The Fear of Exclusion: Individual Effort when Group Formation is Endogenous*

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Abstract
To secure their membership in a popular group, individuals may contribute more to the group’s local public good than they would if group formation were exogenous. Those in the most unpopular group do not have this incentive to contribute. This may result in substantial differences in individual effort level between groups. Our model thus provides one explanation for the existence of group-specific behavioral norms. A principal will prefer exogenous or endogenous group formation depending on whether he prefers high or low levels of the local public good. We analyze two stylized examples: social interaction in schools, and multiple-task teamwork.

Keywords: Multiple-task principal–agent analysis; local public goods; economics of education; group norms; teamwork

JEL classification: C72; D11; D23; L24; Z13

I. Introduction
When interacting with others in a group, people care about who those others are and how they behave. Football players want their teammates to be good players, teamworkers want their colleagues to be efficient and reliable, and most people prefer to have attentive friends. To secure group relationships which are valuable to them, people may be willing to make substantial efforts. For example, athletes exercise more to keep their place

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on the team, and people keep appointments with their friends even when they really want to be somewhere else. In short, fear of exclusion from a popular group can make individuals strive to become more attractive as group members. This requires, of course, that someone’s membership in a group can in fact be influenced by his behavior. If group membership is exogenous to individuals, they may still fear exclusion, but since there is nothing they can do to prevent it, this fear may not affect their behavior.

In this paper, we propose a model of group formation which may explain why norms for socially acceptable behavior vary between groups. Several economists have maintained that group norms can affect behavior in teams; see e.g. Akerlof and Kranton (2003), Encinosa, Guynor and Rebitzer (2007), Hamilton, Nickerson and Owan (2003), Ichino and Maggi (2000) and Knez and Simester (2001). So far, however, few economists have focused on why different teams have different group norms.1 Here we demonstrate that when people are allowed to self-select into teams, group norms will depend on the comparative advantage of the group members. This has important implications for principal–agent theory. Indeed, a principal can use the choice of exogenous versus endogenous team formation as an instrument to influence agent behavior. This result adds to the recent strand of research integrating behavioral economics and principal–agent analysis; see e.g. Benabou and Tirole (2003) and Fehr, Gächter and Kirchsteiger (1997). They demonstrate that social aspects of human interaction—as in our case, the existence of a social sanction mechanism within groups—can have a substantial impact on agent behavior.

We study a population which is to be divided into two equally large groups (school classes, work teams). Each agent shares his time between producing a private good (academic achievement, sales activity, writing single-author papers) and contributing to a group-specific local public good (social activity, helping co-workers, writing jointly authored papers). Agents have identical preferences for the private good, the local public good, and possibly their own contribution to the local public good (e.g. social activity may both be pleasant and provide benefits to other group members); but they differ with respect to their ability in both private and local public goods production. All else given, everyone prefers to be a member of the group with the highest local public good provision. In order to secure their membership in this popular group, agents may be willing to contribute more to the local public good—and hence also produce less of the private good—than they would if group formation were exogenous. We analyze endogenous group formation in a non-cooperative game. In equilibrium,

1 One exception is Rob and Zemsky (2002), who show that when workers have reciprocal preferences and the workforce of each firm is fixed, optimal choice of incentives can lead to cultural differences between firms.
the popular group consists of those who have a comparative advantage in producing the local public good. In this group, many members—though not necessarily all—contribute more to the local public good than they would if groups were formed exogenously.

Group formation has been studied extensively within club theory; see e.g. Tiebout’s (1956) seminal paper on “voting with your feet”, or the surveys of Cornes and Sandler (1986) and Scotchmer (2002).² This literature focuses on competition for members among a large number of endogenously sized clubs, such as electorates offering different local public goods and tax levels.

In our analysis, there are no local authorities that can coordinate and enforce members’ contributions; indeed, individual contributions cannot be enforced through formal contracts at all. However, contributions may be enforced through informal sanctions within the group. Under these assumptions, we study how a non-cooperative group formation game can change individuals’ behavior, compared to the case of exogenous group formation, and how knowledge of this can be useful to a principal who wishes to influence agent behavior.

Our framework can be used to analyze a variety of phenomena, such as the formation of professional partnerships as in Landers, Rebitzer and Taylor (1996), religious groups as in Berman (2000), or “high society”, where people throw excessively expensive parties to secure their position among the rich and famous. After presenting our general framework, we focus on two stylized applications. The first is a case of moral hazard in a multiple-task teamwork situation; the second concerns the relationship between social exclusion and students’ efforts in schools.

II. A Model of Team Formation

Consider a population that is to be divided into two equally sized groups.³ Individuals are identical except for their abilities. Each individual $i$ has to share his total available time (normalized to 1) between individual activities, $r_i$, and group activities, $\ell_i$:

$$r_i + \ell_i = 1.$$ (1)

Time spent on individual activities produces a private good $x_i$,

$$x_i = w_ir_i,$$ (2)

where $w_i \geq 0$ denotes $i$’s ability in production of the private good. Similarly, time spent on group activities produces a local public good, where the

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² For a discussion of evolutionary aspects of group formation, see Bergstrom (2002).

