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Fairness: a survey

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Abstract. In this paper I provide an *excursus,* as complete as I could, of the most important theoretical and experimental works concerning fairness. The aim is twofold. First of all, I want to underline the importance of the role played by experimental economics in testing and improving models on this topic. Secondly, I want to mention some evidence that, even for fair-minded people, economic factors such as competition and costs, still matter in their decisional process.

Introduction

In this paper I provide an *excursus,* as complete as I could, of the most important theoretical and experimental works concerning fairness. The aim to underline the importance of the role played by experimental economics in testing and improving models on this topic.

Section 1 is devoted to economic models concerning fairness, while section 2 surveys the most relevant contributions from other disciplines. Section 3 deals with the experimental evidence and the most important games used to detect fairness. Section 4 (named 'Not only fairness') mentions some evidence that, even for fair-minded people, economic factors such as competition and costs, still matter in their decisional process. Section 5 presents the conclusions.

1. The economic models

Fairness-driven motivations play a relevant role during people's decisional process. Fairness considerations influence human behavior so that individuals act in a different way with respect to the theoretical predictions based on the classical image of the *Homo Oeconomicus.* Several experimental works prove that fairness matters and that not all the subjects are interested only in their material return.[1] A wide range of studies has been conducted on individuals' tendency to appreciate and promote a fair behavior (see for instance, Abbink, Sadrieh and Zamir, 2004; Decker, Stieheler and Strobel, 2003; Carpenter and Matthews, 2005). Consequently, fairness has been introduced in the economic theories and new economic models have been developed to update the classical figure of *Homo Oeconomicus*.

However, even if the idea that fair-minded people exist is almost unanimously accepted among economists, there is still disagreement about which kind of fairness is relevant. Different trends of economic models have been inspired by a couple of notions of fairness. *Inequity-aversion* theories are based on the relevance of the fairness of the outcome (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000); *intention-based reciprocity* theories point to the importance of a fair reaction to someone's intentions (Rabin, 1993; Dufwenberg and Kirchsteiger, 2004); *hybrid models* (Falk and Fischbacher, 2000; Charness and Rabin, 2002; Kohler, 2003) either merge both theories or add social-welfare concern to one of them.

In the first class of models, a subject considers a situation as unfair if and only if the final distribution of the outcomes is not equitable, independently of the intentions of the others and their actions. This means that subjects' utilities depend not only on their own payoff but also on the payoffs of the others and that inequity-averse subjects spend resources to resist to unfairness and have more equitable outcomes.

A relatively simple but at the same time suitable self-centred model is proposed by Fehr and Schmidt (1999). They assume that a player is altruistic towards the others if their material payoffs do not exceed an egalitarian benchmark, but she feels envy when it happens. Subject *i*'s utility function is:

$$U_i(x_1, \ldots, x_N) = x_i - [\alpha_i/(N-1)] max \sum_{j \neq i} \{x_j - x_i, 0\}$$

[1] Bosman and van Winden, 1999, for example, argue that there is no clear-cut distinction between selfish and fair-minded individuals. The idea is that both features are present in a single subject and that, according to the situation, the behavior is consistent with the strongest one.

$$- [\beta_i/(N-1)] max \sum_{j \neq i} \{x_i - x_j, 0\}$$

Where:

α_i is a parameter of envy

β_i is a parameter of altruism

$0 \leq \beta_i < 1$ and $\alpha_i \geq \beta_i$ since the disutility that comes from a position of disadvantage is higher than the disutility that comes from a position of advantage[2];

Note that:

$\partial U_i / \partial x_j \geq 0$ iff $x_i \geq x_j$ since an increase in other people's income is positive if and only if they have a lower level of income with respect to subject *i*.

This modified utility is useful to represent both positive and negative behavior towards the others. Moreover, Fehr and Schmidt assume that people are heterogeneous.

A similar model is developed by Bolton and Ockenfels (2000). Subject *i*'s *motivation function*[3] is:

$U_i = U_i(x_i, \sigma_i)$

Where :

$$\sigma_i = \begin{cases} \dfrac{x_i}{\sum_{j=1}^{N} x_j} & if \sum_{j=1}^{N} x_j \neq 0 \\ \dfrac{1}{N} & if \sum_{j=1}^{N} x_j = 0 \end{cases}$$

The difference is that in the model of Fehr and Schmidt a player compares her payoff to each of the other players. Consequently, subjects' utility decreases as the distribution of payoffs diverges from the egalitarian distribution. In the model of Bolton and Ockenfels the

[2] For a more complete explanation of the parameters see Fehr and Schmidt (1999), pp. 823-4.

[3] Bolton and Ockenfels call it *motivation function* to emphasize the fact that it represents the 'objectives that motivate behavior' (Bolton and Ockenfels, 2000, p.5).

comparison is with the average income. This means that subjects are not egalitarian and they consider their payoff as unfair only if it diverges from the average, independently of the distribution among the others.[4] 'In a real life situation Fehr and Schmidt predict that the middle class would tax the upper class to subsidize the poor' while according to Bolton and Ockenfels 'the middle class would just be satisfied'.[5]

The theories based on models of intention-based reciprocity are characterised by the fact that only the intentions of the subjects matter to determine whether someone's behavior is kind or less. These theories call into question the consequentialism of the standard utility theory, which assumes that the utility of an action depends only on its consequences. This approach implies the use of psychological game theory (Geanakoplos et al., 1989), where utilities depend not only on payoffs but also on players' belief. The first step to introduce fairness into the analysis is to identify what Rabin (1993) calls a *kindness function* $f_i(a_i, b_j)$, which measures how kind player i is being to player j. a_i represents player i's strategy while b_j represents the strategy player i believes player j will adopt. Rabin defines also player i's belief about player j's *kindness function* $f_j(a_j, c_i)$. c_i represents the strategy player i believes player j believes that player i will adopt. Then, all these components enter subject i's utility function $U_i(a_i, b_j, c_i)$. The same happens for player j's utility function $U_j(a_j, b_i, c_j)$. The solution (a_i, a_j) is the so-called *fairness equilibrium* and it represents the Nash equilibrium for psychological games (*Psychological Nash equilibrium – GPS*). The idea is that if player i believes that player j is treating her badly, that is, if $f_j(a_j, c_i)$ is negative, then she wishes to treat player j badly. A similar reasoning is made for the case where player i believes that player j is treating her kindly. However, Rabin underlines that in his model material interest matters: 'the specified utility function is such that players will trade off their preference for fairness against their material well-being, and material pursuits may override concerns for fairness. […] the bigger the material payoff, the less the players' behavior reflects their concern for fairness'.[6] An undesirable feature of this model (and of the models that use psychological game theory in general) is that there are multiple and counterintuitive equilibria and it is very complex to compute them.

