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On intrinsic motivation and crowding-out

Friedel Bolle

European University Viadrina Frankfurt (Oder)
Department of Business Administration and Economics
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Summary

If a previously unpaid activity (donating blood) is paid then we often observe that this activity is reduced. In this paper, it is hypothesised that the price offered is taken as a proxy for the "market value" of the activity. Depending on how the actor valued the activity previously, crowding-out or crowding-in, as well as persistence (or not) of the effect after the abandoning of payment is implied. This "naïve" explanation is confronted with Bénabou and Tirole's (2003) principle-agent model where the opposite signalling effect is hypothesised: a higher price is taken as an indication for a lower value.

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Europa-Universität Viadrina Frankfurt (Oder)
Lehrstuhl Volkswirtschaftslehre
insbesondere Wirtschaftstheorie (Mikroökonomie)
Postfach 1786
15207 Frankfurt (Oder)
e-mail: bolle@euv-frankfurt-o.de

I. Introduction

In his classic investigation, Titmuss (1970) reported that many blood donors stop donating after payment for their activity is introduced. Oberholzer-Gee et al. (1995) report that the acceptance rate of an atomic deposit decreased in a small Swiss town from 51 % to 25 % after the citizens had been offered compensation. Gneezy and Rustichini (2000) conducted a field experiment in Isreali Kindergartens, where parents often called for their children late: they were even later after a fine was introduced. Frey (1997) illustrates this phenomenon by anecdotal evidence of children who, after once being paid for cutting the grass in the family lawn, never do it for free again. In an overview of 128 studies Deci et al (1999) find overwhelming evidence for the existence of such a “crowding-out” effect in several activities. (Sometimes the contrary is also found: a “crowding-in” effect where, after payment, a previously unpaid activity is extended.) If investigated, it is also found that, usually, crowding-out is persistent, i.e. if payment is stopped then the activity is more likely to be (further) reduced than to increase again.

From an economic point of view crowding-in can easily be explained. Without payment, the price of the activity is 0, with payment it is negative. So, except for the case that the activity is a “Giffen good” the reduction of its price should increase demand. Giffen goods are assumed to be rather rare and many economists doubt that they exist at all. In addition, textbook demand theory does not provide us with a reason for the persistence of crowding-out.

For this reason, explanations for crowding-out are usually “psychological”; they are explained (i) as people’s desire to keep control of themselves, and their tendency to define themselves through their activities. Another explanation is (ii) that the actor’s intrinsic motivation is not acknowledged if payment is offered, and that her “involvement and competence is not appreciated” (Frey and Jegen, 2001, p. 594). Note that the following proposals do not contradict, but rather interpret these explanations (in particular (ii)). Neither does the following proposal contradict the analysis of Frey (1997, p. 20-23), but it provides an explanation of why external intervention may undermine intrinsic motivation (which is exogenerous in Frey, 1997). Closest to my proposal are assumptions by Oberholzer-Gee (2006) and

Harackiewicz (1979). Oberholzer-Gee (2006, p. 432) assumes that, when a person in a waiting line lets a stranger jump the queue, 'the willingness to pay for a position in the line indicates how hurried the stranger is.' Harackiewicz (1979) assumes that extrinsic rewards have a "cue value", i.e. performance-contingent rewards convey information about a subject's capabilities. Thus Harackiewicz (1979) and Harackiewicz et al. (1984) compare the effect of performance-contingent tangible rewards with situations of verbal evaluations without tangible reward (lower activity level) and with a control group without reward or evaluation (higher activity level). The difference from my proposal is that their subjects choose the activity level under the "thread" of a later evaluation while, in my environment, the actor is informed about the value (the price) in advance.

