ZEF Bonn
Zentrum für Entwicklungsforschung
Center for Development Research
Universität Bonn

Oded Stark, You Qiang Wang

Towards a Theory of Self-Segregation as a Response to Relative Deprivation: Steady-State Outcomes and Social Welfare

Number
94

ZEF – Discussion Papers on Development Policy
Bonn, December 2004

Oded Stark, You Qiang Wang
Towards a Theory of Self-Segregation as a Response to Relative Deprivation: Steady-State Outcomes and Social Welfare, ZEF – Discussion Papers On Development Policy No. 94, Center for Development Research, Bonn, December 2004, pp. 25.

ISSN: 1436-9931

Published by:
Zentrum für Entwicklungsforschung (ZEF)
Center for Development Research
Walter-Flex-Strasse 3
D – 53113 Bonn
Germany
Phone: +49-228-73-1861
Fax: +49-228-73-1869
E-Mail: zef@uni-bonn.de
http://www.zef.de

The authors:
Oded Stark, University of Bonn, Germany; University of Vienna, Austria; ESCE Economic and Social Research Center, Cologne, Germany and Eisenstadt, Austria.
(contact: ostark@uni-bonn.de).
You Qiang Wang, Tsinghua University, Beijing, People's Republic of China.

Contents

List of Figures

Acknowledgements

Partial financial support from the Humboldt Foundation and the Sohmen Foundation is gratefully acknowledged.

Abstract

We model group formation as a response to relative deprivation. We employ two measures of relative deprivation. We show that in the case of each of these measures the process of deprivation-induced self-selection into groups reaches a steady state, and that the steady-state distribution differs from the distribution that would have obtained had group affiliation been chosen so as to maximize rank. We study the social welfare implications of the deprivation-induced process of group formation and show that when individuals are left to pursue their betterment the resulting state tends to fall short of the best social outcome. We present several implications of the model including federalism and the demand for secession.

Kurzfassung

Wir modellieren die Entstehung von Gruppen als eine Antwort auf relative Deprivation. Wir verwenden zwei Maße für relative Deprivation. Wir zeigen, dass für beide Maße der Prozess der durch Deprivation veranlassten Selbstabgrenzung in Gruppen jeweils einen Gleichgewichtszustand erreicht, und dass die Verteilung in diesem Gleichgewichtszustand sich von der Verteilung unterscheidet, die erreicht worden wäre, wenn die Gruppenzugehörigkeit so gewählt würde, dass die soziale Stellung maximiert wird. Wir untersuchen die Auswirkungen des durch Deprivation veranlassten Prozesses der Gruppenbildung auf die öffentliche Wohlfahrt und zeigen, dass wenn es den Einzelnen überlassen wird, ihre Besserstellung zu verfolgen, der daraus resultierende Zustand dazu tendiert, das gesellschaftlich günstigste Ergebnis zu verfehlen. Wir zeigen verschiedene Auswirkungen des Modells, wie den Föderalismus und das Verlangen nach Abspaltung.

1 Introduction

People who transact individually in markets also belong to groups. Both the outcome of the market exchange and the satisfaction arising from the group affiliation impinge on well-being. But how and why do groups form and dissolve? The pleasure or dismay that arises from group membership can be captured in a number of ways and relative position is an appealing measure. A plausible response to transacting in a market that confers an undesirable outcome is to transact in another market (when the latter exists and participation in it is feasible). Labor migration is an obvious example. Similarly, one reaction to a low relative position in a given group could be a change in group affiliation. What happens then when people who care about their relative position in a group have the option to react by staying in the group or exiting from it?

We study this particular response in order to gain some insight into how groups form when individuals care about their relative position. To enable us to focus on essentials, we confine ourselves to an extremely stark environment. We hold the incomes of all the individuals fixed[1]; we restrict attention to a setting in which incomes are equally spaced; we start with all individuals belonging to a single group (exit is not an option) and then allow the formation of a second group (exit is feasible); and we allow costless movement between groups. We first use a payoff function that is the negative of the sum of the income differences between one individual and others in his group who have higher incomes. Next we use a payoff function that is the proportion of those in the individual's group whose incomes are higher than the individual's times their mean excess income. We derive stark and unexpected results. In the first case we find that the process converges to a steady-state equilibrium of individuals across groups wherein clusters of income sub-groups exist in each group. There is no unique cut-off point above or below which individuals move. In addition, the steady-state distribution differs from the steady-state distribution that would have obtained had group affiliation been chosen so as to maximize rank. In the second case we find that the process converges to a steady-state equilibrium wherein the individual with the highest income is alone in one group while all other individuals belong to the second group. Once again, the steady-state distribution is inconsistent with rank maximization. We characterize and explore the social welfare repercussions of the process.

[1] When utility is derived both from absolute income and from relative income, and the utility function is additively separable, the difference in utilities across groups is reduced to the difference that arises from levels of relative income. Holding absolute incomes constant should not then be taken to imply that the individual does not care about his absolute income, and it enables us to study behavior that is purely due to considerations of relative income.

Suppose there are two groups, A and B, and that the deprivation of an individual whose income is x arises only from comparisons with other individuals in his group; nothing else matters. We abstract from the intrinsic value of x. However, this is of no consequence whatsoever since x is retained (the individual's income is held constant) across groups. We are thus able to study group-formation behavior that is purely due to deprivation. The individual prefers to be affiliated with the group in which his deprivation is lower. When equally deprived (a tie), the individual does not change groups. The individual cannot take into account the fact that other individuals behave in a similar fashion. However, the individual's payoff, or utility, depends on the actions of all other individuals whose incomes are higher than his. A key feature of this situation is that tomorrow's group-selection behavior of every individual is his best reply to today's selection actions of other individuals. What will be the steady-state allocation of individuals across the two groups? What will be the allocation that minimizes the societal relative deprivation?

We employ two measures of relative deprivation. We motivate our use of these measures in sections 2 and 3 below. Measuring social welfare as the inverse of the population's total relative deprivation, we find that while in both cases the level of social welfare associated with the steady-state distribution is higher than the level of social welfare that obtains at the outset, the steady-state allocations do not confer the maximal level of social welfare. Most interestingly, we also find that the allocation of individuals across the two groups that a welfare maximizing social planner will choose is *identical* in the two cases. Thus while we admit a variance in perception and measurement and in the ensuing steady-state outcomes, we also point to a uniformity in policy design. From the perspective of a social planner this finding is of no trivial consequence. When a policymaker finds it difficult to unearth the precise manner in which individuals perceive relative deprivation, he could infer preferences from behavior: when there is a correspondence between observable steady states and hidden perceptions, policy analysts can await realization of the former to deduce the latter and then tailor their policy response to the inferred structure of preferences. Yet if the policy response to alternative structures of preferences happens to be invariant to these structures, awaiting realization of the steady states is not necessary and the policy intervention becomes more efficient.

Let there be a finite discrete set of individuals whose incomes are $x_1, x_2, \ldots, x_n$ where $x_1 \leq x_2 \leq \ldots \leq x_n$. In section 2, the relative deprivation of an individual whose income is x_j and whose reference group consists of the n individuals is defined as $D(x_j) = \sum_{x_i > x_j} (x_i - x_j)$ and $D(x_j) = 0$ if $x_j \geq x_i$ for $i = 1, 2, ..., n$. In section 3, the relative deprivation of an individual whose income is x_j is defined as $RD(x_j) = \sum_{i=j}^{n-1} [1 - P(x_i)](x_{i+1} - x_i)$ for $j = 1, 2, ..., n-1$ where $P(x_i) = Prob(x \leq x_i)$, and $RD(x_j) = 0$ if $x_j = x_n$. Note that both measures incorporate rank-related information beyond rank. (In a population of two individuals, the rank of the individual whose income is 2 is the same regardless of whether the other individual's income is 3 or 30.

However, both $D(\cdot)$ and $RD(\cdot)$ duly differentiate between these two situations. Both measures imply that regardless of their distribution, all units of income in excess of one's own are equally distressing. As will be shown in section 3, $RD(\cdot)$ further implies that a given excess income is more distressing when received by a larger share of the individual's reference group. ($RD(2)$ is higher in a population of two individuals whose incomes are 2 and 3 than in a population of three individuals whose incomes are 1, 2, and 3.)

