

**INCOME DISTRIBUTION SERIES
NO. 1**

**INEQUALITIES IN NEW ZEALAND'S
PERSONAL INCOME
DISTRIBUTION 1983-84:
MEASUREMENTS AND PATTERNS**

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PREFACE

This paper is the first of a series within a multi-disciplinary research project on 'Income Distribution and Inequality in New Zealand'. The study is being conducted at the Social Policy Research Centre, Massey University, under the direction of Professor Ian Shirley and Dr Srikanta Chatterjee.

The Income Distribution Project is designed to establish a longitudinal data base with two major functions. First, to examine the distribution of income over time, including the impact of taxation policies and income/social security transfers. Secondly, to draw international comparisons based on the 14 nation Luxembourg Study.

The overall aim of the Income Distribution Series is to provide sound theoretical and empirical research for policy discussions on income distribution, taxation and social security.

The first paper in the series is a preliminary report on inequalities in personal income distribution in New Zealand in 1983-84. Subsequent reports will expand on this timeframe, as well as focussing on particular issues, such as the impact of consumer-based taxes on income distribution and inequality, both in New Zealand and overseas.

The Social Policy Research Centre would like to acknowledge the support of the Massey University Research Fund Committee in launching this project and in the provision of funds for the first series of papers to be published in 1992. We also acknowledge the support of the University Grants Committee in funding the Post Doctoral Fellowship which allowed Dr Sriyastav to work on this project during its formative stages.

Professor Ian Shirley
Director, Social Policy Research Centre
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ABSTRACT

This empirical study examines inequalities in the distribution of personal incomes in New Zealand in 1983-84. It begins with a theoretical introduction covering the methodology of positive and normative estimates of income distribution. Available statistical information from Inland Revenue sources is then used to work out the positive measures of income inequality (such as the Gini coefficient and the concentration index) as well as a normative measure (the Atkinson index). The positive indices are then decomposed to capture the degrees of inequality amongst the male and the female populations, as well as amongst a number of major factor and non-factor incomes which make up total personal incomes. The results show that a significant proportion of the overall inequality, both positive and normative, is contributed by the female population. Of the six selected income sources, the two factor incomes, wages and salaries and business income, are found to be inequality-enhancing, while all the non-factor incomes are inequality-reducing. Comparisons with an earlier work on income distribution in New Zealand confirm that the degree of inequality, as measured by the Gini coefficient, has been declining over time, although disparities between the male and female populations still remain quite large. Results based on the normative measure, demonstrate dramatically the potential gain in the welfare of society that could result from a more equal distribution of existing incomes. To the best of our knowledge, this is the first study using New Zealand data to quantify the welfare implications of alternative distributional arrangements. The findings have significant policy implications.

1. INTRODUCTION

Issues relating to the distribution of income and wealth and the related phenomena of inequality and poverty have long engaged the attention of economists and other social scientists. Early interests in distributional questions, however, were confined almost exclusively to issues of inter-factoral distribution of a nation's output or income. Since factors such as labour and capital collaborate in the production process, their shares in the total output have naturally been the subject of scientific enquiry. An equally useful line of enquiry in this area is the distribution among individuals or households. Investigations here have a technical dimension, concerned with the measurement of inequalities in given states of distribution, as well as a policy dimension relating to questions of social justice inherent in the given distributional states. Early work on both of these aspects by economists and statisticians, such as Gini (1912), Lorenz (1905), Pigou (1912) and Dalton (1920), have in recent years been revived, further extended and refined by a number of social scientists. Issues of justice and their relationship to different notions of inequality have also received greater attention largely as a result of the philosophical works of Rawls (1972) and Nozick (1974).

Information on the degree of inequality in a country's income distribution, for example, can shed light on a number of interesting questions. Is the country's income distribution less equal than in the past? Is it less equal than in other countries with similar characteristics? What impact do fiscal policies have on income distribution? Answers to these and other questions would clearly be helpful in the formulation of social and economic policies aimed at reducing inequality.

2. AIMS AND PLAN OF THE PAPER

The aim of the paper is to measure the state of income inequality in New Zealand in 1983-84. Both positive and normative (welfare-based) measures of income distribution are used for the population as a whole as well as for male, female and total populations filing an income tax return separately. Also, income inequality indices are decomposed by income-types, such as wages and salary, national superannuation and so on. This helps to quantify the relative contribution of each income-type to the overall inequality index. The choice of the year is somewhat arbitrary and is dictated by the fact that 1983-84 happens to be the latest year for

which published data on incomes and income tax are available. In due course, a more extensive study will update the results reported here with the help of data for more recent years. The larger study will also use data from other sources to avoid some of the deficiencies inherent in the Inland Revenue statistics used here.

After the introductory material of sections 1 and 2, the plan of the paper is as follows. Section 3 covers the methodological issues relating to the measurement of income inequality, introducing and discussing the various measures used in the study. Section 4 extends these measures so that the overall inequality indices may be decomposed in the manner indicated above. Section 5 discusses the data issues, while section 6 analyses the results of the various empirical estimates and their implications. Section 7 seeks to provide a comparative perspective on the findings of the present study. The paper concludes with section 8 which briefly examines some policy implications.

3. MEASUREMENT OF INCOME INEQUALITY

3.1. Methodology: Positive and Normative Measures

Given a certain distribution of income, the degree of inequality can be viewed and estimated using *positive* measures (i.e. without reference to any notion of social welfare) or *normative* measures (which start from a formally derived social welfare function with implications for welfare gains and losses resulting from changes to the degree of inequality). Both types of measures have been used in this study to provide a comprehensive insight into the nature of distributional inequalities.

To take the positive measures first. The purpose here, as stated above, is to capture the existing inequality in a given distributional arrangement. Once the income unit and the population unit to be used in the measurements of inequality are chosen, a positive measure may, for example, aim to provide a statistic which captures what proportion of the population has what proportion of the income. Since it is more meaningful to consider entire distributions rather than merely their extreme values - however large the gap between the extreme values - we select for elaboration the Gini coefficient, one of the most widely used positive measures of inequality.

