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"Inequality of Life Expectancy in New Zealand 1900 – 1995"

Luke Temple
Social and Spatial Inequalities Research Group
Department of Geography
University of Sheffield
Sheffield
S10 2TN

Email:
l.temple@sheffield.ac.uk

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Abstract

Background: Examining life expectancy constitutes an important part of healthcare analysis and comparison. Using a newly available data set, this study calculates the life expectancy of the New Zealand population over the twentieth century. It also furthers the exploration by analysing the geographical inequality of life expectancy between nine regions, focusing on different age groups and gender disparities.

Setting: New Zealand

Method: Digitized data from the General Registrar and Statistics New Zealand was used to calculate Life Tables using the Chiang II Method. The Gini-Coefficient was used to compare inequality over time. The results were compared against the policies and prominent healthcare policies of the time period and for specific age groups.

Results: Life expectancy in general has increased, however not in uniform or incremental steps. Inequality has fluctuated greatly over the twentieth century, suggesting it is responding to contextual policy decisions. Although New Zealander women live longer on average, they consistently faced higher levels of life expectancy inequality compared to men. Perhaps surprisingly, during the height of the welfare state, equality increased for men, but life expectancy decreased. The inequality of life expectancy increases for each age range. Over the twentieth century, cohort data shows that younger and younger age groups face inequality earlier in their lives. Children turning 5 in 1990 faced inequality for their age group not experienced for over 70 years.

Conclusions: The geographical inequality in New Zealand suggests that regions develop very differently to each other, even when in close proximity. This could be that policy is not implemented in a uniform pattern, or that the particular demographic and contextual traits of each region (socioeconomic, ethnic, physical etc.) could respond to policy developments differently, or likely a combination of the two. Inequality appears to respond as expected to policy changes, however, life expectancy does not change in the expected way.

Keywords: inequality, life expectancy, New Zealand

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Analysis and interpretation are my own, as are any errors.

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Section One: Introduction

1.1 Life Expectancy and Inequality

The calculation, examination, and comparison of a population's life expectancy (LE) constitutes a core part of the study of health outcomes and inequality. LE frequently forms an integral part of multi-dimensional health indexes and cross-national comparisons made by bodies such as the World Health Organisation (WHO), Organisation for Economic Co-operation and Development (OECD), CIA World Factbook and United Nations-based projects such as the Human Development Index (HDI) and UNICEF.

Inequalities in health and differences in LEs are not confined to developing countries. A recent geo-demographic comparison of global inequalities in mortality produced twelve different clusters of countries with varying LEs (Day et al 2008: 1006). Those countries typically considered "Westernized" or "developed" were predictably confined to the top three clusters, however, they experienced LE differences between them as wide as ten years.

Clearly, these inequalities manifest themselves both *between* and *within* countries, and analysis of these trends can be insightful for the investigation of healthcare distribution and policy.

1.2 Aims and Objectives of this Study

In New Zealand inequalities in health exist between ethnic and socio-economic groups, people living in different geographic areas, people belonging to different generations, and between males and females (Ajwani et al 2003). Previously, most New Zealand inequality studies have focused on the socioeconomic or ethnic contexts, neglecting the geographical and spatial manifestation of inequality. In particular there has been little work done to monitor how geographical trends have evolved over time (Pearce et al 2006). Some readdressing of this has occurred recently with studies highlighting geographical health inequalities in mortality (Pearce et al 2008, Pearce & Dorling 2006), suicide amongst men (Pearce et al 2007) and cigarette smoking (Moon et al 2010). All of these studies focused on the period from 1980 onwards.

Geographical inequality, as opposed to socioeconomic or inequality between ethnic groups, is a useful focus for looking at the physical distribution of welfare and health outcomes across

space. A number of studies have taken such an approach. In Chile for instance, Agostini and Brown used the Gini-coefficient to examine inequality (in income in this case), finding, 'considerable heterogeneity in inequality among Chile's 341 counties and [we] suggest that geographic considerations may be appropriate for policymakers who wish to address inequality' (2010: 214). Numerous papers in the UK have shown a geographical difference between health outcomes between England and Scotland, even after controlling for deprivation and numerous socio-economic indicators (Walsh et al 2010, Shelton, 2009, Hanlon et al 2005).

This project aims to add to the literature by using a newly digitized dataset that allows for the production of regional LE in New Zealand, and an exploratory analysis of geographical and gendered differences over time. It aims to examine the possibility that the introduction of social and economic policy changes relating to the New Zealand welfare system over the twentieth century were associated with subsequent changes in the inequality of LE for the overall population. This new dataset is a potentially valuable resource as it includes detailed records of births and deaths from 1880 – 2003, providing the ability to describe and examine longitudinal trends and patterns that are, to the author's knowledge, not available in the current literature to such a detailed extent. This extensive time period allows for a wider assessment of trends, examining changes in inequality in a broader context, especially any which develop during times of socio-political reform.

This study will allow the more recent studies of geographical inequalities in New Zealand to be contextualised and, crucially, place the findings within a longitudinal perspective. Results of this study will be of interest to those analysing the development of health inequalities in New Zealand, and should also act as a further resource for general demographic analysis, studies of spatial inequality and comparisons of mortality over time. As Pearce et al argue, 'there is a need to monitor the trend in spatial as well as social inequalities over time and to assess the success, or otherwise, of government strategies for reducing health inequalities. In fact, spatial inequalities often reflect social inequalities not well measured by deprivation indices and social inequalities can partly be inequalities for which geographical factors are an underlying cause' (Pearce et al 2006: 461).

This project is structured as follows. Section 2 provides background information on New Zealand, focusing on demographic structure, and important time periods of political reform

over the twentieth century. Section 3 discusses the methodology and data decisions that were undertaken to produce the results examined throughout the study. New Zealand LE at a glance is examined, followed by the inequality and cohort developments over time in Section 4 and 5, respectively. In order to discuss these developments in greater details, Sections 6 to 8 break the analysis down into three age group focuses: children, 15-24, and 65+. Limitations are then discussion in Section 9, followed by a conclusion. All figures are in the appendix.

Section Two: A Brief Background of New Zealand

2.1 The Place

New Zealand is a small, highly-developed, and sparsely populated country, with a total population of only 4.3 million people in 2010.

Figure 1 is a cartogram of New Zealand from the Worldmapper series, proportioned by population. The three areas where New Zealanders predominantly reside are the three most urbanised regions; Auckland, Wellington and Christchurch. Although the smallest of these, Wellington is the capital of New Zealand and has a high population density and a large CBD. Overall, the North is the more populous of the two islands. For reference, figure 2 outlines the approximate location of areas examined in this project.

Outside these urban centres, New Zealand is predominantly a rural country considered to have a high quality of life, ranking 15th in *The Economist*'s Quality of Life Index (The Economist 2005), and 20th in the HDI (UNDP 2009).

2.2 The Population

New Zealand is a British-settler society where colonisation left indigenous peoples dislocated from traditional homelands and struggling to keep their languages and cultures alive (Humpage 2010). This dislocation has lead to diverging and different health outcomes for the indigenous population (Maori & Pacific Islanders) and settler population (referred to as the Pākehā).

From the signing of the Treaty of Waitangi in 1840 between the Maori and the British crown, Maori were considered subjects of the British Empire and were to be assimilated into the "core culture" (Grbic 2010). However, structural assimilation (e.g., educational and labour market integration) was slow to follow and therefore long-lasting socioeconomic inequalities have endured despite government policies of social integration in the 1960s and the gradual institutionalization of a more positive/active biculturalism in the 1980s (*Ibid*).

These inequalities also manifest themselves in the sphere of health and mortality. Studies have consistently discovered that the Maori and Pacific Islander populations in particular are faced with disparities in contrast to the ethnic majority across a range of health and mortality

issues (Thomson et al 2002, Tobias & Cheung 2003, Bramley et al 2005, Tobias & Yeh 2006, Jatrana & Blakely 2008, Bebbington et al 2009, McLeod et al 2009, Tobias et al 2009). Although government policies have attempted to temper the health inequalities between the groups, the gap still remains unacceptable (Ajwani et al 2003).

This is not an issue specific to New Zealand. Indigenous socioeconomic outcomes are notoriously poor in the liberal welfare states, even with significant indigenous recognition and indigenous involvement in designing and delivering social services in recent years (Humpage 2010). As the dataset does not contain variables relating to ethnicity, this project examines the inequality of LE in the population as a whole.

Examining the population of New Zealand makes for an interesting case study as historically the country has been associated with progressive policy experiments in terms of policy and welfare, gaining the nickname, "the social laboratory", or as Belich put it, "the world's white rat" (Belich 2001: 46).

2.3 The 'Social Laboratory' and Healthcare in the Twentieth Century

The beginning of the twentieth century was turbulent for New Zealand as it fought in the Boer War, World War 1, faced an influenza pandemic in 1918, and was hit by the Great Depression of the 1930s. Just before World War 2, the New Zealand Labour Party (NZLP) won a rare electoral majority of 55.8% in 1938. As a response to collapse of world markets in the Great Depression, the NZLP went on to introduce a welfare state, generally acknowledged to be one of the earliest in the world (McClintock 1998). From this point the welfare state has developed through three stages, often referred to as 'Ways'.

2.3.1 The First Way: 'The Classic Welfare State'

So successful was the NZLP's welfare policy that the predominant opposition, the National Party, simply adopted its policies in a case of political cross-dressing and the system the NZLP initiated has been argued to have lasted from 1935 to 1984, despite what government was in power (Nolan 2010: 102).

The post-war welfare state developed in a context consisting of a low demand for social security by virtue of a high degree of economic development, male full employment, a rather 'young' demographic profile and high home ownership rates (Obinger et al 2005: 174)

Furthermore, on the supply side, trade protectionism and a highly regulated system of wage setting led to high wages – set at a level sufficient to support a wife and family – and to an egalitarian income structure (*Ibid*). This system became known as the "wage-earners' welfare state" (Castles 1985: 102).

In the 1970s, this system of production and trade protection came under heavy strain, mainly due to shifts in the world economy and various social changes such as rising female labour participation and family change (Obinger et al 2005: 174).

These domestic shifts and exogenous economic forces began to change the nature of the economy. For example, in 1966-1967 the price of wool on the international market plummeted, and New Zealand was required to take emergency short-term loans during a crisis of its balance of payments (Singelton 2009). This era saw the proliferation of lender choice as the UK became more reluctant to lend New Zealand Sterling loans. Between 1968 and 1975 New Zealand's overseas debt almost doubled from 639.6 million NZ$ to 1,088 million NZ$. In 1968 50.7% of this debt was in Sterling. By 1975 this had dropped to 15.5% as New Zealand embraced other lenders such as the IMF, World Bank and the United States (*Ibid*). This demonstrates the rising interconnectedness of the global economy and the 'shared fate' of numerous economies to changing trends or crises.

This 'shared fate' is highlighted by the fact that many Western countries during this period were hit with wage spirals as the Bretton Woods system unravelled, budgetary deficits grew and the energy crisis of 1973–1974 took its toll (Nolan 2010). Trade protectionism as comprehensive as New Zealand's was no longer possible, or desirable. These made it difficult for countries to fund comprehensive welfare states, even those as relatively ungenerous as New Zealand's.

From the late 1960s there was the (re)emergence of what were seen as complex social problems and the rediscovery of poverty and inequality (Lunt 2008: 410). By the 1970s, as a result of new costs and growing challenges to provision, the notions of a 'welfare state' and 'welfare' took on negative connotations (*Ibid*).

2.3.2 The Second Way: 'The New Zealand Experiment'

In response to the pressures of the 1970s, the NZLP pursued dramatic structural reforms in the 1980s. These were designed to streamline and overhaul the welfare system. Referring to New Zealand and Australia, Lloyd Cox provides a strong description of the changes undertaken in the 'social laboratory', focusing on the irony of the neoliberal reform, which is worth quoting in full:

> The irony operates at two levels. On the one hand, the foundations on which the original social laboratory reputation had been forged were now objects of transformation if not obliteration. Whereas the earlier 'state experiments' had sought to integrate working-class mobilization into state structures and to soften the destructive effects of unfettered markets by extending the state's role, the new experiments played the film of history backwards, embracing markets and rolling back the state. On the other hand, the resurrection of the Antipodean social laboratory in the 1980s was ironic in that the main architects of this refurbished, economically liberal version were parties of Labour. At the turn of the 19th century, most liberal and radical observers had concluded that although Liberal parties generally ruled in Australasia, the progressive character of its social arrangements was at least in part due to the influence of organized Labour. The 1930s and 1940s Labour governments of Savage in New Zealand and Curtin and Chifley in Australia were even more central in establishing the main planks of recognizably modern welfare states (Cox 2006: 108-109).

From 1984 the NZLP carried out two terms of neoliberal structural adjustment policy that was built upon by the National party from 1990. New Zealand's structural adjustment programmes centred on five 'fundamentals': liberalisation of domestic market and trade; reduction of the size and scope of the state; monetary policy, driven by an overriding goal of price stability; labour market deregulation and deunionisation of the workforce; and fiscal restraint, through broadening the tax base and cutting state spending and social support (Kelsey 1995: 85). Indeed, *The Economist* described the New Zealand administration of 'out-Thatchering Mrs. Thatcher' an observation at the time that was meant, like many media reports on the changes, as a glowing accolade (*Ibid*: 8).

During this time period a number of national governments were following similar neoliberal reforms, perhaps most famously the aforementioned Margaret Thatcher in the United Kingdom (1979 – 1990), Ronald Reagan in the United States (1981 – 1989) and his predecessor George Bush Senior (1989 – 1993) and Augusto Pinochet in Chile (1974 – 1990). In New Zealand the process became synonymous not with the Prime Minister, but with the

Finance Minister Roger Douglas, and the term "Rogernomics" came to be used, paralleling "Reagonomics" in the US.

This reform was shaped by what has been termed 'The Washington Consensus', a guideline to neoliberal policy emanating from the US, focusing on the rolling back of the state, individualism and privatisation (see Beeson & Islam 2005: 202-203, Coburn 2004). In her study on this 'New Zealand Experiment' Kelsey argues that even within this 'consensus', there was a range of positions available, and it was expected that administrations would judge the depth of their reform on the social, political and economic conditions present in their countries: notably, Australia, a country in a similar position to New Zealand, took a very different path in the 1980s. Accordingly, despite frequent claims by those driving the policy that 'there was no alternative', there clearly *was*, and on behalf of the people of New Zealand, the Labour government *chose* to take the Washington Consensus to its neoliberal extreme (Kelsey 1995: 15 – 19).

Other commentators have argued a middle ground to Kelsey's analysis, noting there was not a wholesale revision to laissez-faire practice in New Zealand, that some labour protection remained, and the public provision of education, health and social welfare, though trimmed, continued, as a sector where resistance to the separation of economic and social relations is greatest (McClintock 1998). Even so, the more nuanced arguments tend to agree that inequality was not a concern for the reformists. The government delivered price stability at the sacrifice of income growth, stable employment and a widening income distribution (between 1984 and 1993 the percent of households below the absolute poverty line increased from 4.3% to 10.8%, and between 1978-1985 to 1985-1996 unemployment rose from 2% to 7.2%) (*Ibid*: 501-502). Tackling inequality did not appear to be top of agenda. Indeed, regarding income inequality, in 1995 the finance minister Bill Birch was reported to have said that income disparities 'are widening and they will widen much more. That doesn't worry me.' (Birch, quoted in Kelsey 1995: 271)

2.3.3 The Third Way: 'The Workfare State'

At the start of the 21st century, geographical inequalities in health in New Zealand reached very high levels and continue to increase (Pearce et al 2006). This is somewhat surprising, considering that the Government's Primary Care Strategy document of 2001 contained a striking emphasis on disparities, stating that "A strong primary health system is central to

improving the health of New Zealanders and, in particular, tackling inequalities in health" (Hefford et al 2005). Uptake of this policy has also been very high (over half the population).

Furthermore, a 1999 study analysed a representative sample and found 79% of respondents had utilised the public health service over the previous year, and the poor used the health service somewhat more than expected by their health need (Peacock et al 1999). Although the authors argue that due to the sample size, these results are tentative, they are still indicative of perhaps unexpected trends in the New Zealand health care system. It appears from this study that access barriers are not prominent; additionally, if the function of the New Zealand public health system is simply to provide a decent minimum of care (a safety net) then 'overuse' by the poor would be expected (*Ibid*).

In 2005 the percentage of GDP spent on healthcare and pensions in New Zealand was 18.6%, compared to the OECD 30 average of 20.6% and far below the highest European countries; Sweden (29.94%), France (29.2%), Austria (27.2%) and Denmark (27.1%) (Adema & Ladaique 2009:26).

