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Understanding the influence of guilt, loss and self-awareness on gambling behaviour

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Abstract

The study has two aims. Firstly, to examine the impact of specific emotional factors on gambling expenditures and, secondly, to examine the impact of these emotional factors on problematic gambling behaviours (controlling for socio-economic determinants). Findings are based on a survey of 1196 gamblers in Sardinia, Italy. Using a bivariate probit approach, findings indicate that emotions associated with positive events (win) are related to the amount of money allocated for gambling (gambling expenditure). Findings also indicate the influence of negative emotional factors (experiencing disappointment, guilt and frustration) in gambling loss is related to self-awareness of problematic gambling. Furthermore, feelings of euphoria, anxiety and excitement during the gambling event is also related to self-awareness of problematic gambling. Analysis provides support for the notion that gambling behaviour is strongly associated with both positive and negative emotions.

A.B. and C.D. would like to thank Ricky for his time.

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1. Introduction

Analysis of gambling behaviour is not a novelty in the social science literature; however, previous research has predominately focused on cultural, racial, religious, occupational and gender factors (rather than emotional factors) as risk factors for problematic gambling (Tan *et al.* 2010). Indeed, such research has also predominately focused on consumer theory and the link to the aforementioned broad social factors (Phelps and Sokol-Hessner 2012). Limited research has explored specific emotional factors such as self-awareness on gambling expenditure and behaviour. Empirical studies have also highlighted the relationship between arousal and risk-taking behaviours such as gambling (see Loewenstein *et al.* 2001) with anxiety, nervousness and passion recognized as risk factors for pathological gambling (Vallerand *et al.* 2003). Vallerand *et al.* (2003) found that passion plays an important role in defining and motivating how to invest time and efforts in a given activity. Passion is however a broad concept that often lacks clarity. In an effort to clarify the concept, the authors differentiate between obsessive and harmonious passion on the basis that harmonious passion leads individuals to be in control of the activity whereas obsessive passion is associated with a lack of control of the activity (Lefcourt 1991, Ratelle 2004). Indeed, Mageau *et al.* (2005) found that having an obsessive passion toward gambling is correlated with negative emotions both during and after gambling. Adding to this empirical analysis, the study's aim is to explore the relationship between emotions and gambling behaviour. Specifically, the study extends this research by estimating the relationship between emotions associated with gambling activity and both gambling expenditures and problematic behaviour. That is, the main objective is to identify which emotions can predict gamblers at risk, leading to the development of a model of potential behavioural risk factors.

An important issue concerns the identification of gamblers at risk (problematic gamblers). In the present study, problem related gamblers are identified by a set of items investigating the presence of psychological, economic, relational, labour, emotional and sexual problems directly related to gambling activity. This is a potential bias as participants are required to identify themselves as problematic gamblers. In order to limit the well-known problems of underestimation (due to the gamblers' reluctance to manifest their condition), a bivariate ordered probit model is employed (Johnson *et al.* 1998). This econometric model can control for potential endogenous variables such as socio-economic variables, thus reducing potential bias.

The analysis is focused on Sardinia because of its cultural and ethnic uniformity (compared to other more heterogeneous Italian regions). Therefore, potential bias relating to ethnicity in the sample is mitigated in this study. Sardinia is also a suitable site for the research due to the very high per capita expenditure on gambling activity (compared to other developed countries) and also due to a recent State intervention that will potentially expand the gambling industry dramatically (Hooper 2012).

The paper is organised as follows: Section 2 provides the literature review, Section 3 describes the survey's approach, and Section 4 outlines the econometric approach and the dataset. Section 5 discusses the results. Section 6 concludes the paper.

2. Literature review

The study has two research questions:

1. Do socio-economic and emotional factors influence gambling expenditure and gambling-related problems (problematic gambling)?
2. Do emotional factors contribute to self-awareness of gambling-related problems (controlling for socio-economic determinants)? This is with specific reference to emotional factors during gambling activity, after a win, and after a loss.

The study is unique as it has analysed the profiles and behaviour of gamblers beyond standard socio-demographic data such as age, income, education, family status. Other variables are included

in the analysis such as number of years passed since first gambling experience, game mode (play alone or with other people), frequency of play, and distance from home to gambling sites. Furthermore, the study collected and analysed data on gamblers emotions during the game, post-loss and post-winning. The aim of this is to explore the relationship to gambling expenditure and awareness of problematic gambling.

Various international studies have highlighted that gambling behaviour is twice as prolific in males (compared to females) with reference to both weekly and monthly gambling expenditure (Williams *et al.* 2012a). Differences have also been found in gambling expenditure based on socio-economic status. Recent research in Finland found that people with a lower socio-economic status contribute proportionally more of their income to gambling compared with middle- and high-income groups (Castren *et al.* 2018).

Demographic risk factors for increased gambling expenditure also include having parents or family members who gamble, with problematic and pathological gambling related to onset of gambling activities in adolescence (Vachon *et al.* 2004, Gupta and Derevensky 1997). Other risk factors to pathological and problematic gambling include proximity to gambling sites (particularly for minority and lower class groups) (Welte *et al.* 2004, Sévigny *et al.* 2008). Furthermore, the Spatial accessibility of EGMs (electronic gaming machine) is another important determinant of gambling risk and should be explicitly considered by regulators (Young *et al.* 2012).