³ This assumption is chosen for the purpose of simplification. Introducing more than two groups would not change the logic of the argument substantially, but allowing group size to vary endogenously would complicate our analysis considerably.
production function for individual $i$ is given by

$$s_i = v_i \ell_i,$$

(3)

where $v_i \geq 1$ denotes $i$’s ability in local public good production. Note that the assumption $v_i \geq 1$ implies that each person can produce at least one unit of the local public good.

We assume that $i$’s contribution to the public good $s_i$ is observable by fellow group members, but not by any observer external to the group, such as a principal. We further assume that abilities $w_i$ and $v_i$ are known to $i$ himself, but cannot be observed by others.4

Let the average local public good production in $i$’s group (i.e., average $s_i$ in the group) be denoted $S_i$. Each individual $i$ benefits from his production of the private good, $x_i$, and average contribution to the local public good in his group, $S_i$. In addition, we allow that the individual derives utility from his own contribution to the local public good, $s_i$. Let the preferences of each individual be represented by the following utility function:

$$u_i = x_i + \rho f(s_i) + \gamma g(S_i),$$

(4)

where $\gamma > 0$, $\rho \in \{0, 1\}$ and $f$ and $g$ are strictly increasing and strictly concave. While the notion that individuals have preferences for their own contributions may be unfamiliar to economists, the inclusion of $\rho f(s_i)$ in the utility function is motivated by our focus on informal social interaction and the idea that contributing to social interaction could be conceived as pleasant or interesting in its own right (for example, going to a party).6 If $\rho = 0$, individuals do not have preferences for their own contribution.

Inserting (1)–(3) in (4) yields

$$u_i = w_i(1 - \ell_i) + \rho f(v_i \ell_i) + \gamma g(S_i).$$

(5)

If group membership were exogenous, so that $i$’s membership were independent of $s_i$, the individual would simply maximize utility (5) with respect to $\ell_i$. We assume that the population is a continuum, where each individual has no mass; hence the individual will treat $S_i$ as fixed in this maximization. In the following, we refer to $i$’s unconstrained contribution as the contribution to the local public good $i$ would make if group membership were exogenous.

If $\rho = 0$, (5) is maximized when $i$ spends no time at all on group activities. If $\rho = 1$, maximization of (5) yields the following first-order condition

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4 This rules out inference of $s_i$ via the individual’s time budget. It also rules out direct allocation of group membership based on individual abilities, as well as any incentive mechanism requiring knowledge of individual abilities.

5 Linear separability is assumed for simplicity.

6 Note also that—although the context is different—this corresponds closely to Andreoni’s (1990) “impure altruism”.

for an interior solution:

\[ f'(s_i) = \frac{w_i}{v_i} \equiv \Omega_i. \tag{6} \]

Note that the fraction \( \frac{w_i}{v_i} \equiv \Omega_i \) denotes how many units of the private good the individual must give up to produce one more unit of the local public good. Thus, in the following, \( \Omega_i \) is referred to as \( i \)'s opportunity cost.

We assume that when \( \rho = 1 \), parameters are such that (6) has an interior solution. This simplifies the notation considerably without affecting the main insight of the paper. We now have the following lemma:

**Lemma 1.** Individual \( i \)'s unconstrained contribution to the local public good, \( \hat{s}(\Omega_i) \), is given by

\[ \hat{s}(\Omega_i) = \begin{cases} 0 & \text{if } \rho = 0 \\ f^{-1}(\Omega_i) & \text{if } \rho = 1. \end{cases} \tag{7} \]

We now assume that the opportunity cost, \( \Omega_i \), is uniformly distributed \([m - h, m + h]\), where \( m \) is the opportunity cost for the median person, while \( h < m \) measures the heterogeneity of the population. People may have different opportunity costs because they differ in abilities for private good production, in abilities for local public good production, or in both.

Assume now that the population is partitioned into a popular and an unpopular group through the following group formation game:

**The Group Formation Game**

(i) Each individual makes a commitment, \( c_i \), of how much he will contribute to local public good production if accepted into the popular group.

(ii) An initiator invites half the individuals to become members of the popular group.7 The remaining individuals form the unpopular group.

(iii) Each individual chooses \( s_i \), how much to contribute to the local public good, subject to the constraint that \( s_i = c_i \) if \( i \) is in the popular group. Payoff is then determined by (4).

In deriving our results, we assume that there exists a mechanism which makes commitments \( c_i \) credible. The kind of mechanism we have in mind is social sanctions between group members.8 For example, members of

7 This is similar to Harstad (2005). Since the population is a continuum, our analysis is independent of how the initiator is selected. However, it may be natural to think of the initiator as the individual who has made the highest commitment.

