

## **Research Paper**

# **Impact of Demographic and Economic Changes on Measured Income Inequality**



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## Research Paper

# Impact of Demographic and Economic Changes on Measured Income Inequality

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Analytical Services Branch

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The ABS welcomes comments on the research presented in this paper.

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# IMPACT OF DEMOGRAPHIC AND ECONOMIC CHANGES ON MEASURED INCOME INEQUALITY

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## ABSTRACT

Household income inequality, as measured by the Gini coefficient, increased in Australia by 2.3% during the period between 1994–95 and 2002–03. The aim of this study was to look at factors that may have an impact on measured household income inequality. Demographic factors such as population ageing, household composition and geographic location along with one economic factor (labour market status) were examined during this study.

Data sets used in this study are from the Survey of Income and Housing (SIH). In order to compare the results with the ABS published income distribution statistics, this study uses the Gini coefficient as the main income inequality measure. A special decomposition method has been developed to analyse the SIH data from 1994–95 and 2002–03.

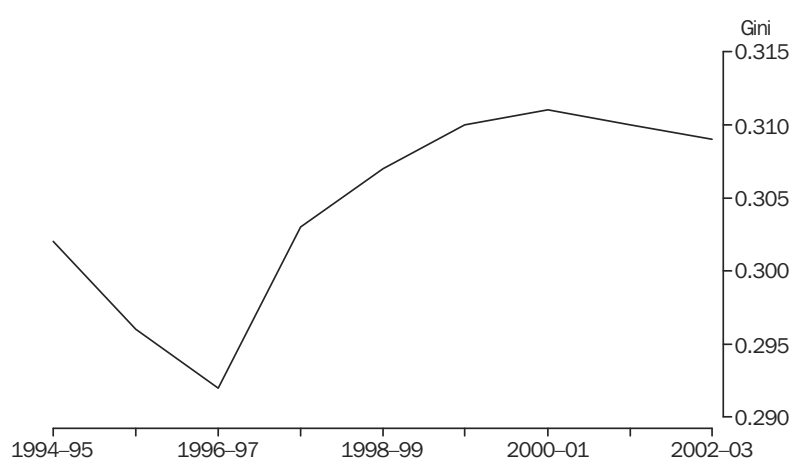
The results show that demographic change over the period from 1994–95 to 2002–03 did increase measured income inequality. About one third of the total increase in the measured income inequality during this period could be explained by demographic factors. The changes in the labour force status during the period tended to a reduction in the measured income inequality.

# 1. INTRODUCTION AND BACKGROUND

## 1.1 Introduction

Between 1994–95 and 2002–03 household income inequality in Australia measured in terms of Gini coefficient increased by 2.3%. Although the figure of increase is not statistically significant, we were interested in understanding the factors behind the increase. The graph below plots the Gini coefficient during the period from 1994–95 to 2002–03.<sup>1</sup>

1.1 Gini Coefficient, 1994–95 to 2002–03



Among other factors, demographic factors may have an impact on the measured income inequality. This study examines the effects of the following demographic factors: population ageing, household composition, and broad level geographic location of households, together with an economic factor, i.e. labour market status.

## 1.2 Possible impacts of the factors

The purpose of the study is to estimate the impacts of above mentioned factors on the measured income inequality.

The age structure of the population has changed significantly over the last century. A decline in birth rate and an increase in life expectancy have meant that children under 15 now make up a smaller proportion of the population, while the share of people with age 65 and over in the population has increased. Population ageing is an issue that most developed nations are now facing. In Australia, men and women of the baby boom cohort are beginning to withdraw from the labour force and retire. This may cause changes in income distribution.

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1 The Gini coefficients are calculated based on the ABS's Survey of Income and Housing (SIH) data. SIH was not conducted in 1998–99 and 2001–02. The Gini coefficient numbers used in the graph for the two financial years are the averages of their neighboring years.



Australian households are continuously changing. Young men and women are getting married later than the previous generation. Some women decide not to have children. For those who decide to have children, they usually have fewer and have the first child later than their parents. These changes together make the size of the average household smaller, and more women stay in employment. It is not difficult to understand that these changes in the structure of the household may lead to changes in the pattern of income distribution.

In many countries, whether a household resides in a capital city or not is an important factor affecting the income level of the household. This is particularly true for a lot of developing countries, where their economic growth is usually accompanied by a rapid urbanisation process. As a developed country, Australia has gone past the rapid urbanisation stages.<sup>2</sup> We do not expect the household geographic location to have a significant impact on income inequality.