Studies have also highlighted the link between problem gambling and emotional factors. Williams *et al.* (2012b) found that pathological gamblers have less adaptive emotional regulation strategies (such as difficulty controlling emotion), reported a greater lack of emotional clarity related to gambling, were more impulsive, and had less emotional self-awareness than a control group. Other emotional factors linked to problematic gambling include inability to effectively regulate negative emotions, impulsive behaviour, suppression and induction of arousal, and a lack of emotional coping strategies (Navas *et al.* 2017, Ricketts and Macaskill 2003). Positive emotions can however, positively affect the player's risk predisposition (Breiter *et al.* 2001, Kuhnen and Knutson 2005, Lee *et al.* 2007). Kahneman and Tversky (1984) found that pathological gamblers exaggerated risk-seeking strategies for losses and exaggerated risk-aversion strategies for wins. These factors combine to indicate that gambling excitement is multifaceted and characterised by impaired impulse control. Evidence suggests that pathological gambling is also associated with shame. A study by Sunghwan (2012) found that gamblers who report shame often demonstrate an increased intensity of problematic gambling, and cope with gambling losses by adopting avoidance strategies. However, gamblers who report a sense of guilt did not report an increase in intensity of problem gambling. Hence, it could be argued that the propensity to shame is one of the predisposing risk factors of problem gambling, while the propensity to guilt can moderate the problems of gambling (Sunghwan 2012).

Evidence also suggests that gamblers who have a greater predisposition to excitement related to gambling ("Excitement-seeking Gamblers") are more likely to report alcohol and drug use, large gambling wins and losses, and symptoms of pathological gambling (Pantalon *et al.* 2008; Wulfert *et al.* 2005).

The literature indicates indirect associations between emotional factors and gambling expenditure, and problematic gambling. The relationship between self-awareness of gambling related problems, however, has not been adequately explored. More precisely, previous analyses have tried to disentangle the effects of positive and negative emotions on gambling behaviour. However, these studies do not consider the two emotion categories associated with gambling outputs, namely losses and wins, in a unique setting. By controlling socioeconomic determinants this study is unique in exploring this relationship by incorporating a large number of emotional factors. This includes both negative and positive emotions during the gambling activity, after a win, and after a loss.

We expect to find that certain types of gambling behaviour can be associated with given emotions. Positive emotions are expected to be related to gambling participation since they increase the pleasure and utility to enjoy the gambling activities, as in Breiter *et al.* (2001), and Kuhnen and

Knutson (2005), while negative emotions are expected to be correlated with self-awareness of problematic gambling (Sunghwan 2012). As a novelty, the study aims to expand the analysis of the emotional factors in a larger setting in which we include several types of emotion and three gambling situations, namely during gambling activity, after a win, and after a loss. From the analysis of the combination of gambling situations and emotion typologies, we intend to analyse in which cases negative and positive emotions are associated with high gambling consumption and problematic gambling behaviour, since our hypothesis is that these interactions could change according to gambling situations. Our prediction is that losses will exacerbate the co-occurrence of negative emotions and gambling related problems while wins will be more associated with positive feeling and consequently with high gambling consumption.

3. Survey and data description

The 34-items questionnaire used for this study was adapted from the South Oaks Gambling Screen (SOGS) developed by Lesieur and Blume (1987). Evidence suggests that the SOGS is a reliable and valid measure of social and problematic gambling (Stinchfield 2002, Gambino and Lesieur 2006).

The purpose and procedure of the study was explained to all eligible participants prior to the administration of the questionnaires. Participants were reassured that all individual identifiable information would be treated as confidential and would not be available to anyone outside the research team. Written informed consent was obtained from participants prior to joining the study. Typically, each questionnaire took 30 minutes (Bussu and Detotto 2015).

Self-report questionnaires (n=1298) were completed by participants at various gambling locations in Sardinia¹ (46% from the Province of Cagliari, 35% from the Province of Sassari, 11% from the Province of Nuoro, and 8% from the Province of Oristano). Although 1298 people completed the questionnaire, 102 of these were deemed as invalid (incomplete or illegible). Analysis was therefore based on a final sample of 1196 (92.1% of the dataset).

Participants ranged in age from 18-79 years with 77.7% of participants' males and 22.3% females. This gender disproportionality is consistent with research indicating that females exhibit less propensity to be involved in gambling (Bussu and Detotto 2015).

Questionnaire item responses varied from binary (yes/no), to a range of fixed choice responses, to open-ended responses. For example, item #28 provided the following question: "*Have you ever experienced any problems related to gambling?*" Respondents could choose either "Yes" or "No" and describe which types of gambling problems experienced (for example, sexual, emotional or economic problems). Another example is item (#20): "*On average how much do you bet every time you play?*" Four different response options were provided and respondents could choose only one. An index, *BET*, expresses these four options as follows: it values 1 for daily total bets of less than 10 Euros, 2 for those between 11 and 50 Euros, 3 for those between 50 and 300 Euros, 4 for those higher than 300 Euros. The distribution is the following: 55.9% of sample bets less than 10 Euros, 27.8% between 11 and 50 Euros, 14.2% between 50 and 300 Euros, 2.1% more than 300 Euros. A binary index, *BINBET*, is then calculated which values 1 if respondent's daily total bets are higher than 11 Euros.

Notably, 15.4% of the sample claimed to have had health, wealth, affective and/or relational problems directly as a result of their gambling. As expected these problems escalated with increased frequency of gambling expenditure. For example, 7.1% of the sample who gambled less than 10 Euros a day reported health, wealth, affective and relational problems, whilst 76% of the sample who gambled more than 300 Euros a day reported such problems² (see Table 1).

¹ The questionnaires were collected in 4 bingo halls, 2 hippodromes and 18 betting outlets in Sardinia, which represent almost all of the betting venues at that time (only one betting outlet was excluded from our analysis since it did not give the permission to administer questionnaires on their premises).

