# Online gambling-related harm: Findings from the study on the prevalence, behavior and characteristics of gamblers in Spain

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**Abstract:** Online gambling has grown into a global social and economic phenomenon. It is, however, regarded as a risky practice, as it may be connected to the development of gambling-related disorders. Literature has shown a growing interest to determine the direction of the relationship between online gambling participation and gambling-related harm, as it raises some endogeneity concerns. This paper aims to contribute to the study of this relationship. Using data from the prevalence study of gambling users in Spain, a two-stage approach with instrumental variables is proposed to address these endogeneity concerns. An ordered probit model is then estimated to explore the correlation between online gambling participation, the intensity of participation, and the risk of developing some kind of gambling-related harm. Findings showed that online gambling had a significant impact on the odds of experiencing a gambling disorder, which worsened as online gambling participation increased.

**Keywords:** online gambling, participation, intensity of participation, problem gambling prevalence, correlation.

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## I. INTRODUCTION

Online gambling has grown into a worldwide social and economic phenomenon. Its market value is estimated to exceed $50 billion by 2019 and is projected to be over $100 billion by 2025, with annual growth rates above 10%. Multiple factors may account for its exceptional scale, including easier access to gambling at lower costs from the comfort of home, improved regulation of operations, social acceptance, high marketing expenditure by gambling operators, some individuals' aversion to gambling at conventional outlets, and potential economic benefits anticipated by players (Griffiths et al. 2005; Humphreys and Perez, 2012; Wood et al., 2007). Anyone can gamble at anytime from anywhere on a wide variety of games that are usually brief, always available, require low wagers, and deliver immediate results (Gainsbury, 2015).

It is clear that participation in gambling, including online gambling, has certain economic motivation. It does, however, involve a trade-off between the benefits of regulation and the negative aspects associated with it—addiction, compulsive gambling, crime, or fraud, to name a few. In fact, online gambling is reported to have become a dangerous practice, as it may be linked to the development of certain gambling-related disorders.

As a result, literature has shown an increasing interest in studying this phenomenon and in trying to explain the direction of the relationship between online gambling and gambling-related harm. Empirical evidence is generally robust and consistent. Griffiths et al. (2009), using the 2007 UK prevalence survey, found that online gambling users had a substantially higher prevalence of problem gambling than offline

users. Griffiths and Barnes (2008), Wood and Williams (2011), Gainsbury et al. (2013) and Canale et al. (2016), among many others, found consistent results for different gambling markets and jurisdictions. In contrast, Philander and MacKay (2014), using the 2010 edition of the UK prevalence survey, concluded that online gambling is instead linked to a reduction in the odds of developing a gambling-related disorder.

In the specific case of Spain, online gambling is becoming increasingly relevant in the domestic market. In 2018, the online gambling industry reported a gross revenue of 699 million euros, and a growth rate of 25.5% year-on-year, while many other key figures—e.g. active players, deposits, or marketing and advertisement expenses—were at all-time highs (DGOJ, 2018). However, online gambling is perceived as both dangerous and addictive. Especially concerned about this addictiveness, the Spanish Gambling Act (Law 13/2011 of 27 May) requires online gambling operators to take preventive measures to protect under legal age children and other potentially vulnerable groups of players, as well as to identify, prevent and treat gambling-related disorders. Gainsbury et al. (2013) showed that online gambling can cause people to develop gambling disorders, especially those potentially vulnerable.

Anyway, the relationship between online gambling and problem gambling remains unclear: does a gambler participate in online gambling because he already is a problematic gambler, or is online gambling what causes the gambling-related disorder? Philander and MacKay (2014) hypothesized that this relationship may be in fact a spurious correlation being conditioned by some other unknown and uncontrollable factors. Many previous papers on this subject have not addressed this issue, so their findings could be biased and therefore inaccurate. Here, a two-stage approach is proposed, in which the use of the internet for leisure is used as instrumental variable to address this endogeneity concern.

Using data from the "Study on prevalence, behavior and characteristics of gambling users in Spain" (DGOJ, 2015), this paper aims to contribute to the study of the relationship between online gambling participation and the prevalence of problem gambling by focusing not only on online gambling participation from a binary perspective, but also on its intensity.