2 The steady-state distribution when relative deprivation is measured by $D(x_j)$

You board a boat in Guilin in order to travel on the Lijiang River. You can stand either on the port side (left deck) or on the starboard side (right deck) admiring the beautiful cliffs high above the banks of the river. Moving to the port side, you join other passengers, several of whom are taller than you. They block your view of the scenery. You notice that the starboard side is empty so you move there, only to find that other passengers who were disturbed by taller passengers have also moved to that side. You find your view blocked, which prompts you, as well as some other passengers, to return to the port side. And so on. Do these shifts come to a halt? Is so, what will the steady-state distribution of passengers between the two decks look like? Will the steady-state distribution confer the best possible social viewing arrangement?

Incomes in the small region R where you live are fully used for visible consumption purposes. Any income (consumption) in your region that is higher than yours induces discomfort – it makes you feel relatively deprived. Another region, R', identical in all respects to your region except that initially it is unpopulated, opens up and offers the possibility that you, and for that matter anyone else, can costlessly move to R'. Who moves and who stays? Will all those who move to R' stay in R'? Will some return? And will some of those who return move once more? Will a steady-state distribution of the population across the two regions emerge? At the steady-state distribution, will the aggregate deprivation of the population be lower than the initial aggregate deprivation? Will it be minimal?

Consider a simple case in which there are ten individuals and individual i receives an income of i, $i = 1,...,10$. Suppose that initially all individuals $1,...,10$ are in group A. Group B just comes into existence. (For example, A can be a village, B - a city; A can be a region or a country, B - another region or country; and so on. In cases such as these we assume that the individual does not care at all about the regions themselves and that moving from one region to another is costless.) Measuring time discretely, we will observe the following series of migratory moves. In period 1, all individuals except 10 move from A to B because the deprivation of individual 10 is zero, while the deprivation of all other individuals is strictly positive. In period 2, individuals 1 through 6 return from B to A because every individual in region B except 9, 8, and 7 is more deprived in B than in A. When an individual cannot factor in the contemporaneous response of other individuals, his decision is made under the assumption of no group substitution by these individuals. In period 3, individual 1 prefers to move from A to B rather than be in A, and the process comes to a halt. Thus, after three periods, a steady state is reached such that the

10th and 6th through 2nd individuals are in region *A*, while the 9th through 7th and 1st individuals are in group *B*. Figure 1 below diagrammatically illustrates this example.[2]

Figure 1: The group-formation process and the steady-state distribution

Period 0		Period 1		Period 2		Period 3	
Region *A*	Region *B*	Region *A*	Region *B*	Region *A*	Region *B*	Region *A*	Region *B*
10		10		10		10	
9			9		9		9
8			8		8		8
7			7		7		7
6			6	6		6	
5			5	5		5	
4			4	4		4	
3			3	3		3	
2			2	2		2	
1			1	1			1

What can be learned from this simple example? First, a well-defined rule is in place that enables us to predict group affiliation and steady-state distribution across groups. Second, until a steady state is reached, a change in group affiliation by any individual n is associated with a change in group affiliation by all individuals $i = 1,2,...,n-1$. Third, the number of individuals changing affiliation in a period is declining in the (rank) order of the period. Fourth, the number of inter-group moves by individuals never rises in their income; individuals with low incomes change affiliations at least as many times as individuals with higher incomes. Fifth, the deprivation motive leads to a stratification steady-state distribution where clusters of income groups exist in each region rather than having a unique cut-off point above or below which individuals move. Sixth, the steady-state distribution differs from the distribution that would have obtained had group affiliation been chosen so as to maximize (ordinal) rank: under pure rank maximization the individual whose income is 3 would have ended up in *B* rather than in *A*.

[2] Since the myopic adjustment dynamics is deterministic, that is, the distribution in period t completely determines the distribution in period $t + 1$, it follows that starting with everyone in *A*, the process will converge (if at all) to a unique steady state. To see this most easily, note that the richest individual will never move. Given the richest individual's immutable location, the second-richest individual has an optimal location and will need at most one period to get there. Given the stable location of the first two individuals, the third richest individual will have his own optimal location, which will be reached at most one period after the second individual has "settled down," and so on. No individual will have to move more times than his descending-order income rank. This reasoning assures us of convergence. As to uniqueness, allowing individuals to choose locations in a descending order of incomes well defines a path, and one path cannot lead to two destinations; the resultant "profile" is the only possible steady-state distribution.

Suppose that when equally deprived in A and B, the individual prefers A to B (an infinitesimal home preference). The steady state reached in this case differs from the steady state reached under the original assumption that when equally deprived (a tie) the individual does not migrate. Looking again at our example we will have the sequence shown in Figure 2. Interestingly, in the case of $(x_1,...,x_n) = (1,...,n)$ and an infinitesimal home preference, the number of periods it takes to reach the steady state is equal to the number of complete pairs in n, and the number of individuals who end up locating in A is $\frac{n}{2}$ when $n = 2m$, $\frac{n-1}{2}$ when $n = 4m - 1$ or $\frac{n+1}{2}$ when $n = 4m - 3$, where m is a positive integer.

Figure 2: The migration process and the steady-state distribution with an infinitesimal home preference

Period 0

Region *A*	Region *B*
10	
9	
8	
7	
6	
5	
4	
3	
2	
1	

Period 1

Region *A*	Region *B*
10	
	9
	8
	7
	6
	5
	4
	3
	2
	1

Period 2

Region *A*	Region *B*
10	
	9
	8
7	
6	
5	
4	
3	
2	
1	

Period 3

Region *A*	Region *B*
10	
	9
	8
7	
6	
	5
	4
	3
	2
	1

Period 4

Region *A*	Region *B*
10	
	9
	8
7	
6	
	5
	4
3	
2	
1	

Period 5

Region *A*	Region *B*
10	
	9
	8
7	
6	
	5
	4
3	
2	
	1

Changing the incomes of all individuals by the same factor will have no effect on the pattern of migration. This homogeneity of degree zero property can be expected; when the payoff functions are linear in income differences, populations with income distributions that are linear transformations of each other should display the same migration behavior. Thus the propensity prompted by aversion to deprivation to engage in migration by a rich population is equal to the propensity to engage in migration by a uniformly poorer population. Migration is independent of the general level of wealth of a population.

Interestingly, the result of a non-uniform equilibrium distribution has already been derived, at least twice, in the very context that constitutes our primary example, that is, migration. Stark (1993, chapter 12) studies migration under asymmetric information with signaling. Employers at destination do not know the skill levels of individual workers – they only know the skill distribution. Employers are assumed to pay all indistinguishable workers the same wage based on the average product of the group of workers. Employers at origin, however, know the skill levels of individual workers and pay them a wage based on their marginal product. When a signaling device that enables a worker's skill level to be completely identified exists, and when the cost of the device is moderate, the equilibrium distribution of the workers is such that the least skilled migrate without investing in the signaling device, the most skilled invest in the signaling device and migrate, and the medium skilled do not migrate. Banerjee and Newman (1998) derive a qualitatively similar result. They study a developing economy that consists of two sectors: a modern, high productivity sector in which people have poor information about each other, and a traditional, low productivity sector in which information is good. Since from time to time individuals in both sectors need consumption loans that they may have difficulty repaying, collateral is essential. The superior information available in the traditional sector enables lenders to better monitor borrowers there as opposed to those in the modern sector. The superior access to credit in the traditional sector conditional on the supply of collateral, and the higher productivity in the modern sector prompt migration from the traditional sector to the modern sector by the wealthiest and most productive workers, and by the poorest and least productive employees. The wealthy leave because they can finance consumption on their own and do not need loans; the most productive leave because they have much to gain; and the poorest and the least productive leave because they have nothing to lose – they cannot get a loan in either location.

A crucial assumption of both Stark's and Banerjee and Newman's models is that information is asymmetric. So far, no migration study has analytically generated an equilibrium distribution of three distinct groups under symmetric information, nor has a migration study analytically generated an equilibrium distribution of more than three groups. As the present example yields an equilibrium distribution of more than three groups, and it does so under symmetric information, our example contributes to the theory of migration.

3 The steady-state distribution when relative deprivation is measured by $RD(x_i)$

In earlier studies on relative deprivation and migration (Stark (1984), Stark and Yitzhaki (1988), and Stark and Taylor (1989, 1991)) we drew largely on the writings of social psychologists, especially Runciman (1966), to formulate a set of axioms and state and prove several propositions, and we conducted empirical inquiry. The measure of relative deprivation of an individual whose income is y, yielded by our analytical work, for the case of a continuous distribution of income, is $RD(y) = \int_y^\infty [1 - F(x)]dx$ where $F(x)$ is the cumulative distribution of income in y's reference group. We have further shown that $RD(y) = [1 - F(y)] \cdot E(x - y \mid x > y)$: the relative deprivation of an individual whose income is y is equal to the proportion of those in y's reference group who are richer than y times their mean excess income. Our empirical work indicates that a distaste for relative deprivation, when relative deprivation is measured by *RD*, matters; relative deprivation is a significant explanatory variable of migration behavior.