In this paper, I would like to offer a simple explanation for crowding-out (or crowding-in) and its persistence. Let me start with activities which are clearly altruistic like the donation of blood or the voluntary provision of a public good (such as cutting the grass) which can be explained along the same lines. The idea is that the benefactor does not exactly know the value of her service for others but that she acts on the basis of an estimate. If paid, she gets a signal, namely a price, which she may perceive as (proportional to) the market value of her activity or as an estimate of the market value by others. After the adoption of the valuation, the consequence is crowding-out if her own estimation had been considerably higher than (in the proposal model at least twice) the price offered. In the next section an economic model of altruism is used to formalise this idea. The fourth section shows that this explanation can also be transferred to other activities. In the fifth section my proposal is compared with a Principal-Agent model by Bènabou and Tirole (2003). The sixth section is the conclusion.

II. Defining intrinsic/extrinsic motivation

"Intrinsic motivation" is difficult to define in general (see Reiss, 2005, and Lindenberg, 2006). Take the example of a child who builds a kite. Should we say the pleasure of putting together the pieces is intrinsic motivation while the pleasure of seeing the kite fly is extrinsic motivation? Or, if we deny the latter, is the pleasure of being admired and envied by other children extrinsic motivation? I think all attempts to define

intrinsic motivation in absolute terms – as a pure pleasure of doing something – will ultimately fail. No man is an island. We always interact with our environment and with other people. Therefore I would like to propose a different approach, namely by defining extrinsic motivation as stemming from a change in the environment.

Imagine a certain well-described situation. For an economist, this is a model-situation as, for example, household demand for goods and services (or activities) under given constraints (time, budget, etc.). For our proposal, it is also important to describe the information level of our decision maker. He knows to a certain degree (estimates) the quality of the goods and activities he consumes (vitamins, cholesterol, etc. in food, risk of an accident when skiing), the value of his services to others, and the social reputation he can gain through certain activities (flying a kite). All the actions within this situation can be called intrinsically motivated – with respect to the situation!

Now assume that there is a change in the parameters of the situation: a price may change, a piece of information may be given, a restriction may become tighter, etc. This change may be called extrinsic motivation and the change in behaviour may be attributed to this extrinsic motivation. If we take the new situation on its own without comparing it to the old one, it is not possible to distinguish between intrinsic and extrinsic motivation. This is the way in which experiments are conducted and what I propose is to set up definitions in the same pragmatic way.

The change in situation which dominates the intrinsic/extrinsic motivation discussion is the adding of tangible or verbal rewards to a certain activity. As we will see in the next section, for this induced change in behaviour, how this reward is interpreted is crucial.

Usually three situations are distinguished: In period T = 0 we have certain initial conditions. In T = 1, a (tangible or verbal) reward for a certain activity is introduced, in T = 2, the reward is abandoned again. In the next section, we will investigate the effects of these changes under certain assumptions. Note that in psychological experiments there are often two separate groups, an experimental group which acts in the situations T = 1 and T = 2 and a control group which acts two times in the situation T = 0. Comparisons are made mainly between T = 0 and T = 2. For

applications of theories and experimental results, however, we are (more) often interested in the comparison of T = 0 and T = 1. Should we pay blood donors, for example?

III. Altruism and crowding out

Let us assume that preferences are monetarised and separable[1]. More exactly, utility is described by[2]

(1) $U(x, y) = y + atx - c(x)$

with

y = own consumption (income),

x = amount of service to others (the donation of time or goods),

$c(x)$ = monetarised costs of the service, $c' = \frac{dc(x)}{dx} > 0$, $c(0) = 0$, $c'(o) < at$, $c'' > 0$ are assumed,

tx = monetarised benefits for others,

a = altruism parameter, $0 < a < 1$.

Case I *(No payment):* $y = y_0 = \text{const}$, $t = t^*$ (estimated). Then the optimal amount of service is given by

(2) $c'(x) = at^*$.

Case II *(Payment):* $y = y_0 + wx$, $t = w$ (estimated)[3], i.e. the price w is taken as a signal for the value of the service to others. The optimal amount of service is given by

(3) $c'(x) = aw + w$

[1] A more general model would imply the same qualitative results. I think, however, for the purpose of illustrating the signalling idea such a simple model suffices.

[2] A similar utility function is used by Tan and Bolle (2006) for the explanation of dictator givings with transfer rates $t \in [1/4, 4]$.

