

A NOTE ON THE IMPACT OF TAX ON INCOME REDISTRIBUTION

BY TOSHIAKI TACHIBANAKI*

Kyoto University, Japan and Stanford University, U.S.A.

Much attention has been paid to the problem of income distribution and the policy issue of redistribution in recent years. The OECD study (Sawyer, 1976) is one of the examples of the studies about income distribution that attempt to collect data internationally, particularly for developed countries, with an additional purpose of comparing the degree of income inequality. That study tried to compare inequalities making use of several measures such as Gini, Atkinson, Champerowne, Kuznets, Theil and log variance. The purpose of this note is not to review the OECD study carefully, but to concentrate on the problem of income redistribution policy by making intensive use of the excellent and unique OECD study. More concretely, the note attempts to evaluate tax policy of the OECD countries from income redistribution policy point of view.

In general, international comparison of income distribution is of great difficulty, not only because the conceptual framework of income differs from country to country, but also because the method and the source of data are different, as the author of the OECD study emphasizes. Consequently, the empirical result derived from the OECD comparative study must be evaluated with caution.¹ The note will first present the coefficient of income redistribution for various countries. Secondly, the source for the contribution to the actual income redistribution policy is examined. Concretely, the contribution due to tax progressivity and to average tax rate is estimated numerically. Thirdly, several comments on income redistribution policy are made on the basis of the empirical results.

Table 1 presents the coefficients of income redistribution by tax policy for various developed countries. The method of deriving these coefficients is simple: the coefficient C is obtained by dividing the difference between the measure of the pre-tax income inequality (Table 5 of the OECD study) and the measure of the post-tax income inequality (Table 6) by the measure of the pre-tax income inequality. The column headings of the Table identify the authors who proposed the particular formula for measuring the degree of inequality, or the method (log variance). Although the values presented in the table differ considerably not only from formula to formula but also from country to country, the rank from the higher coefficient of income redistribution to the lower coefficient is not significantly different from formula to formula. Table 2 shows the rank correlation coefficients between the Gini coefficient (which is the most widely used formula) and the other formulas. Since all the coefficients show values greater than 0.90, it is reasonable to conclude that the various methods for

*The author is grateful to helpful comments given by the referees.

¹After the publication of the OECD study, the French government and several academicians rigorously criticized the study. Since the arguments for weakness and possible incomparability of this study require another big study, covering about fifteen countries, I do not try them. Instead, I evaluate the study as an ambitious first effort for the difficult task.

TABLE 1
COEFFICIENTS OF INCOME REDISTRIBUTION BY TAX POLICY (C)

| | Year | Atkinson | | Champer- nowne | Gini | Kuznets | Theil | Variance of log |
|----------------|---------|-----------|-----------|-------------------|-------|---------|-------|--------------------|
| | | $e = 0.5$ | $e = 1.5$ | | | | | |
| Australia | 1966-67 | 0.000 | 0.004 | 0.006 | 0.003 | 0.012 | 0.000 | 0.084 |
| Canada | 1969 | 0.144 | 0.130 | 0.137 | 0.073 | 0.082 | 0.151 | 0.165 |
| France | 1970 | 0.007 | -0.010 | -0.004 | 0.005 | 0.003 | 0.008 | -0.023 |
| Germany | 1973 | 0.072 | 0.075 | 0.056 | 0.033 | 0.022 | 0.061 | 0.104 |
| Japan | 1969 | 0.118 | 0.103 | 0.082 | 0.057 | 0.061 | 0.116 | 0.103 |
| Netherlands | 1967 | 0.158 | 0.122 | 0.143 | 0.081 | 0.072 | 0.180 | 0.129 |
| Norway | 1970 | 0.255 | 0.246 | 0.299 | 0.133 | 0.127 | 0.247 | 0.299 |
| Sweden | 1972 | 0.206 | 0.157 | 0.186 | 0.127 | 0.129 | 0.247 | 0.167 |
| United Kingdom | 1973 | 0.153 | 0.154 | 0.166 | 0.076 | 0.074 | 0.143 | 0.194 |
| United States | 1972 | 0.116 | 0.098 | 0.105 | 0.057 | 0.061 | 0.111 | 0.127 |
| Average | | 0.099 | 0.088 | 0.092 | 0.044 | 0.048 | 0.093 | 0.119 |

