Universidad de Oviedo
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A Microeconometric Analysis of the Prevalence, Behavior and Characteristics of Gambling Consumers

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RESUMEN DEL CONTENIDO DE TESIS DOCTORAL

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RESUMEN (en español)

Esta tesis doctoral presenta una evaluación del comportamiento de los consumidores de juegos de azar a través de tres ensayos de investigación microeconométrica que abordan aspectos clave en relación con las decisiones de participación y gasto en estos mercados. Dado que el juego es una actividad de ocio con amplias repercusiones económicas, sociales e incluso sanitarias, es necesario que todas las partes involucradas de la industria cuenten con información que permita equilibrar sus aspectos positivos y negativos. En el primer trabajo, se analiza el cambio en la propensión a jugar de los individuos ante un aumento significativo de la oferta de juego producido tras una serie de cambios en la regulación que ha liberalizado el sector. En el segundo, se estudia el efecto del consumo cruzado de otros productos potencialmente adictivos---alcohol y tabaco---sobre el nivel de gasto en juegos de azar. En el tercero y último, se observa la influencia marginal de la intensidad de participación en juegos de azar *online*, dadas su particulares características, sobre la probabilidad de desarrollar algún problema de adicción comportamental relacionado con el juego. Los resultados discutidos a lo largo de la tesis son relevantes para reformar y diseñar nuevas políticas públicas y plantean líneas de trabajo interesantes para futuras extensiones e investigaciones.

RESUMEN (en inglés)

This doctoral thesis examines gambling consumer behavior through three microeconometric research chapters that address key issues related to participation and spending decisions in these markets. Given that gambling is a leisure activity with broad economic, social, and even health implications, it is essential for all industry stakeholders to have information in order to balance its positive and negative aspects. The first chapter assesses the change in individuals' propensity to gamble as a result of a significant increase in the supply of gambling products following a series of regulatory changes that have liberalized the sector. The second chapter studies the effect of cross-consumption of other potentially addictive products, such as alcohol and tobacco, on gambling expenditure. The third and final chapter examines the marginal impact of the intensity of participation in online gambling, given its particular characteristics, on the probability of developing a gambling-related behavioral addiction disorder. The findings discussed throughout the thesis are relevant for reforming and designing new public policies and raise interesting lines of work for potential extensions and further research.

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Abstract

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Resumen

Esta tesis doctoral presenta una evaluación del comportamiento de los consumidores de juegos de azar a través de tres ensayos de investigación microeconométrica que abordan aspectos clave en relación con las decisiones de participación y gasto en estos mercados. Dado que el juego es una actividad de ocio con amplias repercusiones económicas, sociales e incluso sanitarias, es necesario que todas las partes involucradas de la industria cuenten con información que permita equilibrar sus aspectos positivos y negativos. En el primer trabajo, se analiza el cambio en la propensión a jugar de los individuos ante un aumento significativo de la oferta de juego producido tras una serie de cambios en la regulación que ha liberalizado el sector. En el segundo, se estudia el efecto del consumo cruzado de otros productos potencialmente adictivos—alcohol y tabaco—sobre el nivel de gasto en juegos de azar. En el tercero y último, se observa la influencia marginal de la intensidad de participación en juegos de azar *online*, dadas su particulares características, sobre la probabilidad de desarrollar algún problema de adicción comportamental relacionado con el juego. Los resultados discutidos a lo largo de la tesis son relevantes para reformar y diseñar nuevas políticas públicas y plantean líneas de trabajo interesantes para futuras extensiones e investigaciones.

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Introduction

With a global revenue of more than $50 billion in 2019, gambling has evolved into an economic and social phenomenon with far-reaching repercussions. The activity, which was once viewed solely as a means of winning large sums of money, has been repurposed for many people as an alternative form of entertainment and leisure with a significant social component. Although gambling appears to be an irrational behavior from the standpoint of traditional economic theory, it must be understood in a broader context. Games of chance, in fact, provide a set of sensations that are intrinsic to its operation that are rarely matched by other forms of entertainment. As a result, gambling can become a largely emotional (and, again, seemingly irrational) decision.

Thus, gambling is often associated with risky behavior and can result in serious economic and health problems, the costs of which are borne by society as a whole. In fact, throughout modern history, its legalization has always been based on a trade-off between its positive and negative aspects: ideally, its benefits—mostly of an economic nature—should always outweigh its more harmful side. While gambling is a safe activity for most gamblers, unfortunately some engage in irresponsible consumption, which can lead to gambling-related problems.

The main goal of my doctoral thesis is to evaluate the gambling phenomenon from the point of view of economic analysis, and specifically behavioral economics, by employing various microeconometric techniques that allow for alternative data exploitation beyond the common sociological or psychological

approaches. All three original research chapters are devoted to detecting anomalous, irrational, and addictive behaviors through the lens of consumer theory, as well as profiling problem gamblers based on frequency and consumption patterns to estimate their levels of participation and consumption.

My thesis aims to provide gambling industry stakeholders with new, up-to-date and objective insight into three main aspects of consumer behavior regarding gambling consumption. Given the industry's growth in recent decades, first, it is important to assess how individual economic agents have reacted to a significant increase in the supply of gambling as a result of a drastic change in its regulation; second, what effect does the simultaneous consumption of gambling and other potentially addictive products have on them, provided that all these products often coexist in the same leisure venues; and third, how much greater is the risk of developing gambling-related problems as the intensity of consumption of online gambling products increases, considering that empirical evidence to date suggests that online products have a higher addictive component than conventional land-based games.

Throughout this document, I go over all these questions using microeconometric methodology. Notwithstanding, I first present in Chapter 2 an exhaustive description of the domestic gambling market's past and present status to provide some relevant background. Thus, in this chapter I briefly review the historical evolution of Spanish gambling regulation, provide the most recent economic figures to contextualize its scope in the economy, and present both the Responsible Gambling Strategy and the Prevalence Study in detail. As a preview, the Responsible Gambling Strategy was launched alongside the latest major reform and was founded on genuine concern about gambling-related risks and the lack of a modern, reliable study on this regard. To balance the costs and benefits of gambling, it introduced all-new mechanisms for consumer control, prevention and treatment of gambling-related harm, and required all industry stakeholders to actively promote responsible gambling. The Prevalence Study was the most important component of the Responsible Gambling Strategy because it provided information to quantitatively assess the extent of pathological gambling for the first time ever.

The Spanish industry has undergone significant transformations since the beginning of the 20th century. Gambling was completely banned in 1923, with the exception of a few activities specifically sanctioned by the dictatorship government at the time. The veto was lifted in 1977, when the recently re-established democracy gradually began to re-legalize the business. Since then, the industry has expanded dramatically, as games such as *La Primitiva* or the *Lotería Nacional* became really popular. The last major gambling reform was enacted in 2011, legalized online gambling for the first time and introduced important new mechanisms especially aimed at balancing the positive and negative aspects of gambling in order to ensure a healthy, sustainable industry.

Despite the domestic industry's remarkable growth in recent decades, there were no reliable studies available that would allow an accurate assessment of the social, economic and health costs of irresponsible, problematic gambling consumption. To address this, the Directorate General for the Regulation of Gambling (DGOJ, for its Spanish acronym) commissioned—and made available to third-party researchers—the first ever Study on the Prevalence, Behaviour, and Characteristics of Gamblers in Spain for the domestic market in 2015. Even though its goal was ambitious, its execution was certainly short-sighted, as it only consisted of a descriptive analysis of the data, which did not allow for the exploration of relationships between factors. My thesis aims to make up for lack of comprehensive studies by utilizing the data's informative potential to provide answers to the research questions I mentioned earlier. The study data set, which provided the required data to conduct all three original research, collected micro data (socio-demographic and consumption habits information) on nearly 7000 adults from all over Spain. Further details on the survey, the data set and descriptive statistics of the results are available in Chapters 2.2 and 2.2.1.

Chapter 3 presents my thesis' first original research, which is determined to assess how the modern expansion of the Spanish gambling market has impacted individual's propensity to start gambling. The aim is to provide a better understanding of the socio-demographic factors of starting gamblers as well as the social harm commonly associated with an expansion of gambling opportunities. This knowledge will certainly be useful for policy makers and all gambling stakeholders to establish new mechanisms to prevent potentially problematic

individuals (as well as others who are deemed especially vulnerable, such as adolescents) from engaging in gambling. This research contributes a quite novel methodology to the existing literature, for, as far as I know, no other published empirical paper in peer-reviewed gambling journals has ever used a split population duration model to address this question. Fortunately enough, there are some really good research papers on other potentially addictive products that use similar methodologies (Douglas & Hariharan, 1994; Nicolás, 2002), which I have used as references.

Chapter 4 revolves around the drivers of gambling consumption by focusing on how other potentially addictive and harmful substances, such as tobacco smoking and alcohol drinking, affect the decisions of participation and expenditure on gambling products. This should be particularly concerning, because, while previous research has consistently shown that tobacco and alcohol are well-known to share strong interdependencies with gambling, alcohol consumption is permitted in most in-person gambling outlets. In fact, slot machines, which account for a large part of the overall supply, are actually located in hospitality industry establishments. In this regard, existing research has proved that there are common neurobiological (McGrath & Barrett, 2009; Wulfert et al., 2016; Tackett et al., 2017) and social (Ida & Goto, 2009; Griffiths et al., 2010; Okunna et al., 2016) factors that can trigger cross addictiveness between these products. My research makes a contribution in that the estimation of a double-hurdle model can allow us to consider not only tobacco and alcohol consumption from a binary perspective, but also consumption frequency. At the very least, the impact of these products on gambling expenditure is likely to be affected by the frequency with which they are consumed.

Chapter 5 is dedicated 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. Online gambling has never been more popular and is expected to keep growing significantly in the coming years. However, it is widely regarded as a dangerous activity, since it is associated with serious gambling-related disorders. Existing empirical evidence from different jurisdictions is consistent: online gamblers have a higher prevalence of problem gambling than

non-online gamblers (Griffiths & Barnes, 2007; Griffiths et al., 2009; R. T. Wood & Williams, 2011; Gainsbury et al., 2013; Canale et al., 2016). This chapter intends to weigh in on the growing literature on the subject by providing the specific study case of Spain using a novel approach.

Finally, Chapter 6 provides concluding remarks (available in Spanish on page 77) on all of the findings, emphasizing the socio-economic implications that gambling may trigger, the technical constraints imposed on the results by the data and methodologies, and potential extensions and new lines of research that my thesis opens up for future researchers. As gambling opportunities are expanding worldwide, a better, more accurate understanding of these issues would benefit all industry stakeholders, from operators to gambling users.

In short, the purpose of my thesis is to answer those three research questions by empirically analyzing the behavior of Spanish gambling consumers using an eminently microeconometric methodology. These are certainly common questions in the gambling scientific literature, but my thesis proposes novel approaches to developing original, never-before-done studies for the Spanish market.

It should be noted, though, that the three original research chapters are adaptations of individual articles that have been published or are in the process of being published in peer-reviewed journals. These articles were organically conceived and are presented in this thesis in a logical, sequential order.

Chapter 3 (Propensity to Start Gambling) is based on an article originally developed in collaboration with professors Jaume García Villar (Pompeu Fabra University) and Levi Pérez Carcedo (University of Oviedo) tentatively titled "Regulatory Changes and the Propensity to Start Gambling: A Duration Analysis Approach." As of this writing, the article has been submitted to an applied economics journal and is currently under revision.

Abstract | *Gambling opportunities have greatly expanded in recent years leading to an alternative form of leisure but also raising social concerns. Participation in such activities may be conditioned by the availability and exposure of gambling, which is ultimately determined by public decision-makers, but also by the willingness of individuals to gamble. As the Span-*

ish gambling market went through different regulatory changes since its re-legalization in 1977, this paper focuses on how expansion of gambling opportunities affects individuals' propensity to start gambling using a time-varying split population duration model. Each new major gambling regulation reform was found to increase the propensity to start gambling. Additionally, men's episodes as non-gamblers were observed to be shorter than women's while younger and/or high-educated people were found to be more prone to gambling. These results may be helpful in designing public policies for gambling.

Chapter 4 (Gambling and Substance Use) is based on an article originally elaborated with Professor Levi Pérez Carcedo titled "Gambling and Substance Use: A Cross-Consumption Analysis of Tobacco Smoking, Alcohol Drinking and Gambling." It was published in Substance Abuse in April 2021.

Abstract | *Gambling has never been as popular and widely available as it is today. Despite the widespread normalization of gambling as just another form of leisure consumption, its potential interaction with substance use (e.g. smoking and drinking) is nowadays an issue of social concern. In fact, empirical research has found both substances to have strong interdependencies with gambling through multiple factors. Gambling is a two-step decision: potential gamblers first decide whether to participate, then their expenditure. Using data from the Spanish gambling prevalence survey, a double-hurdle model is proposed to estimate the effect of tobacco smoking and alcohol drinking on gambling participation and expenditure decisions utilizing binary consumption and frequency of consumption approaches. In line with previous research, results showed that people who smoked tobacco and/or drank alcohol were more likely to gamble and to have a greater expenditure. Each additional level of frequency of consumption of both products was found to likely increase the prevalence of gambling. The frequency of consumption of tobacco and/or alcohol was positively associated with the likelihood of gambling and spending more on gambling products. Findings may assist gambling stakeholders to prevent potential gambling-related harm.*

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Chapter 5 (Online Gambling-related Harm) is also based on an article originally developed along with Professor Levi Pérez Carcedo titled "Online Gambling -Related Harm: Findings from the Study on the Prevalence, Behavior and Characteristics of Gamblers in Spain." It was published in Journal of Gambling Studies in July 2020.

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.*

Background to the Spanish Gambling Industry

Gambling has undoubtedly become a global phenomenon with significant economic and social implications. For many people, this activity has simply turned into yet another form of entertainment and leisure, with some even planning every detail of their participation in advance.

The phenomenon has not gone unnoticed in Spain, according to its economic figures. The most recent complete data on the state of the domestic gambling industry relates to 2019 (CEJUEGO, 2020). In that year, real spending on gambling (defined as the difference between gross spending and the amount of prizes distributed) totaled €10,226 million, a 3% increase over the previous year and accounting for about 0.8% of GDP. Lottery and on-site games (casino, bingo, gambling venues, sports betting, and slots machines in hospitality industry establishments) contributed the most, with €4,590 million (+6.2%) and €4,860 million (-0.1%), respectively, while online gambling amassed €776 million (+7%). This industry, which was estimated to directly employ nearly 85,000 people, ended 2019 with wagering excise taxes totaling €1,340 million. The Gambling Business Council's technical report provides an in-depth analysis of the industry's economic repercussions (CEJUEGO, 2020). Further complementary information and figures can be found in the DGOJ's annual reports, although privately-run activities were usually not included.

The domestic industry has not been spared the effects of COVID-19. Interim data for 2020 anticipates a 50% drop in real spending on gambling, which would be more than twice as large as the drop seen during the 2009-2014 economic recession. In fact, similar to what happened then, industry professionals expect that COVID-19 restrictions will cause "another deep reconversion" (CEJUEGO, 2020) in users' consumption habits, shifting their gambling preferences to online outlets and games.

In any case, these figures evidence the popularity of gambling in Spain. In short, games of chance have evolved into entertainment products that rarely have a negative impact on players; as discussed in Chapters 4 and 5, the rate of pathological gambling in Spain is among the lowest and most stable in developed countries. While gambling as we know it today dates only from 1977, when the first government of the then-recently reestablished democracy began to timidly lift the near-absolute prohibition that the industry had faced since 1923, its origins actually date back several centuries.

Games of chance were quite common during the Middle Ages, according to historical records. Gambling establishments proliferated to host popular games "such as cards, dice and forms of chess" (Jiménez-Murcia et al., 2014), but both games and establishments were quickly vetoed in 1387, following the implementation of the first absolute ban on all gambling activities.

The country's precarious financial situation, combined with the success of similar experiences in other European countries, prompted King Carlos III to reconsider this ban and to institute the *Lotería Real*, the first nationwide lottery game held on a regular basis, in 1763. *La Primitiva*, as it was commonly known, was intended to be established as an implicit and voluntary tax that would bring in sufficient extraordinary income to recover the public treasury, but participation was lower than expected and the game underwent major structural reforms throughout its existence to boost sales and revenue.

In 1811, the *Cortes de Cádiz* unanimously agreed to the creation of a complementary game, the *Lotería Moderna*, to finance the expenses incurred as a result of the country's ongoing involvement in the Spanish War of Independence. The first annual draws were limited to the Cádiz area, but the game quickly spread nationwide, and, unlike the *La Primitiva*, it offered large prizes. Most likely be-

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cause of this, the *Lotería Moderna* became more popular and quickly surpassed *La Primitiva*, which was eventually discontinued in 1862.

With the popularity of both lotteries, alternative games "such as roulette" (Jiménez-Murcia et al., 2014) emerged, but all of them were banned again in 1923 following Primo de Rivera's dictatorship. This new absolute prohibition was gradually relaxed (at first, only the annual draw of *Lotería Moderna* was permitted; in 1938, a charity lottery for the benefit of the visually impaired (ONCE) was introduced; and in 1946, some sports betting games—football pools—were allowed), but it was not completely abolished until the arrival of democracy. Gambling was re-legalized in 1977 arguing "social interest and defense of fiscal interests," (*Real Decreto-ley 16/1977*) and privately-operated games were gradually sanctioned.

