The social context and the effect of alcohol consumption on economic behaviour

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Abstract

The paper studies how the acute effects of alcohol consumption affect economic behaviour, and in particular risk attitudes, willingness to pay, altruism, optimism and impatience. The paper aims at disentangling its pure pharmacological effect from that attributable to its interaction with the social context in which drinking takes place. Towards this goal we analyze the issue from two distinct but complementary viewpoints: the lab and the field.

In the field subjects self-select into the treatment, and many other relevant factors are at work in the social context where alcohol is consumed. By contrast, in the lab we plan to identify the pure pharmacological causal effect of alcohol, by means of an experiment in which economically motivated subjects are randomly assigned either to the treatment or to the control group.

Preliminary evidence based on pilot experiments shows a slight increase of risk propensity. No significant effect emerges as far as willingness to pay and optimism are concerned. Alcohol seems to induce a more selfish behaviour, while time preferences are characterized by contradictory evidence: in the lab we observe and increase of impatience while the opposite emerges in the field.

JEL codes: D10; I12

Keywords: alcohol consumption, risk attitude, altruism, willingness to pay

Introduction

There is a widespread consensus and social alarm on the potential costs of alcohol consumption, and especially of alcohol abuse, both at the individual and at the social level.

The empirical literature shows that alcohol consumption and abuse, especially (but not only) among adolescents, are related to a number of risky or harmful behaviours, ranging from driving under the influence and associated traffic fatalities (Dee, 1999; Levitt and Porter, 2001) to truancy and high-school drop out (Koch and McGeary, 2005; Chatterji and DeSimone, 2005; Duarte and Escario, 2006), from lower labour productivity and worse labour market outcomes of young adults (Chatterji and DeSimone, 2006) to health diseases (Dills and Miron, 2003), and from risky sexual behaviour (Grossman, Kaestner, and Markowitz, 2005; Grossman and Markowitz, 2005) to violent crimes (Markowitz, 2005).

Yet correlations need not reflect causality. In particular, since individuals self-select into drinking habits, in most empirical studies it is hard to identify to what degree alcohol causes risky or harmful behaviours. In particular, it is hard to disentangle the pure effects of alcohol from context and peer effects (Kremer and Levy, 2008). The latter has received increasing attention in recent years, with studies focusing, for instance, on the effects of fraternity membership (DeSimone, 2007, 2009), of social life and family influence (Buonanno and Vanin, 2007) and of having the "wrong" friends (Lundborg, 2006).

Alcohol might be associated to risky behaviours because it induces a change in attitudes towards risk. A number of studies have investigated the relationship between alcohol and risk preferences. Unfortunately, this literature has not so far yielded conclusive results. Some studies (Sjoberg, 1969; Cutter, Green, and Harford, 1973; Meier, Brigham, Ward, Myers, and Warren, 1996; Breslin, Sobell, Cappell, Vakili, and Poulos, 1999) find no or mixed effects of alcohol on risk attitudes. Abrams, Hopthrow, Hulbert, and Frings (2006) find that after moderate alcohol consumption risk propensity is less likely to emerge in groups than individually. Lane, Cherek, Pietras, and Tcheremissine (2004) finds in a lab experiment a positive pharmacological effect of acute alcohol administration on risk taking, whereas Cortès Aguilar, Espin Martin, Exadaktylos, Segun, Palacios Garcia, and Proestakis (2008) find a negative effect on risk taking of actual (for women) and perceived (for men) alcohol levels collecting data on the field.

Other related experiments investigate the effects of altering mental conditions in various ways. Among them, Kosfeld, Heinrichs, Zak, Fischbacher, and Fehr (2005) find that oxytocin increases trust in humans and Ariely and Loewenstein (2006) investigate how sexual arousal influences preferences and behaviour.

A significant effect of alcohol consumption would be extremely valuable also from a methodological point of view. In fact, a growing behavioural economics literature supported by neuroscientific evidence started modelling the decision process as a compromise between deliberation and emotions. For instance Loewenstein and O'Donoghue (2007) posit that the affective system has initial control, but that the deliberative system can influence behaviour through the exertion of willpower. Cognitive load moves away from the deliberative optimum towards the affective optimum. Alcohol consumption could be a precious instrument that exogenously shifts the weight of a decision from deliberation to emotions, thereby allowing to test such theories. In what follows we borrow heavily from this paper to derive some testable implications for our experiment.

Data gathered in the field about the acute effect of alcohol suffer the problem of self-selection into the treatment (in our case alcohol consumption). Hence, any correlation between alcohol consumption and economic behaviour can be spurious. Moreover, the effect of alcohol is likely to

interact with the social context in which drinking takes places. A randomized experiment in a controlled setting is therefore necessary to isolate the pure pharmacological effect of alcohol.

The treatment consists in drinking a quantity of alcohol, tuned according to subjects' gender and weight, which should result in a Blood Alcohol Concentration (BAC) not too far from 0.8g/l (or, 0.08%, i.e. the legal intoxication threshold for the purpose of driving in many countries like the US and the UK).

The control consists in drinking a placebo, i.e. an alcohol-free long-drink equal at first sight to the one used in the treatment, so that all participants think they have been exposed to alcohol consumption. Of course, proper tricks are adopted to prevent subjects from distinguishing if what they drink contains alcohol or not.

In this way we isolate the pure pharmacological effect of alcohol, also net of the belief of having drunk, on subjects' economic behaviour and in particular on their risk attitude, willingness to pay, altruism, optimism, and impatience.

At the moment only preliminary evidence is available, based on 39 observations gathered at the University of Milan during the first 5 sessions of a randomized experiment, on 27 observations gathered in the field (2 sessions in a wine bar and 1 in a disco club) and on a pilot randomized experiment involving 12 subjects at a party. Pilot sessions have also been used to refine the design of the experiment that has substantially changed over time, before reaching the current and hopefully definitive version. This is the reason why data from the several sources are not always comparable, and why for some treatments data are available only for some sessions.

According to preliminary evidence we observe as the alcohol level increases

- a slight, though significant, decrease of risk aversion in the field, attributable to the non-perceived component of alcohol level. Results point roughly toward the same direction in the randomized experiments, although coefficients are never significant.
- no significant effect as far as willingness to pay and optimism are concerned.
- an increase in selfishness, with donation that decreases for LaVoce in the field and for MSF in the lab.
- contradictory evidence about time preferences. Significantly more impatience emerges in the lab while the opposite happens in the field, though based on really few observations.

The paper is organized as follows: Section 1 summarizes our testable implications. Section 2 describes the design of the experiment. Section 3 presents the preliminary results gathered in the field (Section 3.1) and with a randomized pilot experiment (Section 3.2). Section 4 concludes. Instructions are attached in Appendix.

