

## British Gambling Prevalence Survey 2007: Secondary Analysis

October 2008

Commissioned by the Gambling Commission  
Prepared by

**Professor Leighton Vaughan Williams**

Betting Research Unit, Nottingham Business School, Nottingham Trent University

**Dr. Lionel Page**

University of Westminster

**Dr. Jonathan Parke & Jane Rigbye**

The Gambling Lab Ltd

All enquiries to:

**Professor Leighton Vaughan Williams**

E-mail: [Leighton.Vaughan-Williams@ntu.ac.uk](mailto:Leighton.Vaughan-Williams@ntu.ac.uk)

Betting Research Unit  
Nottingham Business School  
Nottingham Trent University  
Burton Street NG1 4BU

# Contents

<b>Executive summary</b>	<b>4</b>
Statistical approach	4
Introduction	4
Gambling participation	5
Exploratory analysis	5
Inferential analysis	5
Problem gambling	6
Exploratory analysis	6
Inferential analysis	6
Gambling behaviour and young people	6
Conclusions	6
Limitations	7
Implications and future directions	7
Policy and understanding behaviour	7
Methodological implications	7
Scope of report	7
<b>1 Introduction</b>	<b>9</b>
Method	9
Online databases	9
Specialist libraries	10
Comparisons of prevalence data	11
Measures	11
Prevalence survey data	12
Findings from previous research on problem gambling	12
Demographic influences on problem gambling	14
Gender	16
Ethnicity	16
Socioeconomic status	16
Marital status	17
Participation in specific gambling activities	17
Methods used in prevalence surveys	17
Summary	17
<b>2 Gambling participation</b>	<b>18</b>
Exploratory analysis	18
Overview of statistical techniques: PCA/MCA	18
MCA on the participation variables	18
PCA & MCA on the frequency variables	19
Clustering	21
Inferential Analysis	23
Count Model	24
Factors influencing choice of gambling activity	26
Type of gambling participation and level of gambling activity	28
<b>3 Problem gambling</b>	<b>30</b>
Exploratory analysis	30
Frequency as a relevant covariate in determining problem gambling	32

Inferential analysis	34
Non-parametric analysis	34
Parametric analysis	35
Problem gambling: impact of medium, channel and venue	36
<b>4 Young gamblers</b>	<b>39</b>
Specific analysis of young gamblers	39
<b>5 Summary and Conclusions</b>	<b>40</b>
<b>6 Limitations</b>	<b>42</b>
Low number of cases for key categories	42
Limited ability to discriminate between problem and non-problem gamblers	42
Limitations in cross-sectional research	42
Creating an artificial measure of problem gambling	43
<b>7 Implications and future directions</b>	<b>43</b>
Policy and understanding behaviour	43
Play frequency is vital in understanding the link between type of gambling activity and level of problem gambling	43
There is much work to do in understanding gambling and problem gambling among young people and the nature and impact of private betting among all ages	43
Methodological implications	44
We recommend that future prevalence surveys include theory-driven variables	44
There may be value in using 'case comparison' research	44
We recommend that future prevalence surveys include 'historical' variables	44
<b>8 References</b>	<b>45</b>
<b>9 Appendices</b>	<b>48</b>

## Executive summary

- i The central aim of this analysis was to explore the original British Gambling Prevalence Survey (BGPS) 2007 data using sophisticated statistical techniques to learn more about gambling participation, problem gambling, treatment seeking and gambling behaviour among young people. The findings from this analysis may be useful in further understanding various aspects of gambling behaviour; developing understanding of issues related to the planning and design of future prevalence surveys and other research projects; and should serve generally to help inform the debate regarding gambling-related policy.

## Statistical approach

- ii Various higher level statistical techniques were employed to analyse the data set:
  - Multiple Correspondence Analyses (MCAs) were employed as a data reduction technique to provide a visual summary of the relationship between types of gambling activity and frequency of play. If two categories are represented close together graphically it means that a large number of gamblers exist who jointly participate in these activities with similar levels of frequency. This gives an insight into possible groups or types of gambler.
  - Convex Hulls are a convenient way to represent graphically the area of concentration of points. A convex hull connects the points at the outer limit of the scatter plot. If the points from the first convex hull are removed, it is possible to draw a new convex hull on the new scatter plot. We use these 'second convex hulls' to eliminate outlier observations.
  - Clustering Techniques were used to develop an understanding of how gamblers are grouped according to different activities; in other words, to discover if there are distinct groups of gamblers playing distinct activities at various levels of the population.
  - General Additive Models (GAMs) were used as an inferential technique to identify determinants of the number of gambling activities in which gamblers participate and the potential determinants of problem gambling.
  - McFadden Choice Models were employed to estimate how individual and demographic factors may be associated with choice of gambling activity. This is achieved by using a reference activity or base category (in this case the National Lottery) to which each activity will be compared.
  - Poisson Regressions (an alternative to using linear regression when certain theoretical assumptions are violated) were used to estimate the impact of various factors on the number of gambling activities in which gamblers participate and to estimate the impact that environment has on various forms of gambling activity.
  - Discriminant Analysis, which is similar to the MCA method in that it reduces a large number of variables to a smaller number of dimensions, was used to identify variables that discriminate between problem gamblers and non-problem gamblers.
  - Ordered Probit Models are an extension of probit models and are used for binary variables when the dependent variable is not binary but can take several ordered values. A good example is frequency of participation, which can take several ordered values.

## Introduction

- iii Findings from recent gambling prevalence surveys tend to show that younger male gamblers with a lower socio-economic status are more likely to report gambling problems, as are those from ethnic minorities and those who are separated or divorced.
- iv The gambling activities which are most often shown in prevalence surveys to be correlated with problem gambling tend to be those which are continuous in nature and which contain a high element of skill or perceived skill, such as electronic slot machines, sports betting and private or social gambling.

- v There are limitations regarding the comparability of prevalence data across various jurisdictions as a result of differences in survey design, data collection methods and problem gambling measures used. However, cross-cultural comparison is still useful for gaining an insight into gambling and problem gambling behaviour as long as findings are interpreted with caution.
- vi Priority should be given to the development of internationally recognised standards for designing and executing prevalence studies to allow for more direct comparability between jurisdictions.

## Gambling participation

### Exploratory analysis

- vii Those individuals participating in only one or a few activities are more likely to be engaging in activities such as the National Lottery, bingo and/or scratchcards.
- viii Those individuals who are gambling on activities such as spread betting, betting exchanges, online gambling (gaming and betting) and virtual gaming (Fixed Odds Betting Terminals [FOBTs]) are more likely to be engaging in a larger number of gambling activities.
- ix There seems to be a large group of homogeneous gamblers who participate in a wide range of activities, within which exists a smaller subgroup participating in more specific/technical/novel types of gambling such as online betting, FOBTs, spread betting and betting exchanges.
- x Problem gamblers cannot be systematically differentiated from other gamblers according to gambling activity or frequency of play. This does not mean that problem gamblers are necessarily identical to non-problem gamblers but simply that they do not belong to mutually exclusive groups.

### Inferential analysis

- xi Individuals who are younger, male, on a higher income, less educated individuals, those of ethnic origin other than black, and those with parents who gamble, were more likely to participate in a wide range of gambling activities.
- xii While most gambling activities are practised across a wide range of ages and socio-economic groups, some significant socio-demographic differences exist.
- xiii Size of income has an important influence on the type of gambling activities practised. Wealthier individuals were more likely to engage in casino gambling or to bet on the internet while those on lower incomes were more likely to participate in activities like bingo or FOBTs.
- xiv Males were more likely to participate in activities we labelled as more 'sophisticated' like spread betting, betting exchanges, FOBTs, and online betting. The only activity that females were significantly more likely to play was bingo.
- xv Younger gamblers were more likely than older gamblers to participate in most types of gambling; private betting and slot machines in particular. There was no gambling activity in which older gamblers were significantly more likely than young gamblers to engage.
- xvi There were implications for the number of activities in which individuals participated, depending on the channel, medium or venue by which the game was being accessed. Individuals were more likely to participate in a wider range of gambling activities if they: played the National Lottery through any medium other than the shop (TV, internet, mobile phone); bought scratchcards at petrol stations; played online roulette; gambled on horse racing using the telephone or a betting shop rather than at the track (although the reverse was true for dog racing); engaged in private betting (in particular telephone betting); played machines in pubs or betting shops.

## Problem gambling

### Exploratory analysis

- xvii The populations of problem gamblers and non-problem gamblers differed on average on several characteristics: problem gamblers were more likely to be younger, single, have lower qualifications and a low income.
- xviii Problem gamblers were also more likely to engage frequently (ie at least twice a week) with a variety of gambling forms such as horse racing, scratchcards, slot machines, online gaming and online betting.
- xix There was some evidence of a link between problem gambling and playing online roulette as well as private betting, but great caution needs to be exercised in interpreting these results because of the small number of cases.

### Inferential analysis

- xx Individuals who are male, single, have lower qualifications, lower incomes and whose parents have gambled were more likely to exhibit signs of problem gambling. However, while wealthier individuals are more likely to participate in a larger number of activities they are less likely to exhibit signs of problem gambling.

## Gambling behaviour and young people

- xxi With only 245 respondents being under 18 years old there were limitations to the range and level of statistical analysis that could be applied to this subpopulation.
- xxii Consistent with findings from the general population sample, younger gamblers also tended to be made up of a large group of relatively homogeneous gamblers who gamble across a range of activities, within which exists a smaller subgroup participating in more specific/technical/novel types of gambling like online betting, FOBTs, spread betting and betting exchanges.

## Conclusions

- xxiii Individuals were more likely to have a gambling problem if they were male, single, had a lower level of qualifications and had parents who had gambled. This is largely consistent with previous literature.
- xxiv When considering the association between type of gambling activity and problem gambling it is relevant to consider the frequency with which gamblers participate in that activity. The results of the first report on BGPS 2007 tended to suggest, in the absence of a consideration of frequency, that a higher level of problem gambling is linked with spread betting, FOBTs and betting exchanges (p94). Our analysis essentially provides a check of their result on gambling participation using a technique which is more robust to small observations and a large number of covariates. What is important here is that the ranking is not the same. This should be interpreted as inviting caution about the order of activities found in the 2007 prevalence survey rather than as suggesting an alternative ranking.
- xxv The gamblers who participate in various gambling activities seem to be relatively homogeneous as a group, with the exception of a small sub-group who are technically and procedurally proficient and who may be motivated by the various attributes (eg value) afforded by spread betting, betting exchanges and internet gambling.
- xxvi While those on lower incomes may prefer FOBTs and bingo because of their proximity and need for temporary relocation ('getting out of the house'), those on higher incomes may be being tempted online in pursuit of higher stakes and prizes (particularly for slot machines). These explanations are open to further research and empirical investigation.
- xxvii Younger players are more likely to gamble on slot machines and bet privately, probably because these are more easily accessible compared to other forms of gambling.

