Incentives and motivations: to what extend can economics benefit from psychology?

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Introduction

Traditionally, in economics the theory of incentives makes the implicit assumption that the more an individual is paid the higher his effort, even if there is some decreasing returns of payments. It is then possible for a principal to define his (or her) policy in terms of the relation that it is possible to establish between the wage and bonus given to the agents and their efforts.

The idea that monetary incentives are always efficient seems however a too strong assumption. Frey and Oberholzer-Gee (1997), Kreps (1997), and more recently Bénabou and Tirole (2003) show that something like a 'crowding-out effect' may occur. This effect supports the idea that intrinsic incentives (that is motivation) can be crowded out by extrinsic ones, such as monetary rewards. In this way Bénabou and Tirole show that in a context of asymmetry of information an agent can infer some information from the policy of the principal. This information can be linked to the characteristics of the task he (or she) has to perform, the principal's confidence in his (or her) capabilities, the will of the principal to batch his (or her) ego and so on. Those results are however not taking into account the fact that individuals can give a different meaning to the same information. This may be due to differences in (their) preferences or in the value they attach to their work (see for example Vos and al. 2003). Psychologists instead have developed tools in order to explain how individuals react when facing different kinds of incentives. The Cognitive Evaluation Theory (CET) and, more recently, the Self Determination Theory (SDT) are analyzing how incentives may influence intrinsic motivation. Our aim is to show that psychologists' insights can improve the way economists are dealing with incentives.

We first survey economists' recent developments on the relationship between incentives and motivation. We then present psychologists' attempt to theorize those relationships (CET, SDT). We finally propose a theoretical framework that allows a more integrated framework for the understanding of the relationship between incentives and motivation in economics.

1) Incentives and motivations in economics

In economics, the idea that the more an individual is paid, or the higher the expected sanction, the higher his effort is one of the basic assumptions of Incentives Theories. As an example, the principal-agent theory developed its main contributions on the basis of this assumption. Even if it is possible to improve those results by introducing asymmetry of information and then to show that it is sometimes impossible to write an optimal contract between the parties, the basic assumption is not removed. More recently, however, economists have considered to withdraw such an assumption. This attempt is based (a) first on the idea that incentives need to be analyzed as a system of incentives; (b) second on the influence of social psychologists' main results in terms of the relationships between incentives and motivations and (c) third on some recent experimental results.

a. The system-like conceptions of incentives

In a seminal paper, Holmström and Milgrom (1994) develop the idea that within an organization incentives need to be conceived as a system. They argue that the problem of incentives within organizations usually concerns only one kind of incentives: asset ownership, contingent rewards or job design. However, according to Holmström and Milgrom, asset ownership, contingent rewards or job restrictions are complementary. In other words, they consider that the levels of different kinds of incentives need to be balanced in order to be efficient. The problem they attempt to solve is due to the fact that exogenous variables can modify the comovements of the incentives that are the endogenous variables of the model. The great originality of their paper is not only that it introduces the fact that different kinds of incentives are complementary devices but also that it provides a way to appraise the efficiency of the combination of those incentives. They use the properties of supermodular functions that are such that "if the variables of a supermodular function are increased simultaneously, the function value increases by more than if we were to sum up the value changes from increasing the variables one at the time." (Milgrom and Roberts, 1994, p. 978). This manifests some kind of positive externalities between variables and is equivalent to positive cross derivatives. In other words, if a function f is smooth, then it is supermodular if $\partial^2 f/\partial x_i \partial x_j \geq 0$, when x_i et x_j are two arguments of f. Accordingly, they define the conditions for incentives to be positively related and to induce a reinforcement effect. This theoretical framework is completely in lines with empirical results coming mainly from management sciences. This kind of approach is very suitable because it stresses first the fact that an organization is based on a bundle of incentives and second, that this bundle is efficient

depending on the kind of combinations it supports. Bai and Xu (2001) use this model to analyze the incentives system that need to be applied to CEOs in a multitask context.

A similar kind of conception is applied by the Federal Acquisition Institute, which states that "the system of incentives shall include provisions that

(A) relate pay to performance (including the extent to which the performance of personnel in such workforce contributes to achieving the cost goals, schedule goals, and performance), and

(B) provide for consideration, in personnel evaluations and promotion decisions, of the extent to which the performance of personnel in such workforce contributes to achieving such cost goals, schedule goals, and performance goals."[1]

Direct incentives (payment) and indirect ones (promotion) are here seen as complementary.

