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ESTIMATION OF INCOME DISTRIBUTION IN AUSTRALIA

by H. P. Brown

I. INTRODUCTION

AUSTRALIAN interest in the size distribution of incomes over the past thirty years has been mainly for practical administrative purposes. From 1920 to 1938, the main interest was the estimation of the relative taxable capacity of the six states of the federation. This estimate was part of the procedure for determining grants from the central government and was carried out by the late Professor L. F. Giblin. The essential procedure was to estimate an income distribution for each state and then determine the yield of a hypothetical uniform income tax.

After 1938, again under Giblin's guidance, the main interest was to estimate current income distributions against which the yield of possible increased rates of Commonwealth tax could be assessed. These distributions were required as a guide to wartime income tax policy. The early work was mainly done by J. F. Nimmo and the present author. Others who contributed substantially were L. B. Brand, J. A. Stocks, P. H. Karmel and P. J. Cogan. Later work in this field has been done mainly by D. S. Craik and D. V. Youngman.

Throughout the period there was also considerable interest from the point of view of estimating national income and, in particular, the income of non-farm proprietors. Thus an income question was asked in the 1933 census but has not been repeated because of the unsatisfactory response. Among those who displayed interest in this side were J. T. Sutcliffe, A. Smithies, S. R. Carver and Colin Clark. Later work has been the responsibility of the present author and D. V. Youngman. Perhaps the most important result of this interest was the re-casting of income tax statistics from 1937–38 so that they were classified by size of 'actual income' rather than taxable income. 'Actual income' was taxable income plus exempt income and plus deductions for expenditure other than that incurred in deriving taxable income. This improvement in statistics was the work of the Commonwealth Statistician, Roland Wilson.

The main source data for size distribution of incomes is almost inevitably statistics of income tax and two features of the Australian income tax have had considerable effect on the approach to size distributions. The first is that there is no aggregation of husband's and wife's income and hence there is considerable transference of property and other income to wives, partly to reduce income tax otherwise payable. As a result the approach to size distributions has been from the point of view of distribution among productive units rather than from the point of view of welfare. The second is that income tax is imposed on the whole income of companies, and dividends are only included in personal income after payment of this tax. Thus personal income not only excludes undistributed income of companies but also income tax paid by companies (over the last fifteen years, some third of total company income). Since company share owning tends to be concentrated in the highest income groups, it followed that little emphasis could be placed on size distributions as a direct indication of inequality of income. This is, of course, mainly a deficiency from the welfare point of view and not from the point of view of distribution amongst persons actively engaged in production.

Other factors which must be borne in mind in considering Australian income distributions are the relatively high degree of uniformity in earnings throughout the country for specified employee occupations and the high degree of variability in farm incomes not only because of prices but also because of droughts. Even before the war, incomes derived from wool made up a relatively high proportion of the upper incomes and now most other types of farm incomes also tend to be in the upper groups. In the peak year, 1950–51, 90 per cent of those with taxable incomes over £20,000 were classed as farmers.

The income distributions discussed in this paper are primarily for the year 1942–43. It was arranged that income tax returns for that year should include identity card number (which included year of birth). This information, related to a partial census taken in June 1943, made it possible to estimate income distributions separately for each state, sex and age group. It was also possible to subdivide the income distributions for all ages combined into employees, proprietors (persons actively engaged in running their own business, farm or profession) and rentiers (property income only).

From these distributions and income tax statistics for earlier years, size distributions for employees and non-employees were estimated for each year from 1938–39 to 1942–43. These distributions are also discussed together with distributions of weekly income for employees in certain industries in an Australian state for a week in 1938, and distributions for administrative and clerical employees of the Commonwealth Government in 1937 and 1955.

II. GENERAL ASPECTS OF INCOME DISTRIBUTION

Size distributions of incomes may be put into two broad categories – size distributions of income of spending units and size distributions of income of productive units. These may be described respectively as the welfare approach and the production approach. In practice, of course, the nature of the available statistics usually results in a blending of the two approaches. In the welfare approach the main concern is with the inequality of the power to spend and save between different households or units which tend to have a standard of living in common. Australian experience has little to offer in this field.

In the production approach, the main concern is with the way in which the income derived from production is distributed amongst the people engaged in production. The first concern is with the distribution of the aggregate according to nature of income – the distribution between those not actively engaged but who, as rentiers, draw property income from production (as dividends, rent, royalties or interest) and those who are actively engaged as either employees or proprietors (wages or profits). Examination of size distribution then tends to be made separately for the three groups – employees, proprietors and rentiers. These groups may, in turn, be subdivided according to either industry or occupation or according to sex, age or area.

The chief problem in the production approach is that individuals often receive income from more than one of the three main sources of their sub-divisions. Many persons, who are predominantly employees, receive property income or proprietor income from a small spare-time business, and such persons are almost invariably classed in income tax statistics according to size of total income rather than size of income from the predominant source. There is also a fairly steady gradation from

proprietor to rentier. Many proprietors employ a manager and take little active interest in the conduct of the business. Thus the distinction between proprietor and rentier is by no means clear-cut and a substantial part of the income of a proprietor is in fact income from property.

Another problem, common to both the welfare and production approach, is the time interval over which income is measured. The shorter the time interval, the greater the proportion of persons who receive no income or make a loss. This problem cannot be avoided if income tax statistics are the source data. But in the production approach the problem can be avoided for employees by a size distribution of nominal rates of pay, while in the welfare approach the problem can be modified by defining income as income plus dissavings. The size distribution of income of Commonwealth public servants discussed in this paper is based on rates of pay at a specific date and hence avoids the time problem.

For any measure of inequality of income distribution, it would appear that, if any group has income below that necessary to sustain life, then inequality is infinite – or at least that any measure of inequality less than infinity has a very special meaning. And yet any size distribution of income derived from sources other than nominal rates of pay at a date will almost invariably show zero or negative incomes. For employees it would appear necessary to exclude those whose income is below a minimum and perhaps re-include them on an expenditure basis irrespective of the source from which the expenditure is financed. Much the same procedure would appear to be necessary for proprietors although for them a large part of the difficulty can be removed by selecting a time interval long enough to eliminate the short-term fluctuations in proprietor income. Only those who become bankrupt are strictly comparable with the unemployed.

The use of income tax statistics in Australia as a basis for size distribution of income has been found to raise many problems. The first of these problems is the extent to which the statistics are complete and final. The practice up till four or five years ago was to include in the statistics all returns which had been assessed in the eighteen months following the end of the income year on the 30th June. Since that time all assessments for any year have been tabulated as supplementary statistics for that year. It has been

found that the number not assessed within eighteen months is appreciable, that it varies from year to year and that the assessments omitted are by no means representative. It follows that practically complete and unbiased statistics can, after allowing for tabulating time, only be available some four or five years after the close of the income year. This time lag is such as to make the statistics mainly of historical interest. The magnitude of this problem in other countries is not known; in Australia it was thought to be of minor significance until delayed assessments were in fact tabulated. Nor has it been found practicable to obtain statistics from the returns as received – it was found that the time occupied in extracting information from the bulk of returns is an appreciable fraction of the time taken by the Taxation Department in assessing tax and writing the statistical docket. Moreover such statistics would be of limited value for departmental purposes.

The problem of evasion (i.e. deliberate false statement or non-lodgment of income tax returns) is common to all countries and its significance is impossible to determine. It is thought, however, that evasion may be as low in Australia as in any other country.

The problem of avoidance (i.e. legal measures to reduce tax liability) is probably much more serious. Unfortunately it is mainly worth while for higher incomes and the degree to which it is worth while is directly related to the level of income tax rates. Thus, for most countries, over recent decades the tendency to avoidance has probably grown with the result that any apparent reduction in the proportion of high incomes may be fictitious. This is certainly true of Australia and little, if any, significance can be attached to trends towards greater equality of income. It should be remembered, too, that there is probably a considerable time lag in the adoption of avoidance measures and that many of them are irreversible so that reductions in income tax rates only lead very slowly to increases in apparent inequality of income distribution.

Avoidance measures in Australia fall into four main groups. The first group consists mainly of transferring income from one year to another and so deferring tax liability. Such measures may be adopted even when the ultimate tax liability is likely to be higher – the effect is merely to borrow cash at a relatively high rate of interest. The chief means for deferring liability are adjustments of inventory values and classifying capital (and

depreciable) expenditures as current expenditure for tax purposes. These measures are difficult to police and the motive to check them is relatively weak since tax must ultimately be paid.

The second group of avoidance measures consists of charging personal expenses as business expenses. This measure is open both to senior executive officers of companies and to proprietors and may be offered to more junior officers in lieu of salary increases. The direct method is to pay excessive entertainment or travelling allowances. The more indirect method is to provide income in kind such as free use of a car. This type of avoidance is exceedingly common and has been increasing for many years.

