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Preliminary

Redistributive Effects of Discretionary  
and Automatic Tax Policies

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Redistributive effects of discretionary and automatic tax policies

The direct personal income taxation is considered one of the most important instruments for policies of income redistribution. Accordingly numerous studies of the redistributive effects of taxation in different countries have appeared. These studies have mostly confined themselves to a comparison between observed income distribution before tax and observed income distribution after tax. Mostly the comparisons are made on a time series basis, whereby changes in redistributive effects over time can be observed. However, by this approach nothing can be said about what brought about the changes. And as no underlying structural relations are established the studies are of little help when it comes to forecasting, and to evaluating the "redistributive power" of different policy measures.

In our work on the redistributive effects of Swedish personal income taxation since 1951 we have tried to deal with the last mentioned problems by a simulation approach. This paper is a preliminary report on some of the results obtained.

The model used

Our basic tool of investigation is a simulation model of the Swedish system for personal income taxation. The model is presented in [3], where it was used for an investigation of revenue effects of automatic and discretionary fiscal policy measures. In the model the income distribution before tax as well as the relevant public parameters appear explicitly as exogeneous variables, while income distribution after tax is endogeneously determined in the model. The income earners have been partitioned in categories, such that all members of a category are treated approximately equal by the tax-laws. We have been able to obtain observations of before tax income distributions for each of these categories each year in the period 1951-1971. This enables us to assess not only the overall redistributive effects but also the redistributive effects within and between categories.

Representation of income distributions

The income distributions are represented by a measure of inequality suggested by Atkinson [1]. The measure (I) is defined as

$$I = \left[ \sum_i \frac{1}{N} \left( \frac{x_i}{\mu} \right)^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}}$$

where  $N$  = the total number of income earners

$x_i$  = income of the  $i$ :th income earner

$\mu$  = mean income

$\varepsilon$  = parameter

If we confine ourselves to conventional measures they all give the same ordering of income distributions as long as the distributions have non-intersecting Lorenz-curves, which is equivalent<sup>1)</sup> to saying that all the conventional measures order distributions in accordance with Dalton's principles of transfers. The choice of measure is however important as soon as we are dealing with distributions with intersecting Lorenz-curves. As each measure is focussed on a special aspect of a distribution, two measures in this case often come out with different orderings of distributions. Therefore it is a common practice to use two or three different measures of inequality, where each measure is supposed to take care of its aspect. This method, that has been suggested by Dalton, can be used in a more systematic manner by applying Atkinson's measure. The measure is namely parametric, so that the focus of it can be shifted by a change in the parameter. Another interesting and useful feature of the measure is its linkage to a social welfare function.

#### Redistributive effect of taxation 1952-1971

The model has been used for computing income inequalities before and after tax 1952-1971 for all income earners, and for the following categories of income earners:

- (I) Single persons younger than 67
- (II) " " older than 67
- (III) Jointly assessed men (wife not assessed)
- (IV) " " couples (both parties assessed)

The results are presented in diagram 1 ( $\varepsilon = 0,8$ ) and diagram 2 ( $\varepsilon = 2,0$ ). In the diagrams we have indicated the ranking of the categories with respect to income equality before tax (bracketed ordinal number below the dotted line) and after tax (bracketed ordinal number above the solid line).

1) The equivalence is established by a Lemma by Hardy, Littlewood & Polya, and properties of bistochastic matrixes, see [2].

Generally there are only minor variations in the measure during the period 1952-1964. After 1964 the overall impression is, that the gap between the curves widens. One can observe that the tax reforms 1966 and 1971 both have increased the redistributive effect of the tax system. The strongest effect is given by the 1971 reform. The rest of the increase can be explained by higher local tax rates and, to some extent, by automatically increasing redistribution.

On the category level several interesting observations can be made in connection with the rankings for  $\epsilon = 0.8$  and  $\epsilon = 2.0$ . For category II the ranking generally is better for  $\epsilon = 2.0$  than for  $\epsilon = 0.8$ . This indicates that the distribution of incomes in the category is relatively more equal in the lower brackets than in the higher brackets. It can also be seen that the progression is sharper in this category than in the others. As soon as the category is not ranked as number one with respect to income equality before tax the ranking is improved by tax redistribution.

For category III it is seen that the redistributive effect of the 1971 tax reform was relatively smaller in the lower income brackets than in the higher. This can be inferred from the fact that the tax system improves the ranking for  $\epsilon = 0.8$  but leaves the ranking unchanged for  $\epsilon = 2.0$ . In category IV for  $\epsilon = 2.0$  the redistributive effect of the tax system is improved each year after 1964. Measured by  $\epsilon = 0.8$  the redistributive effect is improved only 1966 and 1971, when we had major tax reforms. The interpretation of this is that the redistributive effect has increased continuously in the lower income brackets, while for the higher income brackets, the increase has occurred only when the statutory rates of the state tax have been changed. A similar pattern can be observed in the other categories. It can be explained by the fact that the local government tax has its progression part in the lower income brackets. The heavy increases in the local tax rates have therefore increased redistribution just in these brackets.

### Discretionary and automatic tax policies

#### Simulation in the 1971 system

The most important deduction at both state and local assessment is the basic tax deduction, that is allowed initially to each income earner by an amount of 4 500 Sw.cr. For an income (X) higher than 30 000 Sw.cr. the deduction is reduced by  $0.2(X - 30\ 000)$  Sw.cr.<sup>1)</sup>

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1) This element was introduced in the 1971 reform.

We shall consider the redistributive effect of an increase in the level (4 500 Sw. cr.) of this deduction. It is easy to see that this parameter change has both positive and negative effects on the redistribution. The income earners can roughly be divided in three groups according to their relative gains on the change. Firstly, one group where the incomes are so low that one cannot use the whole deduction. Secondly, we have those who can use and are allowed to use the deduction. Thirdly, there is a group where the incomes are so high that they are not allowed to make the deduction. The parameter change does improve the position of the middle groups relative the two others. Within the middle group those at the bottom make the relatively largest gains.