8 See Kandel and Lazear (1992) for a formal discussion of such social sanctioning mechanisms.
the popular group can turn their backs on a fellow member who breaks a promise by simply ignoring him. Such a sanction may be considered costless to the sanctioner, while still sufficiently severe to make it optimal to keep promises. Below, we focus on equilibria where individuals choose to use these sanctions if promises are broken.\footnote{It seems reasonable to assume existence of such sanctioning mechanisms in light of the substantial experimental evidence of reciprocal preferences, as in e.g. Fehr and Falk (2002), and strictly positive willingnesses to pay to punish norm violators, as in Fehr and Fischbacher (2004).} Moreover, we assume that side payments in terms of individual production $x_i$ are not possible.\footnote{In this model, the individual only allocates time between the use for private benefits and the group. To allow for side payments, the individual also has to allocate income between private use and the group. To keep the analysis simple we have avoided this two-dimensional case, but later on we briefly discuss a case where income and not time is allocated between private use and the group.}

Since an individual’s utility is increasing in the local public good, everyone prefers, \textit{ceteris paribus}, to be in the group that provides the highest $S_i$. Hence, the initiator will always invite the individuals with the highest commitments to become members of the popular group. Let $p$ denote the popular group and $u$ the unpopular group, and let $S^G$ denote the local public good supply in group $G \in \{p, u\}$. Then, $S^p \geq S^u$. This provides an incentive to commit more than one’s unconstrained contribution $\hat{s}(\Omega_i)$ to be allowed into the popular group.

Any individual will now consider whether the benefit of membership in the popular group is high enough for her to be willing to provide the minimum required contribution. Let $s$ be a requirement to achieve membership in the popular group. If $s \leq \hat{s}(\Omega_i)$, individual $i$ satisfies the requirement simply by committing to her unconstrained contribution $c_i = \hat{s}(\Omega_i)$. If $s > \hat{s}(\Omega_i)$, however, the individual will have to contribute something extra to gain membership in the popular group. Individual $i$’s utility, given that she chooses to become a member of the popular group, can be written as follows (noting that $x_i = w_i(1 - \ell_i) = w_i - \Omega_i s$):

\begin{equation}
U_{i,p} = w_i - \Omega_i s + \rho f(s) + \gamma g(S^p).
\end{equation}

If, instead, she seeks membership in the unpopular group, she will provide only her unconstrained contribution. This gives the following utility:

\begin{equation}
U_{i,u} = w_i - \Omega_i \hat{s}(\Omega_i) + \rho f(\hat{s}(\Omega_i)) + \gamma g(S^u).
\end{equation}

Thus, for individuals with $\hat{s}(\Omega_i) < s$, the gain from being in the popular group is given by

\begin{equation}
\Delta U(\Omega_i; s) = -\Omega_i (s - \hat{s}(\Omega_i)) + \rho (f(s) - f(\hat{s}(\Omega_i))) + \gamma (g(S^p) - g(S^u)).
\end{equation}
Individual effort when group formation is endogenous

Note that since $\Omega_i = f'(\hat{s}(\Omega_i))$ when $\rho = 1$, and $\hat{s}(\Omega_i) = 0$ when $\rho = 0$, it follows that

$$\frac{\partial \Delta U}{\partial \Omega_i} = -(s - \hat{s}(\Omega_i)) < 0.$$  \hspace{1em} (11)

Thus we have the following lemma:

**Lemma 2.** A person’s net benefit from entering the popular group is decreasing in $\Omega_i$, her opportunity cost of local public good production.

Note that this lemma holds irrespective of whether people have preferences for their own contributions ($\rho = 1$) or not ($\rho = 0$). Thus, if $S^p > S^u$ in equilibrium, it follows from Lemma 2 that those who have a comparative advantage in local public good production (i.e., $\Omega_i < m$) will be in the popular group, while those with a comparative advantage in private good production (i.e., $\Omega_i > m$) will be in the unpopular group.

Let the lowest contribution among the members of the popular group in equilibrium be denoted by $\bar{s}$. An individual’s local public good production in equilibrium, $s^*(\Omega_i)$, is given by

$$s^*(\Omega_i) = \begin{cases} \hat{s}(\Omega_i) & \text{if } \Omega_i > m \\ \max \{\hat{s}(\Omega_i), \bar{s}\} & \text{if } \Omega_i \leq m. \end{cases}$$  \hspace{1em} (12)

Note that if $\rho = 0$, then $\hat{s}(\Omega_i) = 0$; hence $s^*(\Omega_i) = \bar{s}$ for all $i$ such that $\Omega_i \leq m$.

If $S^p > S^u$ in equilibrium, then the average contribution in each group is given by

$$S^p = \int_{m}^{m+h} s^*(\Omega_i)d\Omega_i,$$

$$S^u = \int_{m-h}^{m} s^*(\Omega_i)d\Omega_i.$$  \hspace{1em} (13)

In equilibrium, a marginal person ($\Omega_i = m$) must be indifferent between the two groups. Thus, the minimum contribution required to obtain membership in the popular group in equilibrium, $\bar{s}$, is determined by

$$\Delta U(m; \bar{s}) = 0.$$  \hspace{1em} (14)

Below, we focus on Nash equilibria in which $\bar{s} \leq 1$, implying that membership in the popular group is feasible for everyone.\footnote{This assumption simplifies the analysis, but is not essential. The case where the minimum requirement may be unattainable to some individuals is discussed in Brekke, Nyborg and Rege (2005, Appendix B).}

The following lemma is proven in the Appendix:

**Lemma 3.** Assume that $\Delta U(m, 1) < 0$. Then, if $\rho = 1$ and/or $\gamma g'(0) > m$, there must be at least one solution $\bar{s} \in (0, 1)$ to equation (14).