Since then, the domestic gambling industry underwent a major expansion. The government reintroduced the *La Primitiva* game in 1985 due to the success of similar games in other jurisdictions (*Real Decreto 1360/1985*), and it quickly became the most popular gambling product. Its success led to the addition of a second weekly draw in 1990 and the introduction of spin-offs and complementary products over the course of the decade (*Bonoloto* in 1988, *El Gordo de la Primitiva* in 1993). In 2004, Spain, France and the United Kingdom launched EuroMillions, a new lottery game known for its massive jackpots, to great success; and, starting in the mid-2000s, the privately-owned operator ONCE popularized a wide variety of instant scratch cards, which usually have a low face value and provide immediate results. In 2008, several bookmakers were licensed to operate sports betting in the Basque Country and Madrid autonomous communities (and other Spanish regions soon after), resulting in the establishment of a completely new sports betting market.

The latest major expansion came in 2011 with the legalization of online gambling (*Ley 13/2011*). The emergence of online gambling, which is frequently operated from locations outside of Spanish jurisdiction, prompted the need for a major reform of gambling legislation in order to establish new regulatory mechanisms that would provide legal certainty to operators and users, as well as the appropriate instruments and measures to protect the most vulnerable consumers and treat problem gamblers, among other things.

2.1 | Responsible Gambling Strategy

The latter led to development of a Responsible Gambling Strategy. As discussed earlier, the 2011 gambling regulation law was a turning point for gambling in Spain as it regulated online gambling for the first time ever and required all industry stakeholders to promote responsible gambling and develop mechanisms and policies for consumer control and protection. While that law motivated the need for a national strategy against pathological gambling and provided the legal framework for its implementation, the DGOJ—the domestic authority for regulating, authorizing, monitoring, controlling and sanctioning gambling activities in Spain—was put in charge of its development in 2013.

Despite the fact that gambling has been around for centuries and is just conceived as another recreational activity, it is still viewed as a phenomenon that may cause severe disorders to a few number of individuals. The recent introduction of online gambling, which has quite particular characteristics—it is accessible from anywhere and at any time—and its subsequent popularization not only exacerbated this perception, but also threatened to worsen the situation. Thus, social concerns about the negative consequences of gambling were increasingly real.

The Responsible Gambling Strategy in Spain, as it was called, was founded on these concerns, as well as a lack of knowledge about the actual extent of pathological gambling in the Spanish population, and would support the development of appropriate instruments to raise awareness and treat the harmful effects of gambling. The DGOJ acknowledged that in order for the plan to be successful, all stakeholders needed to be involved, so it established the Responsible Gambling Advisory Council (CAJR, for its Spanish acronym). The council, which included representatives from civil society, academic and professional research, the gambling industry, and government members, was tasked with establishing an executive, meeting, and arbitration body where all interested parties could collaborate to achieve an "ethical and responsible approach to gambling" (DGOJ, 2013).

The law was quite forceful in this regard: Gambling was a "complex phenomenon" (*Ley 13/2011*), so it called for the creation of a comprehensive reg-

ulatory framework combining actions for prevention, awareness, intervention, and remediation of its negative effects, with particular attention paid to at-risk groups (mainly young individuals, as they are more prone to developing gambling issues due to their more vulnerable habits). In short, the law urged all industry players to balance the costs (mainly social) and benefits (mainly economic) of gambling.

The DGOJ defined responsible gambling as "the sensible and rational selection of gaming options, taking into account the player's personal situation and circumstances, preventing gambling from turning into a problem," which entailed "consumers taking an informed and educated decision, with the sole purpose of seeking entertainment, distraction and when the value of the bets never exceeds the amount the individual can afford" (DGOJ, 2013). The Responsible Gambling Strategy had to provide sufficient mechanisms to ensure that gambling was merely a recreational activity that did not interfere with gamblers' daily lives, as well as to reduce the risk of gambling-related disorders.

At that time, there was no modern, reliable study to understand the real situation of gambling in Spain and support all actions of the Responsible Gambling Strategy. To justify this lack, the DGOJ argued that there was no clear and precise definition of pathological gambling, nor was there a standard methodology for measuring and comparing the prevalence of pathological gambling in specialized scientific literature. It was precisely this lack, as well as the emergence of online gambling, that prompted the DGOJ to conduct the very first prevalence study for the domestic market in 2013. The study was expected to provide a precise and detailed diagnosis of the extent and severity of gambling-related disorders, the activities and factors that posed the greatest risk, the profiles of gamblers, the behavior of at-risk groups, and the activity of non-risk gamblers, and to allow effective awareness-raising, prevention, and treatment actions to be designed for diagnosed problem gamblers.

In a way, the prevalence study was ambitious in its scope, as it considered not only those gamblers who were at risk for gambling-related disorder at the time, but also those who might eventually develop it, even if they were not gamblers at the time of the study. In fact, this nuance is quite important, because not gambling today does not rule out the possibility of gambling later in life. This

is a key point of my research, as in Chapter 3 I propose an innovative approach in gambling literature by using a split population duration model to distinguish between people who are inherently non-gamblers and those who have not yet gambled but might do so in the future.

As part of the Responsible Gambling Strategy, the DGOJ also developed a website, a helpline, and support and guidance materials for diagnosed problem gamblers. The awareness-raising, prevention and treatment actions were designed to achieve long-term results, and involved all industry stakeholders— from the DGOJ, the CAJR and gambling operators, to civil associations, gamblers and representatives of the Healthcare Network and the National Drugs Plan. Detailed information about the scope of these actions are available in the DGOJ's working document (DGOJ, 2013).

2.2 | Prevalence Study

The Study on the Prevalence, Behavior and Characteristics of Gamblers in Spain, as it was finally dubbed, was therefore the most important component of the Responsible Gambling Strategy. It was intended to shed light on the prevalence of gambling consumption, participation and addiction; to describe the socio-demographic characteristics of gambling users; to describe the profiles of gambling users with no risk, mild risk, moderate risk and a likely diagnosis of pathological gambling; and to analyze the personal characteristics of gambling users who were diagnosed with gambling-related disorders. Although no new prevalence studies have been announced as of this writing, the DGOJ intends to conduct new editions to compare the evolution of these endpoints in the future.

While the study was certainly ambitious in its scope, it was also shortsighted in that it only consisted of a descriptive statistical analysis of the results and did not address relationships between variables. My thesis provides a more thorough, in-depth analysis of the data.

The initial survey was developed by a Professor of Behavioural Change at the Complutense University of Madrid and tested with face-to-face interviews on a sample of 50 individuals aged 17 and older from Madrid, Barcelona and

Bilbao. The questionnaire was designed to be completed at people's homes, but it was repurposed to be completed on the street in order to "favor truthfulness in the responses to certain questions concerning sensitive issues and avoid the answers being conditioned by the environment" (DGOJ, 2015). This test validated the survey's adequacy in terms of "generating an atmosphere of trust, adequate time for reflection, and a neutral interaction of the interviewer" (DGOJ, 2015).

Three pilot studies preceded the final sample. These interim studies were independent from each other and served distinct purposes. Pilot study #1 polled 503 Spanish residents over the age of 18 via an online survey; pilot study #2 surveyed 500 Spanish residents over the age of 18 who had gambled online in the previous two months via an online survey, too, to support "further studies" regarding consumer habits; and pilot study #3 polled 305 Spanish residents between the ages of 15 and 17 via an in-person survey to support "initial studies on the approach and sensitivity to gambling by minors" (DGOJ, 2015).

The final sample was collected in 2015 as a representative sample of Spain's demographic distribution, and it included microdata on 6816 individuals who answered about 240 questions from a semi-structured questionnaire administered by a pollster that was completed on the street with the assistance of a computer. The prevalence study's technical report (DGOJ, 2015) provides the survey itself, the sampling methodology and an extensive descriptive analysis. Key findings are presented in Chapter 2.2.1.

The DGOJ released the database to encourage further third-party analyses. My doctoral thesis was precisely born from the informative potential of these microdata. As stated numerous times throughout this document, gambling is a phenomenon that will continue to grow in the coming years, especially due to the expansion and standardization of online gambling, so objective, truthful, and accurate information is required for all industry stakeholders to mitigate its negative aspects and to ensure responsible consumption habits. However, the original database required further depuration and validation work to accommodate it to all three research projects of my thesis, as the file certainly had some inconsistencies and incoherence issues within the data.

2.2.1 | Participation and Expenditure

About 76% of respondents declared to have gambled at least once on any game involving an actual economic bet, though traditional on-site gambling activities still were clearly predominant: Over 70% were offline-only gamblers, while 0.2% were online-only gamblers. Nevertheless, a higher prevalence of online gambling was observed the more severe the pathological gambling: About 32.1% of problem gamblers played both on-site and online games. This offers a cautious first sign that online gambling might indeed be more problematic than offline gambling—I address this issue in detail in Chapter 5.

This high prevalence of offline gambling may well be explained due to the cultural attachment of some specific lottery games. The *lotería de Navidad* (Christmas Lottery) is held every December 22nd since 1812 and has the biggest lottery prize pool worldwide. Similarly, *La Primitiva* was re-designed and re-introduced in 1985 with the goal of producing large jackpots on a regular basis. Despite its decline in popularity in recent years (Díaz & Pérez, 2021), the game has become the most successful of all those marketed since then. In fact, these, along with *ONCE*, were the most popular games among respondents. On the contrary, casino, bingo, card games and slot machines were not as popular but were observed to be the most addictive games as their prevalence increased with the level of pathological gambling.

Because online gambling was only recently introduced, it lacks such an attachment. In fact, as stated earlier, its first specific legislation was enacted in 2011. As a result, only 8% said they had ever gambled online. Online lotteries remained the most popular games, though respondents at risk of pathological gambling were observed playing card games, sports betting, casino, bingo and slot machines far more thank non-risk respondents.

About 55% of self-reported gamblers had an average monthly expenditure on gambling products lower than €10, largely on offline activities. However, as the risk of pathological gambling increased, so did the expenditure, and the expenditure on online gambling activities: 96.5% of non-risk respondents spent their money entirely offline, compared to 71.7% of pathological gamblers.

Similarly, respondents at risk increased their yearly expenditure more than non-risk respondents. In fact, only 4.3% of non-problem gamblers reported higher spending, compared to 38.3% of pathological gamblers. Surprisingly enough, over 60% of pathological gamblers were aware that their spending was "a lot", "too much" or "excessive."

2.2.2 | Pathological Gambling

According to the findings of this prevalence study, gambling in Spain is mostly safe and non-problematic. Over 90% of respondents did not report any negative behavior towards pathological gambling. At this regard, only 4% were preoccupied with gambling in some way, such as spending a significant amount of time thinking about their involvement in gambling activities, discussing how to make money from gambling, and/or organizing their daily activities around gambling. Other notable negative behaviors were the use of gambling as an escape route from personal situations and the compulsively recovery of money previously lost in other gambling activities.

Using the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) screening to classify respondents into risk of pathological gambling groups—I address this in detail in Chapter 5.2—, 6.3% were found to be at risk of having a gambling disorder, whereas only 0.9% were found to have a likely diagnosis of pathological gambling. When only the previous year's gambling activity was considered, this figure dropped to 0.3%. Not surprisingly, though, gamblers at risk had a higher and more frequent prevalence of negative behavior towards gambling than normal gamblers. In fact, these prevalence rates among pathological gamblers were massive: 93.7% showed concerns about gambling, 90% saw gambling as an escape route, 88% gambled compulsively to recover money and 72.8% stated that gambling had definitely ruined relationships. None of these negative behaviors were reported by no-risk gamblers.

The prevalence of pathological gambling was more than twice as high in men as in women. The most problematic age groups were 25–44 and 55–64. As the risk of problem gambling increased, so did the proportion of gamblers who were single or separated/divorced, and unemployed or retired.

In addition, 80% of pathological gamblers were aware of their condition, with slot machines perceived as the most common trigger. When combined with findings discussed earlier in Chapter 2.2.1, slots machines were found to be not only a quite frequent starting activity, but also a problematic one that likely associated with pathological gambling. Pathological gamblers also reported being impulsive and having sought psychological assistance at some point, and seemed to plan their participation in advance (e.g., when to play, how much to spend, which games to play...) in an irresponsible manner, as they prioritized gambling over their other daily activities. They were unable to tell when to stop; felt upset if their gambling schedule were disrupted; and were aware that they were devoting too much time to gambling.

In short, gamblers at risk were concerned about gambling, gambled compulsively to recoup previously lost funds, and saw gambling as a way to escape from personal problems. Other troubling motivations emerged as the risk increased, such as lying and engaging in illegal acts to gain access to gambling.

3

Propensity to Start Gambling

3.1 | Introduction

Market availability of consumer goods is determined, among other factors, by regulatory issues that may affect to some extent consumer exposure and attitudes towards them. This could be particularly relevant for goods which could potentially have some negative effects on consumers, such as recreational drugs, alcohol, tobacco and gambling.

Recently, the prevalence and scale of gambling has significantly increased, becoming an alternative form of leisure and entertainment within an increasingly crowded and highly competitive supply. This trend has been accompanied by a growth in both gambling participation and expenditure (Abbott et al., 2014). As the expansion of gambling opportunities continues, there is considerable public controversy over social concerns and potential harm and other gambling-related disorders. Governments all over the world hold divergent positions on gambling. While some countries have actually banned all forms of gambling, many others allow a wide range of quite different gambling activities. These different gambling regimes are usually determined by cultural and/or religious reasons (e.g., Islamic laws do not allow for any form of gambling) and by regional and historical market factors. However, civilian and political leaders have also been lobbying against gambling, as some consider it to be a harmful, undesirable activity that makes little contribution to society.

The availability of gambling in any jurisdiction is ultimately determined by government regulations. Wherever gambling is allowed, governments have traded its negative aspects for the potential benefits—mainly economic—of its regulation and taxation.

Opponents to gambling usually base their objections on concerns such as the regressivity of gambling taxation (meaning that gambling revenues are disproportionately drawn from low-income people, which has become a widely studied issue in the literature, like Gandullia and Leporatti (2018), and particularly for lottery games, as Pérez and Humphreys (2011) have shown), moral considerations (Basham & White, 2002), and gambling-related harms beyond the loss of money: addiction, crime, work performance or social life issues (Delfabbro & King, 2019). On this subject, Sauer (2001) provided an explanation on the regulation and availability of gambling in the context of a public choice model, while Simmons (2008) contributed to a thorough analysis of the factors that influence the amount of regulation placed on gambling opportunities.

This chapter is based on a case study of the Spanish gambling industry, which has seen dramatic changes in its regulation over the last several decades, likely leading to a significant increase in gambling opportunities. Until 1977, legal gambling in Spain was largely limited to specific sports betting, the Spanish National Lottery (*Lotería Nacional*) and the charity lottery for the benefit of the visually impaired (*Sorteo de la ONCE*), with the exception of other activities specifically sanctioned by the then-dictatorship government.

The democracy brought along its first licenses that further legalized other gambling products. The re-established government actually acknowledged (*Real Decreto-ley 16/1977, de 25 de febrero*) that all prior absolute prohibitions systems had not only failed in their "moralizing efforts," but had also encouraged a situation of "generalized clandestine gambling, with even more real risks." In order to provide legal certainty and to meet the objectives of "social protection and guardianship" and "the defense and promotion of fiscal interests," almost every gambling game and activity (lotteries, betting, casino, bingo and slot machines) were mass legalized.

This resulted in a significant increase in both participation rates and expenditure levels. Consequently, the Spanish gambling industry saw a dramatic ex-

pansion between 1977 and 1985 (Jiménez-Murcia et al., 2014), as, according to Palencia (2009), expenditure on gambling products increased by more than 350% (€5,650 million in 1977 to €25,860 million in 1985; figures in 2000 real euros).

The next major expansion took place in 1985. *La Primitiva* was re-established after being eventually abolished in 1862 and it quickly became, and still remains as of this writing, the most popular lottery game marketed on a regular basis in Spain. A few years later and thanks to the growing popularity of lottery-type games, lottery mania, as Kaplan (1990) termed it, spread across the country: *BonoLoto* was introduced in 1988 and *El Gordo de la Primitiva*, which was presented as a derivative of *La Primitiva* but with lower odds and higher jackpots, was launched in 1993. Gambling consolidated over the 1990s, as its share of the domestic GDP remained stable at around 4% between 1995 and 2000 (Palencia, 2009). Further developments continued well into the 21st century with the introduction of new games, such as the transnational lottery EuroMillions in 2004, of which Spain was a founding member.

No major changes to the legislation were made until the 2011 Spanish gambling law came into force (*Ley 13/2011, de 27 de mayo*), which addressed online gambling for the first time. Until then, online gambling was not strictly forbidden, but it lacked a specific regulation that would provide legal certainty as well as prevention and treatment mechanisms to operators and consumers. This new gambling law was the result of fundamental changes in the Spanish gambling industry following its decriminalization in 1977, its subsequent popularization over the decades and the introduction of new Internet-enabled devices that facilitated access to a huge supply of online gambling activities. In fact, online gambling has become very relevant in the last few years and the government has recently passed new restrictions targeting online outlets advertising in particular in order to minimize its most harmful effects.

Using data from the DGOJ's prevalence study, the goal of this first research chapter of my thesis is to assess the likely effects of significant regulatory changes that are thought to have dramatically expanded gambling opportunities on individuals' propensity to start gambling, as well as to contribute to existing literature by analyzing what factors might lead individuals to eventually engage in gambling activities. A secondary goal is to compare gender differences in this

propensity to start gambling and to observe how it has evolved over successive regulatory reforms.