² In terms of rates of problem gambling according the SOGS, 0.98% of complete questionnaires were classified as from

Table 1. Description of variables

Variable	Description	Obs	Mean
BINBET	1 for bets higher than 50 euros; 0 otherwise	1196	0.44
BET	1 for bets of less than 10 euros; 2 for bets between 11 and 50 euros; 3 for bets between 50 and 300 euros; 4 for bets higher than 300 euros.	1196	1.62
PROBLEM	1 if the respondent states to be suffering from gambling-related problems, namely economic, relational, labour, emotional and sexual problems, and 0 otherwise.	1196	0.15
AGE	Age of the respondent.	1154	34.70
FEMALE	1 if the respondent is female.	1196	0.22
DISTANCE	1 for distances of less than 5 km; 2 for distances between 6 and 25 km; 3 if distances are between 26 and 40 km; 4 if they are between 41 and 60 km; 5 if they are between 60 and 100 km; 6 if they are higher than 100 km.	1196	1.48
SINGLE	1 if the respondent is single, and 0 otherwise.	1196	0.57
DIVORCED	1 if the respondent is divorced, and 0 otherwise.	1196	0.34
WIDOW/ER	1 if the respondent is a widow/er, and 0 otherwise.	1196	0.07
MARRIED	1 if the respondent is married, and 0 otherwise.	1196	0.02
EDUCATION	1 if the respondent is illiterate or unschooled; 2 if he/she has a primary school diploma; 3 if he/she has a middle school diploma; 4 if he/she has a secondary school diploma; 5 if he/she has a tertiary degree; 6 if he/she has a post-graduate degree.	1196	4.13
INCOME	1 for income less than 10,000 euros; 2 for income between 10,000 and 15,000 euros; 3 for income between 15,000 and 20,000 euros; 4 for income between 20,000 and 30,000 euros; 5 for income between 30,000 and 40,000 euros; 6 for income higher than 40,000 euros.	998	2.71
TIME_EXPERIENCE	1 if he/she was less than 15 years old; 2 if he/she was between 15 and 18 years old; 3 if he/she was between 18 and 25 years old; 4 if he/she was between 26 and 30 years old; 5 if he/she was between 31 and 45 years old; 6 if he/she was between 46 and 60 years old; 7 if he/she was older than 60.	907	3.04
PARENTS	1 if the respondent's father, mother or grandparents gamble, and 0 otherwise.	1196	0.03
RELATIVES	1 if the respondent's family (wife/husband or his/her children) gambles, and 0 otherwise.	1196	0.02
WEEK_TIMES	1 if he/shenever gambles; 2 if he/she does it once; 3 if twice; 4 if three times; 5 if more than 3 times.	1189	3.27
N_HOURS	1 if he/she never gambles; 2 if he/she gambles for less than 30 minutes; 3 if he/she gambles for 30 to 1 hour; 4 if he/she gambles for 1 to 2 hours; 5 if he/she gambles for 2 to 4 hours; 6 if he/she gambles for more than 4 hours.	1171	2.95
ALONE	1 if the respondent usually plays alone, and 0 otherwise.	1174	0.46
WIN_EUPHORIA	1 if the respondent is euphoric in case of win, and 0 otherwise.	1196	0.36
WIN_PLEASURE	1 if the respondent feels pleasure in case of win, and 0 otherwise.	1196	0.51
WIN_SATISFACTION	1 if the respondent feels satisfied in case of win, and 0 otherwise.	1196	0.52
WIN_REPLAY	1 if the respondent feels an urge to try again in case of win, and 0 otherwise.	1196	0.18
WIN_OMNIPOTENCE	1 if respondent feels a sense of omnipotence in case of win, and 0 otherwise.	1196	0.03
WIN_OTHERS	1 if the respondent feels a different emotion from the ones listed before in case of win, and 0 otherwise.	1196	0.05
LOSS_GUILT	1 if the respondent feels a sense of guilt in case of loss, and 0 otherwise.	1196	0.11
LOSS_FRUSTRATION	1 if the respondent feels frustrated in case of loss, and 0 otherwise.	1196	0.06
LOSS_DISAPPOINTMENT	1 if the respondent is disappointed in case of loss, and 0 otherwise.	1196	0.61
LOSS_EXCITEMENT	1 if the respondent is excited in case of loss, and 0 otherwise.	1196	0.06
LOSS_ANGER	1 if the respondent is angered in case of loss, and 0 otherwise.	1196	0.26
LOSS_REDEEM	1 if the respondent feels some need of redeeming himself/herself in case of loss, and 0 otherwise.	1196	0.25
LOSS_LOW_SELF_ESTEEM	1 if the respondent has low self-esteem in case of loss, and 0 otherwise.	1196	0.01
LOSS_HELPLESSNESS	1 if the respondent feels helpless in case of loss, and 0 otherwise.	1196	0.03
DURING_EUPHORIA	1 if the respondent is euphoric during the game, and 0 otherwise.	1196	0.29
DURING_PLEASURE	1 if the respondent feels pleasure during the game, and 0 otherwise.	1196	0.47
DURING_SATISFACTION	1 if the respondent feels satisfied during the game, and 0 otherwise.	1196	0.26
DURING_ANXIETY	1 if the respondent is anxious during the game, and 0 otherwise.	1196	0.26
DURING_EXCITEMENT	1 if the respondent is excited during the game, and 0 otherwise.	1196	0.18
DURING_FRUSTRATION	1 if the respondent feels frustrated during the game, and 0 otherwise.	1196	0.11
DURING_ANGER	1 if the respondent is angry during the game, and 0 otherwise.	1196	0.01
DURING_OTHERS	1 if the respondent feels a different emotion from the ones listed during the game, and 0 otherwise.	1196	0.05

Respondents were asked to report their emotions and psychological processes during their gambling activities as part of the questionnaire. Information was divided into three groups for the purpose of analysis: during the game, a win, or a loss. The rationale for this separation is the notion that emotions can affect a range of addictive behaviours, which in turn could impact on gambling expenditure (Bussu and Detotto 2015). That is, focusing on regulation and management of mood/emotions related to gambling control could lead to a failure in self-control and self-regulation

probable pathological gamblers.

in other areas such as substance misuse (Tice and Bratslavsky 2000).

