On Inter- and Intra-Individual Redistribution of the Welfare State*

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Objective. The redistributive effect of the welfare state is traditionally measured by comparing the gross and net distribution of annual income among adults. This standard approach does not account for the fact that a large share of the taxes paid by adults are paid back to the very same individuals later in life. The objective of this article is to examine the factors that determine the difference between redistribution according to the standard approach and redistribution of lifetime incomes. I also discuss under what circumstances intra-individual redistribution is beneficial for low-income earners. *Methods.* A formal model of a simple welfare state in a society with low- and high-income earners is used to describe inequality of gross and net income among adults and for complete lifetime incomes. The model is calibrated with data describing the Swedish welfare state. *Results.* Theoretically, the redistribution of lifetime income can be bigger or smaller than the redistribution indicated by the standard approach. Swedish data suggest that most welfare states are more redistributive when a lifetime perspective is used compared to the standard approach. *Conclusions.* Most of the redistribution carried out by modern welfare states is so-called intra-individual redistribution. Compared to the situation that would arise without the welfare state, intra-individual redistribution is likely to be favorable for low-income earners because it compensates for inequalities in the distribution of assets and access to capital markets.

To what extent do welfare states redistribute income vertically from high-income earners to low-income earners, and how should the redistributive effect of the welfare state be measured? The standard approach to this problem is to compare the distribution of annual gross income to the distribution of annual net income for the adult population or, sometimes, for the whole population.[1] The approach is typically based on aggregating incomes over the time period of one year. The choice of this particular time perspective, however, is arbitrary. When compared to a lifetime perspective, the standard approach may exaggerate or underestimate the redistribution taking place. This is due to the fact that welfare states typically redistribute both between individuals (interindividual redistribution) and over the life-

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[1]Examples include Korpi and Palme (1998) and Goodin et al. (1999). By net income, we mean income post tax, post transfers.

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cycle of individuals (intra-individual redistribution). So-called dynamic micro-simulation models try to capture in detail the complete welfare state for any given country (see, e.g., Falkingham and Hills, 1995). Although excellent for policy analysis, the complexity of such models means that they lack transparency and simplicity. On the other hand, simpler models of redistribution, many of which can be traced back to Atkinson (1970), are typically static and cannot account for the difference between inter- and intra-individual redistribution. The model developed here is an attempt to fill the gap by paying attention to the time perspective while keeping the transparency of static models. This will allow us to see clearly how the level of redistribution indicated by the standard approach depends both on the time perspective used and on the type of welfare state being studied.

In the next section the model and some theoretical results are presented. Then, the model is calibrated with data from Sweden. Finally, I conclude with a discussion of under what circumstances a lifetime perspective is more appropriate than the standard approach.

The Structure of Lifecycle Redistribution—A Simple Model

Theoretically, the time perspective used when describing redistribution can vary from hourly wages to complete lifetime incomes. In the model used here, we focus on comparing work income for adults and lifetime income. Starting with a simple model is convenient because it allows the exclusion of all other aspects except for the one currently being analyzed. There are important aspects of redistribution not visible in the model used here: the model is based completely on individuals. This means that there is no need to use equivalence scales and that the redistribution taking place within households is excluded. The model is a fixed-income model, and thus behavioral responses to taxes and benefits are ignored. The model is built to analyze monetary redistribution only, and no assumptions regarding the redistributive effect of public consumption (e.g., in-kind benefits) are made. Readers interested in these aspects of redistribution will find a large body of literature where these problems are treated. See, for example, Ebert and Moyes (2003) on equivalence scales, Atkinson and Bourguignon (2000) on behavioral responses, and Le Grand (1982) and Saunders (1991) for two different views about the redistributive effect of public consumption.