As mentioned before, the change in labour force status is more related to the economic situation, therefore it is analysed as an economic factor in this study.

A person can make a decision on their own position in the labour force status based on their preference and their judgement of the economic situation. Generally speaking, an increase in the number of employed persons will be associated with a decrease in the number of unemployed, and possibly with a decrease in the number of people not in the labour force (NILF). This will also result in some people moving from lower income groups into higher income groups. In contrast, if the opposite situation happens, that means a significant number of employed people lose their jobs and enter the pool of unemployed or even become NILF. In both cases, there will be some change in the income distribution.

The rest of this paper is organised as follows. Section 2 will discuss issues of data and methodology. Then, Section 3 will examine the empirical results. And finally, several conclusions will be drawn in Section 4.

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<sup>2</sup> In 1911, 43% of Australians lived in rural areas; this proportion had fallen to 14% by 1976 and has stayed around this level since.

## 2. DATA AND METHODOLOGY

### 2.1 Data

Data sets used in this study are from the Survey of Income and Housing (SIH). SIH has been conducted by the Australian Bureau of Statistics (ABS) since July 1994. It provides detailed information on income and housing of individuals and families resident in private dwellings throughout Australia. SIH data sets are available for each financial year from 1994–95 to 2002–03 (excluding 1998–99 and 2001–02).<sup>3</sup> This study makes use of both the earliest and the latest available data sets. The study period is therefore from 1994–95 to 2002–03.

Summary results of SIH are published in *Household Income and Income Distribution, Australia* (ABS cat. no. 6523.0). In order to make a comparison with the ABS published summary statistics, this study uses household as the analytical unit. The Gini coefficient is used as the main summary statistic for income inequality.

In the SIH, income is defined as all regular and recurring cash receipts from employment, investments, and transfers from government, private institutions and other households. Gross income is the sum of the income from all these sources before the deductions of income tax and Medicare levy. For practical reasons, SIH income does not cover income in kind.<sup>4</sup>

Gross income is then adjusted in two ways to facilitate the comparison of economic well-being between households. Firstly, disposable income is derived by deducting estimates of personal income tax and the Medicare levy from gross income. Disposable income better represents the economic resources available to meet the needs of households.

Secondly, disposable income is further adjusted by the application of an equivalence scale to facilitate comparison of income levels between households of different size and composition. A large household needs more income to maintain the same level of living standard than a small household. The so-called ‘modified OECD’ equivalence scale is used by the ABS in analysing the SIH data.<sup>5</sup>

There is a well known problem regarding the use of income data collected from the very low income households. Very low or even negative income figures are often below the safety net of income support provided by the social security system, and sometimes contradict the consumption patterns of those households. So far, we do

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3 From 2003–04, SIH will be conducted biennially.

4 For detailed definition of income used in SIH, please refer to the Explanatory Notes in *Household Income and Income Distribution, Australia* (ABS cat. no. 6523.0).

5 For detailed description on how the ABS uses the scale, please refer to Appendix 3 in *Household Income and Income Distribution, Australia* (ABS cat. no. 6523.0).

not have a satisfactory solution to this problem. The current method used by the ABS to calculate the Gini coefficients is to set the equivalised disposable income to zero if a household's estimated disposable income is negative. This study applies the same method.

## 2.2 Methodology

In order to estimate the impacts of demographic and economic factors on the measured income inequality, a range of decomposition methods have been widely employed. Each has some advantages and some disadvantages. Having examined the existing decomposition methods, we decided to design a particular method to analyse the possible impacts of structural changes in several demographic and economic factors on the measured income inequality. This method is particularly designed to be used on the 1994–95 to 2002–03 SIH data.

In the SIH, expansion factors, or weights, serve as a bridge linking the sample to the population. They are values by which information for the sample is multiplied to produce estimates for the whole population.

Initial weights are determined at the survey design stage. They are allocated to samples according to their probability of being selected. The initial weights are equal to the inverse of the probability of selection in the survey.

Final weights are calculated through an iterative procedure, in which initial weights are adjusted by a calibration process to ensure that survey estimates confirm to independently estimated benchmarks.

In the SIH, the benchmarks represent totals of the population based on estimated resident population counts. Four of them are of particular interest for the study. The first contains counts by age group by state by sex; the second contains counts by category of household composition; the third contains counts by household location within and outside the capital city in a state; and the fourth contains counts by labour force status (LFS) for each state. The first three are main demographic factors, and the last one is treated as an economic factor in this study.

The above description of the weights derivation process is a simplified version. After calibration, the final weighted data set is then used for all estimates including summary income distribution statistics.