Table 2 shows the cross-tabulation between emotions experienced and gambling consumption. Referring to emotions during the game, gamblers pass from euphoria to pleasure as daily gambling expenditure increases. With specific reference to emotional responses associated with positive gambling outputs, gamblers typically switch from pleasure to satisfaction and, then, to the impulse to replay as the daily expenditures increases. This relationship between gambling and happiness or satisfaction has also been found in other studies (Dixon *et al.* 2013, McNeilly and Burke 2000). Finally, in the case of loss, the most consistent emotion is disappointment. This relationship was not found for high expenditure gamblers who are more likely to experience feelings of anger in response to loss.

Table 2. Cross-tabulation between gambling expenditures (BET) and emotions during and in response to gambling

Emotions	BET = 1	BET = 2	BET = 3	BET = 4
DURING_EUPHORIA	28.84%	31.92%	25.88%	20.00%
DURING_PLEASURE	47.08%	47.52%	48.23%	36.00%
DURING_SATISFACTION	25.85%	25.60%	32.35%	24.00%
DURING_ANXIETY	22.42%	31.92%	27.64%	32.00%
DURING_EXCITEMENT	14.64%	22.28%	26.47%	32.00%
DURING_FRUSTRATION	13.75%	7.53%	7.05%	12.00%
DURING_ANGER	0.89%	1.80%	4.70%	8.00%
DURING_OTHERS	4.48%	4.21%	5.88%	28.00%
WIN_EUPHORIA	37.66%	34.63%	36.47%	36.00%
WIN_PLEASURE	53.36%	52.10%	46.47%	32.00%
WIN_SATISFACTION	50.82%	56.32%	51.76%	32.00%
WIN_REPLAY	10.61%	25.00%	31.17%	56.00%
WIN_OMNIPOTENCE	1.49%	3.31%	8.82%	28.00%
WIN_OTHERS	5.97%	3.36%	4.70%	12.00%
LOSE_GUILT	10.31%	15.06%	12.94%	8.00%
LOSE_FRUSTRATION	5.23%	5.12%	14.70%	12.00%
LOSE_DISAPPOINTMENT	63.97%	60.84%	52.94%	40.00%
LOSE_EXCITEMENT	4.03%	8.43%	8.23%	12.00%
LOSE_ANGER	23.01%	28.01%	34.70%	48.00%
LOSE_REDEEM	20.92%	28.91%	32.94%	32.00%
LOSE_LOW_SELF_ESTEEM	0.74%	2.10%	1.76%	8.00%
LOSE_HELPLESSNESS	2.69%	3.31%	4.11%	16.00%

4. Framework approach and analysis

Extending the empirical literature on gambling behaviour (Layton and Worthington 1999, Worthington *et al.* 2007, Tan *et al.* 2010, Bussu and Detotto 2015), this study incorporated a bivariate probit model (illustrated below) to explore the relationship between socio-economic and emotional factors and both gambling expenditure and gambling-related problems.

The econometric model can be expressed as follows:

$$y_{1i} = X_{1i}\beta_1 + e_{1i} \quad (1a)$$

$$y_{2i} = Z_i\gamma + X_{2i}\beta_1 + e_{2i} \quad (1b)$$

for $i = 1, 2, \dots, n$. Model (1a)-(1b) constitutes a system of equations (Cameron and Trivedi 2009), where y_{1i} and y_{2i} represent two binary variables. In our case, y_{1i} indicates the individual attitude to gambling amounts higher than 11 Euros, i.e. *BINBET*, while y_{2i} is the respondents' self-report response of the social problems caused by gambling activities, i.e. *PROBLEM* (Moscovici and Duveen 2000). In other words, the latter variable reflects respondents' answer to questionnaire item

#28 (self-reported problems directly related to gambling). Finally, the variable Z (*BET*) is the four stated gambling daily expenditure classes (1 for bets of less than 10 euros, 2 for bets between 11 and 50 euros, 3 for bets between 50 and 300 euros, 4 for bets higher than 300 euros).

In (1a)-(1b), the endogenous y_{1i} is simultaneously determined with y_{2i} . Hence, X_1 and X_2 are observed matrices, β_1 and β_2 are vectors of parameters, γ is the scale that represents the effect of Z_i on y_{2i} . Finally, e_1 and e_2 are two error terms. These are normally distributed as bivariate with a correlation ρ and uncorrelated with the explanatory variables (i.e. $E(X_i, e_{1i}) = 0$ and $E(X_i, e_{2i}) = 0$).

Vectors of explanatory variables that affect both gambling expenditures and other addictions are in X_1 and X_2 . More precisely, the latter includes socio-demographic and economic characteristics of individuals in the sample. AGE_i represents the age of the i -th respondent, while $FEMALE_i$ is a dummy variable that has a value of one if the player is female. *SINGLE*, *DIVORCED*, *WIDOWER* and *MARRIED* are dummies that indicate the family status of the gamblers. According to Sawkins and Dickie (2002), and Worthington *et al.* (2007), age positively affects the propensity to gamble among American and Australian gamblers. Scott and Garen (1994), Niffenegger and Muuka (2001) and Welte *et al.* (2004) alternatively, found a negative correlation between age and gambling. Perhaps there is a “peak age” for gambling expenditure as Mikesell (1991) found that gambling expenditure increases with age, up to 44 years of age.

DISTANCE measures the distance in kilometres between the respondents’ residences and their habitual gambling places. Longer distances to travel to gambling sites may be associated with higher cost for travel (& hence budget constraints for gambling), or longer travel distances to gambling sites may be associated with a commitment to gambling and greater expenditure on gambling. *EDUCATION* and *INCOME* refers to individual education and income level. According to Winters *et al.* (1993), a negative relationship exists between education and the risk of pathological gambling, with more educated people more risk averse (Scott and Garen 1994, Stranahan and Borg 1998). Such findings were not confirmed by Niffenegger and Muuka (2001) who found that people with tertiary education, on average, spend more in lotteries than other groups. A positive correlation between *INCOME* and gambling expenditure is expected given the potentially higher proportion of disposable income (Mikesell 1991) confirms such positive correlation, although the share of per capita spending on gambling decreases as income becomes higher.