TABLE 2
RANK CORRELATION COEFFICIENTS OF VARIOUS COEFFICIENTS OF REDISTRIBUTION
WITH THE GINI COEFFICIENT

| Atkinson | | Champernowne | Kuznets | Theil | Variance of logs |
|-----------|-----------|--------------|---------|-------|------------------|
| $e = 0.5$ | $e = 1.5$ | | | | |
| 0.970 | 0.948 | 0.973 | 0.927 | 0.982 | 0.906 |

measuring the degree of income redistribution do not provide us with different pictures of actual income redistribution policy. The differences in the numbers are largely due to the properties of the formulas. It is found that Canada, the Netherlands, Norway, Sweden and the U.K. have relatively strong income redistribution by tax policy while Australia, France and Germany do not. Japan and the U.S. fall in the middle.

We can conceive of many factors which will influence income redistribution. The most obvious but powerful factor is taxation. The social security system and public expenditure on items such as public assistance, education, health, housing, etc., have an impact, of course, on income redistribution. It is extremely interesting and important to examine carefully the influence of those policy instruments on income redistribution. International comparison is very rare possibly because of severe data constraints. It is understood in general that social security contributions are very marginally regressive on redistribution. Public expenditures are normally progressive on redistribution, though it is extremely difficult to measure quantitatively the redistributive effect of public expenditures on education, housing, health, etc. Since taxation is the most visible and powerful instrument for income redistribution in most countries, it is not unreasonable to anticipate that the conclusion would not be modified radically even if social security contributions and various public expenditures were taken into account.

There are two elements in the tax system that directly affect income redistribution: tax progressivity and average tax rate. There has been a tendency to emphasize tax progressivity, while average tax rate was ignored. In this note, the two elements are examined numerically in the international context, and we discuss the relative contribution of each element to the total degree of income redistribution by tax policy. The main tool for measuring the relative contribution is a decomposition of the coefficient of income redistribution into three elements. Modifying the formula developed by Kakwani (1977), C in Table 1 can be written as follows:

$$C = \frac{G - G^*}{G} = \frac{1}{G} \left(\frac{t}{1-t} \right) P$$

G = Gini coefficient before tax

G^* = Gini coefficient after tax

t = average tax rate

P = tax progressivity.

Since C (based on the Gini coefficient) is already calculated in Table 1, it is possible to estimate P if t is given. The average tax rate t is approximated by the rate of the total tax revenue as percentage of GDP. The data source is OECD Revenue Statistics. Table 3 presents the numerical estimates of P together with $t/(1-t)$ and $1/G$. The numbers in the last column are the coefficients of income redistribution based on the Gini formula, which is a product P , $t/(1-t)$ and $1/G$. $1/G$ is regarded as a scale factor which indicates a kind of initial condition for redistribution. The lower the value of $1/G$, the greater is the room for redistribution. Table 4 presents the estimated results for P based on the other formulas for comparison. The estimated P 's are quite different from formula to formula. The table does not, however, provide us with radically different pictures

TABLE 3
ESTIMATED VALUES OF TAX PROGRESSIVITY AND OF THE EFFECT OF AVERAGE TAX RATE

| | $t/(1-t)$ | P | $1/G$ | C |
|----------------|------------|------------|------------|------------|
| Australia | 0.336 (9) | 0.030 (8) | 3.195 (1) | 0.003 (10) |
| Canada | 0.466 (7) | 0.060 (3) | 2.618 (6) | 0.073 (5) |
| France | 0.554 (4) | 0.004 (10) | 2.404 (10) | 0.005 (9) |
| Germany | 0.546 (5) | 0.024 (9) | 2.525 (8) | 0.033 (8) |
| Japan | 0.238 (10) | 0.080 (1) | 2.985 (2) | 0.057 (6) |
| Netherlands | 0.629 (3) | 0.049 (7) | 2.597 (7) | 0.081 (3) |
| Norway | 0.666 (2) | 0.070 (2) | 2.825 (5) | 0.133 (1) |
| Sweden | 0.745 (1) | 0.059 (4) | 2.890 (4) | 0.127 (2) |
| United Kingdom | 0.524 (6) | 0.050 (6) | 2.907 (3) | 0.076 (4) |
| United States | 0.416 (8) | 0.055 (5) | 2.475 (9) | 0.057 (6) |
| Average | 0.512 | 0.048 | 2.642 | 0.044 |

*The numbers in parenthesis signify the ranks of each effect by countries.