It is actually expected that the odds of starting gambling may be conditioned by the availability and exposure of gambling opportunities, which are undoubtedly determined by many institutional factors, such as the main regulatory policies, and the willingness of individuals to gamble and their risk aversion. Thus, any gambling episode is ultimately determined not only by an easier access to gambling itself, but also by quite different factors that affect individual decision-making (that is, whether or not to participate and, if so, the optimal amount of spending) and behavior. In fact, if consumers prefer a corner solution to these decisions (that is, they choose not to gamble), an expansion of gambling opportunities will pose no effect to consumer's behavior (Kearney, 2005). To fully accommodate these individuals who are inherently non-gamblers, here I propose a split population duration model. This methodology has been proved successful in studying the propensity to start and quit consuming other potentially addictive products, such as tobacco and alcohol use (Douglas & Hariharan, 1994; Forster & Jones, 2001; Nicolás, 2002), whose users share similar characteristics.

While here I am focusing mainly on the impact of regulatory changes on the propensity to start gambling, I am also paying attention to how men an women have reacted to every new regulation. A better understanding of the characteristics of individuals who eventually decide to gamble and the potential consequences of the expansion of gambling opportunities will help policy makers to comprehend the likely consequences of introducing changes aimed at expanding the industry.

The chapter is structured as follows. First, I describe the specific data for this research and its methodology, which is kind of tricky because individuals who are inherently non-gamblers pose a modeling challenge. Then, I introduce the econometric model that I have developed and discuss my findings. To conclude the research, I provide a brief summary as well as some final remarks, policy advice, and notes on technical limitations and potential extensions.

3.2 | Methodology

The data required for this analysis was obtained from the DGOJ's prevalence survey, which was discussed in detail in Chapter 2.2. However, the data set required further manipulation to accommodate the split population duration model. The first step was to remove from the sample individuals who failed to respond to key variables, as this lack of information makes it impossible to determine how long individuals have been gambling for and therefore the subsequent survival analysis. In relation to this, 860 individuals were dismissed (12.61% of the sample), most of whom (828) did not remember their starting age. The resulting participation ratios were very similar to the original ones. The weights of the original data were also recalculated in order to restore lost effects from dismissed individuals.

The survey did not provide any information about the spell length as a non-gambler. However, such spell length (in years) was inferred based on available information on the exact age, starting age and gambling status of respondents. The duration of current self-declared gamblers as non-gamblers was established as the number of years elapsed until they first gambled minus 13, while the duration of current self-declared non-gamblers was determined to be their exact age at the time of the survey minus 13, for their spells as non-gamblers had not yet ended. I subtracted 13 years from each calculation because descriptive statistics (Table 3.1) showed that a significant proportion of the individuals started gambling at 14, whereas it was anecdotal at earlier ages. It should be noted, though, that while the legal gambling age in Spain is 18, gambling is still easily accessible to minors.

To assess the effect of the regulatory changes that likely led to a significant expansion of the Spanish gambling industry discussed in Chapter 3.1 on the propensity to start gambling, I created new dummy variables for each of the following time periods: 1977-1985 (reintroduction of gambling), 1986-2010 (expansion and maturity), and 2011-2015 (online gambling legalization and expansion). The period prior to 1977, when legal gambling was severely restricted and non-legal gambling mostly criminalized, served as the reference category.

In addition, other exogenous factors usually found by empiric evidence to affect individuals' attitudes towards gambling and therefore to have an impact on the hazards of starting gambling were also included. Gender and education level are common covariates in gambling research, for gambling patterns and behavior are strongly determined by socio-demographic conditions (see Layton and Worthington (1999); Wardle et al. (2011); J. W. Welte et al. (2002); Worthington (2001), among others, for further insight). Existing literature has not found consistent evidence of how personal income affects gambling participation—I address this with more detail in Chapter 4—, though I decided to include the real GDP per capita growth rate as a proxy for the economic cycle, as it seemed reasonable that it might have had some impact on the likelihood of ending the spell as a non-gambler. As far as I know, this is the most reliable time series available on this subject. Finally, a fourth-order polynomial based on the spell length was also included.

3.2.1 | Summary Statistics

Descriptive statistics for this specific sample population show that about 73% of respondents have gambled at least once in their lifetime. The average age of respondents was 47 years old. For those who self-identified as gamblers, their average starting age was about 23 years, whereas their average spell duration as non-gamblers was about 10 years. Astute readers will be surprised to notice that the reported minimum starting age was 14 years old. Indeed, gambling is only legal for adults, but this does not prevent younger people from accessing some types of gambling modalities; hence the 14-year-old mark, as discussed earlier.

Gender and employment status were evenly distributed, but over 65% of individuals had at least a secondary degree (high school or higher) following the Spanish education system. Complete summary statistics are shown in Table 3.1.

Table 3.1: Summary Statistics

Variable	N	Prop.	Mean	SD	Min.	Max.
Gambling						
No	1,601	26.88%	—	—	—	—
Yes	4,355	73.12%	—	—	—	—
Age	5,956	—	47.01	17.58	18	95
Starting age	4,355	—	22.85	8.18	14	75
Spell duration (years)	4,355	—	9.85	8.15	1	62
Gender						
Women	3,046	51.14%	—	—	—	—
Men	2,910	48.89%	—	—	—	—
Education level						
No education	347	5.83%	—	—	—	—
Primary	1,685	28.29%	—	—	—	—
Secondary	2,530	42.48%	—	—	—	—
Higher	1,394	23.40%	—	—	—	—
Employed						
No	2,964	49.76%	—	—	—	—
Yes	2,992	50.24%	—	—	—	—

3.3 | Econometric Modelling

As established in Chapter 3.1, my goal with this research is to assess the effects of regulatory changes since the re-legalization of gambling in 1977 on the propensity to start gambling. These regulatory changes were intended to liberalize the market, and while there is no way to prove causality, they laid the groundwork for the industry's subsequent expansion.

Duration models (commonly known as survival analysis) are quite appropriate for this type of empirical research, as they model the time spent by in-

dividuals in a given state before they transition to another state, and provide information on the factors that have led individuals to transition from one state to the other. This exercise's specific duration model explores the time elapsed between individuals' transition from non-gamblers to gamblers and the factors that have made them more likely to start gambling.

This propensity can be thought of as the probability that the spell length as a non-gambler is greater than a specific time t, and is expressed as the distribution of a positive random duration variable. References in gambling literature are scarce and only Forster and Jones (2001) and Kainulainen (2020) have used survival analysis to study between-session loss-chasing behavior by loyalty card holders playing slot machines and how past gambling outcomes affect current gambling consumption, respectively, so the specific methodology featured here is a rather novel approach in this field.

The data set from the DGOJ is actually a retrospective cross-section survey in which individuals self-reported whether or not they were gamblers, and, if so, their starting age. This means that the sample consists of complete, uncensored spells corresponding to individuals who had already started gambling at the time of the interview ($d_i = 1$), and—unfortunately—right-censored spells corresponding to individuals who had not yet ($d_i = 0$). The latter, specifically referred to as incomplete spells, are in fact formed from two different types of individuals: those who are inherently non-gamblers and therefore will never gamble regardless of market conditions, and those who would eventually have been observed gambling had the monitoring been longer. Sadly, the survey did not include any specific information to distinguish them.

The specific characteristics of the data are relevant to the duration analysis, as they determine how the duration models have to be specified and estimated (Allison, 1982). In this regard, standard duration models only consider complete spells and are therefore not suitable for this data. Previous econometric research (Cameron & Trivedi, 2005; Douglas & Hariharan, 1994; Forster & Jones, 2001; Nicolás, 2002; Schmidt & Witte, 1989) has, however, developed what it is now known as split population duration models, where two equations are considered: first, a discrete choice model to estimate whether or not individuals will start gambling eventually, and second, the proper duration model to esti-

mate the spell length as non-gamblers. This combination of equations enables the model to distinguish between individuals who are inherently non-gamblers and individuals who are not yet gamblers.

Measurement of spell length should also be taken into account (Allison, 1982). Here, I use a discrete-time duration model to avoid potential biases associated with continuous-time models. Discrete-time models are also more flexible in specifying the duration dependence patterns of the conditional propensity to start gambling.

Let s_i be a dummy variable set to 1 for an individual i who will eventually start gambling and 0 otherwise, for which the following binary discrete-choice probit model is defined:

$$
\begin{aligned}
Prob(s_i = 1) &= F(Z_i'\,\delta) \\
Prob(s_i = 0) &= 1 - F(Z_i'\,\delta)
\end{aligned}
$$

(3.1)

where F is the cumulative distribution function of the logistic distribution, Z is the covariates vector and δ is the parameters vector.

On one hand, the contribution to the log-likelihood function of individuals who have already started gambling ($d_i = 1$) at period t_i is the probability of eventually being a gambler ($s_i = 1$) times the probability of starting gambling at period t_i (that is, $Prob(T_i = t_i)$, where T_i is the random variable of the spell length as a non-gambler). On the other hand, the contribution of individuals who are not observed to start gambling ($d_i = 0$) is the probability of never starting gambling ($s_i = 0$) plus the probability of starting gambling after t_i (that is, $Prob(T_i > t_i)$, which is actually the survivor function). The resulting likelihood function is the following:

$$
\begin{aligned}
\log L = \sum_{i=1}^{N} d_i\ \log[Pr(s_i = 1)\ Pr(T_i = t_i)] + \\
(1 - d_i)\ \log[1 - Pr(s_i = 1) + Pr(s_i = 1)\ Pr(T_i > t_i)]
\end{aligned}
$$

(3.2)

27

Defining the discrete time hazard rate as $h_{i_{t_i}}$ as the probability of the *ith* individual starting gambling in period t_i conditional on being a non-gambler for t_i periods (that is, $h_{i_{t_i}} = Pr(T_i = t_i | T_i \geq t_i)$), then:

$$Pr(T_i = t_i) = h_{i_{t_i}} \prod_{k=1}^{t_i-1}(1 - h_{ik})$$

$$Pr(T_i > t_i) = \prod_{k=1}^{t_i}(1 - h_{ik}) \tag{3.3}$$

Notice that there is a one-to-one relationship between the hazard function and the survivor function. The model relies on a logistic function for $h_{i_{t_i}}$:

$$h_{i_t} = \frac{\exp[\theta(t) + X'_{it}\beta]}{1 + \exp[\theta(t) + X'_{it}\beta]} \tag{3.4}$$

where $\theta(t)$ is a 4$^{\text{th}}$ order polynomial function of t to capture the potential duration dependence of the hazard rate; X_{it} is the covariates vector (including time-varying factors and individuals' personal characteristics); and β is the parameters vector. This polynomial function accommodates a flexible specification of the duration dependence of the hazard rate without affecting the significance of estimated coefficients. Also, the fit of this model is better than that of either lower order polynomials or those using a complementary log-log specification for the hazard function instead of the logistic function I used here.

3.4 | Results and Discussion

Table 3.2 shows the estimated coefficients for the propensity to start gambling for both the split population model and the standard model with no participation equation (all incomplete spells are right-censored). The split population model provided a better fit in terms of the Akaike information criterion (AIC). Overall, estimates in both models were strongly statistically significant.

Starting with the participation equation, the age (as a generation cohort effect rather than the exact age effect) showed a negative sign, suggesting that older

Table 3.2: Duration Models Estimated Coefficients

	Split population	Standard model
Participation equation		
Age cohort	-0.009 **	—
Education level		
Primary	1.020 ***	—
Secondary	0.898 ***	—
Higher	0.890 ***	—
Constant	1.212 ***	—
Hazard function		
Gender	0.888 ***	0.744 ***
GDP per capita	-0.010 *	-0.001
Regulation period		
1977-1985	0.694 ***	0.816 ***
1985+	0.903 ***	0.944 ***
2011+	1.114 ***	1.153 ***
Gender * 1977-1985	-0.317 ***	-0.372 ***
Gender * 1985+	-0.199 **	-0.363 ***
Gender * 2011+	-0.330 **	-0.693 ***
Trend	0.405 ***	0.384 ***
Trend^2	-0.030 ***	-0.033 ***
Trend^3/1000	0.782 ***	0.860 ***
Trend^4/10^6	-0.667 ***	-0.740 ***
Constant	-4.605 ***	-4.637 ***
log L	-20093.5	-20226.8
AIC	40161.0	40427.6

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

age cohorts were less likely to start gambling; in other words, younger people are expected to be more prone to gambling. This is not surprising given that young people have typically grown up being exposed to gambling and have directly encountered a mature and large market in which online gambling is becoming increasingly relevant. Overall, this finding is consistent with previous research that found that one's proclivity to gamble decreases over time (Mok & Hraba, 1991; J. W. Welte et al., 2011).

A negative relationship between education and gambling could be anticipated (Coups et al., 1998; Ghent & Grant, 2006), but the education level was actually found to have a positive (and statistically different between the four levels) effect on the propensity to gamble: each additional level of education made gambling more likely, although in a decreasing progression, as shown in Table 3.3. In fact, recent studies suggested that, contrary to what might be expected, people with higher IQ (presumably, educated individuals) are more likely to spend more on and be more successful in certain gambling activities (Muela et al., 2020; Suhonen et al., 2020). However, one should not underestimate the fact that games have become more complex, deeper and sophisticated over time, to the point where it may now require greater intelligence to understand and play them adequately in order to succeed.

Table 3.3: Estimated Probabilities of Starting Gambling

	Education level			
Age	**No education**	**Primary**	**Secondary**	**University**
20	73.80%	88.65%	87.36%	87.27%
30	72.06%	87.73%	86.36%	86.26%
40	70.25%	86.75%	85.29%	85.18%
50	68.38%	85.71%	84.15%	84.04%
60	66.45%	84.59%	82.94%	82.82%

Note: All estimated probabilities are statistically significant.

Coefficients of the duration model showed that the real GDP per capita growth rate had a negative effect on the propensity to start gambling, although weakly significant (and not even that in the standard duration model). This is not surprising at all, as previous research observed quite contradictory findings on this relationship. Kaizeler and Faustino (2011) found an upside-down U-shape link between gambling (lottery sales) and GDP per capita, while Gandullia and Leporatti (2018) suggested that regional economic conditions (precisely measured in GDP per capita) had differently affected diverse gambling products and categories.

The gender coefficient was reportedly positive, hinting that men had shorter spell lengths than women (that is, men started gambling earlier than women), but its interactions with the policy dummies suggested that this gap in the spell length between men and women has been gradually narrowing with each successive new major expansion. In this regard, men are well known to be less risk-averse and more susceptible to over-confidence (Chalmers & Willoughby, 2006), and tend to play more often and spend more than women on gambling products (Kitchen & Powells, 1991; Sawkins & Dickie, 2002; J. W. Welte et al., 2002), which may well condition their behavior and make them more prone to gambling.

Policy dummies coefficients were also positive. Using the period prior to 1977 as a reference (gambling was mostly banned then), each new major gambling legislation seemed to have increased the propensity to start gambling for both men and women in relation to the previous situation. This means that each new policy has shortened the spell further than the previous one. However, its interactions suggest that women's spells have shortened more with every new legislation than men's.

Figure 3.1 illustrates all this more clearly by plotting the empirical and estimated survival functions for starting gambling for both men and women and for each regulatory period.

Estimated survival functions, which plot the probability of "surviving" as a non-gambler after t periods, have shifted to the left with each new expansion, meaning that each expansion has shortened the spell length as a non-gambler. For men, 75% of them took 15 years to start gambling (bear in mind that spells
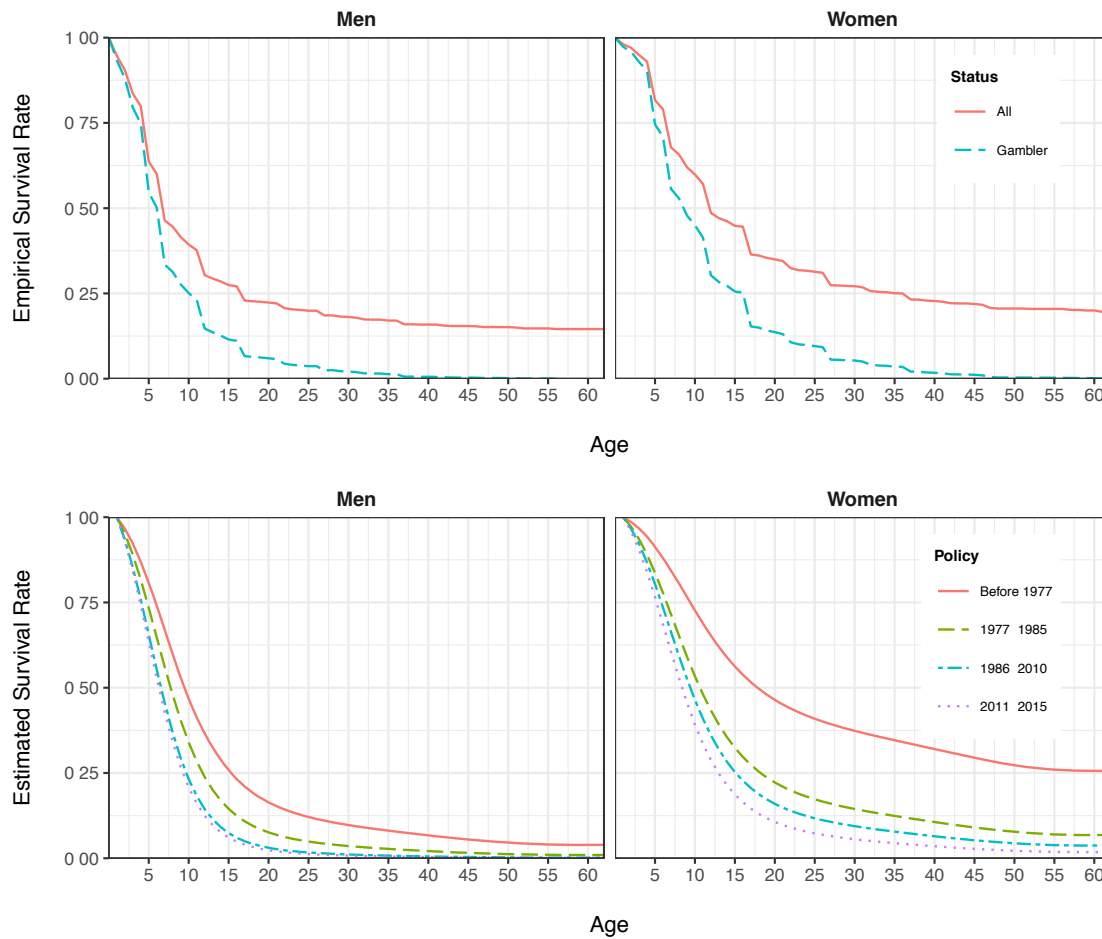
Figure 3.1: Comparison of Survival Functions (Empirical and Estimated)

start at age 14, as gambling was anecdotal at earlier ages; this is explained in Chapter 3.2) in 1977, whereas it now takes less than 10 years after the 2011 legislation. Women's situation has worsened even more: their survival function became asymptotic after a while and never reached the 75% mark with the 1977 legislation, but now it only takes 12.5 years to reach that mark. Furthermore, survival functions decreased more rapidly for females than for males, as observed in the estimated coefficients (Table 3.2). Gambling patterns have clearly changed after the 1977 legislation, which should not surprising, because gambling was mostly banned before it. Of course, people were expected to turn more prone to gambling when it became legal and widely available.