The overall effect of the parameter change can be estimated by simulation in the tax model. (We have in [3] described how budget effects of specific parameter changes are simulated in the tax model. The present simulations are carried out analogously.) The qualitative results of a simulated increase in the level of the basic tax deduction can be seen in table 1. The positive effect dominates the picture. However in the old age categories the gain of the middle group relative the

Table 1. Effects on income equality after tax of an increase in the level of the basic tax deduction

Category	$\epsilon = 0.8$	$\epsilon = 1.2$	$\epsilon = 2.0$
Single persons younger than 67 without children	+	+	+
Single persons older than 67	-	-	-
Jointly assessed men (wife not assessed)	+	+	+
Jointly assessed couples (both parties assessed) younger than 67, with children	+	+	+
Jointly assessed couples (both parties assessed) younger than 67, without children	+	+	+
Jointly assessed couples (both parties assessed) older than 67	+	-	-
Total	+	+	+

group with the lowest income is important enough to bring about negative overall effects. For jointly assessed old people, the estimated overall effect, however, differs with different values of  $\epsilon$ . For higher values  $\epsilon$ , the measure is more sensitive to changes in the lower income brackets, and the negative effect dominates.

The statutory marginal tax rates at state assessment

The tax schedule at state assessment is a stepwise linear function of taxable income. Figure 1 illustrates an increase of the statutory marginal tax rate within a specific bracket (bracket 2 in the figure). The effect of the increase with respect to redistribution can be subdivided in four components: Two are working for increased redistribution:

1. Within the bracket, where the tax is degressive, the increased marginal tax rate gives higher progression.
2. Disposable income in bracket two and higher brackets is diminished while disposable income in bracket one and below is unchanged. People with low income thus increase their share of total disposable income.

The following two components are working for diminished redistribution:

3. Within each bracket above bracket 2 tax is increased while the marginal tax rate is unchanged, which gives a lower progression within the higher brackets.
4. The relative weight of the tax change is decreasing after bracket 2.

Table 2 gives the effect of simulated changes in the 1971 statutory marginal tax rates.

The results differ with different categories. The lower the mean income of the category the lower the bracket where the positive redistributive effects first begin to dominate.

Figure 1. Increase of the statutory marginal tax rate within a specific bracket

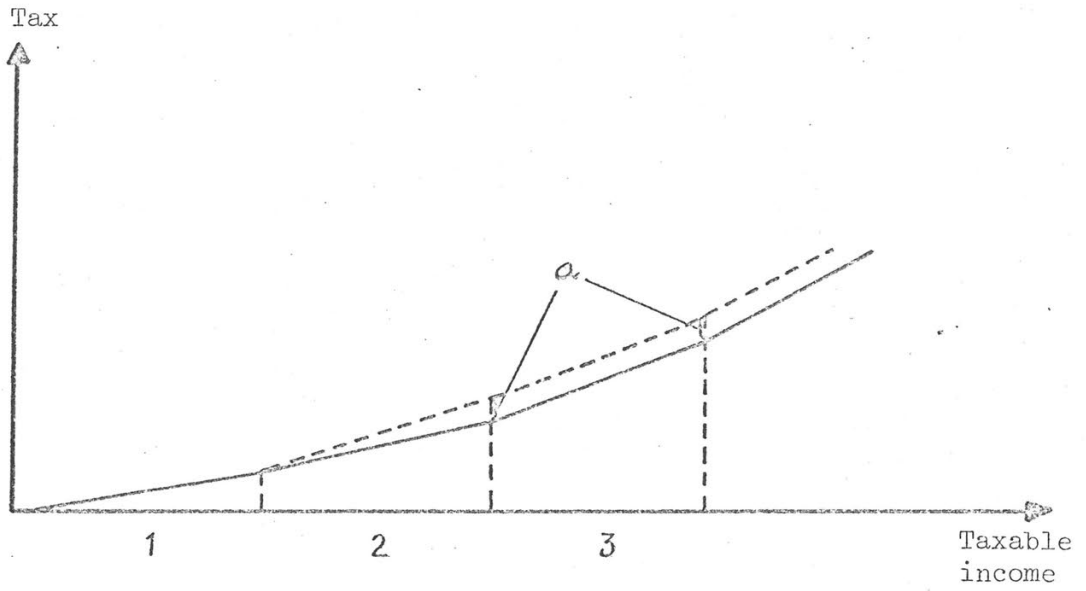


Table 2. Redistributive effect (positive or negative) by simulated changes in the statutory marginal tax rates 1971 (state assessment)

Brackets of assessed income (thousands of Sw.cr.)	Statutory marginal tax rate at state assessment	Category*											
		Single persons younger than 67, without children			Single persons older than 67			Jointly assessed men (wife not assessed)			Jointly assessed couples with children		
		ε			ε			ε			ε		
		0.8	1.2	2.0	0.8	1.2	2.0	0.8	1.2	2.0	0.8	1.2	2.0
0 - 15	10	-	+	+	+	+	+	-	-	-	-	-	-
15 - 20	16	+	+	+	+	+	+	-	-	-	+	+	+
20 - 30	22	+	+	+	+	+	+	-	-	+	+	+	+
30 - 52	28	+	+	+	+	+	+	+	+	+	+	+	+

\* The total effect is always positive.



Table 3. Redistributive effect of the 1971 reform and a simulated increase (by 4 percentage units) of the local tax rates

	<u>Change in the measure of equality after</u>	
	<u>tax reform</u>	<u>increase in the local tax rate</u>
$\epsilon = 0.8$	0.0042	0.0068
$\epsilon = 1.2$	0.0046	0.0093
$\epsilon = 2.0$	0,0052	0,0140

#### Local tax rates

The local tax is degressive. An increase in the rate does therefore always increase redistribution. This was reinforced by the new construction of the basic tax deduction in the 1971 reform. After 1971 changes in the local tax rates therefore have a very strong impact on redistribution. This is illuminated by table 3 where the effect on Atkinson's measure of a simulated increase in the local tax rate is compared with the effect of the 1971 reform. The manipulation of the local tax rate has more impact on the measure than the tax reform had.

#### Automatic redistribution

Redistribution is unaffected by a proportional increase of each individual income if and only if on the micro-level the relation between income after tax ( $y$ ) and income before tax ( $x$ ) is of the form  $y = bx^a$ . During the fifties and the sixties the tax schedules were roughly of this form. Thus simulated proportionate changes of individual incomes have small impact on tax redistribution. The 1971 reform, however, broke the relation of constant elasticity between income before tax and income after tax. This reform thus brought to the system an element of automatically increasing redistribution. That is, a proportionate increase of all incomes before tax gives rise to a considerable increase in the redistributive effect of the tax system. A change in the general level of nominal

income by 50 % gives automatically the same increase in the redistributive effect as was achieved by the discretionary measures taken in 1971. This can be seen in table 4.