1. Testable implications

According to Loewenstein and O'Donoghue (2007), there are two main drivers of actual choices, affect and deliberation. They formulate a number of theoretical hypotheses regarding the effects of a cognitive load. To the extent that, as commonly believed, alcohol consumption shifts weight away from rationality in the decision making process we can test their theoretical conjectures. In particular, we test three hypotheses following from their theory. In all cases, the effects of BAC are meant relative to the placebo condition.

H1: BAC reinforces both risk love and risk aversion. In particular, it raises the lottery selling price when this is above the expected value, and lowers it when it is below. As a corollary, BAC should reduce sensitivity to probability changes in the middle range (see the example provided in Figure 2).

If prospect theory is correct claiming that agents display risk aversion when facing gain and risk propensity when facing losses, we should observe an increase of risk aversion given that the lotteries that we propose are defined on positive outcomes only.

H2: BAC reduces altruism at low levels of sympathy, but increases it at high levels. Hence we should observe a decrease of donations to LaVoce.info as well as an increases of donations to Médecins Sans Frontières.

H3: BAC raises myopia when the tradeoff is between present and future, but not when it is entirely in the future. In particular, it raises the additional sum required to be paid after one day, but it has no effects on the difference between the sums required to be paid in seven days and in eight days.

Experimental economics typically uses monetary incentives and relies for its conclusions on the assumption that the marginal utility of money is constant across the treatment. While in most cases this appears a natural assumption, it is not so natural when the treatment involves alcohol. Indeed, BAC may reduce the ability to identify the optimal choice, and therefore reduce choice precision. This, in turn, would raise the variance of the marginal utility of money. Moreover, it might also affect the mean, although it is not a priori obvious whether it would increase or reduce the value of money. The consequence would be that the value of monetary incentives is different for treated and non treated individuals, so that one cannot disentangle the effect of the treatment, given the same incentives, from its effect through a change in incentives. For instance, an increase in donations would not correspond to an increase in altruism, if money loses values for the treated. We thus test the following two hypotheses.

H4: BAC raises the variance of the marginal utility of money. In particular, it raises the variance of the willingness to pay for a given object.

H5: BAC changes the mean of the marginal utility of money. In particular, it changes the mean of the willingness to pay for a given object.

Similarly, a different behaviour in terms of risk attitude could be spuriously correlated with a distorted perception of the probabilities, in such a way that for instance overoptimism could be confounded with risk propensity:

H6: BAC changes the perception of the probabilities.

➢ 2. Experimental Design[1]

The randomized experiment at the University of Milan will eventually involve 120 non-teetotal voluntary students. Such a number is a good compromise between budget reasons and statistical significance of the results.
The choice of students is due to the fact that, besides being easier to recruit than other categories, they are the ideal term of comparison with the data gathered in the field, since alcohol consumption is particularly high among young people, often as part of their social activities.

At the moment 39 observations (26 males and 13 females) have been collected. They were recruited with mailing list systems, announcing that the experiment might involve the consumption of a moderate quantity of alcohol. We require that volunteers already consumed alcohol before in their life without experiencing any problem, and that their physical and mental health do not advise against the consumption of a moderate amount of alcohol.

On arrival at the laboratory, participants were reminded that the experiment might involve the consumption of a moderate quantity of alcohol and that they could withdraw from the study at any time. Then they were asked to sign a consent form. Subjects randomly drew a number representing their ID during the experiment. On the one hand the number ensured that all their choices during the experiment were anonymous, since this number they typed at the computer is the only way to link each participant to the amount of money (s)he earned. On the other hand, the number was also used to randomly assign them to the alcohol Vs placebo group, something about which they are obviously unaware.

A medical doctor ascertained through anamnesis and visit that each participant was suitable for the experiment without health risks. All participants were given an extra strong lozenge ("Fisherman's Friend") to disguise the taste of the drink. In the alcohol condition, participants drunk a mixture of peach juice and ethanol (0.8ml per kg of body weight, the exact quantity from 0.67ml/kg and 1ml/kg depending on gender, food eaten, and drinking habits). In the placebo condition, they drunk peach juice with 5 ml of ethanol passed on the border of the glass and floated on the surface (a quantity that can barely be registered by means of a breath alcohol test). The amount of ethanol was targeted according to the tables released by the Italian Health Ministry with the purpose of reaching an average intoxication level about 0.8g/l, in many countries the limit to drive under the influence.

All participants were given 6 minutes to drink, being instructed that they should not find it uncomfortable to drink the required amount in 6 minutes, but that they should stop drinking right away if they experience any unpleasant effect.

During the first phase of alcohol absorption, i.e. before any effect of alcohol could be appreciated (so that a subsequent different behaviour cannot be attributed to a different comprehension of the instructions), participants were briefed on the Becker, DeGroot, Marschak (1964) mechanism,[2] an incentive compatible device used very often in experiments to elicit reservation prices. Then instructions were read aloud.

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[1] The design described in this section refers to the randomized experiment at the University of Milan. The design underneath the data gathered in the field is different in some cases, but it is not described in details for the sake of simplifying the expositions. Difference in the design are pointed out in the section describing the results in the field.

[2] Under the BDM, an individual reports a bid (ask) for an item; the item's price is then randomly drawn. If the bid (ask) is above (below) the price, the individual receives (sells) the good and pays (receives) the drawn price. If the bid (ask) is below (above) the price, the individual does not receive (sell) the good and pays (receives) nothing. Instructions attached in Appendix contain a detailed explanation of the BDM mechanism.

Immediately before data collection starts, participants had their Blood Alcohol Concentration (BAC) measured with a Lion500 professional alcolmeter, after asking them what is the intoxication level they perceived.

2.1 Data Collection

The following tasks were implemented in an incentive compatible way, with one of them that at the end randomly selected to determine the actual earnings of each participant (between 0€ and 40€) in addition to a fixed participation fee of 5€.

Each task is explained in more details in the Instructions attached in Appendix. Note that payments in the randomized experiment as described this section as well as in the Instructions involve earnings that are twice as much as those actually paid in the pilot sessions that are described in Section 3, since the former is estimate to last twice as much.