The paper is structured as follows. First, the data and main variables are described. Then, the econometric modelling is properly introduced. Results and findings are discussed right after. Finally, some concluding remarks are provided.

## II. DATA AND VARIABLES

Data were collected from the Spanish prevalence survey (DGOJ, 2015), which was conducted in 2015 by the domestic General Directorate of Gambling Management, the national authority responsible for regulating, authorizing, monitoring, controlling and sanctioning gambling activities. This survey is part of the Government of Spain's responsible gambling strategy, which was promoted in 2013 in order to *"minimize the potential harmful effects of gambling addiction"* through *"raising awareness in society, preventing and protecting the most vulnerable groups, treating and supporting those already affected and studying and researching gambling related problems"* (DGOJ, 2015).

The survey provides a free, open-access nationally representative database of the Spanish population, consisting of 6816 individuals aged 18 and over, as the legal age for gambling in Spain, who answered to a personal survey regarding socio-demographic and gambling factors. The survey includes 17 questions to detect and measure gambling-related disorders based on criteria established by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). This screening allows individuals to be classified into four

increasingly ordered groups of severity: no problematic gambling (no risk); mild but subclinical risk for gambling disorders; moderate but subclinical risk for gambling disorders; and likely diagnosis of pathological gambling. Being classified into any severity group is based on the overall score from this screening (0 points; 1-2; 3-4; 5 or higher, respectively). As it seems reasonable, and for consistency with previous research (see Wardle et al., 2011; and Philander and MacKay, 2014; among others), self-declared non-players and those classified as no risk players were grouped together, as it seems highly unlikely that someone who does not gamble will pose any risk of gambling disorders and will be classified into any group other than the no risk. It should be noted, however, that it is likely that this assumption will bias estimates and overvalue the likelihood of a player being classified into the no risk group—this will be taken into account when addressing the results.

Individuals who either refused to respond to some questions or did not know or remember the answer were removed from the sample, as were observations with encoding errors. Accordingly, 474 individuals (6.95% of the sample) were dismissed, so 6342 were kept for analysis.

Using the DSM-IV screen, the percentage of no problematic gamblers was found to be 93.74%, while 0.836% of individuals had a likely diagnosis of pathological gambling. Additionally, 4.43% of respondents were found to be consistent with mild but subclinical risk for gambling problems, whereas those with moderate but subclinical risk were found to be 0.99%. These figures from the censored sample were consistent with those provided by the Spanish prevalence survey (DGOJ, 2015).

Regarding gambling participation, descriptive analysis showed that over 75% of respondents have gambled in the past, most of whom (90%) have done so in the last year. On average, Spanish gamblers start to play at 23 and participate in three different games.

However, only 8% of respondents declared to gamble online—74% of them just during the last year.

While the seemingly high participation rate may be of concern, the prevalence rate of problem gambling (group 4) was only 0.9% when considering gamblers' entire life, and 0.3% when considering the previous 12 months. Similarly, only 4.4% (2.6% in the previous year) were mild risk gamblers (group 2), and just 1% (0.6% for the last 12 months) were classified as moderate risk gamblers (group 3). The most frequent problem gambler profile in Spain was found to be a single man aged 47 who started to gamble at 19 and currently participates in six different games.

Using the previously described data, a dummy variable that accounts for online gambling participation was created, which was based on self-declared participation frequencies in different online gambling products from the survey data. This variable was encoded as follows: value 0 (no online gambling) was assigned to all gamblers who declared to have never gambled online (93.03%), while value 1 (online gambling) was assigned to everyone else, regardless of their frequency and the number of games they participated in (6.97%).

In order to test how the intensity of participation affects the likelihood of developing a gambling disorder, a variable to proxy online gambling intensity of participation was also created, which was based on the number of online gambling activities in which players took part, ranging between 0 activities (93.03%) and 5 activities or higher (barely 0.6%). As far as we know, previous research has not considered this, and merely assessed online gambling participation from a binary approach—to play or not to play online.