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[4] Engelmann and Strobel (2000) compare experimentally the model of Fehr and Schmidt to the model of Bolton and Ockenfels. They analyse subjects' preferences by presenting three different allocations of money between three persons, of which people have to choose one. According to the selected allocations, it is possible to understand which model has the higher predictive power. The experimental results are in favour of the model of Fehr and Schmidt.

[5] Engelmann and Strobel, 2000, p.2.

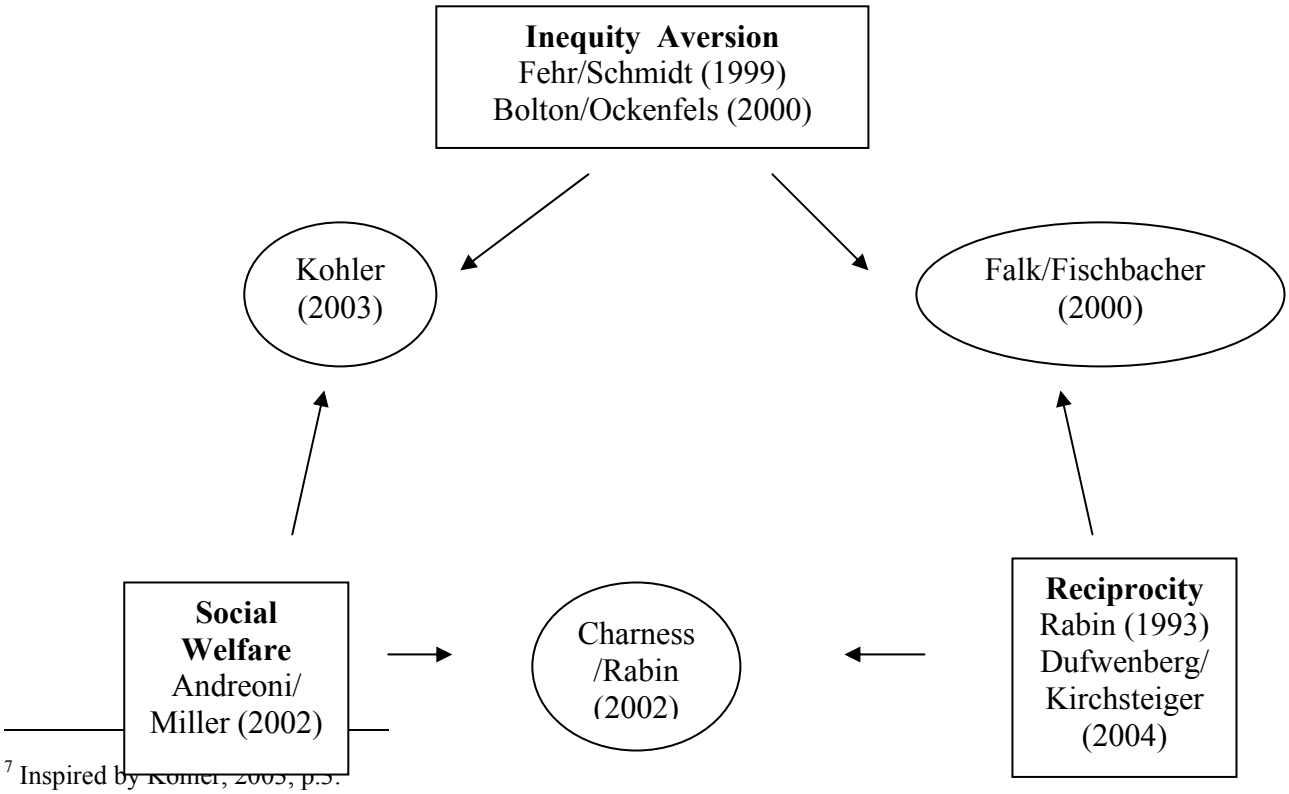
[6] Rabin, 1993, p.1287

Another limitation of this model is that it is suitable only for non-dynamic situations. This is why Dufwenberg and Kirchsteiger (2004) provide an extension of Rabin's model. They consider finite sequential games and they introduce the notion of *Sequential Reciprocity Equilibrium.* The model is very similar to the one proposed by Rabin. Players' utility is the sum of a *material payoff function* and a *reciprocity payoff*. As in Rabin, the reciprocity payoff depends on players' beliefs about other players' strategies and beliefs. The real new point is that at each node that is reached, players' beliefs about others' intentions evolve. This means that every subgame has its equilibrium that depends only on players' beliefs at that particular stage and not on initial beliefs. However, also in this case, the disadvantages of this model are the complexity and the multiple equilibria.

Experimental evidence suggests that a motivation that may explain subjects' behavior in a particular game, is not able to predict people's actions in a different situation (for example, reciprocity may explain why in the Ultimatum Game the Receiver refuses a low offer, but cannot explain a Dictator's transfer greater than 0 in a Dictator Game). The validity of each single motivation in an exclusive domain is the reason why *hybrid models* exist. These models merge different motivations to better predict subjects' actions (Figure 1 presents the three hybrid models treated in this paper).

Figure 1

Pure and Hybrid Models of Social Preferences[7]



[7] Inspired by Kohler, 2003, p.5.