2.1.a Risk attitude (see Instructions, Phase 1). First, we want to assess the risk attitude of individuals asking them the ask price of a battery of 10 lotteries using the Becker, DeGroot, Marschak (1964) mechanism. Lotteries entail the same events (0€ vs. 40€) with the probability to win that ranges from 10% to 100%. Lotteries are presented in a random order.
This task allows to test in a non parametric way the risk attitudes of the subjects along the whole domain of probabilities. Contrary to common wisdom that says that drinking should be associated to a higher risk propensity, testable implication H1 foresees that a higher BAC should imply an increase of risk aversion (since all the lotteries are in the gain domain) and an increasing insensitivity to probability changes in the middle range.
Add comparison with Holt and Laury

2.1.b Willingness to pay (see Instructions, Phase 2).[3] Subjects are endowed with 20€ and we estimate their willingness to pay for a radio-videogame again relying upon the BDM. Testable implications H1 and H2 about risk attitudes raise the question of whether alcohol also affects the marginal utility of money. The idea is that the latter is the utility value attributed to one additional unit of money, when this is spent optimally. If alcohol affects individual ability to calculate the optimal way to spend money, the result may be that one additional unit of money is sometimes spent in high value expenditures and sometimes in low value ones. We may thus conjecture that the variance of the marginal utility of money could be correlated with BAC. This point is of particular relevance when applying the experimental methodology, since the design of incentives in experiments is usually based on the assumption of constant marginal utility of money. To test such effects, we consider whether actual or perceived BAC raise the variance of the marginal utility of money, at least as captured by the willingness to pay for a radio with videogames. Testable implication H5 posits that alcohol consumption could change subjects' willingness to pay. This task is planned mainly as a control for the results about risk attitudes, since what is recorded as a different risk attitude could instead be confounded with a different marginal utility of money.

2.1.c Altruism (see Instructions, Phase 4 and 5). In each phase subjects are endowed with 20€ and we measure individuals' altruism by means of two dictator games in which subjects are asked to choose an amount of money to be handed over two different causes (the humanitarian aid agency Médecins Sans Frontières and the Italian website dedicated to economic information LaVoce.info). Testable implication H2 predicts that drinking should benefit relatively more the "heat" cause, i.e. Médecins Sans Frontières.

[3] Phase 3 was not implemented in the lab, since a Chistmas hat cannot be considered context specific in a University room in March.

2.1.d Optimism (see Instructions, Phase 6). Also this phase has been thought as a control for risk attitudes, since an altered perception of probabilities could affect the results with overoptimism being confounded with risk propensity (testable implication H6). We assess subjects' optimism randomly drawing 21 cards out of a maze of 52 poker cards. Each participant draws one card from the subsample and wins 1€ for each card that has the same colour as hers. In this way the subject is not indifferent between the two colours, with only one of them clearly associated with a success, the other with a loss. They have then to guess how many of the 21 cards they expect to be of the same colour as that drawn by them. Beliefs are elicited in an incentive compatible way assigning a prize of 10€ if the number turns out to be correct.

2.1.e Impatience (see Instructions, Phase 7). In this phase each subject is given a cash card that in which the experimenters will transfer 20€ one hour after the end of the experiment. We measure participants' impatience asking them how much money they want in order to wait for the money transfer to be done one, seven, and eight days after. The use of a cash card allows implementing a very clean design in which trust and transfer cost matter in the very same way in the present and in the future. *Add comparison with Camerer et al*

Our testable implication H3 says that alcohol should raise myopia when the trade-off is between present and future, not when it is entirely in the future

2.2 Debriefing

Data collection phase lasted 30 minutes and finished with subjects filling an anonymous questionnaire aimed at gathering demographic and socio-economic information as well as some self-reported measures of happiness and trust.

Following data collection, participants had their BAC asked and measured for the second time, with subjects obviously unaware of the result of the first measure. For the participants that displayed a BAC above 0.5g/l we suspended the payment and they were invited to remain in the laboratory until their BAC decreased below such a threshold (the legal limit allowed to drive in Italy).

Before leaving the laboratory, they were asked to sign a statement in which they declare that they feel physically and mentally comfortable and that no impairment is perceived following the participation to the experiment.

3. Results

Data analysis correlates measured and perceived BAC with the results in the battery of tests and with demographic and socio-economic information provided in the questionnaire. Results in this section rely on a small number of observations (sometimes extremely small) and should therefore be taken with caution.

3.1 Preliminary results in the field

27 subjects have been individually tested in the field, 19 in a wine bar (in two different evenings), and 8 in a disco club. Both places are located in Belluno, a small town in the North East of Italy. Two third of the sample are males, and age ranges from 22 to 42 years (average 31).

Descriptive statistics about Blood Alcohol Concentration are as follows:

BAC	Mean	St Dev	Min	Max
Measured	.59	.49	0	1.51
Perceived	.72	.53	.1	2

The correlation coefficient between perceived and measured BAC is an astonishing 0.75, showing that people have a very good awareness of their level of intoxication. In fact, two third of the subjects reported having already taken an alcohol test before. However, also those who were unexperienced had on average a very good perception of their alcohol level (correlation 0.68 between measured and perceived BAC), meaning that they learned the rules of thumb to convert what they drink into BAC.[4]

An explanation for this unexpectedly high correlation is that in Belluno a strict policy of controls against driving under the influence have been implemented in the last years, and such a policy was probably successful in increasing people awareness. Nevertheless, 12 subjects displayed a BAC higher than .5g/l, the intoxication level allowed in Italy to drive.

Willingness to pay

To test whether the marginal utility of money is affected by alcohol consumption, we asked the subjects their willingness to pay for two different items, i.e. a videogame with radio and a Christmas hat with blinking lights. The latter is meant to control for possible context effects, as if some effects on the marginal utility of money are triggered by BAC, but only for context-specific items and situations. In this case, drunk subject in the disco club should evaluate the Christmas hat relatively more, while they could have no reason a priori to evaluate differently a neutral item like the radio-videogame.

No significant result emerges. Summing up the willingness to pay for the two items, the result is slightly higher in the disco (9.4€ Vs. 8.4€) and for the subjects with a BAC above 0.5g/l (9.4€ Vs. 8.1€). As far as the difference between the two items is concerned, subjects with a BAC above 0.5g/l evaluate relatively more the Christmas hat (1.75€ less than the video instead of 2.56€). Higher alcohol levels are correlated with higher bids for the hat and lower bids for the radio-

[4] They tend indeed to overestimate a little bit their BAC on average. This might be due to the fact that the tables that convert drinks into BAC circulated by the Italian Health Ministry and that must be exposed in every spot that sell alcohol look quite conservative, as also confirmed in our randomized experiment (see Section 3.2).

videogame. However, none of such differences is statistically significant, and nothing emerges interacting the explanatory variables with the alcohol level. If anything, there seems to be scope for a context effect about the Christmas hat, while there is no evidence of a decrease of the marginal utility of money.

Optimism

Two different tasks have been implemented to test for over-optimism. The first (in the disco and in the first session at the wine bar) consists in guessing how many of 24 dice displayed a number different from six, even, and equal to six in three subsequent rolls. The second (in the second session at the wine bar) coincides to the one administered in the randomized experiment (see Section 2.1.d and Instruction in Appendix, Phase 6)

In both cases a sizeable variance of answers emerges (for instance in the cards game answers range from 8/21 to 13/21) but they are orthogonal both to the measured and to the perceived alcohol level.

