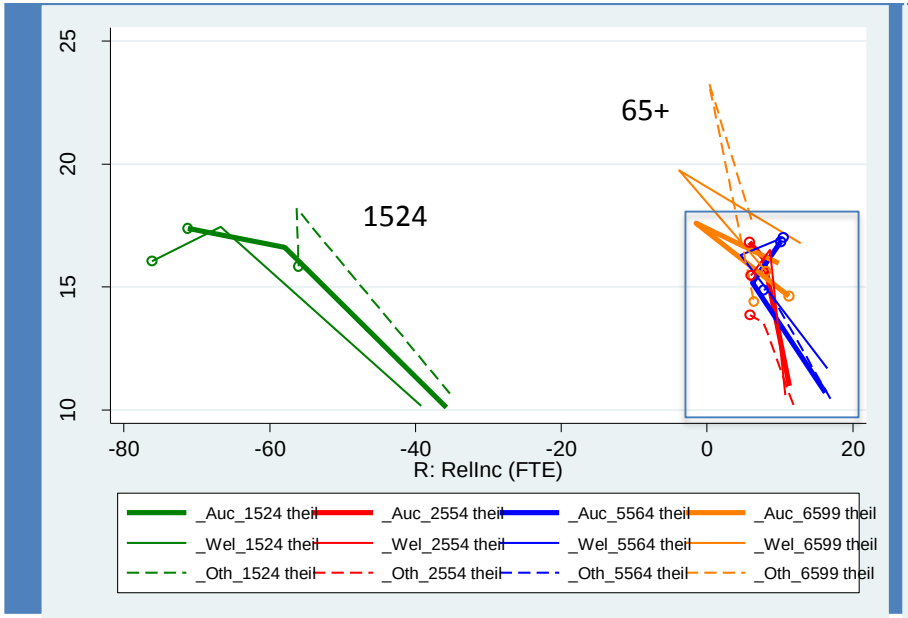
2001-2013

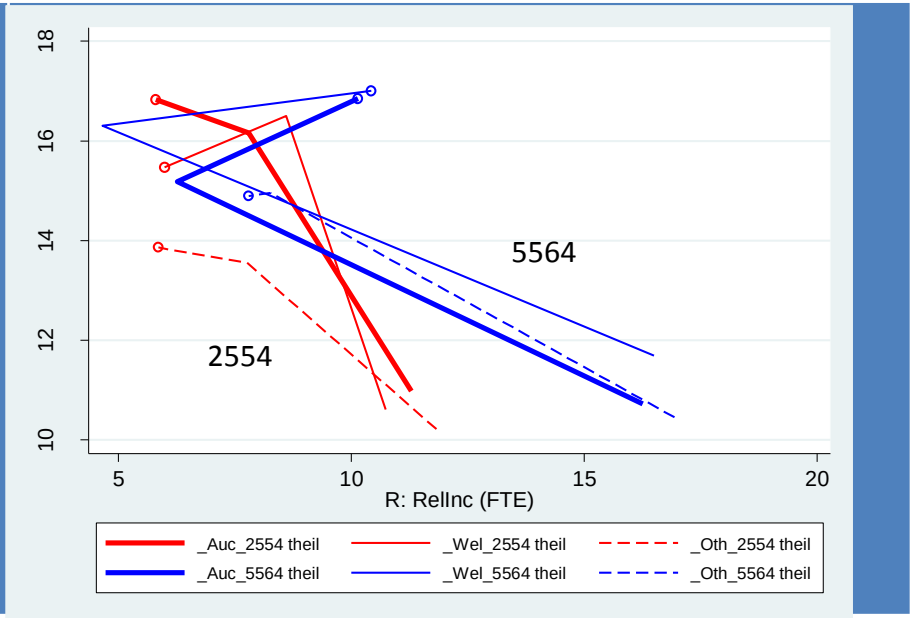
- Within group
  - Auckland: Stronger inequality rise within 25-54 and 15-24
  - Auckland: Stronger inequality rise for 55-64 in Auckland and Wellington
- Between group
  - Relative income gains for 55-64 and 65+ groups
- Composition
  - Auckland had relatively strong FT employment growth for 25-54 and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

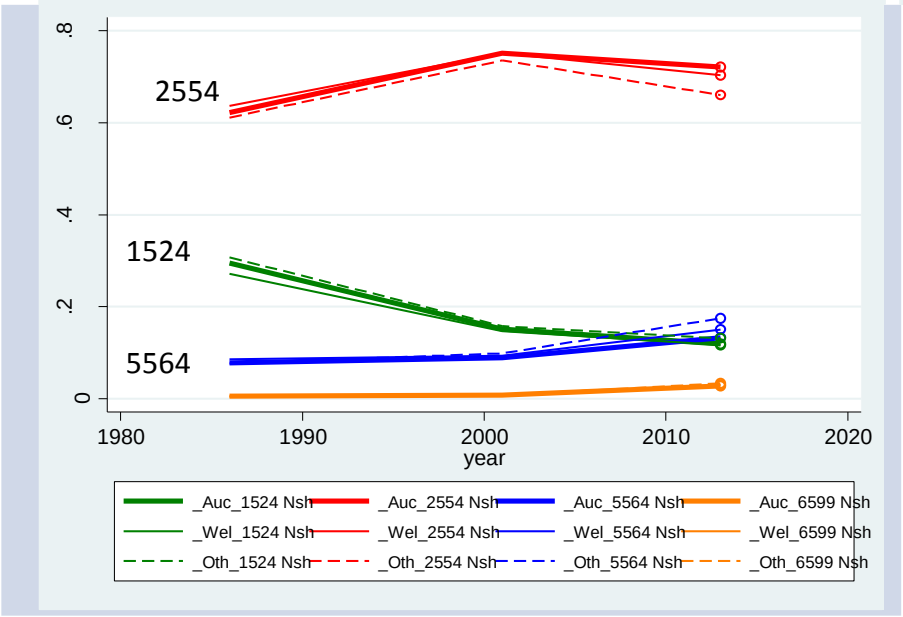




Changes by age group







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 (α)

$$1 - F(\tilde{Y}) = A\tilde{Y}^{-\alpha}$$

    - Different α for each sub-distribution
      - Preferred approach but compromises exact decomposition
  - Use α to create a robust midpoint estimate [von Hippel et al (2014)] as a function of the lower bound (L) of top bracket

$$Med(L) = L * 2^{1/\alpha}$$

    - Less volatile than commonly used $Mean(L) = L * \frac{\alpha}{\alpha - 1}$
    - 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