Perhaps the most easily understood definition of the Gini coefficient is in terms

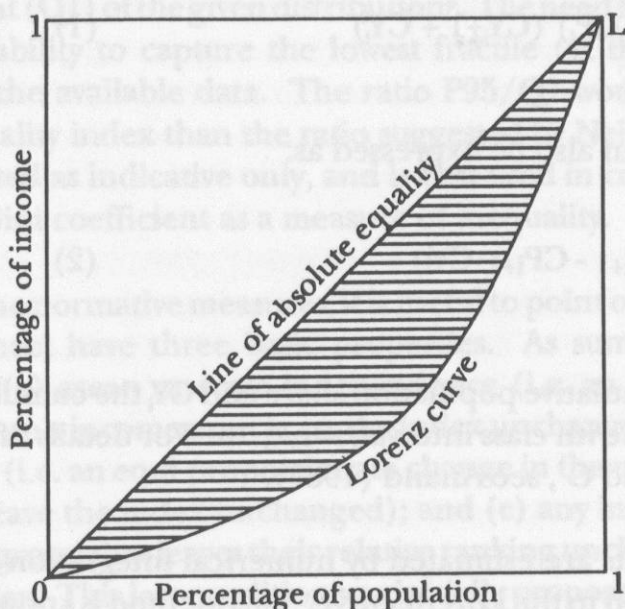


FIGURE 1

of its association with the Lorenz curve which maps the cumulative percentage of the population from the poorest to the richest along the horizontal axis against the cumulative percentage of income received by the bottom x percent of the population up the vertical axis. Figure I above shows a hypothetical Lorenz curve drawn from the origin O to the diagonally opposite point L . The diagonal OL is the line of absolute equality as the points on it show that a given proportion of the population receives the same proportion of the income. Whenever the state of a given distribution is less than perfect, however, (which must be virtually always!), the Lorenz curve would lie below the diagonal as in Figure I.

3.2. The Measurement of the Gini Coefficient and the Nelson Ratio

The simplest measure of the Gini coefficient is in terms of the ratio of the area between the diagonal and the Lorenz curve to the area of the triangle below the diagonal.

There are several other definitions of the Gini coefficient in the literature which are used for different purposes. The formulation used in this study is:

$$G = 1 - \sum_{i=0}^{n-1} (CP_{i+1} - CP_i) (CY_{i+1} + CY_i) \quad (1)$$

This formulation can also be expressed as:

$$G^1 = \sum_{i=1}^n (CP_i \cdot CY_{i+1} - CP_{i+1} \cdot CY_i) \quad (2)$$

Here, CP_i is the cumulative population share and CY_i the cumulative income share corresponding to the i th class interval; $i=1,2,\dots,n$. For details of the derivation and comparison of G and G^1 , see Anand (1983).

The Gini coefficients are estimated by numerical integration under a piecewise-linear approximation to the Lorenz curve. This method is known to underestimate inequality systematically. It has, however, been demonstrated (see Gastwirth, 1972) that if the number of fractile groups used in the construction of the Lorenz curve is large enough, then the downward bias in the inequality estimates is small. The present study uses 38 well-spaced points on the Lorenz curve to estimate the Gini ratios. The results, therefore, are expected to be reasonably accurate.

Alternative methods based on the Lorenz diagram have been suggested by several authors to capture the degree of inequality in a distribution. The works of Kakwani and Podder (1973, 76), Kakwani (1980) and Nelson (1984), among others, belong to this category. The details of the first three of these are not discussed here as they have not been used in this study. Nelson suggests that a simple method for estimating inequality is to measure the distance between the tails of a given distribution. Nelson uses the method of interpolation to calculate the fifth (P5) and the ninety-fifth (P95) income centiles along a Lorenz curve, and uses the ratio P95/P5 to express the distance between the two extremes of the distribution. This ratio is then a measure of inequality. This method, of course, is akin to that of the range which, for purposes of inequality measurement, may be expressed as a ratio of the difference between the highest and the lowest income levels and the mean income of a distribution. Both of these measures (range and Nelson ratio) have the deficiency that, by concentrating on the extreme values only, they ignore the distribution in the intermediate ranges.

As indicated before, the present study uses the Gini coefficient as the measure of inequality. However, as an additional measure along the lines of the Nelson

inequality index, we use the ratio of the incomes of the highest 5 percent (P95) and the lowest 20 percent (Q1) of the given distributions. The need for this modification arose from our inability to capture the lowest fractile (at the 5 percent level) satisfactorily from the available data. The ratio P95/Q1 would almost certainly yield a lower inequality index than the ratio suggested by Nelson (P95/P5). It is therefore best treated as indicative only, and is best used in conjunction with the more satisfactory Gini coefficient as a measure of inequality.

Before turning to the normative measures, it is useful to point out that a satisfactory inequality index must have three basic properties. As summarised by Anand (1983), these are: (a) mean or scale independence (i.e. an equi-proportionate change in every group's income must leave the index unchanged); (b) population-size independence (i.e. an equi-proportionate change in the number of people in each group must leave the index unchanged); and (c) any income transfer from a richer to less rich group that leaves their relative ranking unchanged must reduce the value of the index. This last condition was initially proposed by Dalton (1920), following Pigou's earlier work (1912), and is often referred to as the Pigou-Dalton condition.

The Gini coefficient of inequality, computed from the Lorenz curve, is independent of the mean and the population size. It also satisfies the Pigou-Dalton condition as any transfer from a richer to a less rich income recipient would, by shifting the Lorenz curve upwards between the relevant centiles, reduce the Gini coefficient, i.e. improve equality, as long as the Lorenz curves do not intersect. As a positive measure of income inequality, therefore, the Gini coefficient (based on the Lorenz curve) is an extremely useful device.

3.3. Normative Measures: the Atkinson Index

While the positive measures of inequality are helpful in indicating the nature of a given distributional arrangement, it is the social welfare implications of these arrangements that are perhaps more interesting and useful from a policy point of view. The Pigou-Dalton condition alluded to above, for example, imposes a rather normative requirement on a 'good' positive measure of inequality. The basic idea underlying the Pigou-Dalton condition (viz. that a less unequal distribution state must result from a transfer from the rich to the poor) is rooted in the notion that it is the social welfare potential of one distributional arrangement over another that a measurement ought to be capable of capturing.

