Volume Title: Analysis of Wisconsin Income

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Volume Publisher: NBER

Volume ISBN: 0-870-14164-3

Volume URL: http://www.nber.org/books/hann48-1

Publication Date: 1948

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Chapter URL: http://www.nber.org/chapters/c1008

Chapter pages in book: (p. 117 - 131)

Chapter 5

Distribution of Income by Size

The direction and approximate size of changes in the relative distribution of income over time may be determined by examining the behavior of each income receipt when national income increases or decreases. Two aspects of the behavior of income receipts and their relation to the distribution of income by size are considered: the aggregate of each receipt and its distribution. When national income changes, the aggregate and the size distribution of each receipt also change, with repercussions upon the size distribution of total income. Income tax data do not yield conclusive evidence, because they do not cover the same portions of aggregate income and of recipients each year. Therefore, the analysis, which is confined to the evidence yielded by income tax data, will not indicate precisely the changes in the relative distribution of total income over time.

A Size Distributions of Income Receipts

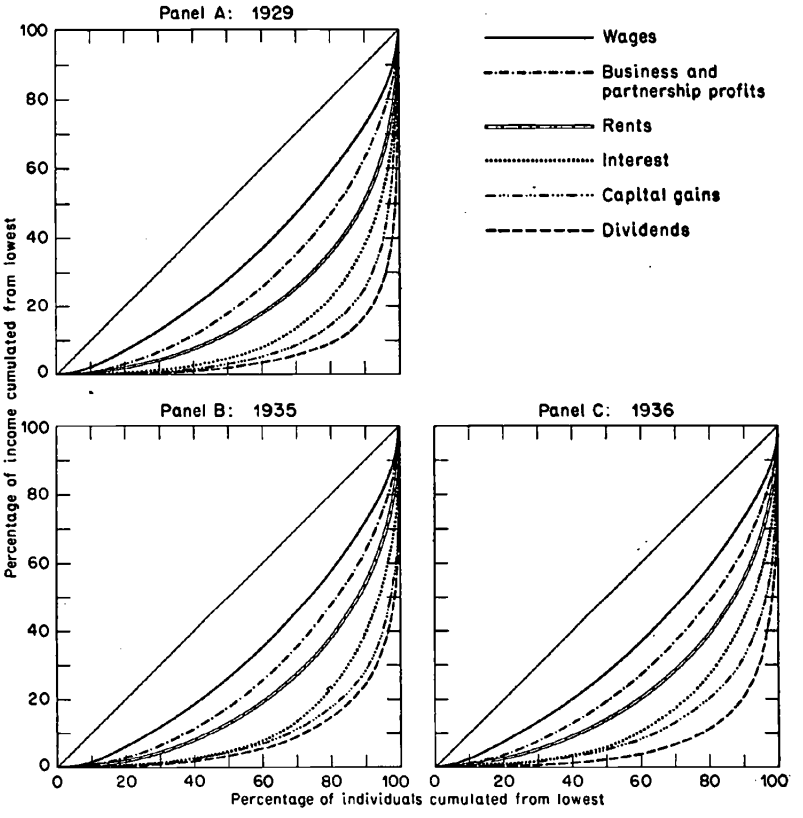
The size distributions of the six most important receipts (wages, business and partnership profits, rents, interest, capital gains, and dividends) [1] of persons filing returns in 1929, 1935, and 1936 are

[1] *Wisconsin Individual Income Tax Statistics: Patterns of Income, 1929 and 1935*, pp. A5-17, A22-34; *1936*, IVA, Table E, pp. 16-7. These six items include more than 97 percent of the income received by persons filing returns each year.

given in Lorenz curve form in Charts 3 and 4. Each panel in Chart 3 gives the Lorenz curves for the six receipts in a single year, facilitating comparisons among receipts. To show temporal changes in the size distributions, each panel in Chart 4 gives the Lorenz curves for each receipt in 1929, 1935, and 1936.