In the study, in order to investigate the impacts of changes in some demographic and economic factors on the measured income inequality, we need to go a few steps further. The basic idea is that we may modify the weights by replacing one of the benchmarks with the corresponding one of another year while holding the rest constant. In doing so, the individual factor's impact could be revealed.

For example, if we replace the 1994–95 LFS benchmark with the 2002–03 one while holding the others unchanged, then after the calibration, the weighted dataset could be used to estimate Gini coefficient. A comparison of the output with the original output based on 1994–95 income data and benchmarks would reveal what would have happened in household income distribution if the pattern of labour force status changed from 1994–95 to 2002–03, and other things remained unchanged. If the Gini coefficient did not change, it would indicate the impact of changes in the labour force status during the study period was negligible. If the Gini coefficient decreased, it would indicate that the changes in the labour force status during the period in question caused a reduction in the measured income inequality.

There are two more important issues that we need to pay attention to when we apply this special decomposition method.

First, a set of benchmarks should be consistent. It would be inappropriate to directly mix some benchmarks of one year with some benchmarks of another year. In order to deal with this issue, another step was taken. That is to choose benchmarks of one year as the standard and then to standardise the benchmarks of the other year.<sup>6</sup> This ensures that all the benchmarks are on a consistent basis.

Second, the individual replacement approach can only reveal the direct effect of the replaced factor. However, some of the demographic benchmarks are highly interdependent. For example, the age structure of the population is a major underlying factor for household formation and the numbers and ages of children. This means that the age structure of the population can have an effect on the income distribution in its own right (the primary effect), but would also have a secondary effect through its effect on the other demographic benchmarks, and this secondary effect would not be measured by the individual replacement method.

Therefore, whether a benchmark reflecting a demographic factor can be individually replaced or not depends on how significant its secondary effect is. It is obvious that the age group structure of the population and the household composition are highly interdependent. The secondary effect of each of them is substantial. However the household location within or outside a capital city is less related to the other factors.

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6 The procedure is relatively simple. For example, when we standardise the 1998 broad level geographic location of household benchmark to 1994 standard, we hold 1994 total household number constant while applying the 1998 breakdown shares of households living in the capital cities and in the balance of the states to calculate the standardised benchmark. Then, we use the standardised household location benchmark to replace the original 1994 one, while holding other benchmarks unchanged, in the calibration process to produce a set of counterfactual weights. If we use this set of weights on the 1994 microdata, we will have a counterfactual income distribution, which is mainly with 1994 demographic characteristics but mixed with 1998 broad level household geographic location characteristics. The Gini coefficient calculated based on this income distribution can be compared with the original 1994 result. The difference between the two results will reflect the impact of changes in the broad level geographic household location on the measured income inequality during the period from 1994 to 1998.

For labour force status, its change is more related to the economic situation rather than the demographic factors. This is especially true over a short time period.

Based on the above analysis, it was decided that LFS and household location within or outside a capital city would be examined in detail as their primary effects were dominant over their secondary effects, while the benchmarks for age group structure and household composition would not be individually replaced. However, their joint impact could still be inferred from the empirical results.

The robustness of the methodology was tested by two separate controlled test runs. In the first test run, we applied the methodology outlined above for all benchmarks from 2002–03 on the 1994–95 microdata. In the second test run, we took the 2002–03 microdata file and performed the same method for all benchmarks from 1994–95. The results from the two separate tests were symmetrical. This indicates that the methodology is robust.

In the study, we applied this specially designed decomposition method to investigate the impacts of changes in demographic and economic factors on household income distribution.

### 3. EMPIRICAL RESULTS

By applying the specially designed decomposition method as outlined in Section 2, the following empirical results are obtained.

#### 3.1 Empirical results

<i>Condition</i>	<i>Gini</i>
1. Original 1994–95 estimates	0.302
2. Original 2002–03 estimates	0.309
3. 1994–95 incomes and LFS with 2002–03 demographic structure	0.304
4. 1994–95 incomes with 2002–03 LFS and demographic structure	0.302
5. 1994–95 incomes and demographic structure with 2002–03 LFS	0.299
6. 1994–95 incomes, LFS and demographic structure but with 2002–03 location of household	0.302

The original 1994–95 and 2002–03 estimates are the results from two uncontrolled runs based on SIH original datasets for the two financial years. The other four runs are controlled runs. The conditions for each run are given in column 1. For example, the third run is based on 1994–95 incomes and LFS, while all benchmarks reflecting demographic factors are replaced by the standardised 2002–03 counterparts.