The third group of avoidance measures consists of subdividing a high income to obtain lower rates of tax on the portions. A partnership between husband and wife where the husband is a proprietor is a common form. Members of the family may be paid wages for nominal duties in lieu of allowances. Individuals with two jobs often work under different names (though this is evasion rather than avoidance). The scope for sub-division of this sort is particularly great for property income and many ingenious devices have been invented whereby the owner retains full control of the assets and use of the income although the tax is chargeable to another person.

The last group of avoidance measures consists of the use of the company form or other forms of association to avoid tax on savings. Pension funds are often used in this way. The ways in which this can be done are legion – the leading text is 'I Can Get It For You Tax Free', by E. Kellie (pseud. – a notorious Australian bush-ranger of the last century).

I do not wish to suggest that avoidance measures in Australia are more rife than in other countries – and certainly not to suggest that the Taxation Department does not act vigorously to check them – but I do believe that they are of such significance as to distort comparisons over time of the equality of the size distribution of income.

These difficulties of comparison over time are, of course, also present in the comparison of the size distribution of income of groups for a given period. Higher incomes are likely to be relatively understated; and for certain groups (e.g. famers) avoidance and evasion may be easier than for other groups. Generally speaking, avoidance is likely to be least for employees, at least in the non-executive groups, but to be fairly substantial

for proprietors and for rentiers (for the latter, mainly by division of income).

Analysis of size distribution of income from a production point of view, is, as stated earlier, mainly concerned with the three broad groups of employees, proprietors and rentiers and with the sub-divisions of those groups. Analysis is concerned with two aspects – the distribution within a more or less homogenous group and the relationships between the average (in a broad sense) income of the various groups. It is quite possible for income to become more equally distributed within each group and yet for the differences between groups to be accentuated. In such circumstances it is of little meaning to say that income distribution has become more or less unequal merely because some inequality measures for the aggregate of all groups shows this result.

This aspect may be illustrated by the post-war Australian experience of two important groups – manual workers and farmers. In the post-war inflation there was a compression of wage differences for manual workers because only the basic portion of the wage tended to be adjusted to rising prices. The additional or marginal wage tended to remain constant in money terms. For farmers a similar trend occurred because prices received rose much more than costs so that net incomes probably tended to become more equal. But while average earnings of manual workers rose to say three times the pre-war level, average incomes of farmers rose to say ten times the pre-war level, so that the income distribution as a whole probably became much more unequal.

It may be noted, too, that even if the incomes of both manual workers and farmers conformed to some mathematical principle of income distribution before and after the war, it is most improbable that the aggregate distribution conformed to the same principle in both periods. Even if we assume a long-term tendency for income distribution in the aggregate to conform to some principle, it is most unlikely that, in the Australian environment, it will conform at any point of time or be capable of statistical demonstration. Incomes of different groups tend to fluctuate markedly in relation to one another and, before compensating adjustments have time to occur, further fluctuations are likely to have occurred.

This is not to deny that some such principle of a tendency to

restore an existing distribution may not be operative. The analysis of Commonwealth public service salaries, discussed below, suggests that this is so. A good example of pressures towards levelling incomes also occurred in the wool boom of 1950–51. Sheep-owners were as conscious as the rest of the community of the fact that their incomes had expanded enormously and they offered little resistance to what might be described as a tacit conspiracy by the rest of the community to charge them differentially higher prices for all their purchases and thus acquire some of the extra income. This occurred through social pressures quite apart from any economic inflationary pressures which might have been engendered and which tended in the same direction.

III. DESCRIPTION OF ESTIMATED INCOME DISTRIBUTIONS

As stated in the introductory section, the main group of estimates discussed in this paper are those for 1942–43. These estimates were made separately for males and females throughout. They were also sub-divided according to

(i) Twelve quinquennial age groups;
(ii) Employees, proprietors and rentiers; and
(iii) Area – the six States of the Federation.

These size distributions, per 10,000 in each group, are set out in Tables I to IV.

The original estimates were made separately for each sex, age group and state giving an aggregate of 144 distributions. The estimates for each sex and state were subsequently divided into the two groups, employees and non-employees, and the non-employee group, for the total of the states only, was then sub-divided into proprietors and rentiers.

The information for the most detailed distributions consisted of the Federal income tax statistics for 1942–43 for each of the six states and for those assessed at the Central Office sub-divided into size groups and sex and age groups. The partial census of June 1943 gave the numbers of employees and proprietors in each age group. Both sets of figures excluded members of the armed forces.

Income tax statistics covered all incomes over £104 except those who were exempt because of dependants – 2.3 per cent of

the final estimated total of male income recipients. For males, the classified statistics for each State which stated age, made up 73 per cent of the finally-estimated number of incomes over £104. This figure was raised to 86 per cent after distributing age not stated between age groups; 86.3 per cent after distributing those assessed at Central Office between the states; and 88.9 per cent after estimating the numbers exempt because of dependants. These three operations could all be carried out with reasonable precision. The remainder, plus those finally estimated to have incomes of £104 or lower, made up 22.3 per cent of the finally-estimated total of male income recipients.

This remainder of 22.3 per cent consisted of those with incomes of £104 or lower plus those with higher incomes who were not included in the income tax statistics either because they had failed to lodge returns or because the statistics were incomplete. Examination of the difference state by state for each age group showed a fairly constant percentage difference for each of the age groups in the adult working age group. This percentage was taken as indicating the degree of incompleteness for all age groups and the remainder was allotted to the £104 and under size group. For Australia as a whole the 22.3 per cent remainder fell roughly equally into the two classes. The 11.1 per cent incompleteness was then spread proportionately over all size groups partly because of the incompleteness of the statistics and partly to make some allowance for understatement of income, as against evasion by failure to lodge returns. The latter would tend to be concentrated in the lower income groups.

For females much the same procedure was followed, but the proportion for which precise or relatively precise information was available was rather lower. For males, the age groups from 24½–30½ to 54½–60½ can be regarded as reasonably accurate while for females the groups from 19½–25½ to 29½–35½ can be placed in the same category.

A special problem throughout the estimates was the inclusion of rentiers in the income tax statistics and their exclusion from the census data. The number of rentiers in each age-group was known but their size distribution was unknown. No attempt was made to exclude rentiers with incomes over £104 from the final distributions of income, but equally no attempt was made to estimate the number of rentiers with incomes of £104 and lower. This latter estimate would, of course, have little meaning since it

would have to include the very large numbers of the population who are not gainfully occupied but have small amounts of property income such as savings bank interest. To this extent there is a discontinuity in the income distributions at an income of £104.

The main problem in sub-dividing the state totals for males and females between employees and non-employees lay in the difference of definition between the income tax statistics and the census. In the income tax statistics any person with employee income tends to be classified as an employee while in completing a census form many such persons would describe themselves as employers. This difficulty mainly affects the higher incomes and accordingly the number of employees and proprietors in the high income groups should be regarded as relatively uncertain. No special problems arose in sub-dividing the Commonwealth total of non-employees into proprietors and rentiers because the number of rentiers in each size group in the income tax statistics and the aggregate number in the total of income receipients was known. It was of course, necessary to assume that the proportion of rentiers not included in the statistics was the same in each size group as for proprietors and this introduces an element of inaccuracy.The final column of Table V gives a distribution for adult male employees. This distribution is approximate, but not much error is involved in estimating the small number of non-employees under 21.

Size distributions of income for employees and non-employees separately (both sexes combined) for the years 1938–39 to 1942–43 are shown in Table V. These distributions were obtained by relating the income tax statistics for 1942-43 to the estimated income recipients of 1942–43 and deducing the full distribution for each earlier year graphically on the basis of this relationship and the known number of income recipients in each year. These distributions formed the basis of national income estimates for non-employees and served as a check against estimates from other sources of the income of employees. In making the 1942-43 estimates the census numbers of June 1943 were used as a basis. The national income estimate for 1942–43 used the average numbers of 1942–43 as a whole and hence differs slightly.

It should be noted that the income distributions in Tables I to V are classed according to the size of total income of the persons

in each group. Thus the distribution for employees is classified according to wage income plus property income or profits (if any) and not according to size of wage income.

The estimates of income distribution in Table VI, on the other hand, are classed only according to size of employee income. The first group was obtained from a special return made by employers in relation to income tax deductions at source from employees. The information is restricted to one state and relates to a week in 1938. Separate distributions are shown for four industries of special interest – building and construction, manufacturing, retail trade and Commonwealth government employees – and for the total of all industries. The industrial classification is that of the employer's predominant industry. The information is restricted to adult males and relates to all persons actually paid in the week. The minimum weekly wage for most industries at that time was £3 19s. per week so that the great majority of those in size groups below £3 15s. received less than a full week's pay – presumably because of short-time arising from illness, weather-conditions, lay-off, absenteeism, etc.