Table 4. Changes in the measure of inequality by the 1971 tax reform and a proportionate increase of all incomes by 50 %

	Tax reform	Increase in level of incomes
$\epsilon = 0.8$	0.0042	0.0032
$\epsilon = 1.2$	0,0046	0,0049
$\epsilon = 2.0$	0.0052	0.0081

#### Comparison between the parameters

The simulation experiment includes a ranking of major public parameters according to their "redistributive power". The ranking is made on the basis of observed redistributive effects from simulated changes in the public parameters. To get a common basis for the comparisons the changes are made so as to give the same budget effect (100 million Sw.cr.) for each parameter. The results appear in table 5. As could be expected the ranking depends on the value of  $\epsilon$ . However, the internal ranking of the statutory marginal tax rates in the different rate brackets is on a priori grounds invariant for changes in  $\epsilon$ , which gives the ranking a certain stability.

Another type of comparison is made in table 6, from which it appears that an increase of the local tax rate with one percentage unit gives the same redistributive effect as an increase of the statutory marginal tax rate by 2.8 percentage units in the bracket 30 000 - 52 000 Sw.cr., or an increase by 14 percentage units in the bracket 70 000 - 100 000 Sw.cr. Automatic redistribution gives this effect at an increase of income before tax by 22 %. (All these relations hold when  $\epsilon = 0.8$ .) The impression that normal changes of the income level and the local tax rate give the same redistributive effect as a major tax reform is thus confirmed.

Table 5. Effects on the measure of inequality of parameter and income changes giving 100 million Sw. cr. in revenue effect

	Ranking for			Required change for a revenue effect of 100 million Sw. cr.
	$\epsilon=0.8$	$\epsilon=1.2$	$\epsilon=2.0$	
*100 -	1	1	1	6.13 percentage units (increase)
*70 - 100	2	2	2	6.25 " " "
*52 - 70	3	4	4	3.84 " " "
Rate of reduction in basic tax deduction	4	3	3	2.6 " " "
*30 - 52	5	5	5	1.05 " " "
*20 - 30	6	6	6	0.78 " " "
*15 - 20	7	7	7	0.93 " " "
Maximal old age pension fee	8	8	9	81 Sw.cr. (increase)
Local tax rate	9	9	8	0.11 percentage units (increase)
Rate of old age pension fee	10	10	13	0.56 percentage units (decrease)
Level of basic tax deduction	11	12	11	57 Sw. cr. (increase)
*0 - 15	12	11	10	0.20 " " (increase)
Level of income	13	13	12	Change of mean income by 0.15 per cent

\* Statutory marginal tax rate. Rate brackets indicated in thousands of Sw.cr.

Table 6. Policies and income changes giving the same effect on the measure as does an increase of the local tax rate by one percentage unit

	$\epsilon = 0.8$	$\epsilon = 1.2$	$\epsilon = 2.0$
<u>Increase in</u>			
local tax rate	1 percentage unit (p.u.)	1 percentage unit (p.u.)	1 percentage unit (p.u.)
income level	22 %	20 %	18 %
rate of reduction in basic tax deduction	7.8 p.u.	7.3 p.u.	7.5 p.u.
maximal old age pension fee	640 Sw. cr.	624 Sw. cr.	696 Sw. cr.
*70 - 100	14 p.u.	15.4 p.u.	20.8 p.u.
*30 - 52	2.8 p.u.	2.9 p.u.	3.75 p.u.

\* Statutory marginal tax rates. Rate brackets indicated in thousands of Sw. cr.



Literature

- [1] Atkinson, A.B., On the Measurement of Inequality, Journal of Economic Theory 2, 1970.
- [2] Berge, C., Topological Spaces, London 1963.
- [3] Jakobsson, U. & Normann, G., A Model of the Swedish System for Personal Income Taxation, European Economic Review 4, 1972.

Diagram 1. Income equalities according to Atkinson's measure ( $\epsilon=0.8$ )  
for different categories during the period 1952-1971

