

## **Why the Rich Are Nastier Than the Poor – A Note on the Distribution of Wealth When Individuals Care for Payoff Differentials\***

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*Some have too much,  
yet still do crave.  
EDWARD DYER*

*Der Reichtum gleicht dem Meerwasser:  
Je mehr man davon trinkt,  
desto durstiger wird man.  
ARTHUR SCHOPENHAUER*

*The great ones eat up the little ones:  
I can compare our rich misers  
to nothing so fitly as to a whale;  
a' plays and tumbles, driving the poor fry before him,  
and at last devours them all at a mouthful.  
WILLIAM SHAKESPEARE*

### I. INTRODUCTION

There is ample empirical evidence that individuals do not simply maximize expected monetary income. Rather, relative positions seem often more important than absolute ones. This can cause surprising effects. In Hesse (Germany), for example, the government has recently decided to abolish lower ranks for policemen<sup>1</sup> and to promote everybody in these ranks within several years. Although, this measure is strictly increasing the policemen's (expected) monetary

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1. Positions in the so-called 'Mittlerer Dienst' will no longer be filled.

income it has caused enormous disgruntlement among those whose promotion did not take place in the first few years. Although their absolute position was increased their relative standing in comparison with colleagues who shared the same rank but were promoted earlier had dropped. In one case a policeman was so seriously embittered that he had to be told out of suicide. He would have remained a much happier man without the new law for promotion<sup>2</sup>.

That income is not evaluated in isolation, but that social comparisons with reference groups are crucial for the well-being of individuals (Frey and Stutzer 1999) is one of the main conclusions that can be drawn from the econometric literature on happiness functions which was initiated by Easterlin (1974). This literature also points out the relevance of income changes for individuals' happiness. Changes may have a bigger impact than absolute levels (Inglehart and Rabier 1986)<sup>3</sup>. At the same time individual happiness rises only slightly under economic growth benefitting the whole population (see, for example, Oswald 1997). Hence, utility rather depends on relative than on absolute standing.

Similar evidence can be found in experimental economics where it is frequently observed that subjects in ultimatum games punish others though doing so inflicts costs on themselves<sup>4</sup>. This has been explained by Bolton (1991) by assuming that individuals' preferences depend on both, absolute and relative income, and Huck and Oechssler (1999) have recently shown that such preferences can result from evolutionary processes.

In fact, the first principle of evolutionary selection provides a general explanation for why individuals should care for relative positions. The reason is that evolution itself is driven by *payoff differentials* and not by absolute payoffs. Though this was already pointed out by Alchian (1950), it took a long time until the economics profession realized that Friedman's (1953) claim that evolutionary forces will eventually bring out pure (absolute) profit maximizers is not necessarily warranted. Meanwhile there is a whole body of literature demonstrating that preferences different from the simple Friedman type can be favored by evolution (see, e.g., Schaffer (1989) who studies market behavior, Güth and Kliemt (2000) who deal with issues of trust, Huck (1998) who studies how institutions may affect preference formation, or, for a general treatment, Königstein and Müller (2000)).

2. This information was personally communicated by a representative on a staff council who wants to remain anonymous.
3. Frey and Stutzer (1999) who analyse Swiss data find this only confirmed for negative changes.
4. See, for example, the surveys by Güth (1995) or Roth (1995).

Hence both, experimental and evolutionary findings, indicate that payoff differentials enter individuals' utility functions. Nevertheless there are surprisingly few studies which analyze the economic consequences of such preferences. Exceptions are Cole, Mailath, and Postelwaite (1992) who show that caring for (relative) status can cause multiple equilibria in a growth model which provides an explanation for different growth rates in different countries; Robson (1992) who shows that such preferences can produce utility functions of the Friedman-Savage type and can account for inefficient distributions; and Konrad and Lommerud (1993) who illustrate that caring for relative positions may induce an socially inefficient risk-taking.

In this note we study – as a benchmark case – a very simple general model in which subjects *maximize* payoff differentials and have the opportunity to make costly investments in their relative standing. The analysis of this benchmark model reveals two main results: First, we show that under plausible assumptions optimal investments in relative standing are increasing in own personal wealth. Second, we show that optimal investments are decreasing in the wealth of others. Both results have the same consequence for the distribution of wealth: Inequality increases. As a consequence, we argue that models assuming standard preferences will typically underestimate the necessity of public interventions to remedy social grievances.

## II. THE MODEL

Consider a situation in which all individuals of a population have gained some consumable resources endowing them with a certain absolute material wealth. The allocation may be the result of a move of nature, the result of a game played by all individuals, the result of many games played by subgroups of the population, or the result of a market process. Suppose that given such a situation an individual can carry out an action harming others by investing some of his resources. Suppose further that individuals maximize payoff differentials. We shall establish *optimal investment profiles*.