Having made these simplifying assumptions, the model is well suited for analyzing the importance of the time perspective. This is fruitful for at least two reasons. First, when it comes to the analysis of public redistribution, the role of the time perspective is a somewhat forgotten area of research.[2]

[2]It is well known that the time perspective matters for general inequality measures. However, the fact that inequality of income accumulated over a 10-year period is typically lower than inequality of annual income is driven mainly by the fact that short-term income

TABLE 1

A Simple Model of a Redistributive Welfare State

		Gross Income		Net Income	
Period Length		h	$1-h$	h	$1-h$
Type	Hi	h	0	$h\ (1-\eta t)$	$(1-h)b$ or $(1-h)r$
	Lo	$h\gamma$	0	$h\gamma\ (1-t)$	$(1-h)b$ or $(1-h)r\gamma$

Second, a simple model is sufficient for producing some clear results regarding public redistribution.

The model is based on the rich and the poor half of the population, called Hi and Lo. Assume that both Hi and Lo spend a proportion h of their life working, and consequently $1-h$ is the proportion of the lifecycle spent not working. Ignoring short spells of temporary sickness and unemployment, the proportion $1-h$ consists of a period in the beginning of the lifecycle and a period at the end of the lifecycle when people are too young and too old, respectively, to support themselves. To keep calculations simple, assume that Hi earns 1 per unit of time spent working, while Lo earns γ per unit of time spent working. By assuming that γ lies in the interval between 0 and 1, the ratio $1/\gamma$ can be used as a simple measure of the wage inequality in this society.[3]

To introduce a simple welfare state in the model, assume that Hi and Lo are taxed when working and receive benefits when retired. This basic welfare state can vary in two important dimensions: taxes can be proportional or progressive, and benefits can be positively income related or flat rate.[4]

Call the tax rate paid by Lo t and let the tax rate paid by Hi be ηt where $\eta \geq 1$. Thus if $\eta = 1$, Hi and Lo pay the same proportional tax rate, and if $\eta > 1$, Hi pays proportionally more.

To describe benefits, let b be the level of flat rate (also known as basic) benefits equal for both Hi and Lo, and let r be the income-replacement rate used if benefits are proportional to earnings. The model is summarized in Table 1.

Because Hi and Lo each represent 50 percent of the population, total tax revenue will be $0.5th(\gamma+\eta)$. Letting c denote public expenditure not directly paid back to individuals (e.g., expenditure on public goods), total public expenditure will be $b(1-h)+c$ if benefits are flat rate and $0.5(1-h)r(1+\gamma)+c$ if benefits are income related.

variations (such as temporary spells of unemployment) have smaller effect in the long run (cf. Björklund, 1998; Goodin et al., 1999). This effect arises independently of the welfare state.

[3]Smeeding (1997) calls this income ratio social distance. In a model with only two different incomes, the inequality ratio behaves just like more complex measures of inequality, such as the Gini coefficient.

[4]Strictly speaking, some further possibilities do exist: taxes may be regressive, and benefits may be targeted (i.e., negatively income related). We limit the analysis by excluding these scenarios.

To determine the tax rate needed to finance different benefit levels, we assume that total tax revenue equals total expenditure. For flat-rate benefits, this means that $0.5th(\gamma+\eta) = b(1-h)+c$. Solving this expression for the tax rate we get:

$$t = \frac{2(b(1-h)-c)}{h(\gamma+\eta)}.$$

The expression for the tax rate confirms that the required tax rate is lower when benefits are lower, when people work longer, and when Lo's relative income γ is higher.

Now, what happens if the standard approach is used to describe the redistributive effect of this welfare state? To see this, let I^g denote gross income equality among working individuals. Because both Hi and Lo work equally long, we have $I^g = 1/\gamma$. Inequality of net income among workers, denoted I^n, is $(1-\eta t)/\gamma(1-t)$. Thus, the standard approach would indicate that this welfare state is redistributive only if $\eta > 1$, that is, if progressive taxes decrease the income ratio between Hi and Lo.