Figures in column 2 are the estimates of the Gini coefficients. The differences among the figures may be not statistically significant, but they are still worth investigating.

We can make four observations here. First, the estimated Gini coefficient increased by 2.3% in the eight years between 1994–95 and 2002–03 as shown by the results from the first and the second runs. About one third of the full increase (i.e. 0.7% out of 2.3%) could be explained by the changes in demographic factors as shown by the results from the first and the third runs. The second, the changes in LFS would decrease the Gini coefficient if all other factors were held unchanged as shown by the results from the first and the fifth runs. The third, the impact of the broad geographic location of households was negligible as shown by the results from the first and the sixth runs. The fourth, based on the results from the last three controlled runs, the joint impact of the structural changes in age group distribution and household composition was to increase the measured income inequality.

### 3.1 Labour force status

Changes in LFS from 1994–95 to 2002–03 of the six main Australian states can be seen in the table below.<sup>7</sup>

### 3.2 Labour force status, Six states, 1994–95 and 2002–03<sup>8</sup>

State	Labour force status	Percentage distribution	
		1994–95	2002–03
New South Wales	1 – Employed	57.12	59.85
	2 – Unemployed	5.66	3.85
	3 – Not in labour force	37.22	36.31
Victoria	1 – Employed	57.37	61.44
	2 – Unemployed	6.30	3.67
	3 – Not in labour force	36.33	34.89
Queensland	1 – Employed	59.39	61.15
	2 – Unemployed	5.37	4.65
	3 – Not in labour force	35.24	34.20
South Australia	1 – Employed	55.59	58.02
	2 – Unemployed	6.29	3.42
	3 – Not in labour force	38.12	38.56
Western Australia	1 – Employed	62.31	63.94
	2 – Unemployed	4.78	4.08
	3 – Not in labour force	32.91	31.98
Tasmania	1 – Employed	54.23	54.74
	2 – Unemployed	6.86	5.63
	3 – Not in labour force	38.91	39.62

Figures in table 3.2 show that from 1994–95 to 2002–03 the labour market conditions improved. The share of unemployed people in the total EAP (economically active population, i.e. people aged 15 and over) decreased in all six states.

The result of the fifth run as shown in table 3.1 shows that the impact of changes in labour force status during our study period would have decreased the measured income inequality if all other factors were held unchanged.

### 3.2 Broad level geographic location of households

In the SIH, the location information of households has been collected at different levels. In this study, we choose a broad level of geographic location to look at, that is households residing within or outside the capital city of a state.

Income difference between capital city residents and the balance of the state does exist in Australia. For example, the average weekly equivalised disposable household

<sup>7</sup> In tables 3.2–3.5, figures are for six main states only, and do not cover ACT and NT because of their small sample sizes.

<sup>8</sup> LFS figures of the six states are calculated based on the benchmarks of the two financial years.

income of capital residents and the balance of the state were \$543 and \$453 in 2002–03 respectively.

Although the income difference between Australian capital city residents and the balance of the state did exist during the period, the change in people living in the capital city or in the rest of a state had a negligible impact on the overall picture of income distribution. This is because the net shift between the two locations was very small. During the period of this study, some people did move out from capital cities, while some others moved in. The table below shows the results of this sort of population dynamics.

### 3.3 Proportion of people residing in or outside capital cities, Six states, 1994–95 and 2002–03

State	Location	Percentage distribution	
		1994–95	2002–03
New South Wales	1 – In the capital city	63.11	63.47
	2 – Balance of the state	36.89	36.53
Victoria	1 – In the capital city	72.61	73.17
	2 – Balance of the state	27.39	26.83
Queensland	1 – In the capital city	46.24	45.92
	2 – Balance of the state	53.76	54.08
South Australia	1 – In the capital city	73.97	74.04
	2 – Balance of the state	26.03	25.96
Western Australia	1 – In the capital city	74.67	74.48
	2 – Balance of the state	25.33	25.52
Tasmania	1 – In the capital city	41.41	42.24
	2 – Balance of the state	58.59	57.76

Figures in table 3.3 show that the shares of people living in the state capitals in the six main Australian states were quite stable. The net shift of people between the two locations was very small during the eight years of this study period, and none of these observed differences are statistically significant.

### 3.3 Age group distribution and household composition

As explained before, the secondary effects of changes in household composition and age group structure are substantial, so the individual replacement approach was not applied to these two factors. Although their individual impact could not be revealed, their combined effect could be inferred from the results summarised in table 3.1.