- xxviii Past research has suggested that males tend to prefer games of skill, whereas females prefer games of chance. Findings from this research are, to some extent, consistent with these claims in that men were relatively more likely prefer to gamble on spread betting and exchanges which require a significant level of knowledge and skill for participation.
- xxix Evidence exists of a link between problem gambling and playing online roulette as well as private betting, but great caution needs to be exercised in interpreting these results because of the small number of cases.

## Limitations

- xxx Because of the low number of cases in various important categories, including problem gamblers, those seeking treatment and younger players aged 16-17, there were limitations on the extent to which more sophisticated analyses could be carried out. More discussion on limitations can be found in Chapter 6 of the report.
- xxxi Information was not collected on certain variables (eg situational, cognitive, individual differences) which are normally considered to be important in determining gambling behaviour and this limited our ability to develop powerful models to explain aspects of gambling participation and problem gambling.

## Implications and future directions

### **Policy and understanding behaviour**

- xxxii When collecting and analysing data relating to type of gambling activity and problem gambling it is important also to consider frequency and possibly length of gambling session as covariates. This will help distinguish between 'dabblers' and 'regulars', an important factor when assessing the impact of game type on gambling behaviour.
- xxxiii More research is needed on gambling among youth and young adults. In the context of increased television coverage, celebrity endorsement, social introductions to gambling (eg poker home games) and the option for some to make money through person-to-person betting, the attraction to gambling may currently be quite strong. Private betting is also a potentially important avenue for future research.

### **Methodological implications**

- xxxiv We recommend that future prevalence surveys consider including theory-driven variables (eg Theory of Planned Behaviour; Technology Acceptance Model) and 'historical' variables which may be useful in introducing a theoretically sound and dynamic perspective to the survey questions which may generate more useful findings.
- xxxv There may be some value in using 'case comparison' research which involves recruiting two groups, one group exhibiting problem gambling and one group without, and measure them across a very large number of variables including individual, cognitive and situational factors.

## Scope of report

- xxxvi In February 2008, Nottingham Business School, The University of Westminster and the Gambling Lab Limited were contracted by the Gambling Commission to execute a secondary analysis of the data set from BGPS 2007, Wardle et al (2007). The overall aim of the project is to provide a more sophisticated level of statistical analysis of the data set which may reveal new insights and/or confirmatory information regarding key areas of gambling-related policy in Great Britain such as gambling type and participation, problem gambling, treatment-seeking behaviour and information specific to gambling behaviour among younger (ages 16-24) gamblers.

xxxvii For the purposes of clarity, the following sections are contained within this report:

1. An executive summary which includes a brief overview of the statistical tests being applied
2. An introduction which includes a review of prevalence research with a particular focus on socio-democratic factors associated with gambling participation and problem gambling
3. A set of exploratory findings in relation to gambling participation
4. A set of inferential findings in relation to gambling participation
5. A set of exploratory findings in relation to problem gambling
6. A set of inferential findings in relation to problem gambling
7. A specific analysis of gambling behaviour among young people
8. A concluding section which summarises the key findings
9. A discussion of the limitations of the data and statistical techniques
10. Consideration of implications and future directions

xxxviii Each section concludes with a 'section summary' which reviews the key findings. This is deemed important given the complexity of the analysis and the technical nature of the way in which some results must be reported. Explanations of more advanced or less common forms of gambling have been presented in Appendix 1.



# 1 Introduction

- 1.1 In order to provide a background to the secondary analysis of the British Gambling Prevalence Survey (BGPS) 2007, a review of prevalence studies conducted in other jurisdictions was undertaken. Comparisons are drawn between different prevalence data, limitations of common prevalence survey methods are discussed and good practice is highlighted.

## Method

- 1.2 During March and April 2008 a range of databases and online libraries were searched for gambling prevalence studies using the following key words:  
(Gambling) and (prevalence)  
(Gambling) and ('demographic variables')  
(Problem gambling) and (prevalence)  
(Problem gambling) and ('demographic variables')
- 1.3 Titles and abstracts were viewed for each piece of evidence, and those which appeared relevant to this review were accessed and downloaded. Excluded from the review were those documents which were older than the first British Prevalence Survey (1999), were not printed in English, documents which were not prevalence studies, and prevalence studies looking at specific populations, such as those in prison, the elderly or students. Some further prevalence studies were identified through a search of the reference section of relevant published articles. In particular, Stucki & Rihs-Middel (2005) highlighted some difficulties inherent in accessing prevalence studies, and noted that some of the studies included in their review were only accessible through informal networks and personal contacts. As such, we have reported upon a number of studies which were covered in Stucki & Rihs-Middel's review but were publicly unavailable, and therefore have only been able to incorporate the data on these studies which they included within their review; they did not report any data on the demographic correlates of problem gambling. Whilst this data should therefore be treated with caution, it does provide us with a good overview of international gambling prevalence rates and was therefore deemed important for consideration. In addition to prevalence studies, other relevant articles have been considered and, where appropriate, data from other studies has been included within the review.
- 1.4 The databases and online libraries in this literature search are outlined below.

### Online databases

A search of the following online databases was conducted to find any potentially relevant literature:

- Academic Search Elite
- Business Source Premier
- Ingentaconnect
- ISI Web of Knowledge
- Key Note
- Lexis Nexis
- Mintel
- PsycArticles
- PsycInfo
- Science Direct
- Swetswise

**Academic Search Elite** features full text for over 1,200 journals, abstracts and indexing for over 3,000 scholarly journals. It also includes coverage of over 1,700 peer-reviewed journals. It is the world's largest academic multidisciplinary database and covers a wide range of academic areas including social sciences, humanities, education, computer sciences, engineering, physics, chemistry, language and linguistics, arts and literature, medical sciences, ethnic studies and more.

**Business Source Premier** is a mainly full text journal database covering all aspects of accountancy, business and management, including full text for more than 300 of the top scholarly journals in this field.

**Ingentaconnect** is a comprehensive multidisciplinary document delivery service providing access to thousands of online journals from leading scholarly, academic and business publishers.

**ISI Web of Knowledge** indexes the published literature of the most significant conferences, symposia, seminars, colloquia workshops and conventions in a wide range of disciplines in science and technology, and lists literature from 1990 onwards.

**Key Note** provides market research reports in a wide range of market sectors. These reports contain a combination of market analysis, commentary, statistics and forecasts.

**Lexis Nexis** contains the up-to-date text of UK legislation, law reports, legal encyclopaedias and commentaries, together with a number of specialist practitioners' texts.

**Mintel** provide consumer market research reports, with full access to all marketing, leisure, retail, finance, industrial and British lifestyle reports.

**PsycArticles** is a database of searchable full text, peer-reviewed articles from over 50 scientific journals. The database covers general psychology and specialised, basic, applied, clinical and theoretical research in psychology.

**PsycInfo** contains more than one million citations and summaries of journal articles, book chapters, books, dissertations and technical reports, in the field of psychology. It also includes information about the psychological aspects of related disciplines such as medicine, sociology, education, linguistics, anthropology, business and law. Journal coverage, which spans from 1887 to present, includes international material selected from more than 1,700 periodicals in over 35 languages.

**Science Direct** offers full text access to all Elsevier journals published online, covering mainly the sciences, technology, medical, social sciences, psychology, environment and business and management subject areas.

**Swetswise** is an electronic journal service providing access to the table of contents and abstracts of over 17,000 journal titles. Full-text articles from over 2,500 of these journals can be viewed. Subject coverage spans the majority of academic disciplines including the arts, business, geography, history, language, management, marketing, medicine, philosophy, religion, sciences, social sciences and technology. Swetswise archives back to 1995.

- 1.5** Each search on each database produced varying numbers of titles and abstracts, with varying degrees of overlap between databases. Full lists of titles and abstracts were viewed, and for those articles which appeared to meet the criteria for this review, full texts were accessed and downloaded.

### **Specialist libraries**

- 1.6** A number of prevalence surveys are published via media other than journal articles, therefore a search of the following online libraries was conducted during April 2008, using the same search terms as outlined above. These libraries are specialist collections put together by governments from jurisdictions worldwide, and by gambling-related organisations. It was hoped that by searching these libraries further literature for this review would be uncovered. Only material which matched the criteria for inclusion was accessed and downloaded.
- Alberta Gaming Research Institute: <http://gaming.uleth.ca>
  - Australasian Gaming Council: [www.austgamingcouncil.org.au](http://www.austgamingcouncil.org.au)
  - eCOMMUNITY: International Journal of Mental Health and Addictions: [www.pasinfo.net](http://www.pasinfo.net)
  - Electronic Journal of Gambling Issues: [www.camh.net/egambling/](http://www.camh.net/egambling/)
  - Gambling Research Australia Secretariat: [www.gamblingresearch.org.au](http://www.gamblingresearch.org.au)

- Institute for Problem Gambling: [www.gamblingproblem.net](http://www.gamblingproblem.net)
- New Zealand Ministry of Health: [www.moh.govt.nz](http://www.moh.govt.nz)
- North American Association of State and Provincial Lotteries, Gambling Studies: [www.naspl.org/studies.html](http://www.naspl.org/studies.html)
- Ontario Problem Gambling Research Centre: [www.gamblingresearch.org](http://www.gamblingresearch.org)
- Queensland Government, Responsible Gambling: [www.responsiblegambling.qld.gov.au](http://www.responsiblegambling.qld.gov.au)
- Responsible Gambling Council: [www.responsiblegambling.org](http://www.responsiblegambling.org)
- Victoria Gambling Research Panel: [www.grp.vic.gov.au](http://www.grp.vic.gov.au)

## Comparisons of prevalence data

- 1.7** As with most subjects which have received international research attention, the gambling prevalence studies conducted to date have used a range of different methodologies, measures and sampling strategies, and have collected a range of data. Jurisdictions around the world also tend to have different regulations in place for gambling, from the age at which their population is legally allowed to gamble to the policies restricting certain types of game and the state of social acceptance of gambling as a pastime. Unsurprisingly, this limits the ability of the researcher to directly compare prevalence studies between and within jurisdictions. Prior to conducting a comparison of the BGPS 2007 with other international prevalence studies, it is important to highlight the challenges that are inherent within the evaluation and comparison of such studies.