TIME_EXPERIENCE measures the number of years passed since first gambling experience. A positive relationship is expected between gambling expenditure and years of gambling (Bolen and Boyd 1968). *ALONE* is a dummy variable with a value of one if the gambler usually plays alone.

PARENTS and *RELATIVES* are two dummy variables. A value of one is given if the parents and grandparents were gamblers and if other members of the family (wife/husband and children) gamble regularly. This allows for the researcher to control for the family behaviour of gamblers. In both, the parents and relatives gambling experience, a positive relationship is expected (Gupta and Derevensky 1997, Welte *et al.* 2004).

WEEK_TIMES and *N_HOURS* indicates the number of times per week and the number of hours per day in which respondents gamble. Since problematic gamblers tend to increase their “dose” over time, a positive sign is expected for both variables.

The last set of variables includes emotional dummies that can affect gamblers’ behaviour. That is, the feelings and psychological processes of gamblers during their gambling activities were collected. The information is divided in three groups according to whether such feelings were experienced during the game, in case of win, and in case of loss.

The first set of dummies represents the feelings in case of win: *WIN_EUPHORIA*, *WIN_PLEASURE*, *WIN_SATISFACTION*, *WIN_REPLAY*, *WIN_OMNIPOTENCE* and *WIN_OTHERS*. The variable *WIN_EUPHORIA* measures 1 (one) if the respondent is euphoric in case of win, and 0 (zero) otherwise. *WIN_PLEASURE* and *WIN_SATISFACTION* indicate the respondent’s feelings of pleasure and satisfaction in case of win. *WIN_REPLAY* represents the gamblers desire to replay immediately. *WIN_OMNIPOTENCE* is a dummy variable. A value of one

indicates that the gambler feels a sense of omnipotence. Finally, *WIN_OTHERS* represent other emotions not listed.

The second group of covariates represents the feelings in case of loss: *LOSS_GUILT*, *LOSS_FRUSTRATION*, *LOSS_DISAPPOINTMENT*, *LOSS_EXCITEMENT*, *LOSS_ANGER*, *LOSS_REDEEM*, *LOSS_LOW_SELF_ESTEEM* AND *LOSS_HELPLESSNESS*. In detail, *LOSS_GUILT* is a dummy variable where 1 represents a sense of guilt in case of loss and 0 otherwise. *LOSS_FRUSTRATION* represents the situation in which the gambler feels frustrated in case of loss. *LOSS_DISAPPOINTMENT*, *LOSS_EXCITEMENT* AND *LOSS_ANGER* indicate the case in which the respondent is disappointed, excited and angered, respectively. *LOSS_REDEEM* AND *LOSS_HELPLESSNESS* assumes the value of 1 when the respondent feels the need to redeem himself/herself and/or feels helpless. *LOSS_LOW_SELF_ESTEEM* is associated with low self-esteem.

Finally, the third set of variables accounts for the gamblers' emotions during the game: *DURING_EUPHORIA*, *DURING_PLEASURE*, *DURING_SATISFACTION*, *DURING_ANXIETY*, *DURING_EXCITEMENT*, *DURING_FRUSTRATION*, *DURING_ANGER* and *DURING_OTHERS*. *DURING_EUPHORIA* indicates that respondents feel euphoria whilst gambling. *DURING_PLEASURE* and *DURING_SATISFACTION* represent positive emotions: with a value 1 indicating that the respondent feels pleasure and satisfaction. *DURING_ANXIETY*, *DURING_EXCITEMENT* and *DURING_ANGER* indicates that the respondents are anxious, excited and angry during the gamble. *DURING_FRUSTRATION* is associated with frustrating emotions while *DURING_OTHERS* indicates if the respondent feels a different emotion from the ones listed during the game (value of 1), and 0 otherwise.

All the above-mentioned variables are included in both matrices X , except for *DISTANCE*, representing the exclusion restriction, which is included in X_1 and not in X_2 . In other words, we expect that the distance between respondents' residences and their habitual gaming places correlates with gambling expenditures but not the respondents' gambling-related problems.

Table 1 gives a short description and summarises descriptive statistics of all variables. The average age of the sample is 34.7 years. The majority of the sample are male (88%). In relation to the emotions felt in case of win or loss, 52.7% and 52.1% of the sample experience satisfaction or pleasure after a win results, while disappointment occurs for 61.7% after a loss.

As shown in Table 1 (3rd column), some variables have missing values. For example, *INCOME* (16.5%), *AGE* (3.5%), *TIME_EXPERIENCE* (24.1%), *WEEK_TIMES* (0.5%), *N_HOURS* (2.1%) and *ALONE* (1.8%). As a result, the number of complete rows is about 60% of the data set. In order to address those missing values a regression based imputation method is employed for the missing data by using the "mi impute chained" command of STATA (Version 14). The linear approach imputation is also used for *AGE*, while the logit approach is employed for the categorical variable *ALONE*. For the other ordinal variables (*INCOME*, *TIME_EXPERIENCE*, *WEEK_TIMES* and *N_HOURS*) the ordered probit is used. The three multiple imputation methods are therefore implemented based on different approaches to perform multiple imputation for continuous and categorical variables (Rubin 1987, Raghunathan *et al.* 2001, Van Buuren 2007). Following this procedure, 100 imputed datasets are obtained. The effect of imputation is tested by generating a binary (0/1) variable to represent unimputed/imputed data and included in the model. The coefficient for the variable was not significant, an indication that the imputation process did not change the results.

5. Results and discussion

Results of the bivariate probit (see Table 3) using both gambling expenditures (*BINBET*) and the respondents' admission to gambling-related problems (*PROBLEM*). The significant ρ statistic (= -0.219; p-value < 0.10) provides evidence of the dependence of the two equations, justifying the use

of a bivariate model.