In health care systems, there are similar approaches. For instance, members of "Partners for Health Reform plus" considers that:

> "Incentives are rewards made to an individual or group that lead to specific behaviours. They can be positive or negative, tangible or intangible. They may be financial, although research indicates that financial incentives alone are not necessarily sufficient, and may not always be the most appropriate way to improve performance. Indeed, multiple types of incentives influence the behavior of workers and organizations in a health care system. Understanding incentives in the existing system as well as those underlying proposed changes is key to achieving the desired outcomes of reforms."[2]

Those conceptions do not however challenge the idea that *ceteris paribus* direct incentives are efficient in terms of the effort they induce.

b. Modeling the crowding-out effect

In 1972, Titmuss shows that it may be counter-productive to pay for blood gift. In a similar way, Kreps (1997) as well as Frey and Oberholzer-Gee (1997) show that the existence of a "crowding-out effect" is not necessarily an exception in economics. Frey and Oberholzer-

[1] http://www.washingtonwatchdog.org/documents/usc/ttl41/ch7/sec433.html
[2] http://www.phrplus.org/Pubs/IR8.pdf

Gee (1997) analyze the acceptation level of households in Switzerland of the set up in their neighborhood of a plant that recycles nuclear waste. They show that when monetary compensations are proposed to household their level of acceptation is decreasing. Those results were extended in two ways. First, the idea was to know why individuals can be de-motivated by incentives and second what are the conditions that make individuals not so. Kreps (1997) gives two kinds of rationale to crowding-out, depending on the context. In a multitask situation, using Holmström and Milgrom (1991) results, he states that "an obvious rationale, then is that the extrinsic incentives that are imposed – which almost necessarily will be relatively objective and formulaic – may be suboptimal, taking into account the full range of desired tasks." (1997, p. 361). In a single-task context, he considers that "the point is, if 'intrinsic motivation' is the response of workers to fuzzy, but nonetheless extrinsic incentives, explicit extrinsic incentives that are imposed may fight rather than complement preexisting incentives." (1997, p. 362). This last interpretation is based on the idea that individuals are almost norms followers and that incentives can possibly disrupt those norms. Bénabou and Tirole (2003), using a simple principal-agent model, show that the explanation of the first problem can be found in some asymmetry of information phenomenon. They assume that the agent does not know precisely how difficult is the task he has to perform, his ability of doing this task, or the cost of the effort he has to make in order to perform this task. On this basis, the main idea is to consider that he tries to find the information in the reward policy of the principal by means of a *looking-glass self effect*.

Suppose the following principal's utility function:

$$U_p = U_p(\beta, e, p)$$

with e the agent's effort, p the principal's payment policy and β, the difficulty of the task the agent has to perform. Suppose that the agent does not know β but infers it from p and a signal σ. Let β_a the agent's conditional expectation of β, that is $\beta_a = \beta_a (p, \sigma)$. If e^* is the agent's optimal effort, the principal expected payoff is:

$$E_\sigma [U_p(\beta, e^*(p, \beta(\sigma, p), p) \mid \beta]$$

If we differentiate this expression, it comes:

$$E_\sigma [(\partial U_p/\partial p + (\partial U_p/\partial e)(\partial e^* /\partial p) + (\partial U_p/\partial e)(\partial e^*/\partial \beta_a)(\partial \beta_a/\partial p) \mid \beta] = 0$$

If the two first parts of this expression are usually well-analyzed by incentives theory, the interesting element is $(\partial U_p/\partial e)(\partial e^*/\partial \beta_a)(\partial \beta_a/\partial p)$. It captures the sensitiveness of the variation of the principal's utility on the variation of the agent's effort due to the variation of her or his perception of the principal's opinion on the task characteristics or the capabilities of the agent linked with a variation of the principal's policy.

Benabou and Tirole then identify two effects: a *profitability effect* and a *trust effect*. On this basis they show that the principal's policies can either crowd out or crowd in the agent's motivation.

Harvey (2005) presents similar results on the basis of a principal-agent model. He uses a Benthamian utility function in order to explain how and why a crowding-out effect occurs. Let:

$$U_p = pe - \hat{w} - re$$

be the principal's utility function, with $\hat{w}$, a fixed wage, p the per unit revenue of the agent's effort and r an incentive payment.