From a welfare perspective, this period of time has become known as the 'workfare state'. The Labour-led coalition elected in 1999 aimed to modernise welfare and maintain government commitment to an active labour market (Lunt 2010: 413) The 'social-investment state' signals a redesigning of the 'welfare architecture' with emphasis on education and training to develop human capital, activation policies and welfare to work, enhancing future opportunities rather than tackling current inequalities, and investment in children (*Ibid*).

Due to data limitations outlined in section 3.3, this project focuses on 1990 – 1995, and most analysis concentrates on the developments during the First and Second Way.

Section Three: Methodology and Data

3.1 Calculating Life Expectancy

LE was calculated from the dataset (see 3.3) for each region in New Zealand, and initially from 1880-2003, using the revised Chiang methodology (sometimes referred to as the "Chiang II Method"). This particular method produces a current life table with LE from birth and the following determined age intervals (Chiang 1972). The calculation of LE and life tables is frequently used in health inequality studies (for examples see Peters 2010, Pearce and Dorling 2006, Marshall 2004 and Khaw 1999). The life table is a powerful and versatile analytical tool (Schoen 1978), and although life expectancy could be determined from every year of life, to keep the table concise, the nine age intervals already present in the data were used: under 1, 1-4, 5-14, 15-19, 20-24, 25-34, 35-44, 45-54, 55-64, and 65+.

Calculating LE of a population is a useful method of presenting health developments and inequality for comparative areas and is generally easier to understand than other measures such as the standardised mortality ratios (SMR), comparative mortality figure (CMF) and directly or indirectly age-standardised rates (ASRs) (Silcocks et al 2001). Governments often use LE as a simple indicator of the health of a particular region. The New Zealand Primary Health Care Strategy focuses on reducing health inequalities by measuring mortality rates, but the attention to LE is the same (King 2001). In the UK the National Health Service has official targets set to reduce the inequality of life expectancy at birth (Department of Health 2002). The United States Department of Health and Human Resources also calculates and uses LE as an indicator of progress (Xu et al 2010).

The Chiang method has been used as it is not susceptible to errors resulting from a count of zero deaths in a particular age-group (Pearce and Dorling 2006). This is particularly useful for data from a developed country with a relatively small population. Additionally, a study on life expectancy calculation for England recommended the Chiang method as a robust measurement for higher geographies (Eayres and Williams 2004). However, the study also noted that age intervals should increase until 85+ for the most accurate results, and that as population size decreases, the standard error for life expectancy decreases, possibly leading to overestimation, especially in the older age intervals. The data set came formatted with age intervals stopping at 65+ and the substantial reformatting required to change it was beyond

the scope of this project. Accordingly, it is important to bear his limitation in mind when examining the results of the life expectancy tables.

3.2 Calculating Inequality

This project used the Gini-coefficient as a measure of inequality. The Gini-coefficient is the most common statistical index of diversity or inequality in social sciences and has been used to calculate inequality in health and mortality schedules across a number of studies, usually expressing inter-individual variability in age of death (Andreev et al 2003: 306).

A predominant argument against such a descriptive approach is that it does not necessarily make sense to consider individuals stripped of their social relations and any approach that lumps together members of a given population because they share a health profile runs the risk of: (a) disregarding meaningful groupings of political relevance; and (b) preventing inquiries into the causes of health inequalities in society (Kawachi 2002: 648).

However, Illsey and Le Grand make a strong argument for this approach, stressing that:

...the individual-based measurement of inequality in health is a way to a universal comparability of degrees of inequality over time and across countries. This makes a difference to the problematic comparability of group-based (social class-based) measurement of inequality in health, which can be biased by differences in subjective labels of social classes and differences in their relative sizes (degrees of group's selectivity). In addition, there is a difficulty in attaching social-class labels to people who are not of working ages or do not work for other reasons. (Illsey and Le Grand, discussed in Andreev et al 2003: 306)

As the focus of this project is regional-inequality over a long time period, this argument justifies the inter-individual descriptive approach taken. The data are used to compare LE over time; equivalent socio-economic data are not available for these particular regions. Aggregating or estimated socio-economic data would be a possibility; however, it would detract from the aim of creating accurate and comparable life tables that can simply and effectively produce LE results. By using inter-individual analysis, the results of this table can be compared to other studies from other case studies, without the inherent problems of determining the comparability of definitions of socio-economic deprivation, citizenship, ethnicity etc.

The Gini-coefficient was generated for this dataset using Stata 11 and the "ineqdeco" code plug-in.

The overall Gini-coefficient figure for each year was produced by: determining the Gini score for each age group; determining the percentage that age group represented of the population (see 3.3) and weighting the final average according to these percentages. For ease of interpretation, all Gini-coefficient scores in this project have been multiplied by 100, and are referred to throughout as Gini*100. Accordingly, the theoretical total inequality is 100, and perfect inequality is 0. A rolling 5-year average was also produced for this data, to minimize further the potential for high-death rates in certain groups (such as the 15-24 age range) to bias the result. The average also allows for the analysis of trends that could otherwise be masked by fluctuations.

3.3 The New Zealand Dataset

This data set is a newly digitized version of General Registrar birth and death information from 1880 to 1986. From 1987 to 2006 data was provided by New Zealand Statistics. This electronic version was produced by Jeela Kumar previously of the University of Canterbury, New Zealand.

As the data set is new, a number of ironing out issues, tweaks and updates had to be made to confirm the reliability of the data. These were made without access to the original data source, using the electronic version only, which was potentially problematic at times. For instance, in the years 1887 – 1890, the Kermadec island data was coded incorrectly for the population interpolation. As the actual figures could not be ascertained, this data was removed entirely. This decision was made as the numbers involved would have been too small to impact upon the LE score.

The first section of data from the General Registrar was split into nine regions: Auckland, Hawke's Bay, Taranaki, Wellington, Nelson, Marlborough, West Coast, Canterbury and Otago. These regions are similar to the 16 regions of New Zealand government; with some splitting and merging (Figure 2 and Table 1). From 1987 onwards the New Zealand Statistics data was split into 40 composite regions, which had to be geographically aggregated to match the original primary nine (Table 2). Importantly, the birth and death data required geographic location as a variable, however, from 1987 an "Other" region was added to the death data.

This data could not be used as it had no geographical reference, and from 1987 to 2003 the "Other" category accounted for 21.5% of deaths registered.

Whilst the death data was a yearly figure, the population data was interpolated from the census. From 1881 to 1911 the census was five-yearly. After 1911 the next census was 1921, and the 1931 census was cancelled due to the Great Depression, with the following census taking place in 1936. The 1941 collection was not undertaken due to World War 2, and so 1945 was the next census to be completed. From 1951 the census was taken even 5 years until the present day, with the next census set to be taken on Tuesday, 8 March 2011 (Statistics New Zealand 2010). Accordingly the census interpolation features different weightings, ranging from the most common 5 years, to a 9 year gap between 1936-1945 and the largest gap of 15 years between 1921-1936. The weightings favour the forthcoming census collection.

In most census collections, the recorded population counts were in five or ten year age ranges, up to 90+. However, for the 1991 census only, the older age groups were aggregated together into a group of 60+. This was problematic for the 55-64 and 65+ age ranges, as the numbers in these groups for the years interpolated from this data had to be estimated. The population estimate, already present in the data set, divided the 60+ group into two, and added half to the 55-64 group, and the remaining half was deemed the 65+ group. However, personal calculations from the previous census data sets suggest the ratio is closer to 1:2, and the 65+ groups is under represented in this data. Unfortunately, due to the scale of the data set, this section could not be re-estimated, and the original weighting is used in this project.

This issue of weighting concerning the older age group, coupled with the introduction of the 'Other' geographic category, impacted upon the reliability of the data in the later years. From 1996 onwards the life tables produced inaccurate results, with LEs jumping to the late 90s or producing unacceptable results of over 100.

Accordingly, this project only used data from 1900 to 1995. In order to check the accuracy of the data, the country level LEs produced by this dataset (male, female and population) were all compared with the data provided by The Human Mortality Database (HMD), a project ran by the Department of Demography at the University of California and the Max Planck Institute for Demographic Research in Rostock, Germany. The HMD uses life tables to produce LEs, however, it uses single year entries, instead of age ranges, and so a slight

difference can be expected. Pearson's Correlation Coefficient was calculated to check the reliability of the New Zealand LEs produced for this study. Overall, the results were very close and all significant at the $p>0.01$ level (male = .921, female = .838. population = .901). The overall average difference for the total population was less than 1.5 years, 1.71 for the male data and 1.57 years for the female data.

In order to produce the overall gini*100, the age structure in each year was also calculated. This required building a table that was used in each year to calculate the percentage of the population in each group (of the total) for both population and death data.

In order to map the data, New Zealand shapefiles were downloaded from the online geographical database Global Administrative Areas (GADM). They were created in March 2009 and are licensed under a Creative Commons Attribution-Noncommercial-Share Alike 3.0 United States License. All mapping work was designed using ArcView GIS 3.2. Exact shapefiles for the regions used in this project were not freely available online, and so these areas are rough approximations, aggregating smaller regions to match the nine in the dataset (see Table 1).

Section Four: Life Expectancy at a Glance

LE (from birth) has been has been steadily increasing in the richer, more developed, countries of the world for a number of decades. Compared to the average of the OECD countries between 1980 and 2007 New Zealand citizens have consistently achieved a higher LE than the overall average for the organisation (Figure 3).

4.1 Trends and Patterns

The data for this project covers a much wider time period than the available OECD data, and accordingly, provides a broader picture. Figure 4 shows LE for New Zealanders from 1900 to 1995. It is clear that, although the overall upward trend is not affected, it is not a uniform increase. In fact, this data presents periods of *decreasing* LE. Most striking is the drop between 1914 and 1919, clearly highlighting the impact of WW1 and the influenza pandemic on the population. The pandemic remains the worst single human health disaster in recorded New Zealand history (Wilson & Baker 2008). The coinciding of a turbulent context with decreasing LE suggests that contextual factors can have a dramatic impact on health in a relatively short space of time.

These fluctuations are interesting from an analytical perspective as they have the potential to hold clues as to the impact of policy decisions being made in a country, particularly during times of rapid social and economic change. Considering elections in New Zealand generally take place every three years, it becomes even more important to examine data that is produced throughout these time periods.

As LE estimations for each year appear to be impacted upon by forces that can drive life-chances up or down, trends of decrease that do not occur during war or pandemics, such as those experienced by men between 1933-1939 and 1953-1964, where LE drops by around two years, become important focus points. Additionally, times of sharp increase are interesting too, such as 1940-1950 for men and women, where LE increased by between four and five years. Similarly, the steep increase from 1970 to the mid 1980s, where LE increased by six or seven years, is also important. Clearly, this data shows that LE does not increase by incremental steps, and is open to manipulation by contextual forces. This data presents trends and patterns that point towards periods of potential interest for researchers of demography and mortality.

4.2 Gendered Differences

Figure 5 highlights the gender differences more clearly, presenting the difference between the genders and the overall average. The highest disparity comes in the years 1918 – 1922 at the height of the influenza pandemic. During the influenza pandemic European female mortality rate was lower overall in New Zealand (McSweeney et al 2007). This is likely as the demographic structure of New Zealand at this point had a higher population of men than women, many who by this point would have been elderly, having immigrated to New Zealand in the 1880s (during a time of increased interest in the Australasian settler colonies). Additionally, the larger urban areas had a bias towards the female population. Although not conclusive, it has been suggested small towns were hit worse than large towns, and large towns worse than cities: likely due to the availability of health services. (*Ibid*).

After this turbulent period the differences converge slightly until they reached only 3.2 years in 1934, the lowest since 1906. However from 1935 to the late 1960's the difference widened considerably and consistently, and the disparity eventually doubled, reaching 6.6 years in 1967. After a brief period of convergence from 1967 to 1973 the genders once again diverged, this time further, with a disparity of 7.4 reached in 1984. From 1987 the gap has narrowed considerably to reach levels similar to that at the turn of the century.

Reasons for difference in male and female life expectancy are usually attributed to economic wealth, social circumstances, health-related behaviour and lifestyle, the environment, and biology, whilst the impact of healthcare systems and their mix of public–private funding remains disputed in the literature (Asiskovitch 2010). From this data, it is difficult to point to an overall pattern or trend, as the disparity is not always driven by women having their LE improve quicker than men. The widening gap from 1935 – 1968 is driven by two different mechanisms: the first half by women having greater increases than men, and the second half by women life expectancy reaching a plateau, and male LE decreasing. The convergence from the mid-1980s shows male LE increasing quicker than women's, which stalls slightly.

Importantly, apart from gendered inequality, this aggregated data provides no insight to disparities within New Zealand, between other categories such as geography, ethnicity or socioeconomic status. Overall LE can continue to go up whilst a population polarizes in terms of who is making the larger gains. Indeed, even during a time of overall increase, LE

for a group or area can go *down* simultaneously, and be missed within the upward trend of aggregate data.

Section 5: Life Expectancy Inequality in New Zealand

This section discusses the trends and patterns demonstrated by the Gini*100 calculations. It analyses the results at the population level, then compares the experiences fared by different cohort groups over the time period. In order to focus the examination and the figures on the developing "Ways", the following sections predominantly discusses the time period from 1925-1995.

5.1 Inequality at the Population Level

Figure 6 shows the Gini*100 for the New Zealander population from 1900-1995, with a five-year rolling average (section 3.3 discusses how this figure was produced).

The figure demonstrates the extent of difference *within* the male and female populations, as opposed to Figure 4 and Figure 5 which highlight the difference *between* the male and female LE.

The turn of the century saw a sharp rise in inequality for males and females. The female Gini*100 dropped before WW1 and stayed around 4, however the male rose during the war, and after a brief decrease, soared up until it reached its highest in 1925, a score of 5.6.

After 1925, apart from a blip between 1934 and 1939, male LE inequality drops considerably until the mid-1960s where it reaches its lowest for the century, of 1.6. This is a dramatic convergence of LE for men across the geographical regions of New Zealand; however, this convergence coincides with a *decrease* in LE for men overall, from 1953-1967.

Significantly, during this time the inequality of LE for females remains almost constantly higher than for males. Whilst males experienced their most equal period, female inequality increases from 2 to 3 and back again between 1960 and 1967. During this time, female LE decreased by a year.

The early 1970s saw a steep rise in inequality for both genders, particularly for females, when inequality doubled between1967-1976 from 1.9 to 4. For the initial half of the 1980s inequality converges for the genders, at between 3.5 and 4. However, the beginning of the last decade of the century saw a dramatic increase for both genders. In 1991, inequality for

females reached a Gini*100 height of 6; the highest of the century. Male inequality also climbed from 3.2 in 1984 to 5.8 in 1990.

After this dramatic increase, inequality appears to begin to decrease. However, from this data it is not possible to judge whether this downwards pattern is a significant trend. Other studies show inequality stabilizes lower than the early 1990s peak, but still at internationally high rates, and there is only limited evidence of a reduction from 1995-2000 (Pearce and Dorling 2006: 600, Tobias et al 2009).

Figure 7 splits the aggregated Gini*100 down, presenting the individual score for each population age group. The age groups are stratified, with younger groups sharing similar levels of inequality, and the inequality rising as the age-groups get older. The overall pattern for is each group over the time period remains the same, only with sharper changes for the older age groups.

In particular, from the age of 55 upwards the population Gini*100 is far higher than the aggregated score: for those over 65, the inequality faced is twice as high as the aggregated population. From the lowest point of 4.5 in 1968 inequality jumps to 9.5 in 1974 and 11.7 in 1990.

5.2 Inequality between Cohort Groups

For males Figures 8 and 9 shows the male data split into cohorts and organised by the year the cohort was born, and by the age of the cohort respectively. Figures 10 and 11 present the same data for females. The data organised by years is predominantly useful as a reference graph, and it is the age data focused on in the following discussion.

The cohort data demonstrates a multitude of experiences for New Zealanders over the twentieth century. Males born in 1925 saw inequality during their childhood and teenage years fluctuate mildly around a Gini*100 score of 3. However, the Gini*100 then steadily dropped and, by the time this cohort group was 40 in 1965, inequality was at 1.42, the lowest of their lifetime. Accordingly, cohort groups born later experienced this low point of inequality earlier in their lives, and each group with a slightly better equality score: those born in 1935 when they were 30 (1.2), those born in 1945 when they were 20 (1), those born in 1955 when they 10 (0.89), and those born in 1965 as soon as they were born (1.04). This

year, 1965, is the time of lowest inequality for all these age groups. For those at ten years old in 1965, they experienced the lowest inequality experienced by New Zealander males in the twentieth century.