Cowell (1977) suggests that an intuitively appealing way of capturing the essence of a social welfare (utility) based measure of inequality is "to consider how far *actual* average social utility falls short of *potential* average social utility (if all income were distributed equally)." To construct such a normative measure, it is necessary to relate actual or potential distributional states to levels of social welfare by means of well-defined social welfare functions.

One such measure was developed by Atkinson (1970). For a given total income, the welfare function underlying the Atkinson measure captures greater equality in the distribution of income as higher social welfare. The social welfare function is assumed to be additively separable, and based on individual *incomes* rather than individual *utilities*.

Individual utilities are assumed to be symmetric and concave functions of individual incomes. Sen (1973), however, demonstrated that, for comparing and ranking alternative distributions in terms of their inequalities, the individual utility functions need to be *strictly* concave. For a concise exposition of these and other related issues, see Osmani (1982).

A formal definition of Atkinson's inequality index is based on the notion of the 'equally distributed equivalent income', YEDE. This, in turn, is defined as the level of per capita income which, if allocated to everybody, generates the same total welfare as that generated by the existing income distribution. If μ is the mean income of a given distribution, the Atkinson index of inequality is expressed as:

$$A = 1 - \frac{\text{YEDE}}{\mu} \quad (3)$$

Assuming that the index is mean-independent, and that each individual has the same utility function (the symmetry assumption), the general form of the index can be written as:

$$A_{\epsilon} = 1 - \frac{1}{\mu} \left[\sum_{i=1}^n (y_i/\mu)^{1-\epsilon} f_i \right]^{\frac{1}{1-\epsilon}}, \text{ for } \epsilon \neq 1 \quad (4)$$

and

$$A'_{\epsilon} = 1 - \exp \left[\sum_{i=1}^n f_i \log_e (y_i/\mu) \right], \text{ for } \epsilon = 1 \quad (5)$$

In this formulation y_i is the income of the i th group and f_i the proportion of the population in the group. Where $\epsilon = 0$, society is indifferent about inequality in the distribution, and when ϵ is very large, approaching ∞ , society is concerned only with the position of the lowest income group.

The attitude to inequality embodied in the last possibility ($\epsilon = \infty$), is akin to the Rawlsian perception which views inequality in terms of the most disadvantaged members of society. The choice of an actual value for ' ϵ ' is obviously arbitrary as it reflects a subjective judgement relating to society's attitude to inequality. Atkinson (1970) used values between 1 and 2.5 in his own study. Stern (1977) suggested values between 1.5 and 2.5 on the basis of his survey of the literature on the elasticity of marginal utility of income. In the present study, we have estimated the Atkinson index with values of the inequality aversion parameter, ϵ , between 0 and 3. This is a sufficiently wide range of values to enable us to consider the implications of various distributional states.

4. DECOMPOSITION OF THE INEQUALITY MEASURES

4.1. Decomposition within and between Population Groups

The inequality measures discussed so far relate to entire populations. While they may indicate existing distributional inequalities and/or intertemporal changes therein, they do not tell us anything about the differences that may exist within or between different subgroups making up the population. This is obviously a deficiency, as it amounts to assuming that the subgroups are essentially similar. To overcome this deficiency, it would be helpful to have an inequality measure which is decomposable into components representing inequalities within the subgroups as well as between them. An inequality measure is said to be additively decomposable if the values of the within-group and the between-group inequality measures add up to that of the over-all measure. The between-group component is estimated on the assumption that everybody within a group receives the mean income of the groups, while the within-group component is the weighted sum of the values of the inequality measures for each group, where the weights are the particular group's share of the relevant totals, such as the total income or population.

In this study, we examine inequalities in the distribution of income for: (a) the population as a whole; (b) within the male population and the female population; (c) between the male population and the female population; and (d) within six different components of the total income. The term 'population' in this context refers to the statistical population which consists of all persons furnishing an income tax return in the year 1983-84. This is explained further in Section 5.

Since we are using estimation procedures which are well-established in the literature, they are discussed only briefly below. For further details, reference may be made to Anand (1983), Cowell (1977), Pyatt et. al. (1980), Kakwani (1980,86) and Podder and Tran-Nam (1991).

The population is assumed to be composed of two subgroups 1 and 2. There are n_1 individuals in subgroup 1 with incomes y_{1i} ($i = 1, 2, \dots, n_1$) and n_2 individuals in subgroup 2 with incomes y_{2j} ($j = 1, 2, \dots, n_2$). The mean incomes of the two subgroups are y_1 and y_2 respectively. There are n individuals in the whole population, so that:

$$n_1 y_1 = \sum_{i=1}^{n_1} y_{1i} \quad (6)$$

and

$$n_2 y_2 = \sum_{j=1}^{n_2} y_{2j} \quad (7)$$

with

$$n = n_1 + n_2$$

and

$$n y = n_1 y_1 + n_2 y_2$$

where y is the mean income of the whole population.

The literature on the question of decomposability of the Gini co-efficient establishes that the sum of the between-group and the within-group components is equal

to the overall Gini coefficient only under special circumstances. In other words, the Gini coefficient is not, in general, additively decomposable in the weak sense. The relationship between the overall coefficient, $G(y)$, and the coefficients for the two subgroups, $G(y_1)$ and $G(y_2)$, is, at best, expressed as an *inequality* of the following form;

$$G(y) \geq \left(\frac{n_1}{n}\right) G(y_1) + \left(\frac{n_2}{n}\right) G(y_2) \quad (8)$$

or,

$$G(y) \geq \left(\frac{n_1 y_1}{ny}\right) G(y_1) + \left(\frac{n_2 y_2}{ny}\right) G(y_2) \quad (9)$$

4.2. Decomposition by Income Components

We proceed now to estimate the inequalities within and between income shares. This will enable us to identify the contribution of each income share to the overall inequality. One way to estimate the contributions of the different components of income to the overall inequality would be to decompose the Gini coefficient of overall inequality. The methodology for this is explained below.

Let the total income y be made up of the components y_k , ($k = 1, 2, \dots, K$), and let μ be the mean of the total income and μ_k that of the k th income component. A well established result in the literature (see Kakwani, 1980, 86) shows that:

$$G(y) = \sum_{k=1}^K \frac{\mu_k}{\mu} C_k \quad (10)$$

where $G(y)$, as before, is the overall Gini coefficient, and C_k the concentration ratio of the k th component of income. $G(y)$ is thus equal to the weighted average of the concentration index of each income component, the weights being proportional to the mean of each income component.