CHART 3

Lorenz Curves for Selected Receipts by Their Own Size
Individual Income Tax Returns, 1929, 1935, 1936



The information in Charts 3 and 4 is summarized by three measures in Table 17: the ratio of concentration, the relative mean deviation, and the coefficient of variation. All three were computed for each receipt in 1936, but as the results were the

CHART 4

Changes in the Lorenz Curves for Specified Receipts by Their Own Size

Individual Income Tax Returns, 1929, 1935, 1936

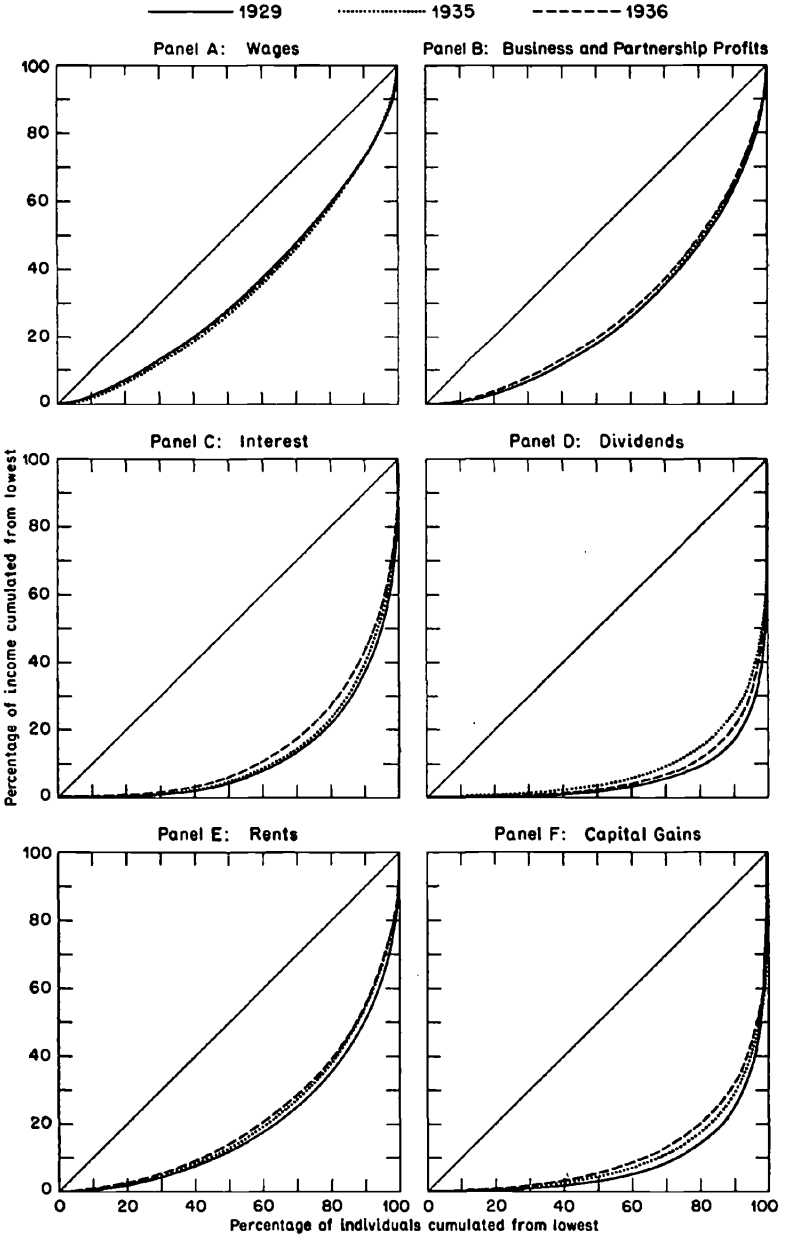


TABLE 17

Variability of Receipts, 1929, 1935, and 1936

TYPE OF INCOME RECEIPT	RATIO OF CONCENTRATION			RELATIVE MEAN DEVIATION	COEFFICIENT OF VARIATION
	1929	*1935*	*1936**	*1936**	*1936**
Wages & salaries	.335	.356	.343	.468	.971
Business incomes	.496	.488	.467	.660	1.296
Net rent	.603	.573	.568	.833	2.705
Interest	.746	.730	.706	1.062	3.408
Capital gains	.821	.793	.766	1.198	4.899
Dividends	.875	.813	.854	1.402	6.110

Computed on the basis of data in *Wisconsin Individual Income Tax Statistics: Patterns of Income, 1929 and 1935*, pp. A5-17, A22-34; *1936*, IVA, Table E, pp. 16-7.