First some notation.

Let  $W_i$  be individual  $i$ 's material wealth after the first phase, let  $\bar{W}_{-i}$  be the average material wealth of all others and assume that both variables are observable. An investment profile is described by a function  $p_i : \mathbb{R}^2 \rightarrow \mathbb{R}$ , prescribing for every vector  $(W_i, \bar{W}_{-i})$  an investment  $p_i = p_i(W_i, \bar{W}_{-i})$ . When individual  $i$  has carried out his investment his final (absolute) payoff is denoted by  $f(W_i, p_i)$ , and the average final (absolute) payoff of the others by  $g(\bar{W}_{-i}, p_i)$ . We make the following straightforward assumptions about  $f$  and  $g$ :

**Assumptions:**

- a) Both functions are twice continuously differentiable. Furthermore,  $\frac{\partial f}{\partial W_i} > 0$  and  $\frac{\partial g}{\partial \bar{W}_{-i}} > 0$ , i.e., final payoffs are increasing in material wealth gained in the first phase.
- b)  $\frac{\partial f}{\partial p_i} < 0$  and  $\frac{\partial g}{\partial p_i} < 0$ , i.e., final payoffs are decreasing in  $i$ 's investment.
- c)  $\frac{\partial^2 f}{\partial p_i^2} < 0$  and  $\frac{\partial^2 g}{\partial p_i^2} > 0$ , i.e., while the marginal cost of an investment is increasing for individual  $i$ , the absolute marginal effect on others is decreasing.
- d)  $\frac{\partial^2 f}{\partial p_i \partial M_i} > 0$ , i.e., the marginal cost of investments is decreasing in personal wealth.

To make the model as simple as possible we assume that at each point in time (i.e., after each 'allocation phase') only one individual selected by chance has the opportunity to make an investment.

Now suppose that individuals maximize the payoff differential

$$R_i(W_i, \bar{W}_{-i}, p_i) = f(W_i, p_i) - g(\bar{W}_{-i}, p_i)$$

To compute the optimal investment profile  $p^*$  one has to solve the following problem:

$$\text{Maximize } R_i(W_i, \bar{W}_{-i}, p_i) \text{ w. r. t. } p_i \text{ and subject to } W_i \geq p_i \geq 0 \quad (1)$$

Solving this problem yields the following lemma:

**Lemma 1:** *The optimal investment profile is characterized by the implicit function*

$$p^*(W_i, \bar{W}_{-i}) : \frac{\partial g(\bar{W}_{-i}, p_i)}{\partial p_i} - \frac{\partial f(W_i, p_i)}{\partial p_i} = 0$$

if  $\partial g(\bar{W}_{-i}, 0)/\partial p_i < \partial f(W_i, 0)/\partial p_i$  and by  $p_i^* = 0$  otherwise.

**Proof:** The first order condition for maximization of  $R_i$  is

$$\frac{\partial R_i}{\partial p_i} = 0 \Leftrightarrow \frac{\partial g(\bar{W}_{-i}, p_i)}{\partial p_i} - \frac{\partial f(W_i, p_i)}{\partial p_i} = 0 \quad (2)$$

Due to assumption c)  $R_i$  is concave in  $p_i$ . Note that there exists some  $\hat{p}_i$  such that  $\frac{\partial R_i}{\partial p_i} < 0$  for all  $p_i > \hat{p}_i$ . Therefore, equation (2) has a (unique) solution with  $p_i > 0$  if and only if

$$\partial g(\bar{W}_{-i}, 0) / \partial p_i < \partial f(W_i, 0) / \partial p_i. \quad (3)$$

If (3) does not hold, this implies that  $\frac{\partial R_i}{\partial p_i} < 0$  for all  $p_i \geq 0$ .

With the help of Lemma 1 we can prove the following proposition showing that the optimal punishment profile  $p^*$  implies that the amount of punishment is increasing in the material wealth gained in the first phase.

**Proposition 2:**  $\partial g(\bar{W}_{-i}, 0) / \partial p_i < \partial f(W_i, 0) / \partial p_i \Leftrightarrow \frac{\partial p_i^*(W_i, \bar{W}_{-i})}{\partial W_i} > 0$ .

**Proof:** Note first that if (3) holds for some  $W_i = W'$  it also holds for all  $W_i > W'$ . If it holds let  $H(W_i, \bar{W}_{-i}, p_i)$  be the implicit function defined by (2). Applying the implicit function theorem yields  $\frac{\partial p_i^*(W_i, \bar{W}_{-i})}{\partial W_i} = -\frac{\partial H / \partial W_i}{\partial H / \partial p_i} = \frac{-\partial^2 f / \partial p_i \partial W_i}{\partial^2 f / \partial p_i^2 - \partial^2 g / \partial p_i^2} > 0$ . If (3) does not hold, then  $\frac{\partial p_i^*(W_i, \bar{W}_{-i})}{\partial W_i} = 0$ .