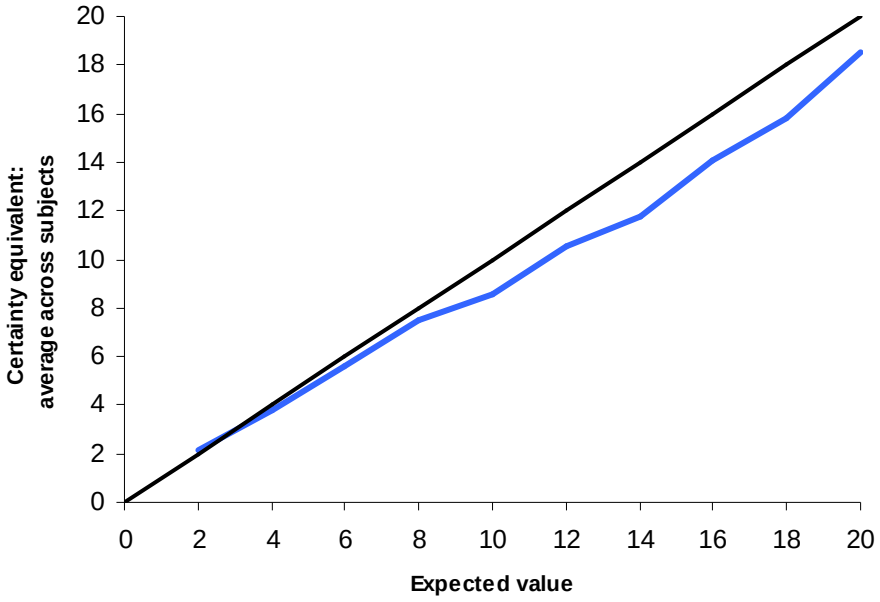
Relying on this result as well as on what found about willingness to pay we can exclude that there can be confounding factors behind possibly different outcomes about risk attitudes.

Risk attitude

Subjects display on average a slight degree of risk aversion. In fact, taking the average across lotteries and across subjects their willingness to receive turns out to be about 10% lower than the expected value of the lotteries (9.82€ vs. 11€).

The willingness to receive tends to be lower than the expected value particularly in the lotteries where the probability to win is higher, as displayed in the following graph.

Figure 1: Certainty equivalent and expected value



Common wisdom says that alcohol should increase risk propensity. However, data seems to contradict this widespread belief, since the measured BAC turns out to be insignificant (see Table 1, column 1). In contrast, if we decompose the measured BAC into perceived and non-perceived alcohol levels what emerges is that the former significantly affects behaviour. Alcohol intoxication beyond subjects' perception decrease risk aversion (Table 1, column 2). Other control variables like gender, age, education, and different context do not display significant correlations.

Table 1. Risk attitudes in the field

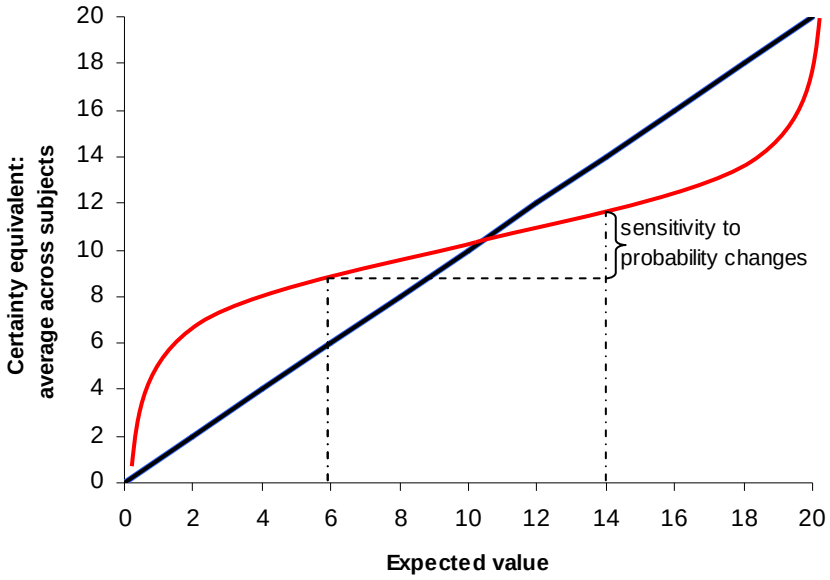
	col 1 avCE	col 2 avCE	col 3 insensitivity	col 4 insensitivity
BAC	0.604		3.561 *	
non perceived BAC		4.979 **		8.960 ***
perceived BAC		0.060		2.890 *
age	0.107	-0.006	0.140	0.015
female	-1.102	-0.639	3.201	3.772
femtest	-0.017	-3.778	-4.426	-9.067 **
education	-1.270	-1.255	-0.293	-0.275
disco club	-0.010	-0.858	1.305	0.259
constant	10.627 **	15.410 ***	0.118	6.022
R-squared	0.147	0.352	0.193	0.369

According to Loewenstein and O'Donoghue (2007) BAC should instead enhance both risk propensity and risk aversion, causing insensitivity to probability changes when both are present. In other words, following overestimation of small probabilities and underestimation of high probabilities, the behaviour of the certainty equivalent should tend towards the shape depicted in Figure 2 as the BAC increases when both risk propensity and risk aversion are present, something we cannot exclude a priory looking at Figure 1. Hence, we take the difference between the certainty equivalent when the probability to win is 70% minus the certainty equivalent when such probability is 30% as a proxy for the sensitivity to probability changes in the middle range. The hypothesis is that the BAC should be negatively correlated with our proxy, but exactly the opposite emerges (see Table 1, column 3) because drunk subjects tend to price the lotteries at their expected value, instead of less.[5]

One could reasonably argue that such a result is due to the fact that drunk subjects have less cognitive capacities, and they are therefore more prone to anchoring their evaluation of a lottery to the only reference point available, i.e. its expected value. However, if we decompose the BAC into perceived and non perceived alcohol level we see that the bulk of the effect is due to the latter (Table 1, column 4). Hence, alcohol seems to genuinely increase risk propensity but only beyond the intoxication level that an individual perceives and probably manages to account for in his behaviour. Moreover, this effect seems to characterize only males.

[5] Evidence that drunk subjects tend to be risk neutral instead of risk averse comes from the negative and significant correlation between BAC and the variance of the differences between ask prices and expected values. This also points against the interpretation that drunk subjects give random answers.

Figure 2: Insensitivity to probability changes



Altruism

Loewenstein and O'Donoghue's (2007) conjecture that mental load should raise altruism at high levels of sympathy, and reduce it at low levels. We try to assess this by means of two dictator games, one in which the beneficiary is Medecines sans Frontiers, which we consider as characterized by a higher level of sympathy, and one in which it is a fund for LaVoce.info,[6] which should stand for an emotionally neutral object. Hence, the positive difference between donations to Médecins Sans Frontières and LaVoce.info should significantly increase with BAC.