* The 1936 distributions include the receipts reported as one of the two largest sources of income on each return, or as tertiary sources of $5,000 or more. Thus, the measures for 1936 overstate slightly the equality of the complete income tax distributions. See *ibid.*, IVA, pp. 13-20.

same, only the ratio of concentration was computed for the 1929 and 1935 distributions.[2]

The measures in Table 17 and the Lorenz curves in Chart 3 indicate that the receipts differ considerably in their size distributions. Wages are the most equally distributed, dividends the least. Between these two extremes lie business incomes, rents,

[2] The ratio of concentration equals the ratio of the area between the Lorenz curve and the line of equal distribution to the area of the entire triangle below the line of equal distribution. The relative mean deviation equals the mean deviation divided by the mean, and the coefficient of variation equals the standard deviation divided by the mean. The three measures indicate perfect equality when they are zero and increase with decreasing equality. The ratio of concentration has an upper limit of 1; the relative mean deviation, of $\frac{2(N-1)}{N}$; and the coefficient of variation, $N - 1$ (where N is the *number* of recipients and there are no negative incomes). See D. B. Yntema 'Measures of Inequality', *Journal of the American Statistical Association*, Vol. 28 (1933), pp. 423-33.

The analysis throughout this chapter is made in terms of the Lorenz curve and the ratio of concentration. No theoretical justification is claimed for this measure in preference to others. However, the ratio of concentration, the relative mean deviation, and the coefficient of variation, all rank the six receipt distributions in 1936 identically (see Table 18). In general, they give approximately the same results, except that the coefficient of variation is more sensitive to extreme items than the ratio of concentration and the relative mean deviation. The latter two are directly related. The relative mean deviation is proportional to the vertical distance between the line of equal distribution and the Lorenz curve at the point where the tangent to the Lorenz curve is parallel to the line of equal distribution. The ratio of concentration and the relative mean deviation can be used interchangeably except when comparing Lorenz curves that cross.

interest, and capital gains, in order of decreasing equality. While the ratios of concentration for every income receipt change in size, their relative ranking with respect to other receipts is the same in 1929, 1935, and 1936.

Since the above data include only the receipts of persons filing tax returns, Charts 3 and 4 do not compare the complete distributions of the various receipts. This study is, of course, concerned with the complete distributions, not with the distribution of filers. The latter is merely an instrument to study the former. Is the order of ranks the same for the corresponding complete distributions? Unfortunately, only the upper portions of the complete distributions can be plotted, but they help to answer the question. By assuming that the income tax tabulations include all receipts above $2,000, and by subtracting the number and amounts of wages and business incomes above the $2,000 level from the aggregate estimates in Part I, Table 1, the number and amounts in one broad interval $1-2,000 can be computed; the remainder is the upper portion of each distribution (Table 18). Since the $1-2,000 group cannot be divided, only the top

TABLE 18

Cumulative Percentage Distribution of Wages and Business Profits
All Wisconsin Recipients, 1936

