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Luxembourg Income Study Working Paper Series

Working Paper No. 41

Two Refinements in the Measurement of Income
Redistribution: Sweden, the U.S. and U.K.

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Two Refinements in the Measurement of Income Redistribution:
Sweden, the U.S., and U.K.

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ABSTRACT

TWO REFINEMENTS IN THE MEASUREMENT OF INCOME REDISTRIBUTION: SWEDEN, THE U.S., AND U.K.

This study uses the Luxembourg Income Study dataset to measure income redistribution in Sweden, the U.S., and U.K. Two refinements are introduced to correct for deficiencies found in previous attempts to measure redistribution and post-fisc inequality. First, Kakwani (1980, 1984) has shown that the redistributive effect of taxation can be decomposed into horizontal and vertical components. Also, Paglin has shown that the shape of the age-income profile has a potentially significant impact on the measurement of post-fisc inequality. Compared to the U.S. and U.K., this study shows that the amount of income compression caused by the Swedish fiscal system is large, but that many of these gains are lost by the introduction of horizontal inequities and a flattening of the age-income profile.

I. INTRODUCTION

A number of authors have discussed the importance of "reranking," which may occur in the process of giving transfers and collecting taxes (see especially Kakwani, 1984; Jenkins, 1988; Plotnick, 1985). Some of these studies have related this phenomenon to the familiar concepts known as horizontal and vertical equity. However, until recently, cross-country comparisons of these processes have been hindered by the absence of good microdatasets.

Also, as Paglin (1975) has shown, the shape of a country's age-income profile has an impact on the measurement of redistribution. If two countries have identical post tax and transfer Gini coefficients, but one has a steeper age-income profile, then it cannot be said that the fiscal system has the same redistributive impacts. Policies which shift the "original" income Lorenz curve inward, may at the same time, flatten the age-income profile.

This study compares income redistribution in Sweden, the United States, and the United Kingdom, using the Luxembourg Income Study (LIS) dataset to measure inequality while accounting for horizontal inequities and age-income effects. The usual result, that Swedish taxes and transfers remove more inequality than the U.S. and U.K. tax and transfer systems, is not overturned. However, after comparing age-income profiles and measuring horizontal inequities, it is found that the wide advantage attributed to Sweden by many authors (e.g. Buhman, et al.) is

considerably reduced. Sweden's "Gini advantage" over the U.S. and U.K. (found by ignoring age-income effects and horizontal inequities) falls significantly when properly measured.

This paper is organized as follows: Section II discusses the importance of reranking and introduces Gini decomposition measures used by Kakwani (1984), Lambert (1985) and Jenkins (1988). Section III relates the shape of age-income profiles to the measurement of redistribution. Section IV discusses equivalence scales and their role in appropriately defining the income unit. Section V describes data, Section VI empirical results, and Section VII re-examines the "original" income debate. Section VIII summarizes the main conclusions of this paper.

II. WHY DOES RERANKING MATTER?

Economists discuss two aspects of equity as it relates to the fairness of a tax and transfer system. Vertical equity suggests that "unequals" should be treated differently by the fiscal system, and this principle can be used to justify progressive taxation. Horizontal equity suggests that "equals" should be treated similarly by the fiscal system. This principle suggests that if two persons are treated differently when they were in the same original position, a violation of horizontal equity has occurred. While this presents a measurement problem, it does not seem

controversial to call reranking a problem of horizontal equity.¹
A simple example can illustrate the problem (refer to Table I):

TABLE I

Income, tax or transfer concept	Person			
	A	B	C	D
(1) Original Income	44	110	111	135
(2) Income Tax	0	10	10	20
(3) (1) - (2)	44	100	101	115
(4) Government transfers	30	7	3	0
(5) (1) - (2) + (3)	74	107	104	115

The tax and transfer systems are both progressive and achieve the goal of redistributing income from top to bottom. Of interest is what happens to persons B and C. Since they were "equals" in the original distribution, the fiscal system seems to generate horizontal inequities. If one calculates a Gini coefficient for original income (G_0), post tax and transfer income with reranking (G_N^F), and post tax and transfer income without reranking (C_N^F), the following results are obtained:

$$G_0 = .228 \quad G_N^F = .105 \quad C_N^F = .100$$

Studies which emphasize the degree to which the tax and transfer system compress the distribution fail to make the distinction between C_N^F and G_N^F . It may be that those authors see

¹ Plotnick (1985) gives a convincing defense of this position. However, in section VII, the issue is reconsidered.

reranking as unimportant, or that reranking is seen as a desired goal of policy. More likely, such studies probably view the magnitude of the problem as small, or cannot deal with reranking because available grouped data are unsuitable for treating the issue properly. This study investigates the legitimacy of these assumptions.