The final two distributions in Table VI relate to administrative and clerical officers of the Commonwealth public service throughout Australia. The persons included differ from the Commonwealth government group in the earlier part of the table because they exclude manual workers and other non-clerical employees. These probably made up more than half the total in state distribution. The administrative and clerical officers of the Commonwealth service make up a homogeneous group in a career service with no restrictions (other than ability, experience and seniority) on promotion from the bottom to the top of the income range. Practically all new appointments are made at the bottom of the range. The income shown in the size classification is the nominal annual salary on an adult male basis and the distribution is unaffected by loss of income through absence without pay. The size groups shown for 1937, December 1954 and 1955 are comparable in that the changes have all been the result of overall decisions on salary increases and the persons in each group in 1937 and 1955 are nominally engaged in occupations of the same 'work value'. The size classifications for December 1954 and 1955 show the effect of the most recent overall decision on salaries.

The income distributions described in this section are discussed in the remaining sections of the paper.

IV. CHARACTERISTICS OF INCOME DISTRIBUTIONS FOR 1942–3

As a first step, I examined the income distributions for males and females for 1942–43 for each age group, mainly with a view to determining relationships between age and income characteristics, but also to see whether a series of closely related income distributions reveals any relationships which would not be otherwise apparent. The results of this examination are set out in Table VII.

As mentioned in the previous section, the income distributions are incomplete in that they exclude rentiers with incomes of £104 and under. These persons are most important in the higher age-groups and result in some discontinuity in the trend of the characteristics with increasing age. It should also be remembered that the distributions relate to 1942–43 – virtually the peak of Australia's war effort. The distributions exclude members of the armed forces, i.e. a very high proportion of males of military age and, as a result, many juveniles, females and older men were engaged in jobs which normally would have been done by more active men. Very long hours were also being worked in munition factories with consequent distortion of income distributions through large overtime payments. These considerations make it difficult to generalize and draw conclusions about more normal years; and any generalizations which follow should be read subject to these qualifications.

The measures of central tendency set out in Table VII indicate that the mean income of males rises to age 40 and reaches a maximum at about age 50. It then declines fairly sharply except that, in the oldest age group, which consists largely of rentiers, there is a rise to about the age 50 maximum. The median income moves in much the same way, but the maximum is reached at about age 42 and there is no rise for the oldest age group. The maximum median is about $\frac{5}{6}$ of the maximum mean income. The modal income reaches its maximum at about age 36 and continues to fall as age increases. Its value at age 36 is about $\frac{9}{10}$ of the maximum median income.

The lower quartile reaches its maximum at about age 40 and

shows some rise in the oldest age group. The maximum for the upper quartile is at about age 45 and for the upper decile at about age 55. Both show some tendency to rise again in the oldest age group. These results may be summarized as follows:

Measure	*Max. at age*
Mode	36
Lower quartile	40
Median	42
Upper quartile	45
Mean	50
Upper decile	55

For females, the influence of rentiers becomes fairly strong in the distributions at ages over 30 and hence the pattern of maxima as revealed for males is largely obscured. The mean, upper decile and upper quartile incomes rise with age throughout. For the median there is a maximum at about age 35 followed by a slight fall before the rise is resumed. For the lower quartile the maximum is at about age 27 falling to a minimum at about age 43 before the rise is resumed. Only the mode shows a similar pattern to that for males, the maximum being at about age 31 with the value falling steadily thereafter.

For both males and females, the median, quartiles and decile were obtained graphically. The mode was obtained by fitting a curve of the fourth degree to the cumulated frequencies around the observed modal group. The mean was calculated by using standard average incomes for each income group except the highest as observed in income tax statistics. For the highest group it was assumed that the Gini δ calculated from the points £4,000 and £5,000 continued to hold for incomes over £5,000 and, accordingly, that the average income over £5,000 was $5{,}000x\delta$.

The cumulated income distributions for each age group were plotted on double logarithmic paper, the cumulations being made both upwards and downwards to obtain two curves for each distribution. The general shape of the curves for the cumulated numbers above given points was as follows. The slope commenced at something near zero and then rose steadily to a maximum. Over this section the curve was concave to the origin. The slope then fell again to make the curve convex to the origin. For the highest incomes (the top 5 or 10 per cent) the

curve approximated to a straight line. This pattern was very marked for those age groups, male and female, where employees made up the bulk of the numbers. But for the higher age groups, the curves tended more and more to become concave to the origin throughout though with very little change of slope for the higher incomes.

The Pareto coefficients for the straight portion of the curve are shown in the last column of Table VII. For males, the coefficient rises from 2.5 for age 17½ to 3.1 for age 27½ and then falls fairly steadily to 1.7 for age 75. For females, the movement is less regular. The coefficient falls from 2.5 at age 17½ to 1.65 at age 42½. It then rises to 1.85 but falls again to about 1.7 for the two oldest age groups.

In examining the curves for each age group it was observed that the curves for cumulated numbers above and below certain points were similar in shape over an appreciable range for some distributions. The analysis of this symmetry is referred to in Table VII as the symmetrical part of the curve. It is, of course, obvious that an upward and downward cumulated curve will be very similar around the median but it was found, by comparison of the curves, that the symmetry was rather better over a wider range from some point other than the median. The procedure adopted was to compare the curves to find the point which would give correspondence over the longest logarithmic range, using as a criterion of correspondence that the curves should, at no point in the range, diverge by more than an amount which was equivalent to 10 per cent. The resulting points, the range covered and the percentage of income recipients included in the range are shown in Table VII. For both males and females a high percentage of all income recipients fall within the range in the middle age groups.

The interpretation I would place on these results is that there is a fairly strong tendency for the percentage of income recipients above a given point to fall off in the same proportion as the number below the same point – in other words that the probability of receiving at least a given percentage more than a certain income is roughly equal to the probability of receiving at least the given percentage less. This in turn suggests that some sort of probability criterion may be validly used to determine income distribution over a fairly wide middle range of incomes.

This suggestion was tested over the male and female aggreate

distributions for all ages divided into the three groups employee, proprietor and rentier. It was apparent that the relationship did not hold. It was observed, however, that the curves of the distribution of numbers above given incomes for employees and rentiers were almost identical in shape above an income about two and a half times the male employee average for both males and females separately. In view of the probability that higher employee incomes included a substantial rentier or similar element, the rentier curves were deducted from the employee curves to give a curve for 'pure' employee income. These two curves showed much the same symmetrical nature as the curves for the middle age groups. Further analysis of the 'pure' employee male curve suggested that this symmetry was fairly close to the log normal probability curve and hence that a fairly strong element in employee income distributions was a random percentage variation from a given level of income.

The theoretical distribution for male employees obtained by combining the actual distribution for male rentiers with the best fitting normal curve as compared with the actual distribution was as follows:

Income Range	Theoretical Number	Observed Number
£		
Over 5,000	5	5
4,000–5,000	3	3
3,000–4,000	6	6
2,000–3,000	16	17
1,500–2,000	26	24
1,250–1,500	24	25
1,000–1,250	40	45
800–1,000	57	86
600– 800	255	308
500– 600	625	572
400– 500	1,766	1,700
350– 400	1,557	1,528
300– 350	1,764	1,708
250– 300	1,241	1,193
200– 250	596	561
150– 200	361	448
104– 150	312	425

These results would give a .95 confidence level for goodness of fit if the number of incomes was approximately 1,000.

In view of the very limited nature of the information used,

and the likelihood that sufficient searching will always disclose some apparently significant relationship, I am not inclined to place much weight on the results obtained. It is possible, however, that the results may throw some light on problems revealed in a similar field in other countries.

V. AN INFERIORITY INDEX

From the point of view of an individual, inequality of income has a rather clearer meaning than for the community as a whole. He is concerned with his own position in relation to his own group, and with the position of his own group in relation to other groups. 'Group' for this purpose may be defined in many ways – the group with whom he went to school, the group he knows of his own age, the group with whom he lives. But perhaps the most important, both from the point of view of the individual and from the production approach to income distribution, is the group with whom he works.

If we consider a man in a career occupation – a government public service, a bank – we can see him comparing his earnings with those of other people of his own age and experience and with those who are older and more experienced. He is concerned with both how well he is doing and with his prospects of promotion. He is also concerned with those who have lower earnings to see how far he has managed to climb the income scale. There are many ways of looking at the other members of the group – for example, how many are on the next income above his in relation to the number on his own income and how many vacancies for promotion there are likely to be – but these various ways can most simply be summed up in (i) what is the average income of those with higher incomes than his own, and (ii) what is the average income of those with lower incomes. By relating these two averages to his own income he gets the first approximation to where he stands – and to how unequal the distribution of income is. If he can say 'My income is only 20 per cent below the average of those above me and is 25 per cent above the average of those below me' he will consider the income distribution of the group fairly even as compared with what it would be if those above were 100 per cent above and those below 50 per cent below. By summing up these relationships for all members of the group and averaging them we can

obtain a first approximation to a figure for the inequality of income distribution. This figure will be fairly precise in meaning for a homogeneous group, but can be extended to bring in other groups as well (or the whole community) to give an overall inequality measure. Its meaning will be somewhat less precise but it will not be without significance, just as the individual is concerned in part with all other groups as well as with his own.