Let $c(\Omega_i)$ denote the equilibrium commitment of person $i$. Clearly, if $\Omega_i \leq m$, then $c(\Omega_i) = s^*(\Omega_i) \geq \bar{s}$; while if $\Omega_i > m$, $c(\Omega_i) \leq \bar{s}$. Any member of the popular group who promises strictly more than her unconstrained contribution $\bar{s}(\Omega_i)$ would have preferred to lower her commitment, had this not meant losing her membership in the popular group. Thus, in equilibrium, some individuals in the unpopular group must have commitments arbitrarily close to the minimum requirement $\bar{s}$. Let $\bar{c}(\Omega_i)$ denote the commitment that makes person $i$ indifferent between membership in the popular and the unpopular group, i.e., the solution to $\Delta U(\Omega_i; \bar{c}) = 0$. Thus, $\bar{c}(\Omega_i)$ is $i$’s maximum willingness to contribute. Then, individual $i$’s commitment is given by

$$c(\Omega_i) = \begin{cases} s^*(\Omega_i) & \text{if } \Omega_i \leq m \\ \bar{c}(\Omega_i) & \text{if } \Omega_i > m \end{cases} \quad (15)$$

Note that by definition $\bar{c}(m) = \bar{s}$. By continuity, $\bar{c}(\Omega_i) \rightarrow \bar{s}$ as $\Omega_i \downarrow m$. Thus, when every individual’s commitment is as specified by equation (15), no one has an incentive to change her commitment (recall that the commitment is conditional on being allowed into the popular group).

Thus, we have the following theorem:

**Theorem 1.** Assume that $\Delta U(m, 1) < 0$, and that either $\rho = 1$ and/or $\gamma g'(0) > m$. Then there exists a Nash equilibrium in which individuals with a comparative advantage in local public good production (i.e., all $i$ such that $\Omega_i < m$) are in the popular group, and those with a comparative advantage in private good production (i.e., all $i$ such that $\Omega_i \geq m$) are in the unpopular group. Each person’s actual contribution to local public good production is determined by equations (12)–(14). Each person’s commitment is given by equation (15).

The requirement that $\Delta U(m, 1) < 0$ ensures that $\bar{s} < 1$, so that the minimum requirement $\bar{s}$ is feasible even for individuals with low social abilities ($v_i = 1$).\(^\text{12}\)

Note that when $\rho = 0$, i.e., people have no preference for their own contribution, then $\bar{s} = 0$ constitutes an equilibrium. In this case, $S^p = S^u = 0$, thus yielding no benefits of membership in one group as opposed to the other. However, the condition $\gamma g'(0) > m$ ensures that the local public good

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\(^\text{12}\) See footnote 11.
is sufficiently important to allow for another equilibrium, in which $\bar{\xi} > 0$.\textsuperscript{13} If people care about their own contribution ($\rho = 1$), then their unconstrained contributions will be strictly positive; this implies $S^p > S^u$, so that membership in the popular group does secure a strictly higher level of the local public good. In this case, every equilibrium will sort individuals perfectly into groups based on their opportunity cost.

Hence, endogenous group formation can be regarded as a screening device. Although neither absolute nor relative abilities are observable as such, the population is separated according to their relative ability, i.e., their opportunity cost, in equilibrium. One implication of Theorem 1 is thus that a principal external to the groups can use exogenous versus endogenous group formation as a tool to influence agents’ behavior.

With endogenous group formation, marginal individuals will provide an effort strictly above their unconstrained supply, and by continuity the same applies to all near-marginal individuals. Hence, endogenous group formation can induce some individuals to increase their local public good production. Conversely, disallowing endogenous group formation can decrease local public good production. From the principal’s point of view, the optimal choice of group formation mechanism depends, of course, on whether increased production of the local public good is beneficial or detrimental to the principal’s interests.

### III. Teamwork

The setting of our first application, which exemplifies how a principal can benefit from using endogenous team formation, is a firm where team members share their time between group tasks and individual tasks.

Holmstrom (1982) demonstrated that teamwork conditions may create a moral hazard problem with substantial free-riding. Further, Holmstrom and Milgrom (1991) showed that when agents have multiple tasks, and effort is not verifiable for some tasks, high-powered incentives may work badly by increasing effort on observable tasks at the expense of unobservable tasks. While much of the literature on these issues has focused on optimal payment schemes, we show that endogenous group formation can reduce the free-riding problem. Moreover, we show that the potential improvement is increasing in the heterogeneity of workers’ relative abilities.