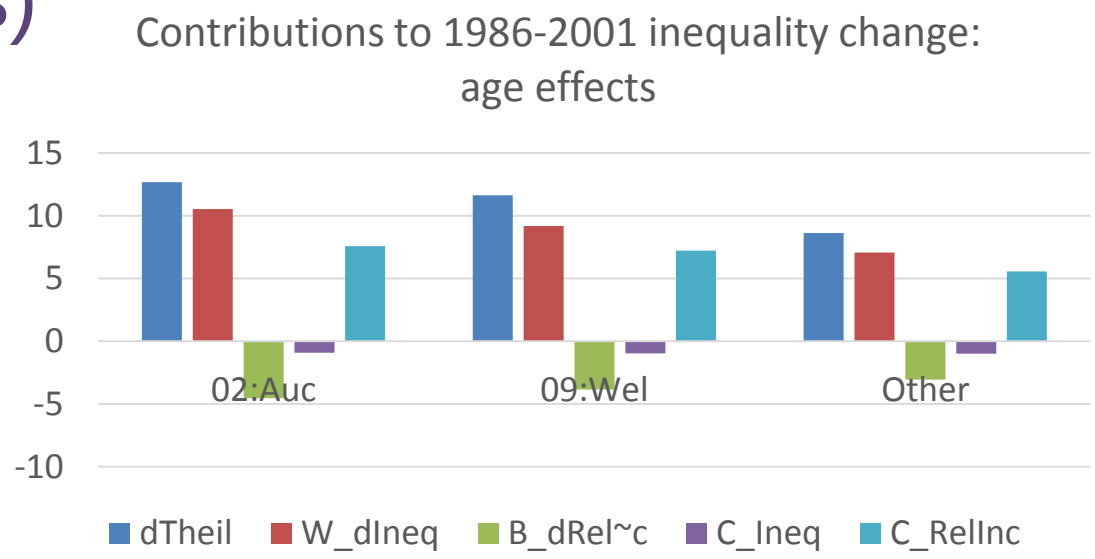
Age contributions to regional inequality change (All adults)