## Measures

- 1.8** Prevalence studies often collect data not only on prevalence of gambling participation and problem gambling, but also on attitudes towards gambling, demographic data, personal experience of gambling and expenditure data. The data collected is often determined by the scope and funding of the study and whilst there is overlap between studies, the questions asked of the participants vary, and therefore it is uncommon to find directly comparable studies. This is particularly true in reference to measures of problem gambling. The studies included within this literature review tended to use one of three measures: the Canadian Problem Gambling Index (CPGI); the Diagnostic and Statistical Manual IV (DSM-IV); or the South Oaks Gambling Screen (SOGS/SOGS-RA). One study also used a version of the Gamblers Anonymous 20 questions, with the indicator for problem gambling being an affirmative answer to more than 33% of the questions.
- 1.9** Whilst arguments on the validity and reliability of the scales used in these prevalence studies have been covered in detail elsewhere in the literature, it is worth noting that prevalence rates of problem gambling obtained with different scales may produce different results within the same population. Therefore comparing prevalence data across studies using different measures should always be treated with caution.
- 1.10** Prevalence rates of gambling participation can vary widely depending upon the context in which questions are asked of the participants. In particular, when asking about lifetime experience of gambling, problem gambling prevalence rates may be inflated when compared with past-year data. This is because of the nature of gambling and problem gambling – it tends to be fluid behaviour in that at different periods of their lives people may be gambling excessively and at other times be gambling very little or not at all. Some studies fail to recognise the difference between past-year data and lifetime data, and therefore it is important to take this into account in any comparison of prevalence studies.
- 1.11** Another factor to take into account when comparing prevalence data is the statistical calculation of prevalence. For instance, studies using the same measure may use different cut-off points for defining problem and/or pathological gambling. The estimation of gambling and problem gambling prevalence may also be skewed by the decision to include or exclude non-gamblers from prevalence rate calculations. See Shaffer et al (1997) for further discussion on this point. Faraone & Tsuang (1994) have also highlighted that often, as is common with much medical and psychiatric research, false positives and false negatives achieved on measures of problem gambling are not accounted for statistically.

This may lead to an under- or over-representation of problem gambling prevalence. Whilst this report is not the place for a methodological and statistical debate about problem gambling measures it is nonetheless important for the reader to be aware of the issues that are related to this field when summarising the literature.

### Prevalence survey data

- 1.12** The initial search of the literature indicated over 150 gambling prevalence surveys have been carried out internationally to date; however, after the exclusion criteria are applied, 38 studies were found which were included in this review.
- 1.13** The first national prevalence survey in Britain (Sproston, Erens and Orford, 2000) found that 72% of the British population had gambled at least once during the past year, and the current rate of gambling participation amongst the adult population in Britain is 68% (Wardle et al, 2007). Estimates of gambling participation vary according to jurisdiction, with as many as 94% of the population reporting having gambled at least once in the past year in New Zealand (Abbott and Volberg, 2000) and as few as 58% in Singapore (MCD, 2005).

### Findings from previous research on problem gambling

- 1.14** Table 1 shows data from all 38 prevalence studies included in this review on gambling participation and problem gambling prevalence. Data is grouped according to the screen used to measure problem gambling. In all cases the terms problem, pathological, moderate and severe (in relation to gambling) are the terms used by the study cited.

First author	Year of publication	Jurisdiction	Data collection method	Sample size	Gambling prevalence (% of total population)	Problem gambling measure	Lifetime or past year	Problem gambling prevalence
Collins	2005	South Africa	Survey	3003	91.70%	GA 20 questions		4.8% affirmative to >33% of GA 20 questions
Focal Research Consultants	2001	Canada (New Brunswick)	*	800	*	CPGI	past year	1.8% problem, 1.4% pathological
Wiebe	2001	Canada (Ontario)	*	5000	*	CPGI	past year	3.1% problem, 0.7% pathological
Patton	2002	Canada (Manitoba)	*	3119	*	CPGI	past year	2.3% problem, 1.1% pathological
Queensland Government	2002	Australia (Queensland)	*	13082	*	CPGI	past year	2.7% problem, 0.83% pathological
Smith	2002	Canada (Alberta)	*	1804	*	CPGI	past year	3.9% problem, 1.3% pathological
Wynne	2002	Canada (Saskatchewan)	*	1848	*	CPGI	past year	4.7% problem, 1.2% pathological
Cox	2003	Canada	Face-to-face interviews	34770	76%	CPGI	past year	2.0% moderate and severe
Marshall	2003	Canada	*	34770	*	CPGI	past year	1.5% problem, 0.5% pathological
Schrans	2003	Canada (Nova Scotia)	*	2800	*	CPGI	past year	1.3% problem, 0.8% pathological

First author	Year of publication	Jurisdiction	Data collection method	Sample size	Gambling prevalence (% of total population)	Problem gambling measure	Lifetime or past year	Problem gambling prevalence
DFC	2006	Australia (South Australia)	National Telephone survey	17000+	70%	CPGI	past year	1.2% moderate risk, 0.4% high risk
Ipsos Reid	2008	Canada (BC)	Regional Telephone survey	3000	73%	CPGI	past year	3.7% moderate problem, 0.9% severe problem gamblers
Fong	2005	Macau	Telephone survey	1121	67.90%	DSM-IV	past year	2.5% problem, 1.78% probable pathological
Wong	2003	Hong Kong	Telephone survey	2004	n/a	DSM-IV	past year	4% problem, 1.8% probable pathological
Boardman	2003	USA (Kentucky)	*	1253	*	DSM-IV	past year	0.7% problem, 0.5% pathological
Gotestam	2003	Norway	*	2014	*	DSM-IV	past year	0.45% problem, 0.15% pathological
Ministry of Community Development	2005	Singapore	Face-to-face interviews	2004	58%	DSM-IV	past year	2% problem, 2.1% pathological
MCYS	2005	Singapore	Face-to-face interviews	2004	58%	DSM-IV	past year	2% problem, 2.3% probable pathological
Olason	2005	Iceland	National Telephone survey	3358	n/a	DSM-IV	past year	1.1% problem, 0.5% probable pathological
Abbott	1999	New Zealand	National Telephone survey	6452	94%	SOGS-R	past year	0.6-1.1% problem, 0.3-0.7% probable pathological
Ronnberg	1999	Sweden	National Telephone /Postal survey	7139	89%	SOGS-R	past year	1.4% problem, 0.6% probable pathological
Productivity Commission	1999	Australia	n/a	n/a	82%	SOGS-R	past year	1.1% problem, 1% probable pathological
Bondolfi	2000	Switzerland	National Telephone survey	2526	.	SOGS	past year	2.2% problem, 0.8% probable pathological
Welte et al	2001	USA	National Telephone survey	2638	82%	SOGS	past year	3.6% problem, 1.9% probable pathological
AIGR	2001	Australia	*	276777	*	SOGS	past year	1.21% problem, 1.91% probable pathological
Ferris	2001	Canada	*	3120	*	SOGS	past year	1.31% problem, 1.31% probable pathological
Gullickson	2001	USA (Michigan)	*	1211	*	SOGS	past year	1.8% problem, 1.0% probable pathological

First author	Year of publication	Jurisdiction	Data collection method	Sample size	Gambling prevalence (% of total population)	Problem gambling measure	Lifetime or past year	Problem gambling prevalence
Volberg	2001	USA (North Dakota)	*	5002	*	SOGS	past year	0.7% problem, 1.4% probable pathological
Volberg	2001	USA (Oregon)	*	1500	*	SOGS	past year	1.4% problem, 0.9% probable pathological
Shapira	2002	USA (Florida)	*	1504	*	SOGS	past year	2% problem gambling
Volberg	2002	USA (Nevada)	*	2217	*	SOGS	past year	2.9% problem, 3.5% probable pathological
MPSSG	2003	Canada (BC)	Regional Telephone survey	2500	85%	SOGS	past year	2.8% problem, 1.1% probable pathological
Volberg	2003	USA (Arizona)	Face-to-face interviews	2750	89%	SOGS	past year	1.6% problem, 0.7% probable pathological
Lund	2003	Norway	National Telephone survey	5235	81%	SOGS-R	past year	0.4% problem, 0.2% probable pathological
Illkas	2003	Finland	National Telephone survey	5013	74%	SOGS-R	lifetime	4% problem, 1.5% probable pathological
Biganzoli	2004	Italy	*	1093	*	SOGS	past year	0.7% problem, 0.4% probable pathological
Ladouceur	2004	Canada (Quebec)	Regional Telephone survey	8842	81%	SOGS	past year	0.9% at risk, 0.8% probable pathological
Schofield	2004	NZ	Regional Telephone survey	1029	90%	SOGS	past year	1% problem, 0.8% probable pathological
Bondolfi	2005	Switzerland	National Telephone survey	2803	n/a	SOGS	past year	0.8% problem, 0.5% probable pathological

\* Study taken directly from Stucki & Rihs-Middel, 2005: demographic data therefore unavailable

**1.15** The prevalence of problem gambling within populations has been the subject of a number of studies, with rates of past-year problem gambling ranging from 0.4% in Norway (Lund and Norland, 2003) to 4.9% in Saskatchewan, Canada (Wynne, 2003), and rates of past-year pathological gambling ranging from 0.2% in Norway (Lund and Norland, 2003) to 3.5% in Nevada, USA (Volberg, 2002). These studies have used a range of methodologies and scales by which to measure problem and pathological gambling and as previously discussed such comparisons across these studies must be treated with caution.

**1.16** As can be seen from Table 1, sample sizes range from 800 to 276,777 with the majority having sampled between 2000 and 6000 participants. The 2007 survey collected data from 9003 participants, putting the sample size slightly above average.

### Demographic influences on problem gambling

**1.17** One of the key aims of the secondary analysis of 2007 British prevalence survey data was to ascertain whether any relationships could be found between demographic variables on the one hand and gambling activity data and levels of problem gambling on the other. Table 2 compares data from the background literature on a number of variables. Studies to which we did not have direct access have not been included in this table, nor have studies which did not consider demographic variables or data on gambling activity.

First author	Year of publication	Jurisdiction	Demographic variables						
			Age	Gender	Marital status	Income	Education	Other	Gambling activity
Abbott	1999	New Zealand	25-34	Male	.	NZ \$40-50000	No academic qualifications	.	Casino slot machines, EGMs not in Casinos and telebingo
Ronnberg	1999	Sweden	<45	Male - 4x more likely	.	.	.	.	Casinos, gambling machines and card games
Productivity Commission	1999	Australia	Young people	Not a significant predictor	Not a significant predictor	Not a significant predictor	Not a significant predictor	.	Slot machines and wagering
Welte et al	2001	USA	.	Male	Living as married' significantly more problems than Married/ Widowed	Lower income group	.	minority groups (Blacks, American Indians, Hispanics and Asians) >3x likely to be PG	.
Lund	2003	Norway	.	Male - 4x more likely	.	.	.	.	Gambling machines and sports betting
Fong	2003	Macau	.	Male - 4.4x more likely	.	Lower income groups >100x more likely	Not a significant predictor	63% of respondents first gambled before the age of 24	.
Wong	2003	Hong Kong	Not a significant predictor	Male - 4x more likely	Not a significant predictor	Lower income groups	Fewer than 9 years of education	.	Horse racing, sports betting and casino gambling
MPSSG	2003	Canada (BC)	18-24	.	.	Lower income group	.	.	Internet gambling and EGMs
Volberg	2003	USA (Arizona)	Not a significant predictor	Not a significant predictor	Not a significant predictor	Not a significant predictor	Not a significant predictor	ethnicity - those in minority groups more likely to be PG, as are those who are disabled or unemployed	Slot machines outside casinos, private betting and casino games
Ladouceur	2004	Canada (Quebec)	18-24	Male	.	Below poverty line	Lower than high school	.	.
Olason	2005	Iceland	Young people	Male - 3x more likely	.	.	Lower level of education	.	.
Collins	2005	South Africa	.	Male	.	Poor/ Middle income	.	.	.