Suppose there are n individuals and that individual i receives income i. Thus the configuration of incomes is $(1,...,n-1,n)$. Suppose that initially all the individuals $1,...,n-1,n$ are in region *A*. Region *B* opens up. (For example, migration restrictions are eliminated, or *B* comes into existence.) We measure time discretely.

Claim 1: If the configuration of incomes is $(1,...,n-1,n)$, then the process of migration in response to relative deprivation reaches a steady state in just one period. Moreover, at the steady state, the individual with income n remains in region *A* while the rest of the population stays in region *B*.

Proof: It is trivial that in period 1 the individual with income n stays in region *A* while the rest of the population migrates to region *B*. Now consider the action of the individual with income i, where $i = 1,...,n-1$. If the individual remains in region *B*, the

individual's relative deprivation will be $\frac{(n-i)(n-1-i)}{2(n-1)}$.[3] If the individual returns to *A*, the individual's relative deprivation will be $\frac{n-i}{2}$. Note that $\frac{(n-i)(n-1-i)}{2(n-1)} < \frac{n-i}{2}$ for $i = 1,...,n-1$. We thus have the result of the Claim. Q.E.D.

Corollary: Given the above setup and a real number $\alpha > 0$, the process of migration in response to relative deprivation will be identical in the two populations $P = \{1,...,n-1,n\}$ and $P_\alpha = \{\alpha,...,\alpha(n-1),\alpha n\}$.

Proof: The proof of the Corollary is a replication of the proof of Claim1 since the two measures of relative deprivation in the proof of Claim 1 are multiplied by α, and therefore the inequality in the proof of Claim 1 carries through to the case of the Corollary. Q.E.D.

It follows that the propensity prompted by relative deprivation to engage in migration by a rich population is equal to the propensity prompted by relative deprivation to engage in migration by a uniformly poorer population. The pattern of migration is independent of the general level of wealth of the population.[4]

---

[3] In the case of $(x_1,...,x_n) = (1,...,n)$, $RD(x_j) = \sum_{i=j}^{n-1}\left(1-\frac{i}{n}\right)$ (recall the last paragraph of section 1). Since in this arithmetic series $a_1 = 1-\frac{j}{n}$, $a_{n-j} = 1-\frac{n-1}{n}$, and the number of terms is *n-j*, it follows that $RD(x_j) = \sum_{i=j}^{n-1}\left(1-\frac{i}{n}\right) = \frac{\left(1-\frac{j}{n}+1-\frac{n-1}{n}\right)(n-j)}{2} = \frac{n-j}{2n}(n-j+1)$. The relative deprivation of the individual with income *i* in region B can also be calculated by using this formula: $RD(i)|_{i\in B} = \frac{(n-1)-i}{2(n-1)}\left[(n-1)-i+1\right] = \frac{n-i}{2}\cdot\frac{n-1-i}{n-1}$.

[4] Note that the results of this section apply even if the population is multiplied by a natural number *k*. To see this, consider the configuration of incomes $\left(\underbrace{1,...,1}_{k},...,\underbrace{n,...,n}_{k}\right)$. In period 1 the *k* individuals with income *n* stay in region *A* while the rest of the population migrates to region *B*. Now consider the action of an individual with income *i*, where $i = 1,...,n-1$. If the individual remains in region *B*, the individual's relative deprivation will be $\frac{(n-i)(n-1-i)}{2(n-1)}$ (as when $k=1$). If an individual with income *i* were to return to *A*, the individual's relative deprivation would be $\frac{k}{k+1}(n-i)$. Since for any natural number *k*, $\frac{k}{k+1}(n-i) > \frac{(n-i)(n-1-i)}{2(n-1)}$, the result of Claim 1 holds also for the case in which the population is multiplied by *k*.

Note that the steady state is independent of whether individuals migrate simultaneously (as assumed) or in the order of their relative deprivation (with the most relatively deprived migrating first, the second most relatively deprived migrating second, and so on). In the latter case the steady state is reached after *n*-1 periods rather than in just one period.

The steady-state distribution differs from the distribution that would have obtained had group affiliation been chosen so as to maximize (ordinal) rank: under pure rank maximization the individuals with incomes $n-3, n-4, n-6, ..., n-(n-2)$ if n is an even number, and the individuals with incomes $n-3, n-4, n-6, ..., n-(n-1)$ if n is an odd number, would have ended up in region *A* rather than in region *B*.

Each of the two groups that form in the steady state is smaller than the original single group. It might therefore be suspected that migration is caused partly or wholly by an aversion to crowding. It is easy to see, however, that this is not so. When 1,000 individuals, each with income y, are in region *A* there is crowding but no migration; when 10 individuals, 5 with income $y>1$ each and 5 with income $y-1$ each are in region *A* there is little crowding but much migration.

4 Societal relative deprivation and social welfare

Suppose we measure social welfare by the inverse of the population's total deprivation, where total deprivation is the sum of the deprivation of all the individuals constituting the population. It follows that social welfare is maximized when total deprivation is minimized. Consider first the case in which the payoff function is the negative of the sum of the income differences between one individual and others in his group who have higher incomes. While the social welfare associated with the steady-state distribution is higher than the social welfare associated with the initial period 0 allocation, individualistic group-formation behavior fails to produce maximum social welfare. The minimal total deprivation (*TD*) obtains when $(n,\ n-1,...,\ i)$ are in A and $(i-1,\ i-2,...,\ 1)$ are in B where $i=\frac{n}{2}+1$ if n is an even number and, as can be ascertained by direct calculation, where $i=\frac{n+1}{2}$ or $i=\frac{n+3}{2}$ when n is an odd number.[5]

Consider next the case in which the payoff function is the proportion of those in the individual's group whose incomes are higher than the individual's times their mean excess income. The steady-state allocation has n in region A and $(n-1,...,1)$ in region B. This allocation is Pareto efficient. However, the minimal total relative deprivation (*TRD*) obtains when $(n,n-1,...,i)$ are in region A and $(i-1,i-2,...,1)$ are in region B where $i=\frac{n}{2}+1$ if n is an even number, and where $i=\frac{n+1}{2}$ or $i=\frac{n+3}{2}$ when n is an odd number.[6]

In both cases then, the policy response to the steady-state distributions attained by individuals who, while pursuing their own betterment, do not achieve a collectively preferred division is to distribute the population across the two regions in precisely the same manner.

As long as the number of different incomes is larger than the number of (reference) groups, total relative deprivation will not be minimized at zero. If there are as many groups as there are different incomes, total relative deprivation will be zero.

Adopting the perspective that social welfare is maximized when total relative deprivation is minimized is not as ad hoc as it may appear to be. Consider the following social welfare

[5] The proof is in Appendix A.1.
[6] The proof is in Appendix A.2.

function: $SW = \bar{y}(1-G)$ where $\bar{y} = \frac{\sum_{i=1}^{n} y_i}{n}$ is income per capita in a society consisting of n individuals whose incomes are $y_1, y_2, ..., y_n$ and G is the Gini coefficient of income inequality. (It is easy to see that *SW* is higher upon an increase in any individual's income, and upon a transfer of any income from a high-income individual to a low-income individual.) It can be shown that $\left(\sum_{i=1}^{n} y_i\right)G = TRD$ where *TRD* stands for the total relative deprivation of the population.[7] Thus, *SW* can be rewritten as $SW = \bar{y} - \frac{TRD}{n}$: social welfare is the difference between income per capita and relative deprivation per capita. Since in the present setting incomes are kept intact, $\bar{y}$ is constant and *SW* is maximized when *TRD* is minimized.

We have implicitly assumed that region B is not subject to a capacity constraint: there is room in region B for the entire but one member of the population. For the sake of concreteness, consider the case of an even n; of migration proceeding in the order of the intensity of relative deprivation; and of relative deprivation being measured by *RD*. We have seen that while individuals 1,2,…,n-1 prefer to relocate to region B, it would be socially optimal to have only individuals $1,...,\frac{n}{2}$ move there. Hence, if it so happens that region B can accommodate only up to one half of the population, migration will come to a halt precisely at a level that is socially optimal. We thus have an example in which a constraint on mobility is conducive to the attainment of maximal social welfare rather than constituting a hindrance to such an attainment.