When considering only gender differences, men were still more likely to start gambling at earlier ages. However, survival rates decreased more for women than for men. Figures were quite similar to those shown above.

Note that the empirical survival functions for both males and females do not converge to zero when considering the whole sample due to incomplete spells from non-gamblers, while the estimated survival functions do converge to zero for males mainly due to the pattern prior to 1977.
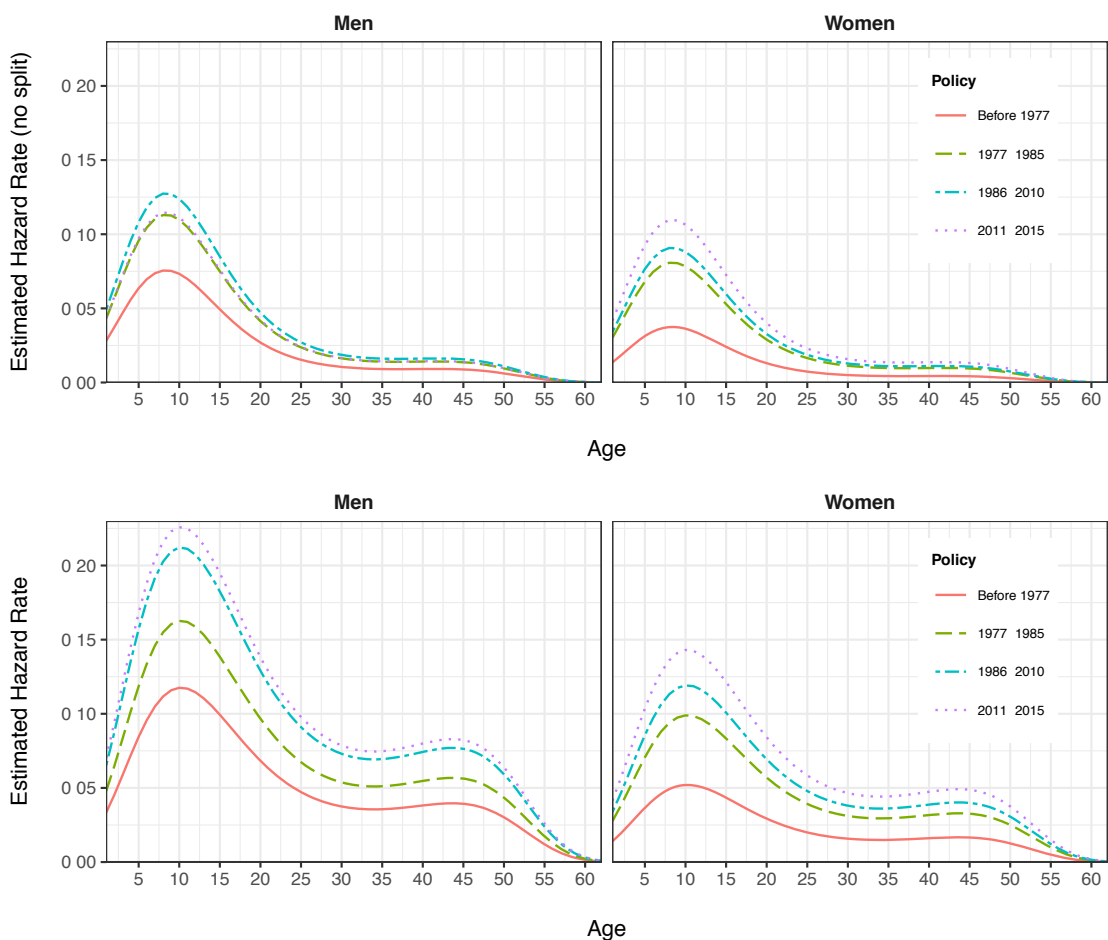

Figure 3.2: Comparison of Hazard Functions (No Split and Split Population)

The risk function of Figure 3.2, defined as one's probability to start gambling conditional on one's survival as a non-gambler up to time t, also pointed in the same direction. Gambling reforms—and likely expansions—between 1977 and

2011 have successively increased the hazard of starting gambling, as the curves have shifted dramatically upward with each new regulation, implying higher risk. In fact, the risk is now two times higher for men and three times higher for women compared to 1977.

Overall, the probability of starting gambling increased more for women (in both absolute and relative terms), although it was still lower than men's. Both genders followed the same trend. Risk increased roughly up to the first 10 years of survival, meaning that the period with the highest risk of starting gambling should be around 24 years old. From then, the risk gradually decreased over time until the 35-years mark, at which point it remained quite constant for several years. It then decreased again to zero at around the 60-years mark.

It is also worth noting that the estimated hazard rates have substantial differences in size—not as much in the pattern they follow—when the split population model, which does consider incomplete spells from non-gamblers, is used instead of the standard one.

3.5 | Closing Remarks

Using Spain as a case study, this first chapter of my thesis offered a significant contribution to the public debate about the consequences of regulatory changes aimed at liberalizing the market, which likely laid the groundwork for the subsequent expansion of gambling opportunities. In this regard, the domestic industry has undergone dramatic changes since 1977, when gambling was mostly banned, through 2011, when the first specific legislation on online gambling was passed, among many other things.

I provided an empirical analysis of how individuals' propensity to start gambling has responded to gambling regulatory changes by utilizing a split population duration model, which is an uncommon approach in gambling research. Duration models are appropriate for measuring and analyzing the length of time people spend in one state before transitioning to another. They are a well-known approach in other fields, such as biostatistics or labor economics, but duration analysis is unusual in empirical gambling research. While tricky, these are mod-

els that are well suited to recurring issues in the industry and provide useful insights to policymakers.

In this first research, I used data from the DGOJ's cross-section prevalence study, and proposed a split population duration model specifically to accommodate both complete and incomplete (right-censored) spells from non-gamblers. This split population model included time-varying regressors and individuals' personal characteristics, used a logistic function and was estimated using maximum likelihood. As the main objective was to assess the effect of regulatory changes over the years on the propensity to start gambling, four dummy variables, which distinguished four clearly different regulatory periods, were defined as the main independent factors of the model. Other common covariates in gambling literature were also included, such as the gender or the education level.

Interestingly, though not surprisingly, gender was found to have a significant effect on the propensity to start gambling, suggesting that men were more prone to gambling than women. Furthermore, the interactions between the gender and the policy variables showed that men were still more prone to gambling after every regulatory change, but women's spell length as non-gamblers decreased more over time. The risk of starting gambling was maximized at about 24 years old. Currently, both men and women are clearly way more likely to start gambling at earlier ages than before. However, this is not unexpected, because gambling was mostly banned prior to 1977, meaning that of course gambling patterns would change after its legalization and widely availability.

In short, regulatory changes aimed at expanding gambling availability and opportunities have successively and gradually made people more prone to start gambling. This is a quite important finding in terms of policy implications, because it could definitely help decision makers, regulators and gambling stakeholders in general to better understand the consequences of consumer decision-making when it comes to introducing and/or increasing gambling availability. This can also lead to a better definition of public policies to minimize potential gambling harm, which I precisely address in Chapter 5. In fact, public health concerns over gambling issues have been the strongest argument against the widespread expansion of gambling opportunities.

These findings support the notion that, while supply and ease of access are likely to drive gambling consumption, the final decision to participate or not is strongly influenced by emotional factors and/or personal characteristics of individuals. However, the prevalence study's cross-sectional and retrospective design makes it impossible to explain the underlying process of these findings. A longitudinal study that provides more detailed information on the characteristics and gambling consumption habits of users over time would benefit all gambling stakeholders, as it would allow researchers to establish causal relationships between factors. A logical extension of this work would be to compare these results to those of future editions of the prevalence study.

4

Gambling and Substance Use

4.1 | Introduction

In most jurisdictions around the world, gambling has never been as widely available and as accessible as it is today, and has turned into just an alternative form of leisure and entertainment within an increasingly crowded and highly competitive supply. Its economic figures are quite remarkable for sure: global gambling market value is reportedly expected to exceed $565 billion by 2022, growing at annual rates of 5.9%, whereas online gambling alone—which has quite particular characteristics, as it allows anyone to gamble at anytime from anywhere on a large variety of games that are usually brief, always available, require low wagers and deliver immediate results (Gainsbury, 2015)—will surpass $100 billion by 2025, according to some reports.

The case is no different for Spain: gambling is so socially normalized that about 75% of the population is estimated to have gambled at least once in their lifetime, while 85% of them did so in 2019 (CEJUEGO, 2020). That year, the domestic industry accounted for 0.8% of GDP, and saw a 3% year-on-year growth in revenue (CEJUEGO, 2020). Despite this rapid expansion of gambling opportunities, diagnosed problem gamblers account for barely 0.3% of Spaniards (DGOJ, 2015), which is one of the lowest and most stable prevalence rates in the world.

As gambling opportunities have expanded over the last decades, and continue to do so at a rapid pace, there has also been growing public controversy over the social consequences of the potential harm and danger associated with gambling. Indeed, the potential interaction of gambling consumption with substance use (e.g., smoking and drinking) has become a quite controversial social concern.

Unfortunately, the Spanish gambling market is still quite uncharted in general and has received little attention from researchers. Potential cross-effects of smoking, drinking and gambling consumption have not been clearly addressed, which is particularly concerning for three reasons. First, it is believed that "there is a common factor underlying many addictive behaviors" (Tackett et al., 2017), suggesting that one addiction can lead to another and worsen existing ones. Second, while smoking is officially prohibited (though not strictly enforced) in interiors, alcohol consumption is completely legal in land-based gambling establishments. In fact, slot machines, which are a large part of the overall supply of gambling opportunities, are actually located in bars and restaurants. Consequently, alcohol and smoking products are regularly consumed concurrently while gambling; not only in traditional in-person games, but also when gambling online or at specific social gambling events.

Precisely, existing research has shown on a constant basis that smoking and alcohol drinking are two established addictive activities that have strong interdependencies with gambling. In fact, McGrath and Barrett (2009)'s systematic review stated that "a growing body of literature" suggested that smoking and gambling "might share similar neurobiological, genetic and/or common environmental influences" that might "enhance gambling behavior and reinforcement." Similarly, Wulfert et al. (2016) proved that "smoking gamblers showed greater skin conductance reactivity to cues, and stronger subjective urges to smoke to smoking and gambling cues," and provided some evidence for "cross-cue reactivity between a substance and a behavioral addiction."

Literature regarding this cross-consumption is quite large and consistent. Griffiths et al. (2010) showed that "gambling, cigarette smoking and alcohol consumption are co-occurring behaviors." Ida and Goto (2009) found "interesting interdependencies among addictive behaviors including smoking, drinking,

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playing pachinko, and gambling on horses." Okunna et al. (2016) concluded that "recreational gamblers are significantly more likely to drink alcohol, use illicit drugs, and smoke heavily compared to non-gamblers." Specifically for cigarette smoking, Griffiths et al. (2010) proved that "smokers were more likely to gamble in the past year, and that smokers were more likely to gamble on most forms of gambling in the past year." For alcohol drinking, Cronce and Corbin (2010) showed that "alcohol consumption was associated with larger average bets and more rapid loss of all available funds."

Men and women do not engage in addictive activities, including gambling, in the same way. Gender research showed that there was "no association between gambling and alcohol consumption in females but among males there was a highly significant association," where "males are more likely to engage in a wide variety of potentially addictive behaviors than females" (Griffiths et al., 2010). Likewise, "men and women have different profiles of gambling-alcohol co-occurrence. For men, gambling and drinking tend to co-occur with risk taking and are both associated with social functions. For women, gambling is more likely to serve as an escape and is more strongly associated with affective dis-regulation and psychopathology" (Tackett et al., 2017). In short, "gambling prevalence is higher among males than females" (Okunna et al., 2016).

Adolescents are being particularly researched as they are considered especially vulnerable to gambling and other potentially addictive behaviors. Overall, results held for them as well. Duenas et al. (2020) showed that both male and female teenage gamblers"have greater risk for reporting lifetime and current use of multiple specific substances." Similarly, "alcohol, tobacco and marijuana use [. . .] are strong independent predictors of gambling" (Buja et al., 2019). They also stated that a "higher prevalence of multiple health-risk behaviors among young gamblers is a commonly recognized problem," which is particularly worrying, as "one type of adolescent problem behavior increases, the likelihood of other problem behaviors developing increases too." The authors concluded that adolescents "have antecedent explanatory factors in common," suggesting that gambling, alcohol drinking and cigarette smoking might indeed be heavily intertwined.

Existing empirical evidence has not found a solid, consistent relationship between income and gambling participation and expenditure, as discussed in Chapter 3.2. On the one hand, papers suchs as Humphreys et al. (2009) argued that "the purchase of lotto tickets is unrelated to income," while Humphreys and Pérez (2012) concluded that their results for the Spanish lottery market did not "show a strong relationship between income and expenditure on lottery tickets." Also, Barnes et al. (2011) found people with the lowest income to be the group that played the lottery the most and had the highest average of gambling days but dismissed the result when controlling for other socio-economic factors. On the other hand, Okunna et al. (2016), among others, showed that "gambling prevalence [...] increases with [...] household income," while Buja et al. (2019) also found that "a higher weekly income was positively associated with all the health-risk behaviors considered [gambling, drinking alcohol and smoking]." Some other studies linked lower income people to a higher likelihood of pathological gambling (Wardle et al., 2011; J. Welte et al., 2001) and to the most spending on lotteries (Clotfelter & Cook, 1991). Due to the contradictory evidence in this regard, as well as the weakly significant results obtained in Chapter 3, I have decided not to include personal income as an explanatory factor in this exercise.

All gambling stakeholders, from policymakers to operators and users, need clear, factual information in order to deliver informed decision-making about cross-consumption. In this regard, the availability of empirical evidence is critical for limiting the harmful cross-consumption effects of these products and designing appropriate protection and treatment mechanisms, particularly for potentially vulnerable individuals (adolescents, self-excluded gamblers and disorder-diagnosed individuals). The current lack of information, in addition to the findings on tobacco and alcohol that I address in Chapter 5.4, has helped me to settle on this particular area as the second research of my thesis.

Using data from the DGOJ, this chapter aims to better understand the drivers of consumer gambling by contributing to the study of determinants of gambling consumption, focusing on how tobacco smoking and alcohol drinking, as the only legal substances in Spain, affect the decisions of participation and expenditure in gambling. Since gambling consumption is actually a two-step process

(individuals first decide whether or not to participate, and then their optimal spending on gambling products), I propose a double-hurdle econometric model to accommodate the empirical exercise, as previous literature (Humphreys et al., 2009) has found this methodology to be the most appropriate.

This chapter is structured as usual. First, I describe the specific data for this research and outline its key variables. Then, I introduce the econometric model that I have developed and discuss the results and findings. Finally, I provide some closing remarks and policy advice, as well as notes on technical limitations and potential extensions.

4.2 | Methodology

As in the previous chapter, the data required for this analysis was obtained from the DGOJ database. Since the purpose of this research is to determine the impact of smoking and alcohol consumption on the decisions of gambling participation and expenditure, the dependent variable is the average monthly spending on any type of gambling product implying an actual economic bet. The survey provides this information in six increasing categories: "less than €10" (35.44% of self-declared gamblers), "between €10 and €50" (26.78%), "between €50.01 and €100" (5.76%), "between €100.01 and €300" (1.21%), and "more than €300" (0.26%). Non-gamblers obviously had no gambling expenditure at all (30.56%).