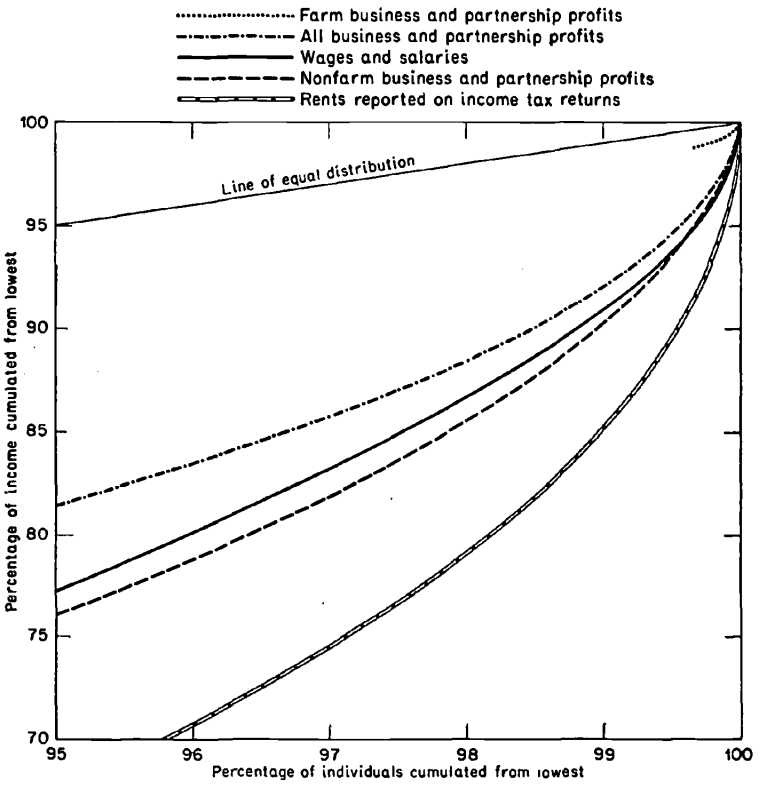
INCOME RECEIPT GROUP	WAGES AND SALARIES		ALL BUSINESS & PARTNERSHIP PROFITS		NONFARM BUSINESS & PARTNERSHIP PROFITS		FARM BUSINESS & PARTNERSHIP PROFITS	
	No.	Amt.	No.	Amt.	No.	Amt.	No.	Amt.
$1- 1,999	93.36	72.96	94.81	81.02	84.74	57.35	99.65	98.78
2,000- 2,499	96.74	82.39	96.63	84.83	89.94	65.61	99.84	99.25
2,500- 2,999	97.98	86.62	97.66	87.45	92.97	71.48	99.91	99.44
3,000- 3,999	99.02	91.05	98.68	90.75	96.03	78.93	99.96	99.62
4,000- 4,999	99.39	93.10	99.14	92.70	97.43	83.36	99.98	99.70
5,000- 5,999	99.59	94.44	99.39	93.98	98.17	86.25	99.99	99.78
6,000- 6,999	99.71	95.40	99.56	95.00	98.68	88.56	100.00	99.83
7,000- 7,999	99.78	96.09	99.67	95.76	99.00	90.29	100.00	99.86
8,000- 8,999	99.83	96.64	99.74	96.32	99.21	91.56	100.00	99.89
9,000- 9,999	99.86	97.02	99.80	96.84	99.39	92.73	100.00	99.92
10,000-14,999	99.95	98.37	99.92	98.20	99.75	95.83	100.00	99.97
15,000-19,999	99.98	98.95	99.96	98.78	99.86	97.16	100.00	100.00
20,000-24,999	99.99	99.27	99.98	99.23	99.93	98.20	100.00	100.00
25,000-49,999	100.00	99.81	100.00	99.87	99.99	99.70	100.00	100.00
50,000 & over	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Number and amounts in the $1-1,999 group are the differences between complete state estimates (Part I) and aggregates above $2,000.

parts of the Lorenz curves, greatly magnified, are shown in Chart 5. The size distributions of farm and nonfarm business income are shown separately.[3] To compare these distributions with the distributions of property income, the distribution of rent received by persons filing tax returns is also plotted in Chart 5.