Category: Single persons younger than 67

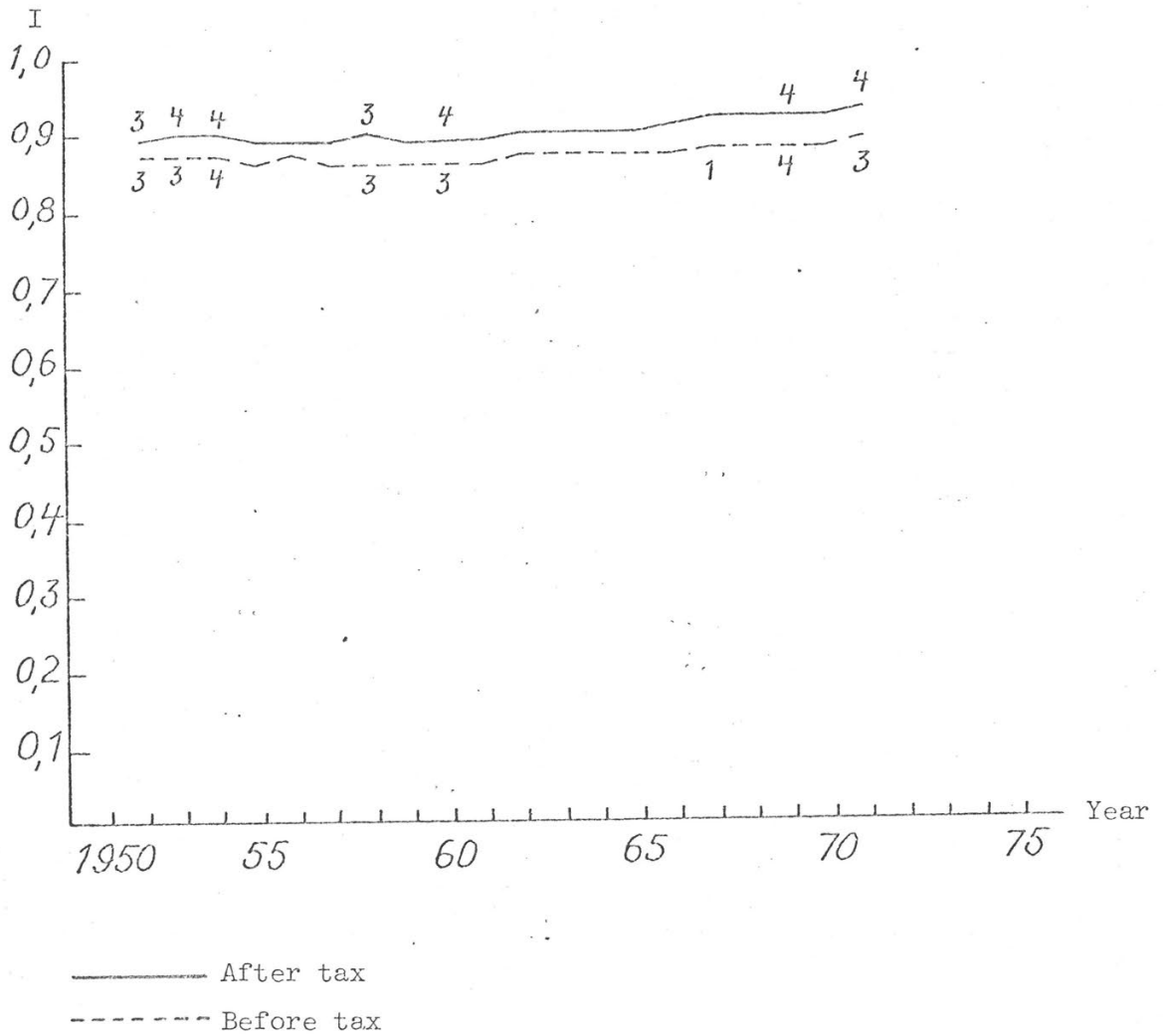


Diagram 1 (continued)

Category: Single persons older than 67

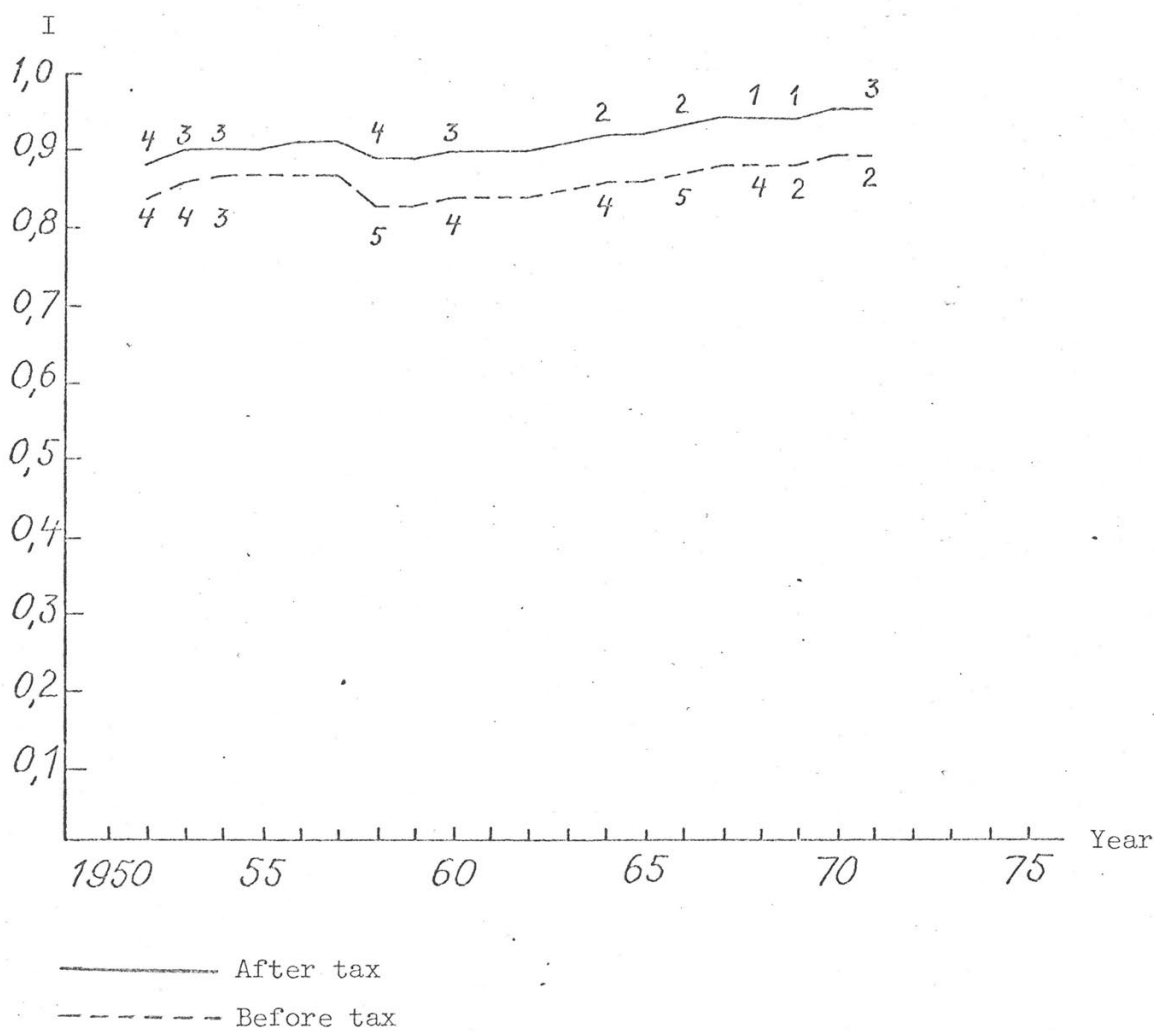


Diagram 1 (continued)

Category: Jointly assessed men (wife not assessed)