Consequently, tobacco smoking and alcohol consumption are the main independent variables of the econometric model, which are included in two ways: from a binary perspective (that is, yes or no) and from a frequency of consumption approach. Smoking frequency is defined as the daily number of packs, while alcohol frequency is defined as the frequency of any type of alcohol consumption. Both frequencies breaks down into six increasing ordered categories. These results will be particularly interesting, because in Chapter 5 I also consider the effects of substance use on the risk of developing gambling disorders specifically associated with online gambling. In any case, it is important to note that I assume that drinking and smoking come before gambling.

Gambling decisions are heavily conditioned by socio-demographic factors, as shown on a constant basis by empirical evidence (and as I myself will evidence in Chapters 5.4.1 and 5.4.2). In fact, gambling patterns and behavior are strongly determined by socio-demographic and health conditions (Barnes et al., 2011; Gainsbury et al., 2013; Humphreys et al., 2009; Okunna et al., 2016; Wardle et al., 2011; J. Welte et al., 2001; J. W. Welte et al., 2002), so other exogenous factors that may affect gambling participation and expenditure, such as gender, age, employment status and education level, are also included.

Individuals who either refused to respond to key questions or did not know or remember the answer were removed from the sample, as were observations with encoding errors. Accordingly, 199 individuals (2.92% of the sample) were dismissed, so 6617 remained. The resulting sample was balanced similarly to the original.

4.2.1 | Summary Statistics

Specific descriptive statistics show that about 76% of respondents have gambled at least once in their lifetime. Modal gambling expenditure was "less than €10 a month" (35.44% of gamblers), although "€10.01-€50" was quite common as well (26.78%). About 72% and 34% of participants claimed to be alcohol and tobacco users, respectively. Modal alcohol consumption was both "sporadically" and "only on weekends" (each totaled about 19.8% of individuals). Modal tobacco consumption was "between half and a pack of cigarettes a day" (16.64%).

Although the DGOJ's prevalence study focused on gambling consumption in 2015, the survey also included some questions about lifetime gambling habits, and the some specifically for the previous year (that is, 2014). Unfortunately, questions on alcohol and tobacco consumption were only referred to 2015, so no further information on these products was available for the analysis. Full summary statistics for this specific research are shown in Table 4.1.

Table 4.1: Summary Statistics

Variable	N	Prop.	Mean	SD	Min.	Max.
Gambling expenditure						
No expenditure	2,022	30.56%	—	—	—	—
€0 – €10	2,345	35.44%	—	—	—	—
€10.01 – €50	1,772	26.78%	—	—	—	—
€50.01 – €100	381	5.76%	—	—	—	—
€100.01 – €300	80	1.21%	—	—	—	—
€300+	17	0.26%	—	—	—	—
Gambling						
No	1,589	24.01%	—	—	—	—
Yes	5,028	75.99%	—	—	—	—
Age	6,617	—	47.89	17.59	18	95
Smoking						
No	4,384	66.29%	—	—	—	—
Yes	2,233	33.75%	—	—	—	—
Smoking (frequency)						
Non-smokers	4,384	66.25%	—	—	—	—
Not daily	169	2.55%	—	—	—	—
Less than 1/2 pack	725	10.96%	—	—	—	—
1/2 – 1 pack	1,101	16.64%	—	—	—	—
1 – 2 packs	224	3.39%	—	—	—	—
More than 2 packs	14	0.21%	—	—	—	—

Table 4.1 Summary Statistics (Continued)

Variable	N	Prop.	Mean	SD	Min.	Max.
Alcohol						
No	1,848	27.93%	—	—	—	—
Yes	4,769	72.07%	—	—	—	—
Alcohol (frequency)						
Non-drinkers	1,848	27.93%	—	—	—	—
Sporadically	1,317	19.90%	—	—	—	—
Once a month	278	4.20%	—	—	—	—
Only on weekends	1,303	19.69%	—	—	—	—
2 – 3 times a week	875	13.22%	—	—	—	—
Once a day	711	10.75%	—	—	—	—
Several times a day	285	4.31%	—	—	—	—
Gender						
Women	3,442	52.02%	—	—	—	—
Men	3,175	47.98%	—	—	—	—
Education level						
No education	399	6.03%	—	—	—	—
Primary	1,952	29.50%	—	—	—	—
Secondary	2,785	42.09%	—	—	—	—
Higher	1,481	22.38%	—	—	—	—
Employed						
No	3,366	50.87%	—	—	—	—
Yes	3,251	49.13%	—	—	—	—

4.3 | Econometric Modelling

As stated earlier, gambling expenditure is actually a two-step process: individuals first decide whether or not to participate, and, if they do, they then decide their optimal spending by maximizing their personal utility function. To account for this, here I propose a double-hurdle approach. Existing econometric literature has found that double-hurdle models are more appropriate than common, conventional tobit or Heckman models for this type of data, since a large number of observations are truncated at zero because people chose not to participate. (Humphreys et al., 2009). Tobit and Heckman models are also found to be too restrictive, whereas double-hurdle modeling allows covariates to have a different effect on both participation and expenditure decisions, which is actually to be expected.

A double-hurdle model is a combination of two equations known as hurdles. The first hurdle, Equation (4.1), models the participation decision; the second hurdle, Equation (4.2), models the expenditure decision. Individuals must cross both hurdles to contribute to gambling expenditure.

$$d_i^* = z_i' \alpha + \epsilon_{1i} \tag{4.1}$$

$$y_i^{**} = x_i' \beta + \epsilon_{2i} \tag{4.2}$$

Equation (4.1) is positive when individuals decide to participate and therefore cross the first hurdle; they now are considered potential contributors, as shown in Equation (4.3). However, even if individuals are willing to participate, their spending decisions may still be zero if this maximizes their utility function. Therefore, the second hurdle is only crossed when the optimal expenditure is greater than zero, as shown in Equation (4.4).

$$\begin{aligned}
d_i &= 0 \quad if \ d_i^* \leq 0 \\
d_i &= 1 \quad if \ d_i^* > 0
\end{aligned} \tag{4.3}$$

$$
\begin{aligned}
y_i^* &= \max(0, y_i^{**}) \\
y_i &= y_i^{**} d_i
\end{aligned}
\tag{4.4}
$$

Hence, the following double-hurdle specification is estimated. Equation (4.5) models the participation decision, while Equation (4.6) models the expenditure decision. Same covariates are used in both equations in order to observe their effects on both hurdles, which will be particularly interesting if either of these show opposite signs in both stages.

$$
\begin{aligned}
GamblingParticipation = \ &\alpha_0 \ + \ \alpha_1 \, Age \ + \ \alpha_2 \, Gender \ + \\
&\alpha_3 \, Education \ + \ \alpha_4 \, Employed \ + \\
&\alpha_5 \, Tobacco \ + \ \alpha_6 \, Alcohol \ + \ \epsilon_1
\end{aligned}
\tag{4.5}
$$

$$
\begin{aligned}
GamblingExpenditure = \ &\beta_0 \ + \ \beta_1 \, Age \ + \ \beta_2 \, Gender \ + \\
&\beta_3 \, Education \ + \ \beta_4 \, Employed \ + \\
&\beta_5 \, Tobacco \ + \ \beta_6 \, Alcohol \ + \ \epsilon_2
\end{aligned}
\tag{4.6}
$$

where *GamblingParticipation* is whether or not the individual is a gambler; *GamblingExpenditure* is the average monthly expenditure on gambling; *Age* and *Age^2* are the linear and quadratic age; *Gender* is each individual's gender; *Education* accounts for the highest education level reached (no education, primary, secondary and higher education); *Employed* is a dummy that controls whether or not the individual is employed; and *Tobacco* and *Alcohol* are categorical variables controlling for tobacco smoking and alcohol consumption from the binary and frequency perspective previously discussed. Keep in mind that the double-hurdle model, Equations (4.5) and (4.6), is estimated for both the binary and the frequency of consumption specifications. This is the only difference in both cases, since everything else (the dependent variable and socio-demographic covariates) remains the same.

4.4 | Results and Discussion

Estimated coefficients for both specifications of the double-hurdle model are shown in Table 4.2. Results for the main variables were statistically significant and positive, with the exception of the effect of alcohol consumption on the expenditure decision for the binary specification. While coefficients sizes are not directly interpretable in this form, their signs were consistent across both specifications and with existing literature. This cautiously suggests that gambling decisions are indeed conditioned by cigarette smoking and alcohol drinking.

The binary consumption model specification showed a strong positive relationship between tobacco and alcohol consumption and the likelihood of gambling. Likewise, gambling expenditure was strongly affected by smoking status, although no significant effect of alcohol was found.

In line with Okunna et al. (2016), the strongly significant quadratic age plots a regular parabola in both hurdles, meaning that the likelihood of gambling and having a greater spending increased up until 58 years old in both cases. The gender effect was as expected in both stages according to existing literature: males have a different gambling profile than females (Tackett et al., 2017) and are more likely to engage in potentially addictive activities (Griffiths et al., 2010; Okunna et al., 2016). All in all, these findings suggest that smokers and drinkers are indeed more likely to gamble, and that smokers are more likely to spend more.

As for the frequency of consumption specification, there was also a strong positive relationship between the frequency of tobacco smoking and alcohol drinking, and the likelihood of gambling. This relationship also applied to gambling expenditure: the more one drank and/or smoked, the more likely it was to have a greater expenditure. These effects, however, were much smaller in size than in the binary specification, though it should be noted that these are additive, since they represent the average effect for each level of frequency of consumption; that is, the more frequent the consumption, the more likely to participate and to spend more. The quadratic age also plots a regular parabola in both hurdles, with a global maximum at about 58 years old. The coefficient for the gender variable was statistically significant and showed the expected posi-

Table 4.2: Double-Hurdle Estimated Coefficients

	Binary Consumption		Frequency of Consumption	
	Participation	Expenditure	Participation	Expenditure
Tobacco	0.117 ***	0.133 ***	0.047 ***	0.048 ***
Alcohol	0.454 ***	-0.015	0.08 ***	0.028 ***
Other controls				
Age	0.07 ***	0.021 ***	0.069 ***	0.0167 ***
Age^2	-0.0006 ***	-0.00014 ***	-0.0006 ***	-0.0001 *
Gender	0.125 ***	0.309 ***	0.108 ***	0.265 ***
Education level	0.013	-0.0799 ***	0.026	-0.08 ***
Employed	0.039	0.046	0.048	0.038

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

tive sign, suggesting that men were still more likely to gamble and spend more (Griffiths et al., 2010; Okunna et al., 2016).

Although the education level was not found to have any effect on the likelihood of gambling, those with higher education appeared to be more likely to spend less on gambling products. This is not unexpected at all, but actually consistent with existing research. Humphreys and Pérez (2012)'s study of the expenditure on three Spanish lottery games showed this very same effect, as did Humphreys et al. (2009). When addressing interdependencies and time preferences for smoking, drinking and gambling, research found that the more education, the less time preference for gambling and therefore likelihood of addiction Ida and Goto (2009). In fact, the authors concluded that "governments might consider education as an effective countermeasure for stopping addictions."

To make the results easier to interpret, I calculated their average marginal effects; that is, the predicted average change in the likelihood of gambling and gambling expenditure for a one-unit change in the corresponding covariate. Table 4.3 presents these marginal effects for both the binary consumption and the frequency of consumption specifications.

Table 4.3: Marginal Effects

	Binary Consumption		
	Participation	**Expenditure (All)**	**Expenditure (Gamblers)**
Tobacco	4.36	15.32	12.15
Alcohol	14.21	22.44	-0.0003†
	Frequency of Consumption		
	Participation	**Expenditure (All)**	**Expenditure (Gamblers)**
Tobacco	1.74	5.85	4.48
Alcohol	2.69	6.17	2.82

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

On average, being a tobacco smoker increased the odds of gambling by 4.36 points; it increased the odds of having a greater expenditure by 15.32 points, regardless of gambler status; and gamblers who smoked were 12.15 points more likely to have a greater gambling expenditure than non-smokers. Likewise, alcohol drinking increased the odds of gambling by 14.21 points; and, regardless of gambler status, it increased the odds of having a greater expenditure by 22.44 points. No statistical differences on gambling expenditure were found for drinking and non-drinking gamblers.

As for the frequency specification, on average, each additional level of tobacco consumption increased the odds of gambling by 1.74 points; they increased the odds of having a greater expenditure by 5.85 points, regardless of gambler status; and gamblers who smoked were 4.48 points more likely to have a greater gambling expenditure than non-smokers. Furthermore, each additional level of alcohol consumption increased the odds of gambling by 2.69 points; they increased the odds of having a greater expenditure by 6.17 points, regardless of gambler status; and drinking gamblers were 2.82 points more likely to have a greater gambling expenditure than non-drinkers.

Intuitively, one would assume that each frequency of tobacco and alcohol consumption is likely to have a different effect on all three probabilities. Each

increase in the frequency of consumption of both products was found to increase those probabilities to some extent. Each additional level of consumption increased the likelihood of gambling in a decreasing progression, while it increased that of spending more on gambling conditioned on being a gambler in an increasing progression. Moreover, the likelihood of having a greater expenditure on gambling regardless of gambler status increased with each additional level of smoking in an increasing progression, but in a decreasing progression with each additional level of drinking. All effects were statistically significant. Details of these calculations are available in Table 4.4.

Table 4.4: Estimate Coefficients (By Level of Consumption)

	Participation	Expenditure (All)	Expenditure (Gamblers)
Tobacco			
Frequency level 1	0.018	0.059	0.045
Frequency level 2	0.017	0.060	0.045
Frequency level 3	0.017	0.061	0.046
Frequency level 4	0.016	0.061	0.046
Frequency level 5	0.016	0.062	0.047
Alcohol			
Frequency level 1	0.028	0.063	0.028
Frequency level 2	0.027	0.063	0.028
Frequency level 3	0.026	0.062	0.028
Frequency level 4	0.025	0.062	0.028
Frequency level 5	0.024	0.061	0.028

Note: All estimated average effects are statistically significant.

In short, this cautiously suggests that the more one smoked or drank, the more likely one was to gamble; to have a greater expenditure on gambling given that one was a gambler; and to have a greater expenditure in general.

4.5 | Closing Remarks

As gambling has never been as accessible and widely available as it is today, it has become an alternative form of entertainment. Gambling is a normalized activity and its global industry is expected to grow at annual rates close to 6% and to exceed \$565 billion by 2022, driven primarily by online gambling. However, widespread adoption is not without risk, as gambling consumption can lead to serious disorders. In fact, gambling regulation is more complicated than most market goods and services because it requires balancing out both its positive—mainly economic—and negative aspects.

Previous research has consistently found that gambling shares solid interdependencies with other potentially addictive behaviors, like tobacco smoking and alcohol drinking. In this regard, empirical findings suggest that this cross-consumption might actually have similar social, environmental, neurobiological and genetic features. Further research has also pointed to large differences in terms of gender, age and social and health conditions. Smoking and drinking are usually identified as having an impact to some extent on both gambling participation and expenditure decisions.

While the situation in Spain is no different, the prevalence rate of problem gambling remains among the lowest in developed countries, despite the large increase in the domestic supply of gambling products and the expansion of its industry over the last decades. As gambling is expected to keep growing in the coming years, policymakers need clear, factual information in order to deliver educated decision-making regarding cross-consumption, prevent problem gambling from worsening, and protect vulnerable groups.

This second chapter provided a reliable study for the Spanish market, with the goal of better understanding the determinants of gambling consumption in terms of how alcohol and tobacco consumption condition gambling participation and spending decisions. As gambling expenditure is actually a two-step decision, here I proposed a double-hurdle model to estimate how smoking and drinking affected the odds of gambling participation and expenditure by focusing not only on consumption from a binary perspective, but also from a frequency of consumption one. Double-hurdle models are established in the

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econometric literature to be the most appropriate methodology for this type of data and empirical exercise. Standard, common socio-demographics covariates in gambling literature were also included as controls.

Overall, smoking and drinking were found to be positively correlated with both gambling participation and spending decisions. These findings suggest, as confirmed by existing research, that tobacco and alcohol users are indeed more likely to gamble and spend more on gambling products. Marginal effects showed that these substances are associated with a significant increase in the odds of gambling and having a greater expenditure for both gamblers and non-gamblers alike. Reportedly, each additional level of frequency of consumption increases those odds to some extent. This means that the more an one smokes and/or drinks, the more likely one is to gamble, to spend more on gambling products given that one is a gambler, and to have a greater expenditure in general, regardless of gambler status.

In terms of policy implications, these results may help decision makers and gambling stakeholders to act against the cross-consumption of alcohol drinking, tobacco smoking and gambling. They are also useful for advertising campaigns, as they may be relevant to the mitigation of potential gambling-related harm. In any case, both public policies and operator actions should aim to ensure responsible consumption of all these products (perhaps even discouraging cross-consumption), particularly among vulnerable groups.

The same limitations apply in this case. The cross-sectional and retrospective nature of the prevalence study precludes understanding the underlying process of these findings, as well as establishing causal relationships between factors. Hence, no definitive claims can be made. Furthermore, the methodology that can be used is severely limited by the manner in which data on alcohol and tobacco consumption was collected. A longitudinal and more exhaustive study would benefit all gambling stakeholders, as it would allow them to determine whether smoking and drinking are actually leading to higher gambling product expenditure.

5

Online Gambling-related Harm

5.1 | Introduction

Online gambling has become its own economic and social phenomenon as a result of its unique and distinguishing characteristics. Multiple factors may account for its scale, including easier access to gambling at lower costs from the comfort of home, improved and expanded regulations, social acceptance, high marketing expenditure by gambling operators, some individuals' aversion to land-based gambling, and potential economic benefits anticipated by players (Griffiths et al., 2006; Humphreys & Pérez, 2012; R. Wood et al., 2007). Technological advancements have enabled anyone to gamble at any time and from anywhere on a wide variety of games that are usually brief, always available, require low wagers, and deliver quite immediate results (Gainsbury, 2015).