Kakwani (1980, 1984) has shown that the redistributive effect of taxation (R^T) may be decomposed into horizontal (H^T) and vertical (V^T) components. Let

$$R^T = H^T + V^T = \frac{G_0 - G_N^T}{G_0} = \frac{C_N^T - G_N^T}{G_0} + \frac{g(C_t - G_0)}{(1-g)G_0} \quad (1)$$

where

G_0 = Gini derived from a pre-tax distribution

G_N^T = Gini derived from a post-tax distribution

C_N^T = concentration index of post-tax income

g = average tax rate

C_t = tax concentration index

$P_t = C_t - G_0$ = index of tax progressivity

Note the crucial distinction between C_N^T and G_N^T . The former assumes that taxpayer units are ranked by pretax order while G_N^T is measured by reranking all taxpayer units. It can easily be shown that $C_N^T \leq G_N^T$. If $C_N^T = G_N^T$, then no reranking has occurred, while

$C_N^T < G_N^T$ suggests that reranking has occurred. The expression also shows that violations of horizontal equity always lower R^T and thus dampen the gains associated with improvements in vertical equity. The most important point is that studies failing to account for reranking will always overstate redistributive effects because they implicitly use C_N^T to measure after tax and transfer inequality. Because H^T may vary from nation to nation, a comparative study must properly account for these effects.

Lambert (1985) advances income distribution measurement by exploring expenditure effects in the Kakwani framework. An important and unappreciated conclusion arises from this study; regressive taxes might actually amplify positive redistributive effects arising from government expenditure. Lambert explains that "taxes which are regressive on original income may be progressive on (the less unequally distributed) income including benefits"(p. 45). Lambert's work shows that a complete discussion of taxes and benefits is needed merely to uncover tax redistributive effects. Net, or "post-fisc" progressivity is not a simple sum of two Kakwani measures.

Jenkins (1988) further extends Lambert's analysis by discussing reranking in the Kakwani-Lambert context. His equations (9) and (10)(p. 69) isolate reranking effects attributed to taxes and transfers and make it possible to measure horizontal inequities with appropriately ranked microdata. Following Jenkins (but

adjusting notation and ignoring Kakwani's G_0 divisor)² yields:

$$R^f = \frac{g}{(1-g+e)} P^T + \frac{e}{(1-g+e)} P^E + H^f \quad (2)$$

where:

R^f = redistributive effects of taxes and transfers

e = average transfer rate

$P^E = (C_e - G_0)$

C_e = concentration index of government transfers

$H^f = (C_N^f - G_N^f)$

C_N^f = concentration index of post-fisc income (original minus taxes plus transfers) without reranking

G_N^f = Gini for post-fisc income with reranking

The importance of this expression is that it isolates in the term H^f , horizontal inequities present in the fiscal system. If no reranking occurs, $H^f=0$. Also, note that H^f equals twice the area between the Lorenz curve for post-fisc income (with reranking) and the concentration curve for post-fisc income ranked by original income. Finally, V^f , is captured in the first two terms of equation (2).

² Including Kakwani's G_0 divisor in each term has the effect of assessing post-fisc inequality as a fraction of market income determined inequality. Leaving it out measures post-fisc inequality as a fraction of maximum possible inequality (the situation where one person has all of society's income). I follow Jenkin's (1988) approach on the grounds that "original" income is less important than original rank.

III. AGE INCOME ADJUSTMENTS

A number of authors, especially Paglin (1975) have questioned the normative interpretation given the 45 degree "line of perfect equality." A well-known criticism of the current income Gini coefficient is that it does not adjust for life-cycle variations in income. In single country studies, ignoring life-cycle variations may be justified on the assumption that age-income profiles change very slowly over time, and may thus be ignored in year to year comparisons of distribution for a single country. However, in a comparative study, ignoring age-income or life-cycle effects is not reasonable since age-income profiles may differ significantly from country to country. Hoffman and Podder (1976) have already shown for the U.S. that life-cycle mobility exists, finding that the Gini for 1973 incomes was 9.9% higher than the Gini for a seven year average of incomes. Schiller (1976), using different data, comes to the same basic conclusion.