Falk and Fischbacher (2000) argue, on the basis of the experimental evidence, that neither inequity aversion nor intentions can be ignored, and they provide a new model for sequential games where they try to merge the previous two approaches. At each node a player *i*'s utility is:

$$U_i(f) = \pi_i(f) + \rho_i \sum_{\substack{n \to f \\ n \in N_i}} \varphi(n)\sigma(n,f)$$

where:
f = the end node of the game;
n = the node where i has to move.

This is the sum of her material payoff $\pi_i(f)$ and of what Falk and Fischbacher call *reciprocity utility*. This element is composed of the *reciprocity parameter* ρ_i, the *kindness term* φ and the *reciprocation term* σ. The *reciprocity parameter* ρ_i represents the intensity of player *i*'s desire to reciprocate with respect to the desire to increase her material payoff. The *kindness term* φ measures how kind an action of a player $j \neq i$ is perceived by player *i*. It is the product of the *outcome term* Δ[8] (the expected difference between two players' payoffs) and the *intention factor* ϑ (ranging 0 to 1, where 0 means that the action is unintentional and 1 that the action is completely intentional). The *reciprocation term* measures how much player *j*'s payoff is altered by player *i* with her move at node *n*.[9] The advantage of this model is that it captures different motivations that play simultaneously a role in the decisional process. Again, the disadvantage is that this model is too complex.

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[8] $\Delta(n) = \pi_i(n, s_i'', s_i') - \pi_j(n, s_i'', s_i')$, where s_i' is the first order belief (*i*'s belief about *j*'s behavior) and s_i'' is the second order belief (*i*'s belief about *j*'s belief about *i*'s behavior). When $\pi_i > \pi_j$, *j* is kind. Otherwise she is considered unkind.

[9] $\sigma(n,f) = \pi_j(v(n,f), s_i'', s_i') - \pi_j(n, s_i'', s_i')$. When this term is greater than 0, player *i* is rewarding player *j*. Otherwise, she is punishing player *j*.

Charness and Rabin (2002) provide a model of social preferences where they mix social welfare concern with reciprocity.[10]

In the function:

$$V_i(\pi_1,\pi_2,\ldots,\pi_N) = (1-\lambda)*\pi_i + \lambda*[\delta*Min[(\pi_1,\pi_2,\ldots,\pi_N)] + (1-\delta)*(\pi_1+\pi_2+\ldots+\pi_N)]$$

where:

$\lambda \in [0,1]$ is a measure of interest in social welfare

$\delta \in (0,1)$ is a measure of maximin preferences

π_i is the payoff of player *i*

they add a *demerit profile* and the desire to hurt undeserving subjects:

$$U_i(s,d) = (1-\lambda)\pi_i + \lambda\left[\begin{array}{l}\delta Min[\pi_i, Min_{m\neq i}\{\pi_m + bd_m\}] + \\ +(1-\delta)\left(\pi_i + \sum_{m\neq i}\max[1-kd_m,0]\pi_m\right) - f\sum_{m\neq i} d_m\pi_m\end{array}\right]$$

where:

b, k and *f* are non-negative parameters of the model;

$d_m \in [0,1]$ represents how much player *m* deserves according to player *i* (the higher d_m the less player *i* thinks player *m* deserves);

f indicates how much player *i* wishes to hurt player *m* when player *m* is undeserving.

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[10] Charness and Rabin start by considering three different distributional models (competitive, difference-averse, social welfare), but they eventually isolate social welfare concern as the best predictor of people's behavior. First of all, they present a general model of social preferences in two-person games. Player B's utility function is:

$$U_B(x_A, x_B) = x_B + (\rho r + \sigma s + \theta q)(x_A - x_B)$$

Where:
$r = 1$ if $x_A < x_B$, $r = 0$ otherwise;
$s = 1$ if $x_A > x_B$, $r = 0$ otherwise;
$q = -1$ if A has misbehaved, $q = 0$ otherwise;
θ is a parameter of reciprocity
ρ and σ are parameters used to model distributional preferences:
$\sigma \leq \rho \leq 0$: competitive preferences
$\sigma < 0 < \rho < 1$: difference-averse preferences
$0 < \sigma \leq \rho \leq 1$: social-welfare preferences
Charness and Rabin test experimentally all the distributional theories summarized in their first model and they argue that subjects are motivated mostly by reciprocity and by the desire of increasing social welfare.

The last step aims to endogenize the demerit profile. This means that the value of d_m associated to player m by player i depends on how much player i thinks that player m is hurting others (and this is true for all the players, player i included). If we consider g_i as the weight player i is thought to put on social welfare and λ^* as the weight he should put, player i generates a level of animosity r_i in other players that correspond to $\text{Min}[g_i - \lambda^*, 0]$.[11] In equilibrium, $d_i = \text{Max}[\lambda^* - g_i, 0]$.

The disadvantages of this models are mainly two: heterogeneous social preferences and positive reciprocity are excluded.

Kohler (2003) affirms that, in subjects' decisional process, social welfare concern plays a relevant role when combined with difference aversion (DASM model). According to Kohler, the utility function[12] of player i is:

$$U_i(x) = (1 - \gamma_i)\, x_i + \gamma_i \sum_j x_j - [\alpha_i/(N-1)] \max \sum_{j \neq i} \{x_j - x_i, 0\}$$

$$- [\beta_i/(N-1)] \max \sum_{j \neq i} \{x_i - x_j, 0\}$$

Where:

α_i and β_i are (as in Fehr and Schmidt) parameters of envy and of altruism respectively

$0 \leq \beta_i < 1$ and $\alpha_i \geq \beta_i$

γ_i is a parameter of surplus concern

$0 \leq \gamma_i \leq 1$

Another interpretation of this model is that player i is, at the same time, difference-averse and altruist. This is clear if we rewrite her utility function as follows:

$$U_i(x) = x_i + \gamma_i \sum_{j \neq i} x_j - [\alpha_i/(N-1)] \max \sum_{j \neq i} \{x_j - x_i, 0\}$$

$$- [\beta_i/(N-1)] \max \sum_{j \neq i} \{x_i - x_j, 0\}$$

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[11] Positive reciprocity is excluded.