Consider a firm in which individuals work together in one of two equally large teams, led by a common principal. Each worker $i$ has to choose how to share his time between two types of tasks. Let $r_i$ denote the time spent

\textsuperscript{13} Note that for $\rho = 0$ there will be no production of the local public good in the unpopular group. In this case an alternative interpretation is that there is only one group, and that $w_i$ is an outside option available for those who do not join the group.
by $i$ on individual tasks, such as sales activities, writing single-authored papers, seeing patients or clients, while $\ell_i$ is the time spent on tasks which increase output for everyone on the team, such as marketing, working on co-authored papers, collection and dissemination of information, or taking part in group discussions (e.g. conferring about others’ difficult patients or clients). Each individual produces a verifiable output $y_i$, which is increasing in private time $r_i$, in ability $w_i$, and in the average contribution to group tasks from members of his team, $S_i$: \[ y_i = w_i r_i + \gamma g(S_i). \] (16)

The worker’s contribution to group tasks $s_i$, which we may think of as helping, is produced according to (3), i.e., $s_i = v_i \ell_i$. Contributions of help are observable to other team members, but cannot be verified by the principal. The principal, however, observes $y_i$, and rewards each person with an exogenously given fraction $\alpha$ of this individual production, while keeping a profit per worker of $(1 - \alpha)y_i$. For specialized professions such as medicine or law, individual output in terms of successful cases or treatments may be observable, but comments and suggestions from colleagues may be crucial for achieving this performance. Alternatively, and equivalently, we may assume that $x_i = w_i r_i$ and $g(S_i)$ are distinct, observable products, and that employees are paid a share $\alpha$ of the former and a share $\gamma \alpha$ of the latter. For example, researchers may form a group of co-authors, where $g(S_i)$ is the published version of their joint paper, while $x_i$ is co-author $i$’s output of individual papers produced during the same time period.

To simplify the analysis, we assume that the individual cares only about his monetary payoff, \[ U_i = \alpha y_i. \] (17)

Inserting (16) in (17), and using (2), yields an expression which is a monotone transformation of the utility function (4) of the general model above, with $\rho = 0$. Lemma 1 then implies that with exogenous group formation, no one will contribute anything to group tasks. Without the threat of exclusion, each team member spends all his time on $r_i$, individual tasks. This is a standard public good problem; everyone would prefer a situation in which all team members contributed, but no one has an individual incentive to do so.

\[ \text{14 The type of teamwork discussed here is thus slightly different from that in Holmstrom (1982), who assumes that individual production is not verifiable by the principal. Our focus is rather on the problem of allocating time between multiple tasks, as in Holmstrom and Milgrom (1991). Moreover, the solution to moral hazard in teams proposed by Holmstrom (1982) would not apply to our setting with continuous population.} \]

\[ \text{15 This is not crucial, but makes the example more transparent.} \]
Assume now that group formation is endogenous. Then, it follows from Theorem 1 (provided its conditions are satisfied) that there exists an equilibrium in which the popular group consists of those workers who have a comparative advantage in helpful activities (i.e., $\Omega_i < m$), while the unpopular group consists of those with a comparative advantage in individual production.$^{16}$ In the popular group, people help each other by contributing $\bar{s}$ to group tasks. In the unpopular group, no help is provided to others.

The principal is interested in promoting the groups’ total production, and thus prefers that workers share their time efficiently between the two tasks. However, since he cannot observe contributions, few instruments are available to reduce the free-rider problem discussed above. Nevertheless, the principal can use the fact that although he himself does not observe contributions, fellow teamworkers do. By allowing endogenous team formation, the principal can indirectly benefit from the existence of an informal sanctioning mechanism among workers, and thus let the fear of exclusion from the popular team be the incentive to help others.

Since $\bar{s} > 0$, endogenous team formation will induce every individual in the popular group to contribute more to group tasks than he would with exogenous team formation, while the behavior of members of the unpopular group is unaffected. Note that $\bar{s}$ can be either higher or lower than that level of $s$ which would have maximized total production in the popular group.

The productivity gain from endogenous group formation for an average worker in the popular group, as compared to the exogenous case, is in fact proportional to the level of heterogeneity in the population. Compared to the case with $s = 0$, the productivity gain of an average worker equals $\gamma g(\bar{s}) - (m - h/2)\bar{s} = h\bar{s}/2$, where the latter equality is derived from the equilibrium condition $\gamma g(\bar{s}) = m\bar{s}$, and where $h$ is a measure of population heterogeneity as discussed above. While the gain from endogenous group formation can be substantial when workers have very different relative abilities, it can thus be negligible if workers are almost identical. The reason is that in the latter case, competition to become a member of the popular group becomes so fierce as to produce inefficiently high contributions.

A principal might wonder whether $S_p$ could thus become too large, i.e., whether the desire to be accepted in the popular team could induce workers to divert so much attention to group tasks, at the expense of individual tasks, that it would be more profitable to let team formation be exogenous after all. This can never be the case, however. The principal will always benefit from endogenous team formation. Under endogenous team formation, everyone in the popular group earns more (otherwise they would not have preferred the popular group). Since the payoff of workers in the unpopular group is

$^{16}$ There also exists an equilibrium with no production of the local public good, i.e., $S_p = S_u = \bar{s} = 0$. 

unaffected, and the principal receives a fraction of every worker’s payoff, the principal’s payoff must be higher in the endogenous case.