This is the concept of an inferiority index to measure inequality of income distribution which is examined in this section of the paper.

In algebraic form, the index measured from average income above a given level may be set out as follows. If the number of incomes at any income level x is f(x), then the aggregate income at the income level x is xf(x). The number of incomes above, say, x is

$$\int_x^\infty f(x)dx$$

and the aggregate income above x is

$$\int_x^\infty xf(x)dx$$

Average income above x is

$$\frac{\int_x^\infty xf(x)dx}{\int_x^\infty f(x)dx}$$

and the ratio of this average to x is

$$\frac{1}{x} \cdot \frac{\int_x^\infty xf(x)dx}{\int_x^\infty f(x)dx}$$

The average of all ratios above x weighted by the number of incomes at each income level is

$$\frac{1}{\int_x^\infty f(x)dx} \cdot \int_x^\infty f(x) \cdot \frac{1}{x} \cdot \frac{\int_x^\infty xf(x)dx}{\int_x^\infty f(x)dx} dx$$

This may be simplified to

$$1 - \frac{1}{F(x)} \int \frac{f(x)F_1(x)}{xF(x)}\, dx$$

where $\frac{d^2}{dx^2} F_1(x) = \frac{d}{dx} F(x) = f(x)$. The index measured from average income below a given level may be expressed analagously, but, in a general form, there is no simple mathematical link between the two.

If the Pareto relationship holds and $F(x)=ax^{-b}$, then the integral is equal to $b/b-1$. This is Gini's δ and is also the value of the ratio for any point x. In this case the inferiority index is merely the average of Gini's δ as obtained from the ratio of the average income above any point to the income at that point.

The method of calculating the inferiority index in its two aspects – looking up to the average above, and looking down to the average below – is set out in Table VIII. The index looking up can be summed from any point x and may be designated ${}_xI_u$. At the same time the average looking up index below any point x may be designated ${}^xI_u$. Similarly the looking down index below any point x may be designated ${}^xI_d$ and the looking down index above any point x, ${}_xI_d$. Of these four partial indexes only ${}_xI_u$ – the looking up index above x – can be obtained from an incomplete income distribution since the other three involve knowledge of the numbers and average incomes below the point x. For complete distributions, summed over the whole distribution, the four indexes become the two basic indexes I_u and I_d.

In some sense these two indexes express a similar thing – the average ratio of an average income above or below a point to that point – but I_u exceeds unity and I_d is less than unity. In order to achieve greater comparability we may take $I_{u'}$, the reciprocal of I_u, and I_d as the pair of indexes. I have plotted the relationship between $I_{u'}$ and I_d for some sixty distributions in Table X and find that they conform reasonably closely to the relationship $I_{u'} = 1.51_d - .5$. Since only $I_{u'}$ can be calculated from incomplete distributions, I have transformed I_d so that $I_{d'} = 1.51_d - .5$. This gives two roughly comparable measurements $I_{u'}$, and $I_{d'}$ of which the mean may be called I′ with a $\pm$ item equal to $I - I_{u'}$. I′ multiplied by 100 and subtracted from 100 gives the inferiority index I which is the average percentage by

which given incomes fall short of the average income above them.

The relationships between these successive measures may be expressed as follows where N is the total number of incomes, ${}^{x}N$ the number below x and ${}_{x}N$ the number above x.

$$({}^{x}N{}^{x}I_u + {}_{x}N_{x}I_d)/N = I_u$$
$$({}^{x}N{}^{x}I_d + {}_{x}N_{x}I_d)/N = I_d$$
$$I_{u'} = 1/I_u$$
$$I_{d'} = 1.5I_d - .5$$
$$I' = \tfrac{1}{2}(I_{u'} + I_{d'})$$
$$I = 100 - 1{,}001'$$

The main results of these calculations for the sixty-eight distributions of Tables I to VI are set out in Table IX. It will be observed that the discrepancy between $I_{u'}$ and $I_{d'}$ is quite large for a number of the distributions. This may arise not only because of the purely empirical relationship between $I_{u'}$ and $I_{d'}$ but also because the sensitivity of the two indexes to errors in the original distributions and to approximations in their calculation may be different. Examination of this sensitivity comes under four heads:

(i) variation in the number in an income group;
(ii) variation in the average income of an income group;
(iii) variation in the lower limit of the lowest income group;
(iv) determination of mean ratio for an income group.

I have examined a fairly representative distribution – males 1942–43 aged 42½ – to see the effect of the first two of these types of variation on $I_{u'}$ and $I_{d'}$. The value of the indexes was .5 and the variations from this value are shown in the following table.

	Raising Number		Raising Av. Inc.	
	$I_{u'}$	$I_{d'}$	$I_{u'}$	$I_{d'}$
500 . . .	−.0028	−.0065	−.0000	+.0024
1,500 . . .	+.0007	+.0005	−.0001	+.0020
2,500 . . .	+.0014	+.0017	−.0001	+.0016
3,500 . . .	+.0016	+.0022	−.0001	+.0012
4,500 . . .	+.0017	+.0022	−.0002	+.0009
5,500 . . .	+.0018	+.0021	−.0003	+.0007
6,500 . . .	+.0018	+.0016	−.0004	+.0005
7,500 . . .	+.0017	+.0008	−.0005	+.0003
8,500 . . .	+.0013	−.0004	−.0008	+.0002
9,500 . . .	−.0012	−.0033	−.0018	+.0000

The first column shows the place in the cumulative income distribution (for 10,000 income recipients) at which the variation was made; the next two the effect of adding 100 income recipients at the average income at that point; and the next two the effect of raising the average income of the 100 recipients around that point by 10 per cent.

It would appear that $I_{d'}$ is more sensitive to variations in number throughout but that this extra sensitivity is most marked for the extremes of the distribution. Bearing in mind that variations in Is, are 1.5 times those in I_d it appears that I_u is slightly less sensitive for the middle ranges of the distribution.

Increases in average income, wherever they occur, lower $I_{u'}$ and raise $I_{d'}$. The effect on $I_{u'}$ is greater the higher the income at which the average is increased, while the effect on $I_{d'}$ is greater the lower the income. Overall, $I_{d'}$ is again somewhat more sensitive than $I_{u'}$. It may also be noted that any change in average income has the effect of widening the gap between $I_{d'}$ and $I_{u'}$ provided the two indexes were equal before the change was made.

In a more refined calculation of the two indexes than has been made in this paper, it should be possible to calculate average income for each group by mathematical interpolation and this might have the effect of reducing the variability between the two indexes $I_{u'}$ and $I_{d'}$. It should be noted, however, that there may be errors in the basic data because of preferences for round figure incomes (e.g. £520=£10 per week) and, accordingly, that mathematical interpolation may not be desirable. Errors of this sort are very apparent in the New Zealand income tax statistics in which the number at each £ of income is shown.

Variation in the lower limit of the lowest income group can only affect $I_{u'}$ since the ratio for $I_{d'}$ at this point is always unity. The variations for $I_{u'}$ can be very significant and if the lower limit is put at nil the ratio becomes infinity and $I_{u'}$ cannot be estimated. I have referred to this matter earlier in relation to measures of inequality of income distribution and would only mention here that, in calculating $I_{u'}$, very careful consideration must be given to the lower limit. Much of the discrepancy between $I_{u'}$ and $I_{d'}$ for the distributions dealt with in this paper may arise from this difficulty.

The determination of the mean ratio of income in a group to average income above the group is a possible further cause of

discrepancies and variations. In this paper I have taken the simplest measure – the arithmetic mean of the ratios for the two limits. Where these ratios differ markedly – in the lower groups for $I_{u'}$ and in the higher groups for $I_{d'}$ – considerable inaccuracy may result. In a more precise calculation of the indexes it would presumably be preferable to determine the mean ratio by mathematical interpolation.

It will be noted that $I_{u'}$ is the reciprocal of the weighted arithmetic mean of the ratios. It could also be calculated directly by taking the weighted arithmetic mean of the reciprocals of the ratios. If this were done, the arithmetic difficulty of an infinite ratio for the lowest ratio, if the lowest income is nil, disappears although the conceptual difficulty remains. The effect of calculating from the reciprocals of the ratios for the distribution used on page 220 is to raise $I_{u'}$ from .489 to .529, $I_{d'}$ being .503. Generally, it may be that the use of weighted harmonic or geometric means of the ratios may be preferable for either I_u or I_d or both.