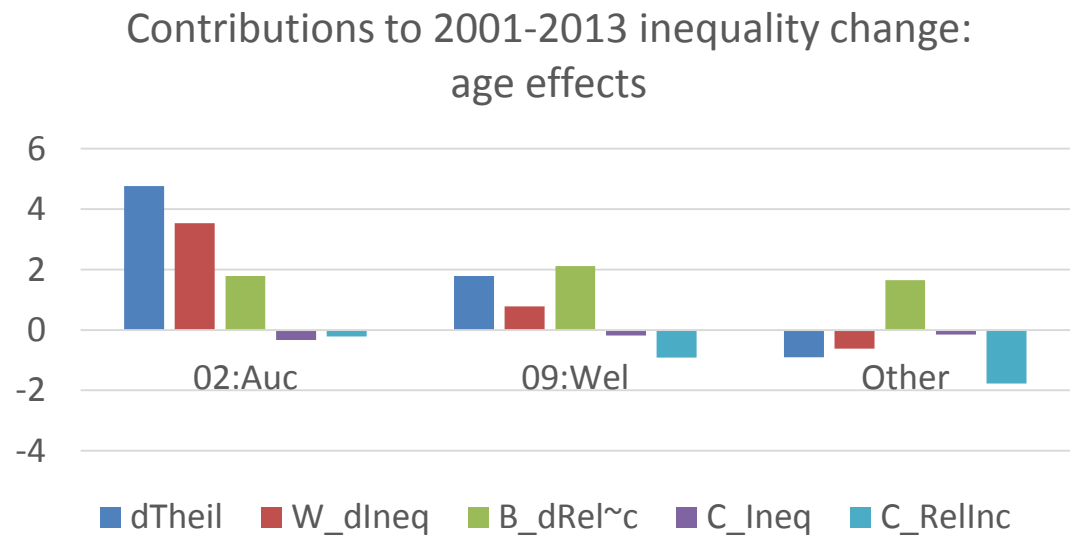
1986-2001

- Differences of degree

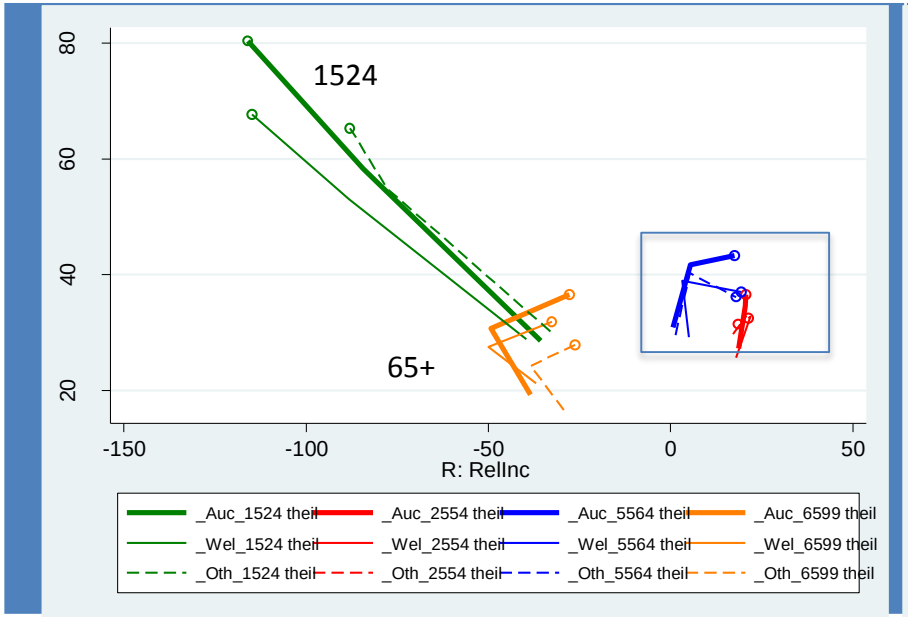
2001-2013

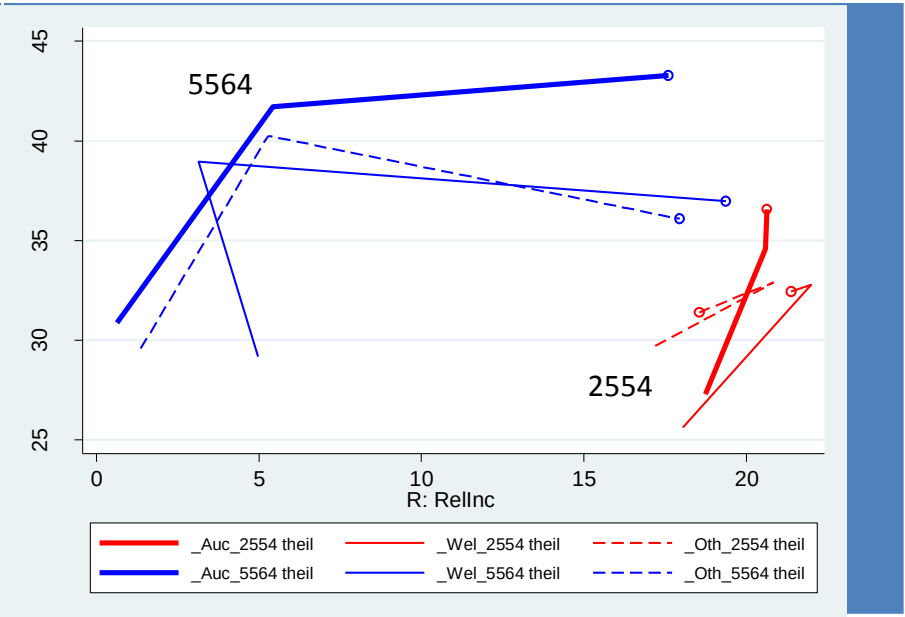
- Within group
  - Auckland: Stronger inequality rise within each age group except 65+
  - Inequality declines in Wgtn & other for 25-54 and 55-64
- Between group
