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May Growth Lead to Higher Deprivation Despite Higher Satisfaction?

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Abstract

In a relative deprivation framework, unless inequality is reduced, growth is associated with both higher satisfaction and higher deprivation. This may help explain the discontent with growth despite its benefits. As is well known in the literature, knowledge of the population's mean income and Lorenz curve is all that

is needed to analyze a distribution, so that this can also be used to assess the satisfaction and deprivation of each individual. Given the normalization used to derive the satisfaction and deprivation measures, satisfaction and deprivation add up to the mean income for the population as a whole as well as for each individual.

This paper—a product of the Development Dialogue on Values and Ethics, Human Development Network—is part of a larger effort in the network to look at some of the assumptions behind standard economic models to assess how conclusions may depend on the assumptions of the models. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The corresponding author may be contacted at qwodon@worldbank.org.

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May Growth Lead to Higher Deprivation Despite Higher Satisfaction?

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1. Introduction

This paper deals with a paradox. Many countries have experienced substantial economic growth over the last two decades (even if this has been dampened recently by the current global economic crisis), and yet there is widespread discontent with the distribution of the benefits from growth. This may reflect a feeling of economic insecurity due to trade openness and liberalization. But it may also reflect feelings of deprivation despite higher standards of living. More precisely, while an individual's well-being or satisfaction depends on what the individual actually consumes, deprivation depends on what the individual is not able to consume, but would like to consume because he/she sees others consuming it. If growth leads to a larger pie and more goods to be desired, it can also lead to a higher feeling of deprivation. In order for this feeling of deprivation to be reduced, growth may have to be accompanied by lower inequality.

The concept of relative deprivation was put forward by Stouffer et al. (1949) in their monograph *The American Soldier: Adjustment During Army Life*, and the classic reference is Runciman (1966),² but Rainwater (1974) suggests that the concept goes at least back to Marx, who wrote: "*Our desires and pleasures spring from society, we measure them therefore, by society and not by the objects which serve for their satisfaction. Because they are of a social nature they are of a relative nature* (quoted by Pedersen, 2001)." Note that the relativity of the concept comes from the reference to the society. Keeping an individual's consumption unchanged, while changing the consumption of other members of the society, may affect the

² Runciman (1966) wrote his book to explain another paradox – that according to his observations, in Britain, the lower the observed inequality, the higher the feelings of deprivation are.

individual's satisfaction.³ Among economists, the concept has not been used as extensively⁴, in part because economists typically assume that the satisfaction provided to any one individual by his/her income does not depend on the income of others, or more precisely, on his/her rank in the overall distribution of income. This assumption is relaxed in Yitzhaki's (1979, 1982) formalization of Runciman's theory of relative deprivation, which leads to a social welfare function equal to the product of the mean income in the population as a whole times one minus the (extended) Gini index of inequality.

There is empirical evidence that individuals do care about relative consumption and deprivation (see for example Alpizar et al., 2005). There is also a debate regarding the link between growth and various measures of subjective well-being. Easterlin (1974, 1991, 1995, 2005) suggested a lack of relationship between economic development and average levels of happiness, but new evidence provided by Stevenson and Wolfers (2008) suggests that higher GDP per capita level may lead to higher subjective feelings of well-being. Part of the complexity in these relationships between growth and well-being stems from the fact that many factors affect subjective feelings. That is, the relationships between growth and feelings of deprivation, satisfaction and happiness is not straightforward, and these various concepts may refer in the mind of authors to quite different things. In this paper, we focus on the links between growth, deprivation and satisfaction within Yitzhaki's relative deprivation framework. This of

³ The group from which the individual derives his aspirations is referred to as the reference group. In the general case, an individual may have several reference groups, and the reference groups of different individuals may differ and change over time. Those extensions are beyond the scope of this paper.

⁴ As noted by Pedersen (2001), a handful of economists have considered deprivation in applied work, including Layard (1980) on the role of status ranking in motivation, and members of the so-called Leiden school for work on poverty and well-being (van Praag 1971; Kapteyn et al 1980; Kapteyn and Wansbeek 1982; van de Stadt et al. 1985). See also the axiomatic definitions of relative deprivation proposed by Podder (1996). There are two fields in which relative deprivation is extensively used: Health and mortality (Eibner and Evans, 2001; Deaton, 2001), and migration (Quinn, 2001; Stark, 1984; Stark and Taylor 1989; Stark and Wang, 2000; Stark and Yitzhaki, 1988).

course does not mean that other factors do not also affect feelings of deprivation, satisfaction and more generally happiness, as pointed out by Dean (2007) among others.