Since the change in the Gini coefficient, caused by replacement of all benchmarks was zero (see the result of run 4 in table 3.1), the impact of shift in residents net reallocation between capital city and the balance of the state was also zero (see the result of run 6 in table 3.1), and the impact of change in labour force status was



negative (i.e. reduced the measured income inequality, see the result of run 5 in table 3.1), the joint impact of structural changes in age group distribution and household composition must be positive (i.e. to increase the measured income inequality). The changes in these two factors during the period are examined in tables 3.4 and 3.5.

### 3.4 Changes in age group structure in EAP, Six states, 1994–95 and 2002–03

<i>Age group</i>	<i>Male</i>		<i>Female</i>		<i>Persons</i>	
	<i>1994–95</i>	<i>2002–03</i>	<i>1994–95</i>	<i>2002–03</i>	<i>1994–95</i>	<i>2002–03</i>
15–24 years	19.51	17.96	18.46	17.05	18.98	17.50
25–34 years	20.46	19.11	20.11	18.74	20.28	18.92
35–44 years	19.80	19.12	19.48	18.94	19.64	19.03
45–54 years	16.15	17.40	15.29	17.11	15.71	17.25
55–64 years	11.02	12.79	10.73	12.34	10.87	12.57
65 years +	13.07	13.62	15.92	15.82	14.51	14.73

Table 3.4 shows that Australia was in the process of population ageing during the period. The shares of persons in the total EAP for younger age groups, i.e. 15–24, 25–34 and 35–44, went down by 1.5, 1.4 and 0.6 percentage points respectively. While the shares of elder groups, i.e. 45–54, 55–64 and 65+, went up by 1.5, 1.7 and 0.2 percentage points respectively.<sup>9</sup>

As people in the 15–24 age group are newcomers in the labour force, the unemployment rate is usually much higher in this group than in the others. For those employed, most of them are at the lower end of the income scale. In contrast, people in the 45–54 and 55–64 age groups are much more experienced in the labour market, especially compared to the 15–24 group. People in these two age groups usually have higher income in terms of higher wages and salaries.

Figures in table 3.5 show that the proportion of smaller households went up during the period. The share of households with one adult and no children and with two adults and no children increased by 2.5 and 1.0 percentage points respectively. The proportion of larger households went down, especially the share of the households with two adults and at least one child dropped by 2.7 percentage points. The overall household size dropped from 2.64 to 2.42.

These structural changes in Australian households meant that from 1994–95 to 2002–03 more women stayed in employment, and therefore earned wages and salaries.

<sup>9</sup> The 0.2 percentage point increase in the share of the 65+ age group is not statistically significant during the study period. Nevertheless, from the trend of age group distribution, we can see that the increase in the share of this age group will become significant in the coming decades.

### 3.5 Changes in household composition, Six states, 1994–95 and 2002–03

	1994–95	2002–03	Move
Household type (% shares)			
1 – One adult without children	22.76	25.23	2.47
2 – Two adults without children	30.86	31.86	1.00
3 – Three or more adults without children	14.57	14.20	–0.37
4 – One adult with at least one child	3.62	4.08	0.46
5 – Two adults with at least one child	20.61	17.88	–2.73
6 – Three or more adults with at least one child	7.57	6.75	–0.82
Household size (persons per household)	2.64	2.42	–0.22

Putting the above analyses together with the big picture depicted in table 3.1, we can be sure that the combined impact of the two factors during the study period was to increase the measured income inequality.

## 4. CONCLUSIONS

Having analysed the empirical results, several conclusions could be drawn.

Firstly, the empirical results of this study show that the changes in all demographic factors jointly increased the measured income inequality by 0.7% over the period from 1994–95 to 2002–03. This accounted for about one third of the full increase of 2.3% as there were other factors, which also influenced income inequality.

Secondly, during the period from 1994–95 to 2002–03, the net shift of residents between the capital cities and the balance of the states was very small, therefore the impact of board geographic location of households on the measured income inequality was negligible.

Thirdly, the empirical results of this study could not assess the individual impact of the structural changes in the age group distribution and household composition. However, the joint impact of the two factors can be estimated. They jointly increased the measured income inequality by roughly 0.7% during the study period.

Fourthly, in contrast to the impact of the demographic factors, the changes in labour force status would lead to a reduction in the measured household income inequality if all the other factors were held constant during the same period.

Finally, this study shows that the main demographic structural changes do impact income distribution. The structural changes in most demographic factors are taking place gradually. We may apply the method developed here in the future when we have a longer series of SIH data.

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