[12] Kohler does not consider the egalitarian motivation $min \{x_1, ..., x_n\}$, since it is included in difference aversion. This is why in his model he talks about a merge of surplus concern and difference aversion rather than a more generic interaction between social welfare concern and difference aversion.

The subject depicted in this model (whatever the interpretation) faces in every scenario a trade-off between difference aversion and surplus concern (or altruism).

2. Contributions from other disciplines (sociology, biology, psychology)

An interdisciplinary approach too tries to solve the 'puzzle of prosociality' (Gintis, 2003) and to find out why people react to unfairness. The peculiarity of this approach is that the whole process through which people react to unfairness is presented. This means that the explanation of the origin of this behavior is provided, as well as its evolutionary consequences.

The first input is given by Gintis (2000), who tries to explain people's resistance to unfairness by introducing the notion of *strong reciprocity*.[13] According to Gintis, 'a strong reciprocator is predisposed to cooperate with others and punish non-cooperators, even when this behavior cannot be justified in terms of self-interest, extended kinship or reciprocal altruism'.[14] More generally, a strong reciprocator is a subject who is willing to sacrifice resources to punish unfair behavior or the violation of a norm, even when this does not provide any current or future material reward (Fehr, Fischbacher, Gächter, 2002). In order to understand why the strong-reciprocity phenomenon exists, an interdisciplinary analysis (as suggested by Gintis, 2003, 2004) should be done. In particular, it should be relevant to combine some important elements coming from sociology (internalisation of norms), biology (evolutionary models of cultural transmission implying vertical transmission, oblique transmission and horizontal transmission) and psychology (people's predisposition to internalize norms and relevance of the role played by emotions in the decisional process).

The process who leads to strong reciprocity behavior is the following. Society can determine people's behavior through moral principles or social conventions (Rushton, 1982). Their creation is aimed to improve the quality of life in society. They create expectations and play a relevant role in the determination of order and stability within the society. As human beings are genetically predisposed to internalize norms, they enter the cultural inheritance that each new individual in the society has to learn in order to get on with the other members. This cultural inheritance influences people's behavior as well as the genetic inheritance (Smith J.M., 1982).

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[13] The relevance of the role played by *strong reciprocity* in the evolutionary process of a society is explained by Gintis (2000) and Boyd et al. (2003). They affirm that kin selection (Hamilton, 1964), reciprocal altruism (Trivers, 1971) and indirect reciprocity (Nowak and Sigmund, 1998) cannot explain the presence of strong reciprocators, while between-group selection favours strong reciprocity. In particular, Gintis shows that *strong reciprocity* is a relevant factor that makes it possible for human groups to survive when facing extinction treats, such as war, pestilence, famine or environmental catastrophes. Boyd et al. (2003) underline the importance of the presence of altruistic punishers (strong reciprocators who punish defectors, although the punishment is costly for them and yields no material gain) to sustain cooperation even in large groups.

[14] Gintis , 2003, p.169

There are two important processes to 'learn' culture: imitation and internalisation[15] (Rushton, 1982). When subjects follow culture principles through imitation, social norms are external. People act pro-socially not because they understand the real meaning of their actions, but either because of social rewards and punishments effect[16] or simply because it is easy and profitable to imitate a shared action. On the other hand, when subjects internalize social norms, they act following a sort of social conscience: they have the duty to give something back to the society (Freeman, 1997). '[…] each individual acquire[s] an entire behavioral model about how to deal with specific types of situations'.[17] To sum up, to internalize means to 'promote some norms from *means* to *goals*'.[18] There are different channels to transmit norms: vertical transmission (from parents to children), oblique transmission (through socialization institutions) and horizontal transmission (from peer interactions). During the process of internalisation also the emotional sphere is involved. Emotions induce individuals to obey social norms. When people internalize culture, they feel morally obliged to follow social norms, and if they violate them they will suffer from an interior self-punishment (Masclet et al., 2003). Moreover, they experience negative emotions (desire of revenge, desire of fighting against injustice, anger) when someone deviates (Bosman and van Winden, 1999; Abbink, Sadrieh and Zamir, 2002; Decker, Stieheler and Strobel, 2003; Glaeser and Sacerdote, 2000).[19] These negative emotions caused by the violation of a social norm are the strongest source of strong negative reciprocity, as well as the positive emotions due to subjects' cooperation or, generally, kind behavior enhance strong positive reciprocity reactions.[20]

An interesting result has been obtained by Brosnan and de Waal (2003) with monkeys. They discover that the sense of justice is widespread also among them. This could be the proof that the desire of fairness and the reaction to unfair situations is not a cultural fact but a

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[15] This theory has been appreciated by some important scholars that have developed interesting economics theory about cooperation and punishment activities introducing social norms, metanorms (Axelrod, 1986) and conventions (Sugden, 1986). In particular, it is relevant to say that Axelrod has provided the first evidence that metanorms and internalization of norms are mechanisms that successfully implement cooperation.

[16] Sacco and Zamagni (1994) call this phenomenon 'enlightened opportunism'.

[17] Henrich et al., 2001, p.9.

[18] Gintis, 2004, p.60

[19] Masclet et al. (2003) talk about the 'internal peer pressure, called *guilt,* and [the] external peer pressure called *shame*' (p.378).

[20] Neuroscientific research shows that emotions play an important role in the determination of decisions (Damasio, 1994; Picard, 1997). Bosman and van Winden (1999) give a good description of how and when emotions emerge, which are their consequences and how it is possible to measure their intensity. Other empirical works have shown that people behave fairly because of the sense of happiness that they feel when they act kindly and pro-socially (Rilling et al., 2002). This means that subjects are genetically and psychologically inclined to act under the influence of emotions. Moreover, it has been shown that, even if emotions are typically of short duration, their effect on decision making is robust and persistent over time (Bosman, Sonnemans and Zeelenberg, 2001) and not of short duration as suggested by Hirshleifer (1987) and Bosman and van Winden (1999).

genetical one. However, not enough evidence about that exists and, at the moment, this approach is not relevant from the economic point of view.