While this result may be taken as a justification for ‘why the rich are nastier than the poor’ we next show that under an additional assumption which has some plausibility our approach may also explain ‘why the poor are treated nastier than the rich’.

**Proposition 3:** *If an individual punishes at all and if  $\frac{\partial^2 g}{\partial p_i \partial \bar{W}_{-i}} > 0$ , then  $\frac{\partial p_i^*(W_i, \bar{W}_{-i})}{\partial \bar{W}_{-i}} < 0$ .*

**Proof:** Note first that if (3) holds for some  $\bar{W}_{-i} = W''$  it also holds, due to assumption d), for all  $\bar{W}_{-i} < W''$ . Now let  $H$  be defined as before. Then,  $\frac{\partial p_i^*(W_i, \bar{W}_{-i})}{\partial \bar{W}_{-i}} = -\frac{\partial H / \partial \bar{W}_{-i}}{\partial H / \partial p_i} = \frac{-\partial^2 g / \partial p_i \partial \bar{W}_{-i}}{\partial^2 f / \partial p_i^2 - \partial^2 g / \partial p_i^2} < 0$ .

### III. DISCUSSION

Our analysis shows that under quite general assumptions utility-maximizing agents who have a material advantage (who are richer) in the first place will invest most to enhance their relative standing. This result is in line with many behavioral patterns that can be established by relying on some sort of casual empiricism as Dyer and Schopenhauer probably did when writing our motto. But there is more evidence than from literature and casual inspection of the world surrounding us. In fact, our result can be tested. Fehr and Gächter (1998) conducted an experiment which has two phases as our model assumes. After playing a round of a public good provision game subjects were informed about the outcome and had the opportunity to punish their opponents. Fortunately, Fehr

and Gächter also collected sociodemographic data about their subjects – in particular income data. It shows that the amount subjects invest in punishment is positively (and significantly) correlated with their income<sup>5</sup>.

Shakespeare's quote from *Pericles* nicely summarizes both of our results: Not only are the rich nastier than the poor (as our first result shows), they also have strong incentives to inflict harm on those who are poor (as our second result shows).

It is also interesting to observe how both of our results work together in changing the distribution of wealth. Since the rich have the greatest incentives to invest in improving their relative standing and since the poor are most likely to be harmed, the distribution of material wealth becomes much more skewed in our model. Whether this carries over to the real world is an empirical question which might be worthwhile to investigate<sup>6</sup>.

Our analysis also shows that standard models in which individuals are only assumed to maximize absolute payoffs underestimate the endogenous degree of inequality within a society.

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5. The Pearson correlation coefficient is small (0.22) but highly significant ( $p = 0.002$ ).
6. Unfortunately, there is no data set covering a sufficiently long period of time. However, Oppenheim and Harker (1996) report that despite of extensive redistributive measures the income distributions in most EU countries has become more unequal in 1980's. On the other hand, Choi (1999) argues that there is no strong evidence for the commonly held belief of the 'rich getting richer and the poor getting poorer'. In Choi's view the main force which holds inequality over time constant is entrepreneurship, a domain in which he claims that the rich have no advantage over the poor. Our results are not necessarily in conflict with this.

## WHY THE RICHT ARE NASTIER THAN THE POOR

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### SUMMARY

In view of empirical and evolutionary findings on the relevance of relative payoffs we study – as a benchmark case – a model in which individuals maximize payoff differentials having the opportunity to invest in their relative standing by harming others. Interestingly, optimal investments are increasing in individuals' own wealth and decreasing in the wealth of others.

### ZUSAMMENFASSUNG

Im Hinblick auf empirische und evolutionäre Befunde bezüglich relativer Auszahlungen, studieren wir ein Modell, in dem Individuen Auszahlungsdifferenziale maximieren und die Möglichkeit haben, in ihren relativen Stand durch Schädigung anderer zu investieren. Interessanterweise ergibt sich, dass optimale Investitionen mit dem eigenen Wohlstand steigen und mit dem Wohlstand anderer fallen.

### RÉSUMÉ

La littérature tant empirique que théorique (théorie des jeux évolutionnaires) soulignent l'importance des gains relatifs sur les comportements individuels. Notre étude analyse ces effets dans un modèle où les individus ont la possibilité d'investir dans leur bien-être au détriment des autres. Ce faisant, ils maximisent leurs gains relatifs. Nous montrons alors que l'investissement optimal est une fonction croissante du niveau de richesse de l'individu et décroissante du niveau de richesse des autres.