Now change the time perspective and study the lifetime incomes of Hi and Lo. If benefits are flat rate, net lifetime inequality, denoted I^l, is $(1-\eta t+b)/(\gamma(1-t)+b)$, and for any positive level of benefits (b), we can conclude that $I^l < I^n$. This can be summed up as follows:

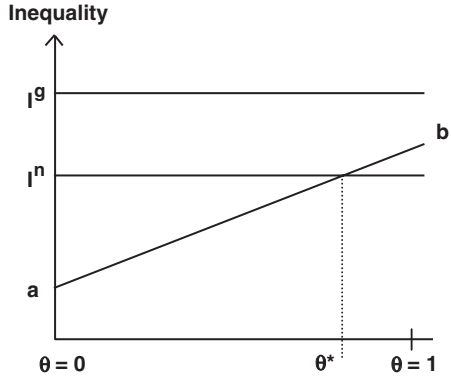
- When benefits are flat rate, the welfare state redistributes from Hi to Lo even if taxes are proportional. The redistributive effect is visible only from a lifetime perspective.
- If benefits are income related with replacement rate r, net lifetime inequality will be $(1-\eta t+r)/(\gamma(1-t)+r\gamma)$, which leads to the following conclusion:
- When benefits are income related, the welfare state does not redistribute from Hi to Lo if taxes are proportional. If taxes are progressive, redistribution will take place, but the redistributive effect will appear bigger using the standard approach compared to the lifetime perspective.

It is no news that a welfare state with proportional taxes and flat-rate benefits has a redistributive effect (cf. Rothstein, 1998). This model highlights the fact that when taxes and benefits are separated in time, the total effect will only be visible if a lifetime perspective is chosen.

To examine how the choice of time perspective has different effects for different types of welfare states, the model will now be modified to make it slightly more realistic. In reality, no welfare states provide completely income-related benefits to the old, nor are the benefits completely flat rate. An obvious example is pension benefits that are income related within an interval between upper and lower limits. To model intermediate systems, let the parameter θ describe the proportion of income-related benefits. More specifically, assume that the benefit level received when retired is $\theta r+(1-\theta)b$ for Hi, and $\theta r\gamma+(1-\theta)b$ for Lo. Thus $\theta = 1$ is the case

FIGURE 1

The Redistributive Effect of Different Types of the Welfare States



when benefits are completely income related and $\theta = 0$ is the case when benefits are completely basic. Figure 1 illustrates inequality levels arising under different scenarios.

The two horizontal lines in Figure 1 mark gross inequality (I^g) and net inequality (I^n) among the working. The distance between the two is the effect of progressive taxes levied on work income, given by the parameter η. This is the effect captured by the standard approach.

When the perspective is changed to lifetime incomes, a bigger redistributive effect will show up if benefits are sufficiently flat rate—but a smaller redistributive effect will be the result if benefits are sufficiently income related. Inequality of lifetime income is indicated in Figure 1 by the line ab where a is the point where benefits are completely flat rate, and b is the point where benefits are completely income related. The value of θ, denoted θ^* in Figure 1, is crucial: if the proportion of income-related benefits is higher than θ^*, the redistributive effect on lifetime incomes is smaller than the effect on incomes among the working.

A curiosity worth noting is that the Point b in Figure 1 may actually be closer to I^g than to I^n. In this case, inequality of gross income would actually be a better approximation of net lifetime income inequality compared to the standard approach. These welfare states can be called illusively redistributive welfare states because assessing the redistributive effect of such welfare states using the standard approach may be misleading. Using the expression for the tax rate derived earlier, it can be shown that the vertical distance between gross income equality and the Point b in Figure 1 is smaller than the distance between Point b and net income inequality among the working if the replacement rate (r) is high enough. The exact condition, derived in Bergh (2003), is:

$$r > \frac{(h(\gamma + \eta) - 2c)}{(1 - h)(\eta + 2\gamma + 1)}.$$

Examining this expression reveals that the crucial replacement rate above which the property of illusive redistribution kicks in is increasing in tax progressivity (η), increasing in time spent working (h), and decreasing in public expenditure other than lifecycle redistribution (c).

To intuitively understand these results, think of a welfare state with only weakly progressive taxes and a long working period before retirement. This leads to the standard approach indicating very low redistribution. This would be correct also from a lifetime perspective because only a small proportion of the lifecycle is spent not working. On the other hand, if people work for only a short period of time, and are subjected to very progressive taxes during this time, the standard approach will paint a very different picture than the lifetime perspective, even if replacement rates are low.