Online gambling participation, which has a clear economic motivation, still involves a trade-off between the positive (e.g., economic benefits from gambling taxes) and negative (e.g., compulsive consumption behaviours, addictive disorders, scams, frauds, and crime) aspects of its regulation, and is well known to produce externalities (usually in the form of a cost). Indeed, the particular characteristics of online gambling combine to form a "perfect storm" because they exploit the impulsive component that is common, and problematic, in its consumption, increasing the risk of disorders. As a result, online gambling is socially perceived as more dangerous than traditional, land-based gambling.

Researchers have shown a genuine interest in studying this social phenomenon and in trying to explain the direction of the relationship between online gambling participation and gambling-related harm, with one major question in mind: Is online gambling actually more harmful than conventional gambling? In this respect, empiric 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, while Griffiths et al. (2006), Gainsbury et al. (2013) and Canale et al. (2016), among many others, also found consistent results for different gambling markets and jurisdictions. On the other hand, Philander and MacKay (2014), using the 2010 edition of the same UK prevalence survey, concluded that online gambling participation is instead associated with a reduction in the odds of developing a gambling-related disorder.

In the specific case of Spain, online gambling is becoming increasingly relevant for the domestic market. In 2019, the online gambling industry reported a gross revenue of €776 million and a growth rate of about 7% year-on-year. Although active gamblers were down by 6.7%, the average monthly active game accounts and new game accounts saw an annual increase of 8.62% and 3.86%, respectively. Many other key figures were at all-time highs and followed an upward trend: marketing expenses, deposits and withdrawals, to name but a few, were up 11.74%, 15.84% and 20.44% year-on-year, respectively. Betting and casino segments accounted for about 87% of the industry's gross revenue and increased by 3.34% and 14.93%, respectively (DGOJ, 2019). However, online gambling is still socially perceived as addictive and potentially dangerous (DGOJ, 2015).

These concerns are not trivial. Gainsbury et al. (2013) precisely showed that online gambling participation can trigger serious gambling-related disorders, particularly in individuals from potentially vulnerable groups (adolescents and self-excluded or diagnosed problem gamblers). These authors also found evidence that online gamblers with actual gambling disorders are less likely to recognize the negative aspects of gambling and even their own gambling problems, as observed in Chapter 2.2.2's descriptive analysis of the sample.

Particularly concerned about this addictiveness, the Spanish government introduced in 2011 its first law on online gambling (*Ley 13/2011, de 27 de mayo, de regulación del juego*). Until then, online gambling was not prohibited, but there was no specific regulation in place to provide legal certainty as well as prevention and treatment mechanisms. The law, which is still in effect and has since undergone only minor amendments, required gambling operators to take preventive action to protect under-age and other potentially vulnerable people, as well as to identify, prevent and treat gambling-related disorders. It also established other new mechanisms for the protection of public order and the prevention of money laundering and terrorist financing, as seen in Chapter 2.1.

In any case, the relationship between online gambling and problem gambling remains unclear: Does a gambler engage in online gambling activities because he/she is already a problematic gambler, or does online gambling trigger gambling disorders? The answer is most likely not straightforward, as existing evidences suggest that this is, in fact, a spurious correlation, meaning that its effects are conditioned by some other unknown, uncontrollable factors. The question also raises the issue of endogeneity, though here I propose a two-stage approach in which the use of the Internet for leisure is utilized as an instrumental variable to address this concern.

Using data from the DGOJ, this last chapter of my thesis aims to contribute to the research of the relationship between online gambling participation and the prevalence of problem gambling by focusing not only on participation from a binary perspective, but also on the intensity of that participation, which is an unusual approach in gambling literature. Previous studies, such as Gainsbury et al. (2013) or Holtgraves (2009), have already hinted at a higher prevalence of problem gambling among online gamblers the higher their participation, so my approach has an empirical grounding.

This last chapter is structured as usual. First, I describe the specific data for this research and outline the methodology for quantitatively and objectively assessing online gambling-related problems. Then, I introduce the econometric model that have I developed and discuss my findings. Lastly, I provide a some final remarks, as well as notes on technical limitations and potential extensions.

5.2 | Methodology

As per usual, the data for this study was obtained from the DGOJ database, which was made from a survey that included 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 (group 1), mild but subclinical risk for gambling disorders (group 2), moderate but subclinical risk for gambling disorders (group 3), and likely diagnosis of pathological gambling (group 4). The classification into each of these severity groups is based on the overall screening score (0 points; 1-2; 3-4; 5 or higher, respectively).

Since it is reasonable and consistent with previous research (Wardle et al., 2011; Philander & MacKay, 2014), non-gamblers and those classified as non-risk players were grouped together, as it seems highly unlikely that a non-gambler would pose any risk of gambling disorders and would be classified into any group other than the no risk. It should be noted, though, that this is likely to bias estimates and overvalue the likelihood that self-reported gamblers will be classified into the no risk group.

Individuals who either refused to respond to key 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 raw information provided by the DGOJ, I created a dummy variable to account for online gambling participation based on self-reported participation frequencies in any online gambling product. This dummy was set to 0 (meaning non-online gambler) for all individuals who self-declared never having gambled online (93.03% of the sample) and to 1 (online gambler) for everyone else, regardless of their participation frequency and the number of games they played (6.97%).

In order to assess how the intensity of participation affects the risk of developing a gambling-related disorder, I also created a categorical variable as a proxy to online gambling intensity of participation, based on the number of on-

line gambling activities in which players participated. This variable ranged from 0 activities (93.03% of the sample) to 5+ activities (0.6%).

Lastly, I took into account other exogenous factors that are believed to affect the prevalence of problem gambling, including gender, age, employment status, education level, self-reported health status, and alcohol and tobacco consumption. As I have noted throughout my thesis, 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 a smoker and/or alcohol user (see Barnes et al. (2011); Gainsbury et al. (2013); Humphreys et al. (2009); Okunna et al. (2016); Wardle et al. (2011); J. Welte et al. (2001); J. W. Welte et al. (2002) for further insight on socio-demographics). Indeed, empirical evidence has identified certain interdependencies and correlations between alcohol, tobacco and gambling (Ida & Goto, 2009). Chapter 4 was precisely dedicated to this very specific issue.

As for online gambling in particular, Gainsbury et al. (2013) showed that younger gamblers are more likely to participate in a larger number of online gambling activities. Accordingly, I included another variable that controls for the number of gambling activities each player engages in, regardless of the outlet channel (offline or online).

5.2.1 | Summary Statistics

Using the DSM-IV screening, the proportion 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 are quite consistent with those provided by the DGOJ.

Specific descriptive statistics for this sample show that over 75% of respondents have gambled at least once in their lifetime. On average, Spanish gamblers

participate in three different games, though roughly 8% of respondents reported to gamble online (74% of them just in the last year).

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

Table 5.1: Summary Statistics

Variable	N	Prop.	Mean	SD	Min.	Max.
Age	5,956	—	48.02	17.64	18	95
Risk group						
No risk	5,945	93.74%	—	—	—	—
Mild	281	4.43%	—	—	—	—
Moderate	63	0.99%	—	—	—	—
Pathological gambling	53	0.84%	—	—	—	—
Online gambling						
No	5,900	93.03%	—	—	—	—
Yes	442	6.97%	—	—	—	—
Intensity of participation						
0 activities	5,900	93.09%	—	—	—	—
1 activity	212	3.34%	—	—	—	—
2 activities	101	1.59%	—	—	—	—
3 activities	60	0.95%	—	—	—	—
4 activities	31	0.49%	—	—	—	—

Table 5.1 Summary Statistics (Continued)

Variable	N	Prop.	Mean	SD	Min.	Max.
5+ activities	38	0.60%	—	—	—	—
Smoking						
No	4,236	66.79%	—	—	—	—
Yes	2,106	33.21%	—	—	—	—
Alcohol						
No	1,801	28.40%	—	—	—	—
Yes	4,541	71.60%	—	—	—	—
Gender						
Women	3,307	52.14%	—	—	—	—
Men	3,035	47.86%	—	—	—	—
Education level						
No education	391	6.17%	—	—	—	—
Primary	1,861	29.34%	—	—	—	—
Secondary	2,634	41.53%	—	—	—	—
Higher	1,456	22.96%	—	—	—	—
Employed						
No	3,233	50.98%	—	—	—	—
Yes	3,109	49.02%	—	—	—	—
Health status						
Very bad	66	1.04%	—	—	—	—
Bad	288	4.54%	—	—	—	—
Okay	1,309	20.64%	—	—	—	—

Table 5.1 Summary Statistics (Continued)

Variable	N	Prop.	Mean	SD	Min.	Max.
Good	2,575	40.60%	—	—	—	—
Very good	2,104	33.18%	—	—	—	—
Internet use						
No use	2,450	38.63%	—	—	—	—
Less than 1 hour	1,750	27.59%	—	—	—	—
Between 1 and 2 hours	1,287	20.29%	—	—	—	—
Between 2 and 3 hours	476	7.51%	—	—	—	—
3+ hours	379	5.98%	—	—	—	—

5.3 | Econometric Modelling

As discussed in Chapter 5.2, the dependent variable of the model is an ordinal categorical variable consisting of the classification of individuals into each four groups of severity. Since this variable is ordered from lowest to highest risk, the most suitable approach is to use an ordered probit model, which is a derivative of the well-known regular probit model and is used to estimate the relationship between an ordinal response variable with more than two ordered outcomes and a set of explanatory factors. Its generic form is shown in Equation (5.1).

$$\Pr(Outcome_j = i) = \Pr(K_{i-1} < \beta_1 x_{1j} + \beta_2 x_{2j} + \ldots + \beta_k x_{kj} + u_j < K_i) \tag{5.1}$$

In this case, the ordered probit model is appropriate for assessing how online gambling participation affects the risk of having a gambling-related disorder. I propose the following model specification to explore this relationship:

$$
\begin{aligned}
\Pr(DSMIVGroup) \;=\; \Pr(K_{i-1} \;<\;& \beta_1\,OnlineGambling \;+ \\
& \beta_2\,Activities \;+\; \beta_3\,Gender \;+\; \beta_4\,Age \;+ \\
& \beta_5\,Employed \;+\; \beta_6\,Health \;+\; \beta_7\,Smoking \;+ \\
& \beta_8\,Alcohol \;+\; u_j \;\leq\; K_i)
\end{aligned}
\tag{5.2}
$$

where $DSMIVGroup$ is the dependent variable; $OnlineGambling$ accounts for either online gambling participation or intensity of participation; $Activities$ adds up the total number of gambling activities that each individual engages in; Age is the exact age; $Gender$ is the gender; $Employed$ 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 ordered in five categories (from very bad to very good); and lastly, $Smoking$ and $Alcohol$ are categorical variables that control whether the individual is a tobacco and/or alcohol user, respectively.

Based on the general specification from Equation (5.2), I estimate the participation model (to assess the effect of online gambling participation from a binary approach on the development of gambling-related disorders) and the intensity of participation model (specifically in order to determine how the intensity contributes to the risk of suffering any kind of harm) separately. This is the only difference between both, since everything else remains the same.

However, estimation of Equation (5.2) raises an issue of endogeneity, as there is a recursive and still undetermined link between online gambling and the risk of having a gambling-related disorder. As I discussed in Chapter 5.1, the gambling literature has yet to find solid, consistent evidence on this specific relationship, its direction remains unclear, and researchers should not make any assumptions about it; if incorrect assumptions are made, estimates and results will be biased. Two-stage methods are a common and standard practice in econo-

metrics to solve endogeneity problems. Here, I propose the following model specification as the first stage of the estimation of Equation (5.2):

$$\Pr(OnlineGambling) \;=\; \Pr(\alpha_0 \,+\, \alpha_1\, InternetUse \,+\, \epsilon_i) \qquad (5.3)$$

where *InternetUse* is an instrumental variable that tracks the daily use of the Internet for leisure in five ordered categories (no use; less than one hour; between one and two hours; between two and three hours; more than three hours). Note that Equation (5.3) is estimated as a regular probit model for the online gambling participation specification, but as an ordered probit model for the intensity of participation specification. Here, it seems reasonable to assume that online gambling participation is highly influenced by personal skills in the use of computers, mobile devices and Internet browsing in general, but not the other way around—that is, better skills do not imply higher odds of gambling online.

In this regard, 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). I tested the strength of the instrument using the Cragg-Donald F statistic, which was 54.61 for the participation specification and 61.48 for the intensity of participation one. Both values greatly exceed all Stock and Yogo (2005) thresholds, so I cautiously consider the instrument to be not weak and therefore valid.

5.4 | Results and Discussion

Estimated coefficients for Equation (5.2) are shown in Table 5.2. Results showed a positive sign with a strong statistical significance for both the online gambling participation and the intensity of participation coefficients, though they were significantly different in size. This finding suggests, as did previous research (Griffiths et al., 2009, 2006; Gainsbury et al., 2013; Canale et al., 2016), that online gambling is positively correlated with the development of gambling-related disorders, the severity of which is likely to worsen as individuals participate in a larger number of online gambling activities. Succinctly , this cautiously points

out that the more one gambles online, the more likely one is to develop a gambling disorder.

Table 5.2: Ordered Probits Estimated Coefficients

	Participation		**Intensity of Participation**	
Online gambling	2.11 ***	1.457 ***	0.509 ***	0.224 ***
Number of 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 level	-0.03	-0.017	-0.012	0.02
Health status	-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%.*

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 (as seen in Chapter 4, this is not surprising at all), and in poor self-reported health (Barnes et al., 2011; Gainsbury et al., 2013; Humphreys et al., 2009; Okunna et al., 2016; Wardle et al., 2011; J. Welte et al., 2001; J. W. Welte et al., 2002). Employed people were found to be less likely to experience problem gambling. No statistically significant results were observed for age or education level (as evidenced in Chapter 4).

5.4.1 | Online Gambling Participation

Since raw estimated coefficients of a probit model are not directly interpretable, I calculated their average marginal effects for each specification; that is, the estimated average change in the DSM-IV classification for a one-unit change in the corresponding independent factor.

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 points, respectively.

Table 5.3: Estimated Probabilities (Participation Specification)

	No risk	Mild risk	Moderate risk	Problem gambler
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.

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 model that is certainly constrained and basic. A mere binary dummy variable seems far too simple to model a phenomenon as multi-layered as online gambling, as one would expect this dummy to capture the effects of a large number of exogenous personal factors in bulk. Precisely, this average effect is strongly influenced by socio-demographic factors and the total number of gambling activities that players engage in.

Indeed, socio-demographic factors play a major role in determining the risk of having a gambling-related disorder. This is evidenced in Table 5.3, where I provide the estimated odds of being classified into each DSM-IV group for different gambler profiles. Using the median gambler profile as a reference (scenarios 1 and 2), offline gambling on its own does not appear to be problematic, as the probability of having any risk of problem gambling was roughly 3.2% for men and 2.3% for women, respectively (however, note that the odds of suffering

a disorder were twice as high for men as for women). When considering online gambling while ceteris paribus (scenarios 3 and 4), these probabilities increased dramatically to approximately 34% for men and 29% for women. What seems particularly troubling about these estimates is that men and women have 7.7% and 6% chance of having a likely diagnosis of pathological gambling.

Although not shown in Table 5.3, a better health condition and no smoking and/or alcohol consumption (as discussed in Chapter 4, these products were positively correlated with both gambling participation and spending decisions, so tobacco and alcohol users were more likely to gamble and spend more on gambling products) significantly lowered the risk for every gambler profiles.

In short, these results show that problem gambling is likely to be strongly dependent on socio-demographic factors, while suggesting that there is a remarkable connection between online gambling participation and gambling-related harm, to some extent stronger than offline gambling.

5.4.2 | Online Gambling Intensity of Participation

Likewise, I computed the average marginal effects for the intensity of participation specification, which are shown in Table 5.4. Overall, results showed that online gambling increased the risk of gambling disorders, and the more one played, the higher the risk. On average, each additional level of intensity reduced the probability of being a non-problem gambler by 2.26 percentage points, while it increased the probability of having a mild risk by 1.46, a moderate risk by 0.404, and a diagnosis of pathological gambling by 0.396 points, respectively.

Intuitively, one would assume that each additional level of intensity could have a different effect on the risk depending on the current intensity, because it seems very unlikely that perseverance in gambling would affect a player who does not play online in the same way as another who plays five or more games. In fact, this intuition is what lead me to believe that the intensity of the participation specification is more thorough in explaining the prevalence of problem gambling than the binary approach, given that it actually considers the frequency of online gambling. Precisely, estimates in Table 5.4 showed that the more intensity, the more risky each additional level of intensity was.

Table 5.4: Marginal Effects (Intensity of Participation Specification)

	No risk	Mild risk	Moderate risk	Problem gambler
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.

Similar to the binary participation specification, the intensity of participation specification also suggests that online gambling significantly increased the risk of gambling-related disorders. It also appears to support the widespread perception that this risk continues to increase as participation intensifies. This is consistent with previous research, such as Gainsbury et al. (2013), who concluded that "the additive impact of multiple gambling activities, rather than specifically engaging in online gambling, may be related to negative consequences of gambling for Internet gamblers," or Holtgraves (2009), who stated that "more frequent playing of any game was associated with increased problem gambling scores."