Recent studies in neuroeconomics (Rilling et al. 2002; Camerer et al., 2004) are devoted to the relation between people's reactions and specific cerebral activities. According to this approach, people with a stronger activation of the *insula* (the region of the brain that detects negative emotions like pain and disgust) and of the *dorsal striatum* (the part of the brain where an emotional reward emerges as the result of a goal-directed action) are more likely to react to unfairness.[21] However, this approach is still in its infancy.

[21] The work of de Quervain et al. (2004) is based on the hypothesis that the possibility of punishing unfair behaviors activates reward-related neural circuits. In their experiment the authors obtain two important results. The first is that people have a sort of taste for punishing the violation of social norms since this leads to a feeling of satisfaction. The second is that, as affirmed by Rabin, intentions matter.

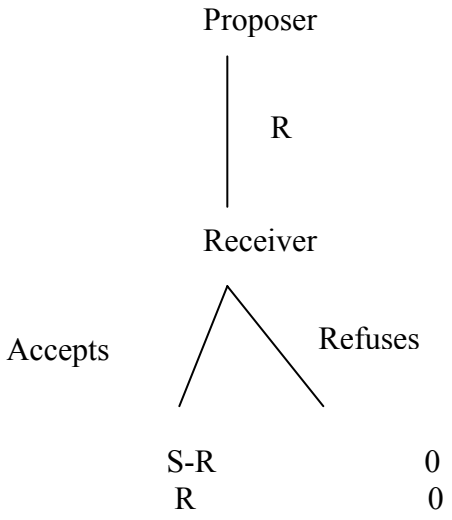
3. The experimental evidence

As it is suggested by Fehr and Gächter (2000) and Fehr (2001), in real world situations fairness matters. It is a relevant factor not only within the family and with friends, but also in public policy issues and in the enforcement of informal agreements and incomplete contracts (for a more complete list of examples, see Fehr, 2001).

However, since in real world scenarios it is difficult (if not impossible) to isolate fairness-driven behavior from strategic actions, a lot of experimental works are devoted to the study of fairness. Experimental economics can provide a large number of laboratory experiments where it is shown that fair-minded people exist and where the different expressions of fairness previously mentioned are tested.

One of the most used games to detect subjects' fair behavior is the ***Ultimatum Game***. It is a sort of take-it-or-leave-it bargaining. There are two players: the Proposer (Player A) who decides how to allocate a sum of money, and the Receiver (Player B) who can either accept or refuse the sum offered by the Proposer. If the Receiver accepts, the payoff of each player will be assigned according to the partition decided by the Proposer. If the Receiver refuses, both players will receive nothing. The refusal can be seen as a sort of costly punishment that the Receiver applies to the unfair Proposer.

Figure 2.
The Ultimatum game



Where:

S = sum to be allocated

R = sum that A transfers to B

The theoretical prediction in one-shot games and finitely repeated games (by backward induction), with rational and self-interested subjects, is that the Proposer will offer a very small quantity of money ε, while the Receiver will accept since ε is greater than 0.[22] However, a large number of experimental results shows that also in one-shot games the Receiver often refuses unfair offers. Typically, a sum of less than 20% of the total is rejected with probability 0.4 to 0.6 and this probability decreases as the size of the offer increases (i.e. Güth et al., 1982; Roth, 1995, Camerer and Thaler, 1995).

Falk, Fehr and Fischbacher (2003) compare the importance of inequity aversion and reciprocity in the decisional process by using different mini *Ultimatum Games*.[23] They find out that both inequity aversion and reciprocity matter and they suggest that mixed models (like the model by Falk and Fischbacher) are probably more suitable to explain subjects' behavior.

Abbink, Sadrieh and Zamir (2004) analyse the propensity to reject unfair offers in mini *Ultimatum Games* to compare inequity-aversion motivations and emotional factors. They find that inequity aversion matters, while they find no support for the hypothesis that the rejections are motivated by emotions.

In the ***Public Good Game*** (a very good, albeit not recent, survey is by Ledyard, 1995) *n* people are endowed with a sum of money and they have to decide whether to contribute to the provision of a public good. The typical monetary payoff of each player is:

$$\pi_i = S_i - g_i + f\left(\sum_{j=1}^{n} g_j\right)$$

for instance:

$$\pi_i = S_i - g_i + \alpha \sum_{j=1}^{n} g_j$$

[22] The situation is a bit different in infinitely repeated games, where the Receiver is more likely to refuse small quantities of money in order to punish the unfair Proposer and to implement a more generous offer.

[23] That is, the Proposer is not allowed to choose any distribution of the given sum between herself and the Receiver, but she faces only two possible allocations. In some treatments, the Proposer has to choose between a fair and an unfair allocation. In other treatments, the Proposer is forced by the experimenter to choose an unfair distribution.

where:

$\alpha < 1$

$\alpha n > 1$

and:

S_i = the endowment of player i

g_i = the amount of money that player i invests in the provision of the public good

$\alpha \sum_{j=1}^{n} g_j$ = the revenue due to the investment of all the players in the provision of the public good

This means that the return of one euro in the public good is less than one. Moreover, the typical features of public goods (non-rivalness in consumption and non-excludability from consumption) make it possible for people to free ride. That is, someone may find it profitable to take all the benefits from those goods without paying for them. On the other hand, it turns out from the structure of the game that high contributions from everyone would make every player better off. In order to enhance the contribution to the public good, the possibility to punish free-riders in a second stage of the game can be added. However, punishment activities have a cost for those who decide to sanction non-cooperative subjects. This is why the theoretical prediction in one-shot games and finitely repeated games, with rational and self-interested subjects, is that nobody will spend to punish free-riders (second order dilemma) and each player will contribute nothing to the provision of the public good.[24]

Fehr and Gächter (2000) report that, when punishment is possible, it is a credible threat. In their experiment, roughly 80% cooperates fully and higher punishments are the reaction to lower contribution levels.