[7] The proof is in Appendix 2 of Stark and Wang (2004).

5 Conclusions and complementary reflections

We have presented an analysis that contributes to the large and growing literature on the theory of non-market, social interactions pioneered by Schelling (1971, 1972) and recently added to, among many others, by Stark (1999), Glaeser and Scheinkman (2000) who provide a useful synthesis, and Becker and Murphy (2001).

We note that individuals belong to groups, clubs, neighborhoods, and various associations. When given a choice, individuals may want to revise their affiliation – form a new group, change their neighborhood, join another club, associate with others. Several considerations, both absolute and relative, impinge on these choices. In this paper we have singled out for close scrutiny one such consideration – a distaste for relative deprivation. We have studied several repercussions when this measure is used as the exclusive determinant of affiliation.

We have assumed a given and uniform dislike of relative deprivation. Relative deprivation is a sensitive measure that encompasses rank-related information beyond mere rank. (It tells us that 1 compared to 3 is worse than 1 compared to 2, even though in both instances 1 ranks second.) An important question that is not addressed in this paper is where the aversion to relative deprivation or, for that matter, the distaste for low rank, originates. Postlewaite (1998) argues that since over the millennia high rank conferred an evolutionary advantage in the competition for food and mating opportunities, the concern for rank is likely to be hardwired (part of the genetic structure). More generally though, any setting in which rank impinges positively – directly or indirectly – on consumption ought to imply a concern for rank.[8] The study of why an aversion to relative deprivation exists and why individuals exhibit distaste for low rank invites more attention.

It is plausible to stipulate that the distaste for low rank will not be uniform across societies. Consequently, the extent of self-segregation across societies will vary. Since segregation is visible, whereas preferences are not, an inference may be drawn from the observed segregation to the motivating distaste, with more segregation suggesting stronger distaste.

We have shown that when individuals who initially belong to one group (costlessly) act upon their distaste for relative deprivation and self-select into any one of two groups, they end up splitting into two groups in a manner that is sensitive to the way in which relative deprivation is sensed and measured. However, when the social planner's response to a split is not sensitive to

[8] In poor societies with meager assets, rank can serve as a proxy for collateral, making it easier for individuals to obtain credit.

the way in which relative deprivation is conceptualized nor, for that matter, to the particular configuration of the split, there is no need to exert effort to unearth the specific configuration of the underlying motive or to await a particular manifestation of the behavior that the motive prompts.

We have described an endogenous process of voluntary segmentation into distinct groups; the division of the population into groups is not the outcome of an exogenous imposition of segregation. Assuming no comparisons between members of one group and another, we have shown that, as a consequence, aggregate relative deprivation is lowered. In broader contexts, the group partitioning could also be associated with improved social welfare as a result of reduced social tensions, fewer conflicts, less crime, and a mediated quest for status (as the inequality between those who compete with each other for status is reduced).

The opening of another region, *B*, facilitates shedding one's relative deprivation by allowing a group to split into two. Consider a reverse process, wherein regions *A* and *B* merge into a single composite region that constitutes everyone's reference group. In all cases (except the degenerate case in which all individuals have exactly the same income) the population's relative deprivation is bound to rise. Groups who are less well off in terms of absolute income will be better off in terms of well-being if they are allowed to secede, without any change in absolute income. Conversely, a group that is less well off in terms of absolute income that is forced to merge with a group that is better off in terms of absolute income becomes worse off. The pressure to form a separate state, for example, can be partially attributed to this aversion to relative deprivation; when such an aversion exists, the sole individual with less than 1 in *B* may prefer that option to having 1 in *A*, where 2 is present.

These considerations relate to federalism. The process of adding new members to a federation of nations usually draws on the expectation that in the wake of the integration, the incomes of the citizens of the new member nations will rise. The European Union, however, has taken great pains to ensure that the incomes of the citizens of the would-be member nations rise substantially *prior* to integration. Our approach suggests a rationale. To the extent that integration entails the formation of a new reference group, relative deprivation when 1 joins 2 would be reduced if 1½ were to join 2, and would be eliminated altogether if 2 were to join 2.

The idea that externalities impinge asymmetrically on individuals' well-being and behavior has been with us for many years. Early proponents of this idea were of the opinion that the well-being of individuals rose in what they had and declined in what more prosperous people had. References of pioneering works that come readily to mind are Duesenberry (1949) who argued that individuals look up but not down when making comparisons, Stouffer et al. (1949) who, in spite of studying a quite different behavior, independently argued likewise, and Davis (1966) who observed that in choosing higher performance career fields, which generally require graduate training, students in colleges and universities in the US were heavily influenced by their subjectively assessed relative standing in their college or university rather than by the subjective

quality of the institution, *and* that they adjusted their career choices in a manner corresponding to their subjective (relative) standing in their college or university, tilting towards the low performance fields as their *relative* standing declined.[9] (As social psychologists, Stouffer et al. and Davis have carefully searched for the relevant set of individuals with whom comparisons are made – the reference group.) A recent manifestation of the asymmetric externalities idea takes the diametrically opposite view that while the utility of an individual rises in his own consumption, it declines in the consumption of any of his neighbors if that consumption falls below some minimal level; individuals are adversely affected by the material wellbeing of others in their reference group when this wellbeing is sufficiently lower than theirs (Andolfatto, 2002). Our impression though is that in the course of the intervening five decades, the bulk of the theoretical work has held the view that individuals look up and not down, and that the evidence has overwhelmingly supported the "upward comparison" view.[10] (Helpful references are provided and reviewed in Frey and Stutzer (2002) and in Walker and Smith (2002)). The analysis in the preceding sections is in line with, and draws on this perspective. Nonetheless, it could be of interest to reflect on the manner in which our results will be affected if comparisons were to assume a symmetrical or quasi-symmetrical nature. It is easy to see why such a revised structure of preferences will not even yield a steady-state distribution to begin with. An example will suffice. Consider the first case and rewrite the payoff function of an individual whose income is x_j as follows: $D(x_j) = \sum_{x_i > x_j} (x_i - x_j) + \sum_{x_k < x_j} \alpha (x_k - x_j)$. Throughout this paper we have assumed that $\alpha = 0$. Let us now have $\alpha > 0$, however small, retain the assumption of two regions, and consider the simplest case of $n = 2$. In this setting a steady state will never be reached: while 1 will want to separate from 2, 2 will want to stay with 1. There will be repeated and endless cycles. Let $\alpha = 1$ and consider the case of $n = 3$. Again, a steady state will not be reached and cycles will ensue: in period zero 3, 2, and 1 are in *A*. In period one, 3 and 2 stay in *A* while 1 moves to *B*. (3 has the minimal sum of gaps (-3) which, if he were to move, would rise to (0); 2 has a sum of (0) and thus stands to gain nothing by moving; 1 has the sum of (3) which, upon a move, will be reduced to (0).) In period two, 3 and 2 move to *B* since each contemplates the move to result in a lowering of his period-one relative deprivation (from (-1) to (-2) and from (1) to (-1), respectively). But now 3, 2, and 1 are in *B*, which is the same configuration as that of period zero, prompting 1 to move to *A*, and so on. Alternatively, if we let $\alpha = -1$, implying that individuals seek to minimize the sum of absolute income gaps (in either direction), we will find

[9] Notably, students judged themselves by their "local standing" in their own college or university (that is, standing within their reference group) rather than across colleges or universities (that is, across reference groups). This self-assessment and the resulting response implied that being a "big frog in a small pond" or a "small frog in a big pond" mattered even when the absolute size of the "frog" did not change. Davis concluded that when parents who aspire their son to opt for a higher-performance career field send their son to a "fine" college or university, " a big pond," they face a risk of him ending up assessing himself as a "small frog" thereby ending up not choosing a desirable career path.

[10] For example, it has been argued that given the set of individuals with whom comparisons are made, an unfavorable comparison could induce harder work. This idea is captured and developed in the literature on performance incentives in career games and other contests. (Early studies include Lazear and Rosen (1981), Rosen (1986), and Stark (1990).) Loewenstein, et al. (1989) provide evidence that individuals strongly dislike being in an income distribution in which "comparison persons" earn more. Clark and Oswald (1996) present evidence that "comparison incomes" have a significant negative impact on overall job satisfaction.

once again, as can easily be verified, that a steady state will not be reached. The results obtained in this paper constitute, therefore, a contribution to the study of group formation when affiliation choices are guided by an aversion to falling behind others, and when this aversion is modeled through particular measures that go beyond the crude measure of rank, are appealing both intuitively and analytically, and are consistent with a large body of theoretical and empirical literature.