However, the oldest age group, born in 1925, went on to face decades of accelerating inequality into their old-age: by the time they were 50 inequality for their age group had almost doubled to 2.74. A decade later they faced inequality of 5.13. By the time they were 65+ the Gini*100 score almost reached 13.

This almost exponential increase, at only 65, demonstrates that males in different geographical regions of New Zealand faced highly varying outcomes when it came to what they should expect from the longevity of their retirements. Inequality is studied less for older age groups often as past the age of retirement information on income and other measures is not routinely collected. For a LE study of older people in the UK, Khaw notes that, "all available data indicate that inequalities persist; while the relative inequality maybe similar in old age, because rates of ill-health are much greater in older people, the absolute inequalities may be far higher" (1999: 33).

It is important to note that this increase in inequality resonates backwards through the years and age-groups. For instance, at the age of 47, those born in 1925 experienced inequality of 2.24. Those born in 1935 faced a Gini*100 of 4.44. For those born in 1945, when they reached the same age, inequality was 6.16.

This is perhaps most problematic during the large inequality from the 1970s onwards, as it has the strongest implications for the younger cohorts, in much earlier stages of their lives. It is striking that for the boys born in 1985, by the time they are 5 years old they face already face a LE inequality of 3.2, a score not faced by any children that age since 1930. Fifteen year old boys in 1990 face a score of 3.9. This level of inequality was not experienced by those born in 1925 until they were 55 years old, and for those born in 1935 until they were 45, when they already had substantial decades of equality, employment and economic prosperity behind them.

For females the pattern is the same except the differences are more pronounced. At the age of five, those born in 1955 and 1965 faced LE inequality of 1.3. For those born in 1985, by the time of their fifth birthday they face a Gini*100 score almost three times higher, at 3.8.

5.3 Discussion

Periods of high inequality for the overall population inequality do not coincide with negative effects on overall LE. During the sharp rise in inequality during the 1970s onwards, LE actually increased between 5 and 7 years for both genders. Regression analysis of the LE and Gini*100 data show no relationship between the yearly score or yearly change over time (results not shown). Perhaps not surprising, as the fluctuating Gini*100 score occurs during LE that has generally increased over time.

The inequality trends do appear to match the welfare developments in New Zealand. Following the introduction of the welfare state, inequality decreased dramatically for a decade, until it reached an impressive low in the early 1960s. During the structural reform and New Zealand 'experiment' from 1984 onwards, there is a sharp increase in inequalities in LE, as the studies by Kelsey (1995) highlighted. This is expected considering the nature of policy pursued in this time. What this data adds is that, when taken in context, this increase is not a new phenomenon and is actually a continuation (or perhaps exacerbation) of a trend that started over a decade before. The early 1960s were a time of equality, but it lasted a limited amount of time, only really applied to men, and coincided with a decrease in LE for men. Inequality between the LEs of women remained much higher during this time period. This decrease is not often mentioned in the literature that criticises the dismantling of the welfare state from 1984 onwards. That it occurred during a time of high employment and earnings makes it an interesting time period for further study.

The rise during the 1970s is also an area for further potential research. During this time the welfare state is generally acknowledged to be operating on the same principles as it was during the improvements in equality. Yet, inequality rises sharply. It has been outlined that this was a time when New Zealand found itself under external forces and global change (see section 2.3.1), and so the limitations of the welfare state in protecting the population from these changes is an area that deserves further analysis. In 1984 the government decision was to roll back the state and welfare provision, in order to improve the efficiency and economic functioning of New Zealand. From this data it is clear that this was followed by a sharp rise in inequality. This begs the question whether inequality could have been tempered by *extending* the welfare state, rather than embracing minimalist neoliberal dogma.

It is apparent that the patterns and relationships between LE and inequality are complicated, and that trends are not necessarily predictable. That male LE is lower than female, yet inequality is consistently higher for females, is perhaps a surprising result.

The cohort data provides further insight into different experiences of the LE inequality across the twentieth century. The repercussions of these experiences are highly significant. The patterns experienced are very different for each group. For those born earlier, they face low inequality during their middle-aged years (at working age) and high levels at retirement. For the later groups, they face these high levels earlier and earlier in their lives. The earliest group are facing it in Primary School. What implications will it have for the younger age groups growing up in times of high geographical inequality?

What is perhaps the most relevant point here is that these older cohorts were involved in outlining the structural reforms that coincided with heights of inequality for the younger generations: for instance, Roger Douglas of "Rogernomics" fame (sees section 2.3.2), was born in 1937. With this in mind, the direction of future policy dictated by younger age groups becomes difficult to predict.

The following sections analyse these trends in New Zealand by focusing on three particular age groups, and examining the regional and spatial dimensions of the patterns, in an attempt to unravel the picture presented by the aggregate data, discussing the possible impact contextual factors could be having on the experiences of these groups.

These age groups were chosen for a number of reasons. The Under 1 age group represents a vulnerable group that will likely require access to healthcare services, as will the mother, during birth, or for follow up post-natal examination. Between 15-24 is interesting as it potentially presents a turbulent time for a population that might be entering the workforce, leaving home, developing independence and susceptible to contextual factors and higher-risk activities (see section7). Finally, the 65+ age group is a growing part of the population in many countries and will likely drive policy in the next few decades. Currently somewhat removed from the economic workforce this age group can be vulnerable.

Section 6: Children and the Under-1 Age Group

New Zealand has one of the lowest child mortality rates in the world. In 1990 it ranked 9th for under-1 mortality rates, by 2008 it had improved to 5th (UNICEF 2008). In 2004 the under-5 mortality rate stood at 7 for males and 6 for females per 1,000 live births (WHO 2006). Between 1922 and 1927 the average deaths for just the under-1's was as high as 40 per 1,000 live births.

However, the degree to which these gains have been shared by New Zealanders universally, as opposed to certain areas of the country, is open to debate: in the region of Taranaki in 1990, a 4 year-old-boy could be expected to live until he was 65, and his female counterpart until 67.5. In the region of Wellington, next door, a four-year-old could expect to live until he was 78, and his female counterpart until 82. The focus of this section is the inequality for New Zealand's children, examining the under-1 age group.

6.1 Inequality by Geography and Gender

In 1900, 11.3% of all male deaths were in the under 1 category, and 9% of female deaths (Figure 12). By 1995 this had fallen to 0.7% of males and 0.6% of females. The most significant down trend occurred between 1900-1935. A slight increase of 0.2% for females occurred between 1955-1965, but from that point both genders decrease and converge.

The Gini*100 score in Figure 13 replicates Figure 7**,** but with gender comparisons**.** Females are shown to experience inequality consistently higher than males. A dip from the 1940s to the 1960s is followed by a surge until 1990, peaking at the highest inequality for 70 years. Overall, the Gini*100 scores in this age group are about half that of the total population Gini*100 for all age groups.

Table 3 presents select figures highlighting overall change from the start to the end of the data set. Hawke's Bay and Westland offer examples of contrasting experiences. In 1925, Westland had the lowest LE at birth for all nine regions (59.94). By 1995 this had grown to the highest (82.04). Over time, Westland faced a differing LE of 32 years, from a very high peak of 89 (in 1991) to a low point of 56 (in 1940). In comparison, in Hawke's Bay the difference between LE in 1925 and 1995 end was only 1.79 years with a range of just 10.86 years.

Figures 14 and 15 outline that LE in Hawke's Bay for males and female underwent a considerable dip from 1940-1970, followed by a rise that only returned to pre-1940s levels around 1990. The Westland rise is also clear (although for males before 1980 it consisted of a number of reductions too). Additionally, Canterbury experiences a dramatic rise from the late 1970s to the early 1980s,followed by a dramatic fall to the lowest of the South Island regions. Secondly, Taranaki bucks the North Island trend. From the 1980s onward LE declines sharply, until males are expected to life 5 years less than the next North Island region (Hawke's Bay), and females 8 years less.

Male LE shows a general decline from 1950 to the mid 1960s. This is most apparent in the rural areas of Otago, Nelson, Hakwes Bay and Westland (although the drop here occurs slightly later). The urban areas saw a flattening out of LE as Auckland, Wellington and Canterbury entered the 1950s with a LE of 67/68 which stayed the same until around 1975. For females, the pattern is not as clear. Wellington flattens out during this time period at 75, but Canterbury increases and Auckland fluctuates wildly: between 65 and 75, LE from birth in Auckland reaches a point 5 years less than the rest of the North Island, and the lowest of New Zealand overall.

The spatial patterning of LE change over time is presented in Figure 16. The map for males and females shows that the year on year average increase is most pronounced on the South Island. Westland's increase of .27 - .33 years every year is almost ten times that of the .03-.09 increase experienced by Taranaki and Hawke's Bay on the North Island, which form a block across the centre, and are flanked by the higher achieving urban centres of Auckland (.15-.21) and Wellington (.09-.15).

6.2 Discussion

The overall picture of child mortality rates in New Zealand is a positive one. They are low, and appear to be staying low. The LE of children under 1 must concern not only the health of the child, but also the health of the mother and the environment in which the child is being raised, as they are inextricably linked.

Pregnancy is a time when the self-care, family care and professional care that women receive can result in long-term benefits for the well-being of both mother and child (Fanslow et al 2008: 398). Once the child is born, there are important social implications to examine. For

instance, postnatal mental illness afflicts a substantial minority of women following childbirth and also has the potential to adversely affect the mental, emotional and physical development of the infant and other children (Thio et al 2006: 814).

In New Zealand there is a lack of information and research available on the rates and impact of mental illness after depression, and studies have found that general major depression in New Zealand was significantly higher than in other countries (*Ibid*: 816-817).

Additionally, a recent study shows that violence during pregnancy, coupled with alcohol and tobacco use by both the father and the mother, is currently an important public health issue (Fanslow et al 2008), one which may not have been on the public health agenda five decades ago. These issues are also more pronounced in rural areas compared to urban areas. Figures 14 and 15 demonstrate that the decline in LE does appear more pronounced in Hawke's Bay, Taranaki and Westland during this period, whereas it flattens out for the urban centres of Auckland, Wellington and Canterbury.

Although not straightforward relationships, increased inequality in society has been linked to increased violence within families (Anderson 2010), increased alcohol consumption (Dzúrova et al 2010, Le at al 2010) and increased risk of mental illness (Burns 2009). This makes the relatively rapid rise in LE from 1984 onwards surprising, as it occurs during a time of rapidly rising inequality. The isolated decline in LE for Taranki demonstrates that the neoliberal structural reform did not have a uniform geographical impact. The fall in inequality *and* LE in the 1950s and 1960s is also unexpected, as the fall occurs during the height of the welfare state, along with high employment and home ownership (see section 2.3.1).

Overall, geographical regions in New Zealand appear to have responded differently to, or been treated differently by, state-led policy. There is divergence during the First and Second Ways. Trying to untangle reasons for this is difficult, as inequality theories related to the health of mothers and newborns does not appear to match up with the trends and patterns displayed in the data, and calls for further research to address these seemingly contradictory outcomes.

Section Seven: The 14 – 24 Age Group

The 15-24 age range is an interesting area of focus. During this time men and women are vulnerable to a number of health issues, particularly those associated with mental health, accidents and violence.

7.1 Inequality by Geography and Gender

Figure 17 replicates Figure 7**,** but with gender comparisons for this age group**.** As with the Under 1 age group, female inequality is consistently higher than male. Overall, the inequality is around 0.5 higher on the Gini*100 than the previous age group.

Figure 18 and 19 show the percentage of total deaths accorded to the 15-24 age range by gender, divided into the two time periods, as well as by the North and South Island. Between 1925-1960, for both males and females there is a considerable downward trend across all regions, with the exception of Marlborough, which spikes between 1940 and 1945, although still reduces overall.

Males had a higher percentage of overall deaths compared to females, with less reduction during the time period. When compared to the Gini*100 this suggests this inequality manifests itself *within* regions stronger than *between* regions. The percentage trends also match the Gini*100 trends, as the regions generally converge from 1940 onwards.

The North Island shows similar patterns in each region. In comparison, the South Island features far more variety and unpredictability, especially for males.

Between 1960-1995 the pattern changes (figures 20 and 21). Unsurprisingly, since the numbers decreased rapidly in the previous years, this downward trend ceases. In the case of females, although it does not rise above 1%, there is an upward trend across all regions until around 1985, after which they begin to decrease again. In the male North Island group the general trend is upwards. For the South Island males the overall trend is down, although not significantly. Interestingly, after the fluctuations of the previous time-period, by 1995, the percentages for regions in the South Island become similar to that of the North, suggesting an eventual narrowing of regional difference over time.

Table 4 shows the ratio of male percentage to female percentage is consistently higher across all regions in both time periods. Most interesting is the increase from 1960-1995. In this time period, the percentage of male deaths was 3 times as high, and almost 5 times in Westland, compared to the early time period where the difference was generally 1.5 times higher.

7.2 Discussion

LE results from this age-range demonstrate trends of inequality *within* gender groups geographically, as well as *between* males and females. Causal mechanisms for such patterns are difficult to pinpoint, however the literature highlights three health issues prominent in the experience of 15 – 24 year olds.

Firstly, in Western countries, the most marked increase in suicide rates over the last 30 years has been witnessed among adolescents and young adults (Gould et al 1994). World Health Organisation data from 2002 demonstrates that New Zealand has a very high suicide rate for 15-24 year olds, the male rate being 5 times that of men in the UK (30.4 of 100,00 as opposed to 10.6), and the female rate being twice as high (5.7 as opposed to 2.5) (Bridge et al 2002). Between 1978 and 1997 the male suicide rate for 15–19-year-olds almost trebled, whilst nearly doubling for the 20–24-year-olds (New Zealand Health Information Service 2001).

Secondly, car accidents are also concentrated in this age range, particularly for men. After any level of alcohol intake, teenage drivers are estimated to have more than five times the risk of drivers aged 30+ and drivers in their twenties are estimated to have three times the risk of drivers aged 30+ (Keall 2004). In New Zealand, Learner Driving Licenses can be acquired from the age of 15, and driving is common as much of the country is rural, and there can be large distances between urban areas.

Thirdly, between 1985 and 1994, youth homicide rates increased in many parts of the world, especially among youths in the 10–24-year-old age bracket (WHO 2002a). Almost everywhere, youth homicide rates are substantially lower among females than among males, suggesting that being a male is a strong demographic risk factor (*Ibid*). New Zealand is no exception. Between 1985 and 1994 the youth homicide rate in New Zealand doubled, from 0.8 per 100,000 to 2.2 per 100,000 (*Ibid*: 27).

Although not specific to this age-group, unemployment has been linked to detrimental health effects across a number of studies (Martikainen & Valkonen 1996, Bartley 1996, Costa & Segnan 1987). The rise of inequality for men coincided with increasing rates of unemployment that resulted from the neoliberal reform: between 1980 and 1991 unemployment rose from 4% of the working population to over 10%. Although it decreased after this peak, it didn't reach 4% again until 2004 (International Monetary Fund 2010). This feeds into social control, or the lack of it, caused by deteriorating job opportunities or socioeconomic position (Bosma et al 1999).

Perhaps most interestingly is that these increased health risks for this age range are strongly gendered towards men, yet until the late 1970s, inequality was consistently higher for women. Kelsey argues that women shared the unequal burden generally:

Before the 1980s recession, a quarter of non-Maori women and almost half of Maori women were totally dependent on social security benefits as their source of income, compared with only 11% of Maori men and 6% of non-Maori men. Women were forced to rely on all public services – from benefits to transport – far more than men. And they were most dependent on the state sector for income and employment in 'women's work' of teaching, nursing, clerical and social services. (Kelsey 1995, 285-286)

Accordingly, in the 1980s onwards, women's inequality increase, although men's actually took over. What is perhaps the case is that whilst this structural inequality was increasing for both genders, men were socially more likely to commit high risk activity in response to it, such as dangerous driving or violent behaviour. Suicide increase has been linked to inequality, although the causal mechanisms are hard to pinpoint. During this time of high-unemployment, men, who were historically the employed gender and had the status of worker and breadwinner, perhaps found themselves struggling to cope with the lack of control and social conditions.