The calculations in the paper are directed towards obtaining a single figure measure of income inequality. This measure is, in fact, very similar to Gini's δ but, while giving much the same result, may have the additional advantage of measuring a more readily perceptible concept – the average ratio of incomes to all incomes above them. But a more important advantage may be the ease with which the index can be sub-divided to show inequality, upwards and downwards, from the point of view of, say, each quartile of the income distribution. In a broad sense, the ratios of average income above and below are fairly constant for all incomes except the lowest for I_u (where infinity is approached) and the highest for I_d (when zero are approached). This suggests that it may be preferable to combine $I_{u'}$ and I_d not in the aggregate but, say, quartile by quartile, giving the lowest quartile little or no weight for $I_{u'}$ and the highest quartile little or no weight for I_d. In this way a single figure aggregate and separate indexes for each quartile would be available for comparison with other distributions.

This procedure may be illustrated for the male distributions for 1942–43 for ages 27½ and 57½. $I_{u'}$ and I_d for each quartile (on page 219 notation, ${}_{\cdot 25}I_{u'}$, ${}_{.25}{}^{\cdot 5}I_{u'}$, etc.) are as shown on opposite page.

If these figures are combined, weighting the quartiles 0, 1, 2

	Age 27½		Age 57½	
	$I_{u'}$	I_d	$I_{u'}$	I_d
1st quartile	.396	.692	.276	.689
2nd quartile	.709	.705	.513	.670
3rd quartile	.750	.718	.516	.665
4th quartile	.706	.624	.485	.481

and 3 respectively for $I_{u'}$ and 3, 2, 1 and 0 for I_d, an aggregate index of .711 for age 27½ and .589 for age 57½ is obtained. By subdivision in this way, a fairly complete description of an income distribution is made possible in terms of figures of similar meaning.

The first group of distributions to consider in relation to the inferiority index is that for the Commonwealth public service. This is the only group in which no difficulties arise with lower limits and which refers to a homogeneous group. It may be noted that, in calculating I_u for this group, it appeared that the ratio of average income above income x to x was much more variable than the absolute difference between the average above x and x. Thus for 1955, the absolute difference varied between £372 and £564 as compared with a variation in the ratios between 1.65 and 1.18. An I_d calculated on the absolute difference basis gives an average amount of £416 which, related to the mean of £1,188, gives an I_u of 1.35 and an $I_{u'}$ of .741 as against .721 calculated on the ratio basis. A similar calculation for 1937 gives an $I_{u'}$ of .709 as against .681 on the ratio basis. On the other hand the ratios for I_d are much less variable than the absolute differences so that the ratio basis seems preferable for general application.

The public service distributions in themselves are mainly of interest in illustrating the tendency for a pattern of income distribution to be maintained under changing conditions. Over the period from 1937 to 1955 the number in the group approximately doubled and the average income trebled. This increase in average income was brought about by a series of administrative decisions, of which the first was to increase all salaries each quarter by an equal absolute amount equal to the increase in the cost of living for the basic minimum salary. There were also three major variations in that part of the salary in excess of the basic minimum. The first, in 1947, consisted of a percentage

increase which was appreciably less than the percentage increase in the basic amount. The second, in 1950, consisted of the addition of flat amounts on a scale which was much less than proportionate to the amounts above the basic minimum. The third, in January 1955, consisted of amounts on a more than proportionate basis, and was designed to go most of the way to restoring 1937 relativities. Throughout the period jobs were being re-classified to higher salaries, nominally because of changes in 'work value'.

The progressive effect of these changes on the inferiority index is shown in Table IX. The index in 1937 was 33 per cent. If the administrative salary increases up to 1954 had occurred but there had been no reclassification of positions, the index would have fallen to 19 per cent. But, in fact, the reclassification of positions had the effect of limiting the fall to an index of 23 per cent. Finally the decision of January 1955 had the effect of raising the index to 28 per cent – approximately half the way to the 1937 index of 33 per cent.

This Commonwealth public service administrative and clerical index of 33 per cent for 1937 may be compared with the index of 39 per cent for all Commonwealth adult male employees in an Australian state in 1938. This income distribution differs in that it includes non-clerical employees (say half the total) and is on the basis of actual weekly income so that it includes those who for some reason received less than a full week's pay. It also includes the effect of overtime and special payments.

The income distributions for other industries for adult male employees in a state in 1938 give indexes of 33 per cent for retail trade and 35 per cent for factories. These indexes seem to reflect the greater concentration of income for these workers as compared with Commonwealth employees. The index for building and construction is higher at 40 per cent but this is mainly due to the relatively high number in the lowest group – possibly because of short time due to wet weather in that week. The overall index for adult male employees is also 40 per cent. I refer below to the effect on the inferiority index of combining non-homogeneous groups (generally speaking to raise it above the level for the individual groups).

This weekly index of 40 per cent in 1938 may be compared with the index of 44 per cent for all Australian adult male employees in 1942–43. If we assume that the index for all adult

male employees followed the same trend between 1938–39 and 1942–43 as that for all employees (male, female, juvenile) – i.e. from 54 per cent to 60 per cent – these two indexes for adult male employees appear reasonably comparable even though one is on a weekly basis and the other on a yearly basis and covering a wider field. The yearly income also includes income from non-employee sources.

The next step is from all adult male employees in 1942–43 (index 44 per cent) to all male employees in 1942–43 for which the index is 55 per cent. These two distributions are comparable in all respects except that the latter includes juveniles as well as adults. The index for all female employees in 1942–43 was 47 per cent and for all employees (male and female) 58 per cent. These indexes illustrate the effect of combining non-homogeneous groups. Adult males (44 per cent) plus juvenile males (approximately 45 per cent) gives a male index of 55 per cent. The addition of females (47 per cent) gives an index for all employees of 58 per cent.

It may be noted here that the index for all employees for 1942–43 on the basis of the average number of employees in the whole year was 60 per cent as against 58 per cent on the basis of the number at the end of the year. The index for all employees had remained fairly steady at about 55 per cent from 1938–39 to 1941–42 but rose sharply in 1942–43 with the first full year's impact of a total war effort. These variations appear relatively minor in view of the 40 per cent rise in average income, the decline of 10 per cent in numbers and the elimination of unemployment (approximately 10 per cent in 1938–39). The year to year figures for non-employees show even less variation, ranging from 65 per cent to 67 per cent, despite a 60 per cent rise in average income, a 25 per cent fall in numbers and severe droughts in 1938–39 and 1940–41.

The relative stability in the year-to-year indexes for employees and non-employees is paralleled by the relatively small differences between states in the indexes for all male and all female income recipients. The range for males is from 58 per cent to 62 per cent with the three less industrialized states at the higher level. But Victoria, the most industrialized state, occupies a midway position. For females, the range is from 52 per cent to 55 per cent, but there is no discernible pattern of variation between states.

Comparison of the indexes for employees with those for proprietors and rentiers in 1942–43 gives these results. For males the employee index was 55 per cent, the proprietor index 67 per cent and the rentier index 58 per cent. The index for all males was 59 per cent. For females the employee index was 47 per cent, the proprietor index 71 per cent and the rentier index 58 per cent. The index for all females was 56 per cent. Combining males and females, we have an employee index of 58 per cent. and a rentier index of 58 per cent. The index for all Australian income recipients in 1942–43 was 61 per cent.

Finally we may consider the indexes for males and females separately for each age group. For males the index rises from 41 per cent for age 17½ to 66 per cent for age 75. The index for age 22½ at 50 per cent is out of line with the trend, presumably because of the combining of adults and juveniles. The overall trend of the index reflects substantially the shift from employee to proprietor to rentier with increasing age. For females the index rises from 35 per cent for age 17½ to 60 per cent for age 52½ and 63 per cent for age 75. The index for age 22½ is in accordance with the trend, presumably because adult rates for females are usually paid at age 18.

I have not analysed the relationship of the inferiority index for two groups combined to the index for the groups separately; but, more or less intuitively, it would appear that the combined index I_u should be approximately equal to the average of I_u for the two groups weighted by the numbers in each group, plus the percentage excess of the average income of the combined group over the average income of the group with the lower average income, multiplied by the ratio of the numbers in the lower group to the total number.

A combination of I_u for males and females in this manner gives the following results for 1942–43:

	Male	Female	Combined	Actual
Employee	2,1590	1.8670	2,3199	2,3042
Proprietor	3.2109	3,8735	3.2940	3,2811
Rentier	2.7683	2.8869	2.8631	2.8342
Total . . .	2.4397	2,3936	2.6224	2.6101

It will be observed from Table IX that the range of I in the

income distributions dealt with is from 19 per cent to 71 per cent. The full theoretical range is from 0 per cent to very nearly 100 per cent so that these distributions give a fairly wide cover of the whole potential range.

Mathematically the index is closely related to Gini's δ, but I have not calculated δ for the distributions in the paper to see how close this relationship is in practice. The main advantages which I see in the index are:

(i) it can be expressed verbally in terms which can be related to an individual's conception of inequality;

(ii) it can be sub-divided to measure inequality for each or any section of the income distribution; and

(iii) it can be calculated (in partial form) where only the upper part of the income distribution is known.