References

Andolfatto, D. (2002): A Theory of Inalienable Property Rights. *Journal of Political Economy*, 110, pp. 382-393.

Banerjee, A. V. and A. F. Newman (1998): Information, the Dual Economy, and Development. *Review of Economic Studies*, 65, pp. 631-653.

Becker, G. S. and K. Murphy (2001): *Social Markets: Market Behavior in a Social Environment.* Harvard University Press, Cambridge, MA.

Clark, A. E. and A. J. Oswald (1996): Satisfaction and Comparison Income. *Journal of Public Economics*, 61, pp. 359-381.

Davis, J. A. (1966): The Campus as a Frog Pond: An Application of the Theory of Relative Deprivation to Career Decisions of College Men. *American Journal of Sociology*, 72, pp. 17-31.

Duesenberry, J. S. (1949): *Income, Savings and the Theory of Consumer Behavior*. Harvard University Press, Cambridge, MA.

Frey, B. S. and A. Stutzer (2002): *Happiness and Economics: How the Economy and Institutions Affect Human Well-Being*. Princeton University Press, Princeton.

Glaeser, E. and J. A. Scheinkman (2000): *Non-Market Interactions*, Working Paper 8053, National Bureau of Economic Research, Cambridge, MA.

Lazear, E. P. and S. Rosen (1981): Rank-Order Tournaments as Optimum Labor Contracts. *Journal of Political Economy*, 89, pp. 841-864.

Loewenstein, G. F., L. Thompson and M. H. Bazerman (1989): Social Utility and Decision Making in Interpersonal Contexts. *Journal of Personality and Social Psychology*, 57, pp. 426-441.

Postlewaite, A. (1998): The Social Basis of Interdependent Preferences. *European Economic Review*, 42, pp. 779-800.

Rosen, S. (1986): Prizes and Incentives in Elimination Tournaments. *American Economic Review*, 76, pp. 701-715.

Runciman, W. G. (1966): *Relative Deprivation and Social Justice: A Study of Attitudes to Social Inequality in Twentieth-Century England*. University of California Press, Berkeley.

Schelling, T. (1971): Dynamic Models of Segregation. *Journal of Mathematical Sociology*, 1, pp. 143-186.

Schelling, T. (1972): A Process of Residential Segregation: Neighborhood Tipping. In: Pascal, A. H. (Ed.), *Racial Discrimination in Economic Life.* Lexington Books, Lexington, MA, pp. 157-184.

Stark, O. (1984): Rural-to-Urban Migration in LDCs: A Relative Deprivation Approach. *Economic Development and Cultural Change,* 32*,* pp. 475-486.

Stark, O. (1990): A Relative Deprivation Approach to Performance Incentives in Career Games and other Contests. *Kyklos*, 43, pp. 211-227.

Stark, O. (1993): *The Migration of Labor.* Blackwell, Oxford and Cambridge, MA.

Stark, O. (1999): *Altruism and Beyond: An Economic Analysis of Transfers and Exchanges within Families and Groups.* Cambridge University Press, Cambridge.

Stark, O. and J. E. Taylor (1989): Relative Deprivation and International Migration. *Demography*, 26, pp. 1-14.

Stark, O. and J. E. Taylor (1991): Migration Incentives, Migration Types: The Role of Relative Deprivation. *The Economic Journal*, 101, pp. 1163-1178.

Stark, O. and Y. Q. Wang (2004): *On the Quest for Status as an Intervening Variable between the Distribution of Wealth and Growth*. Manuscript, University of Bonn, Bonn.

Stark, O. and S. Yitzhaki (1988): Labour Migration as a Response to Relative Deprivation. *Journal of Population Economics*, 1, pp. 57-70.

Stouffer, S. A., E. A. Suchman, L. C. Devinney, S. A. Star and R. M. Williams Jr. (1949): *The American Soldier: Adjustment During Army Life*. Princeton University Press, Princeton.

Walker, I. and H. J. Smith (2002): *Relative Deprivation: Specification, Development, and Integration*. Cambridge University Press, Cambridge.

Appendices

To differentiate between the cases that correspond to payoff functions $D(x_j)$ and $RD(x_j)$, we refer to total relative deprivation in the first case as *TD*, and to total relative deprivation in the second case as *TRD*.

A.1 The minimal level of total deprivation (TD)

Part I

To find the division of a population of *n* individuals across groups *A* and *B* that confers the minimal total deprivation (*TD*) we proceed in two steps. First given the size of the two groups, we show that the minimal *TD* is reached when high income individuals are in one of the groups and low income individuals are in the other group. (That is, the income of *any* individual who is in one group is higher than the income of *any* individual who is in the other group.) Second, given this distribution, we show that the minimal *TD* is reached when *half* of the individuals are in one group and the other half are in the other group.

Lemma: Let *n* be a fixed positive integer. Consider $\{a_1, a_2, ..., a_n\}$ where $a_1 < a_2 < ... < a_n$ and a_i's are positive integers. Let $S(a_1, a_2, ..., a_n) = \sum_{1 \le i, j \le n} |a_i - a_j|$. Then $S(a_1, a_2, ..., a_n)$ reaches its minimum if and only if $a_{i+1} = a_i + 1$ for $i = 1,2,...,n-1$.

Proof: For any $i < j$, we have $|a_i - a_j| = |a_j - a_{j-1}| + |a_{j-1} - a_{j-2}| + ... + |a_{i+1} - a_i|$. Therefore, $|a_i - a_j| \ge j - i$ and $\left(\underset{\text{for all i, j}}{|a_i - a_j| = j - i} \right)$ if and only if $\left(\underset{\text{for } i=1,2,...,n-1}{a_{i+1} = a_i + 1} \right)$. It follows that $S(a_1, a_2, ..., a_n)$ reaches its minimum if and only if $a_{i+1} = a_i + 1$ for $i = 1,2,...,n-1$. (This minimum is $\frac{n(n^2 - 1)}{3}$.) Q.E.D.

Corollary: Consider the configuration of incomes $(1,...,n-1,n)$. Let there be two groups, *A* and *B*, with $(i_1, i_2, ..., i_{n_A})$ in *A*, and $(j_1, j_2, ..., j_{n_B})$ in *B*, $n = n_A + n_B$. Let $TD = TD_A + TD_B$.

Then, if n, n_A, n_B are fixed, *TD* reaches its minimum if and only if $(j_1, j_2, ..., j_{n_B}) = (1,2,...,n_B)$ or $(i_1, i_2, ..., i_{n_A}) = (1,2,...,n_A)$; that is,

either

Region *A*	Region *B*
n	
$\vdots$	
$n_B + 1$	
	n_B
	$\vdots$
	1

or

Region *A*	Region *B*
	n
	$\vdots$
	$n_A + 1$
n_A	
$\vdots$	
1	

Proof: Note that $TD_A = \frac{1}{2} S(i_1, i_2, ..., i_{n_A})$, $TD_B = \frac{1}{2} S(j_1, j_2, ..., j_{n_B})$. Thus, for fixed n_A, n_B, $\min TD_A \Leftrightarrow \min S(i_1, i_2, ..., i_{n_A})$, $\min TD_B \Leftrightarrow \min S(j_1, j_2, ..., j_{n_B})$. Assume that *TD* reaches its minimum at $(i_1^*, i_2^*, ..., i_{n_A}^*)$, $(j_1^*, j_2^*, ..., j_{n_B}^*)$. Without loss of generality, assume that $n \in (i_1^*, i_2^*, ..., i_{n_A}^*)$. Then, if $(i_1^*, i_2^*, ..., i_{n_A}^*) \neq (n_B + 1, ..., n)$, then $(j_1^*, j_2^*, ..., j_{n_B}^*) \neq (1, ..., n_B)$. By the Lemma, we have that $TD_A(i_1^*, i_2^*, ..., i_{n_A}^*) > TD_A(n_B + 1, ..., n)$, and $TD_B(j_1^*, j_2^*, ..., j_{n_B}^*) > TD_B(1, ..., n_B)$. Thus, $TD((i_1^*, i_2^*, ..., i_{n_A}^*), (j_1^*, j_2^*, ..., j_{n_B}^*)) > TD((n_B + 1, ..., n), (1, ..., n_B))$, which contradicts the assumption that *TD* reaches its minimum at $(i_1^*, i_2^*, ..., i_{n_A}^*)$, $(j_1^*, j_2^*, ..., j_{n_B}^*)$. Hence, $(i_1^*, i_2^*, ..., i_{n_A}^*) = (n_B + 1, ..., n)$, and $(j_1^*, j_2^*, ..., j_{n_B}^*) = (1, ..., n_B)$. Conversely, by the Lemma, we have that $TD_A(i_1, i_2, ..., i_{n_A}) \geq TD_A(n_B + 1, ..., n) (or\ (1, ..., n_A))$, and $TD_B(j_1, j_2, ..., j_{n_B})$

$\geq TD_B(1,2,...,n_B)\,(or\,(n_A+1,...,n))$. Therefore, TD reaches its minimum at either of the two configurations. We thus proved the Corollary. Q.E.D.