  - Big relative income rises for 55-64 group across all 3 regions
  - Auckland: Rise in relative income of 25-54
- Composition
  - Auckland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

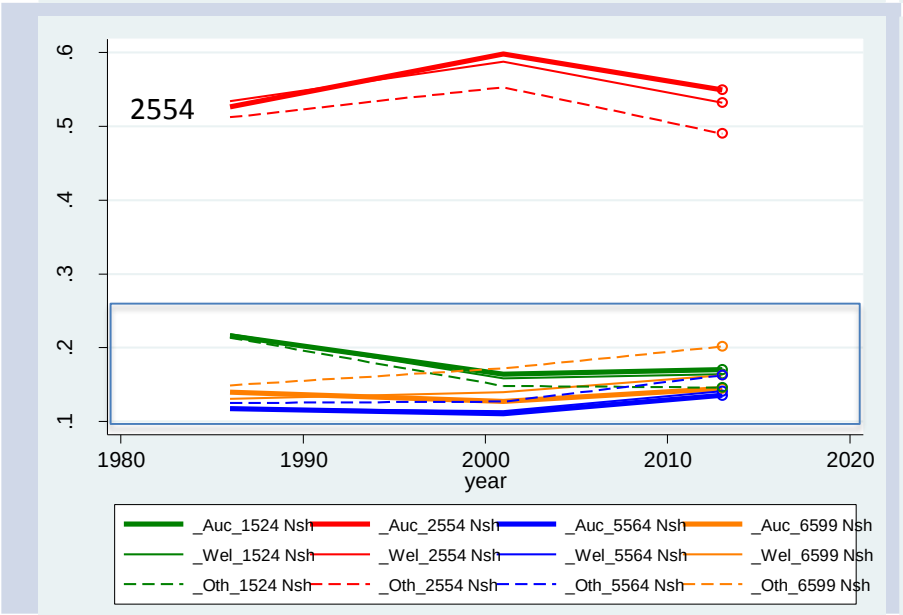


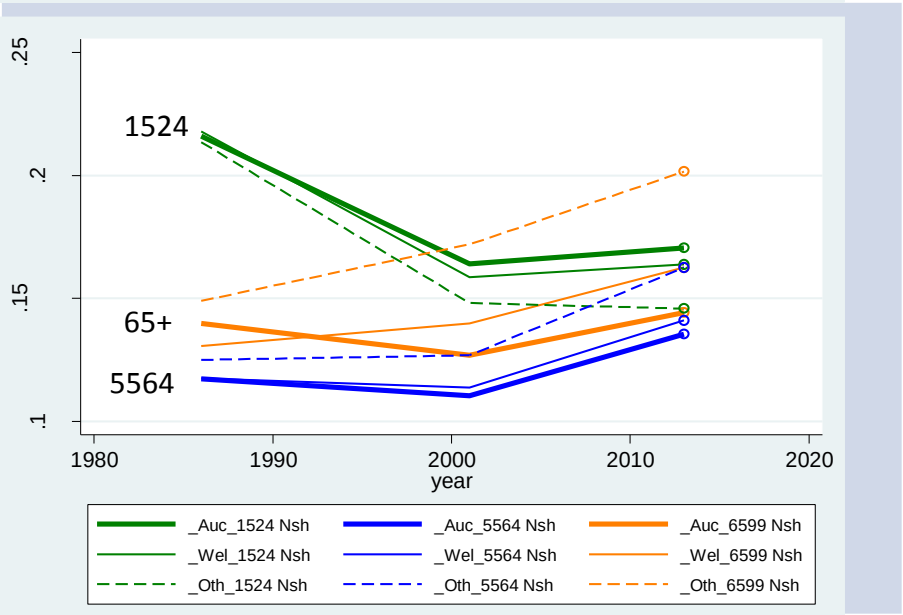


Changes by age group









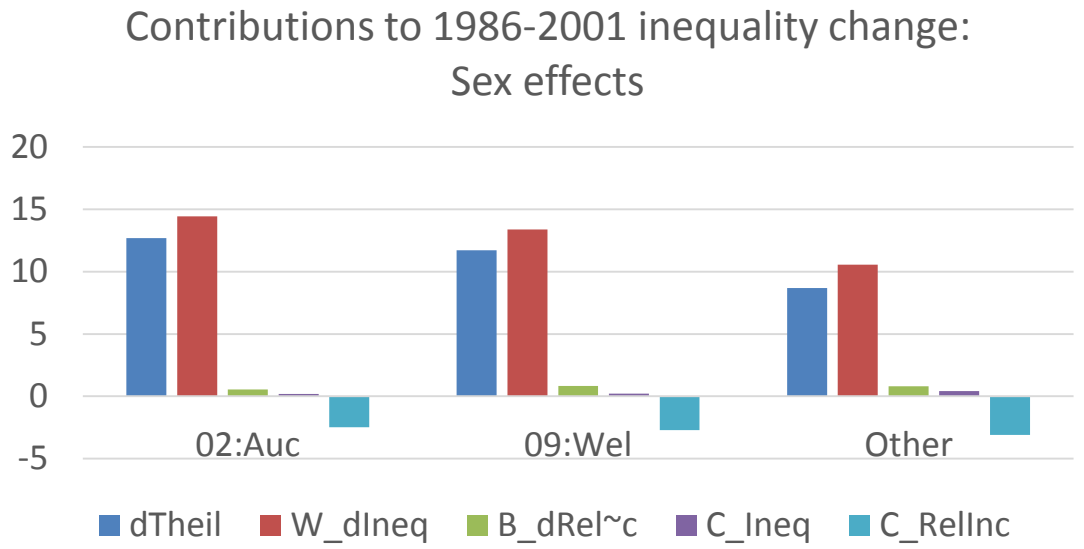
Sex contributions to inequality (All adults)