Let:

$$U_a = \hat{w} + re - e^2 + I\delta s$$

be the agent's utility function with I = {0,1}defining an indicator of the presence or not of an intrinsic motivation of the agent, δ, the value of the agent's motivation and s the object of this motivation. Harvey assumes in a first model that s is the principal's utility function (in a second model he defines s as a social norm). It comes

$$U_a = \hat{w} + re - e^2 + I\delta(pe - \hat{w} - re).$$

Depending of the value of I and r, the agent's optimal effort equals $\hat{e}_1 = 0$ ($I = 0$, $r = 0$), $\hat{e}_2 = \delta p/2$ ($I = 1$, $r = 0$), $\hat{e}_3 = r/2$ ($I = 0$, $r > 0$), or $\hat{e}_4 = (I\delta(p - r) + r)/2$ ($I = 1$, $r > 0$). On this basis, Harvey calculates the corresponding values of δ and the resulting agent's utility values. This model permits Harvey to explain both *why* and *how* the crowding-out effect occurs. Two elements seem important: the object on which the motivation is tied, i.e., s, and the size of the fixed and incentives compensations, $\hat{w}$ and r. The main idea is to consider that those factors impact on the perceptions the agent has of the fact that he is controlled or not.

c. The results of experimental economics

In experimental economics, an impressive number of recent works analyze the "crowding-out effect". They almost all confirm the existence of this effect, even if they interpret it in different ways[3]. Fehr and Gächter (1997) and Fehr, Gächter and Kirchsteiger (1997) explain crowding-out effect by the reciprocity assumption. People are working hard because they reciprocate for high rewards but they reduce their efforts when incentives contracts are proposed to them. Gneezy and Rustichini (2000) show that the introduction of small rewards reduces performances. However high fixed wages implies high agents' efforts. They explain those results by introducing the idea that agents want to compensate high rewards by high effort because of some social norms of reciprocity. Frey and Jegen (2001) explain the possibility of crowding-out effect by the possibility for agent to see their self-determination or self-esteem been affected by incentives. The first idea is linked with the fact that incentives are perceived by agents as a will to control their behaviour. The second captures agents' opinion that incentives are linked with a non-acknowledgment of their competences. Irlenbusch and Sliwka (2005) test the idea "that the introduction of incentives scheme may raise the probability that an agent adopts an *individual maximization frame* rather than a *cooperative frame*, as behaviour is guided to focus on the individual short-term returns of his actions. However, in pure fixed wage setting an agent's attention is guided away from short-term returns since the agent receives no share of the surplus generated by his effort. Naturally his attention should rather be focused on a more cooperative or reciprocal behaviour which may even lead to higher surpluses." (p.1-2). The simple principal-agent model they test permits them not only to corroborate their assumptions but also to identify an experience effect. More precisely, when people are first confronted to variable pay and if they are offered to switch to fixed wage payment contracts, their level of effort is reduced as compared to a situation where they were initially offered a fixed pay contract.

Sanctions are usually considered as improving agents' effort. Punishment is indeed supposed to have the same effect as positive incentives. If an agent expects a sanction when the level of his effort is low, he will increase it in order not to be punished. The efficiency wage theory is based on this kind of assumption. Because he has a higher wage than the market one, a employee works harder, since if he does not, he is dismissed and hence, gets a lower wage

[3] Cameron and Pierce and Eisenberger and Cameron are counter examples.

(the market one). This assumption is the correlate of the positive incentive hypothesis, i.e., higher (positive) incentives give rise to a higher level of effort. Experiments show that such an assumption is also falsified. According to Fehr and Schmidt (2000), agents' efforts are lower when principals condition a fine on the deviation from a desired effort level. Fehr and Gächter (2002) Fehr and List (2002) not only show that positive incentives can crowd out motivations but also that sanctions are not efficient and undermine agents' motivations.

Monitoring, which is another way to improve agents' efforts, is seen by incentive theory as implying for the principal a trade-off between the increase of the agent's effort and the cost of monitoring. However, this possibility is based on an assumed positive relation between monitoring and effort. Here also, experimental economics shows that this positive relation is not corroborated. Dickinson and Villeval (2004) show that crowding-out effect and agency theory are complementary and not substitutes. Their experiments indeed show that "principals monitor less intensely when agents gave high effort in the previous period and monitoring trends up over time while agents' output trends down" and that "agents react to the disciplining power of the monitoring intensity by decreasing shirking when the perceived cost of such behavior is increased" (p. 35). Those results are in line with agency theory. However, they remark that agents are also guided by intrinsic motivations: "when the employment relationship is based on interpersonal links, increasing the monitoring intensity beyond its equilibrium level tends to undermine intrinsic motivation. It shows that the disciplining effect and the crowding-out effect of monitoring may coexist in interpersonal relationships and that the crowding-out effect is probably associated with concerns for the distribution of payoffs between the principal and the agent." (p. 35).