Descriptive statistics point towards this direction since donations to Médecins Sans Frontières are 3.75€ higher on average than to LaVoce.info for the subjects with a BAC above 0.5g/l (Vs. 2€ higher for the other subjects). However, the higher relative contributions derive from lower donations to LaVoce.info, while donations to MSF are similar in absolute terms. The sum of the donations is lower, pointing towards increased selfishness induced by alcohol. Also in this case the results are not statistically significant, not surprisingly since there are only 9 observations.[7]

Time Preferences

Alcohol is expected to raise myopia when the trade-off is between present and future, not when it is entirely in the future. In other words it should foster hyperbolic discounting. Asking subjects how much they are willing to receive additionally in order to cash in their earnings until the day after, in seven days, and in eight days, we should observe subjects with higher BAC demanding a systematically higher amount of money. Moreover, since the effect should be more evident when the present is involved, also the ratio between additional amount of money to wait until tomorrow Vs to wait 24 hours in one week should be higher and positively correlated with BAC.

[6] LaVoce.info is a free online press that is mainly managed by economists working for universities and other institutions. Its articles focus on economic, political and social issues and its editorial style is in the middle between non-specialized press and academic language. LaVoce.info is self-financed by its members and authors of the articles work on a voluntary base.

[7] This phase has been introduced only in the second session at the wine bar.

Results point towards the opposite direction (see Table 2, columns 1-3), in one case even significantly despite the extremely low number of observations (9). People with higher BAC seem to be more patient, as well as to evaluate relatively more 24 hours in the future than in the present although not significantly (Table 2, column4), thereby contradicting our testable implication.

Table 2. Impatience in the field

	col 1 tomorrow	col 2 in 7 days	col 3 in 8 days	col 4 ratio
BAC	-3,77 **	-2,89	-5,34	-1,09
constant	4,88 ***	7,38 ***	10,06 ***	1,67 **
R-squared	0,52	0,20	0,29	0,29

Behaviour

The questionnaire collected some information about demographic variables as well as self-reported measures of happiness and trust.

Females report to be significantly happier than males, but happiness turns out to be orthogonal to alcohol consumption as well as to the context (disco vs. bar).

Females also trust the other people significantly more than males, but only in the wine bar and not in the disco club. Moreover, higher female trust at the bar tends to vanish as BAC of the respondent increases, becoming equal to that of males around a level of 0.8g/l on average.

3.2 Preliminary results from the randomized experiment

In the lab experiment, held at the University of Milan in March 2010, 39 subjects (26 males and 13 females), were randomly assigned to either a placebo or to an alcohol treatment. Session lasted on average about 2 hours and subjects earned on average 19.6€.

Table 3. Measured and perceived BAC

	BAC	Mean	St Dev	Min	Max
Treated	**Measured_1**	.60	.15	.32	.91
Treated	**Perceived_1**	.71	.32	.20	1.50
Treated	**Measured_2**	.56	.11	.32	.77
Treated	**Perceived_2**	.49	.22	.09	1.00
Controls	**Measured_1**	.02	.03	0	.08
Controls	**Perceived_1**	.37	.24	0	.80
Controls	**Measured_2**	.01	.02	0	.07
Controls	**Perceived_2**	.24	.21	0	.65

The amount of ethanol administered was targeted to bring treated participants at an intoxication level about 0.8g/l, in many countries (e.g. UK, USA) the limit to drive under the influence. The algorithm to decide the individual amount of ethanol was derived from the tables released by the Italian Health Ministry, which turns out to be rather conservative, at least when applied to a sample of young healthy people. In fact, the average BAC is around 0.6g/l, as displayed in the Table 3.

Results are also highly idiosyncratic, since BAC ranges from .32g/l to .91g/l. The BAC of control participants is obviously very close to zero.

On the other hand, the random assignment to treatments and placebos was successful since the perceived BAC is significantly higher than zero and only two out of 19 controls figured out that indeed they were not exposed to alcohol consumption. The correlation coefficient between perceived and measured BAC for treated participants is low (0.24 in the first measure, 0.10 in the second) further confirming that our strategy to equalize beliefs between the alcohol and the placebo treatments was pretty successful.

Willingness to pay

As far as the willingness to pay is concerned, we find absolutely no impact of actual and perceived BAC. The average bid price is 3.15€ for treated and 3.91€ for controls. The variance is also very similar. Differences are never significant, either with parametric and non-parametric estimates.

Optimism

Despite the range of choices is quite wide (from 6/21 to 13/21) no difference appears between treated and controls on average (10.55 for treated, 10.79 for controls).

Risk attitude

Results about the potential confounding factors are reassuring since possible differences in the lottery task can be genuinely attributed to different risk attitudes. However, nothing interesting emerges.

By contrast, a large fraction of subjects (about one half) violates monotonicity in pricing the lotteries. This is likely due to the collective instructions: In fact, results in the field where instructions were provided individually are characterized by a very low number of mistakes despite the environment being less suited to perform an experiment. In what follows we exclude form the analysis the participants (11 out of 39) who display contradictory choices, keeping only those who make few or minor mistakes.

Subjects are on average risk neutral. In fact, taking the average across lotteries and across subjects their willingness to receive turns out to be 21.68€, i.e. very close to the expected value of the battery of lotteries (22€), as displayed in Figure 3.

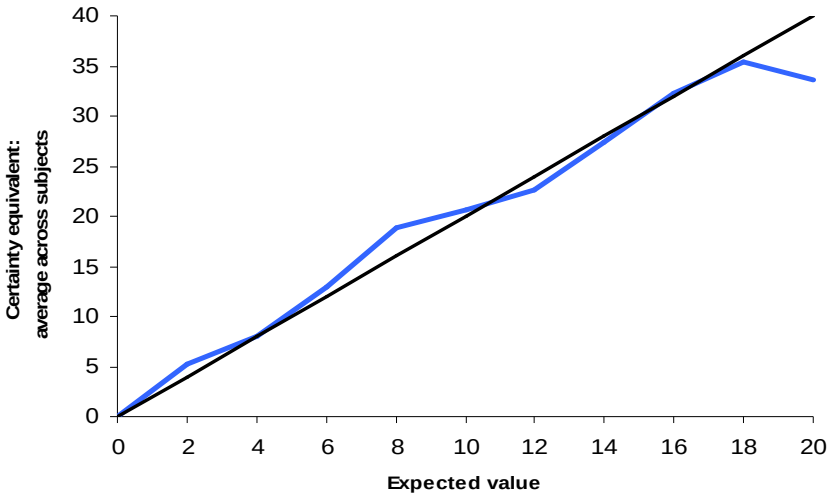
It is particularly striking that the certainty equivalent for the lottery in which the probability to win is 100% turns out to be lower on average than that in which the probability is 90%. This is due to the fact that mistakes are particularly frequent in the former, despite it should be the easiest to price.