The average Relative Variance Increase (RVI) reports the average relative increase (averaged over all coefficients) in variance of the estimates due to missing values. The closer this number is to zero, the less effect missing data have on the variance of the estimate. In our case, average RVI is very small (0.016).

Largest Fraction Missing Information (FMI) reports the largest coefficient estimates due to nonresponse (White *et al.* 2011). It provides an estimate of the minimum number of imputations to be used in the analysis. A rule of thumb is that the number of imputations has to be higher than $100 \times \text{FMI}$ in order to obtain adequate level of reproducibility of multiple imputation analysis. In our example, the largest FMI is 0.214 and the number of imputations is 100. This exceeds the required number of imputations: 22 ($= 100 \times 0.214$) according to this rule. Finally, the F-test on the joint significance of the coefficients is beyond the critical value (at 99% level confidence). The RVI, FMI and F-test provides evidence for a robust index of goodness of fit for the model.

As expected, *BET* ($=0.410$; $p\text{-value} < 0.01$) is highly significant and positive, i.e. the higher the average daily bet the more likely it is that gambling problems will occur. Income, first age experience and playing alone also negatively correlate with respondent's awareness of gambling-related problems. Taken together, gamblers with high disposable income, who begin gambling later in life, largely gamble on their own understood their eventual problematic gambling condition much less frequently. Furthermore, having relatives and parents involved in gambling activities increases respondents' awareness. The frequency of gambling also interacts with problematic gambling, with frequency of gambling directly correlated to problematic gambling.

As expected, no positive emotional factors can be associated with awareness of gambling-related problems. Notably, the sense of excitement both during the gamble and after loss, and the sense of guilt and frustration after a loss increase respondents' problematic gambling likelihood.

The *BINBET* equation indicates that distance, education, income, week frequency and daily gambling duration increase gambling expenditure. Furthermore, single, divorced and widowed individuals are more likely to gamble compared to married people. Interestingly, *DISTANCE*, *WEEK_TIMES* and *N_HOURS* increase the probability of gamblers betting higher values, which indicates that gambling expenditure increases as the distance travelled increases, and the weekly and daily frequency increase. Such findings empirically support the notion that problematic gamblers look for ways to increase their "dose" both in terms of time and money allocated for gambling activities. Finally, evidence suggests that gambling expenditure decreases when gamblers replay events after a win (*WIN_REPLAY*) and that gambling expenditure increases if gamblers are frustrated whilst gambling (*DURING_FRUSTATION*). Results remain unchanged despite the analysis performed using different thresholds to determine the binary dependent variable (*BINBET*). As indicated in Model (2), an interaction variable, namely "*TIME_EXPERIENCE* \times *BET*" is inserted among the regression to check for the presence of a trade-off between the first experience age and gambling bets. According to the statistical test on the significance of the coefficients in column (3) of Model (2), an interaction is evident. Gambling initiation age is negatively correlated with the likelihood of gambling-related problems, however the size of this interaction reduces as expenditure increases. Similarly, the effects of gambling expenditure on problematic gambling are stronger for older gambling initiators.

In relation to the emotional factors during or at the end of the play, two indicators, namely *WIN_REPLAY* and *WIN_OMNIPOTENCE*, are statistically significant. As expected, those gamblers who exhibit the willingness to replay or a sense of omnipotence after a win tend to have a higher probability to bet more than other players. In this model, there appears to be no effect of the emotions felt during the gambling activities or after a loss. In this sense, emotions associated with positive events (win only) seem to play a relevant role in explaining the amount of money allocated for gambling.

Table 3. Results of the bivariate probit regression (Multiple-imputation estimates)