[3] If $t = \alpha w$ were estimated, the model would not change considerably. a would be substituted by $a\alpha$ in (3).

Case III *(Compensation for outlays):* $y = y_0 + wx$, $t = t^*$ (estimated). The optimal amount of service is given by

(4) $c'(x) = at^* + w$

Thus, if compensation for outlays (instead of payment by market prices) is successfully communicated then we should observe the extension of the service. In the case of payment, we would expect crowding-out if and only if

(5) $t^* > \frac{a+1}{a} w$.

So, because $(a + 1)/a > 2$, t^* has to be at least twice as large as w for crowding-out. The smaller w and the smaller a, the more probable is crowding-out. In tracking the influence of a, we should keep in mind that only activities which are estimated to be highly efficient (t^* high) can motivate a person with little altruism to produce a public good. Therefore one should not push blood donation by calling blood “priceless” (as advertised by the German Red Cross) and then, if one doesn’t get as much blood as needed, offer payment. One should at least try to communicate that the real value of blood is higher than the “compensation” offered.

	T = 1 payment is offered	T = 2 payment is abandoned
$t^* > \frac{a+1}{a} w$	activity decreases: $x_1 < x_0$	decreases further: $x_2 < x_1$
$\frac{a+1}{a} w > t^* > w$	activity increases: $x_1 > x_0$	decreases considerably: $x_2 < x_0$
$t^* < w$	activity increases: $x_1 > x_0$	Decreases mildly: $x_0 < x_2 < x_1$
$a = 0$	$x_1 > x_0 = 0$	$x_2 = 0$

Table 1: Consequences of payment and abandoning of payment. x_T = level of activity at time T. For T= 1, 2 it is assumed that t = w.

The simple model above describes also the persistence of the effect. Once payment has been offered, t = w (or even $t \leq w$) is still estimated even when payment is abandoned again. The provision of the service should decrease even more if w is

reduced step by step. If $\frac{a+1}{a}w > t^* > w$ then we can tell the story of the boy who continues cutting grass in the family lawn after payment but stops if payment ceases. If $w > t^*$ then crowding-in persists. In this case as well as in the case a = 0 control with extrinsic rewards is appropriate and successful.

Lastly, let us emphasise a nearly trivial implication of (3): *The larger w, the larger the contribution x.* Note that this describes only the effect of varying w, not the introduction of payment. Not offering payment and offering w=0 are distinct cases.

IV. More examples

In the following, four examples are presented where the "altruism model" could easily be applied after minor adjustments. The basic model needs major adaptations, however, in the case of labour market behaviour where reciprocity should substitute altruism. Voluntary effort induced by unconditionally paid wages is crowded out when incentive payment (contingent rewards or fines) is offered, and this crowding-out effect is persistent. (Gächter et al, 2006). A possible hypothesis could be that the agent (worker) either adopts the norm of reciprocity which is inherent in the incentive contract or he refuses to sign the contract.

VI.1. Working just for fun

All the activities described in experiments and field studies are publicly observed activities – otherwise we would not be able to detect a crowding-in or crowding-out effect.[4] So it does not seem to be far-fetched to assume that many of these activities are (at least) partly motivated by showing one's competence. In the above model we can interpret atx as the utility one receives from impressing others by one's "ability" tx, say by solving a crossword puzzle, or playing the piano, or by attaining good grades in school. The crucial question is how payment is interpreted by a person motivated in this way. One such interpretation may be that payment it proportional to the "true impression".

[4] The early aspiration level experiments (Hoppe, 1931) were however, carried out with „spying". One might object to such a procedure due to ethical reasons. Otherwise it might be interesting to use such experimental techniques for intrinsic motivation.

If one played the piano really “just for fun” then payment might elicit the interpretation that the activity isn’t simply private (as the actor may have assumed) but that it has a public component in which case we are back in the last section’s world. Whatever the interpretation is, if it involves price as a signal for “the true value” of the activity, then the explanation of crowding-in or crowding-out follows the logic of the last section.