First author	Year of publication	Jurisdiction	Demographic variables						
			Age	Gender	Marital status	Income	Education	Other	Gambling activity
Ministry of Community Developm't	2005	Singapore	30-39	Male - 3x more likely	Divorced/ Separated/ Widowed	Over \$4000 per month	Secondary education only	.	Social gambling
Ipsos Reid	2008	Canada (BC)	18-34	Male	Divorced/ Separated/ Never married	Un-employed	.	.	Internet gambling, EGM gambling and poker tournament gambling

**1.18** The 2007 British prevalence survey found that problem gambling was more prevalent amongst younger people. Younger people have consistently been shown to have a higher prevalence of gambling problems than older people, with one study reporting up to three times the rate of problem gambling in younger people compared to older adults (National Research Council, 1999). In studies conducted in Australasia, North America, Europe, and Asia, the lowest prevalence of problem gambling was found amongst older adults (Abbott & Volberg, 1996; Abbott & Volberg, 1999; Ronnberg et al, 1999; Ilkas & Turja, 2003; Ipsos Reid & Gemini Research, 2003; Lund & Norlund, 2003; Fong & Ozorio, 2005). However a number of studies find that being young is not a significant predictor of problem gambling (Wong & So, 2003; Volberg, 2003) and some find that those in slightly older age groups (25-39) tend to have the highest rates of problem gambling (Abbott & Volberg, 1999; MCD, 2005).

**1.19** Those who started gambling at a younger age are more likely to have gambling problems and these problems are likely to be more severe (Ladouceur, 1991, Volberg, 1994) However, this relationship may also be explained by other confounding factors that could go hand in hand with starting gambling at an earlier age, such as gambling being more of a social norm within certain socio-economic groups.

### Gender

**1.20** Men tend to have higher rates of problem gambling than women (Ladouceur, 1991; Nower, Derevensky, & Gupta, 2004; Abbott & Volberg 2000; Wong and So, 2003; and Lund & Nordlund, 2003) and this finding was supported by the 2007 British Prevalence Survey. Men are generally found to be around three times more likely to have gambling problems than women, although Fong & Ozorio (2005) found that men were 4.4 times more likely to have problems. It has been suggested that gender effects may interact with age, as younger men and older women tend to have higher rates of problem gambling (Stinchfield, 2000).

**1.21** Women tend to have a shorter progression to problem gambling than men; in other words, women exhibiting problem gambling behaviour tend to have been gambling for a shorter period of time than men exhibiting problems with gambling (Ibanez et al, 2003; Ladd & Petry, 2003).

### Ethnicity

**1.22** Those from ethnic minorities have regularly been shown to have higher rates of problem gambling, with those from Black or Asian backgrounds having higher problem gambling rates in Great Britain than Caucasians (Sproston et al, 2000). This finding was repeated in the 2007 British prevalence survey. Similar results have been found in North America and Australasia, where indigenous populations tend to be the most affected by problem gambling (Abbott & Volberg, 1999).

### Socioeconomic status

**1.23** Variables which indicate a lower socioeconomic status, ie a lower level of education, and lower income, have been found to be related to problem gambling (National Research Council, 1999) although in some Asian countries, problem gambling is more likely to be associated with a household income in the middle ranges (Wong & So, 2003). The 2007 British prevalence survey found that those with fewer educational qualifications were more likely to have gambling problems.



- 1.24** It has been suggested that those with a lower socio-economic status may have more ready access to gambling activities which are more likely to be associated with problem gambling, such as electronic slot machines (Volberg, 2004). It is impossible to attribute causality in the relationship between these variables and problem gambling, however, as it is unclear whether gambling problems are a cause or an effect of having lower socio-economic status. An early study by Volberg and Steadman (1989) found that high school dropouts were over-represented amongst problem gamblers in Maryland and New Jersey.

### **Marital status**

- 1.25** Marital status has repeatedly been shown to be related to problem gambling, with problem gamblers more likely to be single, widowed or divorced than non-problem gamblers (Abbott & Volberg, 1996; Abbott & Volberg, 1999; Ronnberg et al, 1999; Ilkas & Turja, 2003; Lund & Norlund, 2003; Fong & Ozorio, 2005). However, Wong & So (2003) and Volberg (2003) both found that marital status was not a significant predictor of problem gambling. Further longitudinal research is needed to ascertain whether problem gambling is likely to be a cause or an effect of being single.
- 1.26** An interesting point for consideration is the sampling techniques used in many prevalence studies. Telephone interviews, questionnaires and interviews all share a common problem in that they may not be strictly confidential. This may lead to an under-reporting of gambling problems in those who are not single; as it may be that they do not wish to disclose these issues to their families.

### **Participation in specific gambling activities**

- 1.27** Problem gambling has been shown to be most associated with games which tend to be continuous in nature, and contain an element of skill or perceived skill (Volberg, 2004). Lund and Norlund (2003) found that in Norway problem gamblers tend to play more electronic slot machines, more table games and take part in more sports betting than non-problem gamblers. In Hong Kong (Wong & So, 2003) betting on horses, in the casino, and on football matches were most common amongst problem gamblers. Interestingly, there also appears to be a relationship between social gambling, or private betting between friends, and problem gambling (Volberg, 2003; MCD, 2005).
- 1.28** It has been suggested that there is an interaction between the availability of certain types of gambling activity and socio-demographic variables (Volberg, 2004), eg slot machines may be more accessible to those with a lower socio-economic status, which may impact upon the levels of problem gamblers found within this population.

## **Methods used in prevalence surveys**

- 1.29** Most frequently, prevalence surveys are designed to collect data via telephone interview (Abbott & Volberg, 1999; Fong & Ozorio, 2005; Wong & So, 2003; Olason et al, 2005; Ipsos Reid & Gemini Research, 2008). Whilst this is not the place for in-depth methodological discussion, it is important to note that telephone surveys may exclude certain populations, such as those who work away from home, those with no telephone connection, and members of the population who are in hospital or prison. Frequently, women tend to be in the home more often than men and therefore this may skew survey results as the first point of contact within the home is usually the one who responds to the survey. There may therefore be an element of selection bias.

## **Summary**

- 1.30** The data from the primary analysis of the 2007 British Prevalence Survey is similar to that found in recent prevalence surveys from other jurisdictions. Data tend to show that young, male gamblers with a lower socio-economic status are more likely to have gambling problems, as are those from ethnic minorities and those who are separated or divorced.

- 1.31** Although there are concerns with direct comparison between prevalence surveys which have used different measures and methods, and collected different variations of data related to gambling, these concerns have been noted. It would be useful for future research to take this into consideration and for the gambling research community as a whole to consider an integrative approach to prevalence research. Such an approach would encourage agreement on which sampling methods and problem gambling scales should be employed in order to improve comparability across jurisdictions. It would also rely on setting up of international networks or forums to facilitate information sharing between researchers, clinicians, regulators and even industry. An integrative approach will require better dissemination of findings from international research. Such an integrative approach should maximise the efficiency of research internationally by promoting learning from the successes and failures of different jurisdictions and by minimising continued investment in research paradigms showing little promise.

## 2 Gambling participation

### Exploratory analysis

- 2.1** The first phase of the analysis was exploratory in nature, and aimed to explore different groups of gamblers according to their type of gambling activity and the frequency of these activities. Typically, we would like to know if we can identify from our sample of gamblers some groups who are different from others based on types of participation (eg bingo versus FOBTs) or frequency of participation (eg once a year versus twice a week or more).
- 2.2** To do this we employed two types of technique: PCA/MCA and cluster analysis.

#### Overview of statistical techniques: PCA/MCA

- 2.3** A Principal Component Analysis (PCA) is a technique which identifies dimensions explaining the most variation in the sample (for a set of quantitative variables).<sup>1</sup> A Multiple Correspondence Analysis (MCA) is an extension of PCA to qualitative or categorical variables. PCA and MCA are data reduction techniques which will allow us to see visually, on a two-dimensional graph, the gambling activities which are used by the same gamblers and with the same level of participation.

#### Note: representing groups in PCA/MCA space

PCA and MCA allow us to present in two-dimensional space the relationships between variables. The closer the variables are on an MCA graph, the greater the tendency of individuals who answered positively to one of them also to respond positively to the other. It is possible to place individuals in this space depending on their answers. There is then a very simple relationship between the 'clouds' of individuals and the 'clouds' of variables: the labels of the variables are located at the 'centre' (barycentre) of the clouds of individuals who answered positively to them. The label 'spread betting twice a week' is for instance at the centre of the clouds of individuals participating in spread betting twice a week.

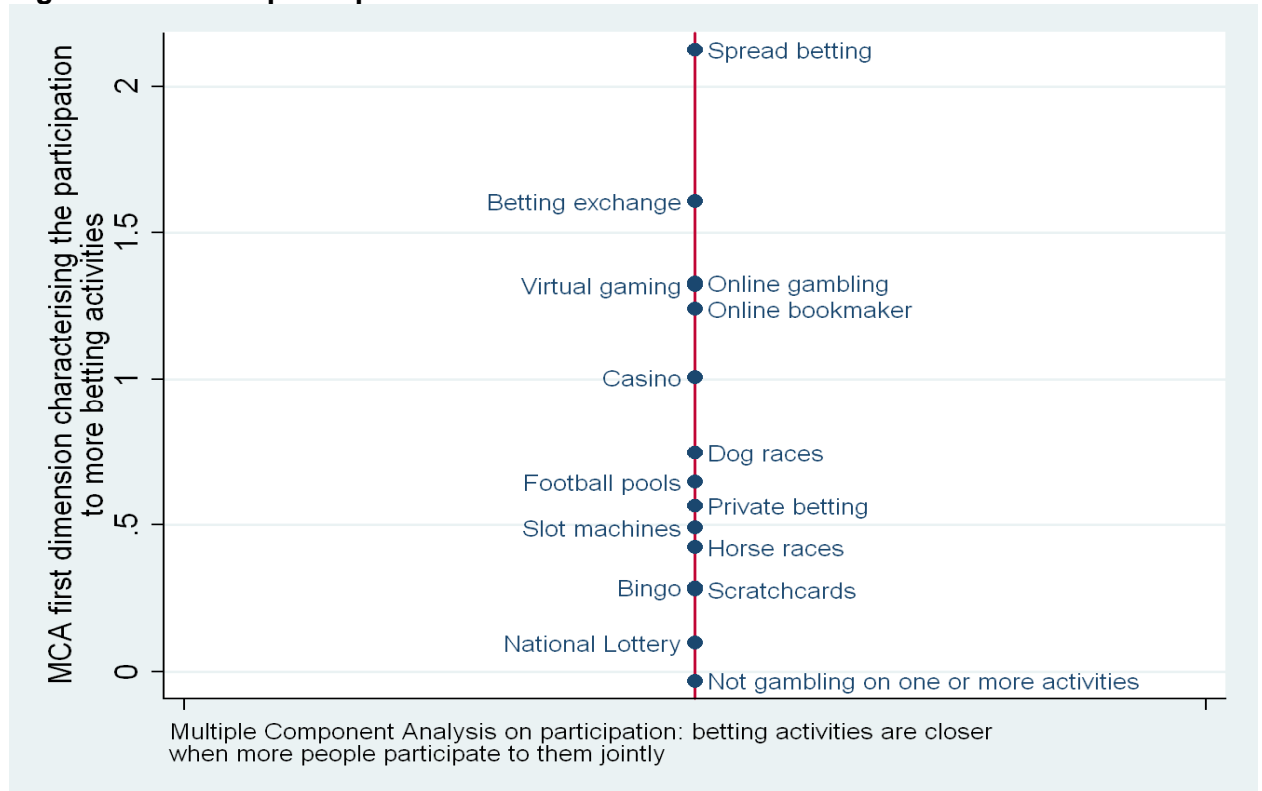
The main way to represent groups in PCA/MCA space is to use concentration ellipses. If the cloud is close to oval-shaped (close to a multivariate normal distribution), then the ellipse gathers around 86% of the individuals in the clouds. When it is not the case, the ellipse may not be the best solution as it may not represent accurately the distribution of the cloud. It is then possible to use a convex hull instead which closely follows the shape of the cloud.