Section Eight: 65+

Population ageing is an increasingly global phenomenon and many developing nations have made the transition from high mortality and relatively high fertility to low mortality and fertility almost within a generation (Statistics New Zealand 2009a). Due to fertility remaining high well into the twentieth century, New Zealand will undergo a demographic transition towards an ageing population less rapidly than countries such as Japan, Germany and Italy. Although the transition will be more gradual, current levels of low mortality and, by historical standards, low fertility, will likely produce population ageing in the next three decades. Migration effects have tended to be relatively short-lived, and overall, migration into New Zealand has done little to mitigate population ageing (*Ibid*).

8.1 Inequality by Geography and Gender

The inequality for the 65+ age group again replicates the pattern previously discussed, but is much higher, averaging around 10, three times that of the younger age groups (see figure 22). Females continue to show the same consistently higher trends as seen with the Under 1, and the 15-24 age groups, although with even stronger differences. In particular, there is a spike for female inequality during the latter half of the twentieth century that is not nearly as prominent for the comparator groups. This reinforces the observation that whilst aggregated LE may increase for a group, this might not capture geographical polarisation within the group, as experienced for women most strongly in the 1970s. By 1995, New Zealand retirees faced a Gini*100 of 11, opposed to 7 at the turn of the century.

Female inequality is driven by the plummeting LE for 65+ in Auckland and Otago during the 1970s (figure 23 and 24. For the 1990s the downward trends are in Taranki and Canterbury. Canterbury sees an LE drops by a half (from around 28 to 14 for both genders), between 1982 and 1990.

The most stable era for this age group seems to have been for males in the North Island during the 1960s, although as discussed, this coincided with a decrease in overall male LE.

Figures 25 and 26 show the spatial manifestation of LE in 1995. For this age group there does not appear to be a distinct rural/urban pattern, as Westland shows the highest LE. Both

islands demonstrate LE differences in regions of close proximity to each, suggesting an uneven distribution of healthcare services for the elderly across New Zealand.

8.2 Discussion

The changing structure of a population is important as it has economic repercussions concerning the dependency ratio of workers to non-workers, and the ability of a welfare system to provide care for the elderly. Concerning the direction of inequality, it becomes dependent on whether healthcare is accessible to all, and improves the lives of those currently living shorter, or if those living older continue to improve their LE whilst others do not.

They are two primary points of discussion regarding possible mechanisms of inequality amongst the elderly.

Firstly, the pension scheme in New Zealand underwent a number of transformations over the twentieth century. Do to the cross-over of government policy, it is difficult to determine whether any particular party can be argued to have a positive or negative effect on pensions and inequality for the retired. For instance, female inequality rose and fell dramatically during the National Party's unbroken terms from 1960-1972. In 1972-1975 an unpopular Labour party managed to cap inequality, and begin a reduction. The incoming National government continued this reduction to a dramatic extent, a fall in female inequality which coincided with the introduction of National Superannuation, a universal, flat-rate pension, deemed very generous at the time.

However, in 1986 the Labour government introduced a highly unpopular 'claw back' tax for better-off pensioners – the Superannuation Surcharge – in 1986 in an attempt to curb the burgeoning cost of Superannuation (Obinger at al 2005: 174–175). In 1991, the National government introduced huge cuts on the pension available. That these time periods coincide with trends of heightened inequality, in particular for women, are not too surprising. As Kelsey (1995) outlines, "women comprised 55.8% of those over 60 and 66.4% of the over-80s. With relatively few savings or assets and little outside income, and being more likely to live alone, women depended more heavily on the basic pension than men" (*Ibid*: 288).

Secondly, the New Zealand government has recently begun to study the internal migration patterns of the 65+ population. Although this population is less likely to move, in a country

as sparsely populated and rural as New Zealand, with limited urban areas, welfare provision is highly important, especially for elderly generations who may experience decreased mobility.

The study showed in the period 2001-2006 that Auckland featured a distinctive outflow of New Zealand 65+, and large inflow of overseas 65+, resulting in a "churning population" (Statistics New Zealand 2009b). This is important for future projections of welfare as Auckland is the predominant urban area by some way in New Zealand, and during 1900-1995 it increased from comprising of 20% of the population to 50%.

In comparison, Otago and Taranki saw decreases in their overall population, and the 65+ population in general moving away. Areas gaining the 65+ group were Canterbury and The Bay of Plenty (not individually in this dataset) (Statistics New Zealand 2009b).

This means the high level of inequality from the 1900-1995 period is likely to continue. As Auckland has such a high weighting, the concentration of overseas elderly plus the elderly who do not wish to move (perhaps due to not having the finances, immobility or simply wishing to stay put) are likely to have lower life expectancy than those able to move and those of the settler population. However, with these more mobile groups moving to smaller and more rural areas, they are possibly increasing the dependency ratio in these areas and the requirement for more dispersive health services.

Section Nine: Limitations

More specific data and method limitations have been discussed in Section 3. Accordingly, this discussion outlines the study limitations and highlights potential directions for further research.

9.1 LE as a Measure

A key limitation of this research is the notion of LE. Although used by a wide-range of health-related bodies, LE is increasingly being criticized on the grounds that, especially in developing countries with longer life spans, it is no longer a reflection of overall quality of life. Instead, with additional data, a healthy life expectancy can be calculated, that takes into account years lived with limiting illnesses. For instance, WHO estimates LE at birth in New Zealand to be 78 for males and 82 for females (WHO 2002b). However, *healthy* life expectancy from birth is 69 for males, and 72 for females, a full decade or more less. This is important, especially in countries with demographic transitions to ageing populations, which New Zealand will undergo, in deciding how inequality show be examined.

9.2 Data Restrictions

The data was limited in that it did not differentiate between ethnic minorities, and the regional split (inherent in the data), did not match up with other regions in order to examine any determining factors to the inequality measures that were produced. Although this study aimed to provide overall trends and patterns that could be described and examined, it was not able to build on these and produce any analysis in terms of causality or provide in-depth theoretical discussion on the drivers of inequality in each geographic region, such as socio-economic deprivation. Causality requires three important criteria of association, temporality and direction (Thomson et al 2002). In this situation, these changes in trends and patterns can be discussed alongside the coincided developments in social and economic policy; however, robust conclusions are limited.

A predominant issue is how quick these policy changes impact upon society. Blakely et al (2000) study the lag time between income inequality and health status, and find that it for certain age groups it could be 15 years before changes manifest themselves in health outcomes. Whilst increased deaths in an age-groups in a year have an immediate impact on

the calculation of LE, the accumulated contextual factors that led to the death (whether health, psychosocial or a combination), may have taken longer than a year to manifest.

Geography remains a valid indicator for health outcomes, as the area is multidimensional, and the more factors are researched, the wider the picture can be produced. Especially in New Zealand where the urban/rural divide is so important, and the population spread so thinly, then the ability of healthcare to meet the needs of people living in all geographical regions becomes paramount.

9.3 Further Research

Further research could take a number of directions. A similar geographical analysis of another comparable county could improve the examination of causality by contrasting the trends and patterns across two case studies. England was initially chosen for this project; however, data was not available to cover a long enough time period in order to make a robust comparison. Interpolating the data between time periods available weakened the comparison, and undermined the aim of the project, which was to focus on the longitudinal patterns and trends across a case-study.

Additionally, in order to deepen the understanding of the trends occurring in New Zealand, the geographical level of inequality could be used as a variable within a wider multivariate multilevel analysis of LE, or healthy LE. In order to complete such a study, this data would require substantial reconfiguring, in order to match the boundary data in New Zealand at the government of health authority level. These boundaries have changed numerous times over the twentieth century.

Conclusion

Although with limitations, this data has shown the pattern and trends of inequality for LE in New Zealand over the twentieth century. The data demonstrates that patterns of inequality coincide with times of social and economic upheaval. Examination of the cohort experience shows that over this time period younger and younger age groups have faced increasing levels inequality. The repercussions of this for society in the long term are an important consideration.

Gendered results show that, although women can be expected to live longer, in New Zealand they have consistently faced higher levels of regional inequality when it comes to how long they can expect to live. This is important as gender equality often focuses on the gains of certain sectors of the female population compared to their male counterparts, and examination must also consider whether the female population is polarizing in terms of LE outcomes at this time, or whether these equality developments can be achieved universally.

The analysis has looked beyond aggregated data to show that LE does not necessarily improve in continuous incremental steps, and that sometimes developments reduce the estimated length of life of a population. In New Zealand a surprising downward trend occurred for men during the early stages of welfare implementation (1950-1960), a period of high employment and economic vitality. This trend is unlikely to be an artefact of the statistical method employed. This combination of improved equality but degrading LE is an area that deserves further attention. The welfare "Ways" appear to have impacted upon levels of inequality, but not necessary upon the overall improvements in LE. Further research could attempt to separate the drivers of these two patterns, in order to help welfare systems determine whether they are designed to extend LE, equalise LE across a population, or improve health status throughout life.

In New Zealand, the geographical inequality has shown that regions develop very differently to each other, even when in close proximity. This could be that policy is not implemented in a uniform pattern, or that the particular demographic and contextual traits of each region (socioeconomic, ethnic, physical etc.) could respond to policy developments differently, or likely a combination of the two.

Overall, the geographical difference in New Zealander's LE is an important and substantial one, and something that requires further research in order to improve the assessment of the impact of health policy on the quality of people's lives.

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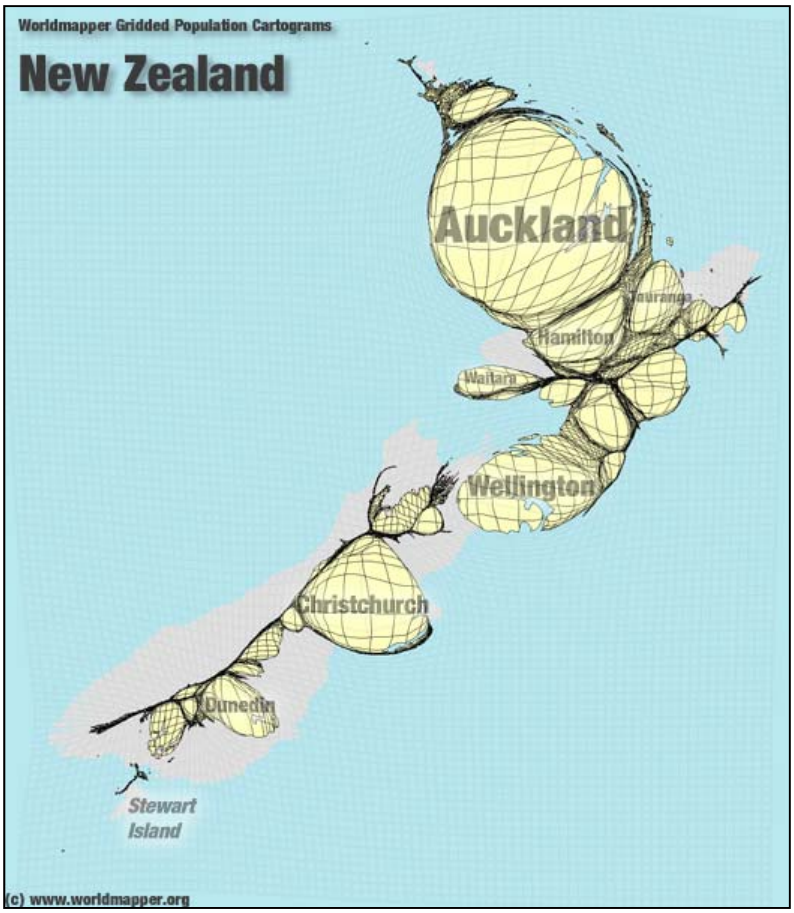
Appendix

Figure 1: New Zealand Cartogram



Source: Worldmapper.org

Figure 2: Map of regions used in this project and approximate location

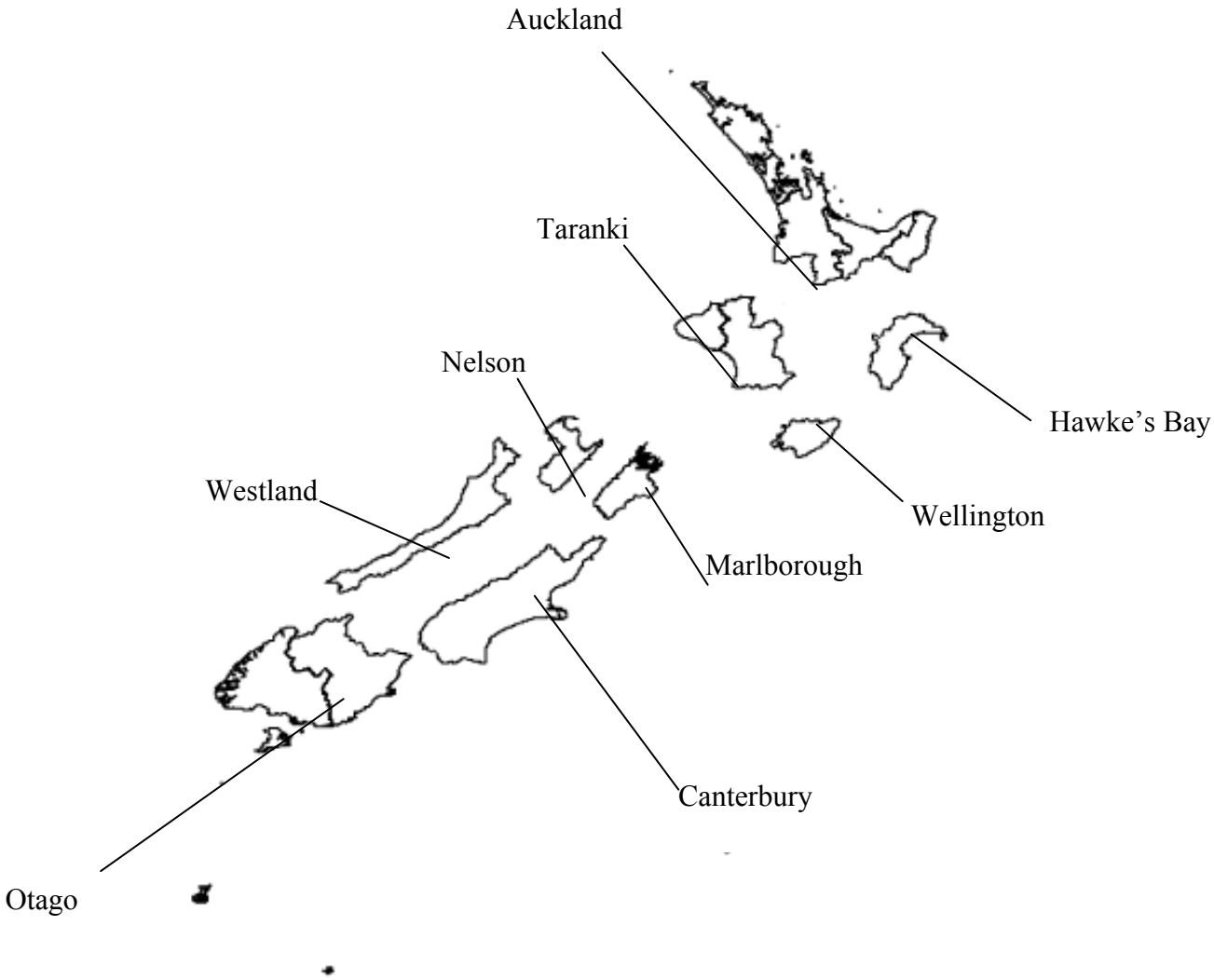


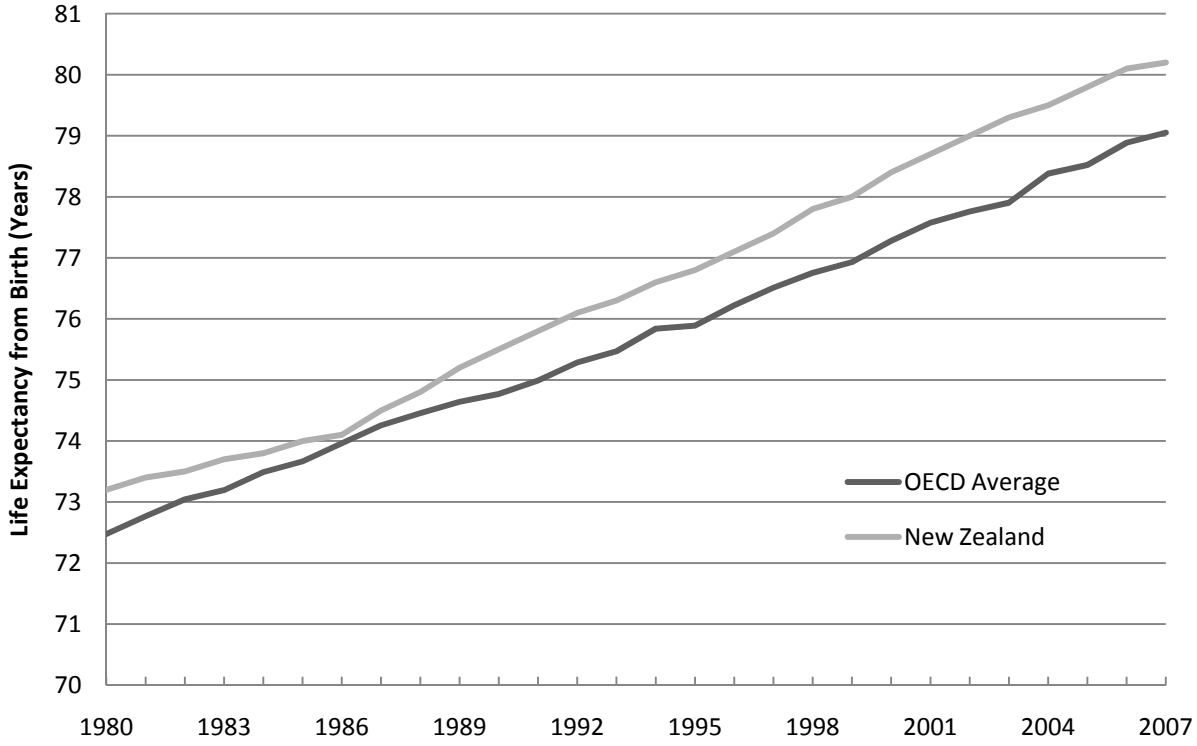
Table 1: Primary Regions and Composite Regions for New Zealand Shapefile.