VI.2. Negative external effects and fines

If at < $c'(0)$, formally, negative x may be optional. -c(x), x < 0, describes the person’s benefits, tx her estimate of the damage she causes, and atx her “guilty conscience”. If a fine fx is introduced with f < t she may take this as a signal that the social damage is not as high as she initially believed. She then extends her “asocial” activity – for example, calling her children even later from the Kindergarten.

VI.3. Letting someone jump the queue

Imagine our altruist to be in a waiting line and someone asks her to let him in before her because he is in such a hurry. Would she let him in? And if he offers her some monetary reward, would she take it? Oberholzer-Gee (2006) experimentally investigates this situation. It is different from the situation analysed in Section III, first, because there are two other parties whose welfare is affected by the altruist’s decision (the person who wants to jump the queue would gain, those behind her would lose) and, second, because the beneficiary himself offers the reward.

Let us substitute atx in (1) by $a[y_B+t(n+1)-qn]x$, with x=waiting time for proceeding one place in the queue, n= number of persons behind the altruist, y_B = income of the potential beneficiary (who wants to jump the queue), and t,q= estimated disutility of x. If no monetary reward is offered (but, in this experiment, the person tells that he is in a hurry), she estimates t=t*, q=q*. If a reward w is offered, she estimates t=αw, q=q*. If she accepts the reward w her income y is substituted by y+w and y_B is substituted by y_B-w. After a monetary reward has been offered there are three possible decisions in the experiment of Oberholzer-Gee (2006) (instead of two in Section III): declining the request to jump the line, granting the request and taking the reward, or granting the request but rejecting the reward. Nonetheless, similar

consequences as in Section III can be derived, in particular we find (comparing only situations where rewards are offered) that larger rewards cause higher rates of granting requests. That coincides with the experimental results of Oberholzer-Gee (2006).

VI.4. Uncertain costs and compensation

In a way, this case is contrary to the model investigated in Section III. Above, high payment is “good news”: the value of one’s service is high. Here, high payment is “bad news”: one’s costs are high. No wonder that the effect of high payment can be opposite: Higher payment may *reduce* the activity, while in Section III higher payment *increased* the activity. (Again, comparing only situations where payment is introduced.)

Let us come back to the model of the blood donor. She could, alternatively, understand the payment offered to her as a compensation for the risks of donating. She may have assumed her costs to be low until compensation was offered. If she interprets the compensation to be equal to the expected costs (which are higher than her ex ante estimation) and if she is risk averse then she may stop donating. While in the case of blood donations our original model still seems to be more appropriate, in the case of nuclear waste deposits the second interpretation is more plausible.

Formally, we may assume

(6) $U(x, y) = y + ax - c(x) - brx$

where $c(x)$ are “normal” costs (mainly opportunity costs), rx is an expectation value of health effects and $b > 1$ measures (in a rather simplified way) risk aversion. “Health effects” r^*x describe knowledge about the average effect. So, before receiving a wage offer she donates according to

(7) $c'(x) = a - r^*b,$

after receiving the wage offer and assuming that the true health effects are wx, she donates according to

(8) $c'(x) = a - wb + w.$

So, she decreases her contributions if

(9) $w > \frac{r^* b}{b-1}$.

(8) shows that, in this model, *the activity level x decreases with w.*

V. Why pay? Why assume the price to be a signal?

Up to now we have accepted payment and beliefs about the message of a price as exogenously given. Payment originates in

(i) a naïve belief that a larger reward causes more activity

or

(ii) in the sophisticated belief that case $t^* < \frac{a+1}{a}w$ (Section III) or $r^* < \frac{b-1}{b}w$ (Section 4.4) applies.

(i) is a standard assumption in Economics – so why should it not be held by those who pay for donating blood or give their children monetary incentives to cut the grass or improve their performance in school? If this is supported by the model in Section 2 and (ii), the standard assumption even survives a modification with social preferences and incomplete information. And why shouldn't the Red Cross be surprised because, contrary to the belief in (ii), case $t^* > \frac{a+1}{a}$ or $r^* > \frac{b-1}{b}w$ applies?