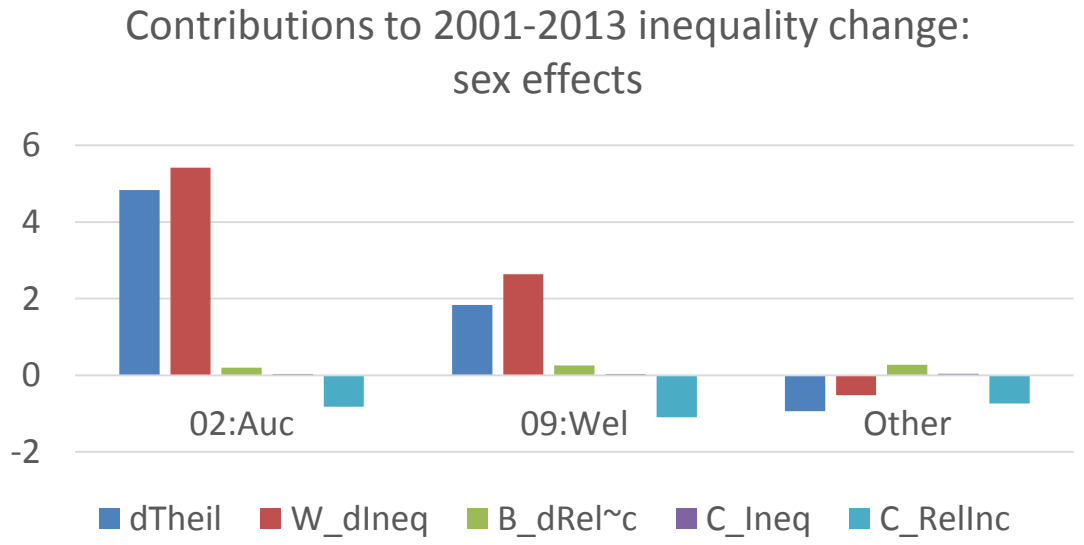
1986-2001

- Differences of degree

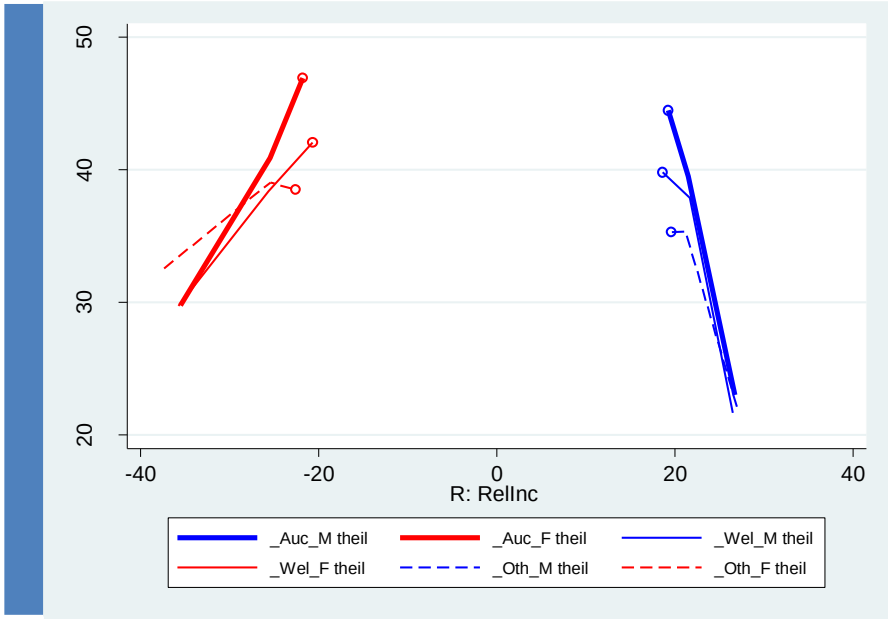
2001-2013

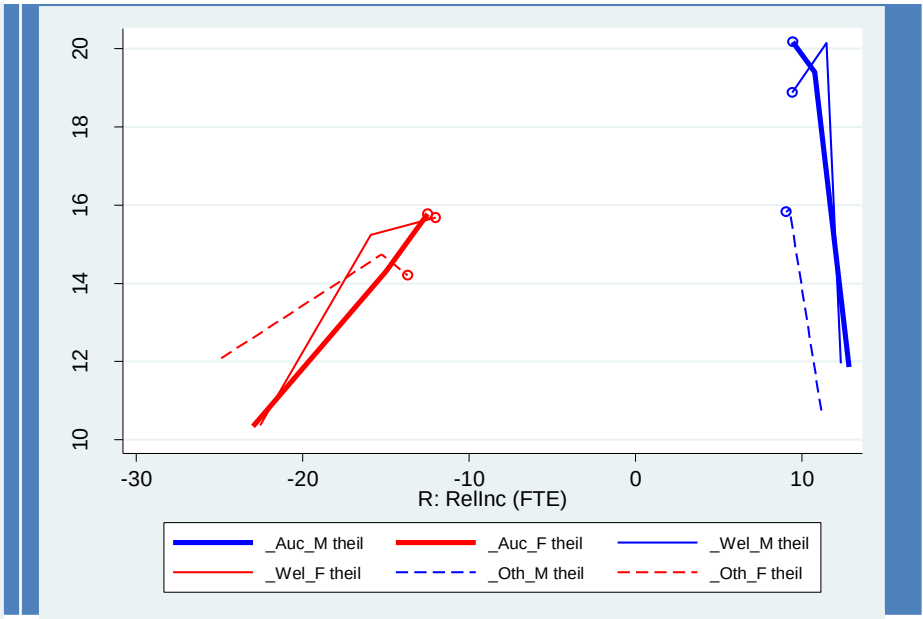
- Within group
  - Auckland: Stronger inequality rise for both men and women
  - Slight fall in within-group inequality outside Auckland and Wellington
- Composition
  - 'Other' regions maintained lower ratio of women to men
  - Wellington is most feminised