CHART 5

Segments of the Lorenz Curves for Wages and Business Income Received by All Recipients and of Rents Received by Filers, 1936



At least for the top parts of the distributions, all business incomes combined are apparently distributed more equally than

3 It is generally conceded that farmers tended to underreport their incomes; thus the number of farmers in the groups above $2,000 is probably understated. Data are not available to correct the distributions for underreporting and nonreporting; see Part I.

wages. Chart 5 shows the distribution of rent received by persons filing tax returns, but not the complete distribution, which may be even less equal; yet the complete distributions of wages and business income are more equal than the distribution of rent based upon tax returns alone. Since rent is the property receipt most equally distributed (Chart 3) it may be concluded that service incomes (wages and business incomes) are probably distributed more equally than property incomes.[4]

Although the Lorenz curves for the various receipts do not change rank over a period of years, no generalization can be drawn about how the size distribution of each receipt changes over time. Apparently changes in the size distribution of wages and dividends are associated with changes in their aggregates (Chart 4). When dividends increase (decrease) their Lorenz curve shows less (greater) equality. Of the 'dividend Lorenz curves' (Chart 4, Panel D), that for 1935 is nearest the line of equal distribution, and that for 1929 furthest away (the 1936 curve lying between them). The wage distribution changes in a different manner: the greater aggregate wages, the more equally are they distributed among the lower income groups, and the less among the upper income groups.[5]

The distributions of the other income items do not seem to bear any relation to their aggregates. Interest, rent, and capital gains are most equally distributed in 1936 and least in 1929 (the 1935 Lorenz curves for all lying between the 1936 and 1929 Lorenz curves). The distributions of business incomes in 1929 and 1935 are almost the same (the 1935 Lorenz curve is slightly more equal in the upper part of the distribution), while the 1936 distribution is more equal than either the 1935 or the 1929.

The evidence of Chart 4, that the variations in the distributions of only two receipts, wages and dividends, can be associated

[4] However, there is no basis for judging whether the complete property income distributions are ranked in the same order as the income tax distributions (see Chart 3). While the aggregate for each property receipt was estimated in Part I for 1936, the total of individuals with receipts other than wages and business income was not. To draw a Lorenz curve, the number of recipients as well as the amounts received are required.

[5] However, when equality is measured in terms of the ratio of concentration, the distribution of wages as a whole is less equal when aggregate wages are low, and more equal when aggregate wages are high, because the Lorenz curves cross at a point high up on the income scale (see Chart 4, Panel A).

consistently with changes in their aggregates, is not conclusive, based as it is upon income tax data. The different percentages of all income recipients who filed returns in each of the various years could, by themselves, account for any apparent lack of relation between changes in the distribution of four of the receipts and changes in aggregates.

However, the distributions of the various receipts of the above mentioned sample of 13,184 taxpaying families who filed each year 1929-35 supply some evidence. Although these identical taxpaying families may not be representative of all income recipients, it is reasonable to suppose that the *direction* in which the distribution of their receipts changes is representative.

The following relations between the distributions and aggregates of the various receipts were established from this sample (see Part III, Ch. 3): When aggregate wages increase, the Lorenz curve for wages indicates more equality at the lower end and less equality at the upper. When it decreases, the indication is the reverse. The equality of the size distributions of dividends and interest is directly associated with their aggregates: the bigger the aggregate, the less equal the distribution. Changes in the rent and capital gains distributions are apparently not related to changes in their aggregates. Changes in the equality of the distributions of four of the six receipts may, therefore, be associated with changes in their aggregates. These four receipts accounted for approximately 93 percent of the aggregate income received by persons filing tax returns in 1936 (see Table 1).[6]

B Effect of Changes in the Size Distribution of Receipts on the Size Distribution of Total Income

Table 18 and the Lorenz curves in Chart 4 show that the largest temporal changes are in the 'dividend Lorenz curves'. Yet, the 1935 curve, which is nearest the line of equal distribution, is only 7 percent nearer, on the average, than that for 1929, which is furthest away. The changes in the equality of the other receipts

[6] The increases in federal estate and gift tax rates, under the Revenue Acts of 1932, 1934, and 1935, were followed by large increases in the total volume of non-charitable gifts. This may account, in part, for the greater equality of the size distribution of property incomes in 1935 and 1936 than in 1929.

are less than 7 percent. What, then, is the effect of such minor changes on the size distribution of total income?