Experimental economics almost always, depending on the institutional set up, confirms the existence of the crowding-out effect. The rationales that are given are however very different and less systematized than they are in social psychology.

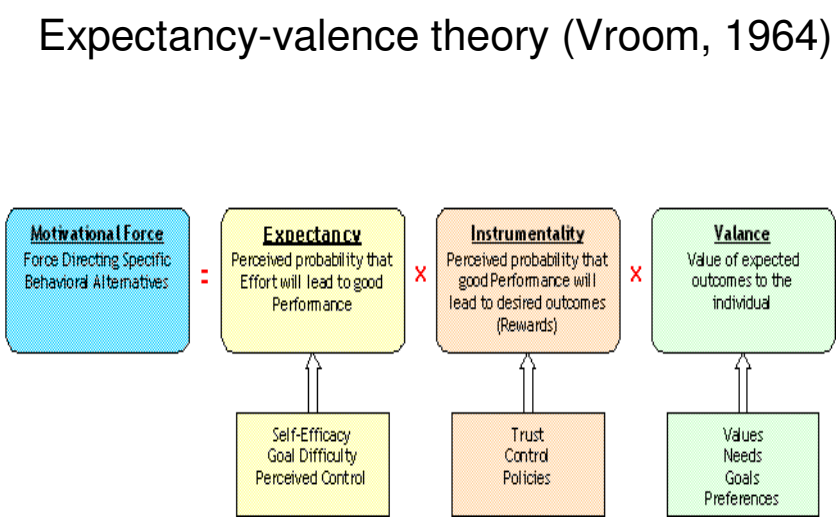
2) Incentives and motivations in social psychology

It has been shown in social psychology that incentives and motivation are not necessarily evolving in the same way. It is difficult to provide an exhaustive presentation of the literature on this topic. However, it is possible to identify three kinds of theories: expectancy-valence theory of motivations, cognitive evaluation theory (CET), and self-determination theory (SDT).

a. Expectancy-valence theory of motivations

This theory, developed by Vroom (1964), is based on the idea that people are goal oriented and that they act on the basis of beliefs and values. Vroom considers valences, defined as affective orientations towards particular outcomes time the strength of the expectancies of their instrumentality, that is, their utility. This product is conceived as a measure of the force on a person to perform a particular act: the motivational force. The expectancy theory is often used to predict job satisfaction, one's occupational choice, the likelihood of staying in a job, and the effort one might expend at work.

According to Fishbein (1967), individuals' behavior is strongly influenced by intentions. Intentions, in turn, are functions of one's attitudes to the behavior in question and one's subjective norms. Attitudes result from one's beliefs that a behavior will lead to a particular outcome and one's evaluation of that outcome. The subjective norms are a combination of an individual's beliefs of how significant others feel about the normative appropriateness of the expected behavior and the individual's decision as to the value of those predicted norms. The following figure presents the relationships between motivational force, expectancy, instrumentality and valence.



Expectancy is the belief that one's effort will result is attainment of desired performance goals. The variables affecting individuals' expectancy probability are self-efficacy, i.e., a person's belief about his or her ability to perform a particular behavior successfully, goal difficulty, or perceived control over performance (e.g., many profit-sharing plans do not motivate individuals to increase their effort because these employees do not think that they have direct control over the profits of their large companies). Instrumentality is the belief that if one does meet performance expectations, he or she will receive a greater reward. This reward may come in the form of a pay increase, promotion, recognition or sense of accomplishment. The variables affecting individuals' instrumentality probability are trust, control (when workers do not trust their leaders, they often attempt to control the reward system through a contract or some other types of control mechanism) and reward policy (the degree to which pay and reward systems are formalized in written policies has an impact on the individuals' instrumentality perceptions). As a result, formalized policies linking rewards to the level of performance tend to increase instrumentality. Valence refers the value the individual personally places on the rewards. The variables affecting individuals' valance are values, needs, goals, preferences and the sources of motivation; extrinsic as well as intrinsic motivations (such as intrinsic satisfaction from validating one's skills and abilities or from knowing that your efforts have a positive influence in helping someone).