Table 5.5: Estimated Risk (Intensity of Participation Specification)

	No risk	Mild risk	Moderate risk	Problem gambler
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.

This way, online gambling from the intensity of participation specification does not seem to be as concerning as in the binary specification, because occasional online gambling was found to be non-problematic. Table 5.5 shows the odds of being classified into each risk group for each level of intensity. On average, an individual who participated in only one online gambling activity is about 8% likely to experience some risk of problem gambling. These odds increased as online gambling intensified, up to 27% for a gambler who was involved in five or more different online products. Although this happens in all three risk groups in general, the effect is concentrated mostly in the mild risk group. However, the higher the level of intensity, the more likely it was to have a potential diagnosis of pathological gambling rather than a moderate risk.

5.5 | Closing Remarks

Online gambling has grown into a very profitable industry worldwide. There are many factors that may account for its scale, but technological development has certainly led to easier access, lower costs, and availability at all times and from anywhere. However, online gambling still involves a trade-off between the benefits of its regulation and its negative aspects, with pathological gambling being the main concern of governments, operators and society.

The situation of the Spanish industry is no different. Online gambling set a record revenue of about €776 million in 2019, a year-on-year increase of 7% and about one million active monthly players. Online gambling is socially perceived as more addictive and potentially harmful than traditional, land-based gambling, likely because of its particular characteristics. At this regard, previous research has precisely shown that online gambling can trigger serious gambling-related disorders, particularly in individuals from potentially vulnerable groups. The Spanish Government passed its first law on online gambling in 2011 requiring gambling operators to take concrete action to protect minors and potentially vulnerable people, as well as to identify, prevent and treat gambling-related disorders.

Scientific literature has shown an increasing interest in trying to shed light on the relationship between online gambling and the risk of suffering some kind of gambling-related harm. Existing empirical evidence is generally robust and consistent: online gamblers have a significantly higher prevalence of problem gambling than offline gamblers.

This last chapter of my thesis attempted to contribute to this ever-growing literature by focusing not only on online gambling participation from a binary perspective, but also on the intensity of participation, which is an unusual, though empirically grounded, approach in gambling research. In addition, I also addressed the endogeneity concern inherent in this exercise, as there is a recursive and still undetermined link between online gambling and gambling-related disorders that, if not resolved, would bias estimates.

In short, online gambling participation was found to have a significant impact on the risk of developing gambling-related disorders, which increased as participation intensified. If online gambling were a harmful practice as it is believed, the estimated risk from the intensity of participation specification should increase, which is exactly what the findings suggest. As expected from prior research, socio-demographic factors played a key role in determining the risk. In particular, the results showed strong interdependencies between smoking, alcohol and online gambling-related harm. Chapter 4 precisely concluded that they were positively correlated with both gambling participation and spending decisions, so their users were more likely to gamble and spend more on gambling products.

However, the cross-sectional and retrospective nature of the prevalence study makes it impossible to provide definitive claims about the underlying process of these results. As public health concerns over gambling issues have been the strongest argument against the widespread adoption of online gambling, further longitudinal studies would be beneficial to determine whether online gambling actually leads to problem gambling and to shed light on the endogenous relationship. Furthermore, there are likely to be significant differences in the risk between games, modalities, and even online operators (e.g., lottery should not be as problematic as slots machines), which I have not addressed in this study. This is a promising extension for future research papers.

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Concluding Remarks

My doctoral thesis has attempted to provide objective information on three key aspects of individual economic agents' gambling behavior: how they react to drastic changes in its regulation, which have likely resulted in a significant increase in gambling supply, the effect of cross-consumption of gambling products and other potentially addictive products (e.g., alcohol and tobacco) on them, and the risk of having a gambling-related disorder specifically associated to the consumption of online gambling as opposed to traditional, land-based gambling.

The Directorate General for Gambling Regulation (DGOJ)'s first study of the prevalence of pathological gambling and the characteristics of gambling users, conducted in Spain in 2015, served as the foundation for the three different research studies that comprise this thesis. Although the economic scope of the gambling industry was well known, until then there was a lack of reliable scientific evidence on the extent of the risks linked to gambling in Spain in accordance with a responsible gambling strategy. The survey collected a wide range of socio-demographic information as well as information on gambling, tobacco, alcohol, and other entertainment products and services consumption habits from about 7000 adults across Spain.

The prevalence study, which was embedded in the DGOJ's first Responsible Gambling Strategy and was supported by industry stakeholders and health professionals, resulted in a technical report based solely on a descriptive analysis of the data. The three research chapters featured in this document, on the other hand, have provided a conditional analysis that have also considered potential

correlations between individuals' factors.

In the first one, I have explored how the propensity of the Spanish population to start gambling has changed after a number of significant changes in its regulation, which has led to a very significant increase in the supply of gambling products. The Spanish gambling industry has undergone major modifications throughout history, and, in recent decades, the domestic market has seen an expansion of gambling opportunities as a result of its progressive liberalization, transitioning from almost total prohibition prior to 1977 to instant and always available access beginning in 2011 with the legalization of online gambling. The economic figures grew accordingly, implying that participation had also increased—in fact, it is to be expected that the consumption of a good increases as it becomes more accessible—but there was no reliable data to back this up.

This empirical exercise had to take into account a distinctive characteristic of the population under study. It is assumed that some people are inherently non-gamblers and will never consume gambling products regardless of market supply or access conditions. For the econometric model to be robust, such individuals could not be given the same consideration as those who were not gamblers at the time of the survey but would be at some point in the future; otherwise, the estimates would include a bias that would be difficult to quantify. To account for this particularity, I have proposed a split population duration model in which the estimated probability of starting to gamble of individuals who were not yet gamblers provided feedback to the estimate of the general population's propensity to start gambling.

The findings have but confirmed the hypothesis that a greater supply of gambling, as a result of gradual market liberalization and normalization of gambling products, has increased the likelihood of starting to gamble. In general, younger age cohorts are more likely to start gambling at some point in their lives, though this effect diminishes over time. This is not surprising at all for a number of reasons. Young people, generally educated in largely digital environments, have been directly exposed to a wide supply in which online games, accessible at any time and from anywhere, have an increasing presence; in-person gambling establishments and betting venues have proliferated over the last few years; and

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advertising and gambling promotions in online and offline channels have intensified.

On the contrary, it was certainly unexpected to observe that those with a higher level of education were more likely to gamble. After all, allocating a portion of one's disposable income to gambling products is an irrational decision in itself, because gambling products, particularly lotteries, exhibit a negative expected value. This logical reasoning process requires a mathematical skill, which is presumed to be inherent in the educational level. Thus, gambling has always been associated with uneducated people—"gambling is a tax on stupidity" or "lottery is a tax on people who are bad at math"—who lack the ability to make rational decisions without giving in to emotions. However, recent empirical evidence suggests that participation in and spending on gambling products are associated with higher intelligence (as measured by IQ, presumably higher the higher the level of education). Individuals who are a supposed to be more rational also behave irrationally when it comes to gambling, implying that the consumption of gambling products is likely motivated by emotional and/or recreational reasons.

In any case, each change in regulation has contributed to a decrease in the average duration as a non-gambler; in other words, it has contributed to increasing individuals' propensity to gamble. In fact, each change has marginally increased this propensity more than the previous one. From a gender perspective, men—generally more prone to risk, uncertainty and overconfidence—continue to gamble more and earlier than women, but the situation for women has gotten marginally worse with each increase. Overall, these results show that the liberalization of the industry that began in 1977, resulting in greater supply and improved accessibility, has dramatically changed consumers' attitudes and behavior toward gambling. This was actually to be expected, since gambling was banned prior to that time. Its access was very restricted, so that, if there was an interest in gambling, opportunities for initiation were scarce (and illegal, if it involved gambling in a black-market setting).

These findings provide relevant knowledge about the impact of public policies aimed at expanding gambling opportunities. Here is evidence that greater gambling availability not only increases the likelihood of participation, but also

increases the likelihood of starting earlier—particularly among the younger population—, so future industry reforms must take into account that expansive policies will continue to encourage and facilitate participation. If policymakers' true goal is to balance the negative and positive aspects of gambling, it may be time to align public policies with responsible gambling strategies, such as the one promoted by the DGOJ.

In this regard, strong restrictions on betting and gambling advertising were introduced in November 2020, despite industry opposition: operators are not permitted to sponsor sports teams in any way; radio and television advertising is limited to the late-night slot; internet advertising cannot be directed to minors under any circumstances and to the adult population only with the recipient's consent, and cannot use the image of "celebrities"; and recruitment bonuses are banned, while offers can only be directed to verified players and never to pathological gamblers. Meanwhile, some autonomous communities—privately operated gambling regulation competences are decentralized—have begun to reform their regulations in order to limit the placement of betting and gambling outlets nearby schools, to strengthen access control to prevent minors and self-excluded individuals from entering, and to turn on slot machines in the hospitality industry at the express request of an interested party. The evaluation of the scope of these measures could be a very interesting future line of research.

In the second research chapter of my thesis, I I have looked at the concurrent use of gambling and other potentially addictive consumer products. Gambling opportunities have not only expanded over the last few decades, as I have discussed in previous paragraphs, but they have also entered new locations. Among other things, the industry's liberalization that started in 1977 allowed the deployment of gambling machines with betting and chance components—the regulation classifies these machines into type "A", "B", or "C" depending on their mode of operation—in hospitality establishments, at the same time that casino and gambling venues expanded across Spanish territory. All of this has enabled gambling to be consumed alongside tobacco and alcohol, both of which are widely known for their ability to cause addiction, dependence, and other serious health problems. As gambling becomes more popular as a leisure and social activity, there is concern that these three products will feed off each other,

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exacerbating their negative aspects.

The empirical evidence is quite clear in this regard. The consumption of gambling products is strongly correlated with the consumption of tobacco and alcohol, but not only because of cross-consumption, but also because all three share aspects that can aggravate the joint response and, thus, ease and worsen the development of potential physical and mental health problems. As a result, it has been observed on multiple occasions that people who smoke and/or drink engage in and spend more money on gambling products. Although these conclusions are expected to hold true for the Spanish market, as far as I am aware, my thesis presents the first empirical research that quantifies this phenomenon by studying how tobacco and alcohol consumption influence gambling participation and spending decisions.

The availability of empirical evidence is critical for addressing the cross-effects of these products and designing appropriate protection and treatment mechanisms. In fact, it is essential that public policies give special consideration to young people, as they are a high-risk group for a variety of reasons. They are constantly exposed to alcohol, drugs, and even gambling as a result of their lifestyles; they are more likely to develop addiction problems due to their inexperience and naivety; they lack the capacity to consume these products responsibly; they are unaware of the seriousness of potential health, social, and economic problems that they can trigger; and the development of an addictive disorder during their youth can seriously affect their adult life.

In the empirical exercise, I have estimated a double-hurdle model to account for the fact that the expenditure decision on gambling products is in fact a two-stage process: first, one decides whether or not to participate, and then the optimal amount to spend. While the methodology is fairly common in microeconometric research, in this case I have considered not only alcohol and tobacco consumption in binary terms (yes or no), but also the intensity of consumption. Here, it seems reasonable to assume that the impact of these products on gambling expenditure is also influenced by the intensity with which they are consumed.

The findings have supported previous hypotheses and reproduced the findings in other countries. Consumption of alcohol and/or tobacco is not only asso-

ciated with a higher likelihood of consuming and spending more on gambling, but the more frequently consumed, the higher the probability and expenditure. As with the propensity to start gambling, interest in gambling gradually fades over time, and men are more likely to participate and spend more than women, presumably due to their lower risk aversion.

In the third and final research, I have analyzed the marginal effect that online gambling participation has on the likelihood of developing gambling-related harm. Online gambling has some peculiar characteristics—it is always available, can be accessed from anywhere through multiple electronic devices, and provides consumers with a variety of games and activities that generally deliver immediate results—that can lead to a number of behavioral problems. If gambling disorders are triggered by experiences that exploit and abuse the neurological systems of pleasure and reward as the literature claims, online gambling may come to be perceived as a riskier product than offline gambling.

In this regard, empirical evidence suggests that online gambling is associated with a higher prevalence of gambling-related problems than traditional gambling. The effect is present in all users, but it is especially pronounced in young people and other at-risk groups for the same reasons discussed above; thus, having reliable information is critical in order to devise appropriate protection and treatment mechanisms. However, the direction of causality of this relationship remains unclear and actually raises suspicions of an endogeneity problem: do online gambling users turn to online gambling because they already have problems, or does online gambling trigger the problems?

The gambling regulation reform enacted in 2011 was a milestone for the Spanish market, among other things, because it regulated online gambling for the first time. It was not illegal until then, but there was no specific legislation to provide consumers with rights and protection and operators with legal certainty. However, as I have previously stated, the consequences of this regularization have received little empirical attention. We already know from the first research chapter that successive market liberalizations have made consumers more likely to participate; in this final one, I have addressed the relationship between online gambling consumption and the prevalence of gambling-related problems for Spanish gamblers.

The analysis was approached using the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) methodology to estimate gamblers' risk of developing gambling problems. The DSM-IV is a standard widely used by researchers and healthcare personnel to classify gamblers into four ordered groups of increasing risk (from "no risk" to "probable diagnosis of pathological gambling") based on their gambling habits. Using this screening, 93.74% of gambling users were classified into the no risk group, while 0.84% were classified into the highest risk group. I have proposed an ordered probit model with instrumental variables to address potential endogeneity, in which online gambling consumption was the main predictor, to estimate the probability that a user was classified into each group. As in the case of tobacco and alcohol, it is to be expected that risk is driven to some extent by the intensity of consumption, so here I have also considered online participation from a binary perspective and in terms of its frequency. This is a novel approach in gambling literature, although previous research had already anecdotally observed a higher prevalence of gambling problems as online participation increased.

The findings were consistent with prior research. In short, online participation is associated with an increased risk of developing a gambling problem, and such risk becomes increasingly higher as the intensity of gambling increases. However, the findings also suggest that other personal determinants (e.g., socioeconomic status or consumption of other potentially addictive products) have a significant impact on that risk. In any case, light online gambling does not seem to be problematic.

Furthermore, there are likely to be significant differences in the risk of pathological gambling between games, modalities, and even online establishments (e.g., own promotions in the form of sign-up bonuses, free bets, and improved betting odds), which has not been discussed here but was anecdotally addressed in the DGOJ's descriptive results of the prevalence study. For instance, online lottery ticket purchases do not appear to be as problematic as slot machines, which attempt to capitalize on the impulsive nature of games to increase consumption.

All industry stakeholders' efforts should therefore be focused on preventing compulsive gambling consumption. As discussed earlier, the most recent

changes to gambling regulation law imposed restrictions on operators' commercial communications with the goal of making their advertising less enticing to consume. Indeed, one of the major criticisms leveled at online gambling in recent years has been that its advertising was too aggressive, due largely to the frequency with which it appeared, as well as the use of appealing statements and celebrities. To address all of these issues, policymakers and operators could come to an agreement to implement additional measures, such as broadening the scope of these restrictions, imposing limits on the maximum duration of gambling sessions and spending amounts within a certain time frame, or reinforcing control over minors and self-excluded users on the service.

All of this, in conjunction with the results discussed throughout this doctoral thesis, opens up the possibility of extensions that would be very interesting as new lines of work for future research For instance, to extend the scope of the analysis of the risk specifically associated with online gambling to distinguish between different games, modalities, and operators to test the hypothesis that not all pose the same risk; to assess the scope of all the new restrictions discussed in previous paragraphs; to replicate some of my research chapters with future editions of the prevalence study to compare the evolution of the results; or to use other methodologies in case future editions—or alternative studies—provide more exhaustive information on the consumption of other potentially addictive products.

The prevalence study's information design on alcohol and tobacco consumption strongly conditions (and reduces) the potential econometric methodology to be used, so future studies should consider including this information in a more disaggregated and precise manner. In any case, the three research chapters share the same general technical limitations as a result of the prevalence study's retrospective and cross-sectional nature, as this does not allow interested parties to truly clarify the underlying processes of the effects discussed throughout the thesis, nor to establish causal relationships between factors. A longitudinal prevalence study would greatly benefit all industry stakeholders, from policymakers to operators and consumers, in order to overcome these limitations and design more and better prevention policies to ensure responsible gambling consumption.

Conclusiones finales en español

Mi tesis doctoral ha tratado de aportar información nueva, actual y, sobre todo, objetiva sobre tres aspectos clave del comportamiento de los agentes individuales en relación con los juegos de azar: cómo reaccionan ante unos cambios drásticos en su regulación que probablemente ha llevado a un aumento significativo de la oferta de juego, qué efecto tiene sobre ellos el consumo cruzado de productos de azar y otros potencialmente adictivos (por ejemplo, el alcohol y el tabaco), y el riesgo de experimentar algún problema relacionado con el juego asociado específicamente al consumo de juegos de azar *online* en comparación con los juegos tradicionalmente presenciales.

Los diferentes ejercicios de investigación en los que se estructura esta memoria han tenido como base común el primer estudio de prevalencia de juego patológico y características de los usuarios de juegos de azar para el mercado español realizado en 2015 por la Dirección General de Ordenación del Juego (DGOJ). El alcance económico de la industria del juego era ciertamente conocido, pero hasta entonces no existía evidencia científica fiable sobre el alcance de los problemas derivados de los juegos de azar en la sociedad española alineado con una estrategia de juego responsable. La encuesta fue respondida por casi 7000 adultos de todo el país y recogió multitud de información sociodemográfica y de hábitos de consumo de juegos de azar, tabaco, alcohol y otros productos y servicios de entretenimiento.