Lastly, the effects from other exogenous factors that may affect the prevalence of problem gambling were controlled as well, including gender, age, employment status,

education level, self-reported health status, and alcohol and tobacco consumption. Prior empirical research has consistently shown that problem gambling is strongly determined by socio-demographic factors and existing health conditions. In general, gambling disorders are usually associated with being male, young, low-educated, low-income, in poor self-reported health, and/or smoker or alcohol user (Wardle et al., 2011). In fact, empirical evidence has indeed found certain interdependencies and correlations between alcohol, tobacco and gambling (Ida et al, 2009). As for online gambling, Gainsbury et al. (2013) showed that younger gamblers were more likely to participate in a greater number of online gambling activities. Accordingly, a variable that controls for the number of gambling activities a player engages in—regardless of sales channel (offline or online)—was included.

## III. ECONOMETRIC MODELLING

As discussed earlier, the dependent variable is an ordinal, categorical variable used to compute the estimated probability of belonging to each of the four risk groups considered, ordered from lowest to highest risk (no risk, mild risk, moderate risk and likely diagnosis of pathological gambling). Accordingly, the following ordered probit model specification was estimated to explore the relation between online gambling participation and the risk of developing some kind of gambling-related harm:

$$\begin{aligned} Pr(DSMIVGroup) = Pr(K_{i-1} < \beta_1 OnlineGambling + \beta_2 Activities + \beta_3 \\ Gender + \beta_4 Age + \beta_5 Employed + \beta_6 Education + \beta_7 Health + \beta_8 Smoking \\ + \beta_9 Alcohol + u_j \leq K_i) \end{aligned} \quad (1)$$

where *DSMIVGroup* is the dependent variable; *OnlineGambling* accounts for either online gambling participation or intensity of participation; *Activities* sums up the total number of gambling activities each individual engages in; *Gender* is the gender; *Age* is the exact age; *Employed* is a dummy variable, where 1 indicates employed and 0 otherwise; *Education* accounts for the highest education level reached (no education, primary, secondary and higher education); *Health* controls the self-reported health status, ranked through five levels (from very bad to very good); and lastly, *Smoking* and *Alcohol* are categorical variables controlling whether the individual is a tobacco and/or alcohol user.

Two model specifications were estimated: a participation model, to evaluate the effect of online gambling from a binary approach on gambling-related disorders, and an intensity of participation model, to determine how the intensity of participation affects problem gambling. In both cases, socio-demographic controls remained the same.

Estimation of Equation 1 raised an issue of endogeneity, as there was a recursive and undetermined link between online gambling and the severity of a potential gambling-related disorder. As discussed earlier, the direction of this relationship still remains unclear. In order to solve this concern, a two-stage approach is proposed. In the first stage, the model's endogenous variable was estimated as follows:

$$Pr(OnlineGambling) = Pr(\alpha_0 + \alpha_1 InternetUse + \varepsilon_j) \quad (2)$$

where *InternetUse* is an instrumental variable that tracks the daily use of the internet for leisure in five categories (no use; less than one hour; between one and two hours; between two and three hours; more than three hours). Note that Equation 2 was estimated as a probit model for the online gambling participation specification, and as an ordered probit model for the intensity of participation specification.

Econometric literature states that a single instrument should be sufficient to produce consistent estimates, although these are expected to have a lower explanatory power (Wooldridge, 2010). Here it seems reasonable to assume that online gambling participation is highly influenced by personal abilities in the use of computers, mobile devices and Internet browsing, but not the other way around— that is, better skills do not imply higher odds of gambling online.

The strength of the instrument was tested using the Cragg-Donald F statistic, which was 54.61 for the participation model specification and 61.48 for the intensity of participation. Both values greatly exceeded all Stock and Yogo (2005) thresholds, so the instrument was cautiously considered not weak and therefore valid.

## IV. RESULTS

Table 1 presents the estimate coefficients for Equation 1. Results showed a positive sign for both the online gambling participation and the intensity of participation coefficients, though they were significantly different in size. This suggests, in line with previous research, that online gambling is (positively) correlated with the development of gambling-related disorders, which are likely to increase as individuals participate in a greater number of online gambling activities.

Controls were also consistent with previous findings in the literature: higher problem gambling prevalence was associated with being a male, a smoker and/or alcohol user, and poor self-reported health. Employed people were found to be less likely to experience problem gambling. No statistically significant results were observed for age or education level.