The *Public Good Game* is used in another study by Falk, Fehr and Fischbacher (2005) to show that 'within the class of fairness theories, those that are based on the notion of retaliation[25] are the most promising'.[26]

Carpenter and Matthews (2005) use two variants of the *Public Good Game*: the *Mutual Monitoring Game* and the *Social Reciprocity Game.* In the former, they look for the presence

[24] The situation is a bit different in infinitely repeated games, where punishment is a sort of investment to enhance cooperation in the long run.
[25] That is, reciprocity.
[26] Falk, Fehr and Fishbacher (2005), p.31.

of strong reciprocators as people who sacrifice their material interest to react against subjects who free-ride within their group, while in the latter, they search for social reciprocators as individuals who sacrifice their pecuniary well-being to sanction also people who free-ride in another group. In other words, *social reciprocity* is a generalised notion of *strong reciprocity,* effective not only in a contest of membership but also in different groups of people (for example, groups of neighbours). Their results report that both kinds of reciprocity exist and that, under some circumstances where the population is balanced[27], they survive selection. On the other hand, where the population is unbalanced and the number of free-riders is too high, they decline and eventually die.

A game that is very similar to the *Public Good Game* is the ***Prisoner's Dilemma.*** It is well known that the only Nash equilibrium is mutual defection, while mutual cooperation would make players better-off. To avoid defection, the possibility to punish non-cooperative players can be added in a second stage of the game. However, as in the previous game, punishment activities have a cost and also in this case we face a second order dilemma. Therefore, the theoretical prediction in one-shot games and finitely repeated games, with rational and self-interested subjects, is that nobody punishes and mutual defection is established. Once again the empirical evidence does not confirm the theoretical results: on average, 60-70% of cooperators punish defectors (Falk, Fehr and Fischbacher, 2005). Fehr and Fischbacher (2004a) obtain a similar result.

The ***Third Party Punishment Game*** is a two-stage game that involves three players: the Dictator (player A), the Recipient (player B) and an Observer (player C).

In the first stage, a *Dictator game* between A and B is played. This means that player A is endowed with a sum and he can transfer part of it to player B, while player B cannot react to any decision of A.

In the second stage player C observes the division of the sum between the two players and decides whether to punish A if the partition is too unfair. Punishment[28] is costly for player C and consists of a reduction of the payoff of player A. Figure 3 describes the situation.

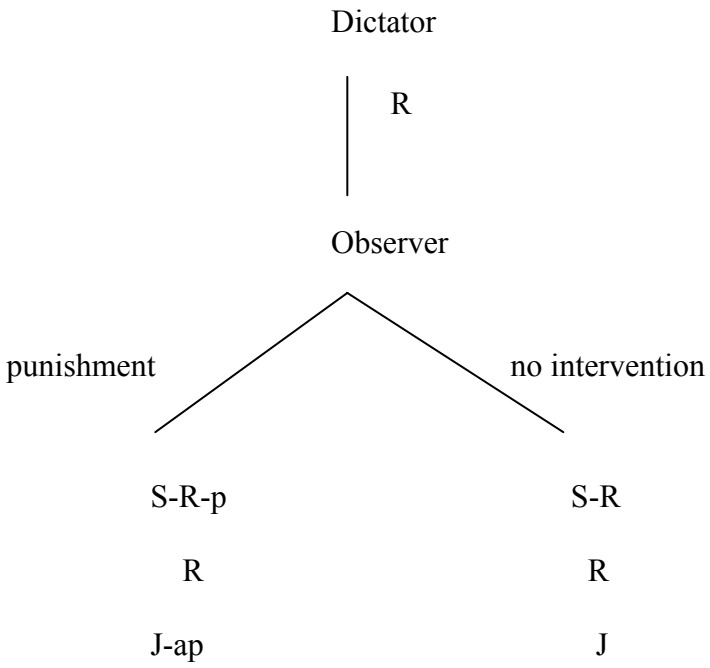
---

[27] In a balanced population there is the same initial fraction of people belonging to the different groups. In the example presented by Carpenter and Matthews the five considered groups are: Strong Reciprocators, Social Reciprocators, Pure Social Reciprocators (they react only against outgroup free riders), Second order Free Riders (they do not free ride but never react to others' free riding) and Free Riders.

[28] This is what is called 'altruistic punishment' since this activity implies only a cost for the Observer and no gain (Fehr and Gächter , 2002).

Figure 3.

The Third Party Punishment Game



Where:

S = sum to be allocated

R = sum that A transfers to B

J = C's initial endowment

p = sanction decided by C

a = cost of each single unit of punishment

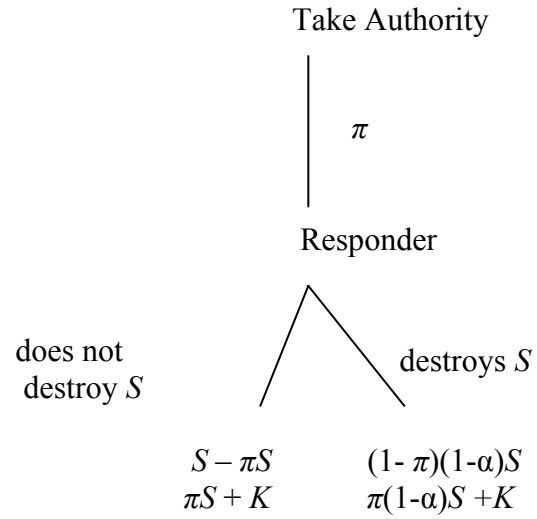
The economic theoretical prediction is that, in a situation with rational and self-interested subjects, since the punishment is costly and player C is not supposed to gain material benefits from this activity, he will never punish player A. Consequently, player A will give no money to player B.

However, also in this case, the empirical evidence is not in line with the previous theoretical prediction: at any level of the Dictator's transfer below half of her endowment, roughly 60% of the Observer punish the unfair Dictator (Fehr and Fischbacher, 2004).