The failure to account for life-cycle effects introduces a possible source of error in interpreting Gini coefficients, one that tends to overstate post-fisc inequality. Furthermore, the steeper the age-income profile, the greater the magnitude of error. The decision to flatten the age-income profile is as significant a political decision as that of redistributing current income (Lindbeck, 1983). In fact, attempts to redistribute current income may flatten the age-income profile. To use a musical chairs

analogy, a society that has a low Gini for current after tax and transfer income, but which restricts "chair mobility," may be less preferred than a country where some higher degree of current income inequality is tolerated but where chair mobility is present.

The social security systems of most western nations may be considered in this light. If citizens are taxed heavily in high income years to generously aid older citizens in their retirement and newly formed families, the current income Gini for that country will be low but the nation's age-income profile will also be flat. Sweden's high payroll and income taxes combined with generous pension and family benefits programs may simultaneously flatten the age-income profile and lower the current income Gini.

Figure I summarizes the arguments of this and the preceding section by showing that inequality is attacked from two sides. First, a redistributive tax and transfer system shifts the original income Lorenz curve (L^0) inward toward the 45 degree line to L^N .³ Second, an age-income profile with any slope yields an age Lorenz, a-la Paglin, (L^A), that proxies the degree of chair switching in the musical chairs game.⁴ The higher the age Gini, the less

³ Actually, this is the net result of two shifts. First, L^0 is moved inward to C^Y by income "compression" resulting from the fiscal system, and then back to L^N by any reranking which may occur. These movements correspond to the components of equation (2), and represent vertical and horizontal redistribution respectively.

⁴ Paglin (1975) calculates G^A by dividing the population into subgroups by age. All members of each subgroup are assigned the mean income for the subgroup, and from these data a Gini coefficient is calculated. In the empirical section of this paper, I use a similar construction.

inequality implied by a given current income Gini. Thus areas (b+c) of Figure I represent "true" inequality after taxes and transfers, rather than (a+b), which would represent post-fisc inequality if we ignore reranking and age-income effects.