TABLE 4
ESTIMATED TAX PROGRESSIVITY BASED ON THE VARIOUS FORMULAS

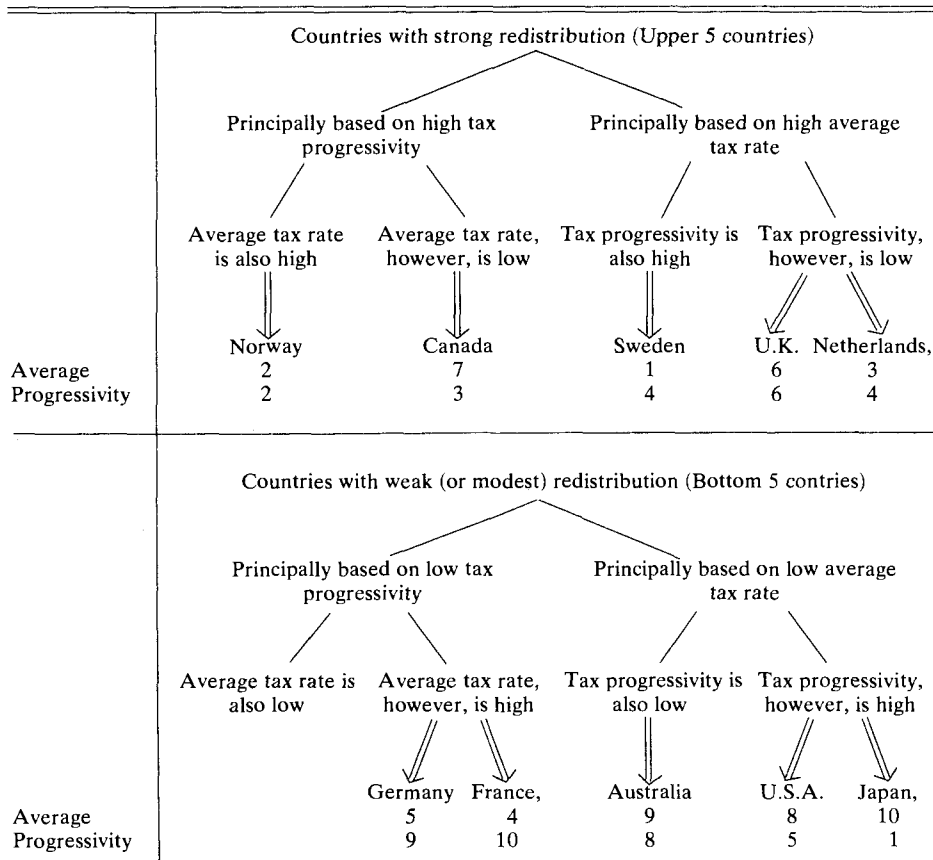
| | Atkinson | | Champernowne | Gini | Kuznets | Theil | Variance of logs |
|----------------|---------------|---------------|--------------|-------|---------|-------|---------------------|
| | ($e = 0.5$) | ($e = 1.5$) | | | | | |
| Australia | 0.000 | 0.003 | 0.003 | 0.030 | 0.009 | 0.000 | 0.020 |
| Canada | 0.038 | 0.107 | 0.075 | 0.060 | 0.053 | 0.034 | 0.047 |
| France | 0.001 | -0.007 | -0.002 | 0.004 | 0.002 | 0.002 | -0.005 |
| Germany | 0.016 | 0.043 | 0.023 | 0.024 | 0.012 | 0.013 | 0.018 |
| Japan | 0.042 | 0.105 | 0.058 | 0.080 | 0.067 | 0.042 | 0.025 |
| Netherlands | 0.030 | 0.060 | 0.050 | 0.049 | 0.034 | 0.031 | 0.019 |
| Norway | 0.040 | 0.120 | 0.103 | 0.070 | 0.054 | 0.033 | 0.048 |
| Sweden | 0.026 | 0.060 | 0.048 | 0.059 | 0.048 | 0.028 | 0.020 |
| United Kingdom | 0.028 | 0.085 | 0.063 | 0.050 | 0.038 | 0.022 | 0.030 |
| United States | 0.038 | 0.096 | 0.069 | 0.055 | 0.047 | 0.031 | 0.038 |