While other authors (e.g., Berrebi and Silber, 1985; Bishop, Chakraborti and Thistle, 1991, and Sen, 1973) have used the same social welfare function, Yitzhaki relies on this function specifically in the context of relative deprivation, as opposed, for example, to the argument that individuals may compare themselves to others when evaluating their level of well-being (Duclos, 1998, and Hey and Lambert, 1979). It may well be true that individuals compare themselves to others,⁵ and the Gini index itself can be written as a sum of such pairwise comparisons of income, but the logic in Runciman's argument is different. It relies on the idea that scarcity determines the value attached to each unit of income, and in Yitzhaki's formalization of this idea, on a given measure of scarcity. Ebert and Moyes (2000) present axiomatic derivation for the relative deprivation function⁶.

The idea that individuals value goods (in order to assess their satisfaction or deprivation) in relationship to their rank in the overall population as a measure of scarcity has been suggested in other settings. Within a firm, the value of a position depends on how high the position is in the overall distribution of positions (Stark and Yitzhaki, 1988). The smaller the number of Vice Presidents, the higher the value of being a Vice President.

Another imperfect, yet possibly revealing analogy is that of the decathlon, an athletic two-day event with ten different disciplines (100 meters sprint, long jump, shotput, high jump, and 400 meters in that order on the first day, and 110 meters hurdle, discus, pole vaults, javelin,

⁵ Duesenberry (1951), Frank (1985), and Kapteyn et al. (1980) present evidence on the dependency of preferences on others. For a survey of the issues involved, see Weiss and Fershtman (1998).

⁶ There have also been a number of extensions of and alternatives to the approach proposed by Yitzhaki to analyze relative deprivation. For example, Verme and Izem (2008) suggest an alternative index of relative deprivation that allows for the selection of the reference group and imperfect information, with an application to US wage data. See also Hopkins (2008) for a survey of different theoretical models of relative concerns and their link to inequality.

and 1500 meters on the second day). A scoring table is used to award points for performance in each discipline, and the winner is the athlete with the highest total score after the ten events. To draw the analogy with a market economy, the ten disciplines can be considered as commodities, and the scoring system as prices. The utility function of each athlete may be defined over the physical units of achievements in every field. The first stage in constructing the analogy, can be referred to as the micro-economic problem: each athlete allocates his/her practicing time in order to maximize his/her utility subject to a time constraint and the scoring structure (prices). A proper solution (in a competitive environment) is to allocate time so that, for each athlete, the marginal cost of achieving each additional point is equal for the various events. The allocation of time and effort may also be interpreted as if each athlete were maximizing his/her points (income) subject to the time constraint. The second stage is the general equilibrium process which determines the prices. To reach an “equilibrium”, the scoring structure is adjusted by a committee to avoid that any one discipline overshadows all others (in our analogy, this is akin to the demand and supply mechanisms in markets).

The result of applying the prices (scores) to individual achievements in each field to get the total score of the individual athlete is that we end up with points of equal value from the point of view of production (given the pricing system, each point requires an equal marginal cost or effort to produce). However, an athlete’s satisfaction depends not only on his/her total score, but also on the achievement of others; in other words, it depends on his/her ranking. We refer to this process of evaluation as the social evaluation, and relative deprivation theory is applied at this stage. We will show that given the distribution of abilities, and given our formalization of relative deprivation theory, the social evaluation for each athlete can be summarized by the rank of the athlete. We argue that there is no envy nor altruism, except the need to be able to evaluate

the achievement of the various athletes. We show that if there is an overall inequality-neutral improvement in scores, there is higher satisfaction (all athletes have improved their personal record), but there is also higher deprivation because the distance separating the athletes from those at the very top has increased. However, if there is a constant increase in points that is equal among all athletes, then satisfaction increases while deprivation stays at the same level.