NOTES TO TABLE VIII

Col. 1 The limits of the observed income groups. The lowest (.050) is arbitrary. inf.=infinity. Expressed in 000s.

2 The averages observed in income tax statistics. The lowest (.075) is arbitrary. For calculation of highest (9.520) see below. Expressed in 000s.

9 int.=interpolated – the mean of the ratios for the two limits of the group. For the highest group the lower limit is taken since it is assumed that the Pareto type income distribution holds.

14 The ratio for the lowest income is necessarily unity.

15 See Col. 9.

Calculation of I_u and I_d is by dividing the aggregates for Cols. 10 and 16 (26,101 and 5,941) by the number of incomes (10,000).

Calculations of the average income over £5,000 is on the assumption that the Pareto distribution $\log y = a - b \log x$ holds above £4,000. The number of incomes over £4,000 is 16, over £5,000 is 10. The difference in logs of these two numbers is .2041 and the difference in logs of the two incomes .0969. Hence $b = 2.106$ and $b/b - 1$ is 1.904. Average income over £5,000 is 5,000 multiplied by 1.904 equals 9,520.

TABLE I

Australia – 1942–43 – *Males*

Income Distribution by Age Groups

Per 10,000

Income	To 20½	19½–25½	24½–30½	29½–35½	34½–40½	39½–45½	44½–50½	49½–55½	54½–60½	59½–65½	64½–70½	Over 69½
£												
Under 105 . .	6,531	1,200	417	299	266	309	349	435	615	1,147	1,540	812
105– 150 . .	1,730	387	258	219	197	194	204	240	323	504	769	1,227
151– 200 . .	926	672	457	427	374	354	393	434	554	767	1,012	1,390
201– 250 . .	408	1,007	647	591	571	544	583	625	742	891	991	1,127
251– 300 . .	198	1,657	1,285	1,145	1,116	1,137	1,237	1,325	1,405	1,424	1,261	1,059
301– 350 . .	102	1,864	2,013	1,857	1,744	1,696	1,738	1,739	1,674	1,482	1,107	899
351– 400 . .	46	1,441	1,900	1,846	1,760	1,634	1,553	1,472	1,323	1,046	780	656
401– 500 . .	38	1,344	2,032	2,198	2,185	2,057	1,863	1,684	1,458	1,082	882	801
501– 600 . .	10	292	591	735	812	856	804	750	634	507	448	451
601– 800 . .	6	89	244	391	509	596	618	588	552	455	443	524
801–1,000 . .	2	22	69	121	179	226	224	235	235	215	226	293
1,001–1,250 . .	1	11	38	70	105	133	138	148	154	146	155	211
1,251–1,500 . .	1	4	19	33	57	79	83	92	87	85	104	137
1,501–2,000 . .	1	5	14	33	62	83	89	97	99	105	110	153
2,001–3,000 . .	—	4	10	23	39	58	71	73	79	79	92	133
3,001–4,000 . .	—	1	4	6	12	21	25	30	29	28	35	49
4,001–5,000 . .	—	—	1	2	6	10	11	13	14	14	16	25
Over 5,000 . .	—	—	1	4	6	13	17	20	23	23	29	53
Total . .	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000

TABLE II

Australia – 1942–43 – Females

Income Distribution by Age Groups

Per 10,000

Income	To 20½	19½–25½	24½–30½	29½–35½	34½–40½	39½–45½	44½–50½	49½–55½	54½–60½	59½–65½	64½–70½	Over 69½
£												
Under 105 . .	6,417	1,192	1,359	1,687	1,781	2,103	2,021	1,818	1,696	901	514	196
105– 150 . .	2,577	2,464	1,825	1,646	1,594	1,522	1,671	1,721	1,786	1,862	2,056	2,042
151– 200 . .	861	4,114	3,165	2,632	2,372	2,188	2,105	2,100	2,010	1,900	1,769	1,800
201– 250 . .	106	1,597	2,146	1,948	1,767	1,508	1,319	1,260	1,129	1,216	1,215	1,252
251– 300 . .	21	428	864	1,036	1,036	968	880	830	815	878	859	931
301– 350 . .	8	127	347	473	581	577	546	570	566	630	663	634
351– 400 . .	3	30	104	182	244	289	319	352	376	442	505	484
401– 500 . .	2	19	80	161	223	295	380	440	480	627	649	690
501– 600 . .	1	9	34	73	115	148	207	232	281	384	384	432
601– 800 . .	2	9	31	69	122	150	208	275	304	404	474	512
801–1,000 . .	1	5	15	32	50	74	105	125	166	244	264	298
1,001–1,250 . .	—	2	12	21	39	56	82	80	122	170	204	218
1,251–1,500 . .	1	1	6	13	23	32	38	56	71	100	104	131
1,501–2,000 . .	—	1	5	13	20	36	49	57	80	100	127	145
2,001–3,000 . .	—	1	5	8	18	30	40	49	66	79	107	126
3,001–4,000 . .	—	—	1	3	9	13	13	15	19	24	55	45
4,001–5,000 . .	—	1	—	1	3	5	5	7	12	12	25	18
Over 5,000 . .	—	—	1	2	3	6	12	13	21	27	26	46
Total . .	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000

TABLE III

Australia – 1942–43 – States

Income Distribution – Male and Female

Per 10,000

Income	Males						Females					
	N.S.W.	Vic.	Q'land	S.A.	W.A.	Tas.	N.S.W.	Vic.	Q'land	S.A.	W.A.	Tas.
£												
Under 105 . .	1,080	1,213	1,565	1,248	1,495	2,156	2,613	2,367	4,190	2,960	3,597	4,333
105– 150 . .	457	456	519	544	490	658	2,239	1,993	1,729	2,416	2,023	1,986
151– 200 . .	517	528	645	633	636	799	2,489	2,449	1,554	2,055	1,899	1,704
201– 250 . .	606	592	779	706	723	887	1,161	1,383	1,084	1,082	964	837
251– 300 . .	1,103	1,053	1,224	1,248	1,252	1,392	540	684	512	601	554	400
301– 350 . .	1,566	1,549	1,292	1,667	1,442	1,295	295	367	257	254	309	192
351– 400 . .	1,431	1,455	1,056	1,365	1,162	929	143	180	143	132	147	124
401– 500 . .	1,713	1,635	1,342	1,319	1,321	940	173	183	156	151	166	141
501– 600 . .	647	611	598	495	535	361	92	101	85	87	88	73
601– 800 . .	422	423	460	365	439	259	98	108	95	101	98	84
801–1,000 . .	156	166	177	148	178	122	48	57	52	52	54	44
1,001–1,250 . .	97	105	107	89	121	74	35	39	43	35	36	32
1,251–1,500 . .	56	60	66	54	67	41	21	23	25	20	16	18
1,501–2,000 . .	64	63	73	51	68	40	22	25	28	23	19	15
2,001–3,000 . .	48	49	55	39	42	31	17	22	28	16	17	9
3,001–4,000 . .	17	18	21	14	15	9	6	8	10	6	7	6
4,001–5,000 . .	8	8	9	7	6	3	3	3	4	3	3	1
Over 5,000 . .	12	16	12	8	8	4	5	8	5	. 6	3	1
Total . .	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000

TABLE IV

Australia – 1942–43

Income Distribution by Sex and Grade of Occupation

Per 10,000

Income	Employees			Proprietors			Rentiers			Total		
	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons
£												
Under 105 . .	1,346	3,220	1,969	1,066	2,076	1,176	—	—	—	1,264	2,864	1,763
105– 150 . .	425	2,146	997	578	828	605	1,837	2,346	2,187	482	2,092	983
151– 200 . .	448	2,390	1,094	893	993	904	1,846	1,891	1,877	566	2,268	1,095
201– 250 . .	561	1,204	774	947	911	943	1,260	1,289	1,280	653	1,196	822
251– 300 . .	1,193	536	975	950	810	935	950	907	921	1,138	584	966
301– 350 . .	1,708	249	1,224	852	659	831	719	651	672	1,514	308	1,139
351– 400 . .	1,528	94	1,052	719	544	700	569	474	503	1,344	153	973
401– 500 . .	1,700	81	1,162	1,066	759	1,033	748	656	685	1,552	171	1,123
501– 600 . .	572	31	392	716	518	694	480	414	435	600	93	442
601– 800 . .	308	24	213	821	660	803	588	481	514	418	101	319
801–1,000 . .	86	9	61	432	351	424	298	273	280	161	52	127
1,001–1,250 . .	45	6	32	298	262	294	238	200	212	101	38	81
1,251–1,500 . .	25	3	17	179	159	177	141	115	123	59	22	47
1,501–2,000 . .	24	3	17	203	182	201	149	121	130	63	23	51
2,001–3,000 . .	17	2	12	158	159	158	96	100	99	48	19	39
3,001–4,000 . .	6	1	4	58	61	58	33	36	35	17	7	14
4,001–5,000 . .	3	—	2	25	25	25	18	16	17	8	3	6
Over 5,000 . .	5	1	3	39	43	39	30	30	30	12	6	10
Total . .	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000