All the statistics (average and variance of the certainty equivalents, a measure of insensitivity to probability changes in the middle range) are orthogonal to perceived and measured BAC levels. Nothing significant emerges either with parametric or with non-parametric analysis. The same applies even restricting the analysis to the 20 subjects who commit only a minor mistake if any.

In particular, the lab experiment confirms the result obtained in the field, that BAC per se is not significantly correlated with risk aversion. Regressing the average selling price on BAC, the

coefficient is positive (1.28), i.e. pointing towards higher risk propensity, but not significant. Nothing happens if BAC is decomposed into perceived Vs non-perceived components.

Figure 2: Certainty equivalent and expected value (lab)



The next question we ask is whether actual and perceived BAC affect the variance of risk aversion. The idea is that, by blurring precision of mental calculations, alcohol might introduce noise into decisions, and such noise should translate in an increase in variance. One way to measure this is by looking at the average squared difference between selling price and expected gain. When we regress it on BAC using several specifications, the coefficient is always positive but insignificant. When BAC is decomposed into perceived and non-perceived components, the coefficient of the latter turns out to be about three time as much as the former. However, all the specifications return non-significant coefficients.

Nothing worth notice as far as insensitivity to probability is concerned.

While given the small numbers of observations, our preliminary results should obviously be taken with a grain of salt, at first glance they are at odds with with Loewenstein and O'Donoghue's (2007) idea that alcohol or mental load in general should reinforce both risk aversion and risk propensity. In contrast, they seem to follow common wisdom that says that alcohol increases risk propensity.

Altruism

Regressing the difference between the donation to MSF and that to LaVoce.info we find a negative and significant coefficient. Decomposing BAC we see that the bulk of the effect is due to the perceived component (coefficient -8.2, significant), while non-perceived BAC is characterized by a negative (-3.2) though non-significant coefficient. This striking result is driven by significantly lower donations to MSF by treated subjects, while there are no differences with respect to the controls as far as LaVoce.info is concerned. H2 is therefore contradicted.

Time preferences

BAC is significantly and positively correlated with impatience. In particular, perceived BAC significantly increases the amount required to postpone the payment in all the three dates. However,

no evidence that alcohol increases hyperbolic discounting. In other words,. requests do not increase more than proportionally when the present is involved.

Table 3. Impatience in the lab

	col 1 tomorrow	col 2 in 7 days	col 3 in 8 days	col 4 ratio
perceived BAC	5.80 *	6.38 **	7.62 **	0.55
non-perceived BAC	0.89	1.24	1.27	0.13
constant	2.98	6.32 ***	7.59 ***	1.65 *
R-squared	0.09	0.12	0.15	0.01

Behaviour

Both happiness and local trust turn out to be orthogonal to both actual and perceived alcohol consumption.

4. Summary and comparison between field and lab

We find that the absolute value of willingness to pay is significantly higher in the field than in the lab, but it is not significantly affected by either actual or perceived BAC. Hence, such a different can be attributed to a context effect.

Both in the lab and in the field optimism is orthogonal to alcohol consumption.

Risk propensity is positively correlated with drinking. However, while in the field this result is significant and only due to the non-perceived component, in the lab the two components have both a positive sign but perceived BAC always displays a larger coefficient. However, none is statistically significant.

The correlation of the variance of the certainty equivalent with perceived and measured BAC has opposite signs in the lab and in the field, but all coefficients are not significantly different from zero.

Donations are also higher in the field than in the lab, consistently with the evidence about willingness to pay. Both could be explained by the fact that people tend to be more generous with windfall gains than with earned money. Although payments in the lab are about twice as much than in the field, the time spent is proportionally longer. Moreover, in the field participants did not incur any transportation cost, and they probably suffered a lower opportunity cost since the experiment took place during their leisure time.

Evidence about time preferences is contradictory at least at first glance. More impatience emerges in the lab, while less in the field. The number of observations in the field, however, cast a shadow on those results.

In the field there is also a level effect: subjects ask less in order to postpone the payment. There are two factors not apparent at first glance but that should be considered. First, the endowment was half in the field, so in relative terms the answers are not so different. Second, in the field postponing the payments should have implied meeting the subjects again. Hence, the cost of postponing was higher than in the lab where payments of this phase would take place by means of a cash card regardless of the date. Overall, participants are more patient in the field.

	Lab	Field-Disco	Field-Bar
bid price for the videogame	3.52	5.75	5.31
bid price for the Christmas hat	n.a.	3.62	3.08
cards of one's colour	10.66	n.a.	10.55
donation to LaVoce	2.60	n.a.	5.89
donation to MSF	5.88	n.a.	8.67
tomorrow	5.94	n.a.	2.00
in 7 days	9.52	n.a.	5.78
in 8 days	11.46	n.a.	6.55
N. of observations	39	8	19

5. Conclusions

Data collected so far do not allow to draw any sensible conclusion on the effect of alcohol consumption on economic behaviour, and we recognize that talking about significance throughout the paper dealing with such a small number of observations is somehow heroic. Nevertheless, preliminary results are promising from several points of view.

First, the correlation between measured and perceived BAC is interesting. Although it is intuitive that such a correlation is higher in the field where people know how much they have drunk, the numbers are striking nevertheless (.75). Moreover, our design is effective in implementing the randomness of the assignment in such a way that subjects cannot recognize after having drunk whether they belong to the treatment or to the control group.

Second, both the field and the lab show that there is no effect of alcohol consumption on optimism and on willingness to pay. This is reassuring about the absence of interactions between the estimate of risk attitudes and a misperception of the likelihood of the events as well as an altered evaluation of the money at stake. More generally, this is consistent with the assumption of constant marginal utility of money usually (and implicitly) made when running experiments.

Third, in our data the difference between treated and control groups is lower when dealing with perceived than with measured BAC, since controls usually think they were instead exposed to alcohol consumption. At the same time perceived BAC has more explanatory power, while non-perceived BAC plays almost no role. On the one hand, this point towards the existence of a placebo effect. On the other hand, it says that the two groups are not so different in terms of behaviour, as confirmed also by non-parametric tests that never rejects the equality of means when comparing the behaviour of treated and controls.

Whether this is due to the very small number of observations, to a really limited pharmacological effect of alcohol, or instead to an insufficient quantity of alcohol administered in order to trigger significant behavioural differences is something that needs further research in order to be ascertained.