Having noted the theoretical possibility of illusive redistribution, two new questions need to be answered.

1. Are existing welfare states more or less redistributive in terms of lifetime incomes than they appear according to the standard approach? Phrased differently, is the θ value for existing welfare states more or less than θ^* in Figure 1?
2. When the degree of redistribution varies depending on the time perspective, what time perspective is more appropriate?

The first question can be solved by using actual values of the parameters h, γ, c, t, b, and r and then calculate θ^* for any given actually existing welfare state. The values chosen are based on the situation in Sweden in the year 2000, as described in Table 2.

Using the values in Table 2, the inequality levels in Figure 1 can be calculated numerically. Gross income inequality is simply $1/0.6 = 1.67$; net income inequality among the working is $(1 - \eta t)/(\gamma(1 - t)) = 1.51$. Inequality of net lifetime income will depend on θ, and the crucial value θ^* is equal to 0.81. This means that if more than 81 percent of the benefits in the lifecycle redistribution of the Swedish welfare state are completely income related, then the redistribution of lifetime income is smaller than the redistribution of income among the working. It seems safe to conclude that the Swedish welfare state is more redistributive in terms of lifetime incomes compared to incomes among the working.[5] Because Sweden is well known

[5]In 2000, the lifecycle redistribution to the retired in Sweden amounted to approximately 12 percent of GDP. The only explicitly positively income-related component is the partially income-related part of the public pension system ATP, at approximately 5 percent of GDP, according to public statistics. Including 50 percent of the public health-care expenditures as lifecycle redistribution does not change the main conclusion.

TABLE 2

Parameter Values Based on the Current Swedish Situation

Parameter	Value	Comment
h	0.5	Based on a life expectancy slightly above 80, a retirement age slightly above 60, and a labor force entry at approximately 20.
γ	0.6	The poorer half of the population each year earns 60 percent of what the richer half does. The average tax rate is 10 percent higher for the richer half. Own calculations based on full-time employees age 20–64. Source: Statistics Sweden (1999:Tables 49 and 50).
η	1.1	
c	0.12	Corresponds to 31 percent of GDP devoted to public expenditure not considered to be lifecycle redistribution. Note that GDP in the model is $0.5h(1+\gamma)$.
t	0.49	Corresponds to total tax revenue at 52 percent of GDP.
r	0.21	These values are calculated by assuming a balanced budget so that total tax revenue equals total expenditures.
b	0.17	The value of b is for the case where all benefits are basic, and the value of r holds if all benefits are income related. This allows us to use the parameter θ to construct a balanced budget combination of the two extreme cases where benefits are completely flat rate or income related, respectively.

for having a high level of public lifecycle redistribution with high positively income-related benefits, it is likely that the same conclusion applies to other welfare states as well.

What Time Perspective is More Appropriate?

It is not obvious that the most appropriate measure of the redistributive effect of the welfare state is the interindividual redistribution of lifetime income. To see this, consider the following two situations.

- *Situation A*: In the two-period model from the previous section, Lo has no work income: $\gamma = 0$. The welfare state taxes Hi, and in the next period, both Hi and Lo receives the flat-rate benefit b.
- *Situation B*: Identical to Situation A, with the exception that the welfare state gives Lo the benefit b during the first period, not in the second.

From a lifetime perspective, the welfare state appears to be equally redistributive in both situations. However, it is not necessarily the case that the redistribution of lifetime income produces a redistribution of consumption possibilities in both situations—this depends on the distribution of assets and on the possibilities of using capital markets for consumption smoothing. In Situation B, Lo can smooth consumption over her lifecycle simply by saving. Consumption smoothing is more difficult in Situation A. One possibility is that Lo has assets that can be consumed during the first period while waiting for the benefit in Period 2. If Lo lacks assets, another possibility is that capital markets allow Lo to borrow with future benefits as security.[6] In terms of redistribution of consumption possibilities, Situations A and B are equivalent only if capital markets work flawlessly or if Lo has private assets that can be used for consumption smoothing.