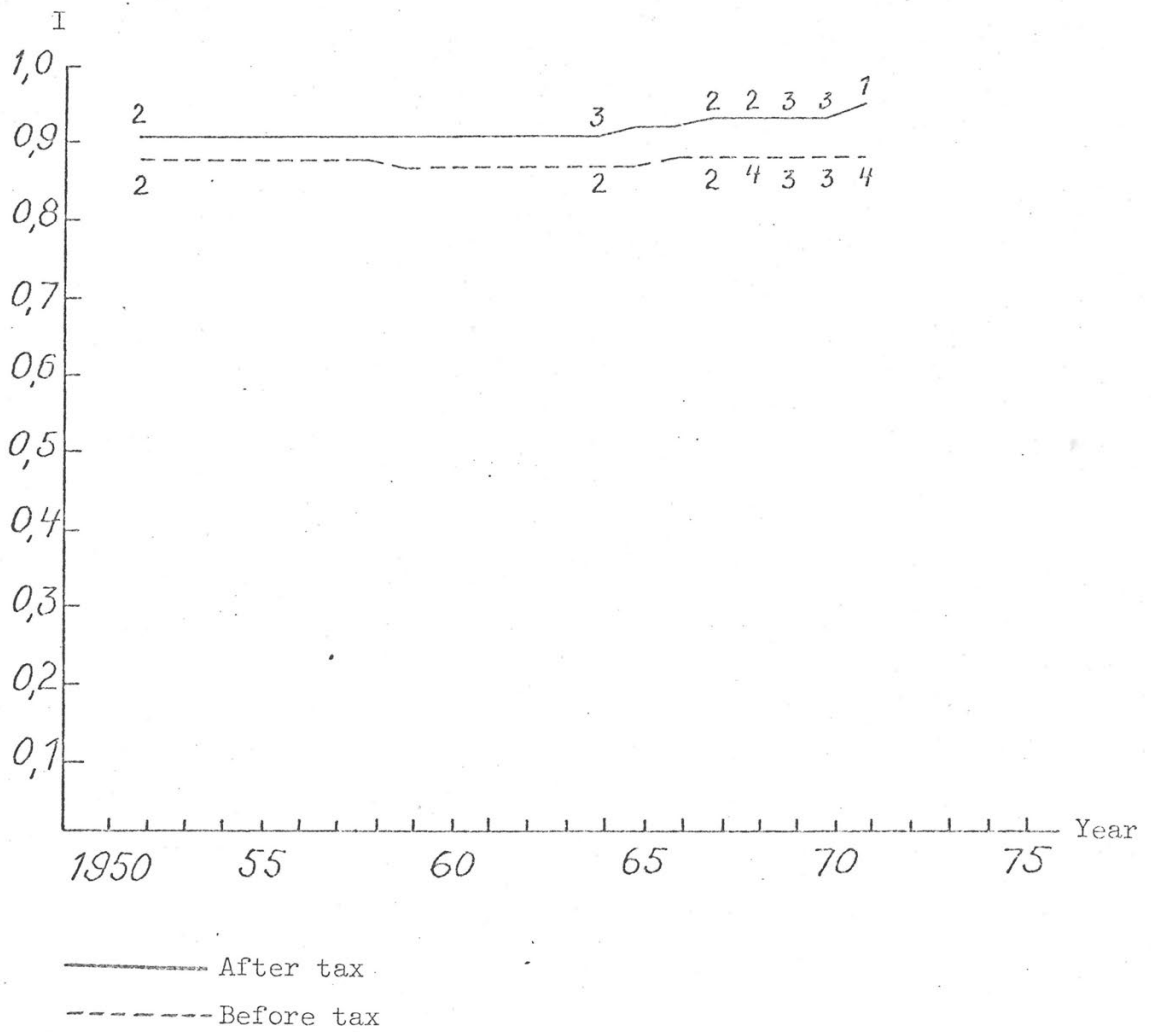




Diagram 1 (continued)

Category: Jointly assessed couples (both parties assessed)

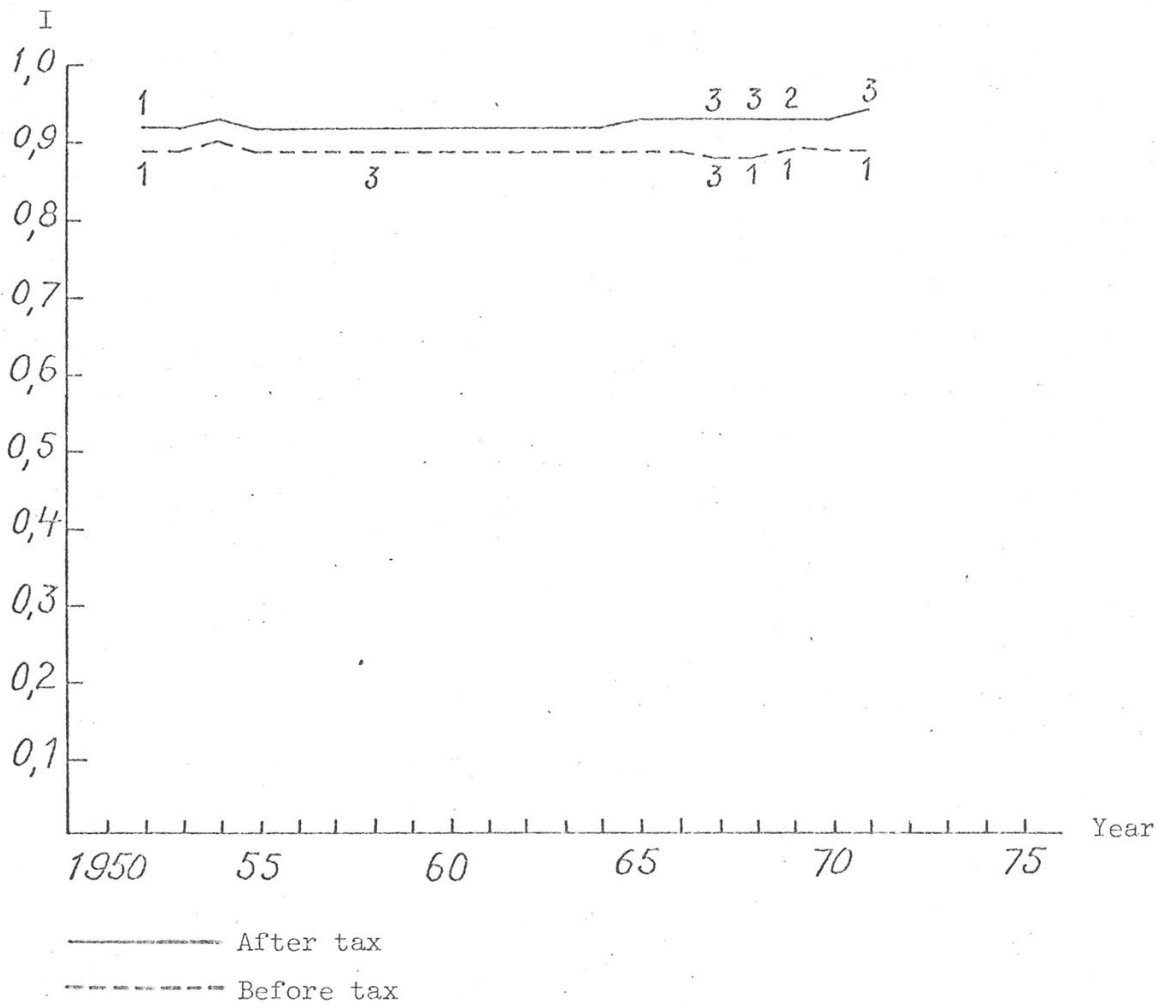


Diagram 1 (continued)