The concentration index of a factor income in this formulation (equation 10) is understood to measure "how evenly or unevenly that factor income is distributed

over the total household income” (Kakwani, 1986, 94). However, as demonstrated in a recent paper by Podder and Tran-Nam (1991), there are inconsistencies involved in using this interpretation to disaggregate the Gini coefficient. These authors have suggested an alternative method in which “the concentration ratio of the kth component can be interpreted only in relation to the Gini of total income reflected through the elasticity of the component with respect to total income” (Podder and Tran-Nam, 1991, p.6).

Their suggested method is based on the following re-arrangement of the terms in equation (10) above:

$$\sum_{k=1}^K \frac{\mu_k}{\mu} [C_k - G(y)] = 0 \quad (11)$$

If now the left hand side of this equation is defined as S_k , i.e. if

$$S_k = \left[\frac{\mu_k}{\mu} \right] [C_k - G(y)] \quad (12)$$

then, following Kakwani (1980), $[C_k - G(y)]$ is interpreted as “an index of the weighted sum of the deviation of elasticity from unity of the kth component of income with respect to total income over its entire range” (Podder and Tran-Nam, 1991, p.4). Equation (12) is equivalent to the relationship

$$\sum \frac{\mu_k}{\mu} (\eta_k - 1) = 0 \quad (13)$$

where η_k is the elasticity of y_k with respect to y . The degree to which a change in y_k , resulting from a change in y , affects the overall inequality thus depends both on the elasticity and the share of y_k in the total income. If S_k is positive (negative) for a particular k , then that component increases (reduces) the overall inequality. The magnitude of S_k indicates the relative significance of the particular component in the overall inequality. In the present study, the disaggregation of the overall inequality index by income components has been done with the help of equation (12). This will enable a more accurate evaluation of the contributions of the different income components to the overall inequality.

5. THE DATA

5.1. The Source and Coverage

The statistics on which the inequality estimates reported here are based come from the *Statistics of Incomes and Income Taxes of Persons* published by the Inland Revenue Department. This once-regular annual report (referred to hereafter as the Report) ceased publication with the 1983-84 issue (unpublished information relating to subsequent years, however, is available on request from the Inland Revenue Department).

The Report contains detailed statistics on personal income which is divided into 16 components. The statistics relating to these components are presented in a frequency distribution form with 38 income intervals. For the purposes of this study, therefore, the information is readily usable.

The statistical population to which the Report refers consists of all persons furnishing personal income tax returns to the Inland Revenue Department for the financial year 1983-84. Total income is defined as the sum of the positive amounts of all income components such as salary and wages, assessable profits, withholding payments less expenses, interest income, net rents, net dividends and so on. To keep our empirical work manageable, and still obtain a useful picture of the state of the distribution, we selected the following six major components of income out of the 16 items listed in the Report.

- (1) Income from wages and salaries, which includes salary and wages, salary and other compensation paid to shareholder employees and earnings-related accident compensation.
- (2) Business income, which includes income from self-employment, i.e. assessable profits plus withholding payments less expenses, minus current and previous losses.
- (3) Investment income, which includes income from interest, rent, dividends and royalties.
- (4) National superannuation.
- (5) Social security benefits, estimated as unemployment benefit added to standard allowances as a proxy for other social security benefits.
- (6) Other incomes, which includes occupational pensions or annuities.

These income components clearly cover quite a wide cross-section of income

sources, ranging from earned income from work and investment to retirement income and incomes from social security-based transfer payments.

5.2. Some Assumptions and Limitations

Given the way the Report presents the data, some assumptions have had to be made to make them amenable to statistical manipulation for estimating the intended inequality indices. For example, the mean income for a class interval has been assumed to be the actual income of each individual in that group. This mean income has, in turn, had to be worked out by dividing the total income of the group by the number of persons in the group, as given in the Report. This method of averaging, of course, conceals any concentration of the income range around the extremities. The problem is, perhaps, even more serious for the last (38th) income interval, which is an open-ended one. However, since this last income interval represents the highest recorded income range, the number of people with incomes substantially in excess of the starting point of this interval is likely to be small. So, our method of estimating the mean income of this income range is unlikely to introduce too strong a bias.

The mean incomes thus worked out have been multiplied by the number of males, females and the total number of persons in each income class to obtain the total incomes of these groups belonging to the income class in question. The cumulative proportions of the respective population groups and their corresponding cumulative shares in the total (group-specific) incomes have then been worked out for estimating the inequality indices for the groups.

In using the data, we are conscious of its many limitations. In particular, in the context of estimating inequalities in the distribution of income, it is extremely important that the data cover the lowest and highest incomes in a comprehensive manner. Given the source of our data, the coverage is somewhat limited as the data relate only to those who furnished an income tax return to the Inland Revenue Department. Since individuals with incomes less than a specified amount are not obliged to furnish a return, a fair proportion of low income individuals probably would not do so and, therefore, would not be covered in the data we are using. Some categories of social welfare benefits, likewise, were tax-exempt, and individuals whose incomes derived from such benefits were not therefore required to furnish a return. However, national superannuation and unemployment benefit paid to individuals without dependent child(ren) were both taxable in 1983-84. The data, therefore captures some of these beneficiaries who would no doubt constitute a

large proportion of the low-income individuals.

A notable feature of New Zealand's direct taxation system is the absence of a capital gains tax, although certain types of gains are treated as income for tax purposes. With gains arising from the sale of such assets as one's private residence, business or farm property as well as shares and stocks being exempt, however, the total incomes of at least some individuals furnishing a return would be under-reported. Small amounts earned in interest and dividends are also exempt, thus making the declared incomes from these sources incomplete as well.

Although it would be impossible to generalise, tax payers of relatively high income are more likely to benefit from the absence of a capital gains tax. At the other end of the income scale, many social welfare beneficiaries are likely to be low-income individuals who would not be required to furnish a tax return. Hence the reported incomes are underrepresented at both ends. As a consequence the Gini coefficients estimated with the help of these income figures are likely to be imperfect. Contributions made by different income components to the overall inequality (as estimated by disaggregating the Gini coefficient) are also likely to be somewhat distorted by the arbitrary nature of the income disclosure requirements for tax purposes.

