



Reference Group Behaviour and Economic Incentives: A Remark

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Kurzbeiträge / Short Articles

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A Remark*

by

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It has repeatedly been claimed that social norms might be much more important in the determination of individual behaviour than economic incentives. The aim of this note is to render some tangibility to the proposition that this kind of *individual* behaviour might lead to a *very strong* sensitivity of *aggregate* response to economic incentives if the social standards of behaviour are formed according to reference group theory¹. The argument will be developed along the lines of an example taken from labour economics, but other applications, e.g. to the theory of consumer behaviour, are straightforward.

Assume that productivity π of a given worker is determined by average productivity π^* prevailing in his reference group (among his fellow workers), and by the strength of an economic incentive e , which might represent a piece-rate in the simplest case, or, more generally, measure the incremental benefits accruing to the worker in terms of income and promotion if he increases his productivity. Thus, individual productivity π is assumed to be a function of reference productivity π^* and of the economic incentive e :

$$(1) \quad \pi = f(\pi^*, e) .$$

If reference productivity π^* increases, the worker will increase his productivity π even if the economic incentive e remains constant. This is so because the individual perceives himself as being put into a social rôle and will try to fulfil the associated requirements (which are perceived as π^*) in order to maintain his self-esteem and to avoid being an outsider².

We assume, however, that an increase in reference productivity π^* increases individual productivity not by just the same amount, but to a slightly lesser extent due to the fact that the individual comes closer now to his capability

* Thanks to J. Frohn for a conversation which led me to put down the argument.

¹ It is the great merit of DUSENBERRY [1949] of having introduced these considerations into economics.

² See IRLE [1975], pp. 165–175 and SINGER and HYMAN [1968] for some psychological and sociological background and a less crude line of argument.

limit. In other words, the partial derivative f_{π^*} is assumed to be between zero and unity:

$$(2) \quad 0 < f_{\pi^*} < 1 .$$

Furthermore, a positive influence of the economic incentive on individual productivity is stipulated:

$$(3) \quad f_e > 0 .$$

Given a set of identical individuals forming a reference group, given a fixed economic incentive, and starting from a historically given reference productivity π^* , each individual will fix his individual productivity according to (1). If π happens to be above π^* , observed productivity will be above π^* in the next period. This will increase reference productivity for the whole group. Conversely, if π is below π^* , this will lead to a decrease in reference productivity.

More formally, the following differential equation can be put down to describe the process:

$$(4) \quad \dot{\pi}^* = \mu \{f(\pi^*, e) - \pi^*\} , \quad \mu > 0 .$$

(The dot represents the time derivative, and μ denotes a speed of adjustment.)

Because of (2), the derivative $\partial \dot{\pi}^* / \partial \pi^*$ is negative, and the process (4) approaches an equilibrium productivity $\bar{\pi}$ which (if it exists) is uniquely characterised by the condition

$$(5) \quad f(\bar{\pi}, e) = \bar{\pi} .$$

This condition defines equilibrium productivity implicitly as a function of the economic incentive e . If one looks at the impact of the economic incentive, one has to compute $d\bar{\pi}/de$, which is

$$(6) \quad \frac{d\bar{\pi}}{de} = \frac{f_e}{1 - f_{\pi^*}} .$$

It turns out, therefore, that the impact of the economic incentive becomes particularly strong if f_{π^*} is close to unity: *If reference group behaviour is very important individually, the economic incentive becomes very powerful even if it is rather unimportant individually*, i.e. if f_e is very small.

A further observation can be added: If reference group behaviour is important, implying f_{π^*} to be close to unity, the speed of convergence of process (4) will be rather small, too: *A slow reaction to economic incentives might imply that these incentives are very important*, since it might indicate that the “social multiplier” $1/(1 - f_{\pi^*})$ is particularly large.

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 A Further Remark*

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The argument given in SCHLICHT [1981] can be generalized to the case of heterogeneous individuals.

Assume n workers forming a reference group. Denote actual productivity of a given worker by π_i and his reference productivity by π_i^* . In presence of an economic incentive e , the i -th worker determines his productivity according to

$$(1) \quad \pi_i = f^i(\pi_i^*, e), \quad 0 < f_1^i < 1, \quad f_2^i > 0,$$

where f_1^i denotes the partial derivative of $f^i(\cdot)$ with respect to the first argument, etc.

Reference productivity π_i^* follows the observed average productivity of the other workers which is perceived as

$$(2) \quad \frac{1}{n-1} \sum_{j \neq i} \pi_j.$$

Hence the process (4) in SCHLICHT [1981] is replaced by the system of differential equations¹

$$(3) \quad \dot{\pi}_i^* = \mu_i \left\{ \frac{1}{n-1} \cdot \sum_{j \neq i} f^j(\pi_j^*, e) - \pi_i^* \right\}, \quad i = 1, 2, \dots, n.$$

The equilibrium values of $\pi^* = (\pi_1^*, \dots, \pi_n^*)$ for given e are defined by the conditions

$$(4) \quad \bar{\pi}_i^* = \frac{1}{n-1} \sum_{j \neq i} f^j(\bar{\pi}_j^*, e), \quad i = 1, 2, \dots, n.$$

This gives rise to the following proposition:

If there exists a set of equilibrium aspiration levels $\bar{\pi}^ = (\bar{\pi}_1^*, \dots, \bar{\pi}_n^*)$ satisfying (4), it is unique and globally stable.*

* This note has been written in response to one of several points of criticism of SCHLICHT [1981] by R. Cremer.