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Appendix:

INSTRUCTIONS

Welcome!
Thanks for participating to this experiment on decision making. By following these instructions, you can win an amount (included between 0 and 40 €) that will be paid once the experiment is concluded.
Your choices as well as any personal information will remain be anonymously analyzed in aggregate terms and used for scientific purposes only.
Finally, there are not correct or wrong answers to the following tasks. Your choices will exclusively depend upon personal characteristics such as your preferences and your attitude to participate to gambles.
It is extremely important that you make your choices having completely understood these instructions. For this reason, feel free to ask questions about the instructions.

Luca Corazzini, Università di Padova
Antonio Filippin, Università di Milano
Paolo Vanin, Università di Bologna

The experiment

In this experiment you will participate to 7 consecutive phases, in each of which you will be required to make some economic choices. At the beginning of each phase, you will be given the instructions for the corresponding decisional task. Although you will participate to 7 consecutive phases, your final earnings uniquely depend on the outcome of one single phase. In particular, the phase used to determine your final earnings will be randomly selected at the end of the experiment by drawing one of seven cards, numbered from 1 to 7. Since phases have the same probability of being selected, you should make each choice as if it was the one effectively used to determine your final earnings. If you do not have any question, we can start with the experiment.

THE MARKET MECHANISM BDM

During the experiment, you will be required to make some choices using a peculiar market mechanism called BDM (from the names of the three economists that invented it, Becker, De Groot e Marschak).

In this market mechanism you will interact either with a seller robot or a buyer robot.

Seller robot. Suppose that you want to buy a generic item X from a seller robot and you are endowed with 10.00€. The bargaining is conducted as follows. The seller robot selects the price of X randomly, by picking a value included between 0.00 and 10.00€ (in steps of 0.10€) with equal probability. Before knowing the price selected by the seller robot, you will be asked to state the maximum price (included between 0.00 and 10.00€, in steps of 0.10€) you are willing to pay for X. If the price stated by you is lower than the price selected by the seller robot, then no agreement is reached: you do not buy X and the seller robot does not receive any amount of money. On the

contrary, if the price stated by you is higher than or equal to the price selected by the seller robot, then an agreement is reached: you buy X paying to the seller robot what it haw randomly selected.
Example. Suppose the price you are willing to pay for X is 6€ and the price selected by the seller robot is 4.90€. Given the previous instructions, an agreement is reached. You buy X paying 4.90€ to the seller robot.
It is easy to show that there is no incentive to miss-report the amount you are willing to pay for X. Suppose that, although you are willing to pay 6.00€ for X, you state a lower price, say 4.00€. Suppose that the seller robot selects a price equal to 4.10€. Although you would have been happy to buy X for 4.10€, the agreement is not reached since the price stated by you is lower than the price selected by the seller robot. Generally speaking, you should never report a lower price than what you are willing to pay for X because your choice does not affect the selling price and you might lose the opportunity to buy the item for a favorable exchange.
Instead, suppose that, although you are willing to pay 6.00€ for X, you state a higher price, say 7€. Suppose that the seller robot selects a price equal to 6.50€. In this case an agreement is reached but you have to pay a price which is higher than what you are willing to pay. Generally speaking, you should never report a higher price than what you are willing to pay for X because your choice does not affect the selling price and you might buy the item for an unfavorable too high price

Buyer robot. What said above also holds in a slightly different context in which you interact with a buyer robot. Suppose you have the opportunity to sell a generic item Y to a buyer robot which is endowed with 10.00€. The bargaining is conducted as follows. The buyer robot selects the price it is willing to pay for Y randomly, by picking a value included between 0.00 and 10.00€ (in steps of 0.10€) with equal probability. Before knowing the price selected by the buyer robot, you will be asked to state the minimum price (between 0.00 and 10.00€, in steps of 0.10€) you require to sell Y. If the price stated by you is higher than the price selected by the buyer robot, then no agreement is reached: you do not sell Y and the buyer robot does not pay any amount of money to you. On the contrary, if the price stated by you is lower than or equal to the price selected by the buyer robot, than an agreement is reached: you sell Y to the buyer robot for price it has selected. Even in this case, there is no incentive to miss-report the amount you require to sell Y.

PHASE 1

Please look at the following table carefully.

	LOTTERY	PRICE
L1	You receive 40€ if the number of the selected ball is included between 1 and 4. Otherwise, you do not receive anything if the number of the selected ball is included between 5 and 10.	_____ €
L2	You receive 40€ if the number of the selected ball is included between 1 and 9. Otherwise, you do not receive anything if the number of the selected ball is 10.	_____ €
L3	You receive 40€ if the number of the selected ball is included between 1 and 5. Otherwise, you do not receive anything if the number of the selected ball is included between 6 and 10.	_____ €
L4	You receive 40€ if the number of the selected ball is 1. Otherwise, you do not receive anything if the number of the selected ball is included between 2 and 10.	_____ €
L5	You receive 40€ if the number of the selected ball is included between 1 and 6. Otherwise, you do not receive anything if the number of the selected ball is included between 7 and 10.	_____ €
L6	You receive 40€ if the number of the selected ball is included between 1 and 3. Otherwise, you do not receive anything if the number of the selected ball is included between 4 and 10.	_____ €
L7	Whatever the number of the selected ball, you receive 40€	_____ €
L8	You receive 40€ if the number of the selected ball is included between 1 and 8. Otherwise, you do not receive anything if the number of the selected ball is included between 9 and 10.	_____ €
L9	You receive 40€ if the number of the selected ball is included between 1 and 2. Otherwise, you do not receive anything if the number of the selected ball is included between 3 and 10.	_____ €
L10	You receive 40€ if the number of the selected ball is included between 1 and 7. Otherwise, you do not receive anything if the number of the selected ball is included between 8 and 10.	_____ €

The previous table reports 10 lotteries, numbered from L1 to L10. As you see from the table, the only difference between lotteries concerns the probability of receiving a prize of 40 €. For each line of the table, you are asked to state in the last column (PRICE) the minimum price you are willing to sell the right to participate to the corresponding lottery to a buyer robot. At the end of the experiment, if this phase is selected, your final earnings will be determined according to the following procedure.

1) **Which lottery?**

Although you are asked to make a choice for each of the 10 lotteries reported in the table, you final earnings will uniquely depend on the outcome of a single lottery. In particular, the lottery to use will be randomly selected by drawing one of ten cards, numbered from L1 to L10, such that the probability of each lottery is the same.

2) **Do you participate to the lottery or sell this opportunity?**

Whether you will (or won't) participate to the selected lottery depends on the outcome of the BDM market mechanism explained above. In particular, the price that a buyer robot is willing to pay for participating to the selected lottery will be randomly selected by picking a value included between 0.00 and 40.00€ (in 0.10€ steps). If the price selected by the buyer robot is higher than or equal to the price stated by you for the selected lottery, then an agreement is reached and you sell the right to participate to the lottery for the price of the buyer robot. On the contrary, if the price selected by the buyer robot is lower than the price stated by you for the selected lottery, then an agreement is not reached: you will not receive any price from the buyer robot and you will participate to the selected lottery.