However, it has to be remembered that the rapid inflation of the period since the mid 1970s had largely eroded the real value of nominal capital gains and of some other incomes from investment. The effect of their non-inclusion then might not have been very serious as far as the real living standards of these individuals are concerned. For a preliminary glimpse at the state of inequalities in New Zealand's personal income distribution, therefore, the income tax returns provide useful and reasonably comprehensive information, despite the limitations referred to above.

6. THE RESULTS AND THEIR INTERPRETATION

Since the results are based on the reported incomes of individuals who furnished a tax return, all references to a population in the discussion below must be taken to refer to the reporting population only, whether or not they are specifically mentioned as such.

6.1. Positive Measures: the Within-Group Inequalities

The statistics relating to the positive measures are presented in Table 1. The mean weekly income of the reporting population, at around \$245, is about a fifth lower than that of the reporting male population, but over two-fifths higher than that of the reporting female population. The average income of the males, at around \$305, is over 75 percent higher than that of the females. The disparities within the groups are captured in the values and the ranking of the Gini indices of inequality. The female index, at 0.397, shows the greatest inequality, followed by the marginally lower index of 0.392 for the population as a whole, while the male index is the lowest at 0.344. The female population thus receives a lower per capita income on average and experiences a less equitable distribution of income. Further confirmation of this last result is provided by the size of the 'Nelson ratios'. The ratio for females at 4.29 is nearly 50 percent higher than that for males and over 29 percent higher than that for the reporting population as a whole. Interestingly enough, the income share of the top 5 percent of the reporting female income earners is actually higher than their counterparts in both the male and total populations, although when one looks at the shares of the top 20 percent, female income earners rank third after those in the male and the total populations. Females thus have to get to very high income levels before their income-shares exceed those of the other groups.

The shares of the top 5 percent of income earners in all three groups are over 3 times the shares of the bottom 20 percent. For the female group, the top 5 percent earn proportionately more than the bottom 40 percent. While the bottom 20 percent in all three groups receive less than 5 percent of the total income of the group, the top 20 percent receive over 36 percent. All these distributions, of course, point to the degree of overall inequality captured in the summary measure, the Gini coefficient.

6.2. The Between-Group Inequalities

The estimation of the Gini index *between* population groups is taken up next. As explained in Section 4, a 'perfect' decomposition of the Gini index requires that the sum of the within-group and the between-group components of the inequality indices be equal to the overall index. But this is only possible if the distributions within the subgroups are identical - obviously an unlikely prospect. In general, therefore, the results of decomposing the Gini coefficient are imperfect, and they provide only the lower bounds of the index.

Table 1 - Personal Income Inequality and Income Distribution in New Zealand 1983-84

Population	Number of Individuals	Mean Personal Income (NZ\$ per week)	Gini Index	Percentage of Income by Percentile group						R = $\frac{P95}{Q1}$
				Quintile Shares					highest 5% P95	
				Lowest 20% Q1	Q2	Q3	Q4	Q5		
Males	964,150 (55.16)	304.93	0.344	4.83	12.27	19.1	24.9	38.9	13.9	2.88
Females	783,640 (44.84)	172.41	0.397	3.64	11.06	16.7	31.8	36.8	15.6	4.29
Total	1,747,790 (100)	245.43	0.392	4.31	10.89	17.9	28.7	37.85	14.3	3.32

Note: Figures in parenthesis are percentages
Source - own estimates

Table 2 - Decomposition of Inequality Index between Population Groups

Population	Number of Individuals	Mean Personal Income	Gini Coefficient	Contribution to total inequality	Percentage share of total inequality
Male	964,150 (55.16) ⁽¹⁾	304.93 ⁽²⁾	0.199	0.137	35
Female	783,640 (44.84)	172.41	0.631	0.203	52.4
Total	1747,640 (100)	245.43	0.392	0.34	100
Unexplained				0.052	12.5

(1) Figures in parenthesis are percentages

(2) Expressed in NZ\$ per week

Table 2 presents the estimates of the Gini index decomposed for the population groups. The overall Gini index has a value of 0.392, while the indices for the reporting male and the female population groups are 0.199 and 0.631, respectively. The relative contribution of each of these groups to the overall index has been worked out with the help of relationship (9) above. The female group has contributed 0.203, and the male group 0.137 out of the overall index value of 0.392, thus leaving a share of 0.052 unexplained.

Expressed in percentage terms, the female group's contribution to the total inequality index is 52.4 percent, the male group's 35 percent-which together explain 87.4 percent of the overall inequality, thus leaving unexplained 12.5 percent of the total. The reason for the overall Gini being greater than the sum of the weighted average Gini co-efficients of the male and female subgroups must be that the distributions within the subgroups are different. In interpreting these findings, however, it must be remembered that the female population, with a much lower mean income than the male, is also likely to contain a proportionately larger number of low income earners who do not furnish a tax return. The gender-based inequalities detected in the results are therefore not representative of the entire population of males and females. They are likely to be even more acute for females, if entire populations were used in estimating the inequalities.

6.3. Decomposition by Income Components

In the literature, formulae involving the concentration ratio, such as equation (10) above, have been widely used for decomposing the Gini index by components of income. The concentration index, C_k , of a particular income component, k , can be higher or lower than the overall Gini coefficient, $G(y)$. A higher (lower) value of C_k would indicate a more (less) uneven distribution of that income component relative to income as a whole. Unlike the Gini coefficient, however, the concentration index can assume both positive and negative values. A positive C_k is interpreted as indicating that the particular income component enhances the overall income inequality, while a negative one reduces it.

However, as Podder and Tran-Nam (1991) demonstrate, this interpretation of the concentration index is misleading. Their alternative method for disaggregating the Gini index is captured in equation (12) above. Results based on equation (12) enable the contribution of each income component to the overall inequality to be ranked relative to one another - their signs indicating whether the contribution has had a positive or a negative effect on the inequality. Table 3 presents the empirical results of decomposition based on equation (12).