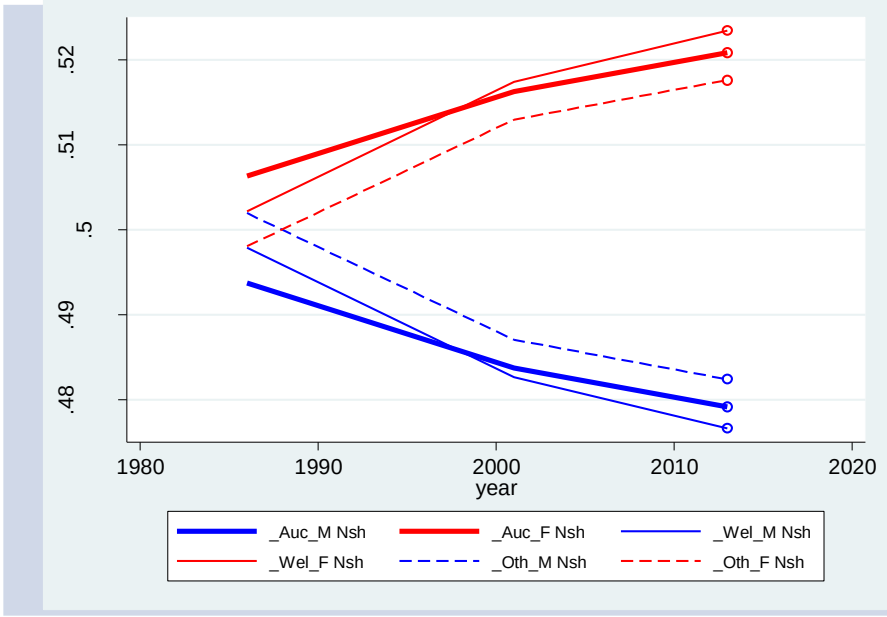


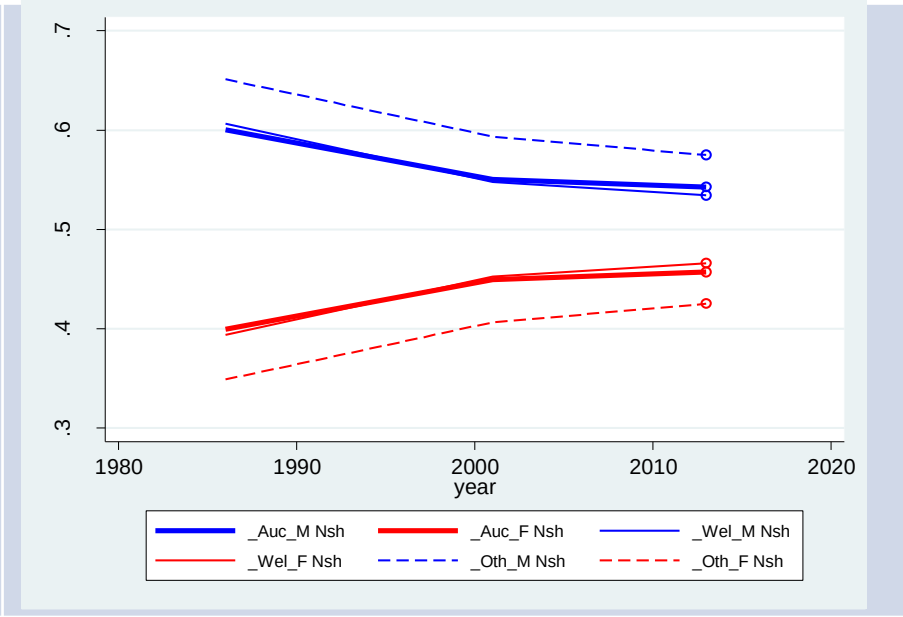


Changes by sex

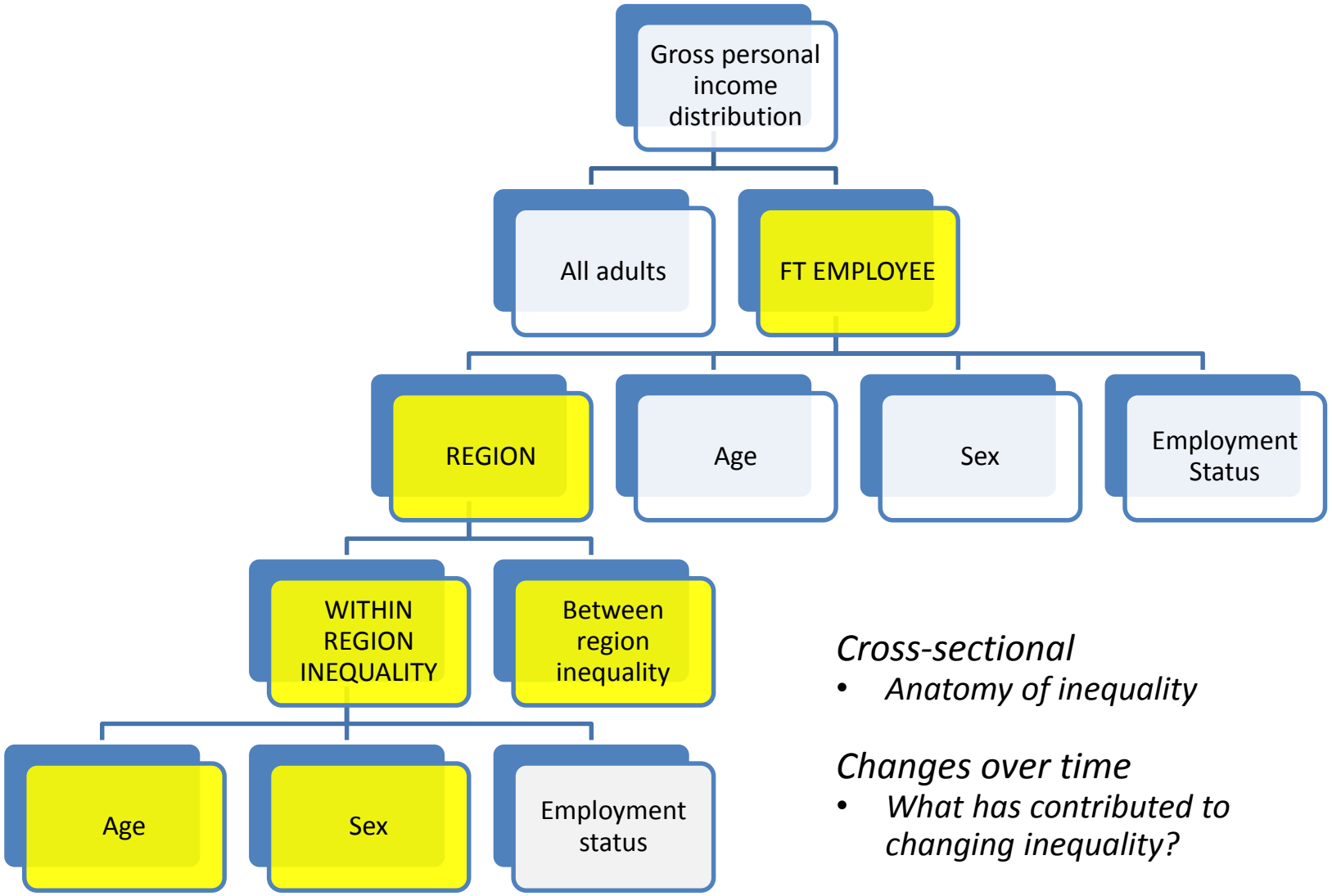








A map of the analysis



Cross-sectional

- *Anatomy of inequality*

Changes over time

- *What has contributed to changing inequality?*

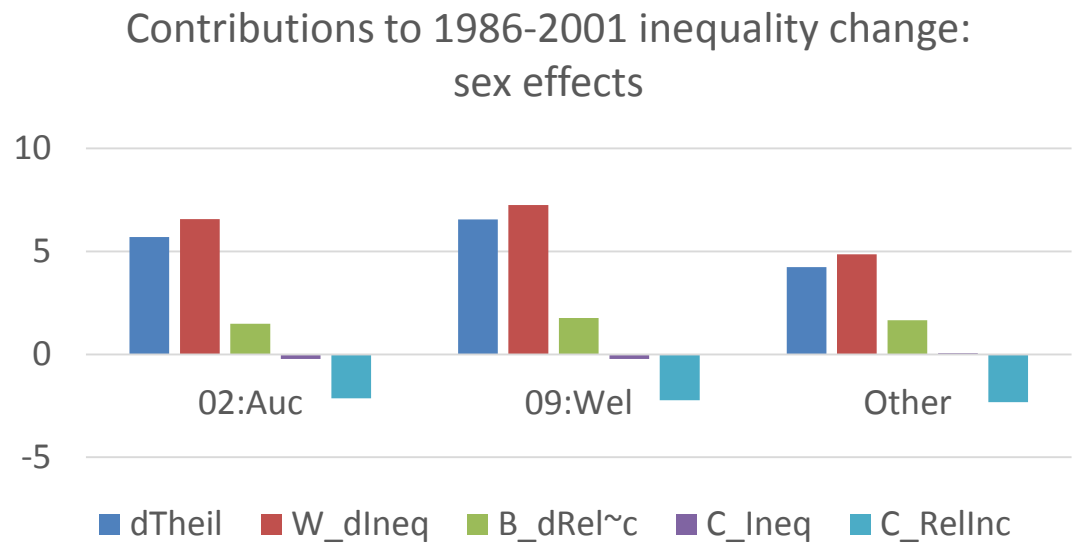
Sex contributions to inequality (FT Employee)