Primary Region	**Composite Region**
Auckland	Auckland, Bay of Plenty, Gisborne, Northland, Waikato
Taranaki	Taranaki, Manawatu-Wanganui
Hawke's Bay	Hawke's Bay
Wellington	Wellington
Marlborough	Marlborough
Nelson	Nelson
Westland	West Coast
Canterbury	Canterbury, Chatham Islands
Otago	Otago, Southland

Table 2: Primary Regions and Composite Regions in Data Set

Primary Region	**Composite Regions**
Auckland	Northern Auckland Zone Western Auckland Zone Central Auckland Zone Southern Auckland Zone Hamilton Zone Tauranga Rotorua Gisborne Pukekohe Taupo Tokoroa Cambridge Zone Whakatane Whangarei Te Awamutu
Taranaki	New Plymouth Hawera Wanganui
Hawke's Bay	Napier Zone Hastings Zone
Wellington	Upper Hutt Zone Lower Hutt Zone Palmerston North Porirua Zone Wellington Zone Feilding Levin Kapiti Masterton
Marlborough	Blenheim
Nelson	Nelson
Westland	Greymouth
Canterbury	Christchurch Timaru Ashburton
Otago	Oamaru Dunedin Invercargill Gore

Figure 3: OECD Average Life Expectancy 1980 – 2007 compared to New Zealand



Source: OECD 2010

Figure 4: LE in New Zealand from 1900-1995 for Males and Females (5 year average)

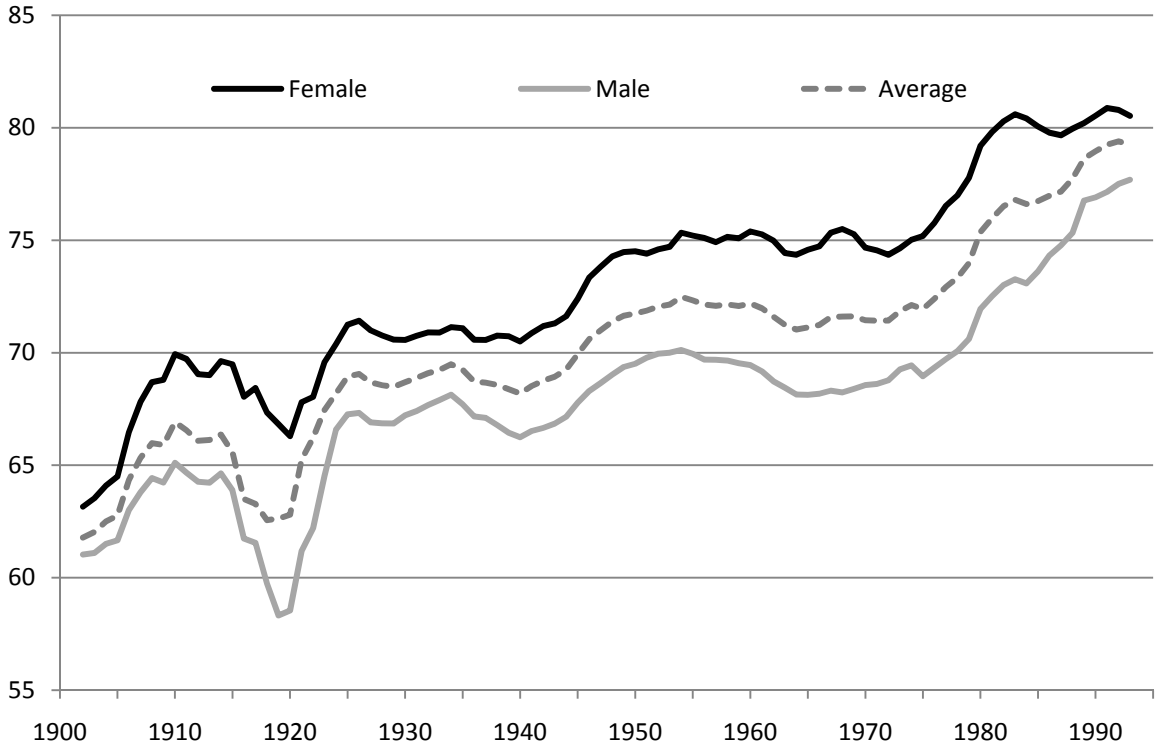


Figure 5: Male and Female LE difference to Average in NZ 1900-1995 (5 year average)

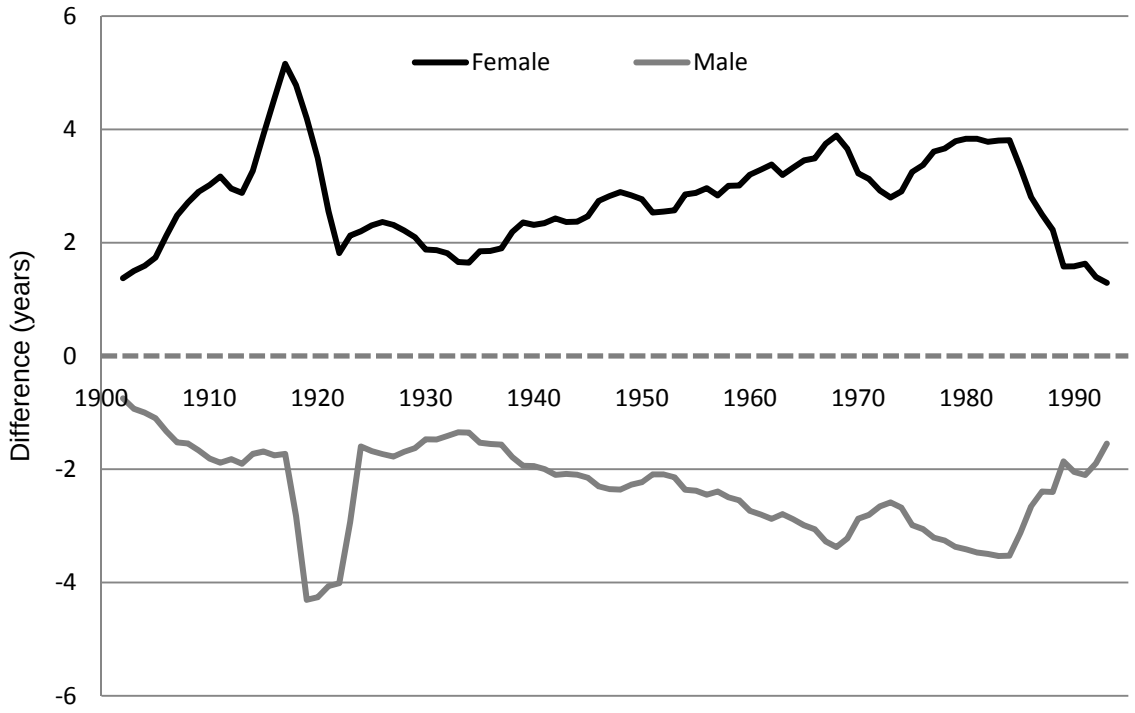


Figure 6: Inequality of New Zealand Population (5 year average)