With a slight reinterpretation of model variables, other ways to organize teamwork can be analyzed using our model. First, inserting (16) in (17), rearranging, and using that \( r_i = 1 - \ell_i \), we find that (17) can be written as

\[
U_i = \alpha \gamma g(S_i) - \alpha w_i \ell_i + \alpha w_i. 
\]

Now, let \( \alpha \gamma g(S_i) \) be the teamworker’s monetary payoff, proportional to team production \( g(S_i) \), which is observable. Further, let \( w_i \) represent the individual’s effort costs, where \( \ell_i \) now represents individual effort. The term \( \alpha w_i \) is fixed and will thus not affect behavior; consequently, (18) is behaviorally equivalent to

\[
\tilde{U}_i = \alpha \gamma g(S_i) - \alpha w_i \ell_i. 
\]

The latter expression can be interpreted as the utility of a teamworker who is paid according to her team’s total production, and whose utility consists of monetary payoff, \( \alpha \gamma g(S_i) \), less her costs of effort \( \alpha w_i \ell_i \). Note that it takes an effort \( \ell_i = \bar{s}/v_i \) to attain membership in the popular group, and hence the cost of membership is \( \alpha \bar{s} \Omega_i \). With this interpretation, the model can also be applied to situations where workers are paid according to a group piece rate only, while group productivity depends on individual effort.

Hamilton et al. (2003) analyzed data from a garment factory that introduced voluntary team formation. Starting from a situation in which seamstresses worked independently, performed one specific task and were paid by individual piece rate, the plant introduced module production, in which autonomous teams of six or seven workers would perform all sewing tasks. By working in teams, workers sat together in one room, which made mutual monitoring effort easy, thus allowing for informal sanctions. Measurement of output from individual team members, however, was costly for managers. Thus, team members were paid a group piece rate. It was found that in spite of the opportunity to free-ride on others’ effort, introduction of teams improved productivity by, on average, 18 percent. Further, the first teams to be formed yielded the highest gains. These results are consistent with our model.\(^\text{17}\) In the case of the garment plant, all teams, even the last to be formed, increased average productivity. This would be consistent with our model if workers have a preference for social interaction, i.e., \( \rho = 1 \). Our next example deals with a such case.

\(^{17}\) One-fifth of the increased productivity could be explained by the fact that highly productive workers were more likely to join teams; the remaining 14 percent reflects a team effect. The former result is consistent with our model if \( v_i \) and \( w_i \) covariate such that \( v_i \) is increasing more than proportionally in \( w_i \). This could be the case e.g. if return to human capital is higher in teamwork because skills can be taught to other team members.
IV. Unpopular Nerds

It was demonstrated above that endogenous group formation can be used as a policy tool for principals who want to influence non-verifiable effort in teams. We now illustrate how our model can be used to understand the formation of group-specific social norms, using endogenous social group formation in schools as our example.

Academic excellence—although frequently envied by others—is not necessarily a trait that makes a student popular among her peers; see Eder and Kinney (1995). Sociologists have long been aware that in schools, students categorize themselves into social groups such as “nerds”, “jocks” and “burnouts”, each group with its separate requirements of appearance and behavior; see Coleman (1961) and Eckert (1989). The requirements of such social categories seem to affect students’ school effort, and may hence also indirectly affect the productivity of resources allocated to schools.

Akerlof and Kranton (2003) argue that theories of identity may help explain student performance in school. They assume that different groups, like jocks, nerds or burnouts, have different ideals for student behavior and performance, and that these ideals affect the behavior of students belonging to those groups. The ideals, however, are exogenous in their analysis. Below, we derive such group-specific ideals endogenously. Our analysis thus provides one possible explanation as to why devoting time and energy to academic study in fact seems to make a student less socially popular, all else given; see Bishop (1999) and Lyng (2007).\(^{18}\) This can make some students reduce their learning efforts in order to become acceptable as members of a popular group.

For the sake of transparency, we make several simplifying assumptions. Most notably, we assume that students are identical in all respects except academic ability, thereby disregardin differing preferences, wealth and social ability. We focus on the case of perfectly endogenous group formation, i.e., teachers do not intervene at all, and describe the equilibrium in this case.

Thus, let each student have preferences for private payoff achieved through school work, \(x_i\), and for social quality, where the latter consists of benefits arising from one’s own social activity \(f(s_i)\) and from the social activity of others \(\gamma g(S_i)\). This is as specified in equation (4) above, assuming that \(\rho = 1\). Private benefits from studying are increasing in student ability \(w_i\) and time spent studying \(r_i\), as specified in (2). Private benefits from studying can, for example, be future college entry, parent

\(^{18}\) According to Lyng (2007, p. 17), “The students in my study hold that there is a certain inverse connection between the positions of the two hierarchies: Those who want to be cool and hip care less about school, while those who are most committed to school work are not very popular.”
approval or higher future earnings.\textsuperscript{19} A low $w_i$ may be caused either by low academic talent, or by factors external to the individual which affect the rewards he will obtain from his studies.\textsuperscript{20} Moreover, assume that $v_i = 1$ for all $i$, i.e., every student is equally productive in contributing to the group’s social activity. In terms of our model, this implies that $s_i = \ell_i$, and $\Omega_i = w_i$.\textsuperscript{21}