3) **The outcome of the selected lottery.**

On the contrary, if the price selected by the buyer robot is lower than the price stated by you for the selected lottery, then an agreement is not reached: you will not receive any price from the buyer robot and you will participate to the selected lottery. In this case, we will randomly draw one of ten balls, numbered from 1 to 10, with equal probability and your earnings will be determined according to the rules of the selected lottery reported in the table.

PHASE 2

Look at this item carefully. It is a combo radio-videogame that includes batteries.

You are asked to state the maximum price you are willing to pay (between 0.00€ to 20.00€, in steps of 0.10€) for buying this item from a seller robot knowing that in this phase you are endowed with 20.00€.

At the end of the experiment, if this phase will be randomly selected, your final earnings will be determined according to the BDM market mechanism explained above. In particular, the seller robot will randomly select the price it requires to sell the item by picking a value included between 0.00 and 20.00€ (in 0.10€ steps). If the price stated by you is higher than the price selected by the seller robot, than an agreement is reached: you buy the item for the price selected by the seller robot and you receive an amount given by the difference between 20.00€ and the price you paid. On the contrary, if the price stated by you is lower than that selected by the seller robot, no agreement is reached: you do not buy the item and receive an amount of 20.00€.

MAXIMUM PRICE YOU ARE WILLING TO PAY FOR THE ITEM (between 0.00 and 20.00€)

PHASE 3

Look at this item carefully. It is a Christmas hat with lights and included batteries.

You are asked to state the maximum price you are willing to pay (between 0.00€ to 20.00€, in steps of 0.10€) for buying this item from a seller robot knowing that in this phase you are endowed with 20.00€.

At the end of the experiment, if this phase will be randomly selected, your final earnings will be determined according to the BDM market mechanism explained above. In particular, the seller robot will randomly select the price it requires to sell the item by picking a value included between 0.00 and 20.00€ (in 0.10€ steps). If the price stated by you is higher than the price selected by the seller robot, than an agreement is reached: you buy the item for the price selected by the seller robot and you receive an amount given by the difference between 20.00€ and the price you paid. On the contrary, if the price stated by you is lower than that selected by the seller robot, no agreement is reached: you do not buy the item and receive an amount of 20.00€.

MAXIMUM PRICE YOU ARE WILLING TO PAY FOR THE ITEM (between 0.00 and 20.00€)

PHASE 4

In this phase, you are asked to state the amount (between 0.00€ to 20.00€, in steps of 0.10€) you want to donate to "LaVoce.info" knowing that in this phase you are endowed with 20.00€.

At the end of the experiment, if this phase is selected, your final earnings will depend on the amount you have donated to "LaVoce.info." In particular, you will receive an amount that is equal to the difference between 20.00€ and what you have donated to "LaVoce.info."

LaVoce.info is a free online press that is mainly managed by economists working for universities and other institutions. Its articles focus on economic, political and social issues and its editorial style is in the middle between non-specialized press and academic language. LaVoce.info self-financed by its members and authors of the articles work on voluntary base.

AMOUNT TO DONATE TO "LAVOCE.INFO" (between 0.00 and 20.00€)

Within 14 days from the end of the experimental sessions, your donation together with those of the participants overall sessions will be sent to "LaVoce.info" through postal transfer. The details of the postal transfer and the list of anonymous donations made by the participants to this experiment will be emailed on request.

PHASE 5

In this phase, you are asked to state the amount (between 0.00€ to 20.00€, in steps of 0.10€) you want to donate to “Médecins Sans Frontières” knowing that in this phase you are endowed with 20.00€.

At the end of the experiment, if this phase is selected, your final earnings will depend on the amount you have donated to “Médecins Sans Frontières” In particular, you will receive an amount that is equal to the difference between 20.00€ and what you have donated to “Medici sans Frontier.”

“Medici sans Frontier” is a humanitarian institution that offers medical and sanitary support in war areas.

AMOUNT TO DONATE TO “MÉDECINS SANS FRONTIÈRES” (between 0.00 and 20.00€)

Within 14 days from the end of the experimental sessions, your donation together with those of the participants overall sessions will be sent to “Médecins Sans Frontières” through postal transfer. The details of the postal transfer and the list of anonymous donations made by the participants to this experiment will be emailed on request.

PHASE 6

In this phase, each participant will be assigned a maze of 52 standard poker cards. Given his/her maze, for each participant, an experimenter will randomly select a subset of 21 unobserved cards. For simplicity, let us refer to this subset of cards with the word the “sample.” Please chose one card of your sample and observe it. At the end of the experiment, if this phase is selected, you will paid 1.00€ for each card in your sample reporting the same color (black or red) of that you have just selected.

Moreover, you are asked to guess the number of cards in your sample reporting the same color (black or red) of that you have just selected. If your conjecture is correct, you will receive an additional amount of 10.00€.

NUMBER OF CARDS IN YOUR SAMPLE REPORTING THE SAME COLOR OF THE ONE YOU HAVE SELECTED (BETWEEN 0 AND 21, INCLUDING THE ONE YOU HAVVE SELECTED)

PHASE 7

In this phase you are endowed with 20€.

As follows, we ask you to state the minimum additional amount (between 0.00 and 20 €) you would require from a hypothetical borrower to post-pone the payment by 1, 7 and 8 days respectively. In all these cases, the payment will occur through debit card.

At the end of the experiment, if this phase is selected, pone of the three possible dates will be randomly chosen by drawing one of three cards, numbered 1, 7 and 8 respectively. Given the date and following the BDM market mechanism explained above, the borrower robot will select the additional amount it is willing to pay to postpone the payment at that date by randomly picking a value included between 0.00 and 20.00€ (in 0.10€ steps) with equal probability. If the amount selected by the borrower robot is higher than the amount stated by you, then an amount of 20.00€ plus what selected by the borrower robot will be transferred to your debit card at the corresponding date. On the contrary, if the amount selected by the borrower robot is lower than the amount stated by you, then at the end of the experiment you will be paid 20€ in cash.

MINIMUM ADDITIONAL AMOUNT (BETWEEN 0.00 AND 20.00€) YOU REQUIRE FROM THE BORROWER ROBOT TO POSTPONE THE PAYMENT OF 20.00€ BY 1 DAY.

MINIMUM ADDITIONAL AMOUNT (BETWEEN 0.00 AND 20.00€) YOU REQUIRE FROM THE BORROWER ROBOT TO POSTPONE THE PAYMENT OF 20.00€ BY 7 DAY.

MINIMUM ADDITIONAL AMOUNT (BETWEEN 0.00 AND 20.00€) YOU REQUIRE FROM THE BORROWER ROBOT TO POSTPONE THE PAYMENT OF 20.00€ BY 8 DAY.