The relation cannot be established conclusively: size distributions of the various receipts and of total income are available for only three years, and the changes in the distributions based upon tax returns probably do not represent changes in the complete distributions. To show the effect of assumed changes in the size distributions of the various types of receipt on the size distribution of total income, several calculations were based upon income tax data for 1936 holding the number of individuals constant. The complications continuously recurring from a changing number of recipients in comparing income tax distributions for different periods were thus avoided.

As testing the effect of a change in the size distribution of each receipt on the size distribution of income would be too time-consuming, the first test was confined to the two extreme distributions, wages and dividends, and to one intermediate distribution, interest. The equality (measured in terms of the Lorenz curve) of each distribution, in turn, was increased 25 percent, on the assumption that the number of recipients of each receipt, aggregate income, and the aggregate of each receipt remained constant at the 1936 level. The choice of a 25 percent shift toward the line of equal distribution was purely arbitrary.

The method is described in detail in Appendix C. As applied to wages it is in brief: (1) The size distribution of the total income of persons reporting some income from wages was subtracted from the size distribution of the total income of all recipients. The remainder was a size distribution of the total income of persons who received no wages and would not be affected by changes in the distribution of wages. (2) The distribution of the total income of wage recipients was then modified to meet the condition that wages are 25 percent more equally distributed. Separate calculations were made for individuals receiving wages only and for individuals receiving income from other sources as well. For the former, each income (composed entirely of wages) was moved 25 percent closer to the mean wage. For the latter, the wage incomes were moved 25 percent closer to the mean wage and the new wage incomes were then added to their other receipts which remained unchanged. (3) The new

distributions of total income of both groups of wage recipients were added to the total income distribution of those not receiving wages. The same procedure was used to determine the effect of changes in the size distributions of interest and dividends.

Chart 6 shows the original distribution of total income reported on income tax returns and the distribution after the Lorenz curve for wages had been shifted 25 percent closer to the line of equal distribution; also the effect of a similar shift in the dividends curve. The change in the total income distribution due to the redistribution of interest was too small to be plotted in Chart 6. In terms of the ratio of concentration, the results of these computations are:

Original 1936 total income distribution	.419
Total income distributions after Lorenz curves for the following items were shifted 25 percent toward the line of equal distribution:	
Wages	.356
Dividends	.403
Interest	.414

Thus, when the Lorenz curve for wages was shifted 25 percent toward the line of equal distribution, the Lorenz curve for total income moved 15 percent toward the line of equal distribution. When the dividend Lorenz curve was shifted 25 percent toward the line of equal distribution, the Lorenz curve for total income moved only 4 percent toward the line of equal distribution.

Three conclusions can be drawn. First, changes in the distribution of one receipt are associated with much smaller changes in the distribution of total income. Second, changes in the distributions of the receipts least equally distributed are not necessarily associated with the largest changes in the distribution of total income. Third, a change in the distribution of any receipt that is a small portion of total income will affect the distribution of total income relatively little.

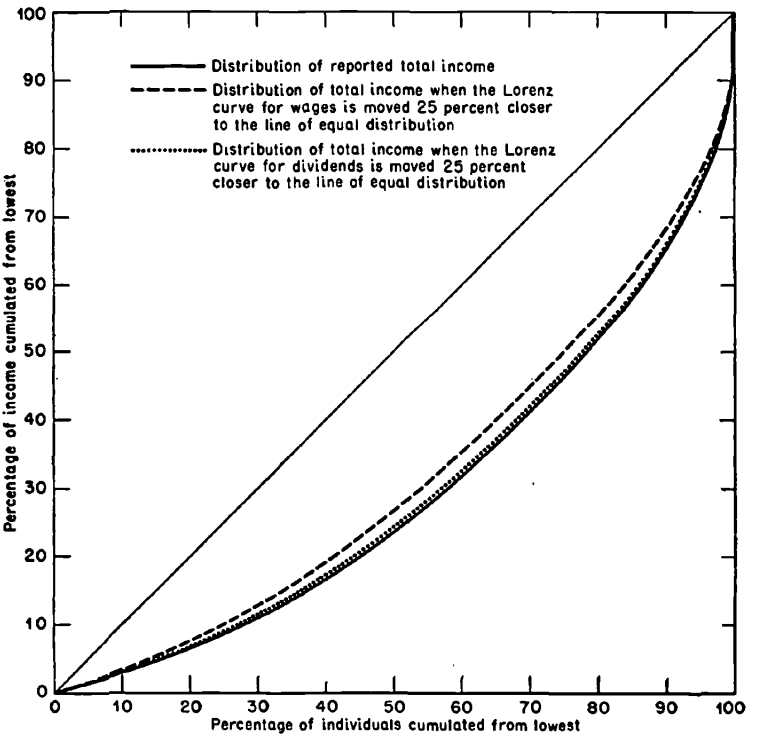
The greatest change in the distribution of any income item between 1929 and 1936 was in dividends, 7 percent. The above calculations show that even a 25 percent change in the distribution of dividends affects but slightly the distribution of total income. Consequently, the changes in the dividends distribution could not have greatly altered the distribution of total income.