TABLE V

Australia – 1938–39 *to* 1942–43

Income Distribution – Employees and Non-employees and Adult Male Employees 1942–43

Per 10,000

Income	Employees					Non-Employees					Adult Males
	1938–39	1939–40	1940–41	1941–42	1942–43	1938–39	1939–40	1940–41	1941–42	1942–43	1942–43
£											
Under 105	2,706	2,426	2,115	1,966	1,862	2,806	2,490	2,494	1,568	885	371
105– 150	1,928	1,816	1,581	1,370	1,110	1,835	1,790	1,657	1,466	946	164
151– 200	1,567	1,425	1,288	1,132	1,091	1,228	1,193	1,202	1,163	1,131	349
201– 250	1,269	1,386	1,270	1,051	773	918	978	946	1,025	1,017	582
251– 300	1,028	1,235	1,388	1,213	990	690	703	740	872	922	1,377
301– 350	605	699	1,023	1,188	1,201	515	545	565	708	825	2,015
351– 400	324	371	552	859	1,070	370	401	433	576	656	1,814
401– 500	285	326	424	738	1,150	477	560	569	746	954	2,024
501– 600	117	125	154	233	392	298	337	361	459	640	683
601– 800	84	93	102	133	213	318	373	385	518	742	368
801–1,000	31	35	38	44	61	162	191	194	273	393	103
1,001–1,250	19	21	22	26	32	117	132	142	193	276	54
1,251–1,500	10	12	12	13	17	70	84	87	118	166	30
1,501–2,000	11	12	12	14	17	80	91	92	130	187	29
2,001–3,000	8	9	10	11	12	63	72	74	104	146	21
3,001–4,000	3	4	4	4	4	23	27	26	37	54	7
4,001–5,000	2	2	2	2	2	12	12	12	16	23	3
Over 5,000	3	3	3	3	3	18	21	21	28	37	6
Total	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000

TABLE VI

Adult Male Employees – Weekly Income Distribution

Commonwealth Public Service – Income Distribution 1937 *and* 1955

Per 10,000

Income	Adult Male Employees 1938					Commonwealth Public Service				
						1937		1955		December 1954
	Building	Factory	Retail	C'wealth	Total	Income	Number	Income	Number	Income
£ per week										
Under 3 . .	1,365	417	344	127	684	198– 294	2,453	722– 890	2,358	722– 818
3 – 3½ . .	287	131	103	27	273	295– 390	3,151	891–1,058	2,535	819– 962
3½– 3¾ . .	200	84	41	386	134	391– 462	1,700	1,059–1,226	1,478	963–1,058
3¾– 4 . .	297	330	239	647	411	463– 534	1,557	1,227–1,394	1,277	1,059–1,154
4– 4½ . .	540	1,293	1,048	952	1,285	535– 624	548	1,395–1,562	949	1,155–1,262
4½– 5 . .	1,980	1,866	3,129	1,088	1,753	625– 696	235	1,563–1,730	490	1,263–1,382
5 – 5½ . .	985	1,562	1,679	680	1,330	697– 792	120	1,731–1,900	431	1,383–1,502
5½– 6 . .	1,103	1,472	1,248	707	1,140	793– 988	142	1,901–2,320	284	1,503–1,874
6 – 6½ . .	1,967	853	585	865	709	989–1,388	71	2,321–3,000	159	1,875–2,370
6½– 7 . .	570	559	403	781	538	Over 1,388	23	Over 3,000	39	Over 2,370
7 – 8 . .	414	598	430	888	689					
8 – 9 . .	113	300	215	723	355					
9 –10 . .	81	172	180	709	223					
10 –11 . .	32	89	67	370	143					
11 –12 . .	26	67	58	282	92					
12 –15 . .	18	90	92	528	122					
Over 15 . .	22	117	139	240	119					
Total . .	10,000	10,000	10,000	10,000	10,000		10,000		10,000	

TABLE VII

Australia – 1942–43 – Male and Female

Main Characteristics of Income Distributions by Age

	Lower Quartile	Upper Quartile	Upper Decile	Median	Mode	Mean	Symmetrical Part of Curve			Upper Pareto Coeff.
							Point	Range	% No. Included	
	£	£	£	£	£	£	£	£ to £	£	
Males										
To 20½	—	126	185	(77)	—	110	—	—	—	2.50
19½–25½	211	373	441	303	311	296	235	170– 330	42	2.80
24½–30½	284	417	499	348	343	360	320	240– 420	59	3.10
29½–35½	296	439	546	361	347	391	350	270– 460	60	2.50
34½–40½	301	455	598	368	350	420	365	230– 580	77	2.50
39½–45½	301	470	649	373	341	446	380	140–1,050	92	2.10
44½–50½	293	471	664	364	332	451	390	110–1,400	94	2.10
49½–55½	282	465	675	356	324	450	390	110–1,350	92	2.05
54½–60½	262	453	675	338	320	439	380	120–1,190	90	2.00
59½–65½	203	416	652	308	306	403	360	310– 420	25	2.00
64½–70½	162	405	671	280	278	396	310	250– 380	29	1.95
Over 69½	167	437	828	271	(170)	452	280	180– 420	43	1.70
Females										
To 20½	(70)	120	151	(90)	—	100	—	—	—	2.50
19½–25½	131	196	232	167	168	168	145	110– 195	62	2.25
24½–30½	136	223	277	179	177	190	150	105– 220	59+	2.25
29½–35½	129	238	302	183	178	204	155	105– 230	55+	2.25
34½–40½	127	249	333	184	175	222	155	105– 230	51+	1.80
39½–45½	114	256	373	181	172	237	155	105– 230	47+	1.65
44½–50½	120	268	429	182	163	258	175	105– 290	58+	1.75
49½–55½	125	278	474	184	159	277	200	105– 380	67+	1.85
54½–60½	127	303	547	187	152	310	230	110– 480	69	1.85
59½–65½	145	358	661	215	133	362	255	135– 490	63	1.85
64½–70½	148	387	735	227	—	402	275	145– 520	60	1.65
Over 69½	158	415	817	236	—	443	290	160– 520	56	1.75

TABLE VIII

Inferiority Index

Sample Calculation

Australia – Persons – 1942–43

Income Group Limits	Av'age Income	Number in Group	Income in Group 2×3	Number Over Limit 3 cum.	Income Over Limit 4 cum.	Av'age Over Limit 6/5	Ratio to Limit 7/1	Ratio for Group 8 int.	Aggreg. for Group 9×3	Number Under Limit 3 cum.	Income Under Limit 4 cum.	Av'age Under Limit 12/11	Ratio to Limit 13/1	Ratio for Group 14 int.	Aggreg. for Group 15×3
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
.050				10,000	3,210	.321	6.420	5.007	8,827				1.000	.861	1,517
.104	.075	1,763	132	8,237	3,078	.374	3,593	3.154	3,100	1,763	132	.075	.721	.672	660
.150	.126	983	124	7,254	2,954	.407	2.715	2.479	2,714	2,746	256	.093	.623	.602	660
.200	.174	1,095	191	6,159	2,763	.449	2.243	2.088	1,716	3,841	447	.116	.582	.562	462
.250	.225	822	185	5,337	2,578	.483	1.932	1.847	1,784	4,663	632	.136	.542	.538	519
.300	.277	966	268	4,371	2,310	.529	1.762	1.738	1,979	5,629	900	.160	.533	.535	609
.350	.326	1,139	371	3,232	1,939	.600	1.714	1.728	1,682	6,768	1,271	.188	.537	.532	518
.400	.375	973	364	2,259	1,574	.697	1,742	1,819	2,042	7,741	1,636	.211	.528	.505	567
.500	.444	1,123	498	1,136	1,076	.947	1.895	1.951	862	8,864	2,134	.241	.481	.453	200
.600	.544	442	240	694	836	1,205	2.008	2.035	649	9,306	2,374	.255	.425	.381	145
.800	.681	319	217	375	619	1.650	2,062	2.051	260	9,625	2,591	.269	.337	.307	39
1.000	.890	127	113	248	506	2.039	2.039	2.015	163	9,752	2,704	.277	.277	.252	20
1.250	1.113	81	90	167	416	2,488	1.991	1.971	93	9,833	2,794	.284	.227	.210	10
1.500	1.366	47	64	120	351	2.928	1.952	1.932	99	9,880	2,859	.289	.193	.171	9
2.000	1.718	51	88	69	264	3.822	1.911	1.899	74	9,931	2,946	.297	.148	.125	5
3.000	2.407	39	94	30	170	5,662	1.887	1.896	27	9,970	3,040	.305	.102	.090	1
4.000	3.432	14	48	16	122	7.614	1.903	1.904	11	9,984	3,088	.309	.077	.070	—
5.000	4.437	6	27	10	95	9.520	1.904	1.904	19	9,990	3,115	.312	.062	.031	—
inf.	9.520	10	95							10.000	3,210	.321	—		
Total									26,101						5,941