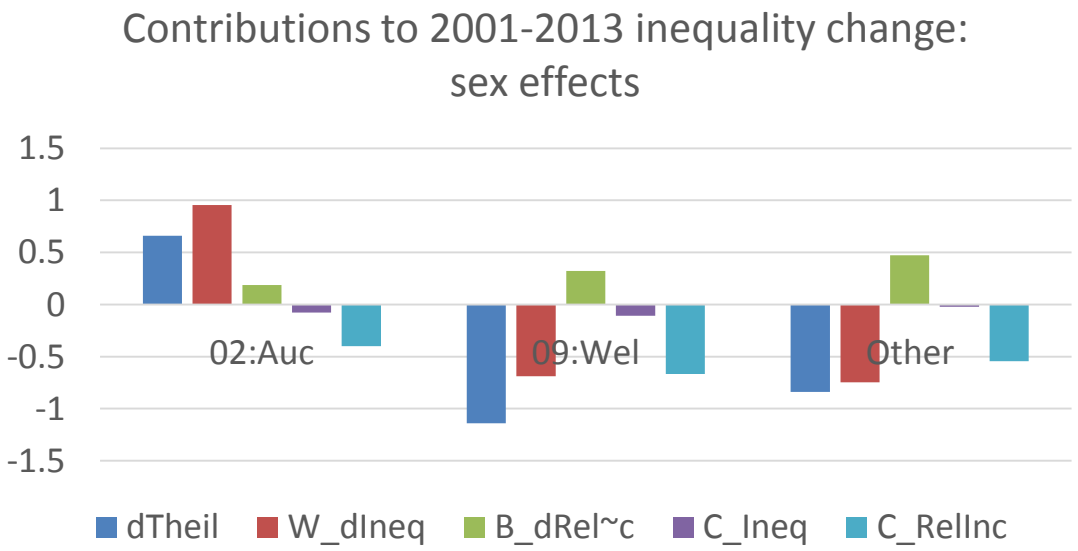
1986-2001

- 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

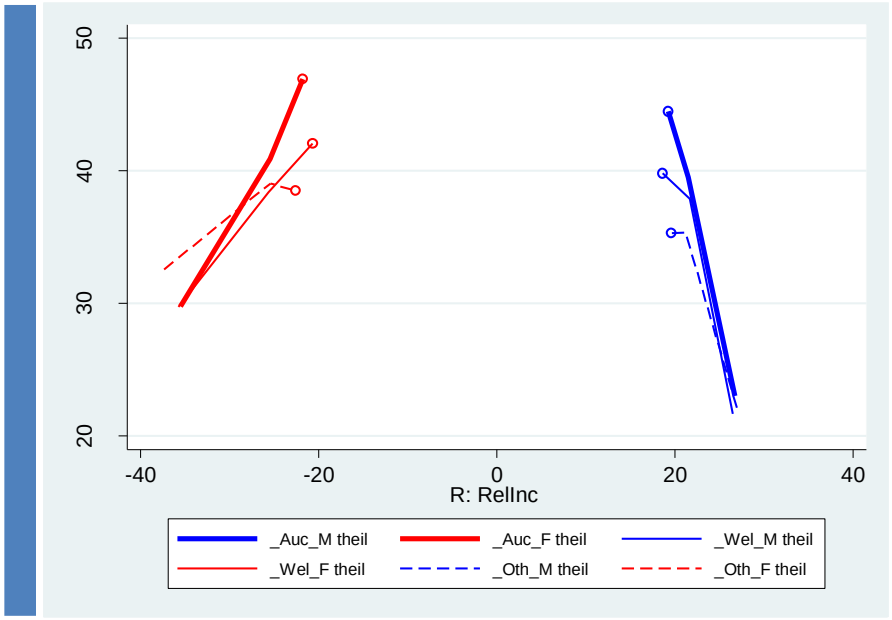
2001-2013

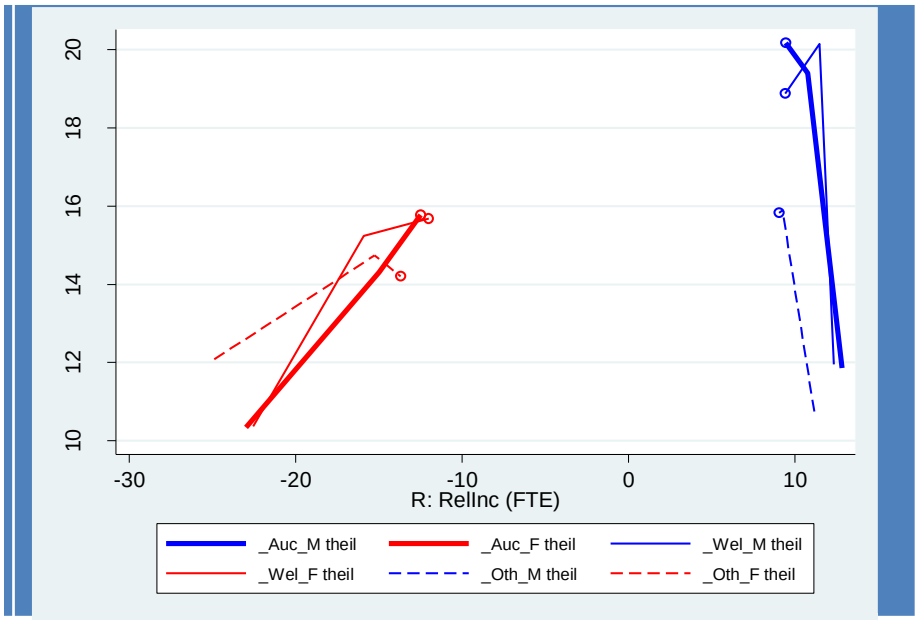
- Within group
  - Auckland is very different: Increased inequality within both men and women (for men only in Wellington
  - 'Other' regions had small declines in inequality for both
- Composition
  - Wellington and Auckland are closest to gender-balanced