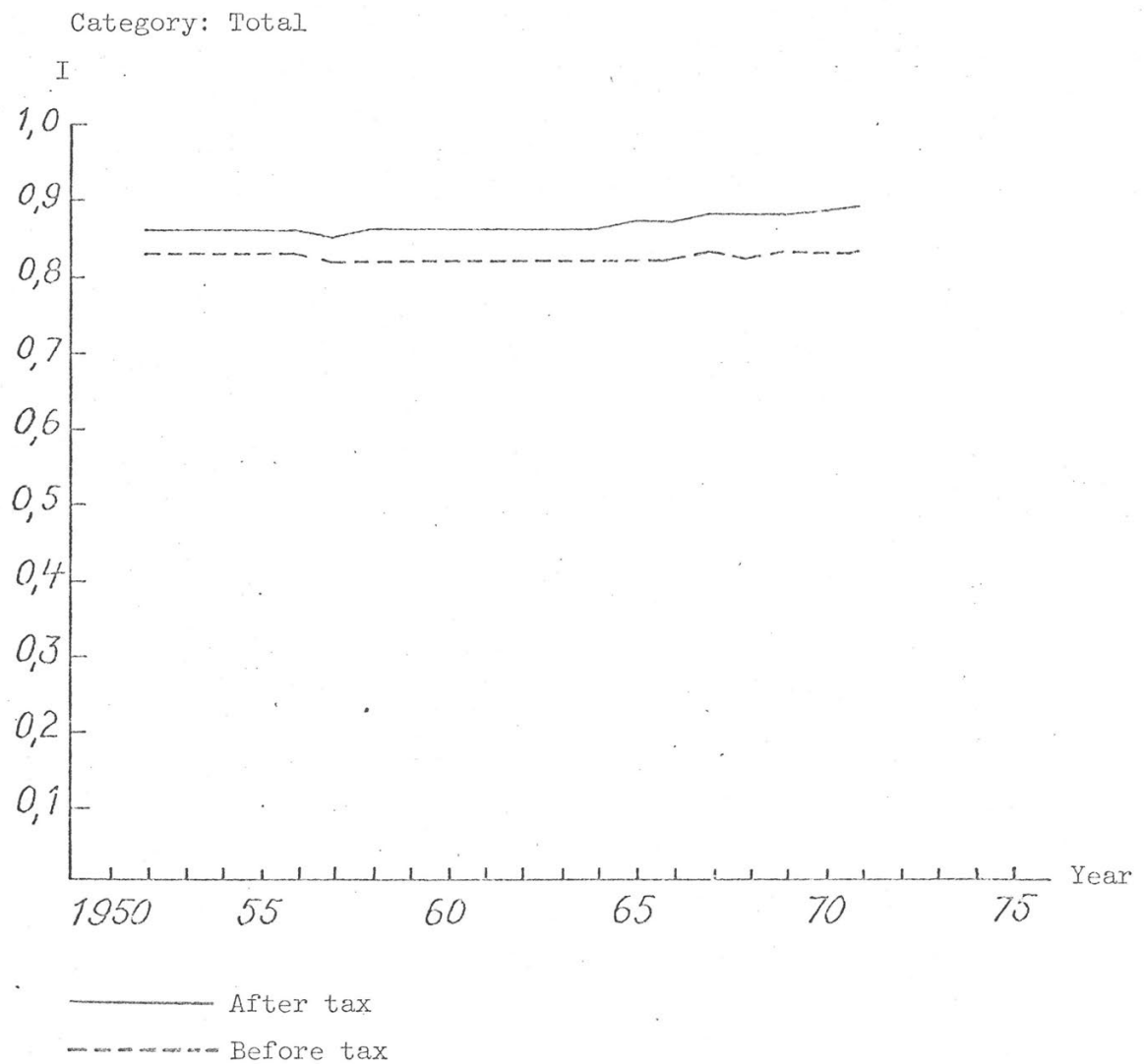


Diagram 2. Income equalities according to Atkinson's measure ( $\epsilon=2.0$ )  
for different categories during the period 1952-1971