For notes to Table see page 227

TABLE IX

Inferiority Index

Summary of Results

	Number	Av. Inc. £	I_u	I_d	$I_{u'}$	$I_{d'}$	I'	I
1942–43 Males								
Age $17\frac{1}{2}$	221,341	109.9	1.7916	.7533	.5582	.6299	.5940±.0359	40.6±3.6
$22\frac{1}{2}$	103,861	296.4	1.8280	.6409	.5471	.4614	.5042±.0429	49.6±4.3
$27\frac{1}{2}$	156,027	360.4	1.6710	.6848	.5984	.5272	.5628±.0356	43.7±3.6
$32\frac{1}{2}$	183,232	391.3	1.7336	.6871	.5769	.5306	.5537±.0232	44.6±2.3
$37\frac{1}{2}$	201,380	419.9	1,8390	.6818	.5438	.5227	.5332±.0106	46.7±1.1
$42\frac{1}{2}$	198,670	445.8	2.0025	.6678	.4994	.5017	.5005±.0012	50.0± .1
$47\frac{1}{2}$	190,522	450.6	2.1080	.6596	.4744	.4894	.4819±.0075	51.8± .7
$52\frac{1}{2}$	195,932	450.3	2.2225	.6467	.4500	.4700	.4600±.0100	54.0±1.0
$57\frac{1}{2}$	159,617	438.7	2.3942	.6265	.4177	.4398	.4287±.0110	57.1±1.1
$62\frac{1}{2}$	117.757	403.4	2.7025	.5951	.3700	.3926	.3813±.0113	61.9±1.1
$67\frac{1}{2}$	61,017	396.3	3.0904	.5803	.3236	.3704	.3470±.0234	65.3±2.3
75	50,644	451.9	3,2426	.5850	.3084	.3775	.3430±.0345	65.7±3.4
State								
N.S.W.	723,106	387.4	2.3617	.6088	.4234	.4132	.4183±.0051	58.2± .5
Victoria	509,355	390.6	2.4899	.6026	.4016	.4039	.4027±.0012	59.7± .1
Queensland	272,668	369.8	2,6220	.5870	.3814	.3805	.3810±.0005	61.9± .1
S.A.	166,020	356.2	2.3381	.6066	.4277	.4099	.4188±.0089	58.1± .9
W.A.	108,942	362.1	2.5017	.5925	.3997	.3887	.3942±.0055	60.6± .6
Tasmania	59,909	299.6	2.5249	.5962	.3961	.3943	.3952±.0009	60.5± .1
Employees	1,427,611	341.8	2.1590	.6211	.4632	.4316	.4474±.0158	55.3±1.6
Proprietors	378,475	510.8	3.2109	.5608	.3114	.3412	.3263±.0149	67.4±1.5
Rentiers	33,914	423.0	2.7683	.6530	.3612	.4795	.4203±.0592	58.0±5.9
Total	1,840,000	377.3	2.4397	.6042	.4099	.4063	.4081±.0018	59.2± .2

TABLE IX (Cont.)

	Number	Av. Inc. £	I_u	I_d	$I_{u'}$	$I_{d'}$	I'	I
1942–43 Females								
Age 17½	232,309	99.5	1.5515	.7744	.6446	.6616	.6531±.0085	34.7± .8
22½	146,500	168.4	1.5202	.7214	.6577	.5821	.6199±.0378	38.0±3.8
27½	88,046	189.9	1.7156	.6923	.5829	.5384	.5606±.0223	43.9±2.2
32½	68,382	203.9	1.9372	.6687	.5163	.5030	.5096±.0066	49.0± .7
37½	58,735	222.2	2.1392	.6531	.4675	.4796	.4735±.0061	52.6± .6
42½	55,431	236.9	2.4327	.6386	.4111	.4579	.4345±.0234	56.5±2.3
47½	48,644	258.2	2.6542	.6293	.3768	.4439	.4103±.0336	59.0±3.4
52½	42,475	276.8	2,7486	.6230	.3638	.4345	.3991±.0354	60.1±3.5
57½	31,769	309.7	3.0295	.6173	.3301	.4259	.3780±.0479	62.2±4.8
62½	21,233	362.1	3.0067	.6081	.3326	.4121	.3723±.0398	62.8±4.0
67½	14,827	402.1	3.0988	.6105	.3227	.4157	.3692±.0465	63.1±4.6
75	23.160	442.9	3.2038	.6135	.3121	.4202	.3661±.0541	63.4±5.4
State								
N.S.W.	321,868	193.8	2.2991	.6674	.4350	.5011	.4680±.0331	53.2±3.3
Victoria	265,727	213.0	2.4476	.6591	.4086	.4886	.4486±.0400	55.1±4.0
Queensland	104,955	184.3	2,5919	.6703	.3858	.5054	.4456±.0598	55.4±6.0
S.A.	69,511	190.5	2.3895	.6692	.4185	.5038	.4612±.0426	53.9±4.3
W.A.	46,533	181.3	2.3639	.6683	.4230	.5024	.4627±.0397	53.7±4.0
Tasmania	22,917	162.0	2.2875	.6851	.4372	.5276	.4824±.0452	51.8±4.5
Employee	710,243	157.4	1.8670	.6851	.5356	.5276	.5316±.0040	46.8± .4
Proprietor	46,106	460.4	3.8735	.5427	.2582	.3140	.2861±.0279	71.4±2.8
Rentier	75,162	398.0	2.8869	.6667	.3464	.5000	.4232±.0768	57.7±7.7
Total	831,511	196.6	2.3936	.6642	.4178	.4563	.4370±.0193	56.3±1.9
1942–43 Persons								
Employees	2,137,854	279.6	2,3042	.6036	.4340	.4054	.4197±.0143	58.0±1.4
Proprietors	424,581	504.6	3,2811	.5573	.3048	.3359	.3203±.0156	68.0±1.6
Rentiers	109,076	405.3	2.8342	.6621	.3529	.4931	.4230±.0701	57.7±7.0
Total	2,671,511	321.0	26.101	.5941	.3831	.3911	.3871±.0040	61.3± .4

TABLE IX (Cont.)

	Number	Av. Inc. £	I_u	I_d	$I_{u'}$	$I_{d'}$	I'	I
Persons								
Employees								
1938–39	2,346,400	200.8	2.2243	.6472	.4496	.4708	.4602±.0106	54.0±1.1
1939–40	2,339,800	212.2	2.2136	.6304	.4517	.4456	.4486±.0030	55.1± .3
1940–41	2,283,300	230.6	2.2024	.6308	.4540	.4462	.4501±.0039	55.0± .4
1941–42	2,260,700	253.3	2.2477	.6170	.4449	.4255	.4352±.0097	56.5±1.0
1942–43	2,157,200	280.2	2.3078	.5765	.4333	.3647	.3990±.0343	60.1±3.4
Non-Employees								
1938–39	752,800	290.3	3.3047	.6034	.3026	.4051	.3538±.0513	64.6±5.1
1939–40	735,600	315.6	3.3674	.5973	.2970	.3959	.3464±.0495	65.4±5.0
1940–41	678,800	321.0	3.3748	.5931	.2963	.3896	.3429±.0467	65.7±4.7
1941–42	589,500	392.3	3.3479	.5749	.2987	.3623	.3305±.0318	67.0±3.2
1942–43	535,800	484.6	3.2230	.5657	.3103	.3485	.3294±.0191	67.1±1.9
Adult Males Employees								
1942–43	1,186,000	386.7	1.7786	.6999	.5622	.5498	.5560±.0062	44.4± .6
Weekly 1938	(a)							
Building	32	5.11	1.5835	.7096	.6314	.5644	.5979±.0335	40.2±3.3
Factory	331	5.74	1,5290	.7637	.6540	.6455	.6497±.0042	35.0± .4
Retail	53	5.69	1.5411	.7885	.6489	.6827	.6658±.0169	33.4±1.7
Commonwealth	15	7.00	1.5805	.7269	.6327	.5903	.6115±.0212	38.9±2.1
Total	1,000	5.68	1.6147	.7273	.6194	.5909	.6051±.1042	39.5±1.4
C'wealth. Pub. Service	(a)							
1937 No. 1937 Inc.	1	399.5	1.4690	.7752	.6808	.6628	.6718±.0090	32.8± .9
1937 No. 1954 Inc.	1	974.6	1.2405	.8741	.8062	.8111	.8086±.0025	19.1± .2
1955 No. 1954 Inc.	2	1,031.8	1,2991	.8490	.7698	.7735	.7716±.0019	22.8± .2
1955 No. 1955 Inc.	2	1,188.3	1.3870	.8107	.7210	.7160	.7185±.0025	28.2± .2

(a) Relative