If students are allowed to form groups endogenously, those who contribute most to the group’s social quality will be the preferred group members. This gives students an incentive to contribute more social time, and consequently study less, than if their group affiliation had been exogenous. Theorem 1 implies that in this (extremely simplified) case, there exists an equilibrium in which a student’s popularity will depend on her opportunity cost $\Omega_i = w_i$. Students with low academic ability now have a comparative (although not absolute) advantage in socializing. They will thus be in the popular group, while the most able students will be in the unpopular group. Hence, in equilibrium, students will be perfectly separated according to their academic ability $w_i$, with the least able students as the most popular. It follows that students’ commitments and actual levels of social activity can be illustrated as in Figure 1.

The higher a student’s academic ability, the lower her unconstrained supply of social time, since able students have a high opportunity cost in terms of foregone academic achievements. Further, some students with $w_i < m$ will make commitments which are substantially higher than their unconstrained supply. They do this because if they promised less, someone else would take their place in the popular group. For those with very low ability, however, unconstrained social activity levels exceed the minimum requirement to become accepted. Hence, these students will contribute even more social time than required by the group—and their popularity is unthreatened. It is those whose ability level is in the middle range, but below the median, who will change their behavior in order to gain popularity. Note,

\textsuperscript{19} Note that although private, none of these benefits can readily be used by students who wish to make side payments to increase their own popularity.

\textsuperscript{20} For example, if $i$ belongs to an ethnic or social minority subject to discrimination in the labor market, and $j$ does not, then even if $i$ and $j$ have the same academic talent, the skills produced from $j$’s effort may yield higher earnings than an equivalent effort from $i$, implying that $w_i < w_j$.

\textsuperscript{21} If the teacher had perfect knowledge of $w_i$, he could simply forbid social activity in school, or otherwise instruct each student how to share her time between studying and social activity. He could then infer from each student’s academic achievement and the time constraint whether she had adhered to the rule. If abilities were observable for students, they would be able to enter explicit contracts with each other. Nevertheless, even in the case of perfect observability of $w_i$, the analysis of endogenous group formation would be unaffected as long as students cannot, for some reason, enter binding contracts with each other, and teachers allow endogenous group formation to take place.

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Fig. 1. Contribution $s^*(w_i)$ to the local public good (solid line).

Notes: $\Omega_i = w_i$; $\hat{s}(w_i)$ is the unconstrained contribution, $\bar{s}$ is the minimum requirement in equilibrium and $\bar{c}(w_i)$ is the maximum willingness to contribute.

however, that although more able students will end up as less popular, and with a lower social quality, their utility, including the benefits of academic achievement, will be higher than the utility of less able, but more popular students.\(^{22}\)

The assumption that students are identical except for academic ability is obviously simplistic. Since Theorem 1 allows $\nu_i$ to vary, the above results can readily be generalized to hold for the case in which students also differ with respect to their social ability. The conclusion is still that those with a comparative advantage in production of social quality are in the popular group, while those with a comparative advantage in academic work are in the unpopular group. In this case, however, students who are “good at everything” may, if their comparative advantage indeed lies in production

\(^{22}\) In his essay “Why Nerds are Unpopular”, Graham (2003) asks: “Why don’t smart kids make themselves popular?” His answer is that nerds “want to be popular, certainly, but they want even more to be smart. And popularity is not something you can do in your spare time”.

of social quality, end up in the popular group. In general, therefore, it is not academic ability as such which makes a student unpopular; it is the time and effort devoted to school work that could, alternatively, have been spent producing social quality for the group. This conclusion accords well with sociological and pedagogical studies such as Bishop (1999), Lyng (2004, 2007) and Schreiner (2006).23

If a teacher’s goal is to maximize students’ academic achievements, and exogenous group formation were in fact possible, she would prefer to use it. If students can self-select into groups, some of them will choose to spend less time studying in order to secure their membership in the popular group.24 Here, however, the crucial assumption is the teacher’s preference that students produce the private good, but not the public good. In some contexts, the opposite may be true. The teacher may, to some extent, value students’ social quality or, alternatively, the public good may be interpreted as the result of a group project (corresponding to the teamwork example above, but with $\rho = 1$). In such cases the teacher might prefer endogenous group formation.

The context of our partial model does not provide a comprehensive description of the learning environment in schools. For example, peer effects in learning, as in e.g. Whitmore (2005), have been disregarded, as well as any possible interaction effects between social quality and learning. Moreover, the same students may meet both in and outside of class (or school), so that exogenous group formation at school may not fully remove the incentive to spend effort making oneself popular. For these reasons, the policy conclusions concerning exogenous or endogenous group formation are not straightforward. Nevertheless, our analysis contributes to the understanding of group-specific social norms. It demonstrates, for example, why a nerd will not risk social exclusion by his peers if he studies hard, while a marginally popular “cool” student will.