The first row of Table 3 gives the mean income of each income-type. The second row shows the percentage share of each income-type. Wages and salaries has by far the highest percentage share (.74.4), followed by business income (8.41), investment income (7.71) and national superannuation (7.51), with the remaining 2 percent being the combined share of social security benefit and other income. The next five rows give the quintile shares of each income-type, when the income earners are arranged in terms of their total income. The eighth row gives the share of the top 5 percent of the income earners in each factor income. The ninth row gives the concentration indices corresponding to each income-type as well as the overall Gini index. The tenth row gives the values of

$$\frac{\mu_k}{\mu} [C_k - G(y)]$$

for each income component as a measure of its contribution to the overall inequality. The rank-order of these contributions is given in the next row with a positive or a negative sign next to the rank-order to indicate whether the presence of the particular income component enhances or reduces the overall inequality. The final row gives the Nelson ratios, R (i.e. the ratio of the incomes of the top 5 percent

(P95) and the bottom 20 percent (Q20) in respect of each income-type as well as the total income).

The concentration indices corresponding to the income components reveal a number of interesting features. For example, the concentration index of business income, at 0.524, is higher than the Gini index of total income, 0.392. This implies that business income is more unevenly distributed in favour of the higher income individuals than income as a whole. This is also reflected in the quintile shares which show that the top 20 percent of income earners receive over 55 percent of total business income, while the bottom 20 percent receive only 1.8 percent. A substantial part of the inequality in total income therefore resulted from the very skewed distribution of its business income component.

Similarly, the concentration index of wages and salaries, while lower than that of business income, is still much higher than the total Gini index. The distribution of this component of the total income is also very uneven in favour of the richer individuals. This too is confirmed by the quintile shares which show that the top two quintiles receive 71 percent of the wages and salaries, while the bottom two receive less than 10 percent. Wages and salaries, therefore, constitute a significant proportion of the total incomes of the high income individuals.

These two components (business income, wages and salaries) are the only ones with a positive index of disaggregation (i.e. their presence in the total income enhances the degree of inequality). The concentration ratios corresponding to both investment income and other income are lower than the overall Gini index, thus implying that these components of income are more evenly distributed over the total income of individuals. The quintile shares of these incomes confirm this, with the shares of all but the bottom quintile being over 10 percent. The result may appear somewhat surprising, particularly for investment income, which is normally expected to be concentrated at the higher income levels. One possible explanation for the relative evenness of the distribution of investment income could be that a large number of retired persons - who receive a significant part of their total income from investment - are otherwise low or middle income earners. Similarly for other income, the explanation for its relatively even distribution may not be unrelated to its composition. Occupational pensions and annuities constitute the major part of such income, and their shares in the total income of many retired persons within the low to middle income range are often high.

The two non-factor incomes, national superannuation and social security benefits, are examined next. Being in the nature of 'transfer payments', these income

Table 3 - Income Inequality by Factor Components: New Zealand 1983-84

	Income Components							Total Gross Income
	Wages and Salary	Business Income	Investment Income	National Super- annuation	Social Security Benefits	Other Incomes		
Mean Personal Income ⁽¹⁾	183.73	20.71	19.04	18.45	2.42	2.53	247.4	
Percentage share of each factor	74.4	8.41	7.71	7.51	0.98	1.03	100	
Quintile Share:								
Q1	3.2	1.8	7.16	1.96	16.3	1.28	4.31	
Q2	6.9	9.3	13.84	55.4	19.7	9.32	10.89	
Q3	19.0	16.1	18.7	20.4	15.8	29.1	17.9	
Q4	26.9	17.7	17.4	10.5	16.7	31.8	28.7	
Q5	43.9	55.1	42.9	11.3	31.5	28.5	37.85	
P95	12.2	31.0	21.4	3.5	12.1	9.2	14.3	
Concentration Index	0.437	0.524	0.346	-0.115	0.143	0.332	0.392	
μ_k — [C _k - G(y)]	0.334	0.0111	-0.00354	-0.0380	-0.0024	-0.0015	0.3919	
μ								
Ranking in terms of contribution	1(+)	2(+)	2(-)	1(-)	3(-)	4(-)		
R = P95/Q1	3.81	17.22	3.00	1.79	0.74	7.19	3.32	

(1) Expressed in NZ \$ per week.

components would be expected to be biased in favour of the poor. The negative sign of their index of disaggregation indicates that they do have an inequality-reducing effect. However, there are one or two perhaps unexpected elements in the distribution of these incomes as reflected in their quintile shares. For example, the very small share of the bottom quintile in national superannuation, followed by the very large share of the next higher quintile, is a finding for which there is no obvious explanation. To be eligible for the (then) universal superannuation, of course, a recipient had to be above a certain minimum age. The very small share of the bottom quintile would seem to indicate that few of the very low income individuals are superannuitants. The next higher quintile, by contrast, would seem to include the largest number of superannuitants. The two highest quintiles, between them, receive around 22 percent of their incomes from superannuation. Thus, over 75 percent of the superannuation payout goes to quintiles two and three. In other words, neither the very rich nor the very poor derive their incomes from national superannuation in any significant manner.

Social security benefits are much more evenly distributed over the first four quintiles. The share of the top quintile, at over 31 percent, is rather high. These benefits include unemployment, family support and other social security allowances - many of which are means-tested. Hence, the unexpectedly large share of the top quintile could have arisen from a proportionately larger number of low income beneficiaries not filing their tax returns. Their share is thus not captured fully, and as a result the share of the top quintile is artificially inflated.

In terms of their ranking, national superannuation has the strongest inequality reducing effect, followed by investment income, social security benefits and other incomes, respectively. It is interesting to observe that while the shares in total income of both investment income and national superannuation are much the same, the values of their indices of disaggregation, though both negative, are markedly different. This has obviously resulted from their very different concentration indices, both in magnitude and sign. Investment income is concentrated to a much greater extent amongst the higher income quintiles. The use of equation (10), in a situation like this, would not have yielded a negative disaggregation index because the equation weights only the concentration index by the ratios of mean incomes. Therefore, unless the concentration index itself is negative, the coefficient of disaggregation would be positive. Equation (12), on the other hand, captures the contribution of a particular income share more accurately by weighting $[C_k - G(y)]$ by the ratio of the mean incomes. In this case, if the concentration index, C_k , is smaller than the index of overall inequality - i.e. the Gini coefficient, $G(y)$, - the disaggregation coefficient would be negative. A lower

concentration index, of course, implies that the income component in question is more evenly distributed over the quintiles than total income. Accordingly, it should help to mitigate, to a degree, the overall inequality. The use of equation (12) thus makes more intuitive sense.