Part II

From the Lemma we know that the minimum of $S(a_1, a_2, \cdots, a_n)$ is $\frac{n(n^2-1)}{3}$. The total deprivation TD of $(n, n-1,..., 1)$ is $\frac{1}{2}$ of this minimum, that is $TD=\frac{n(n^2-1)}{6}$. Let $n=n_A+n_B$, $n\geq 2,\quad n_A\geq 1$. Then, by the Corollary, $TD_A=\frac{n_A(n_A^2-1)}{6}$, $TD_B=\frac{n_B(n_B^2-1)}{6}$. Therefore, $TD=\frac{n_A(n_A^2-1)}{6}+\frac{(n-n_A)[(n-n_A)^2-1]}{6}=\frac{n^3-3n^2n_A+3nn_A^2-n}{6}$.

We seek to solve $\min_{1\leq n_A\leq n} TD$. Since $\frac{dTD}{dn_A}=\frac{1}{6}(-3n^2+6nn_A)$ and $\frac{d^2TD}{(dn_A)^2}=n>0$, we have that the minimal TD obtains when $\frac{dTD}{dn_A}=0$, that is, $n_A=\frac{n}{2}$. Therefore, if n is an even number, half of the n individuals will be in each of the two groups. With $TD_A=TD_B=\frac{n(n^2-4)}{48}$, $TD=TD_A+TD_B=\frac{n(n^2-4)}{24}$.

A.2 The minimal level of total relative deprivation (TRD)

Part I

Part I of Appendix B is identical to Part I of Appendix A except that *TD* in Appendix A is replaced by *TRD* in Appendix B.

Part II

We next determine the size of the subgroups that brings *TRD* to a minimum.

Let $(n,...,i)$ be in region *A*, and let $(i-1,...,1)$ be in region *B*. Total relative deprivation in A is[11]:

$$TRD_A = \frac{1}{n-i+1}\cdot 1 + \frac{2}{n-i+1}\frac{1+2}{2} + ... + \frac{n\text{-}i}{n\text{-}i+1}\frac{1+2+...+n-i}{n-i}$$

$$= \frac{1+(1+2)+...+(1+2+...+n-i)}{n-i+1} = \frac{(n-i)(n-i+2)}{6} \quad .$$

Total relative deprivation in *B* is:

$$TRD_B = \frac{1}{i-1} + \frac{2}{i-1}\frac{1+2}{2} + ... + \frac{i-1-1}{i-1}\frac{1+2+...+i-1-1}{i-1-1}$$

$$= \frac{1+(1+2)+...+(1+2+...+i-2)}{i-1} = \frac{i(i-2)}{6} \quad .$$

Hence, $TRD = TRD_A + TRD_B = \frac{1}{6}\left[(n-i)(n-i+2)+i(i-2)\right]$. We seek to solve $\min_{1\le i\le n} TRD$. Since $\frac{dTRD}{di} = \frac{1}{3}(-n+2i-2)$ and $\frac{d(TRD)^2}{di^2} = \frac{2}{3} > 0$, we have that the minimal *TRD* obtains when $\frac{dTRD}{di} = 0 \Rightarrow -n+2i-2 = 0 \Rightarrow i = \frac{n}{2}+1$. If *n* is an even number then the *i* that brings *TRD* to a minimum is $i^* = \frac{n}{2}+1$, and, by direct calculation, $TRD = \frac{1}{12}(n^2-4)$. If *n* is an odd number, direct calculation yields that when $i = \frac{n+1}{2}$, $TRD = \frac{1}{12}(n^2-3)$, and that when $i = \frac{n+3}{2}$, $TRD = \frac{1}{12}(n^2-3)$. Therefore, if *n* is an odd number, the *i* that brings *TRD* to a minimum is $i^* = \frac{n+1}{2}$ or $i^* = \frac{n+3}{2}$.

The result pertaining to the optimal split of the *n* individuals between the two regions can also be obtained by noting that for $(1,2,...,n)$, $TRD = \frac{n^2-1}{6}$. (This equation can be inferred, for example, from the expression above of $TRD_B = \frac{i(i-2)}{6}$ by setting $i-1=n$.) Let $n = n_A + n_B$, $n \ge 2,\ n_A \ge 1$. Then $TRD_A = \frac{n_A^2-1}{6}$ and $TRD_B = \frac{(n-n_A)^2-1}{6}$. Therefore,

[11] $\sum_{k=1}^{n}(1+2+...+k) = \sum_{k=1}^{n}\frac{(1+k)k}{2} = \frac{1}{2}\sum_{k=1}^{n}k + \frac{1}{2}\sum_{k=1}^{n}k^2 = \frac{1}{2}\frac{(1+n)n}{2} + \frac{1}{2}\frac{n(n+1)(2n+1)}{6} = \frac{n(n+1)(n+2)}{6}$. Substituting $n-i$ for *n* yields the last expression of TRD_A.

$TRD = \frac{2n_A^2 + n^2 - 2n \cdot n_A - 2}{6}$. We seek to solve $\min_{1 \le n_A \le n} TRD$. Since $\frac{dTRD}{dn_A} = \frac{4n_A - 2n}{6}$ and $\frac{d(TRD)^2}{d^2 n_A} = \frac{4}{6} > 0$, we have that the minimal TRD obtains when $\frac{dTRD}{dn_A} = 0 \Rightarrow 4n_A - 2n = 0 \Rightarrow n_A = \frac{n}{2}$. Therefore, if n is an even number, half of the n individuals will be in each of the two regions. With $TRD_A = \frac{\left(\frac{n}{2}\right)^2 - 1}{6}$ and $TRD_B = \frac{\left(\frac{n}{2}\right)^2 - 1}{6}$,

$$TRD = TRD_A + TRD_B = 2\frac{\left(\frac{n}{2}\right)^2 - 1}{6} = \frac{1}{12}\left(n^2 - 4\right).$$

The following papers have been published so far:

No. 1	Ulrike Grote, Arnab Basu, Diana Weinhold	Child Labor and the International Policy Debate Zentrum für Entwicklungsforschung (ZEF), Bonn, September 1998, pp. 47.
No. 2	Patrick Webb, Maria Iskandarani	Water Insecurity and the Poor: Issues and Research Needs Zentrum für Entwicklungsforschung (ZEF), Bonn, Oktober 1998, pp. 66.
No. 3	Matin Qaim, Joachim von Braun	Crop Biotechnology in Developing Countries: A Conceptual Framework for Ex Ante Economic Analyses Zentrum für Entwicklungsforschung (ZEF), Bonn, November 1998, pp. 24.
No. 4	Sabine Seibel, Romeo Bertolini, Dietrich Müller-Falcke	Informations- und Kommunikationstechnologien in Entwicklungsländern Zentrum für Entwicklungsforschung (ZEF), Bonn, January 1999, pp. 50.
No. 5	Jean-Jacques Dethier	Governance and Economic Performance: A Survey Zentrum für Entwicklungsforschung (ZEF), Bonn, April 1999, pp. 62.
No. 6	Mingzhi Sheng	Lebensmittelhandel und Kosumtrends in China Zentrum für Entwicklungsforschung (ZEF), Bonn, May 1999, pp. 57.
No. 7	Arjun Bedi	The Role of Information and Communication Technologies in Economic Development – A Partial Survey Zentrum für Entwicklungsforschung (ZEF), Bonn, May 1999, pp. 42.
No. 8	Abdul Bayes, Joachim von Braun, Rasheda Akhter	Village Pay Phones and Poverty Reduction: Insights from a Grameen Bank Initiative in Bangladesh Zentrum für Entwicklungsforschung (ZEF), Bonn, June 1999, pp. 47.
No. 9	Johannes Jütting	Strengthening Social Security Systems in Rural Areas of Developing Countries Zentrum für Entwicklungsforschung (ZEF), Bonn, June 1999, pp. 44.
No. 10	Mamdouh Nasr	Assessing Desertification and Water Harvesting in the Middle East and North Africa: Policy Implications Zentrum für Entwicklungsforschung (ZEF), Bonn, July 1999, pp. 59.
No. 11	Oded Stark, Yong Wang	Externalities, Human Capital Formation and Corrective Migration Policy Zentrum für Entwicklungsforschung (ZEF), Bonn, August 1999, pp. 17.