#### MCA on the participation variables

- 2.4** The first MCA considered participation in gambling activities. The result of this MCA gives an indication of the extent of association between gambling activities. Two gambling activities A and B will be closely 'linked' in the graph if a gambler playing on activity A typically plays on activity B also. The MCA on the participation variables is a way to give a graphical representation of Table 2.6 in the BGPS 2007 report, page 30.

<sup>1</sup> PCA is often used as an exploratory factor analysis.

**Figure 1. MCA on participation variables**



NB Virtual gaming = FOBTs

**2.5** Figure 1 shows the first dimension of this MCA which discriminates mostly between gamblers who do not participate in some activities and gamblers who participate in different types of activities. This graph is useful in understanding how gambling activities are associated with each other (labels are shortened for simplicity; their exact definition is given in the Appendix). In an MCA, if two categories are close it indicates that they tend to be chosen jointly by respondents. This MCA indicates that gamblers participating in activities such as the National Lottery, bingo or scratchcards are closer to individuals who do not participate in many gambling activities while individuals participating in spread betting, betting exchanges, online bookmakers and FOBTs tend to participate in more activities. Gambling activities located above one on the axis<sup>2</sup> are on average practised by gamblers having participated in more than 6.7 different gambling activities in the last 12 months. On the contrary, activities located below one are on average practised by gamblers who participated in 1.3 activities in the last 12 months.

**2.6** We can also say that people who tend to play the National Lottery are also those who tend to play bingo. On the contrary, those who spread bet or use betting exchanges are more distinct. The way the activities are located along the axis suggests also that the main way to differentiate gambling activities is by their level of technicality and the specific knowledge in gambling practice that they require. Activities like National Lottery or bingo are easy to understand and often linked to social activities in peer groups.

**2.7** Activities like spread betting, betting exchanges and online betting are more individual and require more sophisticated gambling skills.

### PCA and MCA on the frequency variables

**2.8** We also observed the frequency of participation. We ran a PCA using the frequency variables as quantitative variables<sup>3</sup>. The result of this PCA gives us an idea about the link between the different frequencies of usage of the different gambling activities.

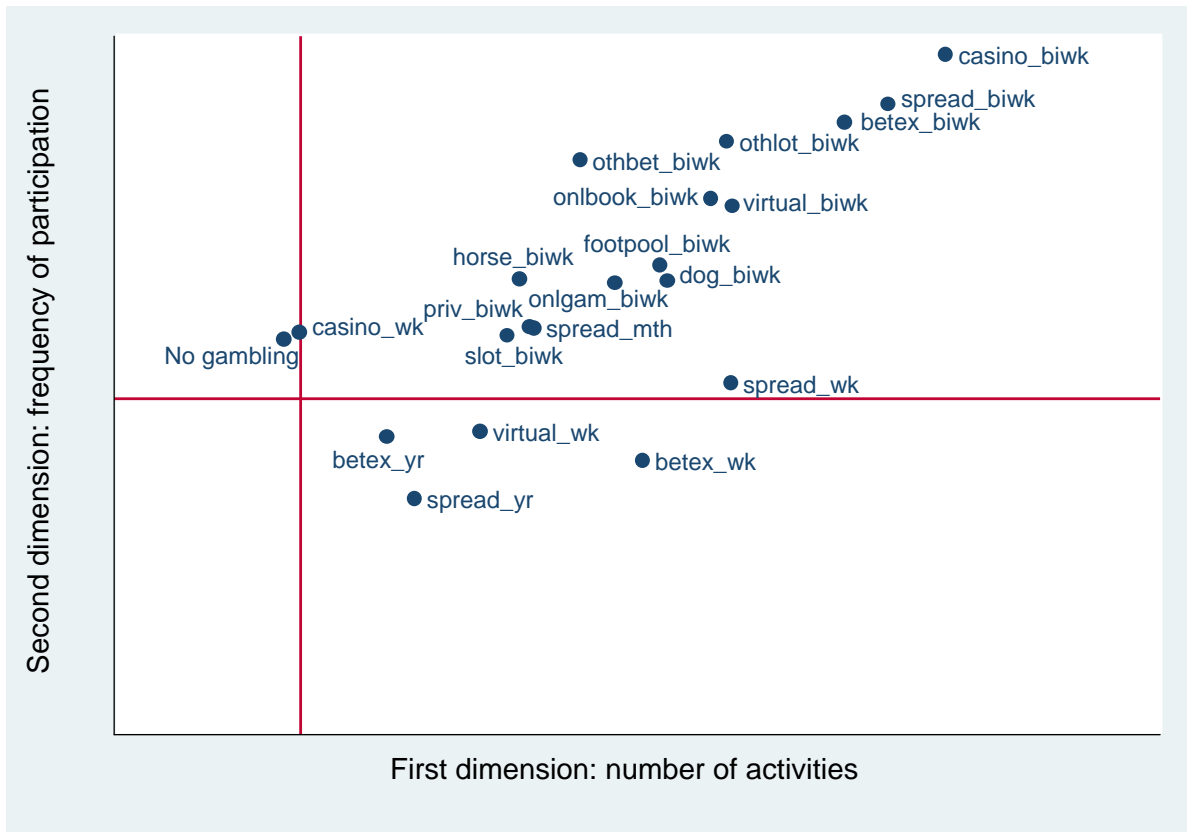
<sup>2</sup> The scale of the vertical axis has no specific meaning, it can however help us to locate categories.

<sup>3</sup> These variables (nldy to othy in the data set) present the frequency of participation for each gambling activity. Strictly speaking these variables are ordered variables (their values go from 'no participation in the last 12 months' to 'at least twice a week'). The PCA takes into account the ordering of the modalities.

If individuals frequently play bingo and also frequently play the National Lottery, then these two categories will be graphically close<sup>4</sup>. The results of this PCA are extremely similar to the MCA on the participation variables. For this reason we will not present these results extensively. Once again, the PCA revealed that the different categories of individual (according to the descriptive variables available) share for the most part common gambling patterns of participation and frequency.

**2.9** In order to allow the highest flexibility in the exploratory analysis of the data, we used an MCA on the whole set of frequency variables<sup>5</sup>. Figure 2 presents the corresponding result for the variables<sup>6</sup> (keys for the labels are provided in the appendix). It appears once again that most modalities are close and that few modalities (eg participating twice a week on spread betting, betting exchanges, FOBTs, other lottery) stand out. This means that these activities are practised at a higher level of intensity by only a small minority in the sample.

**Figure 2. MCA on the frequency of participation variables**



NB Virtual = FOBTs

**2.10** To help visualise the relationship between these gambling activities and the different groups of problem gamblers and non-problem gamblers, we superimposed the groups of problem gamblers and non-problem gamblers on this space and kept only some of the gambling variables. Figure 3 presents this 'individual x variable' space.

<sup>4</sup> No table in the report is similar to this analysis. This is quite normal as such a table would have 102 rows and columns since there should be one row and column for each of the different answers to each variable (17 variables and 6 answers).

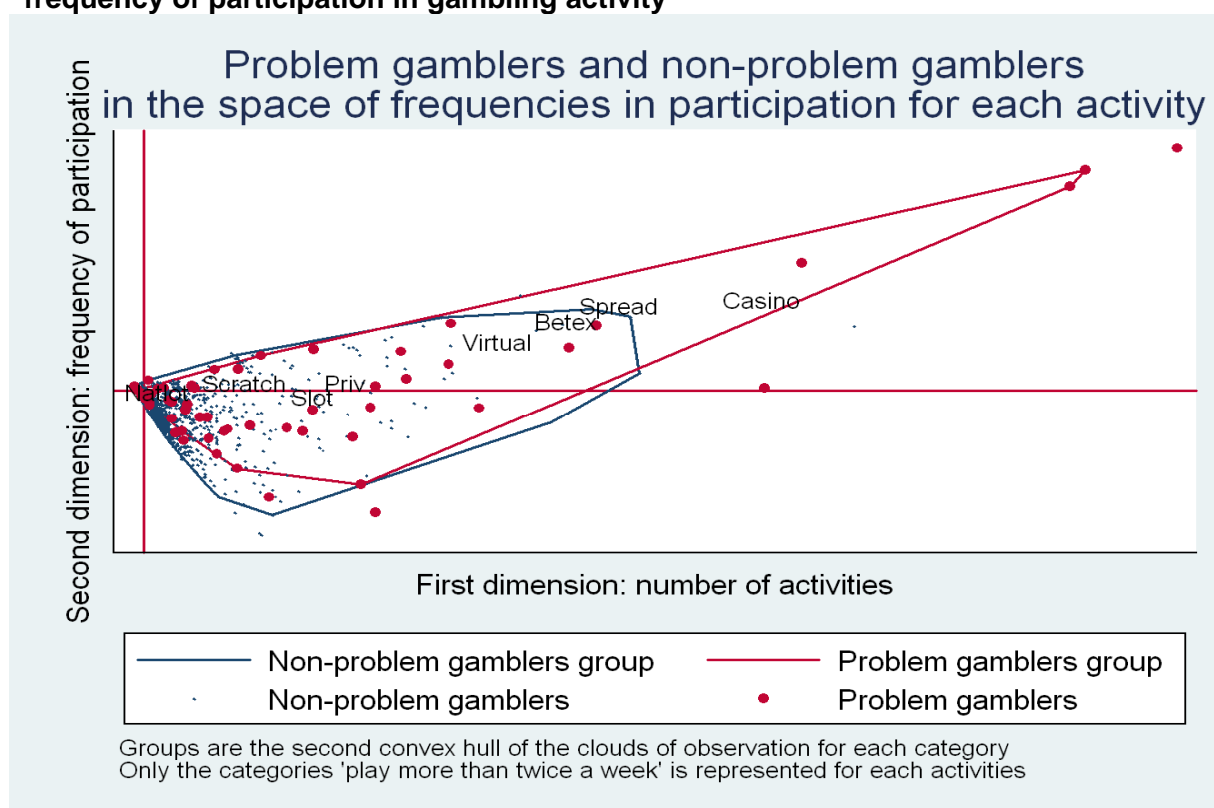
<sup>5</sup> An MCA on these variables is more flexible as it removes the hypothesis of linearity of the PCA. It is a way to do a non-linear PCA analysis (Saporta, 2006, p. 230-231).