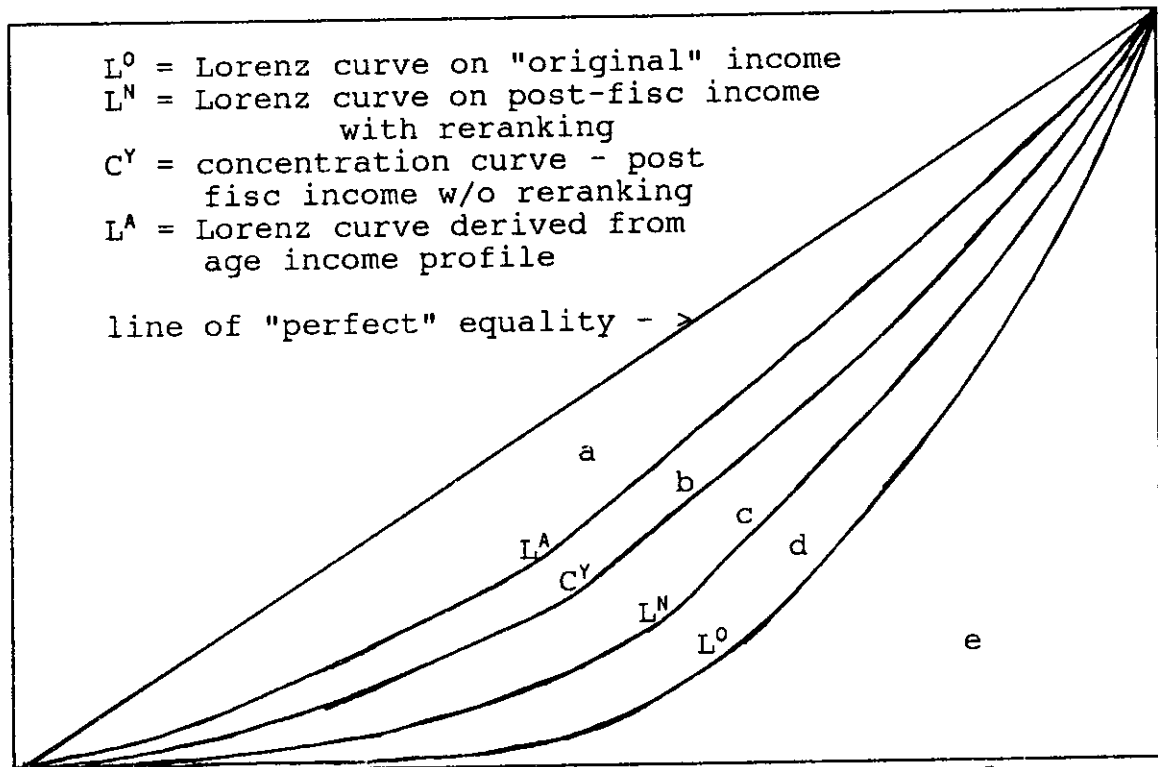


Figure 1 Redistributive Impact of Taxes and Transfers

IV. ROLE OF EQUIVALENCE SCALES

If two families have the same income, family well-being will not be equal if family size is not equal. How should family well-being be determined? Simply dividing family income by the number of persons in the family, an often used adjustment method in inequality studies, is inadequate because it ignores joint consumption possibilities within the family. For example, two family members may require only 1.5 times the income needed to

consumption possibilities within the family. For example, two family members may require only 1.5 times the income needed to sustain a single person family, because a house can provide shelter for two as easily as one.

Buhman, et al. (1988) discuss the role of "equivalence scales" in comparative studies of poverty and inequality, concluding that it is possible to adequately proxy family well-being (W) with the following expression:

$$W = Y / S^e \quad (3)$$

where

Y = family income

S = family size

and e = equivalence elasticity coefficient $0 \leq e \leq 1$

If $e=0$, then $Y=W$, implying that any number of persons can live as well as one. If $e=1$, W equals family income per capita, implying that no joint consumption possibilities are possible in family living. Clearly, the "true" e lies somewhere between 0 and 1.

After surveying 34 programs in ten countries, Buhman, et.al., find that a wide range for e exists in these programs. For this study, e was set equal to .54 for all countries, the mean value implied by Dutch, Swedish, Australian, Swiss, U.S., British, German, and Canadian poverty lines. In setting $e=.54$, it is assumed that a family of two needs 45% more income than a family of one to achieve equivalent well-being per person; similarly, 81%

more income is needed by a family of three.

V. DATA

Income concepts used in this study are transformations of variables found in the Luxembourg Income Study (LIS) microdataset. These data are constructed from the Swedish Income Distribution Survey (1981), the U.K. Family Expenditure Survey (1979), and the U.S. Current Population Survey. The data cover 97.5% of the U.S. population, 96.5% of the U.K. population, and 98% of the Swedish population; The number of actual households sampled was 15,000 (U.S.A.), 9,600 (Sweden), and 6,800 (U.K.). Since the dataset was designed specifically for cross-national comparisons, the sponsors, the Center for Population, Poverty, and Policy Studies, have gone to great lengths to ensure that income concepts are comparable across countries. The LIS data are probably the best available for a study of this type. For a description of the dataset, see Buhman et al. (1988).

Table II gives a detailed description of the major income concepts employed in this study: market income, post-tax income, post-fisc income, and by inference, post-transfer income.

Brief discussion is in order regarding the market income variable. Previous authors, e.g. O'Higgins et al. (1989), have ignored the role of employer contributions, both mandatory and non-mandatory in the income formation process. This can affect the results of any attempt to measure income redistribution. Labor economists analyzing payroll tax incidence (e.g. Pechman, 1985, p.

215-217) have concluded that the labor supply function in western advanced capitalist economies is quite wage inelastic, suggesting that the burden of the employer paid portion of the payroll tax is almost completely on the wage earner. Since the employer contribution in Sweden is over 30% of wage income, this is certainly not a trivial point. Thus it appears appropriate to add mandatory employer contributions to obtain market income, and to subtract it in finding post-tax income. Ignoring this issue biases Gini coefficients downward and implicitly assumes that the wage elasticity of labor supply is infinity. Non-mandatory employer contributions are also important. Pension contributions, life and health insurance premiums, and accident and health insurance premiums certainly add to well-being and must be included in market income.