In those models, the motivational force concerns the way individuals make decisions regarding various behavioral alternatives. Expectancy and instrumentality represent individual's subjective perceptions of the likelihood that effort will lead to performance and performance will lead to the desired outcomes. These perceptions are modulated by the individual's experiences (individual learning), self-perceptions but also by observations of others (social learning). Extrinsic motivation requires an instrumentality between the activity and some separable consequences such as tangible or verbal rewards, so satisfaction comes not from the activity itself but rather from the extrinsic consequences to which the activity leads. Intrinsic motivation involves people doing an activity because they find it interesting and derive satisfaction from the activity itself. Porter and Lawler (1968) advocate structuring the work environment in order to make jobs more interesting and thus more intrinsically rewarding and make extrinsic rewards clearly contingent upon effective performance. In this kind of models, there is an implicit assumption that intrinsic and extrinsic rewards are additive.

b. The Cognitive Evaluation Theory

The Cognitive Evaluation Theory (CET) is based on the idea that when looking at task, individuals evaluate it in terms of how well it meets their needs to feel competent and in control. If individuals think they will be able to complete a task, they will be *intrinsically motivated* to complete it, *requiring no further external motivation*. The basis assumption of CET is that there are fundamental innate needs for autonomy and competence that determine the way individuals react to external incentives. The notion of perceived locus of causality (PLOC – deCharms, 1968) is the link between motivation and action. Then external factors, such as tangible rewards, deadlines, surveillance tend to diminish feelings of autonomy or competence and prompt a change in PLOC from internal to external that undermines intrinsic motivation. Accordingly, if rewards are given *independently of specific task engagement* (e.g. a salary) or *when they are not anticipated* (e.g. an unexpected bonus), tangible extrinsic rewards do not undermine intrinsic motivation (Deci, Koestner and Ryan, 1999) meta-analysis). When rewards are contingent on *high-quality performance* and the *interpersonal context is supportive rather than pressuring*, tangible rewards enhance intrinsic motivation relative to comparison condition with no rewards and no feedback (cf. Ryan, Mims and Koestner, 1983) (but performance-contingent rewards lead to lower intrinsic motivation than a control group that gets positive feedback comparable to that conveyed by the rewards). Accordingly, contingent, tangible rewards and other extrinsic factors such as competition and evaluations can be detrimental to outcomes such as *creativity, cognitive flexibility, and problem solving* (Amabile, Goldfarb and Brackfield, 1990).

The problems with CET are first that most studies were laboratory experiments rather than in true organizations, second that it is difficult to incorporate CET findings into prevalent behavioral and expectancy-valence approaches, third that the choice of the activity in work organizations (not many activities are good candidates for testing CET propositions) is not self-evident, fourth that there is a rather unavoidable necessity of using monetary rewards in work organizations, and fifth that there is a dilemma of focus for managers and management theorists; either they concentrate on participation and empowerment in order to increase intrinsic motivation, while minimizing the use of extrinsic motivation or they use extrinsic rewards in order to maximize extrinsic motivation, while ignoring the importance of intrinsic motivation.