<sup>6</sup> An MCA is a projections technique of an initial multidimensional space (whose number of dimensions is the number of variables) on a space of smaller dimensions (here a 2 dimensional space). The figure must therefore be seen as a way to summarise visually how the frequency of gambling in each type of activity is associated by gamblers. If two categories are close, like spread betting at least twice a week and betting on the exchanges at least twice a week, this means that there are many gamblers who jointly participate in these activities with these frequencies. The dimensions themselves have no special meaning a priori and must be interpreted given the way the categories appear positioned on the graph. The first dimension is the one explaining the highest amount of spatial variation in the data. For clarity, only a subset of all the possible categories of gambling activity frequency is displayed in Figure 2.

Given the non-oval shape of the groups, we decided to use convex hulls<sup>7</sup> to represent them. We only displayed on this figure the location of the modality 'play at least twice a week' for a selection of activities. The dimensions have no a priori meaning and must be interpreted with the way the categories are spread. The horizontal dimension is the first dimension because it explains most of the variance of the sample. Figure 3 indicates that gamblers playing at least twice a week on betting exchanges, spread betting and casinos tend to be the same while they tend to differ from those playing at least twice a week on the National Lottery and on scratchcards.

- 2.11 It appears from this analysis that the MCA on the frequency variables does not allow us to discriminate fully problem gamblers from non-problem gamblers. Gamblers are spread out over the space and are just characterised by a higher variance: typically, problem gamblers may be more likely to play more frequently on some specific gambling activities, but you can also find problem gamblers who do not participate much in these activities.
- 2.12 However, patterns of play such as participation in betting exchanges, spread betting and casino-style gambling at least twice a week are more likely to characterise problem gamblers than non-problem gamblers.

**Figure 3. Representing problem gamblers and non-problem gamblers in the space of frequency of participation in gambling activity**



### Clustering

- 2.13 Clustering techniques attempt to determine the natural grouping of observations. The clustering analysis, for instance, will allow us to see if there are different groups of gamblers. For example, do some gamblers only play bingo, while others only bet on horse and dog racing? Clustering is not always useful or relevant. For example, the more homogeneous a population, the less interesting or relevant are the findings from the clustering analysis. Even if the clustering algorithm finds 'subgroups', these may not represent substantial differences in gambling behaviour<sup>8</sup>.

<sup>7</sup> Convex hulls are like 'onion layers' of the cloud of points (scatterplot). The first convex hull is the set of points forming the outer layer of the onion. The second convex hull we are using here is the underlying outer layer when the first layer has been removed (some talk of the analogy of 'onion peeling'). We keep the second convex hull to remove outliers which could overly influence the shape of the group.

<sup>8</sup> Technical point: a clustering algorithm groups together individuals who, relative to some specific characteristics (here gambling activities), look alike enough and differ enough from individuals from other groups. A clustering algorithm will always find 'groups', however if the population is homogenous, these groups may not be very meaningful in that they are actually very

- 2.14** To determine whether discrete groups of gamblers exist we ran several clustering analyses on the variable 'gambling participation'. The aim was to explore if there are distinct types of gamblers playing distinct activities at various levels of participation.<sup>9</sup>
- 2.15** We imposed the partition of the sample in 2, 3, 4 and 5 groups<sup>10</sup>. We found that clustering analyses on the participation variables do not produce groups which are very meaningfully different relative to the question of problem gambling. That is, no specific group contained most of the problem gamblers. In order to improve the possible discrimination of groups with respect to problem gamblers we used the DSM-IV and Problem Gambling Severity Index (PGSI) scale as a second stage to define, as starting points, groups of gamblers with different levels on this scale. Neither of these procedures produced groups discriminating clearly between problem gamblers and other gamblers. This means that problem gamblers do not form a specific group of gamblers with very specific gambling activities. Problem gamblers can be found with a wide range of gambling activities.
- 2.16** The groups obtained from the clustering analysis are close in their characteristics. This indicates that the sample of gamblers is not heterogeneous. There is a continuum between the different activities in the sense that there are no clear niches of activities where some gamblers participate without participating in others. Typically this would suggest that most gamblers participate in a wide range of activities, with a minority also participating in more specific/technical/novel types of gambling like online bookmakers, FOBTs, spread betting.
- 2.17** When we divide the sample into 4 or 5 groups, a group with a significant number of problem gamblers appears from the cluster analysis. However, this group identifies problem gamblers very imprecisely. First, it is quite important in terms of size (N=899 for the group in the clustering in 4 groups and N=703 for the group in the clustering in 5 groups), and for this reason, it includes lots of non-problem gamblers. In addition, it contains individuals with large differences in gambling patterns. Second, this group includes only a fraction of the problem gamblers: in the clustering in 4 groups it contains 60% of the problem gamblers while it gathers 45% of them in the clustering in 5 groups.
- 2.18** A point of interest of this clustering analysis was to examine if groups of problem gamblers are different from others relative to their gambling activities. We found that problem gamblers are spread over different groups and the clustering algorithm does not separate them naturally from other gamblers. Put simply, this means that problem gamblers can not be differentiated from other gamblers according to gambling activity. Dividing into more groups produces a split of the group containing the most problem gamblers (group 5/3) rather than a concentration of problem gamblers in a specific group. This is therefore an additional indication that the problem gamblers cannot really be singled out as a specific group given their types of gambling activities.
- 2.19** This does not mean that problem gamblers are identical to non-problem gamblers. Our results indicate that we need more variables than betting activities to discriminate between problem gamblers and non-problem gamblers.
- 2.20** Overall the gamblers are more homogeneous than not: they share, for the most part, common gambling practices. The gambling activities are not divided into different markets with different customers. Most gamblers participate in gambling activities taken from a common pool of available activities. The only difference seems to be that some activities are less common and only subgroups participate in these: e.g. spread betting, online gambling, FOBTs. Males and younger<sup>11</sup>, gamblers are more likely to participate in these activities.

---

similar. On the other hand, if there are really different groups (in a usual sense) in the population, the clustering algorithm will be able to identify them precisely.

<sup>9</sup> To run a clustering on the participation variables (variables nldpy to othpy) we transformed these variables into binary variables and used a kmean algorithm with a Jaffard coefficient of binary similarity. Given that the variables about the frequency of gambling activity have ordered values, another possibility would have been to consider them as continuous.

<sup>10</sup> *Technical point:* A clustering algorithm always needs some starting points to build the groups, and the final result of the algorithm depends on the starting points. To give the highest flexibility to the clustering algorithm, we initially specified random starting points. In practice, the final results were very consistent across different sets of starting points randomly selected. Only minor differences could be noticed in the size and composition of the groups.

<sup>11</sup> 'Younger gamblers' is referred to as a continuous variable throughout the report, ie there is not specific age group to characterise this.

### **Summary – Exploratory analysis on gambling participation**

Those individuals participating in only one or few activities are more likely to be engaging in activities such as the National Lottery, bingo and/or scratchcards.

Those individuals who are gambling on activities such as spread betting, betting exchanges, online gambling (gaming and betting) and FOBTs are more likely to be engaging in a larger number of gambling activities.

There seems to be a large group of homogeneous gamblers who participate in a wide range of activities, within which exists a smaller subgroup participating in more specific/technical/novel types of gambling like online betting, FOBTs, spread betting and betting exchanges.

Problem gamblers cannot be systematically differentiated from other gamblers according to gambling activity or frequency of play. This does not mean that problem gamblers are necessarily identical to non-problem gamblers but simply that they do not belong to mutually exclusive groups.

### **Inferential Analysis**

- 2.21** Factors influencing participation were then examined. To do this we have tried to be very flexible in the estimation technique. For this reason, we initially use non-parametric estimations to allow for full flexibility of estimation.<sup>12</sup>
- 2.22** We first looked at the characteristics of the individual participating in a wide range of activities and tried to see if and how they differ from people not participating in gambling or participating only in very few activities. One of the main limitations of the data set is the lack of variables such as cognitive (eg knowledge of odds; biased reasoning), situational (eg location to nearest gambling venue; type of local gambling opportunities) and dispositional (eg personality variables). This limits our ability to develop a model to explain gambling participation and possibly participation in problem gambling. After careful consideration of the available variables, we decided that one additional variable could be considered in the analyses: the numbers of years the gamblers have been gambling.<sup>13</sup> We introduced this variable *experience* (for gambling experience) in order to test whether such a trend could be noticed. We used a general additive model (GAM) which is a natural extension of multiple regression to the non-parametric domain. The impact of every variable on the fact of participation in a large range of activities is estimated non-parametrically<sup>14</sup> (ie locally) while controlling for the impact of other variables. The explained variable is the number of activities the individual has participated in during the last 12 months.
- 2.23** In Figure 4 the central line represents, for each of the variables, the local average of the number of activities the respondent participated in during the last 12 months. The two surrounding lines represent the confidence interval of the estimation.<sup>15</sup> It appears clearly that participation in a wider range of activities is associated with younger age, and a more accepting attitude toward gambling. It also seems that participation in a wide range of gambling activities increases steeply just after beginning to gamble for the first time. The relationship between income and gambling participation does not seem to be significant.