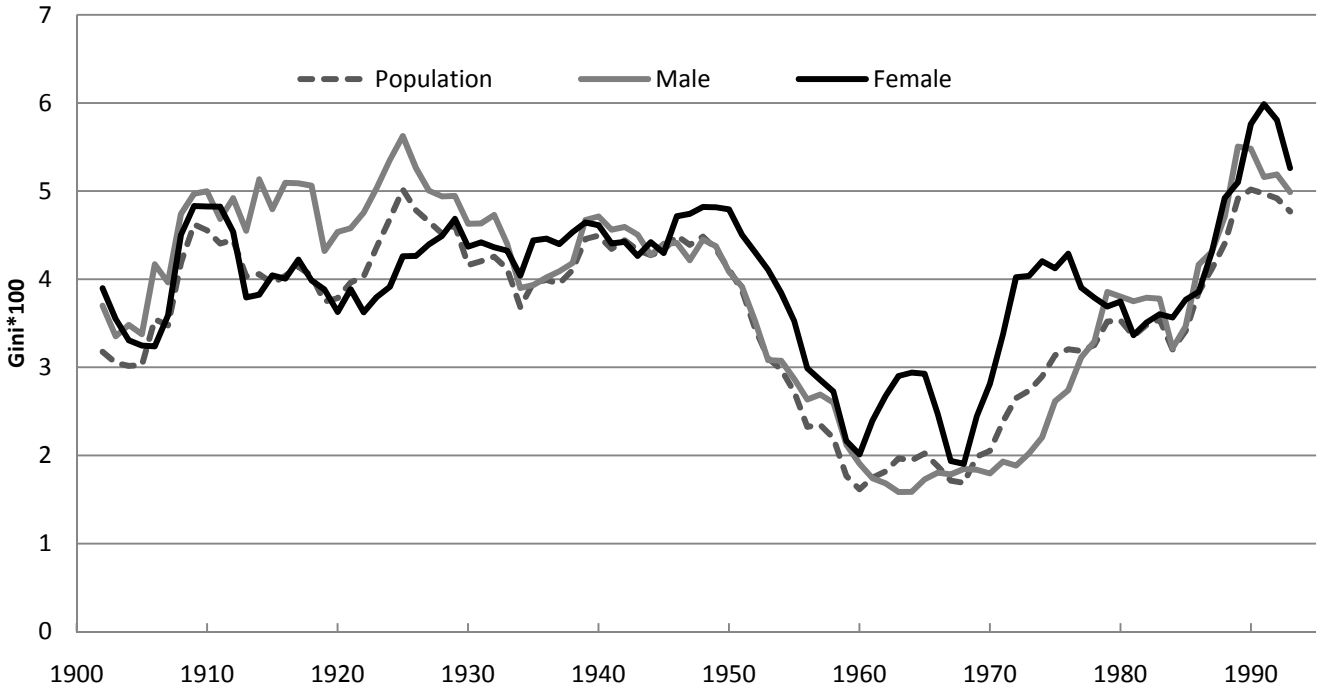


Figure 7: Inequality of New Zealand Population by Age Group

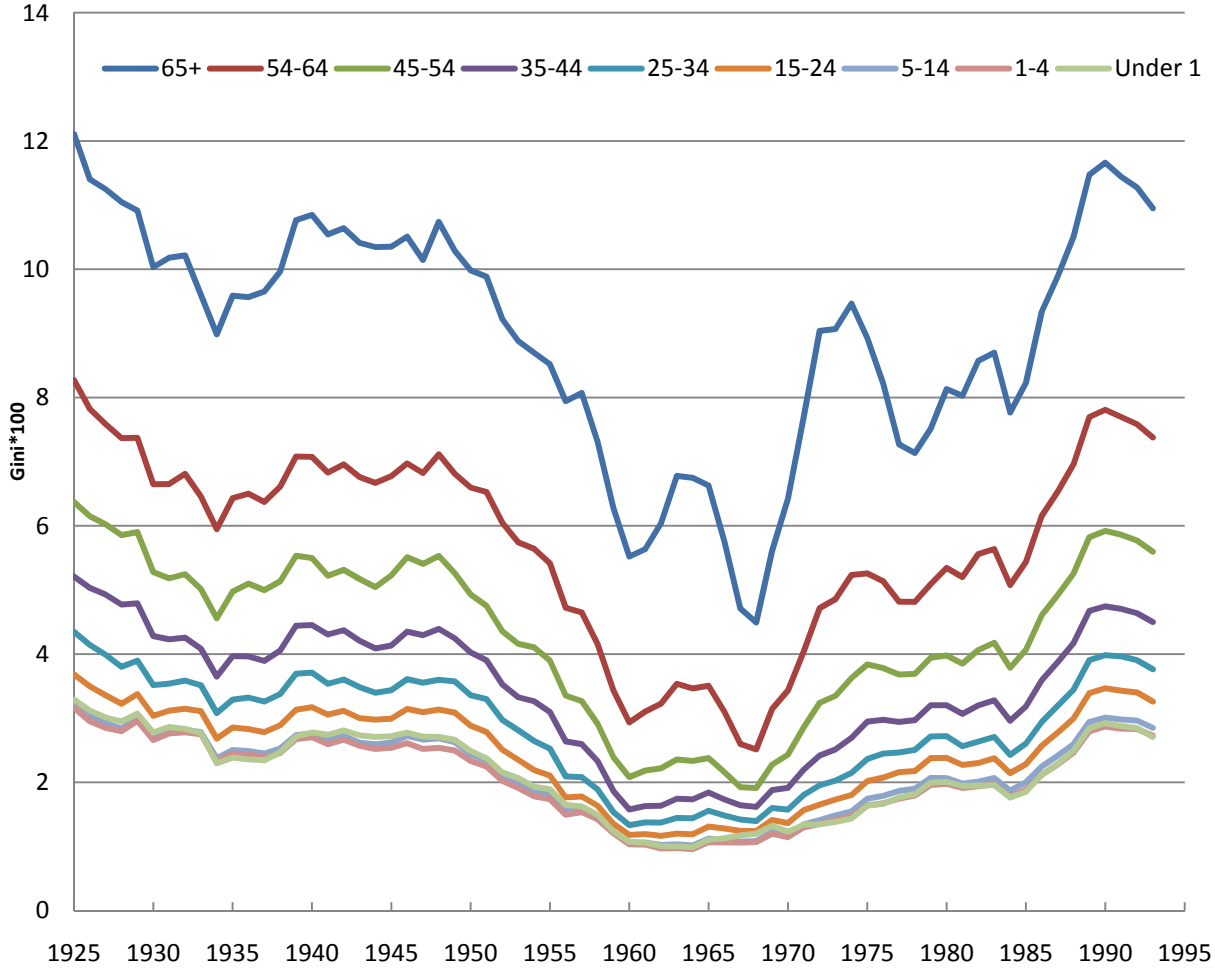


Figure 8: Male Cohort LE Inequality by Years

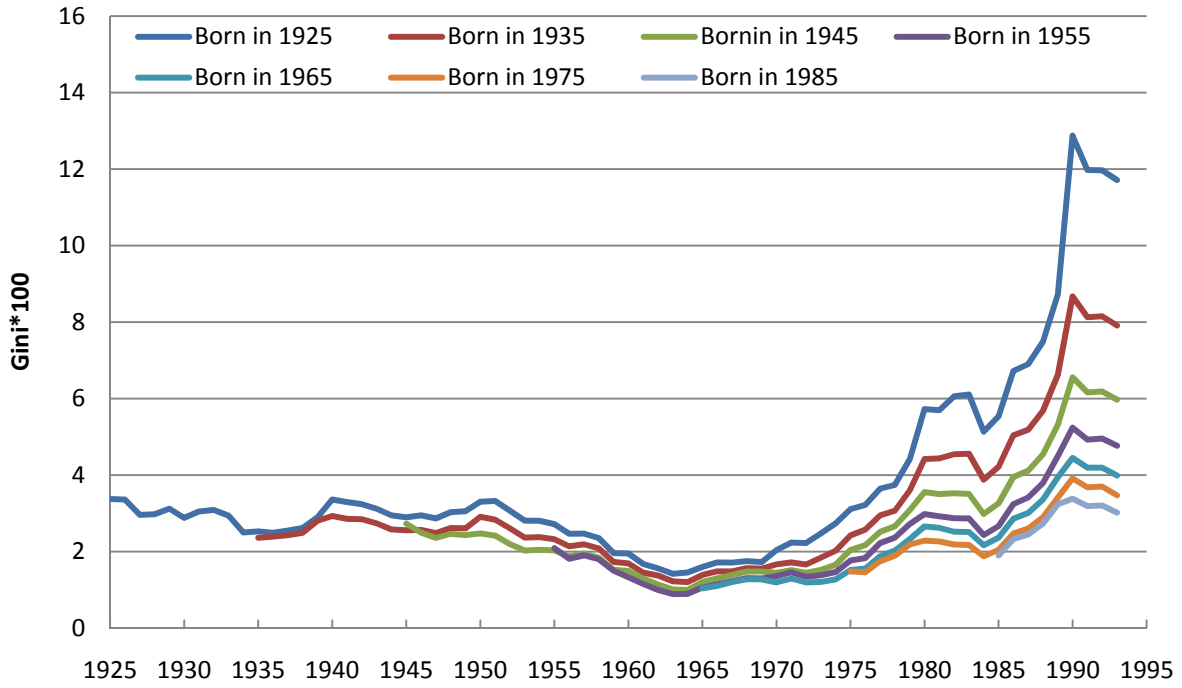


Figure 9: Male Cohort LE Inequality by Age

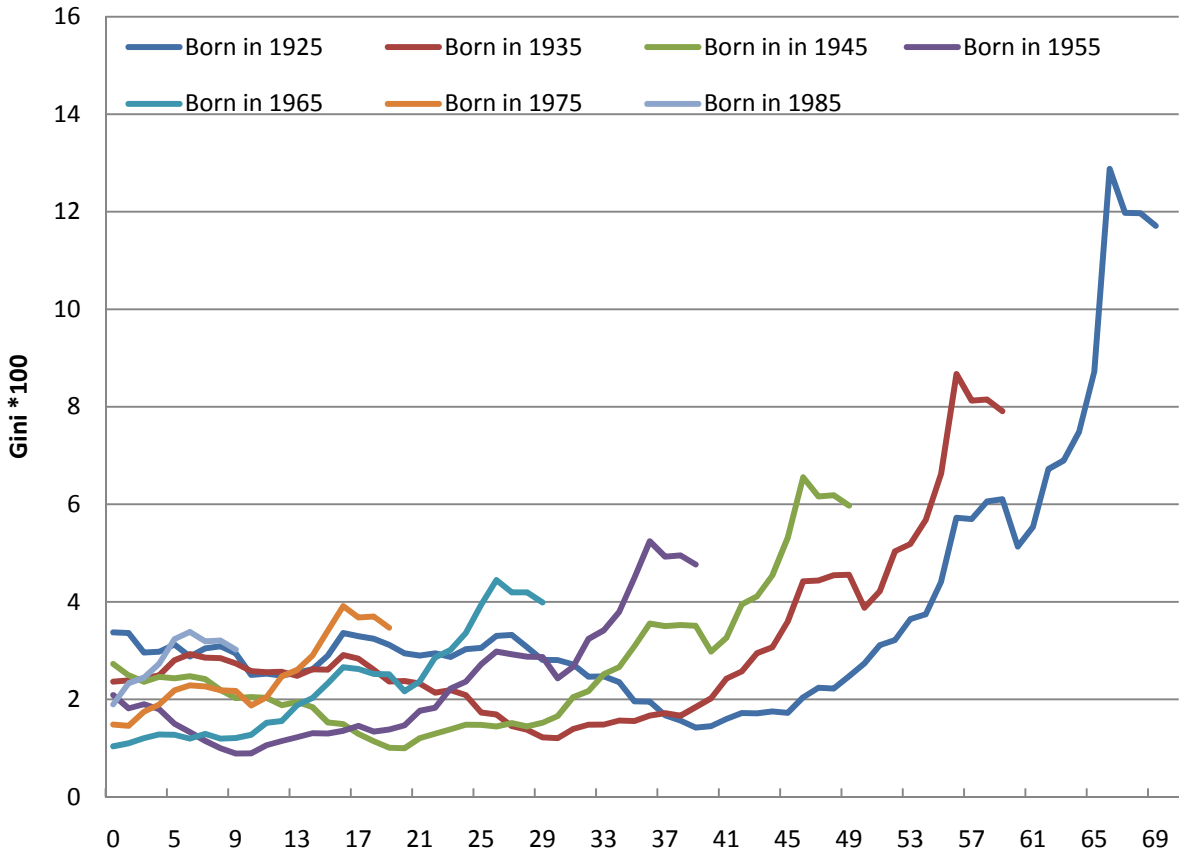


Figure 10: Female Cohort LE Inequality by Year

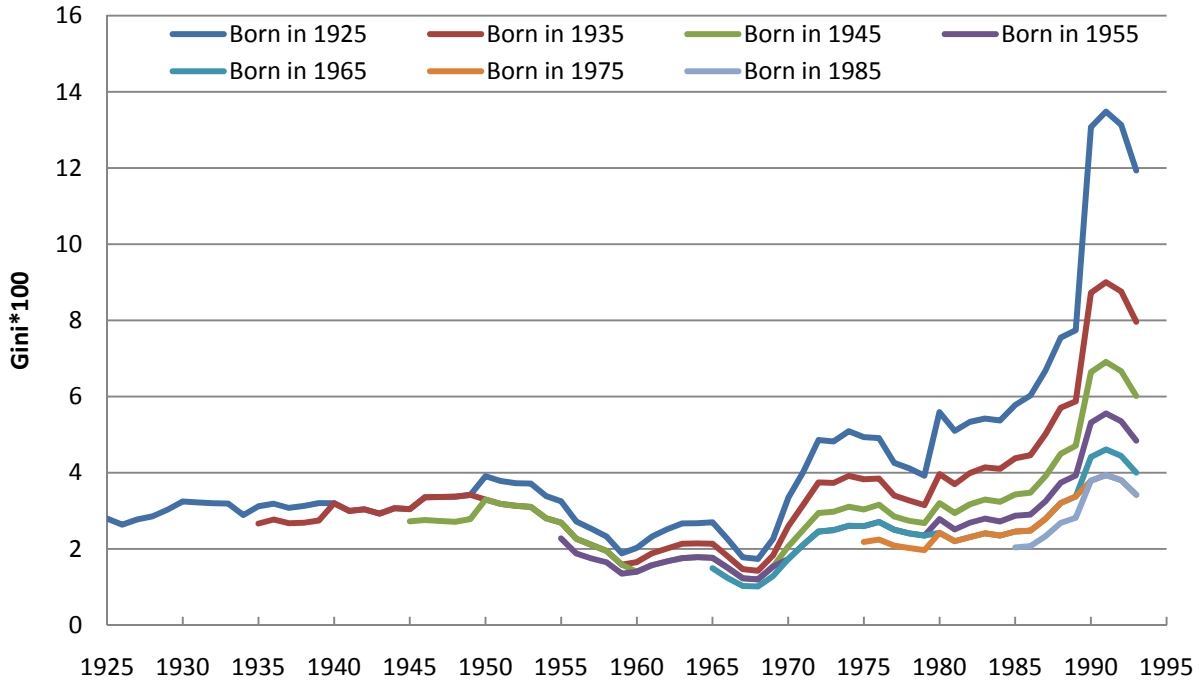


Figure 11: Female Cohort LE Inequality by Age

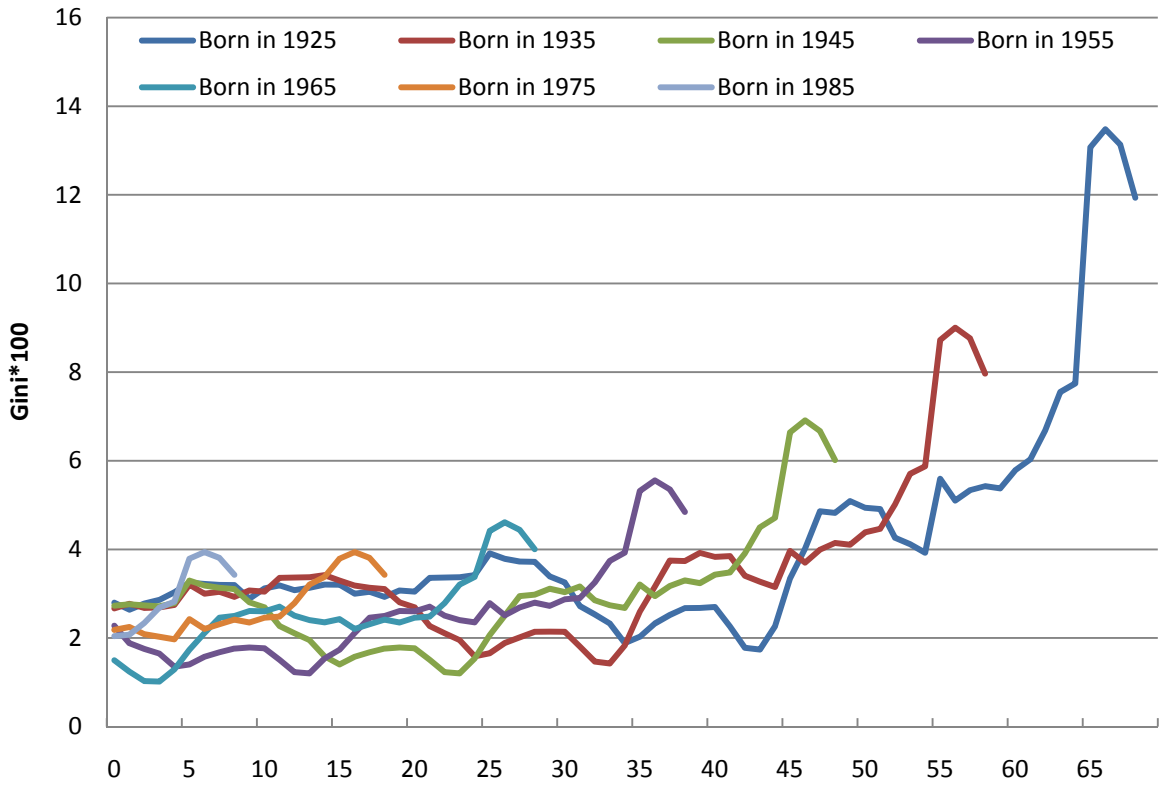


Figure 12: Percentage of deaths and births of under 1s (as part of the total population)

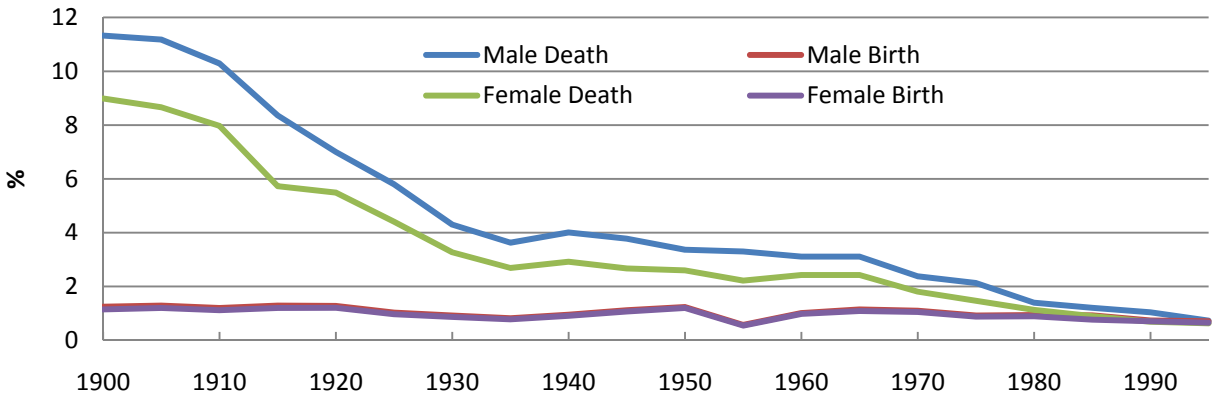


Figure 13: Inequality of LE at Birth

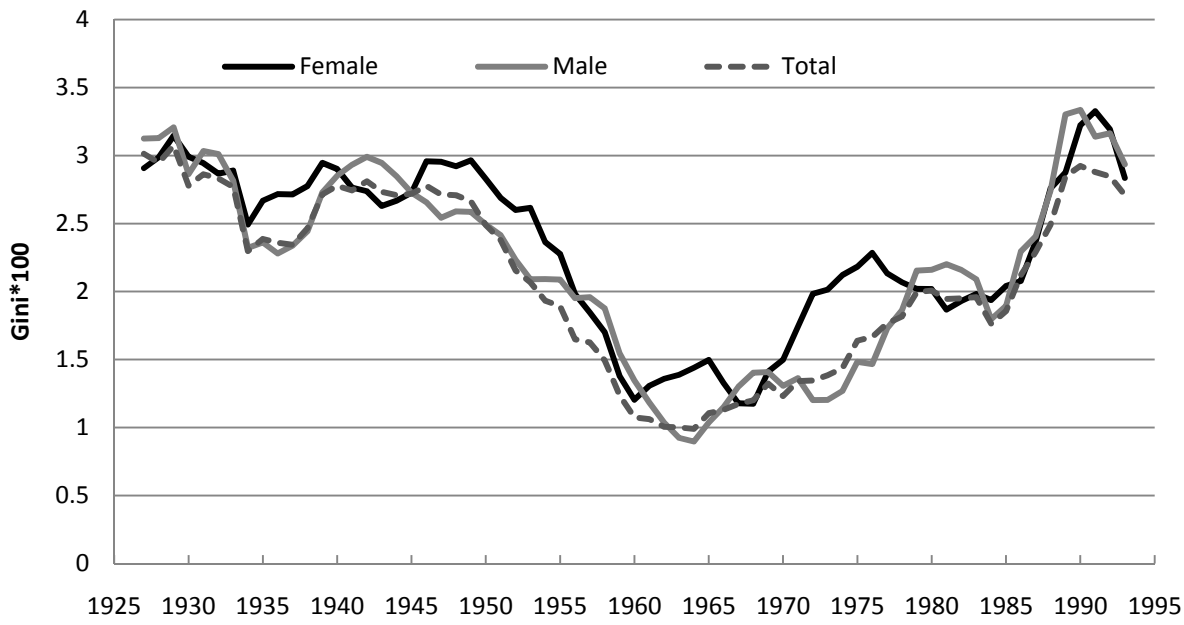


Table 3: LE Statistics for the Under 1 Age Group

	LE in 1925	LE in 1995	Difference	Range	Highest	Lowest
Auckland	64.04	76.54	12.5	15.18	76.54	61.36
Taranaki	66.38	70.46	4.08	11.63	72.35	60.76
Hawke's Bay	72.84	74.63	1.79	10.86	75.97	65.11
Wellington	68.65	78.59	9.94	14.58	79.47	64.89
Marlborough	67.86	79.26	11.37	21.78	85.47	63.69
Nelson	70.11	80	9.89	19.36	83.15	63.79
Westland	59.94	82.04	22.1	32.81	89.54	56.73
Canterbury	67.42	75	7.58	19.94	81.98	64.04
Otago	71.83	78.59	6.76	10.67	78.87	68.20