El estudio de prevalencia, integrado en una Estrategia de Juego Responsable desarrollado por la DGOJ con el apoyo externo de representantes de todas las

partes implicadas de la industria y profesionales sanitarios, dio lugar a un informe técnico basado únicamente en un análisis descriptivo de los datos recogidos. En cambio, los tres capítulos de investigación de esta tesis doctoral han aportado un análisis condicional que ha considerado las posibles relaciones entre las diferentes variables incluidas en la encuesta.

En el primero de ellos he estudiado cómo ha variado la propensión a comenzar a participar en juegos de azar de la población española tras una serie de cambios significativos en su regulación que ha llevado a un aumento muy importante de la oferta de productos de azar. El mercado del juego español ha experimentado grandes cambios a lo largo de la historia y, en las últimas décadas, el sector nacional ha vivido una expansión de las oportunidades de juego como consecuencia de su progresiva liberalización, pasando de una prohibición casi absoluta antes de 1977 a un acceso inmediato y siempre disponible a partir de 2011 con la legalización del juego *online*. Los resultados económicos crecieron consecuentemente, lo cual ya dejaba intuir que la participación también había aumentado—de hecho, es de esperar que el consumo de un bien aumente cuanto más accesible sea—, pero no existía información veraz para contrastarlo.

El desarrollo de este ejercicio empírico debía considerar una particularidad de la población objeto de estudio: es de suponer que algunos individuos son inherentemente no jugadores y, por tanto, nunca consumirán productos de azar indistintamente de la oferta de mercado o de las condiciones de acceso. Para que el modelo econométrico fuera sólido, tales individuos no podían recibir la misma consideración que aquellos individuos que todavía no eran jugadores en el momento de la encuesta pero que lo serían en algún momento futuro; de lo contrario, las estimaciones incorporarían un sesgo difícil de cuantificar. Para tener en cuenta esta peculiaridad, he propuesto una metodología inusual en la literatura científica específica: un modelo de duración de población dividida (*split population duration model*) en el que la probabilidad estimada de comenzar a jugar a juegos de azar de los individuos que todavía no eran jugadores retroalimentaba la estimación de la propensión de comenzar a jugar de la población general.

Los resultados no han hecho sino confirmar la hipótesis de que una mayor oferta de juego, fruto de la paulatina liberalización del mercado y popular-

ización de los productos, ha incrementado la propensión de comenzar a jugar. En general, las cohortes de edad más recientes son más propensas a comenzar a jugar en algún momento, si bien el efecto decae progresivamente a lo largo de la vida. Este efecto no es para nada sorprendente por diversas razones. Los jóvenes, generalmente educados en entornos ampliamente digitales, se han encontrado directamente con una amplia oferta en la que los juegos *online*, accesibles en cualquier momento y desde cualquier lugar, tienen cada vez mayor presencia; las salas de juegos y locales de apuestas presenciales han proliferado durante los últimos años; y la publicidad y las promociones de juego en los canales *offline* y *online* se han intensificado.

Al contrario, sí que ha sido ciertamente inesperado encontrar que las personas con mayor nivel de educación eran más propensas a jugar. Al fin y al cabo, destinar parte de la renta disponible a gasto en productos de azar es una decisión irracional en sí misma, pues los juegos, especialmente las loterías, tienen generalmente un valor esperado negativo. Este proceso de razonamiento lógico requiere una habilidad matemática suficiente que se presume inherente al nivel formativo. De esta manera, los juegos siempre han estado vinculados a individuos sin formación—la lotería es «el impuesto de los tontos» o su equivalente en inglés, «*gambling is a tax on stupidity*»—que no tienen la capacidad necesaria para tomar decisiones racionales sin entregarse a las emociones. Sin embargo, la evidencia empírica más reciente apunta en la dirección contraria: la participación y el gasto en productos de azar parecen estar efectivamente asociados a una mayor inteligencia (medida por el cociente intelectual, presumiblemente mayor cuanto mayor sea el nivel de educación). Los individuos a priori más racionales también se comportan irracionalmente a la hora de jugar, por lo que es probable que el consumo de productos de azar obedezca simplemente a motivos emocionales y/o lúdicos.

En cualquier caso, cada cambio en la regulación ha contribuido a reducir la duración media como no jugador; dicho de otra manera, ha hecho que la población española sea más propensa a participar en el juego. De hecho, cada cambio ha aumentado marginalmente más dicha propensión que el cambio anterior. Desde una perspectiva de género, los hombres—generalmente más proclives al riesgo, la incertidumbre y la sobreconfianza—siguen jugando más y

más temprano que las mujeres, pero la situación de las mujeres ha empeorado más en términos marginales con cada incremento. En conjunto, estos resultados constatan que la liberalización del sector iniciada en 1977, resultando en una mayor oferta y mejor accesibilidad, han cambiado significativamente la actitud y el comportamiento de los consumidores para con los juegos de azar. Esto era de esperar, pues el juego estaba prohibido antes; el acceso estaba muy restringido, por lo que, de tener interés por el juego, las oportunidades para iniciarse eran escasas (e ilegales, si involucraba juego clandestino).

Estos resultados aportan una información relevante acerca de las repercusiones de las políticas públicas dirigidas a ampliar las oportunidades de juego. Aquí se ha visto que una mayor disponibilidad de juego no solo hace más probable que alguien participe, sino que empiece a hacerlo antes—afectando especialmente a la población más joven—, por lo que futuras reformas del sector deben tener en cuenta que políticas expansivas seguirán fomentando y facilitando la participación. Si el verdadero objetivo de los responsables políticos es equilibrar los aspectos negativos y positivos de la actividad, quizás sea el momento de alinear las políticas públicas con la Estrategia de Juego Responsable promovida por el propio regulador.

A este respecto, en noviembre de 2020 se introdujeron fuertes restricciones a la publicidad de apuestas y juegos de azar (los operadores no pueden patrocinar de ninguna manera equipos deportivos; la publicidad en radio y televisión debe circunscribirse sólo a la franja de madrugada; la publicidad en internet no puede dirigirse en ningún caso a menores de edad y a la población adulta sólo cuando exista consentimiento expreso del receptor, y no puede usar la imagen de «celebridades»; y los bonos de captación quedan prohibidos, y las ofertas sólo pueden dirigirse a jugadores verificados y nunca a jugadores patológicos) con la oposición de la industria, mientras que algunas comunidades autónomas—las competencias de regulación del juego presencial están descentralizadas—han comenzado a reformar sus normativas para limitar el emplazamiento de salas de apuestas y juegos a partir de cierta distancia de centros educativos, reforzar el control de acceso para dificultar la entrada de menores y personas autoexcluidas, y activar las máquinas tragaperras en la hostelería a petición expresa de un interesado. El análisis del alcance de estas medidas podría resultar ser una

futura línea de investigación realmente interesante.

En el segundo capítulo de investigación de la tesis he analizado el consumo simultáneo de juegos de azar y otros productos de consumo potencialmente adictivos. Las oportunidades de juego no solo han crecido durante las últimas décadas como he discutido en los párrafos anteriores, sino que también se han adentrado en nuevas localizaciones. Entre otras cosas, la liberalización del sector iniciada en 1977 permitió la instalación de máquinas recreativas con componentes de apuestas y azar—se distinguen máquinas de tipo «A», «B» y «C» en función de su modalidad—en establecimientos de hostelería, al mismo tiempo que se expandieron por toda la geografía española casinos y salas de juego. Ello ha posibilitado que la participación en estas actividades se realizara junto al consumo de tabaco y alcohol, productos ampliamente conocidos por su capacidad de generar adicción, dependencia y graves problemas de salud. Sin embargo, dicho consumo simultáneo no se ha circunscrito únicamente a casinos y bares; con el juego convirtiéndose cada vez más en una actividad lúdica y social, existe la preocupación de que estos tres productos se retroalimenten entre sí acentuando los aspectos negativos de su consumo.

La evidencia empírica a este respecto es clara. El consumo de productos de azar está fuertemente correlacionado con el consumo de tabaco y alcohol, pero no sólo por el consumo cruzado en sí mismo, sino también porque los tres comparten aspectos que pueden agudizar la respuesta conjunta y, por tanto, facilitar y agravar el desarrollo de posibles problemas tanto de salud física como de salud mental. De esta manera, se ha encontrado en múltiples ocasiones que las personas que fuman y/o beben participan y gastan más en productos de azar. Aunque es de esperar que estas conclusiones se mantengan también para el mercado español, hasta donde conozco, esta tesis doctoral presenta la primera investigación empírica que cuantifica este fenómeno al estudiar cómo el consumo de tabaco y alcohol condicionan las decisiones de participación y gasto en juegos de azar.

La disponibilidad de evidencia empírica es clave para limitar el efecto cruzado de estos productos y diseñar mecanismos adecuados de protección y tratamiento. De hecho, es relevante que las políticas públicas hagan una especial consideración hacia la población adolescente. Los jóvenes conforman un

grupo de riesgo severo por múltiples razones. Por sus modos de vida, están continuamente expuestos al consumo de alcohol, sustancias estupefacientes e, incluso, juegos de azar; son más proclives a desarrollar problemas de adicciones dada su inexperiencia e ingenuidad; carecen de la capacidad necesaria para realizar un consumo responsable de estos productos; no están sensibilizados ante la gravedad de los problemas sanitarios, sociales y económicos que pueden desencadenar; y el desarrollo de un trastorno adictivo durante la juventud puede condicionar seriamente la vida adulta.

En el ejercicio empírico he optado por la estimación de un modelo de doble valla (*double-hurdle model*) para tener en cuenta que la decisión de gasto en productos de azar es en realidad un proceso de dos etapas: primero se decide si se va a participar o no y luego la cantidad a gastar. Si bien la metodología es habitual en la literatura microeconométrica, en esta investigación he considerado no sólo el consumo de alcohol y tabaco de forma binaria (sí o no), sino también su intensidad; parece lógico que el efecto de estos productos sobre el gasto en juego esté también condicionado por su intensidad de consumo.

Los resultados han confirmado estos supuestos y replicado los hallazgos para otros países. El consumo de alcohol y/o tabaco no sólo está relacionado con una mayor probabilidad de consumir juegos de azar y de gastar más en ellos, sino que cuanto más frecuente sean esos consumos, mayor será también la probabilidad y el gasto. Como sucedía con la propensión a comenzar a jugar, el interés por el juego se diluye progresivamente a lo largo de la vida y los hombres son más propensos a participar y a gastar más que las mujeres, probablemente debido a su menor aversión al riesgo.

En la tercera y última investigación he tratado de analizar el efecto marginal que ejerce la participación en juegos de azar *online* sobre la propensión a desarrollar un problema relacionado con el juego. El juego *online* presenta unas características peculiares—está siempre disponible, se puede acceder a él desde cualquier lugar a través de múltiples dispositivos electrónicos, y pone a disposición de los consumidores una variada oferta de juegos y actividades que generalmente proporcionan resultados inmediatos—que pueden derivar en ciertos problemas de adicción comportamental. Si los trastornos adictivos se desencadenan con experiencias que explotan y abusan de los sistemas neurológicos

de placer y recompensa como mantiene la literatura, los juegos de azar *online* podrían llegar a percibirse como un producto con más riesgo que el juego presencial.

En este sentido, la evidencia empírica ha aportado indicios de que el juego *online* está relacionado a una mayor prevalencia de problemas relacionados con el juego que el tradicional. El efecto se da de manera general para todos los usuarios, pero se acentúa especialmente en el caso de los adolescentes (y otros grupos de riesgo) por las mismas razones argumentadas previamente; y he aquí la importancia de contar con información certera para diseñar mecanismos adecuados de protección y tratamiento. Sin embargo, la dirección de causalidad de dicha relación sigue sin aclararse y hace sospechar de la presencia de un problema de endogeneidad. ¿Recurren los usuarios de juegos *online* a ellos porque ya presentan problemas o son los juegos *online* los que desencadenan los problemas?

La reforma de la regulación del juego aprobada en 2011 supuso un claro punto de inflexión en el mercado español, entre otros motivos, al regular por primera vez el juego *online*. Hasta entonces, no era ilegal, pero carecía de una legislación específica que dotara de derechos y protección a los consumidores y de seguridad jurídica a los operadores. Sin embargo, y como ya he repetido previamente, apenas se ha estudiado empíricamente las repercusiones de esta regularización. Ya sabemos del primer capítulo de investigación que las diferentes liberalizaciones del mercado han hecho más probable que los consumidores participen; en este último, he tratado de abordar para los usuarios españoles la relación existente entre el consumo de juegos *online* y la prevalencia de problemas relacionados con el juego.

El análisis se ha planteado utilizando la metodología del *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV) para calcular el riesgo de los usuarios de desarrollar problemas del juego. El DSM-IV es un estándar ampliamente utilizado por investigadores y personal sanitario para clasificar a jugadores en cuatro grupos ordenados de riesgo creciente (de «no riesgo» a «probable diagnóstico de juego patológico») en función de sus hábitos de consumo de productos de azar. El 93,74% de los usuarios ha quedado clasificado en el grupo sin riesgo y el 0,84%, en el de mayor riesgo. Para estimar la probabilidad de que

un usuario fuera clasificado en cada grupo, he propuesto utilizar un model de probit ordenado con variables instrumentales (*IV ordered probit*) para corregir la posible endogeneidad en el que el consumo de productos de azar en línea fuera el principal predictor. Como en el caso del tabaco y alcohol, es de esperar que el riesgo esté condicionado hasta cierto punto por la intensidad del consumo, por lo que aquí también he considerado la participación *online* de forma binaria (sí o no) y en función de su frecuencia. Éste es un enfoque novel en la literatura, aunque algunas publicaciones científicas ya habían observado anecdóticamente una mayor prevalencia de problemas de juego cuanto mayor era la participación *online*.

Los resultados obtenidos han sido consistentes con investigaciones previas. En resumen, la participación *online* está asociada a un aumento del riesgo de desarrollar un problema de juego y dicho riesgo se vuelve cada vez mayor cuanto mayor sea la intensidad de juego. No obstante, también señalan que otros condicionantes personales de los usuarios (situación socioeconómica, consumo de otros productos adictivos...) ejercen una influencia significativa sobre el riesgo. El juego *online* ocasional, en cualquier caso, no resulta problemático.

Además, es probable que haya grandes diferencias en términos de riesgo de juego patológico entre juegos, modalidades e incluso establecimientos *online* (cada uno establece sus propias promociones en forma de bonos de captación, ofertas de saldo adicional, mejores cuotas, etc.), como ya se anticipaba anecdóticamente en la interpretación de la DGOJ de los resultados descriptivos del estudio de prevalencia, que aquí no se ha tratado. En este sentido, se antoja improbable que, por ejemplo, la adquisición *online* de participaciones de loterías sea tan problemática como el uso de máquinas tragaperras, que intentan aprovechar la impulsividad de las jugadas para intensificar el consumo.

Los esfuerzos de todas las partes interesadas en la industria del juego deberían centrarse, por tanto, en evitar que el consumo *online* se haga de manera compulsiva. Los últimos desarrollos—comentados en párrafos anteriores—a la ley de regulación del juego han introducido restricciones a las comunicaciones y ofertas comerciales de los operadores con el objetivo de que incentiven menos al consumo. De hecho, una de las grandes críticas que ha recibido el juego en línea en años recientes es que su publicidad era demasiado agresiva por su fre-

cuencia de aparición y el uso de personajes conocidos y mensajes provocadores. Para abordar todas estas cuestiones, responsables políticos y operadores podrían acordar la introducción de otras medidas complementarias, tales como ampliar el rango de dichas restricciones, limitar forzosamente la duración máxima de las sesiones de juego y de gasto en un determinado intervalo de tiempo y reforzar el control de menores y usuarios autoexcluidos en el servicio.

En conjunto con los resultados discutidos a lo largo de esta tesis doctoral, todo esto plantea posibles extensiones que resultarían muy interesantes como nuevas líneas de trabajo para futuras investigaciones: ampliar el alcance del análisis del riesgo asociado específicamente al juego *online* para incorporar una distinción entre los diferentes juegos, modalidades y operadores y comprobar la hipótesis de que no todos entrañan el mismo riesgo; observar el alcance de todas las nuevas restricciones comentadas en párrafos anteriores; replicar alguno de los trabajos incluidos en mi tesis doctoral con futuras ediciones del estudio de prevalencia y comparar la evolución de los resultados; o, incluso, utilizar otras metodologías en caso de que futuras ediciones o estudios alternativos proporcionen una información más detallada en relación con el consumo de otros productos potencialmente adictivos.

Precisamente, el diseño de la información del estudio de prevalencia relativo al consumo de alcohol y tabaco condiciona (y reduce) mucho la posible metodología econométrica a utilizar, por lo que futuros estudios deberían considerar incluir esta información de manera más desagregada y precisa. En cualquier caso, los tres trabajos de investigación presentan las mismas limitaciones técnicas generales como consecuencia del carácter retrospectivo y transversal del estudio de prevalencia, pues esto no permite esclarecer verdaderamente los procesos subyacentes de los efectos que hemos visto a lo largo de la tesis ni tampoco establecer relaciones de causalidad entre factores. Todos los participantes de la industria, desde los propios responsables políticos, hasta los operadores y los consumidores, se beneficiarían enormemente de un estudio longitudinal que permitiera sortear estas limitaciones y diseñar más y mejores políticas de prevención para garantizar un consumo responsable de los juegos de azar.

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