The Nelson ratios reported along the bottom row show that the share of the top 5 percent in the total income is over three times that of the bottom 20 percent. If this is considered to be 'high', there are three income components in respect of which the ratios are even higher. For business income, the top 5 percent receives over 17 times the share of the bottom 20 percent, and for other income (composed mainly of occupational pensions and annuities) the ratio is over 7, while for wages and salaries, it is 3.81. On the other hand, the share of the top 5 percent in investment income, at 3 times that of the bottom 20 percent, is less than the corresponding share in total income. For national superannuation, the share of the top 5 percent, at 1.79, while larger than that of the bottom 20 percent, is much smaller than the two groups' relative shares in the total income. Only in respect of social security benefits is the ratio less than unity. Thus, the values of the Nelson ratios are, on the whole, in line with the concentration indices of the particular factor incomes discussed above.

6.4. The Atkinson Index

As explained in Section 3 above, the concept of the equally distributed equivalent income (YEDE), and its corresponding index of inequality - the Atkinson index - are used for estimating this normative measure of inequality.

The results are presented in Table 4. The inequality indices are estimated for six different values of the distributional parameter, ϵ . It will be recalled that, when $\epsilon = 0$ society is indifferent about distribution, and that, as ϵ assumes larger and larger values, more and more weight is given to the share of the lowest income group. For $\epsilon = 0$, YEDE is simply the mean income of the distribution, and the Atkinson index is almost zero. For $\epsilon = .99$ (shown as 1.00 in the Table), YEDE = \$175.00 which implies that, if incomes were equally distributed it would only have required \$175.00 a week per person to achieve the same level of social welfare as the existing distribution with a mean income of \$245.43. The resulting inequality index, calculated with the help of equation (3) above, has a value of 28.7. This is a measure of the 'loss' to social welfare caused by unequal distribution of the given income. In other words, the same level of social welfare could be reached with only (1.00 -

0.287) = 71.3 percent of the existing total income. In equivalence terms, the potential gain from redistribution, resulting in equality of income, is 28.7 percent of the existing income. At higher values of ϵ , the corresponding values of the inequality index are also higher, thus indicating larger and larger 'losses' caused by inequalities in the distribution of income. Just how large these 'losses' are can be captured by looking at the value of the inequality index for the female population, for example, when $\epsilon = 3$. The relevant inequality index is 0.843 which implies the same level of social welfare can be achieved with less than 16 percent of the present income.

It is also interesting to note that, at each value of ϵ , the inequality index for the reporting female population is higher than those for the male and the total population groups, the differences being more pronounced at lower values of ϵ . For given degrees of inequality aversion on the part of society, therefore, the equally distributed equivalent income for the female population is lower, as a proportion of its mean income, than the corresponding proportions for the male and the total populations. Once again, the female population contributes disproportionately more to the overall inequality in this normative framework of measurement, just as it did in the positive framework as reported in Table 2. One implication of this 'gender-bias' inherent in the distributional arrangements is that policy initiatives aimed at achieving greater income equality would succeed better by prioritising the female population.

7. SOME COMPARATIVE PERSPECTIVES

As interesting as the above findings on the state of income distribution and inequality in New Zealand may be, it is recognised that cross-sectional data for one country and for one year provide a rather narrow focus.

The usefulness of such findings is improved by putting them alongside comparable findings from another period and/or country. However, intertemporal and interspatial comparisons are notoriously difficult on a like-with-like basis. The scope and coverage of data invariably change over time, and different countries may use different methods of collecting and disseminating information on such variables as income, wealth, expenditure and other cash and non-cash transactions. There are also different methods of estimating the degree of inequality in the distribution of income in a country. It is hardly surprising, therefore, that studies involving such comparisons are not plentiful, and the ones that exist are usually done by the same researcher(s), which ensures greater consistency. Since the

Table 4 - Equally Distributed Equivalent Income and Atkinson's Inequality Index for Personal Income Distribution

Population	Number of Individuals	Values of Epsilon (ϵ), Corresponding YEDE and the Atkinson Indices						
		0.0	1.00 ⁽³⁾	1.5	2.0	2.5	3.0	
Male	964,150 55.10%	304.93 ⁽¹⁾	289.68 (0.005) ⁽²⁾	226.56 (0.257)	160.39 (0.474)	107.64 (0.647)	75.63 (0.752)	
Female	783,640 44.84%	172.41	86.2 (0.5)	65.34 (0.621)	47.58 (0.724)	35.0 (0.797)	27.07 (0.843)	
Total	1,747,640 100	245.43	175.0 (0.287)	131.06 (0.466)	91.79 (0.626)	63.81 (0.74)	47.12 (0.808)	

(1) Expressed in NZ\$ per week

(2) Figures in parenthesis are the Atkinson Indices.

(3) The estimates for $\epsilon = 1.0$ have been made using $\epsilon = 0.99$. This has enabled us to use equation (4) above for all the estimates. The degree of inaccuracy in the results is very small.

primary focus of our study is New Zealand, no detailed analysis of other countries is attempted here. There is, however, one study (Easton, 1983) for which the findings can be reasonably compared with our own.

Easton's findings on personal income distribution are of direct relevance to those reported here. Easton (1983, 186, Table 10.7) uses data from the publication *Statistics of Incomes and Income Tax of Persons* to estimate, among other statistics, the Gini coefficients of income distribution of the male, female and total reporting populations for each year over the period 1953-54 to 1976-77. The coefficients for each group show a generally downward trend, indicating reductions in inequality over time. The Gini coefficients for the total, male and female populations were 0.666, 0.428 and 0.889, respectively, in 1953/54. These fell to 0.581, 0.371 and 0.737, respectively, by 1973/74 - the latest year for which the coefficients for all three population groups are given in the study. The Gini coefficient for the total population fell further to 0.523 by 1976/77.

The findings of our study point to a continuation of this downward trend in the values of the coefficients for all three groups. The coefficients for the total, male and female populations in 1983/84, as reported in Table 3 above, were 0.392, 0.199 and 0.631, respectively. There have been some changes to the Pay-as-you-earn (PAYE) system of income tax assessment and collection in New Zealand in the period since the latest year in Easton's study, 1976/77. However, most of the major changes have taken place in the period since 1984. The two sets of findings are therefore largely comparable, although the decomposition reported in the present study has a more sound theoretical basis, as explained in Section 6.3 above.