23 Bishop (1999) quotes a study by Tannenbaum (1960), who provided students at a high school in New York with descriptions of eight fictitious students and asked the respondents to rate them. Their ratings were as follows: (1) athlete: brilliant, nonstudious; (2) athlete: average, nonstudious; (3) athlete: average, studious; (4) athlete: brilliant, studious; (5) nonathlete: brilliant, nonstudious; (6) nonathlete: average, nonstudious; (7) nonathlete: average, studious; (8) nonathlete: brilliant, studious. While accounting for athletic performance, which is an important determinant for student popularity, would require an extension of our model, the above is consistent with the idea that while academic ability may have ambiguous effects on popularity, being studious seems to be unambiguously negative; see Eder and Kinney (1995).

24 Note, however, that students will have conflicting interests concerning the group formation mechanism. In our model, exogenous group formation amounts to drawing groups at random. For students whose unconstrained contribution exceeds $\bar{s}$, behavior is independent of the mechanism used; nevertheless, exogenous group formation reduces their social quality. A similar argument holds for the “nerds”; their behavior is unaffected, but exogenous group formation will increase their social quality. These conflicting interests make it difficult to draw unambiguous conclusions on welfare effects.
So far, students were assumed to have no other resources to spend than their time. It was also assumed that the private good produced by studying, e.g. good grades, could not be used for side payments. However, if students differ with respect to monetary wealth, this may affect the sorting process. For example, a wealthy student may make a monetary contribution, e.g. by throwing a party, to enhance her popularity. In fact, the model could easily be modified to describe situations where wealth is the main resource used in the competition for popularity. If the marginal utility of income were decreasing in income levels, and individuals differed with respect to wealth, rather than abilities, our framework would imply that some individuals will spend more money for the benefit of their group than they would have under exogenous group formation, for example by throwing extravagant parties. Hence, our framework can also be used to analyze “high society”.

The generalizable conclusion is that those with the lowest opportunity cost of contributing to the group will form the popular group. Similarly, if preferences vary among individuals, it is those with the lowest opportunity costs, valued by their marginal rate of substitution between the two goods, who will form the popular group.

V. Conclusions
Modern societies are highly structured socially. The rich mingle with the rich, intellectuals mingle with each other. Different groups seem to endorse varying behavioral norms. In some groups, social acceptance requires helping others or throwing extravagant parties or abstaining from studying hard. But the same aspects do not hold for other groups. Such structures and norms should not simply be regarded as arbitrary or fixed. To a large extent, social groups are formed endogenously and spontaneously; the process through which group formation takes place may influence individual behavior in important ways.

Within the logic of a model of endogenous group formation, we have shown that in a multi-task teamwork context, a principal can increase his profits by allowing endogenous team formation and exploiting informal social control due to the fear of exclusion from the most popular team. We have also demonstrated that with endogenous group formation in schools, those who study the hardest will, all else equal, become less popular socially, and that this will induce some students to study less than if social exclusion had not been a concern.

The impact of threats of exclusion on individual behavior may be an important consideration for teachers, firm managers and others who deal with teams. In general, whether a principal should choose endogenous or exogenous group formation varies from case to case. The key question in this respect is whether individual contributions to group-specific, local
public goods are beneficial or harmful to the principal. In the case of schools, a teacher may want students to study hard and not spend too much time socializing with each other; the teacher’s goal is then best served by influencing students as little as possible regarding their group affiliations. In the teamwork case, however, the opposite result obtains. The principal wants team members to help each other and, if team formation is endogenous, some workers will contribute more to common tasks in order to retain their membership in a popular team.

Appendix

Proof of Lemma 3

If \( \Delta U(m, s) > 0 \) for some \( \epsilon > 0 \), then, since \( \Delta U(m, 1) \leq 0 \) and \( \Delta U(m, s) \) is continuous in \( s \), it follows that there is an \( \delta \in (\epsilon, 1] \) such that \( \Delta U(m, \delta) = 0 \). We claim that with \( \rho = 1 \) or \( \gamma g'(0) > m \) there does exist a (small) \( \epsilon \geq 0 \) such that \( \Delta U(m; \epsilon) > 0 \).

Consider first the case \( \rho = 1 \), and consider a minimum requirement \( s = \epsilon = 0 \). In this case, \( s^*(\Omega) = s(\Omega) \), and since \( s(\Omega) \) is declining in \( \Omega \), it follows that \( S^p > S^o \). Thus

\[
\Delta U(m; 0) = \gamma (g(S^p) - g(S^o)) > 0.
\]

Next, when \( \rho = 0 \), \( s(\Omega) = 0 \) for all \( i \). Hence \( S^p = s \), while \( S^o = 0 \). Now

\[
\Delta U(m; s)_{s=0} = \gamma (g(S^p) - g(S^o)) = \gamma (g(0) - g(0)) = 0.
\]

Using (10), \( S^p = s \) and \( S^o = 0 \),

\[
\frac{\partial \Delta U(m; s)}{\partial s} = \gamma g'(s) - m > 0.
\]

Hence, there exists an \( \epsilon > 0 \) such that \( \Delta U(m; \epsilon) > 0 \). ■

References


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