Figure 14: Male LE from Birth by Region

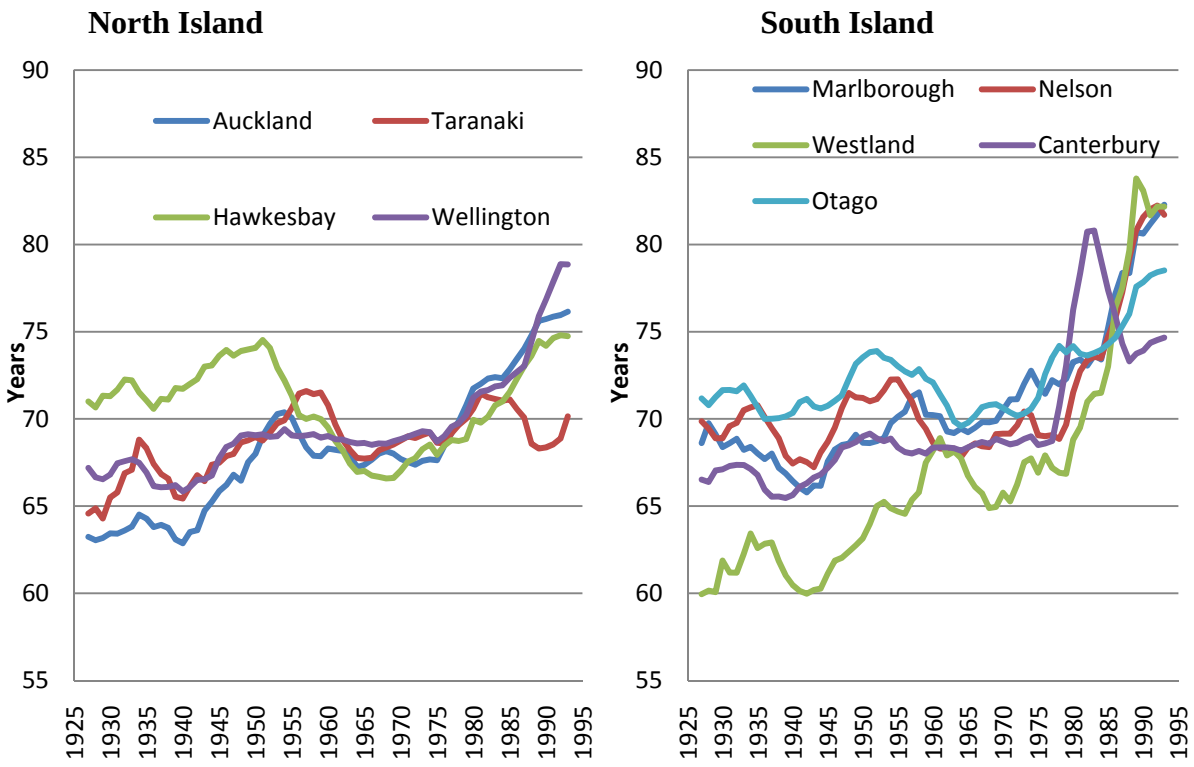


Figure 15: Female LE from Birth by Region

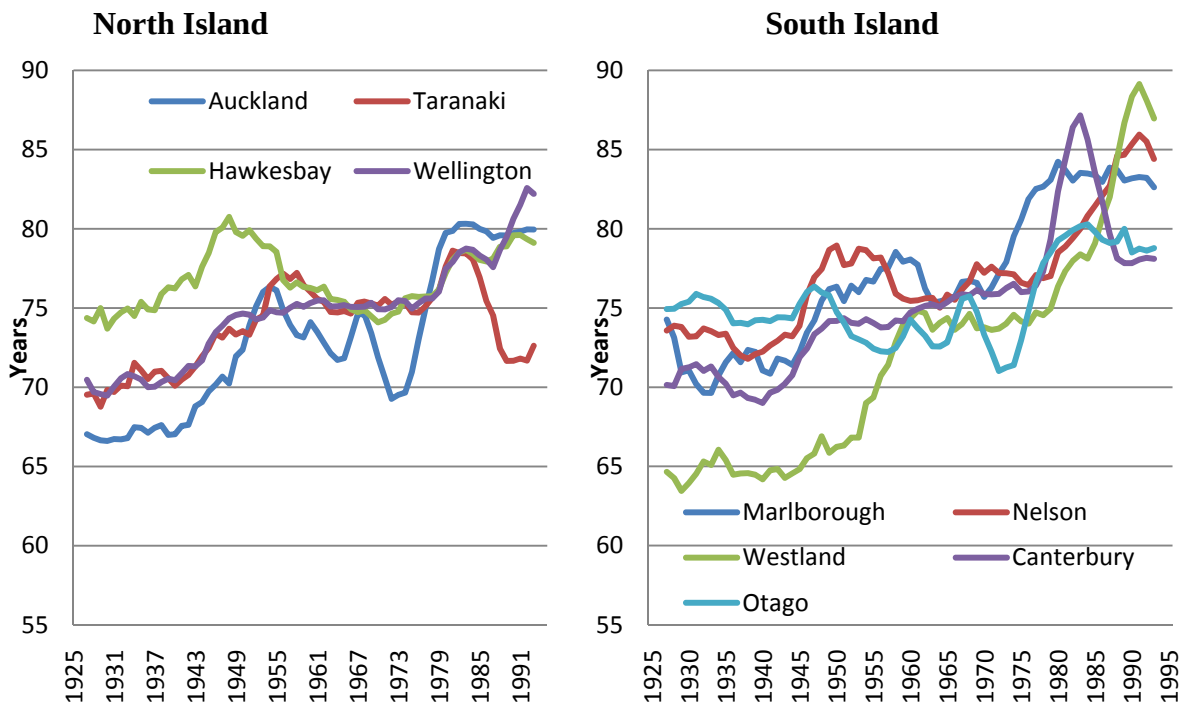


Figure 16: Map of Average Year on Year Increase of LE by Region

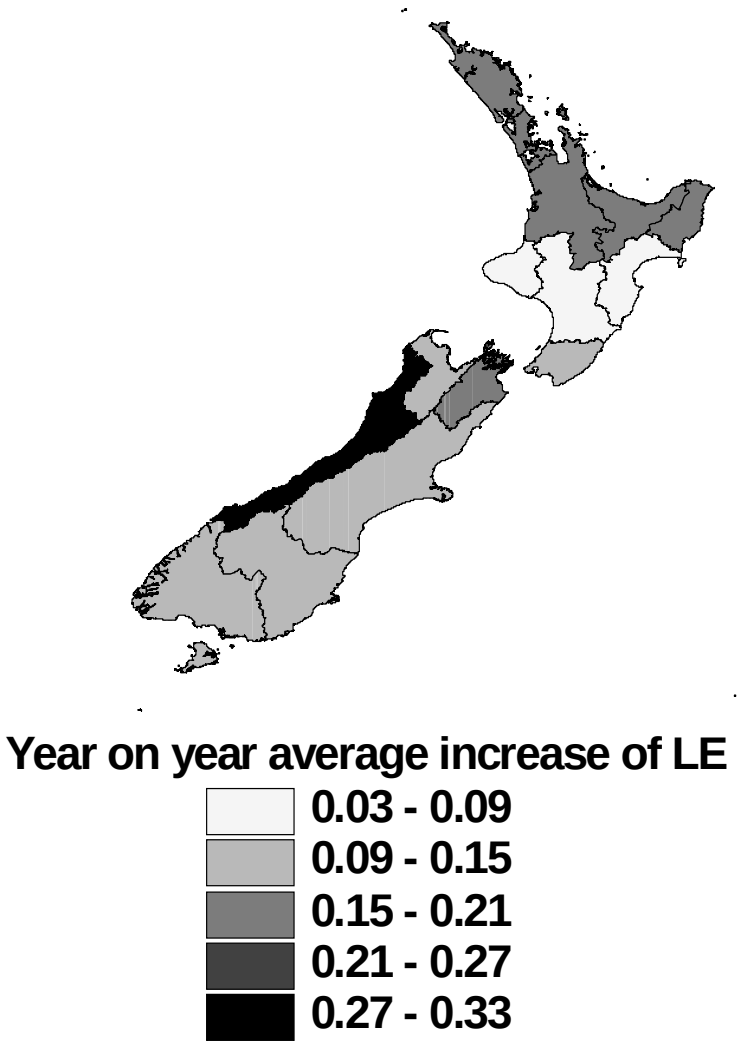


Figure 17: Inequality of LE for the 15-24 Age Group

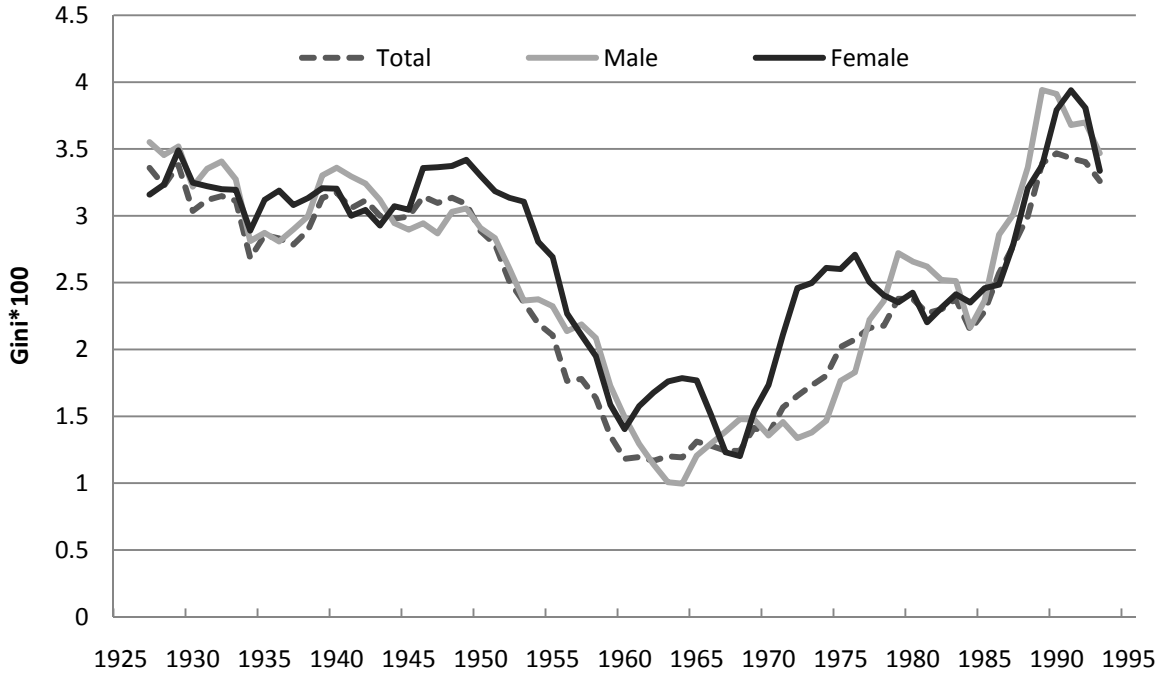


Table 4: Averaged Percentage of Male/Female 15-24 Dying between 1925-1960 and 1960-1995 plus ratio of M/F deaths (female =1)

	Gender	A	T	HB	WELL	M	N	W	C	O
1925-1960	Female	1.15	1.15	1.09	1.23	1.24	1.21	1.03	1.13	1.02
	Male	1.72	1.73	1.88	1.81	2.42	2.32	1.93	1.47	1.60
	Male/Female	**1.49**	**1.51**	**1.73**	**1.47**	**1.96**	**1.91**	**1.30**	**1.30**	**1.57**
1960-1995	Female	0.68	0.58	0.62	0.63	0.51	0.51	0.38	0.51	0.48
	Male	1.82	1.74	1.82	1.60	1.79	1.50	1.80	1.47	1.53
	Male/Female	**2.68**	**2.98**	**2.95**	**2.54**	**3.54**	**2.95**	**4.77**	**2.89**	**3.19**

A = Auckland, T = Taranaki, HB = Hawkes Bay, WELL = Wellington, M = Marlborough, N = Nelson, W = Westland, C = Canterbury, O = Otago

Figure 18: Percentage of Males aged 15-24 dying (of total deaths) by region 1925-1960

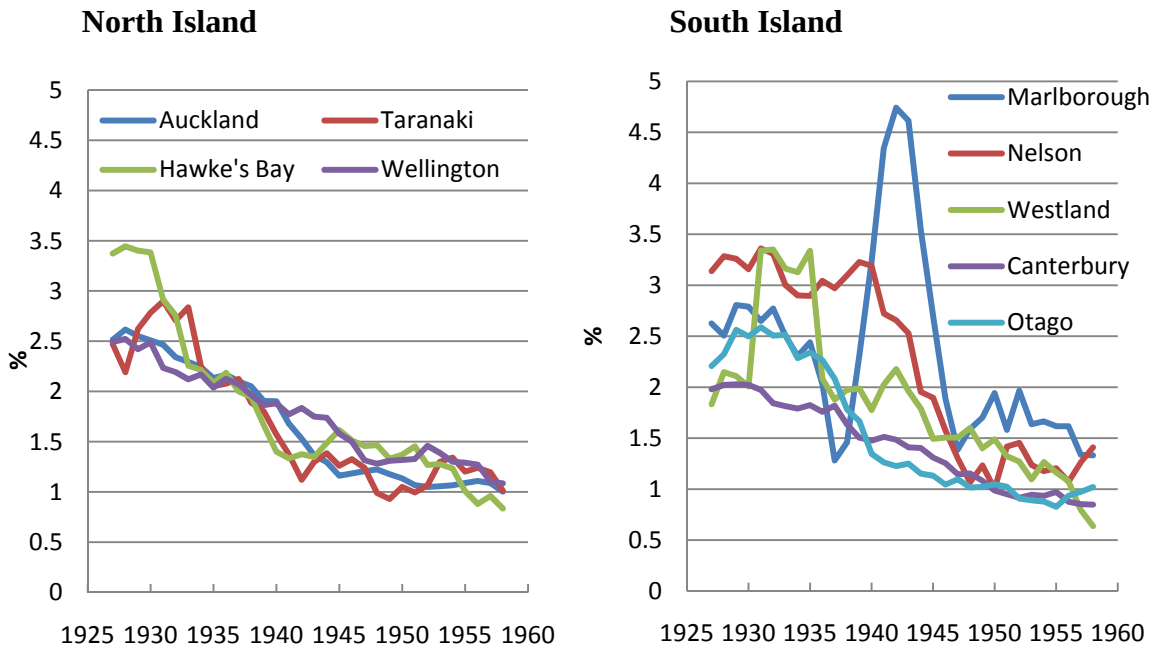


Figure 19: Percentage of Females aged 15-24 dying (of total deaths) by region 1925-1960

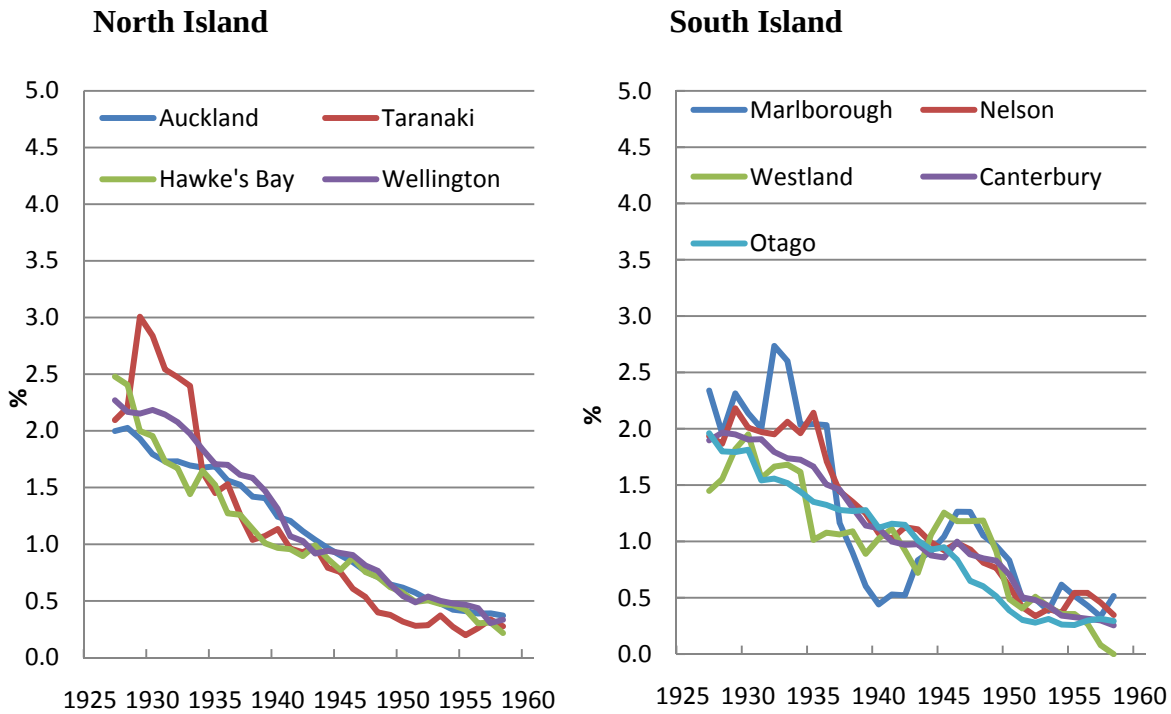


Figure 20: Percentage of Males aged 15-24 dying (of total deaths) by region 1960-1995