The same idea can be applied to growth. In a relative deprivation framework, unless inequality is reduced, growth is associated with both higher satisfaction and higher deprivation, which may help explain the discontent with growth despite its benefits. This is in turn related to a distinction by Kolm (1976) between “rightist” and “leftist” inequality measures. A rightist inequality measure does not change if a proportionate amount of income is added or subtracted from all incomes. This is of course a property of most traditional measures of inequality, including the (extended) Gini index. By contrast, a leftist inequality measure does not change if an absolute amount of income is added or subtracted from all incomes. We will show that the concept of deprivation, as used here, is a leftist approach.

In what follows, we use Yitzhaki’s formalization of deprivation theory to analyze the impact of growth and changes in inequality on satisfaction and deprivation. The main conclusion is very simple. Growth will often increase both satisfaction and deprivation in a society. The fact that growth increases satisfaction is trivial. The fact that it also increases deprivation is less clear. It occurs because growth also increases the scope of commodities to be desired. Therefore, unless growth is accompanied by a reduction in inequality, it is not going to decrease the feelings of deprivation in countries that experience it, and therefore we should expect dissatisfaction from growth. This may help explain part of the discontent in many countries, even in the countries that have done relatively well over time. The paper provides also

a number of new results, as well as an intuitive graphical interpretation of the concepts of satisfaction and deprivation. The most important new result is that the knowledge of the population's mean income and the Lorenz curve is all that is needed to assess the satisfaction and deprivation of each individual. This is because for both the population as a whole and each individual, satisfaction and deprivation add up to the mean income.

2. Growth, Satisfaction, and Deprivation

In textbook economics, social welfare is assumed to be symmetric and additive. Symmetry implies that two individuals with the same income have the same level of welfare. Additivity implies that welfare for society as a whole is the sum (possibly adjusted for population) of individuals' welfare. Denoting social welfare by W , individual income by I_i , prices by p , and the individuals' indirect utility function by w (assuming that two individuals with the same income have the same social evaluation of the indirect utility function), an additive social welfare function can be written as:

$$W = \sum_{i=1}^N w(I_i, p) \quad (1)$$

According to Runciman (1966:10): “[a person] is relatively deprived of X when (i) he does not have X , (ii) he sees some other person or persons, which may include himself at some previous or expected time, as having X (whether or not that is or will be in fact the case), (iii) he wants X , and (iv) he sees it as feasible that he should have X .” In formalizing Runciman's discussion, Yitzhaki (1979, 1982) suggests that each unit of income (say, a dollar), represents a basket of commodities that individuals can buy (a unit of income should be interpreted as normalizing the different commodities to units of equal cost to produce; we will elaborate on this point later.) Each dollar represents a bundle of commodities with equal marginal alternative

cost, but the social value for the individual (the marginal utility or the social evaluation of the marginal utility) associated with the first unit of income (dollar) is higher than that associated with the second, which in turn is higher than that associated with the third, etc. While each unit of income can be considered as X in Runciman's quote above, the value that individuals attach to each X depends on the number of individuals they see having X. There is no envy nor altruism, it is simply a way of evaluating what one has.

Following Runciman, Yitzhaki suggests to measure deprivation (and satisfaction) by the share of the population, which has X.⁷ As shown in the appendix, it is possible to generalize the function by allowing deprivation to be a decreasing function of the share of the population which have X. This, then, uses the extended Gini as opposed to the standard Gini presented below. In other words, all the results presented here can be generalized to allow flexible (social) preferences. Since the gain from such an extension is overshadowed by the complexity, this extension is relegated to the appendix.

The dependency of the social valuation on scarcity may be interpreted as an extension of the law of diminishing marginal utility, which says that *ceteris paribus*, the more of commodity X one has, the lower its marginal utility. Applying the same rule to units of income, the more people one sees as not having the unit, the less deprived one feels from not having it. Alternatively, the more people one sees having it, i.e., the less people are deprived of it, the more important for a person to have the unit and hence the more the person feels deprived from not having it. Denoting by $F(I_i)$ the position of individual i in the cumulative distribution of income, this leads to a social evaluation of the marginal utility of income equal to $1-F(I_i)$, because this term represents the share of people in the society who have the I -th unit of income. The

⁷ We assume that there is one reference group, identical to all members of the society, and it is the society as a whole.