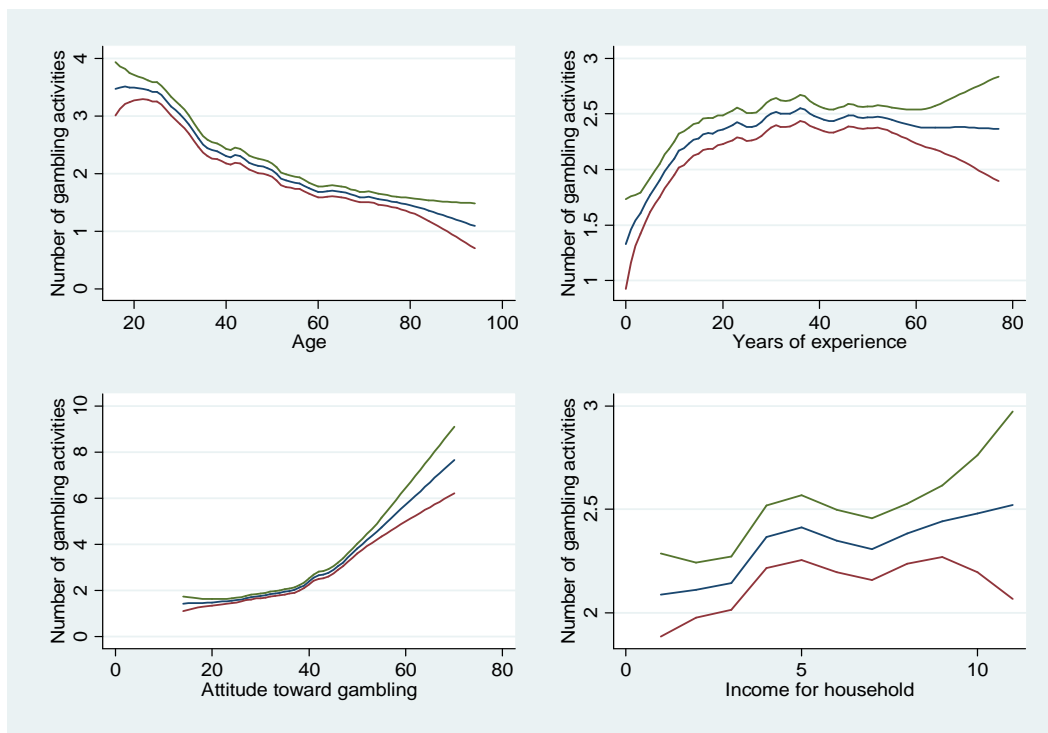
<sup>12</sup> Non-parametric estimations do not rely on prior assumptions on the relationships between variables.

<sup>13</sup> Current age minus age of first gambling practice.

<sup>14</sup> We used a running line technique.

<sup>15</sup> It should be noted that it is not possible to use the weight of the survey design in such estimations. Given that the sample of the survey was very close to a representative sample of the British population we believe that is not likely to introduce any major bias into our results.

**Figure 4. Non-parametric estimation of the determinants of participation**



**2.24** After this first step, we used two parametric models to model participation in gambling activities. First, to estimate the impact of different factors on the number of activities the gamblers participate in, we used a count model (Poisson regression); then, to identify the factors determining the participation in one gambling activity rather than another, we used a McFadden choice model which allows us to estimate the effect of each descriptive variable on each individual choice to participate in a gambling activity.<sup>16</sup>

### Count Model

**2.25** The count model allows us to identify factors leading to participation in a higher number of gambling activities. Given that gamblers tend to participate in fewer than 15 activities, a Poisson regression model should be preferred to a linear regression model<sup>17</sup>. Table 3 presents the results; it contains three different estimations as we estimated the model in three different ways to make sure that the results are robust. The technical note below explains our approach.

**2.26 Technical note:** One of the problems we encountered in the estimation is the high number of missing values. Typically, many respondents did not answer a question in the survey (not always the same question). This is problematic because the subsample of people having answered all the questions may have different characteristics compared to the rest of the sample. In addition, when this subsample is too small, we can face difficulties implementing the survey estimation techniques.<sup>18</sup>

In order to ensure the robustness of our findings, we chose to run three versions of the model:

1. A simple estimation on the subsample of individuals having answered to all the questions
2. An estimation on the same subsample with the sampling weights and the clustering of observation by Primary Sampling Unit (PSU)<sup>19</sup>

<sup>16</sup> Technically, this model is similar to a multinomial logistic model with the possibility for the individual to select positively several gambling activities.

<sup>17</sup> When the explained variable is an integer between 0 and a positive and relatively small number, linear regression (which assumes a normal distribution of the error term) is not well suited as an estimation tool.

<sup>18</sup> Typically, if in this subsample there is one stratum with only one primary sampling unit, it is not possible to compute the proper matrix of variance in regression models. In addition, any estimation on a subsample is bound to be biased as an incorrect number of Primary Sampling Unit (PSU) will be used in the variance computation formula.

<sup>19</sup> This procedure is *conservative* in the sense that it does not take advantage of the stratification of the survey design to decrease the size of the standard error.



3. The same estimation is run on a sample where missing values are imputed.<sup>20</sup>

**2.27** The last procedure allows us to check if our results are not biased due to differences in observed characteristics between the individual answering all the questions and those who do not<sup>21</sup>.

**Table 3. Factors determining the number of gambling activities in the last 12 months**

Poisson regression	(1)	(2)	(3)
	Participation	Participation	Participation
Age	-0.019 (13.82)**	-0.018 (10.23)**	-0.014 (8.31)**
Male	0.121 (5.75)**	0.138 (4.54)**	0.158 (5.95)**
Income	0.036 (7.62)**	0.039 (5.97)**	0.049 (7.03)**
Professional qualification or above O or A level	(ref) 0.148 (6.20)**	(ref) 0.134 (3.86)**	(ref) 0.150 (4.50)**
Lower qualification	0.189 (6.14)**	0.185 (4.21)**	0.123 (3.11)**
Attitude	0.032 (25.49)**	0.032 (13.81)**	0.041 (23.82)**
Married	(ref)	(ref)	(ref)
Separated/Divorced	0.088 (2.53)*	0.096 (2.03)*	0.073 (1.80)
Single	0.018 (0.72)	0.017 (0.43)	-0.060 (1.70)
Widowed	0.108 (2.11)*	0.118 (1.93)	-0.023 (0.44)
Civil partnership	0.098 (1.13)	0.088 (0.91)	-0.029 (0.25)
Years of experience	0.006 (4.59)**	0.005 (3.33)**	0.004 (2.42)*
White	(ref)	(ref)	(ref)
Asian	-0.125 (1.41)	-0.171 (1.33)	-0.643 (6.13)**
Black	-0.399 (4.22)**	-0.433 (2.90)**	-0.556 (4.43)**
Other ethnicity	0.020 (0.30)	-0.004 (0.03)	-0.300 (2.69)**
Parents gambling	0.105 (4.94)**	0.109 (3.71)**	0.231 (7.63)**
Constant	-0.100 (1.37)	-0.113 (1.02)	-0.865 (9.04)**
Observations	4796	4796	9003
* significant at 5% ** significant at 1%			
Robust z statistics in parentheses			
Absolute value of z statistics in parentheses			

**2.28** The three columns of Table 3 respectively represent the three estimation methods described above. The coefficients indicate the effect of each variable on the participation.

<sup>20</sup> We used the MICE algorithm (multiple imputation by chained equations) which is the best technique available to impute missing values. This technique takes into account the uncertainty associated with the imputation of the missing values in the estimation of the statistical model.

<sup>21</sup> It must be noted that this does not control for unobserved differences. If individuals who do not answer all the questions have some specific psychological traits which are not observed with the survey questions and which influence their betting behaviour, then this would introduce a bias in our estimation. There is unfortunately no way to control for it apart from having a specific model explaining the choice not to answer the questions.

If a coefficient is positive and significant, it indicates that this variable is linked with participation in a greater number of activities.

- 2.29** It appears that the variables identified in the non-parametric estimation are significant. In addition, the education level of the individual plays a significant role in determining levels of participation. For qualitative variables (qualification, marriage, ethnicity), the coefficients indicate the difference in participation between the specific category and a reference category. For instance, relative to the reference category 'Professional qualification or above', less qualified individuals participate in a wider range of gambling activities. It also appears that divorced individuals are more likely to participate in a large range of activities than married individuals. This result could, however, be driven by the fact that divorced individuals have different individual and situational characteristics (that we cannot control for here) which would explain their divorced status and their gambling activity. We cannot unambiguously interpret this coefficient as indicating a causal effect of divorce on gambling behaviour.
- 2.30** Regarding ethnicity, black individuals tend to participate in a lower number of activities than white individuals. Finally, the number of years of gambling experience also has a positive impact which supports the idea raised by the MCA analysis that gamblers who participate in a wider range of activities have a longer experience of gambling.

### Factors influencing choice of gambling activity

- 2.31** Once we have analysed the variables linked with the act of gambling, we may be interested in learning how people chose between different gambling activities. In order to study this question, we will focus on those gambling and look at the variables linked with participation in each specific activity.
- 2.32** We use a McFadden choice model to estimate how individual characteristics are linked with the choice of gambling activity among all the activities available. To do so, we must select a reference activity (base category) to which each activity will be compared. It seemed natural to take the participation in the National Lottery as a base category as it is the most widespread gambling activity in the UK. The results of the McFadden choice model are presented in Table 9 in the Appendix 3. Every coefficient must be interpreted relatively, in two ways. If the variable 'Male' is significantly positive for 'Slot Machines' this means that males are more likely *than females* to play slot machines *rather than to play the lottery*. Typically this means that the ratio of slot machine gamblers/lottery gamblers will be higher for males than for females.
- 2.33** The results of this estimation indicate that:
- Younger gamblers** are more likely to play these activities, rather than the National Lottery, relative to older gamblers (the activities are ranked by order of importance of the estimated effect of age<sup>22</sup>):
1. Private betting
  2. Gaming machine
  3. FOBTs
  4. Online gambling
  5. Casino
  6. Dog races
  7. Betting exchange
  8. Online bookmaker
  9. Horse races
  10. Scratchcards
  11. Bingo
- Males** are more likely than females to participate in these activities rather than the National Lottery:
12. Spread betting
  13. Online bookmakers
  14. Football pools
  15. Betting exchanges
  16. FOBTs

---

<sup>22</sup> Only activities whose age had an effect significant at 5% are reported.

17. Casino
18. Gaming machines
19. Private betting
20. Online gambling
21. Dog races
22. Horse races

Are less likely to participate in:

1. Bingo

**Wealthier individuals** are more likely to participate to these activities rather than the National Lottery:

1. Online bookmaker
2. Casino

Are less likely to participate in:

1. FOBTs
2. Bingo
3. Slot machines
4. Scratchcards

**Individuals having a more positive attitude toward gambling** are more likely to participate in these activities rather than the National Lottery:

1. Betting exchange
2. Online gambling
3. Casino
4. FOBTs
5. Horse races
6. Dog races
7. Online bookmaker
8. Slot machines

**Individuals with a longer experience of gambling** are more likely to participate in these activities rather than the National Lottery:

1. Private betting
2. Horse races
3. Dog races
4. Gaming machines
5. Football pools
6. Casino
7. Online bookmaker
8. Bingo

**2.34** On the whole the count model and the McFadden choice model allow us to estimate the factors influencing the level of participation in gambling and the type of gambling activity chosen. These models are logically complementary. One of the main results of both these estimations is that younger males tend to gamble more and they tend to participate in more sophisticated types of gambling activity, on average.

**2.35** Regarding the existence of a dimension of professionalism discriminating individuals, more experienced gamblers participate more often in activities other than the National Lottery, but are not more likely to participate in relatively sophisticated activities such as spread betting or betting exchanges than in the National Lottery.

This could be due to the fact that experienced gamblers participate more in the National Lottery<sup>23</sup> or to the fact that expertise in activities like spread betting and betting exchanges can be gained over a short period of time<sup>24</sup> (one year or less).