But why should one assume the price to be a signal? In Section 2, a blood donor assumes w to be the true social value of her service but, of course, we could substitute this belief with the more general belief that the true value is αw, α = const, or g(w), $g' > 0$. This would complicate the model but would not deliver different

results. The intrinsic question is: why should she take p as a positive signal at all? This belief can originate in

(iii) a naïve belief that joint profits are split with respect to a certain fair rule or

(iv) in the sophisticated belief that rewards are caused by beliefs (i) or (ii) and that rewards signal higher costs or higher social values.

The fact that people are endowed with a sense of fairness and judge fairness according to certain rules is an old credo of social scientists (Homans, 1958; Güth, 1988). The belief that people try to be “fair” is the message of many modern models of social behavior (Bolton and Ockenfels, 2000; Fehr and Schmidt, 1999; Tan and Bolle, 2006). So, perhaps, (iii) is not really naïve.

With (iv) we enter a new level of analysis. If the receiver of the rewards speculates about the motives of the offerer and vice versa we find ourselves in a “signalling game”. The question is whether we should really base our explanation of the phenomena of voluntary contributions and their payment on game theory reasoning. Experimental economics show that game theory is, mildly expressed, not always capable of explaining subjects’ behaviour. With respect to signalling games, Potters and van Winden (1996) interprete their data in such a way that a “decision theoretic approach” (which merely relies on the players’ own parameters/incentives) is more appropriate than a “game theoretic approach” which also takes into account parameters/incentives of the co-player.

A Principal-Agent model of a situation as in 4.4 has been proposed by Bènabou and Tirole (2004). The principal (say, the Red Cross) offers the agent (the blood donor) a compensation w from which he concludes how large his costs are (c(x) + brx in 4.4). In Bènabou and Tirole (2004), x is restricted to x = 0 or x = 1. A separating equilibrium is necessarily in mixed strategies. It has the attributes (see Bènabou and Tirole, 2004, Proposition 1):

(a) Rewards are short term reinforcers: *the higher w, the higher the probability of compliance*, i.e. x = 1.

(b) Rewards are bad news: Higher wage offers signal higher costs.

(c) The estimation of c via (b) has a “permanent” influence on the agent’s cost estimation.

(a) is a necessary consequence of the agent’s “goal” to make at least some types[5] of principals indifferent to different rewards. Vice versa, (b) is determined by the principal’s “goal” to make at least some kinds[6] of agents indifferent between x = 0 and x = 1.

This sophisticated model has the advantage that it implies (b) while, in our naïve model above, (b) is assumed. On the other hand, however,

- we can hardly imagine the Red Cross playing a mixed strategy, and

- (a) describes completely different behaviour compared with the models of Section 2 and 4.4 where we found: the higher w the *smaller* x is. (The higher the compensation for tolerating a nuclear deposit, the smaller the rate of acceptance.) If we would transfer Bènabou and Tirole’s (2004) model to that of Section III it would result in smaller x induced by higher w while we, again, expect the contrary. In Oberholzer-Gee’s (2006) experiment higher rewards induce higher rates of granting the request to jump the line.

In order to describe behaviour in situations which may be interpreted as games we always have to ask ourselves whether the people involved believe that they are in such a situation, i.e. whether or not they believe that the Red Cross acts strategically. I would not like to emphasise here the limited abilities of people to carry out the necessary computations (which are much more demanding in the game theory model): these may be approximated by certain heuristics.

[5] We have a „reversed“ asymmetry of information (see also Bolle, 2004). So there are types (in the sense used in game theory) of principals distinguished by their knowledge about the agent’s costs.
[6] See footnote 5.

VI. Conclusion

Although there is a lot of empirical work on intrinsic motivation and crowding-out/crowding-in, most authors seem to be uneasy about the theoretical foundations of these effects. The advantage of the signalling hypotheses over competing hypotheses is that it can explain all types of (crowding-in/crowding-out, persistent or not) behaviour while psychological theories need different approaches. Let me emphasise that I do not contradict arguments of self-determination, etc.; more than one influence may possibly play a role. It will be an empirical question of how well the signalling hypothesis performs, compared with psychological theories as well as game theory.

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