The ***Power to Take Game*** is a two-stage game played by two participants: the Take Authority (player A) and the Responder (player B). Before the beginning of the first stage, each player has to do a real effort task to earn the initial endowment.

In the first stage, player A decides which percentage of B's income (a sort of tax rate) is to be transferred to the Take Authority after stage two. In the second stage the Responder can either keep her income untouched and transfer to the Take Authority the stated percentage, or destroy any part of her own income in order to transfer to the Take Authority a lower amount of money. Then, income destruction can be considered as a punishment for player A. Also in this game, punishment is costly for player B.

Figure 4.
The Power to Take Game



Where:

π = tax rate

S = initial endowment of the Responder

K = initial endowment of the Take Authority

α = percentage of income destroyed by the Responder

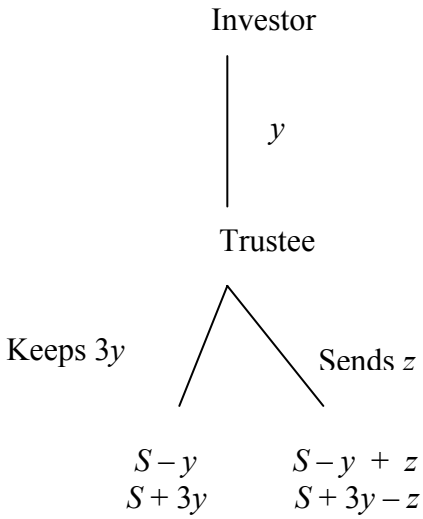
The economics theory for one-shot and finitely repeated games predicts that, since the punishment is costly and player B is not supposed to gain material benefits from this activity, she will never punish player A. Consequently, player A will ask a very high tax rate (even 99%) to player B.

However, also in this case, the empirical evidence is not in line with the previous theoretical prediction: in the experiment by Bosman and van Winden (1999), when the tax

rate is equal to or higher than 70%, 42% of the responders destroyed their income in a one-shot scenario. Moreover, almost everyone who decided to destroy her own income destroyed the whole income.[29]

The ***Trust Game*** is a bilateral game where an Investor and a Trustee receive the same endowment *S* from the experimenter. In the first stage the Investor can invest the whole sum *S* or a part of it by sending any amount *y* (between 0 and *S*) to the Trustee. The experimenter triples the amount sent to the Trustee such that she receives 3*y*. In the second stage the Trustee can send part of the investment (any amount between 0 and 3*y*) back to the Investor.

Figure 5.
The Trust Game



[29] Bosman and van Winden find out that there is a correlation between the Responder's negative emotions due to the Authority's unfairness and the probability to destroy her income. Moreover, they confirm Rabin's idea that the intentions matter: intentional hurting raises the intensity of the consequent negative emotions.

Where:

y = sum sent to the Trustee by the Investor

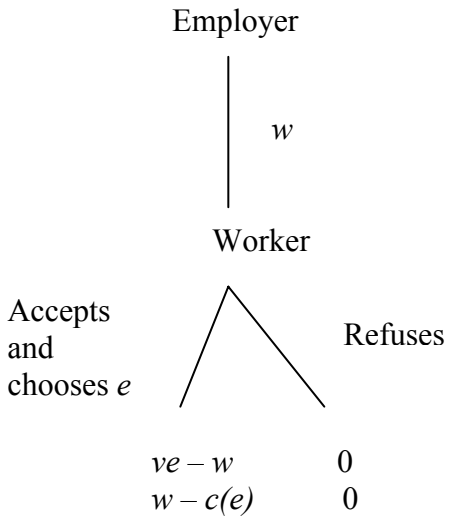
z = sum sent back to the Investor by the Trustee

S = each player's initial endowment

The theoretical prediction in one-shot games and finitely repeated games (by backward induction), with rational and self-interested subjects, is that the Trustee will send back to the Investor 0, and, consequently, the Investor will send 0 to the Trustee. In the experiments the Investor invests more than 0 and the Trustee gives back to the Investor more than 0 (Berg et al., 1995). Camerer and Fehr (2003) say that on average y is equal to $0.5S$ and z is a bit less than y. Moreover, it seams that z increases as y increases, as a sort of positive reciprocity between the Investor and the Trustee.

The ***Gift Exchange Game*** is a variant of the previous game that describes the principal-agent relation in an incomplete contracts contest. In the first stage, the Employer (the principal) offers a wage $w \in [\underline{w}, \bar{w}]$ (where $\underline{w} \geq 0$) to the Worker (the agent). The Worker decides whether to accept or not. If she rejects, both players receive nothing. In the second stage, the Worker decides her effort $e \in [\underline{e}, \bar{e}]$ (where $\underline{e} > 0$).

Figure 6.
The Gift Exchange Game



Where:
w = wage proposed by the Employer
v = marginal value of effort for the Employer
e = effort chosen by the Worker
$c(e)$ = effort cost for the Worker