The Easton study also estimates what it calls the "Gini" coefficients for selected components of total income. The method used for this decomposition is rather crude, and the findings therefore are not strictly comparable with ours which are based on a more sophisticated methodology. The income components used in the two studies are also not entirely the same.

Comparisons with the findings for another country are fraught with even more serious pitfalls. The more readily available international studies are almost always based on information gathered from (among other sources) population censuses, labour force surveys, budget surveys or estimates of specific models. As is to be expected, these different data sources use different definitions of the income unit. Such variations obviously have a significant impact upon the estimated measures of income inequality. It is more common to use the household or the family rather than the individual as the income receiving unit. Aspects of international comparison

which are of relevance to New Zealand will be covered in subsequent studies forming part of the overall project.

8. CONCLUSIONS

The paper has examined, in positive and normative terms, the nature of New Zealand's personal income distribution in 1983-84. The empirical results clearly establish that New Zealand still has a long way to go in reducing the income gaps between the very rich and very poor of both sexes.

In particular, the female population endures greater inequalities, in both positive and normative terms, than both the male and the total populations. The distribution of income within the female group is also more unequal than the other two groups. The summary measure, the Gini coefficient for the statistical population as a whole, conceals glaring differences that still exist between the different population groups. The decomposition of the overall index into separate factor income components also indicates the major sources of inequality.

Any long term policies aimed at addressing income inequalities must take these factors into account. For example, our findings based on a normative measure of inequality, demonstrate the weakness of the argument often used by politicians and policy analysts that it is the "size of the cake", rather than how it is distributed, that determines the economic welfare of society. Our results clearly illustrate the significance of income redistribution in enhancing economic welfare. If policy makers attached greater importance to the income shares of low income groups, and used policies to redistribute incomes more equally, substantial social welfare gains could be achieved even without an increase in the "size of the cake". This is not to deny the role of income growth in the promotion of higher living standards for society; it is to emphasise the role of distributional objectives and policies in promoting social welfare even when income growth is unlikely in the short run, as in contemporary New Zealand.

The other finding that may be highlighted in the context of the current economic debate in New Zealand relates to the strong role of national superannuation in reducing income inequality. A very large proportion of low income people derive a significant part of their income from this source. Policies that reduce superannuation are bound to increase income inequalities in society.

These and other findings of the paper, interesting as they are, must be viewed with

due caution. They relate to one year only and they are based on individual rather than family incomes. The larger study of which this preliminary report is a part, will address many of these and other issues. The present findings are best treated as being indicative.

REFERENCES

- Anand, S. (1983): *Inequality and Poverty in Malaysia: Measurement and Recomposition*, Oxford University Press, New York.
- Atkinson, A.B. (1970): 'On the Measurement of Inequality', *Journal of Economic Theory*, 2, 244-63.
- (ed, 1980): *Wealth, Income and Inequality*, Oxford University Press, Oxford.
- Cowell, F.A. (1977): *Measuring Inequality*, Philip Allan, Deddington
- Dalton, H. (1920): 'The Measurement of the Inequality of Incomes', *Economic Journal*, 30:348-61.
- Easton, B. (1983): 'Income Distribution in New Zealand', Paper 28, NZ Institute of Economic Research, Wellington.
- Gastwirth, J.L. (1972): 'The Estimation of the Lorenz Curve and the Gini Index', *Review of Economics and Statistics*, 54:306-16.
- Gini, C. (1912): *Variabilità e mutabilità*, Bologna.
- Kakwani, N.C. and Podder, N. (1973): "On the Estimation of Lorenz Curves from Grouped Observations", *International Economic Review*, 14:278-91.
- (1976): 'Efficient Estimation of the Lorenz curve and Associated Inequality Measures from Grouped Observations', *Econometrica*, 44: 137-148.
- Kakwani, N.C. (1980): *Income Inequality and Poverty: Methods of Estimation and Policy and Policy Application*, Oxford University Press, New York.
- (1986): *Analyzing Redistribution Policies: A Study Using Australian Data*, Cambridge University Press, Cambridge.
- Lorenz, M.O. (1905), 'Methods of Measuring the Concentration of Wealth', *Publication of the American Statistics Association*, 9:209-19.
- Nelson, J.I. (1984): 'Income Inequality: The American States', *Social Science Quarterly*, 65 (3):854-860.
- Nozick, R. (1974): *Anarchy, State and Utopia*, Oxford University Press, Oxford.
- Osmani, S.R. (1982): *Economic Inequality and Group Welfare: A Theory of Comparison with Application to Bangladesh*, Clarendon Press, Oxford.
- Pigou, A.C. (1912): *Wealth and Welfare*, Macmillan, London.
- Podder, N. and Tran-Nam, B. (1991): *Uses and Abuses of the Disaggregation of Gini Index by Factor Components (Mimeo)*.
- Pyatt, G. (1976): 'On the Interpretation and Disaggregation of Gini Coefficients', *Economic Journal*, 86:243-295.

- Pyatt, G., Chen, C.N. and Fei, J. (1980), 'The Distribution of Income by Factor Components', *Quarterly Journal of Economics*, 94:451-73.
- Rawls, H.S. (1972): *A Theory of Justice*, Oxford University Press, London.
- Sen, A.K. (1973): *On Economic Inequality*, Clarendon Press, Oxford.
- Department of Statistics, 1983-84 (1987): *Statistics of Incomes and Income Tax of Persons*, Department of Statistics, Wellington.
- Stern, N.H. (1977): "Welfare Weights and the Elasticity of the Marginal Valuation of Income", in M. Artis and R. Nobay, (eds), *Current Economic Problems*, Basil Blackwell, Oxford.

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ACKNOWLEDGEMENTS

For helpful comments on an earlier draft, the authors wish to thank Brian Easton, Tom Merz and Andrew Trlin. Part of the work reported here was completed when the first named author was a Visiting Fellow at Edith Cowan University, Perth, Western Australia. The support and encouragement of the Business School of the University are gratefully acknowledged.