of each country's tax progressivity (e.g. rankings). The difference in the estimated numbers arises largely from the properties of the formulas adopted. We evaluate tax policy mainly on the basis of the Gini formula in view of its popularity and its roughly consistent ranking with the others, without claiming its superiority to the others. Minor modifications that would result from applying the other formulas must be, of course kept in mind.²

It is found that the values of $t/(1-t)$ and of P are considerably different from country to country. For $t/(1-t)$, the highest value is 0.745 (Sweden) which is almost triple the lowest, 0.238 (Japan). For P , the highest value is 0.080 (Japan), while the lowest value is 0.004 (France). The value of P , the tax progressivity, is more highly dispersed than the effect of the average tax rate. More importantly, Table 3 shows that the relative contributions of the effect due to average tax rate and that due to tax progressivity to the total redistribution differ significantly from country to country. Concretely speaking, some countries rely principally on the effect of a high average tax rate for strong redistribution, while some countries depend mainly on the effect of tax progressivity. We can point out, of course, the inverse case; low average tax rate and low tax progressivity for weak redistribution. Table 5 illustrates a rough classification of the countries on the basis of the redistribution pattern by tax policy. Norway and Sweden show the most powerful redistribution policy: both the high tax progressivities and the high average tax rates contribute to the strongest redistribution, although we should not overlook the slight difference between the two countries with respect to their heavier reliance on either the progressivity or the average rate. Norway and Sweden are, roughly speaking, in the bottom of a hierarchy of post-tax inequalities (Table 6 of the OECD study). Canada, Japan and the U.S. have high tax progressivities, relatively speaking. The low average tax rates, however, of Japan and the U.S. cancel the effect of tax progressivity on redistribution. The Japanese case is extreme since it shows the lowest average rate despite the very high tax progressivity. Relatively speaking, low tax pro-

²Since the purpose of this note is not to review the merits of each formula, discussion of it is not attempted.

TABLE 5
SCHEMATIC CLASSIFICATION OF THE COUNTRIES



*The numbers written under the name of the country are the ranks of the effect of the average tax rate and of the tax progressivity respectively on redistribution.

gressivities are observed in Australia, France, Germany, the Netherlands, and the U.K. France is very special with respect to this point since the degree of tax progressivity is nearly zero. France is the opposite example from Japan: very low tax progressivity but very high average tax rate. This is due to the high rate of indirect tax in France. Germany and the Netherlands are somewhat similar to France. Australia is very unique in the sense that neither tax progressivity nor average tax rate contributes to redistribution. Finally, the classification of the U.K. in Table 5 is slightly ambiguous.

The simple correlation coefficient between tax progressivity and the effect of the average tax rate, $t/(1-t)$, calculated from Table 3, is -0.109 . The small negative correlation coefficient signifies no particular relation between tax progressivity and the effect of the average tax rate. In other words, it is misleading to anticipate that a country with high tax progressivity would have also a high average tax rate.

A final comment is necessary: although we estimated the degree of income redistribution by tax policy for various developed countries, it must be emphasized that it is quite premature to conclude that the countries with strong redistribution policy are equality-oriented, while countries with weak redistribution policy are not. The degree of income redistribution describes only a transaction from the primary income (i.e. the pre-tax income) to the secondary income (i.e. the post-tax income). Also, it must be emphasized that it is slightly risky to evaluate the overall effect of income redistribution only by tax policy and income inequality. As noted previously, public expenditures also have a redistributive impact.

REFERENCES

- Kakwani, N. G., Measurement of Tax Progressivity: An International Comparison, *Economic Journal*, Vol. 87, March, 1977.
Sawyer, M., Income Distribution in OECD Countries, OECD Occasional Studies, OECD, July, 1976.
O.E.C.D. Revenue Statistics.