satisfaction of the individual is defined as the sum of the satisfaction derived from each unit of income he possesses while his deprivation is the sum of deprivations from all units of income that he does not possess. This yields the following values for individual satisfaction $s(I_i)$ and deprivation $d(I_i)$:

$$s(I_i) = \int_0^{I_i} [1 - F(z)] dz \quad \text{and} \quad d(I_i) = \int_{I_i}^{I_B} [1 - F(z)] dz, \quad (2)$$

where I_B is the maximum income observed in the society. That is, the social value of the income is the sum of the social values of the units of income one possesses, while deprivation is the sum of the feelings of deprivation on all units of incomes one is deprived of. For each individual, satisfaction and deprivation add up to the population's mean income. To see this note that:

$$s(I_i) + d(I_i) = \int_0^{I_B} [1 - F(z)] dz. \quad (3)$$

Integrating by parts the right hand side term, with $u=1-F(z)$, $u'=-f(z)$, $v'=1$, $v=z$, leads to:

$$\int_0^{I_B} [(1 - F(z))] dz = [1 - F(z)]z \Big|_0^{I_B} + \int_0^{I_B} zf(z) dz = \mu \quad (4)$$

In Equation (2) deprivation is defined on the units of income that the individual does not have (but sees other people having). Satisfaction is defined on the units of income the individual possesses. In this sense, deprivation is a mirror image of satisfaction.

It is shown in the Appendix, that the satisfaction of individual i can also be written as:

$$s(I_i) = \mu[(1 - F_i)L'(F_i) + L(F_i)] , \quad (5)$$

where F_i is the rank of individual i in the society, $L()$ is the Lorenz curve, and $L'()$ is the derivative of the Lorenz curve (the derivative of the generalized Lorenz curve is $\mu L'()$.) Note

that although (5) suggests that satisfaction is a decreasing function of the rank of the individual in the society, a full derivative would show that satisfaction is an increasing function of rank. Note also that while the satisfaction of each individual is a function of his/her income, (5) shows that given the Lorenz curve, one can find the satisfaction of each individual by knowing only the mean income in the society and the rank of the individual in the distribution of income.

The deprivation of the individual is:

$$d(F_i) = \mu - w(F_i) = \mu[(1 - L(F_i)) - (1 - F_i)L'(F_i)] , \quad (6)$$

which implies again that given the shape of the Lorenz curve, individual deprivation can be estimated by knowing the rank of the individual, and the mean income in the population.

Figure 1, which provides a graph of the generalized Lorenz curve, shows the connection between the rank of the individual and his/her satisfaction and deprivation.⁸ On the vertical axis on the right, the distance from the horizontal axis to A is equal to $\mu L(F_i)$, and the distance from A to B is equal to $\mu(1-F_i)L'(F_i)$. Hence individual satisfaction is measured by the height of B. Since for each individual satisfaction and deprivation add up to the population's mean income, the distance from B to C is the measure of individual deprivation. At the aggregate level, the area between the diagonal OC and the generalized Lorenz curve is equal to half the population's deprivation, namely $\mu G/2$. The area below the generalized Lorenz curve is equal to half the population's satisfaction, namely $\mu(1-G)/2$. The fact that for a given mean, a higher level of inequality leads to lower satisfaction and higher deprivation is thus easy to visualize. It can also

⁸ The concept of rank is usually associated with positional goods (e.g., Frank, 1985). Note, however, that we did not assume here that the units of income are positional goods, and we have derived the rank as a summary statistics that describes the satisfaction of the individual.

be shown that the higher the rank of any individual, the lower his/her deprivation is, and the higher his/her satisfaction is as well. The proof is based on the convexity of the Lorenz curve.⁹

Aggregating satisfaction and deprivation in society as a whole yields:

$$S = \int_0^{I_B} s(z)f(z)dz \text{ and } D = \int_0^{I_B} d(z)f(z)dz \quad (7)$$

Denoting by G the Gini index of inequality, and by μ the mean income in the population, Yitzhaki (1979) proves that (5) is equivalent to:

$$S = \mu(1-G) \text{ and } D = \mu G \quad . \quad (8)$$

Finally, it is worth emphasizing that one could use more complicated measures of the deprivation resulting from the scarcity of the I -th unit of income, such as $(1-F(I))^v$, where $v > 1$ is a parameter determined by the investigator, to get the same qualitative results. See the Appendix.