**Table 1.** Ordered probit estimates.

| | Participation | | Intensity of participation | |
|---|---|---|---|---|
| **Online gambling** | 2.11 *** | 1.457 *** | 0.509 *** | 0.224 *** |
| **Number of gambling activities** | — | 0.237 *** | — | 0.266 *** |
| **Gender** | 0.165 *** | 0.134 ** | 0.252 *** | 0.228 *** |
| **Age** | 0.002 | 0.0005 | 0.0003 | -0.003 |
| **Employed** | -0.138 ** | -0.167 *** | -0.122 ** | -0.16 *** |
| **Education** | -0.03 | -0.017 | -0.012 | 0.02 |
| **Health** | -0.159 *** | -0.183 *** | -0.173 *** | -0.197 *** |
| **Smoking** | 0.29 *** | 0.262 *** | 0.318 *** | 0.267 *** |
| **Alcohol** | 0.264 *** | 0.135 * | 0.269 *** | 0.139 * |

***Note:*** ** Significance at 10%; ** significance at 5%; *** significance at 1%.*

*4.1. Online gambling participation*

Since coefficients were not directly interpretable, the average marginal effects—that is, the estimated average change in DSM-IV classification for one-unit change in the corresponding covariate—were calculated for the participation model. Online gambling was found to reduce the odds of being a non-problem gambler (group 1) by 14.75 percentage points, while increasing the odds of having a mild risk (group 2) by 8.25, a moderate risk (group 3) by 2.54, and a potential diagnosis of pathological gambling (group 4) by 3.96 percentage points, respectively. Although the effect of online gambling on the prevalence of problem gambling may seem quite remarkable, it should be noted that this is the average effect of a certainly constrained model—a dummy variable is far

too simple for modelling a phenomenon as deep as online gambling—and that this effect is highly influenced by socio-demographic factors and by the total number of gambling activities the individual participates in.

Indeed, socio-demographic factors play a major role in determining the link between online gambling and the development of gambling disorders. This is evidenced in Table 2, where the estimated odds of being classified into each DSM-IV group for different individual profiles are provided.

**Table 2.** Estimated probabilities (Participation model).

| | **No risk** (Group 1) | **Mild risk** (Group 2) | **Moderate risk** (Group 3) | **Problem gambler** (Group 4) |
|---|---|---|---|---|
| **Scenario 1** | 96.82% | 2.57% | 0.39% | 0.21% |
| **Scenario 2** | 97.66% | 1.93% | 0.28% | 0.14% |
| **Scenario 3** | 66.12% | 19.66% | 6.51% | 7.72% |
| **Scenario 4** | 70.83% | 17.72% | 5.48% | 5.97% |

***Scenario 1:*** *man, no online gambling, median number of offline gambling activities, median level of self-reported health.* ***Scenario 2:*** *woman, no online gambling, median number of offline gambling activities, median level of self-reported health.* ***Scenario 3:*** *man, online gambling, median number of offline gambling activities, median level of self-reported health.* ***Scenario 4:*** *woman, online gambling, median number of offline gambling activities, median level of self-reported health.* ***Note:*** *All estimated probabilities were statistically significant.*

Based on the median player profile, offline gambling on its own appeared to be non-problematic (scenarios 1 and 2)—that is, being classified into any risk groups hardly accumulates a probability of 3.18% and 2.34%, depending on the gender. However, although relatively small, the odds of suffering from gambling-related disorder are twice as high for men as for women. When considering online gambling (scenarios 3 and 4),

the probability of problem gambling increased dramatically to 33.88% for men and 29.17% for women. As stated, problem gambling is strongly dependent on socio-demographics—better health condition and being a non-smoker or non-alcohol user were associated with a lower risk. These findings suggest that there is a significant link between online gambling participation and gambling-related harm, to some extent stronger than that offline gambling.

*4.2. Online gambling intensity of participation*

The intensity of participation model specification appeared to be more thorough in explaining the prevalence of problem gambling, as it considered the frequency of online gambling participation. On average, each additional online gambling activity reduced the probability of being classified as a non-problem gambler by 2.26 percentage points, while increasing the probability of being classified into the other risk groups by 1.46 (mild risk), 0.404 (moderate risk) and 0.396 percentage points (potential diagnosis of pathological gambling), respectively. These results are shown in Table 3.