	Model (1)				Model (2)			
	Dependent variable: BINBET		Dependent variable: PROBLEM		Dependent variable: BET		Dependent variable: PROBLEM	
	Coeff.	Std. Er.	Coeff.	Std. Er.	Coeff.	Std. Er.	Coeff.	Std. Er.
BET			0.410***	(0.132)			0.099	(0.185)
AGE	0.001	(0.005)	0.002	(0.006)	0.001	(0.005)	0.002	(0.006)
FEMALE	-0.071	(0.106)	-0.133	(0.148)	-0.073	(0.106)	-0.137	(0.149)
DISTANCE	0.074*	(0.041)			0.074*	(0.041)		
SINGLE	0.649*	(0.390)	0.132	(0.504)	0.654*	(0.390)	0.086	(0.501)
DIVORCED	0.816**	(0.377)	0.220	(0.502)	0.820**	(0.376)	0.171	(0.499)
WIDOW/ER	0.988**	(0.405)	0.448	(0.522)	0.995**	(0.405)	0.372	(0.520)
EDUCATION	0.057*	(0.034)	0.048	(0.045)	0.056*	(0.034)	0.041	(0.046)
INCOME	0.104***	(0.032)	-0.112***	(0.043)	0.104***	(0.032)	-0.111***	(0.042)
TIME_EXPERIENCE	-0.021	(0.041)	-0.094*	(0.054)	-0.020	(0.041)	-0.325***	(0.118)
TIME_EXPERIENCE * BET							0.121**	(0.050)
PARENTS	0.179	(0.258)	0.932***	(0.289)	0.184	(0.259)	0.960***	(0.291)
RELATIVES	0.767**	(0.329)	1.302***	(0.283)	0.780**	(0.330)	1.341***	(0.287)
WEEK_TIMES	0.266***	(0.037)	0.170***	(0.053)	0.266***	(0.037)	0.172***	(0.053)
N_HOURS	0.297***	(0.034)	0.133**	(0.051)	0.297***	(0.034)	0.136***	(0.050)
ALONE	0.034	(0.087)	-0.258**	(0.114)	0.035	(0.087)	-0.264**	(0.113)
WIN_EUPHORIA	-0.047	(0.107)	-0.104	(0.155)	-0.048	(0.107)	-0.089	(0.156)
WIN_PLEASURE	-0.028	(0.098)	-0.124	(0.139)	-0.028	(0.098)	-0.115	(0.140)
WIN_SATISFACTION	0.047	(0.102)	-0.036	(0.149)	0.046	(0.102)	-0.022	(0.151)
WIN_REPLAY	0.398***	(0.123)	0.200	(0.160)	0.397***	(0.123)	0.195	(0.161)
WIN_OMNIPOTENCE	0.397	(0.276)	0.097	(0.295)	0.392	(0.275)	0.111	(0.287)
WIN_OTHERS	0.006	(0.222)	0.037	(0.288)	0.003	(0.222)	0.112	(0.294)
LOSE_GUILT	-0.002	(0.132)	0.330**	(0.153)	-0.001	(0.132)	0.331**	(0.151)
LOSE_FRUSTRATION	0.138	(0.166)	0.402**	(0.196)	0.138	(0.166)	0.413**	(0.161)
LOSE_DISAPPOINTMENT	-0.011	(0.095)	-0.031	(0.124)	-0.011	(0.095)	-0.043	(0.125)
LOSE_EXCITEMENT	0.147	(0.184)	0.514***	(0.193)	0.150	(0.184)	0.507***	(0.192)
LOSE_ANGER	-0.108	(0.105)	0.124	(0.135)	-0.107	(0.105)	0.112	(0.135)
LOSE_REDEEM	0.141	(0.110)	-0.050	(0.138)	0.141	(0.110)	-0.059	(0.136)
LOSE_LOW_SELF_ESTEEM	0.231	(0.351)	0.208	(0.322)	0.224	(0.349)	0.238	(0.325)
LOSE_HELPLESSNESS	0.140	(0.269)	0.106	(0.319)	0.141	(0.268)	0.178	(0.315)
DURING_EUPHORIA	-0.058	(0.106)	0.196	(0.142)	-0.057	(0.106)	0.187	(0.132)
DURING_PLEASURE	-0.080	(0.100)	0.025	(0.131)	-0.078	(0.100)	0.009	(0.147)
DURING_SATISFACTION	-0.112	(0.111)	-0.058	(0.146)	-0.112	(0.111)	-0.046	(0.146)
DURING_ANXIETY	0.123	(0.115)	0.132	(0.146)	0.123	(0.115)	0.111	(0.146)
DURING_EXCITEMENT	0.122	(0.121)	0.273*	(0.138)	0.122	(0.121)	0.264*	(0.140)
DURING_FRUSTRATION	-0.299*	(0.160)	0.075	(0.226)	-0.299*	(0.160)	0.059	(0.226)
DURING_ANGER	0.163	(0.331)	-0.643	(0.513)	0.169	(0.331)	-0.703	(0.494)
DURING_OTHERS	-0.021	(0.237)	0.446*	(0.268)	-0.022	(0.238)	0.453*	(0.272)
AVERAGE RVI		0.016				0.018		
LARGEST FMI		0.214				0.214		
RHO		-0.219* (0.136)				-0.252* (0.130)		
N. OBS		1196				1196		
IMPUTATIONS		100				100		
F-TEST		F(72, 1192.9) = 8.24***				F(73, 1192.9) = 8.26***		

* *p*-value < 0.1; ** *p*-value < 0.05; *** *p*-value < 0.01. Standard errors are in parenthesis.

The emotions in a win, loss and during gambling relate with the probability of respondents suffering from malaise. Those players who experience guilt (*LOSS_GUILT*) and frustration (*LOSS_FRUSTRATION*) when they lose are more likely to have gambling-related problems. Hence, negative feelings arising from a loss can be a positive self-regulatory factor by allowing gamblers the opportunity recognise their condition and associated problems. In other words, the sense of guilt and frustration could be used as an indicator allowing specialists to identify gamblers at risk of a problematic condition.

As emotional factors can be correlated (or co-morbid), a number of different model specifications have been run to explore the relationship between emotions and gambling behaviours. Table 4 indicates that including the emotional factors by group. In the case of a gambling win the willingness to replay (*WIN_REPLAY*) seems to be the incentive to increase bets and to become aware of problematic gambling. In the case of gambling loss, excitement (*LOSE_EXCITEMENT*) and low self-esteem (*LOW_SELF_ESTEEM*) increases the gambling likelihood, whilst negative feelings such as frustration (*LOSE_FRUSTRATION*), disappointment

(LOSE_DISAPPOINTMENT) and anger (LOSE_ANGER), are the main factors that contribute to gambling-related problem awareness. During the gamble, anxiety (DURING_ANXIETY) and excitement (DURING_EXCITEMENT) also increases gambling expenditure and problematic gambling awareness. Notably, the likelihood of problematic gambling is also positively related to euphoric experiences during gambling, while feeling a sense of frustration decreases gambling expenditure.

Table 4. Results of the bivariate probit regression (Multiple-imputation estimates)