No. 12	John Msuya	Nutrition Improvement Projects in Tanzania: Appropriate Choice of Institutions Matters Zentrum für Entwicklungsforschung (ZEF), Bonn, August 1999, pp. 36.
No. 13	Liu Junhai	Legal Reforms in China Zentrum für Entwicklungsforschung (ZEF), Bonn, August 1999, pp. 90.
No. 14	Lukas Menkhoff	Bad Banking in Thailand? An Empirical Analysis of Macro Indicators Zentrum für Entwicklungsforschung (ZEF), Bonn, August 1999, pp. 38.
No. 15	Kaushalesh Lal	Information Technology and Exports: A Case Study of Indian Garments Manufacturing Enterprises Zentrum für Entwicklungsforschung (ZEF), Bonn, August 1999, pp. 24.
No. 16	Detlef Virchow	Spending on Conservation of Plant Genetic Resources for Food and Agriculture: How much and how efficient? Zentrum für Entwicklungsforschung (ZEF), Bonn, September 1999, pp. 37.
No. 17	Arnulf Heuermann	Die Bedeutung von Telekommunikationsdiensten für wirtschaftliches Wachstum Zentrum für Entwicklungsforschung (ZEF), Bonn, September 1999, pp. 33.
No. 18	Ulrike Grote, Arnab Basu, Nancy Chau	The International Debate and Economic Consequences of Eco-Labeling Zentrum für Entwicklungsforschung (ZEF), Bonn, September 1999, pp. 37.
No. 19	Manfred Zeller	Towards Enhancing the Role of Microfinance for Safety Nets of the Poor Zentrum für Entwicklungsforschung (ZEF), Bonn, October 1999, pp. 30.
No. 20	Ajay Mahal, Vivek Srivastava, Deepak Sanan	Decentralization and Public Sector Delivery of Health and Education Services: The Indian Experience Zentrum für Entwicklungsforschung (ZEF), Bonn, January 2000, pp. 77.
No. 21	M. Andreini, N. van de Giesen, A. van Edig, M. Fosu, W. Andah	Volta Basin Water Balance Zentrum für Entwicklungsforschung (ZEF), Bonn, March 2000, pp. 29.
No. 22	Susanna Wolf, Dominik Spoden	Allocation of EU Aid towards ACP-Countries Zentrum für Entwicklungsforschung (ZEF), Bonn, March 2000, pp. 59.

No. 23	Uta Schultze	Insights from Physics into Development Processes: Are Fat Tails Interesting for Development Research? Zentrum für Entwicklungsforschung (ZEF), Bonn, March 2000, pp. 21.
No. 24	Joachim von Braun, Ulrike Grote, Johannes Jütting	Zukunft der Entwicklungszusammenarbeit Zentrum für Entwicklungsforschung (ZEF), Bonn, March 2000, pp. 25.
No. 25	Oded Stark, You Qiang Wang	A Theory of Migration as a Response to Relative Deprivation Zentrum für Entwicklungsforschung (ZEF), Bonn, March 2000, pp. 16.
No. 26	Doris Wiesmann, Joachim von Braun, Torsten Feldbrügge	An International Nutrition Index – Successes and Failures in Addressing Hunger and Malnutrition Zentrum für Entwicklungsforschung (ZEF), Bonn, April 2000, pp. 56.
No. 27	Maximo Torero	The Access and Welfare Impacts of Telecommunications Technology in Peru Zentrum für Entwicklungsforschung (ZEF), Bonn, June 2000, pp. 30.
No. 28	Thomas Hartmann-Wendels Lukas Menkhoff	Could Tighter Prudential Regulation Have Saved Thailand's Banks? Zentrum für Entwicklungsforschung (ZEF), Bonn, July 2000, pp. 40.
No. 29	Mahendra Dev	Economic Liberalisation and Employment in South Asia Zentrum für Entwicklungsforschung (ZEF), Bonn, August 2000, pp. 82.
No. 30	Noha El-Mikawy, Amr Hashem, Maye Kassem, Ali El-Sawi, Abdel Hafez El-Sawy, Mohamed Showman	Institutional Reform of Economic Legislation in Egypt Zentrum für Entwicklungsforschung (ZEF), Bonn, August 2000, pp. 72.
No. 31	Kakoli Roy, Susanne Ziemek	On the Economics of Volunteering Zentrum für Entwicklungsforschung (ZEF), Bonn, August 2000, pp. 47.
No. 32	Assefa Admassie	The Incidence of Child Labour in Africa with Empirical Evidence from Rural Ethiopia Zentrum für Entwicklungsforschung (ZEF), Bonn, October 2000, pp. 61.
No. 33	Jagdish C. Katyal, Paul L.G. Vlek	Desertification - Concept, Causes and Amelioration Zentrum für Entwicklungsforschung (ZEF), Bonn, October 2000, pp. 65.

No. 34	Oded Stark	On a Variation in the Economic Performance of Migrants by their Home Country's Wage Zentrum für Entwicklungsforschung (ZEF), Bonn, October 2000, pp. 10.
No. 35	Ramón Lopéz	Growth, Poverty and Asset Allocation: The Role of the State Zentrum für Entwicklungsforschung (ZEF), Bonn, March 2001, pp. 35.
No. 36	Kazuki Taketoshi	Environmental Pollution and Policies in China's Township and Village Industrial Enterprises Zentrum für Entwicklungsforschung (ZEF), Bonn, March 2001, pp. 37.
No. 37	Noel Gaston, Douglas Nelson	Multinational Location Decisions and the Impact on Labour Markets Zentrum für Entwicklungsforschung (ZEF), Bonn, May 2001, pp. 26.
No. 38	Claudia Ringler	Optimal Water Allocation in the Mekong River Basin Zentrum für Entwicklungsforschung (ZEF), Bonn, May 2001, pp. 50.
No. 39	Ulrike Grote, Stefanie Kirchhoff	Environmental and Food Safety Standards in the Context of Trade Liberalization: Issues and Options Zentrum für Entwicklungsforschung (ZEF), Bonn, June 2001, pp. 43.
No. 40	Renate Schubert, Simon Dietz	Environmental Kuznets Curve, Biodiversity and Sustainability Zentrum für Entwicklungsforschung (ZEF), Bonn, October 2001, pp. 30.
No. 41	Stefanie Kirchhoff, Ana Maria Ibañez	Displacement due to Violence in Colombia: Determinants and Consequences at the Household Level Zentrum für Entwicklungsforschung (ZEF), Bonn, October 2001, pp. 45.
No. 42	Francis Matambalya, Susanna Wolf	The Role of ICT for the Performance of SMEs in East Africa – Empirical Evidence from Kenya and Tanzania Zentrum für Entwicklungsforschung (ZEF), Bonn, December 2001, pp. 30.
No. 43	Oded Stark, Ita Falk	Dynasties and Destiny: On the Roles of Altruism and Impatience in the Evolution of Consumption and Bequests Zentrum für Entwicklungsforschung (ZEF), Bonn, December 2001, pp. 20.
No. 44	Assefa Admassie	Allocation of Children's Time Endowment between Schooling and Work in Rural Ethiopia Zentrum für Entwicklungsforschung (ZEF), Bonn, February 2002, pp. 75.