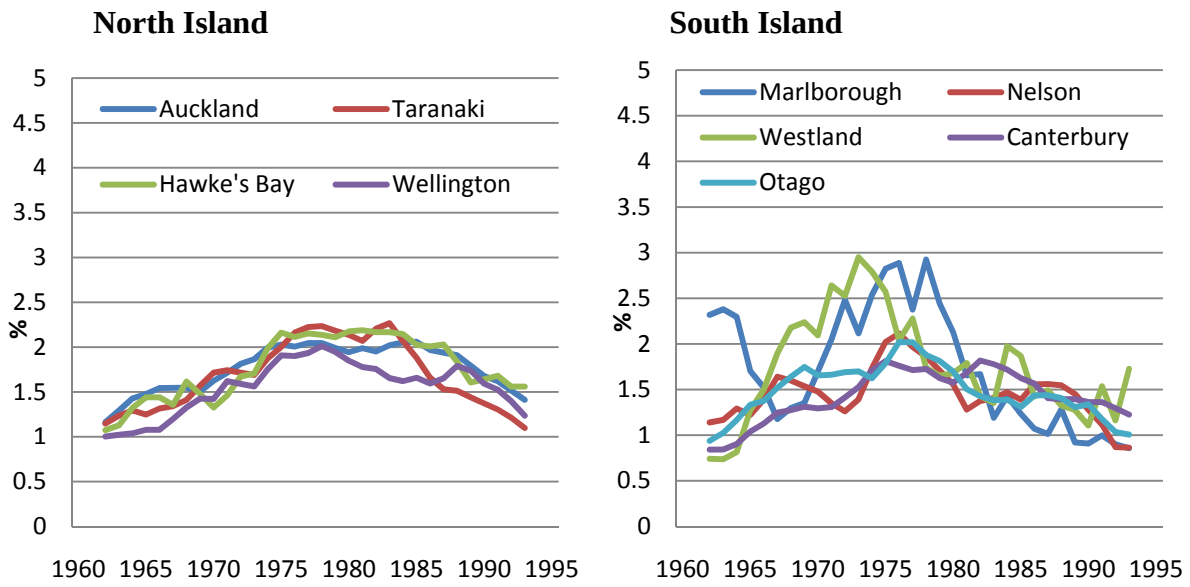


Figure 21: Percentage of Females aged 15-24 dying (of total deaths) by region 1960-1995

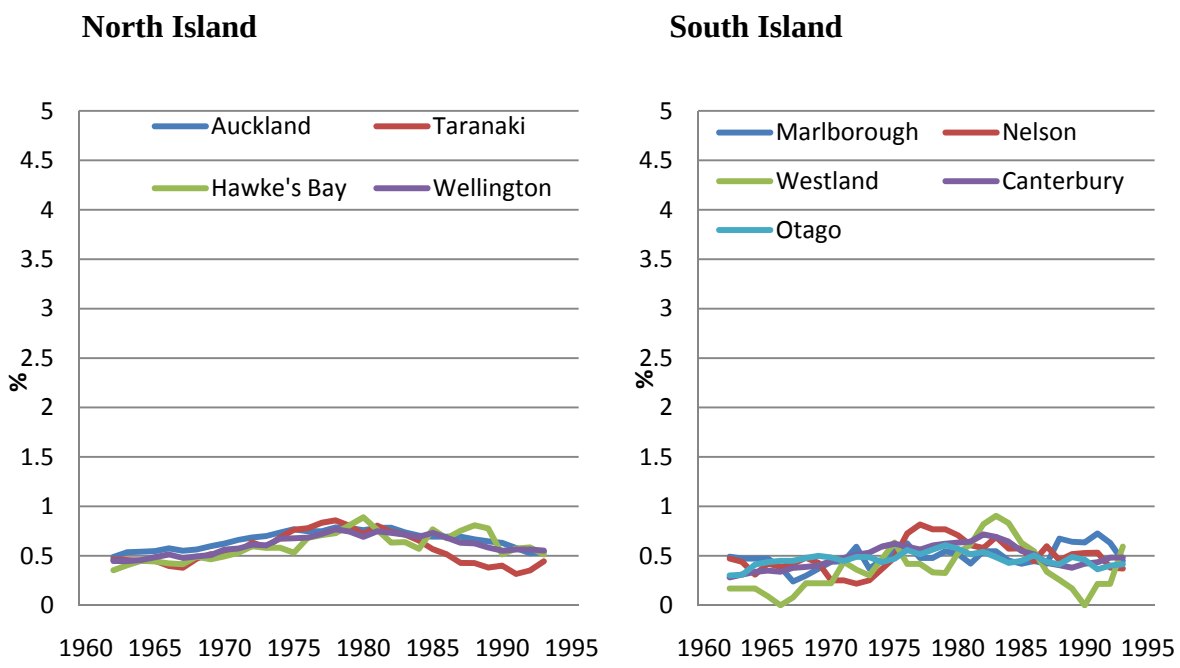


Figure 22: Inequality of LE for the 65+ Age Group

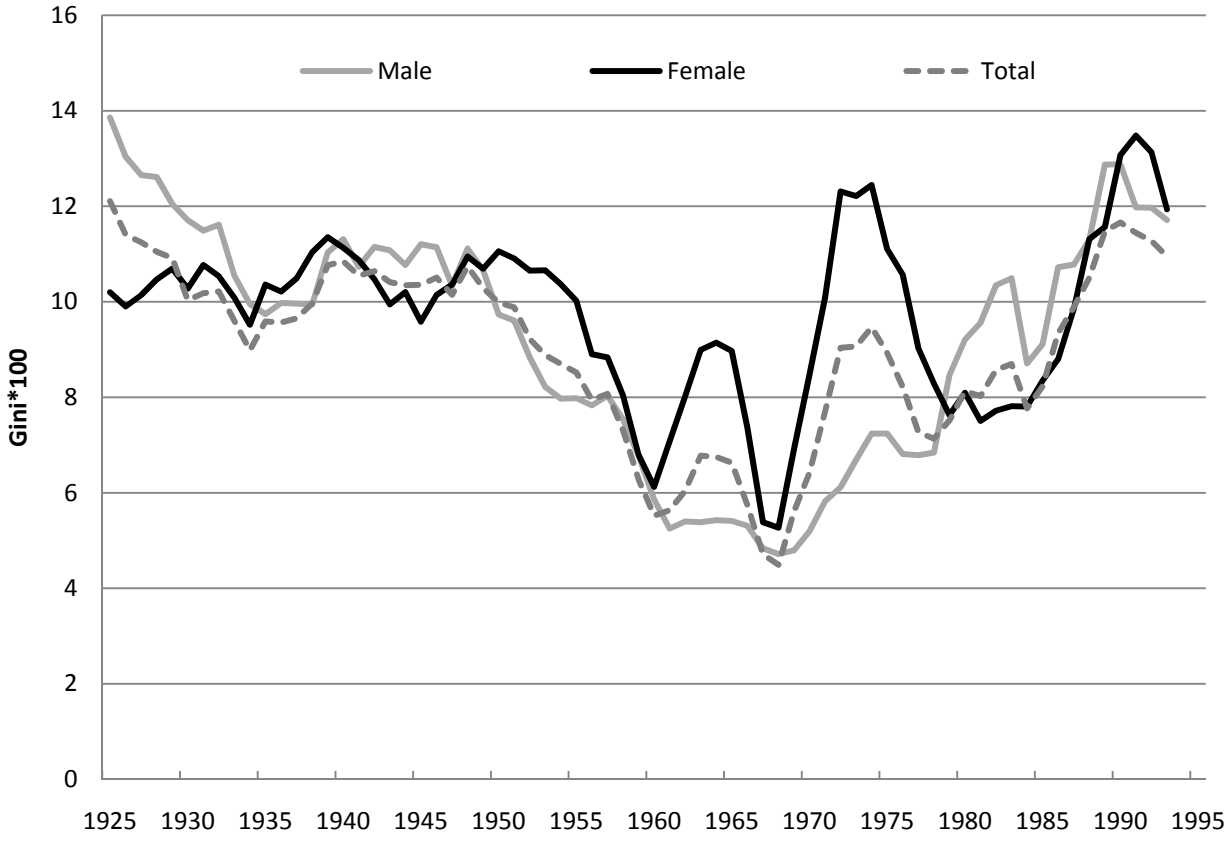


Figure 23: Male LE from 65+ by Region

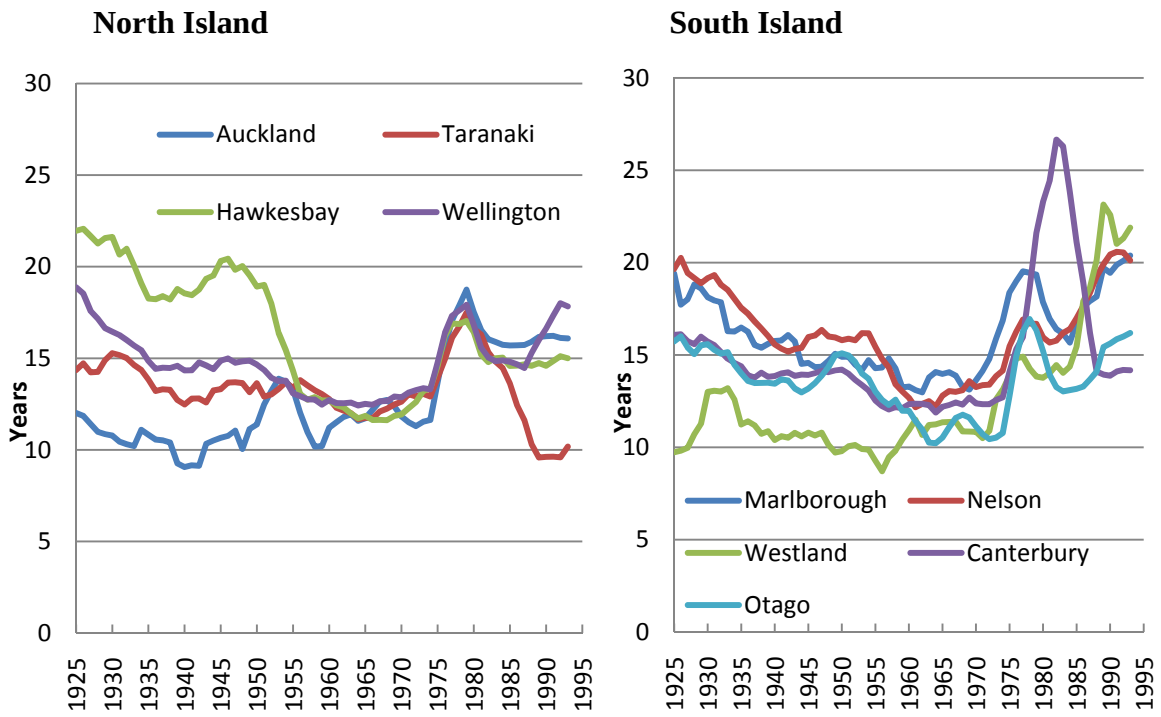


Figure 24: Female LE from 65+ by Region

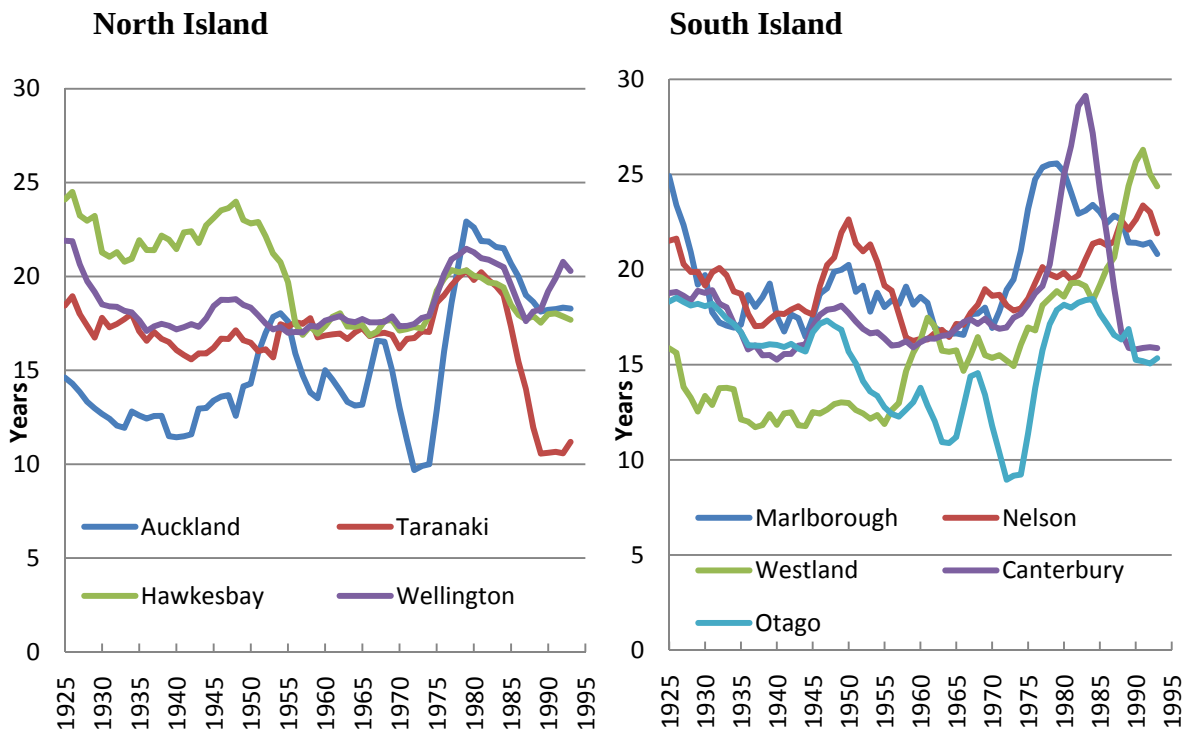
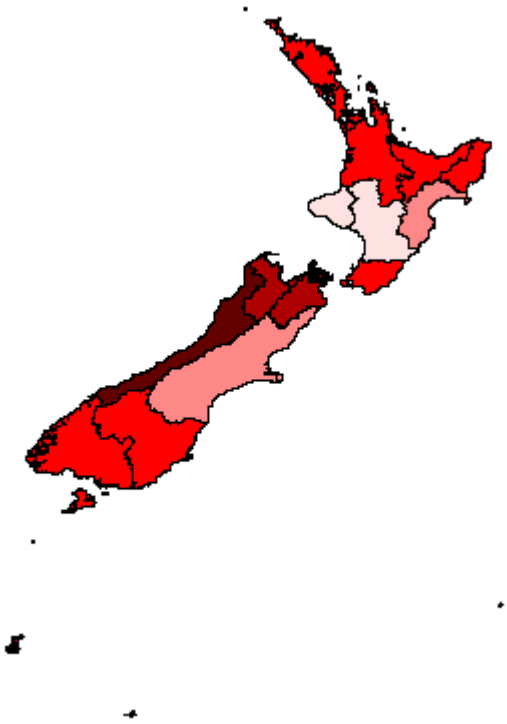
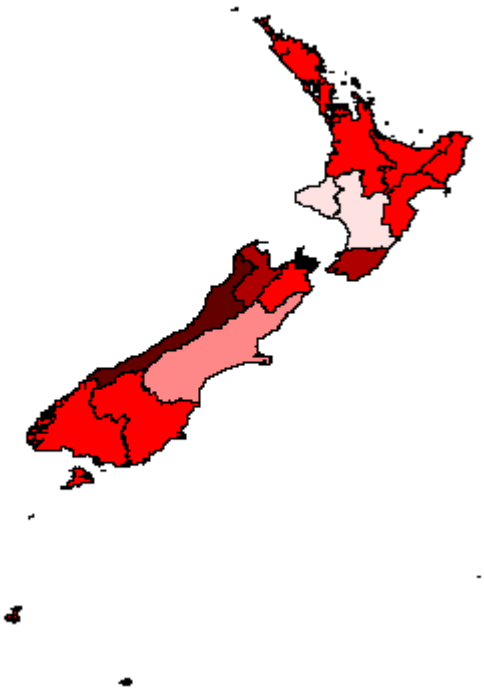


Figure 25: Map of Male LE from 65+ in 1995



LE (in years)	
	10.55-13.076
	13.076-15.602
	15.602-18.128
	18.128-20.654
	20.654-23.18

Figure 26: Map of Female LE from 65+ in 1995



LE (in years)	
	11.15-13.538
	13.538-15.926
	15.926-18.314
	18.314-20.702
	20.702-23.09