Category: Single persons younger than 67

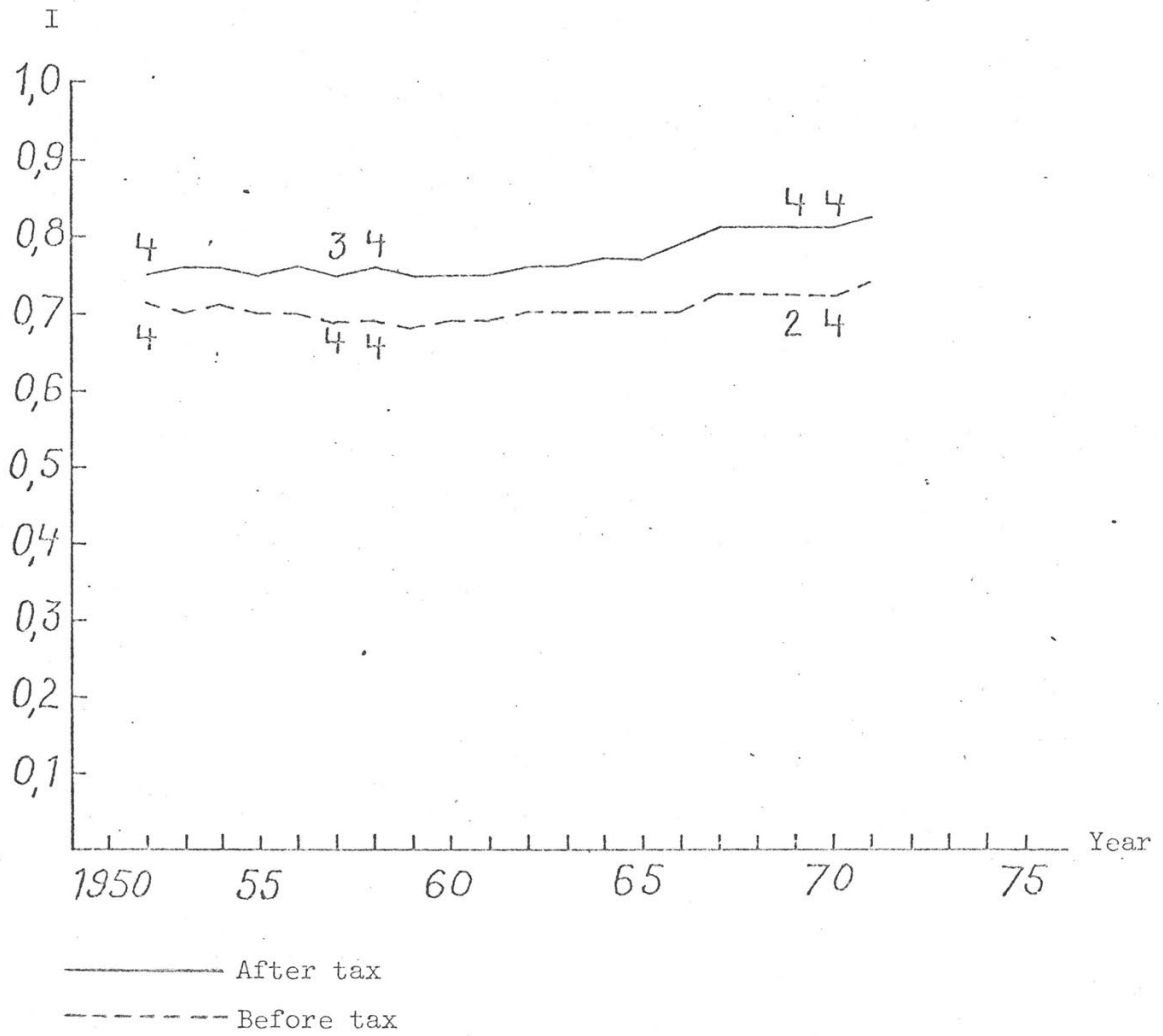


Diagram 2 (continued)

Category: Single persons older than 67

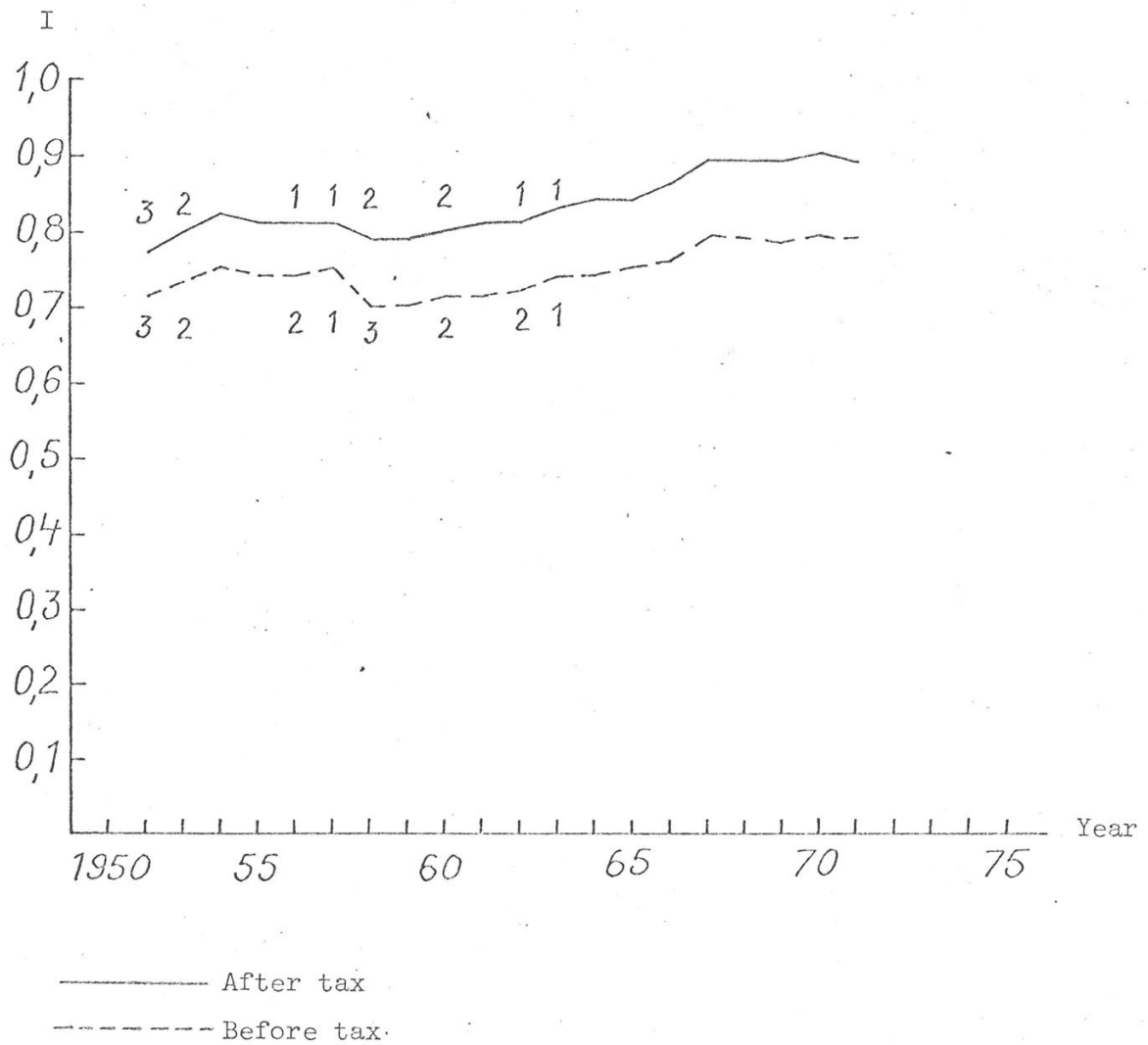




Diagram 2 (continued)

Category: Jointly assessed men (wife not assessed)