TABLE II

Income Concepts Used in this Study
(Converted from LIS data)

(1) Wage and salary income
+(2) Mandatory employer contributions
+(3) Non-mandatory employer contributions
+(4) Farm self-employment income
+(5) Non-farm self-employment income
<u>+(6) Cash property income</u>
Equals: Market Income
-(7) Mandatory employer contributions
-(8) Mandatory contributions for self-employed
-(9) Income tax
-(10) Property or wealth taxes
-(11) Mandatory employee contribution
-(12) Other direct taxes
<u>-(13) Other indirect taxes</u>
Equals: Post-tax Income
+(14) Sick pay and unemployment pay
+(15) Accident pay and disability pay
+(16) Social retirement and veteran's pay
+(17) Child allowances and maternity allowances
+(18) Cash benefits (e.g. AFDC, SSI)
+(19) Near cash benefits (e.g. housing and study allowances, food stamps, school lunches)
+(20) Medical benefits (Medicare and Medicaid)
<u>+(21) Other social insurance</u>
Equals: Post-fisc Income

VI. EMPIRICAL RESULTS

Table III summarizes the results of this study on the redistributive effects of taxes and transfers. The original, or market income Gini(G_0) for the three countries shows similar degrees of inequality. As expected, the Swedish tax and transfer system does much to compress the post-fisc concentration of

income(C_N^f). In fact, the Swedish C_N^f is 97 points lower than C_N^f for the U.S. Assuming one is willing to ignore age-income effects and reranking, this figure indicates the amount of post-fisc inequality. The corresponding figure for the U.K. is 72 Gini points.

However, the Swedish "Gini gap" falls to 37 points for the U.S. and to 15 for the U.K. after redefining post-fisc inequality as the difference between G_N^f and G^A . In terms of Figure I, "true" inequality is now defined as area (b + c) divided by the triangle under the line of "perfect" equality. By ignoring both refinements discussed in this paper, post-fisc inequality would be viewed as the sum of areas (a + b) divided by the same lower triangle.

Horizontal inequities are responsible for a 60 point gap between G_N^f and C_N^f for Sweden while the difference is 20 points for the U.K. and 26 points for the U.S. These differentials of course, explain much of the erosion of the 97 and 72 point gaps referred to above. These same gaps fall further because the Swedish age-Gini is 26 points lower than its U.S. counterpart; the U.K. age-Gini is 17 points higher than the Swedish figure.⁵ The net result of both refinements discussed in this paper is that the reduction in inequality attributed to the Swedish tax and transfer system is indeed significant, and that it has a more significant impact on

⁵ The age - Gini (G^A) is calculated by dividing families into the following subgroups : under 25 years, 25 - 34, 35 - 44, 45 - 54, 55 - 64, 65 - 74, and over 75. The age of the family head is used to determine the family's category. The mean income for each subgroup is then assigned to that family, and a conventional Gini is calculated.

distribution than in the U.S. and the U.K.⁶ However, the key result is that the differences are significantly less than others have found (Ringen, 1986)(Buhman, et al., 1988).

TABLE III

Redistributive Effects of Taxes and Transfers

Country	G_0	C_N^F	G_N^F	H^F	V^F	R^F	G^A	"True" Inequality
Sweden	.446	.223	.283	-.060	.223	.163	.152	.131
U.K.	.476	.295	.315	-.020	.181	.161	.167	.148
U.S.A.	.473	.320	.346	-.026	.153	.127	.178	.168

Note 1: "Original" Income = Market Income (as defined in Table II)

Note 2: Post-fisc Income (as defined in Table II)

Note 3: Equivalent income concepts are always used. As explained in the text, family equivalent income = Y / S^e .

Note 4: "True" Inequality = $G_N^F - G^A$

⁶ Using LIS data, similar calculations were done for Australia and Canada. They suggest that age-income effects and horizontal inequities are similar in magnitude to those found in the U.K.

Country	G_0	G_N^F	C_N^F	H^F	V^F	R^F	G^A	"True" Inequality
Australia	.466	.329	.318	-.011	.148	.137	.175	.154
Canada	.450	.327	.314	-.013	.136	.123	.172	.155

VII. THE "ORIGINAL" POSITION DEBATE

Consider a society of five persons as arranged in Table IV. What exactly does it mean to say that the market outcome is "unfair" in this society? An absolutist might contend that A's income is too low to maintain a decent standard of living and that he must be improved regardless of how these funds are collected from the other members of society. A relativist might contend that E's income is too high in relation to A's regardless of whether A is below some poverty line or other needs-defined standard. One may be willing to subscribe to both of these standards of distributive justice yet agree that reranking cannot be justified under any circumstances.