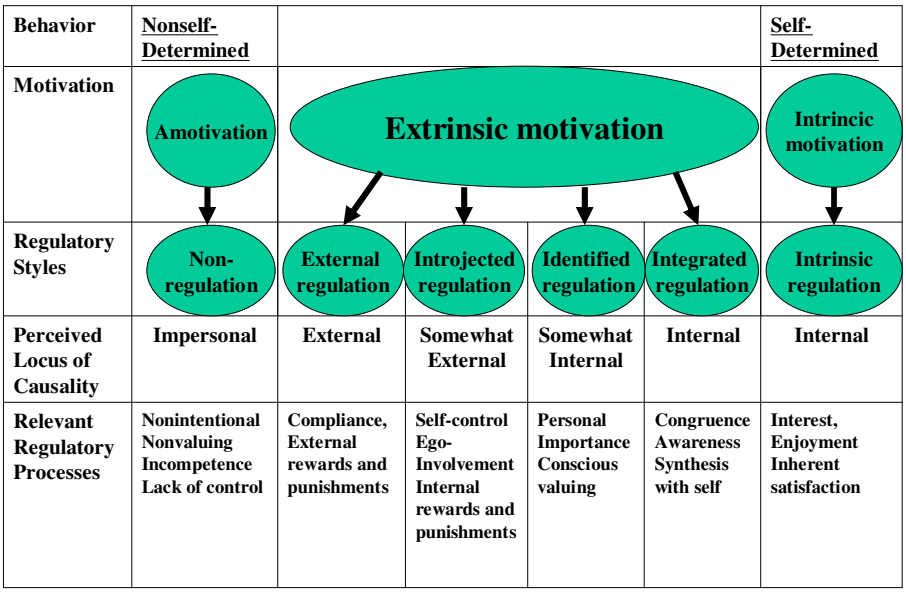
c. The Self-Determination Theory

The Self Determination Theory (SDT) can be considered as an answer to the CET drawbacks. It indeed analyses how the three main innate psychological needs, competence, autonomy and relatedness can be fostered or undermined by the environmental context. One of its main focus is on the process of internalization, which refers to 'taking in' a behavioral regulation and *the value that underlies it*. Extrinsically motivated behavior can then become autonomous. As compared with CET, SDT smoothes the dichotomy between external and internal motivation and seems more suitable for analyzing the link between incentives and motivation. SDT assumptions are consistent with experiments showing that extrinsically motivated behavior can be efficient as far as the more fully an external regulation has been internalized, the more autonomous will be the subsequent extrinsically motivated behavior. As a consequence, control through regulation and not only through external influence by a principal may be efficient because there is a cognitive feedback effect from the agent. According to SDT, there are three main ways of regulation:

- Introjection, i.e, 'taken in' by the agent but not been accepted as his or her own (e.g. to feel worthy or avoid guilt).
- Identification that makes an individual feels greater freedom and volition because his behavior is more congruent with his personal goals or identity.
- Integration that involves the identification with other aspects of oneself (other identifications, interests, and values). The activity is instrumentally important for personal goals, while still being considered as extrinsic motivation.

The following figure illustrates the SDT's main features (Gagné and Deci, 2005)

The Self-Determinacy continuum



3) Towards a new conception of the relationships between incentives and motivations in economics

The usual way economists have analyzed the crowding-out effect has been to treat the issue as a yes or no problem. In other words, they distinguish between two completely separated situations. The first, which is characterized by the fact that intrinsic motivations are reinforced by extrinsic incentives; the second where at the opposite, incentives crowd out motivations. This way of analyzing the relationship between incentives and motivations is interesting *per se* and improves the Theory of Incentives in economics. It however simplifies considerably the problem and does not present a satisfactory approach of this problem. It seems that this drawback is due to a weak analysis of the mechanisms that support the relationship between incentives and motivations. By contrast, when psychologists show that this relationship between incentives and motivations is not reducible to a yes or no problem, they root their approach in a sophisticated analysis of the mechanisms that explain the nature and the importance of this relationship. In this way, SDT is very fruitful because it assumes that there is a continuum of relationships between

incentives and motivation and that the regulation that supports those relationships is much more complex that economic analysis usually supposes. This view can be illustrated in terms of the supermodularity approach. This approach indeed assumes that there is a positive relationship between variables (Holmstöm and Milgrom, 1994). It is then possible to define crowding-in effects as linked with supermodularity, whereas crowding-out effects can be seen as resulting from submodularity. Assumes as an example that the utility function of an agent has the following form:

$$U_A = U_A\,(w\,,\, p(e),\, e\,,\, m(a,\, c,\, r))$$

with $m'>0$, w be the wage, $p(.)$ the principal's incentive policy, e the agent's effort, a the agent's need for autonomy, c the need for competency and r the agent's need for relatedness. In this expression $m(.)$ is the agent's motivation. If U_A is differentiable and smooth, there is a crowding-in effect, i.e., U_A is supermodular if

$$\partial^2 U_A / \partial p \partial m \geq 0$$

Symmetrically a crowding-out effect is linked with the submodulariry of U_A which means that:

$$\partial^2 U_A / \partial p \partial m \leq 0$$

Our idea is to analyze the characteristics of such a function in order to systematize the contexts where agent's motivation is crowded in or crowded out.

Conclusion

In this paper, we are considering how economists and psychologists' analyses of the relationship between crowding-in and crowding-out effects could be combined. We have first shown that economic approaches, be there economic theory or experimental economics usually conceive the crowding-out effect as a 'yes or no' problem. By contrast, psychologists and in particular Self Determination Theory consider that the relationship between motivations and incentives should be defined as a continuous phenomenon, involving some process of internalization on the part of the individuals. On this basis, we

propose to use a supermodular utility function in order to formalize both crowding-in and crowding-out effects.

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