On the other hand, the distribution of wages changes less than 2 percent from year to year (Chart 4, Panel A); however, it takes a 25 percent shift in the wage distribution to cause a 15

CHART 6

Probable Effects on the Distribution of Total Income of Moving the Lorenz Curve for Wages and Dividends 25 Percent Closer to the Line of Equal Distribution

Individual Income Tax Returns, 1936



percent shift in the distribution of total income. Therefore the observed changes in the wage distribution could not have induced large changes in the distribution of total income.

Although similar calculations were not made for the other income receipts, it can be surmised that since business incomes are the second largest (Table 1), shifting the Lorenz curve for business incomes 25 percent toward the line of equal distribution would cause a greater change in the total income distribution than the change due to shifts in the Lorenz curves for any other receipt except wages. Generally, when total income and other receipts remain the same, the distribution of total income is not seriously affected by changes in the distribution of one receipt.

C Effect of Changes in Aggregate Receipts on the Size Distribution of Total Income

What is the effect of changes in the aggregate of each receipt on the distribution of total income? The calculations were made by a method similar to that used to determine the effect of a change in the distribution of a receipt on the distribution of total income. But in this case, the distribution of each receipt is unaltered; only its aggregate is changed. To save time, only the effects of changes in wages and dividends were studied, on the assumption that each decreased proportionately 50 percent.

A 50 percent decrease in each wage and dividend receipt gives the following ratios and concentration:

Original 1936 total income distribution	.419
Total income distribution after receipts from the following sources were decreased 50 percent:	
Wages	.496
Dividends	.399

When wage receipts are reduced 50 percent, the Lorenz curve for total income moves away from the line of equal distribution an average of 19 percent (Chart 7). When dividend receipts are reduced 50 percent, the Lorenz curve for total income moves 5 percent toward the line of equal distribution. The opposite effect is due to the larger share of wages in the total incomes of individuals at the lower income levels and the larger share of dividends at the higher levels. A fall in wages hits low incomes hardest; a fall in dividends, high incomes. Similar computations assuming increases in dividends and in wages would reverse the shifts in total income. The greater percentage change in the distribution of total income due to the change in wages is natural, since they constitute a larger part of total income.