	Model (1)				Model (2)				Model (3)				
	Dependent variable: BET		Dependent variable: PROBLEMS		Dependent variable: BET		Dependent variable: PROBLEMS		Dependent variable: BET		Dependent variable: PROBLEMS		
	Coeff.	St. Er.	Coeff.	St. Er.	Coeff.	St. Er.	Coeff.	St. Er.	Coeff.	St. Er.	Coeff.	St. Er.	
WIN_EUPHORIA	-0.034	(0.086)	0.108	(0.109)									
WIN_PLEASURE	-0.046	(0.083)	0.029	(0.106)									
WIN_SATISFACTION	0.019	(0.083)	0.112	(0.107)									
WIN_REPLAY	0.455***	(0.106)	0.433***	(0.123)									
WIN_OMNIPOTENCE	0.450*	(0.268)	0.441	(0.275)									
WIN_OTHERS	-0.076	(0.209)	0.274	(0.250)									
LOSE_GUILT					0.041	(0.122)	0.403***	(0.146)					
LOSE_FRUSTRATION					0.239	(0.155)	0.396**	(0.186)					
LOSE_DISAPPOINTMENT					-0.015	(0.083)	-0.022	(0.105)					
LOSE_EXCITEMENT					0.317*	(0.173)	0.619***	(0.181)					
LOSE_ANGER					-0.018	(0.093)	0.244**	(0.117)					
LOSE_REDEEM					0.200**	(0.096)	0.037	(0.116)					
LOSE_LOW_SELF_ESTEEM					0.277	(0.352)	0.262	(0.310)					
LOSE_HELPLESSNESS					0.140	(0.228)	0.343	(0.279)					
DURING_EUPHORIA									-0.006	(0.090)	0.249**	(0.112)	
DURING_PLEASURE									-0.035	(0.087)	0.041	(0.108)	
DURING_SATISFACTION									-0.040	(0.098)	-0.023	(0.119)	
DURING_ANXIETY									0.223**	(0.096)	0.278**	(0.115)	
DURING_EXCITEMENT									0.223**	(0.105)	0.424***	(0.122)	
DURING_FRUSTRATION									-0.249*	(0.145)	0.110	(0.191)	
DURING_ANGER									0.318	(0.302)	-0.400	(0.439)	
DURING_OTHERS									0.079	(0.198)	0.576	(0.233)	
AVERAGE RVI		0.023				0.021					0.022		
LARGEST FMI		0.213				0.213					0.205		
RHO		-0.183 (0.132)				-0.172 (0.132)					-0.173 (0.125)		
N. OBS		1196				1196					1196		
IMPUTATIONS		100				100					100		
F-TEST		F(40, 1192.7) = 12.71***					F(44, 1192.9) = 12.36***					F(44, 1192.9) = 12.39***	

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors are in parenthesis.

Other explanatory variables: AGE, FEMALE, DISTANCE, SINGLE, DIVORCED, WIDOW/ER, EDUCATION, INCOME, TIME_EXPERIENCE, PARENTS, RELATIVES, WEEK_TIMES, N_HOURS and ALONE.

6. Conclusions

The relationship between emotions and gambling behaviour has become increasingly relevant in the last decade (Phelps and Sokol-Hessner 2012, Bussu and Detotto 2015). The emotions felt after gambling in case of a win, loss, and during the gamble affect the probability that the gambler will move from a social gambler typology to a problematic or a pathological one. Gambling is a sensation seeking activity where positive reinforcement is linked to the anticipatory arousal felt during the game (Zuckerman 1979), depending on the player and on game typologies (Coventry and Brown 1993). In this regard, the near-misses phenomenon is relevant as the emotions felt during the gamble can provide stimulus in problematic gamblers, as they are perceived as almost as rewarding as wins (Chase and Clark 2010).

Understanding the risks of gambling and the emotions associated with gambling self-regulation represents the first step in providing social policies that effectively address gambling issues. Gambling and gaming are not inherently negative as they reflect some relevant aspects of our social life, such as audacity, competition and risk. Hence, promoting prevention campaigns and providing psychological interventions is necessary not only in the presence of gambling addiction or problematic gambling but also for recreational gamblers as this incentivizes responsible approaches to gaming.

By employing a bivariate probit approach, this paper aims to examine both the socio-economic and

the emotional determinants of game behaviour, in terms of expenditures and probability for a player to become self-aware of problematic gambling factors. In this sense, the self-reported information could be taken as measures of gambling-related problems (in terms of economic, psychological, labour difficulties directly linked to gambling) and problematic gambling. Hence a number of explanatory variables and characteristics were explored including age, income, education, family status, presence of other gamblers in the respondent's family, attitude to playing alone. Furthermore, a set of emotional indicators were considered in order to estimate the relationship between the emotions felt during the game, after a win and after a loss and both gambling expenditures and the probability of gambling related problems.

The findings indicate that income, education, high frequency gambling, having a sense of omnipotence and distance to gambling site is positively associated with the likelihood of increased gambling expenditure. Furthermore, the willingness to replay in case of a win, excitement after a loss and/or during the game, positively relates with average gambling expenditure. Such findings are consistent with recently published literature indicating that positively aroused feelings may incentivize risk taking (Breiter *et al.* 2001, Kuhnen and Knutson 2005). However, such findings link with the so called "mood maintenance hypothesis" in which people in a good mood are reluctant to gamble because losing could interrupt their good mood (Isen *et al.* 1988).

Our predictions are confirmed by the analysis. The willingness to replay in case of win, the negative emotions in case of loss (frustration, disappointment and anger), and emotions during the gamble (euphoria, anxiety and frustration) are linked to the gamblers' awareness of their condition.

There are however, limitations to this research. Firstly, although self-reported data offers rich information about the emotions and health of respondents, some problems could arise from underestimation and overestimation of problematic gamblers rates (social desirability bias), reducing the explanative power of proposed models. To avoid such bias, a bivivariate probit model was employed. Secondly, the results of the present study may have limited generalizability as the study focussed on a single region of Italy. Thirdly, the researchers are aware that respondents reported their emotions relating to gambling in a questionnaire after the gambling experience. This required participants to recall events and emotions, and hence was a potential source of bias. Despite this, this study may shed some light on the relationship between gambling behaviour and gamblers emotions. Future research, subject to data availability and a coherent experiment design, should explore the causal relationship between emotional responses (beyond anticipatory self-reported measures) and gambling involvement. Another limitation is related to the presence of missing values which led to incomplete rows (about 40% of the data set). In surveys, missing data is the result of a combination of factors. Respondents may refuse to answer due to privacy issues or low interest or simply because he/she does not understand the question. Or, the respondent would have answered, but the answer he or she might have given was not one of the options presented. This aspect could be an issue since it can seriously affect our estimates if the missing cases are not a random sample of all cases. In order to try to address this issue, a regression based imputation method is employed. Even if these techniques have to be carefully applied, the results seem to not be affected by the imputation process.

7. References

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