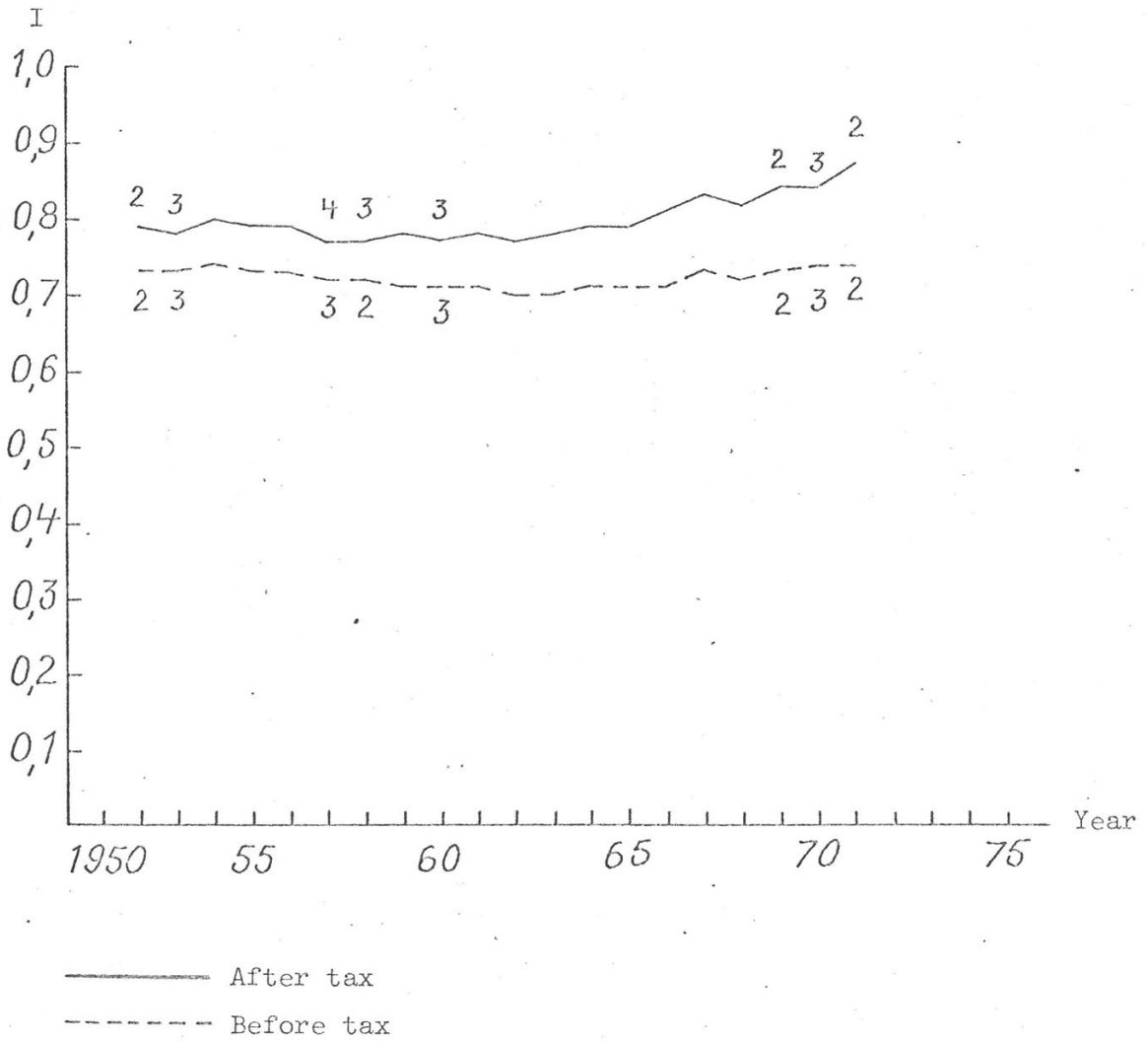


Diagram 2 (continued)

Category: Jointly assessed couples (both parties assessed)

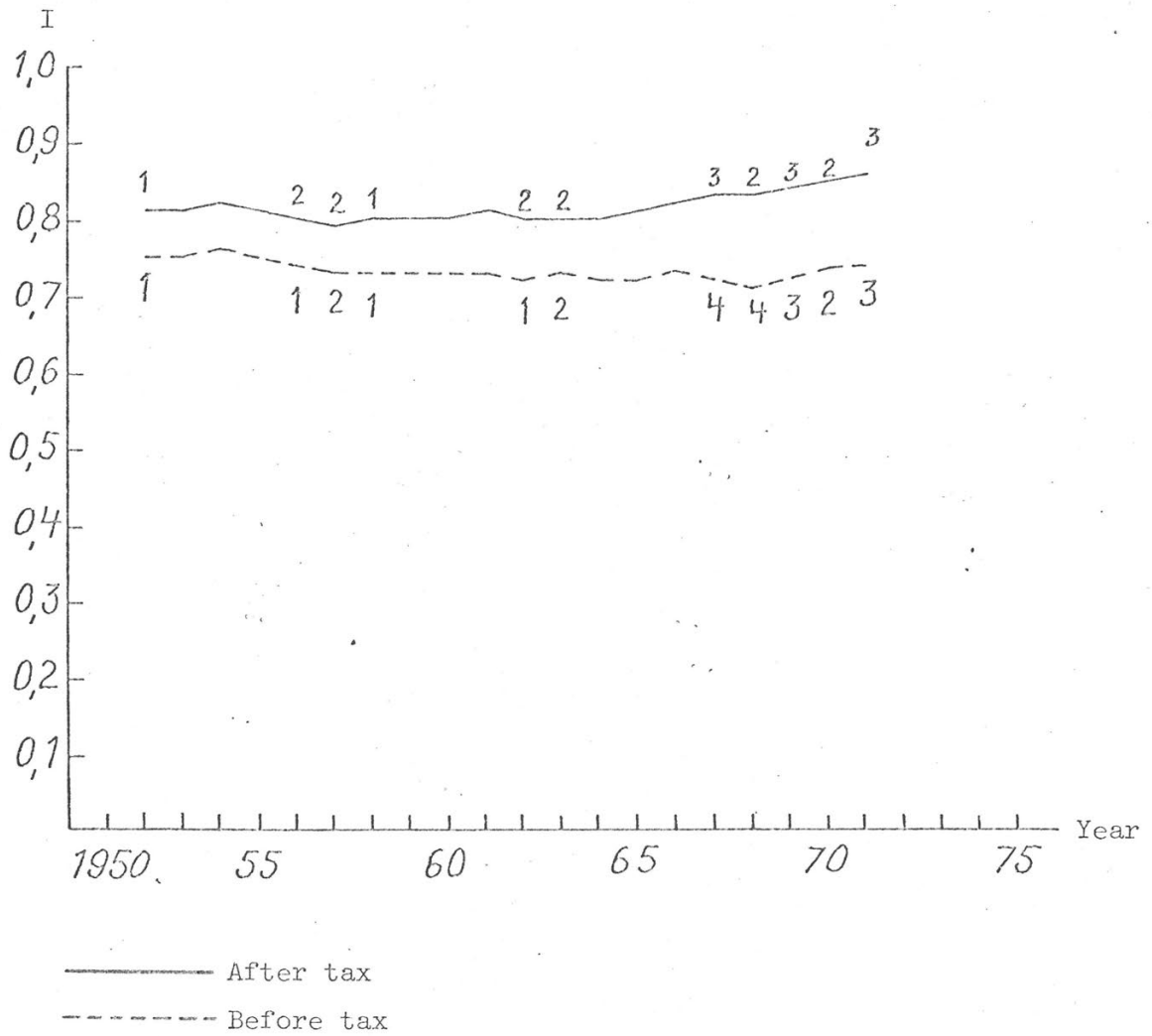


Diagram 2 (continued)

Category: Total