¹ Due to a printing error, the dot over $\dot{\pi}^*$ on the left-hand side of (4) in SCHLICHT [1981] has been omitted.

Proof:

1. (Uniqueness) It is easy to check that the Jacobian of system (3) has a dominant diagonal. This establishes uniqueness, see NIKAIDO [1968], theorems 21.1 and 20.4.

2. (Global stability) Define

$$(5) \quad A_i = \mu_i \left\{ \frac{1}{n-1} \sum_{j \neq i} f^j(\pi_j^*, e) - \pi_i^* \right\}$$

as functions of π^* , and consider the Ljapunov function²

$$(6) \quad V = \max_i |A_i| .$$

It is to be shown that this function is decreasing over time. For a given state π^* , let $v \in \{1, 2, \dots, n\}$ denote the index which maximizes the expression in (6) during the next instant (v need not be unique). Hence we have $V = |A_v|$ and the time derivative

$$(7) \quad \dot{V} = \dot{A}_v \cdot \text{sign } A_v .$$

Since

$$(8) \quad \dot{A}_v = \mu_v \left[\frac{1}{n-1} \sum_{j \neq v} f_1^j A_j - A_v \right]$$

and since $|A_v| \geq |A_j|$, $f_1^j < 1$ for all j , this implies $\dot{A}_v < 0$ for $A_v > 0$ and $\dot{A}_v > 0$ for $A_v < 0$.

Hence \dot{V} is negative whenever it is defined.

Since V is a continuous function which is piecewise continuously differentiable, the above argument is sufficient to establish the proposition that V is strictly decreasing over time. This proves stability.

The impact of a change of the economic incentive e on equilibrium productivity can be calculated by noting that (4) implies

$$(9) \quad \frac{1}{n} \sum_i \bar{\pi}_i^* = \frac{1}{n} \sum_i f^i(\bar{\pi}_i^*, e) ,$$

i.e. that the average aspiration level and the average productivity are equal in equilibrium. Hence average productivity $\bar{\pi}$ can be identified with the average aspiration level

$$(10) \quad \bar{\pi} = \frac{1}{n} \sum_i \bar{\pi}_i^* .$$

Formula (4) can be re-written now as

$$(11) \quad \bar{\pi}_i^* = \frac{n}{n-1} \cdot \bar{\pi} - \frac{1}{n-1} \cdot f^i(\bar{\pi}_i^*, e) .$$

² On the Ljapunov technique, see BHATIA and SZEGÖ [1970], theorem 2.2, p. 66.

This can be differentiated and solved for $d\bar{\pi}_i^*/de$. Summation with respect to i yields

$$(12) \quad n \cdot \frac{d\bar{\pi}}{de} = \sum_i \frac{n}{n-1+f_1^i} \cdot \frac{d\bar{\pi}}{de} - \sum_i \frac{f_2^i}{n-1+f_1^i}.$$

Solving for $d\bar{\pi}/de$ gives the desired expression describing the impact of the economic incentive on productivity

$$(13) \quad \frac{d\bar{\pi}}{de} = \sum_i a_i \cdot f_2^i$$

where

$$(14) \quad a_i = \frac{1}{n} \cdot \left(\frac{1}{n+f_1^i-1} \right) / \left(\sum_j \frac{1}{n+f_1^j-1} - 1 \right) > \frac{1}{n}.$$

It is easy to see that a_i is close to $1/n$ if social interdependence is weak (f_1^j close to zero for all j) and that it tends to infinity if social interdependence is strong (f_1^j close to unity for all j). Furthermore, each a_i is strictly increasing if f_1^j increases for one j . Hence, if one individual changes in such a way that his reference productivity becomes more important for him, this will increase the social productivity effect for all other individuals.

Formula (13) is the analogue to (6) in SCHLICHT [1981]. The associated "social multiplier" can be defined as

$$(15) \quad s = \frac{\sum_i a_i f_2^i}{\frac{1}{n} \sum_i f_2^i}.$$

It gives the productivity increase induced by a "direct" productivity increase of unity. This term will be particularly large if reference group behaviour is important, i.e. if f_1^i is close to unity for many individuals. In this respect, the proposition of the earlier paper remains valid.

The same can be said with regard to the relationship between the speed of the approach to equilibrium and the strength of the social multiplier: If all f_1^j were equal to unity, the eigenvalues of the Jacobian of system (3) would be all equal to zero. Hence the speed of adjustment in any direction would be zero. Since the eigenvalues are continuous functions of the matrix elements, it can be concluded that the speed of adjustment will be slow, and the social multiplier will be large, if reference group behaviour is important.

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