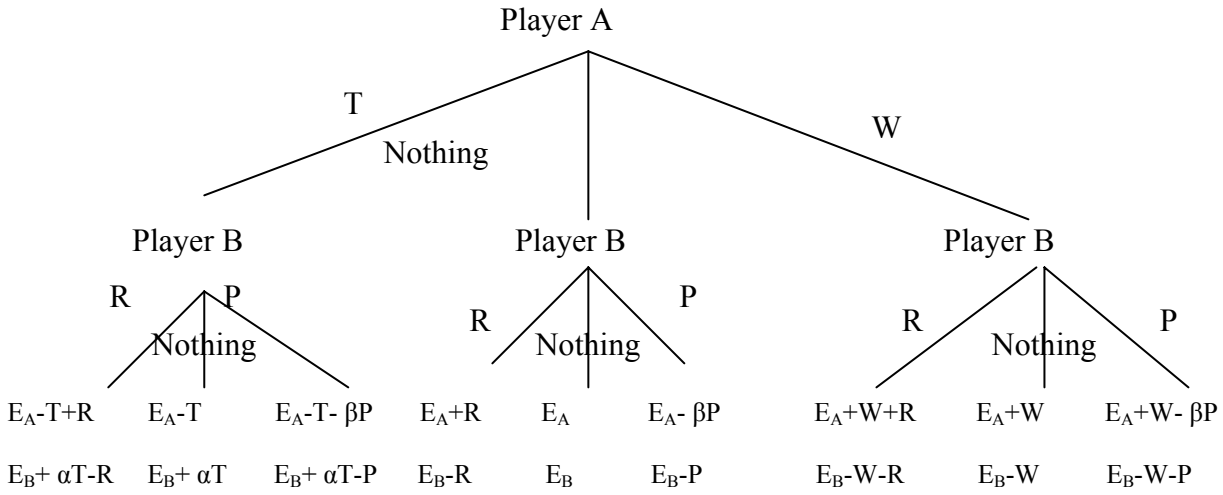
The theoretical prediction in one-shot games and finitely repeated games (by backward induction), with rational and self-interested subjects, is that the Employer offers the minimum wage $\underline{w}$ and that the Worker never rejects and chooses the lowest level of effort $\underline{e}$. The experimental evidence (Fehr et al., 1993) reports that the effort level increases as w increases. This means that the Worker rewards with a high level of effort a generous wage (40% to 50% of the cases).

The ***Moonlight Game*** (Falk, Fehr and Fischbacher, 2000) is a two-player sequential game. In the first stage both players are given an endowment (E_A and E_B respectively). Player A has to choose an action. She can give money (T) to B, take away money (W) from B or do nothing. If she decides to give money to B, the experimenter will multiply A's transfer by a parameter α (the real transfer that is received by B is αT). In the second stage player B can spend resources either to punish (P) or to reward (R) A, or she can decide to do nothing. If she decides to punish, A's income will be reduced of βP.

The game is depicted in Figure 7 where:
E_A = initial endowment of player A
E_B = initial endowment of player B
T = transfer from A to B
W = A's withdraw of money from B's endowment
R = reward
P = punishment
α = reward coefficient
β = punishment coefficient

Figure 7.

The Moonlight Game



By backward induction, player B will neither punish nor reward and player A will always take away from B the maximum amount of money. Actually, the more A takes away from B, the more B is willing to sanction (Falk, Fehr and Fischbacher, 2000).

4. Not only fairness

The fact that fair-minded subjects exist does not mean that fairness is the unique factor that influences people's actions. Even fair-minded people react to economic incentives and it is possible that a subject who behaves fairly in a particular scenario does not in a different situation (Bosman and van Winden, 1999).

Fehr and Schmidt (1999), and Fischbacher, Fong and Fehr (2003), show that competition may override fairness effects if there is no possibility for a single player to enforce an equitable outcome. A typical example is the *Ultimatum Game* with Responder competition. Consider the case where one Proposer offers a sum (s) to several Responders. If all the Responders reject her offer, all the players receive nothing. If one Responder accepts the Proposer's offer, the Proposer and the accepting Responder receive (1-s) and (s) respectively. If more than one Responder accepts, the Proposer receives (1-s) and a randomly chosen Receiver receives (s).

When more than one Responder interacts with the Proposer, it is probable that at least one of the Responders is self-interested. This implies that at least one of the Responders accepts the Proposer's offer and that the rejection of a fair-minded Responder either to punish the unfair Proposer or to ensure a more equitable outcome is useless (Fehr and Schmidt, 1999). The result is that even fair-minded people act as self-interested individuals. Moreover, the stronger the competition, the stronger the result (Fischbacher, Fong and Fehr, 2003).

The 'cost' of fairness seems to be relevant too. An example is provided by some pilots I run in ALEX by implementing the *Solomon's Game* (Ottone, 2005). In the first stage two subjects play a *Dictator Game*. In the second stage a third player enters the game and decides whether to punish the Dictator and/or to transfer money to the Receiver. It turns out that people intervene more (by punishing and/or transferring) when the cost of intervention is lower.

It is also possible that more that one motivation (including fairness) may explain subjects' not self-interested behavior. Engelmann and Strobel (2000, 2004) show that in distribution experiments it is not always possible to establish without any doubt why people act. It may be the case that they want 'to redistribute money from the rich to the poor because [they] dislike inequality, because they care for efficiency, or because they care particularly for the poorest'.[30] They provide an experimental setting that allows to better identify

[30] Engelmann and Strobel, 2004, p.3.

subjects' preferences and underline how efficiency and maximin preferences[31] influence subjects' actions.

[31] $U_i = \min\{x_i, x_j\}$

5. Summary and conclusions

In this paper I surveyed the most important theoretical and experimental studies dealing with fairness. Several results that are useful for our theme emerge.

First of all, the experimental evidence suggests that fair-minded people exist.

Secondly, the contribution given by experimental economics to the theory of fairness is crucial both for the provision of a controlled setting (where fairness-driven actions can be studied since strategic elements are removed) and for the feed-back of experimental results on theoretical models of social preferences. In what regards the models of social preferences, *hybrid models* may provide a better description of human behavior, but they are too complex. Every choice between *pure models* and *hybrid models* implies a trade-off between likeliness and simplicity.

Third, even fair-minded people are influenced by economic factors.

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KLEIN, B., R. G. CRAWFORD and A. A. ALCHIAN (1978), "Vertical Integration, Appropriable Rents, and the Competitive Contracting Process," *Journal of Law and Economics*, 21(2), 297-326.

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NELSON, R. R. and S. G. WINTER (1982)*, An Evolutionary Theory of Economic Change*, 2nd ed., Harvard University Press: Cambridge, MA.

Contributions to collective works:
STIGLITZ, J. E. (1989), "Imperfect Information in the Product Market," pp. 769-847, in R. SCHMALENSEE and R. D. WILLIG (eds.), *Handbook of Industrial Organization,* Vol. I, North Holland: Amsterdam-London-New York-Tokyo.

Working papers:
WILLIAMSON, O. E. (1993), "Redistribution and Efficiency: The Remediableness Standard," Working paper, Center for the Study of Law and Society, University of California, Berkeley.