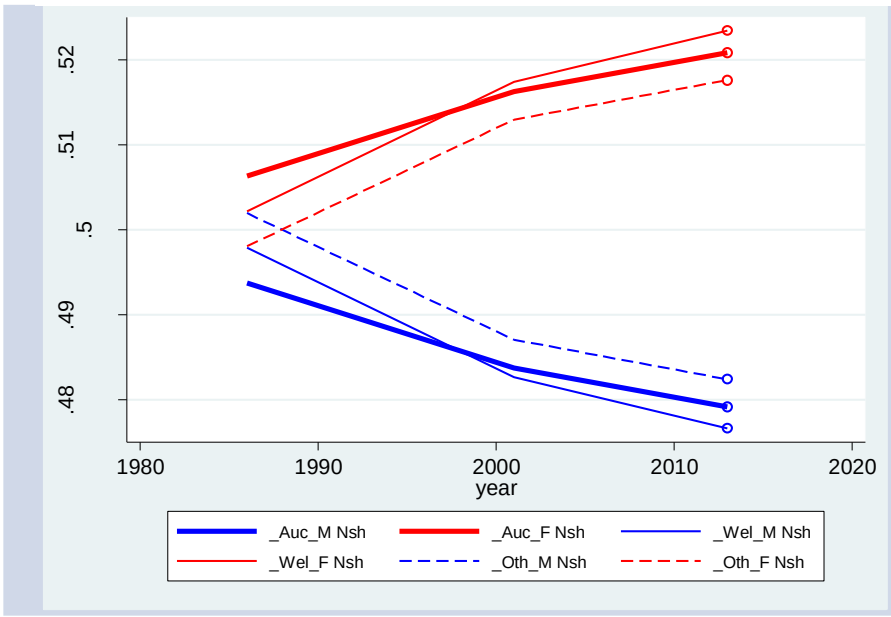


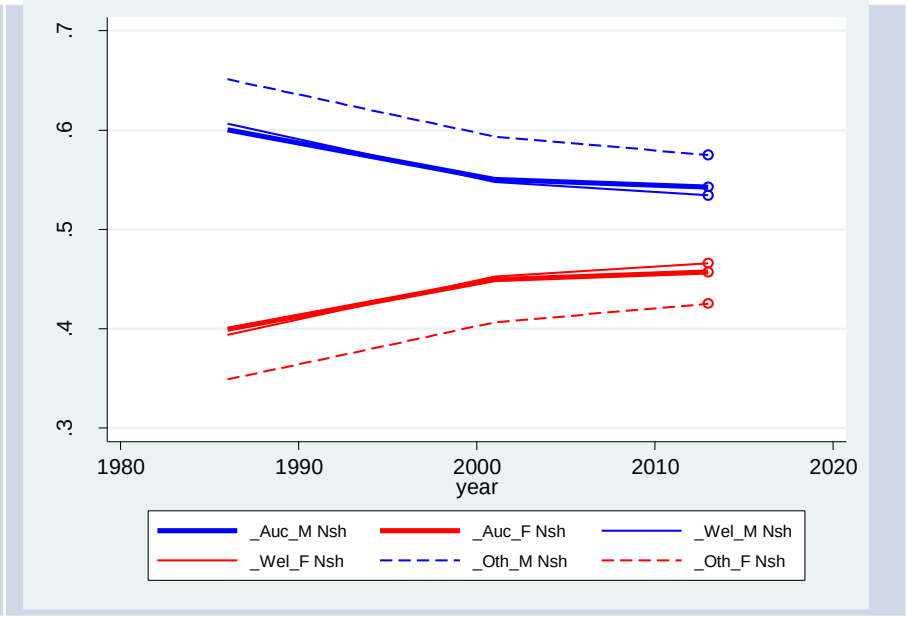


Changes by sex

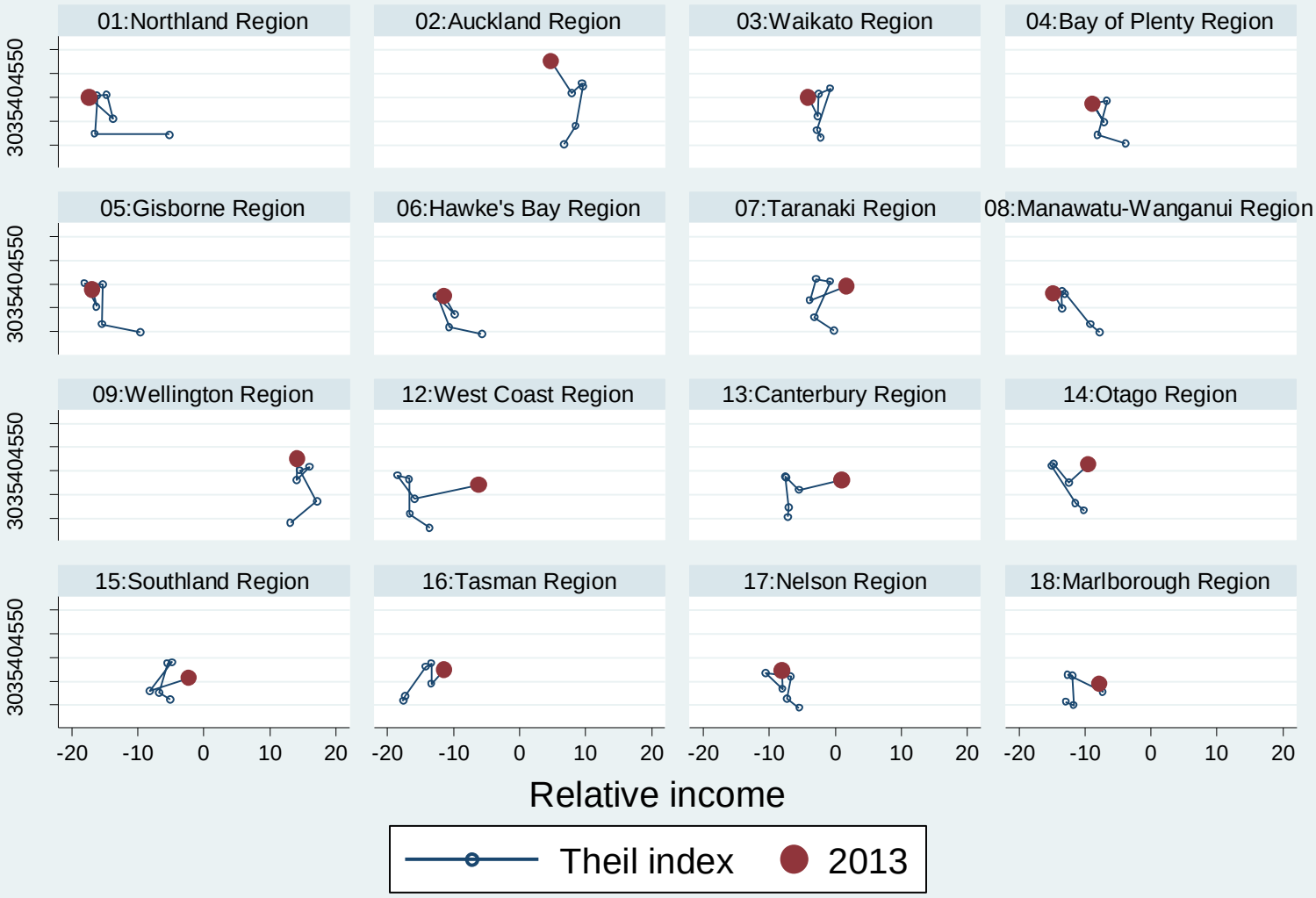




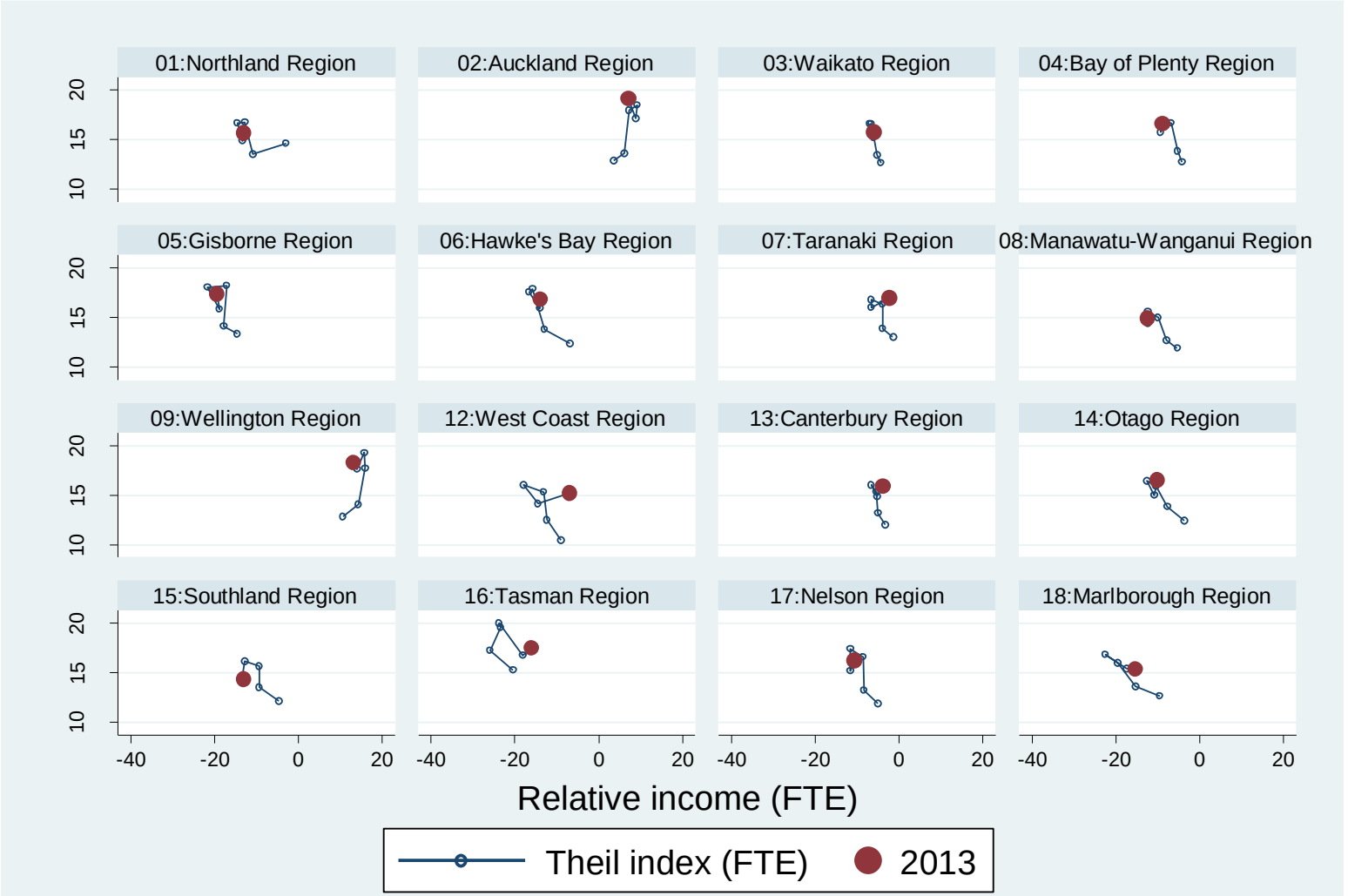




Inequality within & between regions



Inequality within & between regions (FT Employed)



Future work

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

Other sources of population diversity