No. 45	Andreas Wimmer, Conrad Schetter	Staatsbildung zuerst. Empfehlungen zum Wiederaufbau und zur Befriedung Afghanistans. (German Version) State-Formation First. Recommendations for Reconstruction and Peace-Making in Afghanistan. (English Version) Zentrum für Entwicklungsforschung (ZEF), Bonn, April 2002, pp. 27.
No. 46	Torsten Feldbrügge, Joachim von Braun	Is the World Becoming A More Risky Place? - Trends in Disasters and Vulnerability to Them – Zentrum für Entwicklungsforschung (ZEF), Bonn, May 2002, pp. 42
No. 47	Joachim von Braun, Peter Wobst, Ulrike Grote	"Development Box" and Special and Differential Treatment for Food Security of Developing Countries: Potentials, Limitations and Implementation Issues Zentrum für Entwicklungsforschung (ZEF), Bonn, May 2002, pp. 28
No. 48	Shyamal Chowdhury	Attaining Universal Access: Public-Private Partnership and Business-NGO Partnership Zentrum für Entwicklungsforschung (ZEF), Bonn, June 2002, pp. 37
No. 49	L. Adele Jinadu	Ethnic Conflict & Federalism in Nigeria Zentrum für Entwicklungsforschung (ZEF), Bonn, September 2002, pp. 45
No. 50	Oded Stark, Yong Wang	Overlapping Zentrum für Entwicklungsforschung (ZEF), Bonn, August 2002, pp. 17
No. 51	Roukayatou Zimmermann, Matin Qaim	Projecting the Benefits of Golden Rice in the Philippines Zentrum für Entwicklungsforschung (ZEF), Bonn, September 2002, pp. 33
No. 52	Gautam Hazarika, Arjun S. Bedi	Schooling Costs and Child Labour in Rural Pakistan Zentrum für Entwicklungsforschung (ZEF), Bonn October 2002, pp. 34
No. 53	Margit Bussmann, Indra de Soysa, John R. Oneal	The Effect of Foreign Investment on Economic Development and Income Inequality Zentrum für Entwicklungsforschung (ZEF), Bonn, October 2002, pp. 35
No. 54	Maximo Torero, Shyamal K. Chowdhury, Virgilio Galdo	Willingness to Pay for the Rural Telephone Service in Bangladesh and Peru Zentrum für Entwicklungsforschung (ZEF), Bonn, October 2002, pp. 39
No. 55	Hans-Dieter Evers, Thomas Menkhoff	Selling Expert Knowledge: The Role of Consultants in Singapore´s New Economy Zentrum für Entwicklungsforschung (ZEF), Bonn, October 2002, pp. 29

No. 56	Qiuxia Zhu Stefanie Elbern	Economic Institutional Evolution and Further Needs for Adjustments: Township Village Enterprises in China Zentrum für Entwicklungsforschung (ZEF), Bonn, November 2002, pp. 41
No. 57	Ana Devic	Prospects of Multicultural Regionalism As a Democratic Barrier Against Ethnonationalism: The Case of Vojvodina, Serbia´s "Multiethnic Haven" Zentrum für Entwicklungsforschung (ZEF), Bonn, December 2002, pp. 29
No. 58	Heidi Wittmer Thomas Berger	Clean Development Mechanism: Neue Potenziale für regenerative Energien? Möglichkeiten und Grenzen einer verstärkten Nutzung von Bioenergieträgern in Entwicklungsländern Zentrum für Entwicklungsforschung (ZEF), Bonn, December 2002, pp. 81
No. 59	Oded Stark	Cooperation and Wealth Zentrum für Entwicklungsforschung (ZEF), Bonn, January 2003, pp. 13
No. 60	Rick Auty	Towards a Resource-Driven Model of Governance: Application to Lower-Income Transition Economies Zentrum für Entwicklungsforschung (ZEF), Bonn, February 2003, pp. 24
No. 61	Andreas Wimmer Indra de Soysa Christian Wagner	Political Science Tools for Assessing Feasibility and Sustainability of Reforms Zentrum für Entwicklungsforschung (ZEF), Bonn, February 2003, pp. 34
No. 62	Peter Wehrheim Doris Wiesmann	Food Security in Transition Countries: Conceptual Issues and Cross-Country Analyses Zentrum für Entwicklungsforschung (ZEF), Bonn, February 2003, pp. 45
No. 63	Rajeev Ahuja Johannes Jütting	Design of Incentives in Community Based Health Insurance Schemes Zentrum für Entwicklungsforschung (ZEF), Bonn, March 2003, pp. 27
No. 64	Sudip Mitra Reiner Wassmann Paul L.G. Vlek	Global Inventory of Wetlands and their Role in the Carbon Cycle Zentrum für Entwicklungsforschung (ZEF), Bonn, March 2003, pp. 44
No. 65	Simon Reich	Power, Institutions and Moral Entrepreneurs Zentrum für Entwicklungsforschung (ZEF), Bonn, March 2003, pp. 46
No. 66	Lukas Menkhoff Chodechai Suwanaporn	The Rationale of Bank Lending in Pre-Crisis Thailand Zentrum für Entwicklungsforschung (ZEF), Bonn, April 2003, pp. 37

No. 78	Eric T. Craswell Ulrike Grote Julio Henao Paul L.G. Vlek	Nutrient Flows in Agricultural Production and International Trade: Ecology and Policy Issues Zentrum für Entwicklungsforschung (ZEF), Bonn, January 2004, pp. 62
No. 79	Richard Pomfret	Resource Abundance, Governance and Economic Performance in Turkmenistan and Uzbekistan Zentrum für Entwicklungsforschung (ZEF), Bonn, January 2004, pp. 20
No. 80	Anil Markandya	Gains of Regional Cooperation: Environmental Problems and Solutions Zentrum für Entwicklungsforschung (ZEF), Bonn, January 2004, pp. 24
No. 81	Akram Esanov, Martin Raiser, Willem Buiter	Gains of Nature's Blessing or Nature's Curse: The Political Economy of Transition in Resource-Based Economies Zentrum für Entwicklungsforschung (ZEF), Bonn, January 2004, pp. 22
No. 82	John M. Msuya Johannes P. Jütting Abay Asfaw	Impacts of Community Health Insurance Schemes on Health Care Provision in Rural Tanzania Zentrum für Entwicklungsforschung (ZEF), Bonn, January 2004, pp. 26
No. 83	Bernardina Algieri	The Effects of the Dutch Disease in Russia Zentrum für Entwicklungsforschung (ZEF), Bonn, January 2004, pp. 41
No. 84	Oded Stark	On the Economics of Refugee Flows Zentrum für Entwicklungsforschung (ZEF), Bonn, February 2004, pp. 8
No. 85	Shyamal K. Chowdhury	Do Democracy and Press Freedom Reduce Corruption? Evidence from a Cross Country Study Zentrum für Entwicklungsforschung (ZEF), Bonn, March2004, pp. 33
No. 86	Qiuxia Zhu	The Impact of Rural Enterprises on Household Savings in China Zentrum für Entwicklungsforschung (ZEF), Bonn, May 2004, pp. 51
No. 87	Abay Asfaw Klaus Frohberg K.S.James Johannes Jütting	Modeling the Impact of Fiscal Decentralization on Health Outcomes: Empirical Evidence from India Zentrum für Entwicklungsforschung (ZEF), Bonn, June 2004, pp. 29

No. 88	Maja B. Micevska Arnab K. Hazra	The Problem of Court Congestion: Evidence from Indian Lower Courts Zentrum für Entwicklungsforschung (ZEF), Bonn, July 2004, pp. 31
No. 89	Donald Cox Oded Stark	On the Demand for Grandchildren: Tied Transfers and the Demonstration Effect Zentrum für Entwicklungsforschung (ZEF), Bonn, September 2004, pp. 44
No. 90	Stefanie Engel Ramón López	Exploiting Common Resources with Capital-Intensive Technologies: The Role of External Forces Zentrum für Entwicklungsforschung (ZEF), Bonn, November 2004, pp. 32
No. 91	Hartmut Ihne	Heuristic Considerations on the Typology of Groups and Minorities Zentrum für Entwicklungsforschung (ZEF), Bonn, December 2004, pp. 24
No. 92	Johannes Sauer Klaus Frohberg Heinrich Hockmann	Black-Box Frontiers and Implications for Development Policy – Theoretical Considerations Zentrum für Entwicklungsforschung (ZEF), Bonn, December 2004, pp. 38
No. 93	Hoa Ngyuen Ulrike Grote	Agricultural Policies in Vietnam: Producer Support Estimates, 1986-2002 Zentrum für Entwicklungsforschung (ZEF), Bonn, December 2004, pp. 79
No. 94	Oded Stark You Qiang Wang	Towards a Theory of Self-Segregation as a Response to Relative Deprivation: Steady-State Outcomes and Social Welfare Zentrum für Entwicklungsforschung (ZEF), Bonn, December 2004, pp. 25

ISSN: 1436-9931

The papers can be ordered free of charge from:

Zentrum für Entwicklungsforschung (ZEF)
Center for Development Research
Walter-Flex-Str. 3
D – 53113 Bonn, Germany

Phone: +49-228-73-1861
Fax: +49-228-73-1869
E-Mail: zef@uni-bonn.de
http://www.zef.de