A key implication of the above is that in principle, knowing whether mean income and inequality have increased or decreased (without knowing the magnitude of the changes in each) is insufficient to know the direction of the change in satisfaction and deprivation. However, because inequality in per capita income tends to change at a much slower pace than mean per capita income, it is likely that the impact of growth on satisfaction and deprivation will be larger than the impact of changes in inequality. This leads to the paradox alluded to in the introduction. If inequality remains unchanged, while growth will lead to higher satisfaction, it will also lead to higher feelings of deprivation, in the sense that what individuals do not have, but wish they had and believe they could have (because others now have it), will increase as well.

⁹ A sketch of the proof: Let $F_1 < F_2$ be two ranks, and let $L(F_1) < L(F_2)$ be the associated points on the Lorenz curve. Because of the convexity of the Lorenz curve, $L(F_2) > L(F_1) + (F_2 - F_1) L'(F_1)$ and $[L'(F_1) - L'(F_2)](1 - F_2) < 0$.

3. Conclusion

Our main objective in this paper has been to provide a better understanding of the nature and properties of the theory of relative deprivation, as formalized by Yitzhaki (e.g., 1979, 1982). In a relative deprivation framework, unless inequality is reduced, growth will be associated with both higher satisfaction and higher deprivation, so that there may be some discontent with the growth process even though it does clearly provide benefits. The theory of relative deprivation may help in explaining the apparently widespread discontent with traditional growth processes which have not led to reductions in inequality. While the framework does not help in suggesting how to achieve both growth and a reduction in inequality, it points to the necessity of doing more work in this area because growth alone is probably not good enough.

The paper has also provided new results and an intuitive visualization of the concepts of satisfaction and deprivation. Since information on mean income and the Lorenz curve provide a full characterization of a distribution of income, knowledge of the population's mean income, of the Lorenz curve, and of an individual's rank in the distribution of income is all that is needed to assess the satisfaction and deprivation of the individual. Given the normalization used to derive the satisfaction and deprivation measures, satisfaction and deprivation add up to the mean income for the population as a whole as well as for each individual.

Appendix

This appendix proves the main results of the paper. We will derive the results using the extended Gini. To derive the results presented on the Gini, simply set $v=2$, and repeat the steps. Assume that due to scarcity, the value attached to a unit of income is $[1-F(y)]^{v-1}$, where $v > 1$ is a constant and $F(y)$ is the cumulative distribution of income. Note that $1-F(y)$ is the number of individual who do posses income unit y . The satisfaction of the individual is the sum of the satisfactions from all the units of incomes that he/she possesses, while the deprivation is the sum of the deprivation from all the units that he/she does not have. That is, for an individual with income I_i :

$$s(I_i) = \int_0^{I_i} [1 - F(y)]^{v-1} dy \quad \text{and}$$

$$d(I_i) = \int_{I_i}^{\infty} [1 - F(y)]^{v-1} dy .$$

Using integration by part with $u=[1-F(y)]^{v-1}$, $u'=- (v-1)[1-F(y)]^{v-2} f(y)$, $v'=1$, $v=y$, we get:

$$s(I_i) = [1 - F(I_i)]^{v-1} I_i + \int_0^{I_i} [1 - F(y)]^{v-2} y f(y) dy .$$

By transformation of the variable $F_i=F(I_i)$, and using $I_i/\mu = L'(F_i) = \partial L/\partial F$ as the derivative of the Lorenz curve, one gets

$$s(I_i) = \mu[(1 - F_i)^{v-1} \frac{\partial L}{\partial F} + v \int_0^{F_i} (1 - F)^{v-2} \frac{\partial L}{\partial F} dF] .$$

This implies that given the Lorenz curve, the mean income in the society and the rank of each individual in the distribution of income fully determine the satisfaction and the deprivation

of the individual in the society. Yitzhaki (1983) then shows that summation of the satisfaction over all members of the society leads to:

$$S = \mu(1 - G(v)) = \int_0^{\infty} s(I)f(I)dI$$

where $G(v)$ is the extended Gini. Similarly, Average deprivation in the society is:

$$D = \mu G(v).$$

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Figure 1: The Generalized Lorenz Curve, Satisfaction and Deprivation.