Instinctively, each additional activity should have a different impact depending on the current gambling intensity, as it is very unlikely that perseverance in gambling can affect a player who does not gamble online in the same way as another who does gamble on five activities or more. Estimates in Table 3 show that the greater the total number of gambling activities the individual participated in, the more harmful each additional activity was.

Therefore, the online gambling intensity of participation model suggests that online gambling had a significant impact on the odds of developing a gambling-related disorder, and also appears to support the common belief that this pathology worsens as online gambling participation intensifies. Table 4 shows the probability of being classified into each DSM-IV group depending on the intensity of participation.

**Table 3.** Marginal effects for each intensity level (Intensity of participation model).

| | **No risk** (Group 1) | **Mild risk** (Group 2) | **Moderate risk** (Group 3) | **Problem gambler** (Group 4) |
|---|---|---|---|---|
| **Average ME** | -2.26 | 1.46 | 0.404 | 0.396 |
| **Intensity #1** | -2.85 | 1.82 | 0.53 | 0.5 |
| **Intensity #2** | -3.66 | 2.17 | 0.72 | 0.8 |
| **Intensity #3** | -4.54 | 2.46 | 0.92 | 1.16† |
| **Intensity #4** | -5.42 | 2.64 | 1.12 | 1.65† |
| **Intensity #5** | -6.24 | 2.65 | 1.31 | 2.27† |

***Note:*** *Marginal effects are measured in percentage points.* † *Not statistically significant.*

**Table 4.** Estimated probabilities (Intensity of participation model).

| | **No risk** (Group 1) | **Mild risk** (Group 2) | **Moderate risk** (Group 3) | **Problem gambler** (Group 4) |
|---|---|---|---|---|
| **Intensity #1** | 92.07% | 5.7% | 1.27% | 0.96% |
| **Intensity #2** | 88.82% | 7.69% | 1.89% | 1.59% |
| **Intensity #3** | 84.72% | 10.02% | 2.71% | 2.55% |
| **Intensity #4** | 79.74% | 12.58% | 3.73% | 3.95% |
| **Intensity #5** | 73.89% | 15.24% | 4.96% | 5.9% |

***Note:*** *All estimated probabilities were statistically significant.*

On average, an individual who participated in only one online gambling activity was about 8% likely to experience some risk of problem gambling. This probability increased as online gambling intensified, up to 27% for a gambler who was involved in five or more different online gambling activities. While this occurred for all three risk groups, the effect was concentrated mostly in the mild risk group. However, the higher the intensity of participation, the more likely it was to be classified into the problem gambling group rather than into the moderate risk group.

## V. CONCLUDING REMARKS

Online gambling has grown into a very profitable industry. It is expected to gross $50 billion by 2019 and exceed $100 billion by 2025 worldwide, while multiple other key figures are currently at their all-time highs. Many factors may account for this growth, including easier access and lower costs due to technological development, among others. However, online gambling also involves a trade-off between the benefits of regulation and its negative aspects, the main concern being problem gambling.

Consequently, scientific literature has shown a growing interest in trying to understand the relationship between online gambling and gambling-related harm. Empirical evidence is generally robust and consistent—online gamblers have a significant higher prevalence of problem gambling than offline gamblers.

This paper contributed to this literature by focusing not just on online gambling participation, but also on the intensity of participation, for the case study of Spain, based on DGOJ (2015). Additionally, the endogeneity concern—there is a recursive and undetermined correlation between online gambling and gambling-related disorders, the direction of which still remains unclear—was also addressed using a two-stage approach with instrumental variables.

Participation in online gambling was found to have a significant impact on the odds of developing gambling-related disorders, which worsened as online gambling participation increased. If online gambling were a harmful practice, then the estimated risk from the intensity of participation model should increase—this is consistent with the findings. As expected from prior research, socio-demographic factors played a key role in determining link between online gambling and the development of gambling disorders—in particular, the findings showed strong interdependencies between smoking, alcohol, and online gambling-related harm.

The different association of the correlates with online gambling participation and its intensity can influence how the actual gambling stakeholders define potential strategies to minimize gambling harm. In fact, public health concerns over gambling issues have been the strongest argument against the widespread adoption of online gambling.

Nonetheless, given the cross-sectional nature of this study, no definitive claims about causality can be made. Future longitudinal studies are required to determine whether online gambling is actually leading to the problem gambling scores discussed in this research.

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