In a more realistic case, where both assets and access to capital markets are unequally distributed in Hi's favor, it can be argued that the lifetime perspective is misleading because it forces us to view Situations A and B as equivalent when this seems highly unreasonable. Under such circumstances, public intra-individual redistribution is favorable to low-income earners. The need for intra-individual redistribution has empirical support: Rank and Hirschl (2001) show that between the ages of 25 and 75, 51 percent of Americans will have an income below the poverty line during at least one year, and 51 percent will experience at least one year of affluence (defined as having an income higher than 10 times the poverty line). This suggests that in many cases income smoothing could alleviate poverty. What we do not know is to what extent individuals in different income intervals are able to

[6]Strictly speaking, Situations A and B are equivalent only if the benefits received late in life are high enough to compensate for the interest that must be paid when borrowing (and would be gained when saving).

use assets and capital markets to achieve consumption smoothing. Another example is Attanasio et al. (2002), who use cohort data for U.K. households to show that income inequality within cohorts rises steeply with age while expenditure inequality rises much less steeply, and that for some cohorts and time periods, expenditure inequality seems to be constant. The authors conclude that there is something happening to incomes that is not completely feeding through to consumption, and attribute this to intertemporal consumption decisions. It remains to be explored how these intertemporal consumption decisions vary between different income intervals.

So far, I have described what the redistributive effect will look like from two specific perspectives: annual work income, and lifetime income. The analysis can easily be made more general. Let $R(d)$ be the ratio between inequality of gross and net income accumulated over a time period of d years. The higher ratio, the bigger is the difference between gross and net inequality, and the bigger is the redistribution. Thus $R(1)$ is simply the redistribution according to the standard approach, and $R(d_l)$ is the redistribution of lifetime income given that d_l is the duration of a complete lifecycle.[7] As shown previously, $R(1)$ will be bigger or smaller than $R(d_l)$ depending on the type of taxes and transfers used.

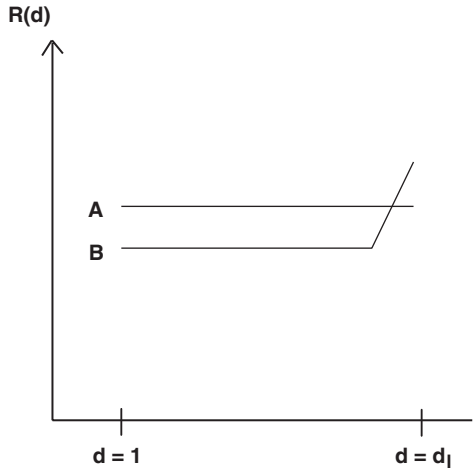
Theoretically, it is straightforward to calculate for any welfare state a curve $R(d)$ where d is increased from 1 to d_l. The $R(d)$ curve describes the redistribution of the welfare state when evaluated from different time perspectives. For values of d close to 1, $R(d)$ will mainly reflect the effect of the personal income tax. If taxes are progressive, then inequality of posttax income will be smaller than inequality of pretax income. When the time period is increased, an increasing number of short-term benefits will be included in the measure. If these benefits are positively income-related social insurance benefits, such as sickness pay, this is likely to decrease the redistributive appearance of the welfare state. However, if low-income earners are more likely to receive social insurance benefits, positively income-related benefits might still generate some vertical monetary redistribution. When the time period is increased even more, pension benefits will also be included. Finally, when the time period is the complete lifecycle, all intraindividual redistribution will be paid back to each individual, and $R(d_l)$ contains only the effects of interindividual redistribution.

Consider now the two $R(d)$ curves in Figure 2. Welfare State A has slightly progressive taxes and, toward the end of the lifecycle, benefits leave the redistributive effect constant. Welfare State B, however, has less progressive taxes on everyone during the main part of the lifecycle, but toward the end of life, big redistributive benefits are paid out, causing the redistribution of lifetime income to be higher than in Welfare State A. How do

[7]Variations in longevity are ignored because they raise complex normative questions: Should a short and wealthy life be considered equivalent to a long but poorer one if the total lifetime income is the same? Such questions justify a separate analysis.