TABLE IV

<u>Person</u>	<u>Market Income</u>	<u>Post-fisc 1</u>	<u>Post-fisc 2</u>	<u>Post-fisc 3</u>	<u>Post-fisc 4</u>
A	100	100	175	373	250
B	200	200	200	374	200
C	375	375	375	375	375
D	400	400	400	376	400
E	800	800	725	377	650

Post-fisc (i.e. post tax and transfer) distributions 1,2, and 3 all involve very different results in terms of vertical equity, but more important, none of the distributions have introduced horizontal inequities. Post-fisc distribution 4 has certainly compressed incomes in the society but has unfairly treated B if one is willing to argue that the market determined ranking was fair. The important point is that one need not accept market determined

incomes to argue that reranking is unfair. If one is willing to argue that there can be no justification for allowing A to end up ahead of B in the post-fisc result, it is possible to discuss horizontal equity without discussing vertical equity, and without endorsing any particular standard of distributive justice which is tied to vertical equity.

Some authors (eg. O'Higgins, et al., 1989) have also argued that market income is not a good counterfactual against which redistributive impacts can be measured. O'Higgins et. al. argue that allowing market income to represent original income "appears to assume that in the absence of government tax and transfer programs, the income distribution would be as represented by the original or market distribution." (p. 111) Apparently, O 'Higgins et. al. also question whether market income rank has any meaning. One might also argue that market ranks are "unfair," and policy should seek to rerank in some cases. Following this line of reasoning, not all instances of reranking can be considered inequitable. In this case, measures of H^f like those found in Table II will be inaccurate.

A strong case can still be made for measuring horizontal inequities by equating market income with original income. However, to examine the effect of using different original rankings, see Tables V and VI. Table V examines tax progressivity on a transfer expanded income base. Thus, original income now equals market income plus all transfer payments to individuals. H^f now determines how much reranking occurs as taxes are taken from

the expanded base. This information is useful if one is willing to question the rationale for further attempts to introduce redistribution with the tax system when transfers may have already accomplished redistributive goals.

For example, it may be argued that Sweden's transfer system is so generous and broadly accessible that it makes no sense to distort the fiscal system any further; the transfer system should be adequate to meet all redistributive goals. In this light, the size of H^T seems even more troublesome than H^F may have been for Sweden. H^T is nearly one-third V^T . The implication is that much of the redistributive effect of taxes on the expanded base is upset by the introduction of horizontal inequities.

Regardless of how one defines original income (see also Table VI), Sweden's fiscal system clearly introduces more horizontal inequities as seen by comparing H^F , H^T , and H^E across countries. Generally, it is also true that H/V is larger for Sweden, and this ratio may be viewed as an indicator of how much of the redistributive effect is lost by the introduction of horizontal inequities.

TABLE V

Tax Progressivity on Expenditure Expanded Income Base

Country	G_0	C_N^T	G_N^T	H^T	V^T	R^T
Sweden	.336	.260	.283	-.023	.076	.053
U.K.	.340	.310	.315	-.005	.030	.025
U.S.A.	.388	.338	.346	-.008	.050	.042

Note : "Original " income equals market income plus all transfers.

TABLE VI

Expenditure Progressivity on Tax Contracted Income Base

Country	G_0	C_N^E	G_N^E	H^E	V^E	R^E
Sweden	.511	.219	.283	-.064	.292	.228
U.K.	.478	.299	.315	-.016	.179	.163
U.S.A.	.455	.327	.346	-.019	.128	.109

Note : "Original" income equals market income minus all taxes (or post-tax income).

VIII. CONCLUSIONS

Policies designed to compress incomes may introduce horizontal inequities and flatten the age-income profile. To the extent that these effects occur, and are ignored by researchers measuring redistribution, the redistributive effect of tax and transfer systems is improperly measured. Compared to the U.S. and U.K., it is clear that redistribution accomplished by the Swedish system is significant. However, a substantial amount of the vertical equity gains normally associated with compression are lost because reranking induces violations of horizontal equity. These results obtain whether market income or an expanded income concept is used.

Post-fisc inequality is in the final analysis, larger in the U.S. and U.K. than in Sweden. But the wide advantage normally attributed to Sweden is shown to be significantly less than many would expect.

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