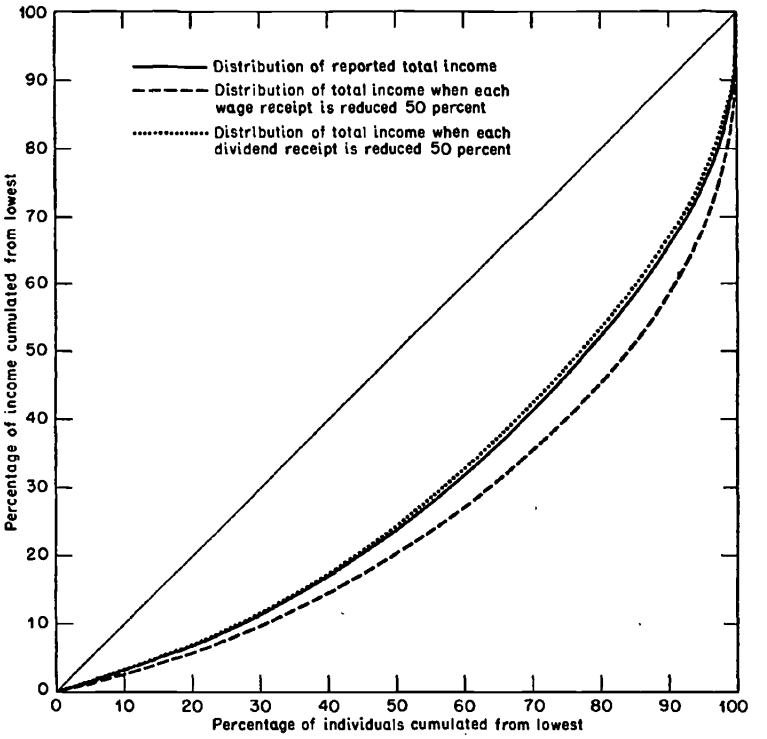
What happens to the distribution of total income when the other receipts increase or decrease? As noted in Chapter 2, interest and capital gains constitute a large percentage of income at the highest income levels, while business incomes and rents constitute a large percentage of income at the lower and intermediate levels. Changes in the distribution of total income due to changes in aggregate business income and rent would, therefore, be in the same direction as those due to changes in wages. Changes

due to increases or decreases in interest and capital gains would be in the same direction as those due to changes in dividends.

CHART 7

Probable Effects on the Distribution of Total Income of Reducing Each Wage or Each Dividend Receipt 50 Percent

Individual Income Tax Returns, 1936



Changes in aggregate income and in the aggregates of the various receipts tend to be associated with smaller percentage changes in the distribution of total income. Furthermore, when aggregate wages or dividends decrease, the aggregates of the other income receipts will probably decrease also, and the degree to which the total income distribution becomes more or less equal will depend upon the differences in the percentage changes among the various income sources. Since the change in the Lorenz curve for total income is a net effect of changes in the amounts and size distributions of all income sources, and some of the

changes in receipts may be offsetting, the changes in the distribution of total income in Chart 7 are probably much greater than the changes in the Lorenz curve for total income from year to year.

D Changes in the Relative Distribution of Total Income

Changes in the distribution of total income are due to changes in the amounts and size distributions of the various types of receipt. So far the analysis has proceeded upon one of two assumptions: *either* the amount *or* the size distribution of a given income source was altered, but not both. What happens when the amounts and the distributions of not one, but all the income sources change simultaneously, as they do in reality?

The effects of a *decrease* in the aggregates of the various receipts coincident with a *decrease* in total income are:

1) The Lorenz curves for both dividends and interest move toward the line of equal distribution. The Lorenz curves for wages and business incomes in successive years cross—the lower part of the Lorenz curve moving away from the line of equal distribution, and the upper part toward it.

2) Decreases in wages, business incomes, and rent cause the Lorenz curve for total income to move away from the line of equal distribution; decreases in interest, dividends, and capital gains cause it to move toward it.

3) The effects of changes in either the amounts or the distributions of any of the various income receipts on the distribution of total income are small.[7]

From these facts alone it is not possible to judge how the distribution of total income changes over time. If the changes in the size distribution of the incomes of the 13,184 identical taxpaying families are representative of changes in the entire distribution (see Part III), the two ends of the income distribution would probably react differently. The analysis of the incomes of these identical families indicates that the distribution of total income tends to become more equal in the lower and less equal

[7] The effects of *increases* in the aggregates of the income receipts are the reverse of those enumerated above.

in the upper end during the upswing of a business cycle; conversely during the downswing. In other words, the Lorenz curves for total income in two adjacent years may cross. These changes in the distribution of total income seem to indicate that the wages and business income distributions, which behave in the same manner during a business cycle, determine the behavior of the entire distribution.

Even if Lorenz curves for total income do not cross when total income changes, it is clear that, whatever the nature of the short-run temporal changes in the relative distribution of total income, they are very small.