FIGURE 2

R(*d*)-Curves for Two Hypothetical Welfare States



these welfare states compare in terms of redistribution of consumption possibilities? The answer once again depends on the distribution of assets and on how well the capital markets are functioning. If they work well, or if low-income earners have sufficient assets, then Welfare State B is without doubt the most redistributive. This is so because even if Welfare State A levies higher progressive taxes on work income, low-income earners in Welfare State B know that toward the end of the lifecycle they will receive high benefits. Knowing this, they can increase their consumption earlier in life, either by consuming assets or by borrowing against future benefits from the welfare state.

The answer also depends on the degree of political uncertainty. Welfare State B is subjected to the risk that the rules are changed and that the equalizing benefits are not paid out. Even a small political uncertainty can substantially decrease the possibilities of enjoying, for example, high pension benefits early in life.

What we have shown is that even if the complete $R(d)$ curves for two welfare states are known, there is no simple rule for determining which of the two is the most redistributive.

It is possible to include political uncertainty and capital market imperfections in the measure inequality simply by analyzing consumption inequality rather than income inequality. This follows from the so-called lifecycle hypothesis (Ando and Modigliani, 1963), according to which individuals try to smooth consumption over the lifecycle. If consumption smoothing is possible, inequality of consumption among the working will reflect inequality of lifetime income.

In terms of Welfare States A and B in Figure 2, using inequality of consumption among workers will lead us to conclude that Welfare State B is

more redistributive than Welfare State A only if the higher redistribution of lifetime income actually translates into more equal consumption patterns throughout the lifecycle. However, this observation does not mean it is possible to compare the redistributive success of different welfare states in different societies because consumption inequality does not depend on public redistribution only. Thus, when it comes to general measurement of inequality of condition, inequality of consumption is probably more appropriate than inequality of income. However, we cannot know for sure the extent to which equality of consumption depends on the redistribution of the welfare state. To describe the redistributive effect of the welfare state, we would need to compare actual consumption inequality to the hypothetical consumption inequality that would arise without the welfare state. Doing this requires assumptions regarding the extent to which it would be possible for individuals to smooth consumption over their lifecycles in the absence of a welfare state. The extent to which intra-individual redistribution should be reflected in measures of interindividual redistribution depends on the distribution of individual possibilities to perform similar redistribution themselves in a society without a welfare state.

Conclusions

We have shown that the standard approach to describing the redistributive effect of the welfare state does not take into account the difference between inter- and intra-individual redistribution. Consequently, it is not advisable to rank the redistributive success of actual welfare states only according to the difference between inequality of gross and net annual income. It may well be the case that the ranking is reversed when the time perspective is changed from one year to longer periods. A careful conclusion to be drawn from this is that if the standard approach is used, it should be complemented with a system-based analysis in order to examine if the redistribution registered by the standard approach is strengthened or weakened by transfers that do not show up in annual data.

It has also been shown that even if measures based on the lifetime perspective solve some problems with the standard approach, the lifetime perspective cannot generally be recommended over the standard approach. This is the case because the timing of benefits has a large effect on the distribution of consumption possibilities when capital markets are imperfect, when assets are unequally distributed, or when there is political uncertainty regarding future benefits.

The empirical application to the case of Sweden suggests that the redistributive effect of the Swedish welfare state is strengthened when viewed from a lifetime perspective. If Sweden can be considered a society with relatively well-functioning capital markets and relatively low uncertainty regarding the future of the welfare state, then there seems to be a case for

arguing that the redistributive effect of the Swedish welfare state is bigger than suggested by measures based on the standard approach. At least, this is the conclusion reached by modeling the redistribution between the richer half to the lower half of the population and assuming that life lengths and retirement decisions are equal for both groups. Relaxing these assumptions and thereby increasing the realism of the theoretical model are two obvious suggestions for future research.

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