<sup>23</sup> A specific analysis of participation in spread betting, betting exchange and FOBTs indicates that betting exchange play and FOBTs activity tend to increase with years of experience. The McFadden model result indicates that the participation in these activities does not increase more than the participation in the National Lottery. The participation in spread betting does not increase with the number of years of experience.

<sup>24</sup> Our variables 'years of gambling' experience would be ill suited to capture differences in gambling expertise gained over a period of time of one year or less.

## Type of gambling participation and level of gambling activity

**2.36** In terms of participation by gambling activity, we find a correlation between the way people participate in individual gambling activities and their overall gambling activities. The tables below report the coefficient of Poisson regressions. When participation in a certain type of gambling activity is associated with more gambling activities, the coefficient is positive. It is important to note, however, that this does not indicate causality as the causality could be reversed (for instance, heavy gamblers choosing these types of activity for other reasons).

**Table 4. Poisson regressions on number of activities**

	Nat Lot	Scr cards	Online	Horses	Dogs	Private
Shop	0.0829* (0.020)	0.112 (0.220)				
Internet	0.323*** (0.000)	0.189 (0.332)				
Mobile	1.235*** (0.000)					
TV	1.151*** (0.000)					
Supermarket		0.0769 (0.388)				
Petrol station		0.400*** (0.001)				
Numbers			-0.271 (0.063)			
Poker			0.180 (0.168)			
Card			-0.0259 (0.927)			
Roulette			0.535*** (0.000)			
Slot			0.164 (0.455)			
Track				-0.184 (0.257)	-0.635** (0.009)	
Betting shop				0.386** (0.003)	-0.354 (0.117)	
Telephone				0.525*** (0.000)		0.729*** (0.000)
Sportsground						-0.189 (0.201)
Work						0.252** (0.001)
Home						0.235*** (0.000)
Other home						0.150* (0.027)
Pub						0.331*** (0.000)
Email						0.556* (0.020)
Constant	0.886*** (0.000)	1.258*** (0.000)	1.919*** (0.000)	1.261*** (0.000)	2.351*** (0.000)	1.462*** (0.000)
F test	<0.001	0.115	0.001	<0.001	0.021	0.001
Observations	3094	532	68	226	56	217

### Poisson regressions on number of activities (continued)

	Slot machines
<b>Pub</b>	0.255*** (0.001)
<b>Betting shop</b>	0.544*** (0.000)
<b>Arcade</b>	0.0377 (0.693)
<b>Bingo hall</b>	0.0794 (0.488)
<b>Fast food</b>	0.0592 (0.681)
<b>Mini cab</b>	0.0703 (0.812)
<b>Railway station</b>	0.392 (0.292)
<b>Casino</b>	-0.0109 (0.948)
<b>Sports centre</b>	-0.157 (0.440)
<b>Fairground</b>	-0.265 (0.458)
<b>Social club</b>	-0.0538 (0.620)
<b>Work</b>	0.200 (0.272)
<b>Constant</b>	1.494*** (0.000)
<b>F test</b>	<0.001
<b>Observations</b>	301

*p*- values in parentheses

\* *p* < 0.05    \*\* *p* < 0.01    \*\*\* *p* < 0.001

#### 2.37 Overall, we find for example that:

- People playing the National Lottery on TV or on the internet participate in more gambling activities on average. This is in line with our previous results indicating that gamblers using more technical and individual ways to gamble have on average a higher degree of participation.
- People who play slot machines in betting shops tend to gamble on a wider than average range of activities.

#### **Section summary– Factors associated with gambling participation**

Individuals who are younger, male, on a higher income, less educated individuals, those of ethnic origin other than black and those with parents who gamble were more likely to participate in a wide range of gambling activities.

While most gambling activities are practised across wide range of ages and socio-economic groups, some significant socio-demographic differences exist:

Size of income has an important influence on the type of gambling activities practised.

Wealthier individuals were more likely to engage in casino gambling or to gamble on the internet while those on lower incomes were more likely to participate in activities like bingo or FOBTs.

Males were more likely to participate in activities we labelled as more 'sophisticated' like spread betting, betting exchanges, FOBTs, and online betting. The only activity that females were significantly more likely to play was bingo.

Younger gamblers were more likely than older gamblers to participate in most types of gambling; private betting and gaming machines in particular. There was no gambling activity in which older gamblers were significantly more likely than young gamblers to engage.

There were significant implications for the number of activities in which individuals participated depending on the channel, medium or venue by which the game was being accessed. Individuals were more likely to participate in a wider range of gambling activities if they:

- played the National Lottery through any medium other than the shop (TV; internet; mobile phone)
- bought scratchcards at petrol stations
- played online roulette
- gambled on horse racing using the telephone or a betting shop rather than at the track - but the reverse was true for dog racing
- engaged in private betting by telephone or text message
- played machines in pubs or betting shops.

### 3 Problem gambling

#### Exploratory analysis

- 3.1** Initially, we used discriminant analysis to find the factors discriminating between problem gamblers and non-problem gamblers. It should be noted that the logistic regression used in BGPS 2007 is already a discriminant analysis. We use here, however, a linear discriminant analysis as a complement to the logistic regression used in the original report.<sup>25</sup>
- 3.2** The main problem we have in studying problem gambling is the small number of problem gamblers (N=59)<sup>26</sup>. To resolve this problem, we turned back to the DSM-IV and PGSI scales as they are the best indicator of problem gambling. We summed these two scales and created three categories: one for individuals answering negatively to all the items (N=7623), one for individuals who answered positively to one or two items on these scales (N=612) and one for individuals who answered positively to three or more items (N=768). We will call this new variable with three categories *prob*.<sup>27</sup>
- 3.3** Table 5 presents the factor loadings of the discriminant analysis on the first dimension which discriminate the most between problem gamblers and non-problem gamblers (as defined by our aggregated variable). The loadings indicate the correlation between the gambling practice and the tendency to answer positively to the items of the problem gambling scales. Variables with a positive loading indicate a positive correlation with problem gambling, while the variables with a negative loading indicate a negative correlation with problem gambling. Gamblers who are younger, male, from an Asian background, have lower incomes and lower level of qualifications and single or divorced are more likely to exhibit signs of problem gambling. These results are fully consistent with the results in the BGPS 2007 report (Table 5.6 p. 102). In addition, some variables which were not in the BGPS 2007 report also seem to be linked with problem gambling: gamblers who are widows or black seem to be more likely to be problem gamblers, while people with more years of experience seem less likely to be problem gamblers.

<sup>25</sup> A linear discriminant analysis is similar to the PCA/MCA method in the fact that it reduces a large number of variables to a smaller number of dimensions. The specificity of linear discriminant analysis is that the dimensions are chosen to maximise the differences between the groups.

<sup>26</sup> Taking a large definition: we include here individuals who are defined as such either with the DSM scale or by the PGSI scale.

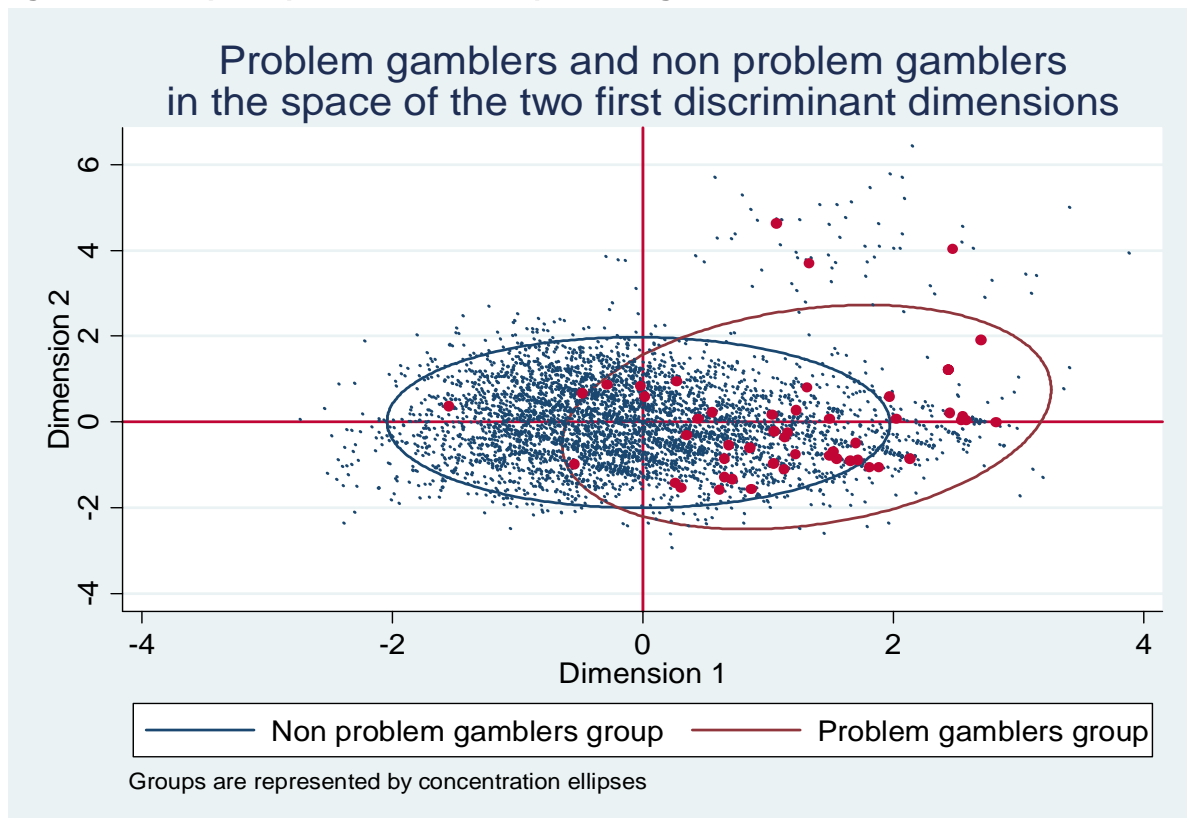
<sup>27</sup> The use of a synthetic measure drawing information from both scales is fully justified by the high consistency between the two scales. The items of the two scales measure the same uni-dimensional construct (as evidenced by a high Cronbach alpha coefficient, 0.90).

**Table 5. Link between individual characteristics and problem gambling (factor loadings of the first dimension of the discriminant analysis)**

Factors	Link with problem gambling
Single	0.3395336
Low education level	0.2226506
Divorced	0.1893378
Asian	0.1725206
Widow	0.1353069
A level education	0.0967283
Partnership	0.060789
Black	0.0253411
Years of experience	-0.0214759
White	-0.0497161
Drinking	-0.0814483 <sup>28</sup>
Income	-0.461054
Age	-0.5503457
Female	-0.574475

**3.4** It is also possible to use the discriminant analysis to graph different groups using the two first dimensions of the discriminant analysis. This is useful to present visually the ability of the discriminant analysis to discriminate the population of problem gamblers from the general population. Figure 5 presents the group of problem gamblers (defined strictly as a problem gambler relative to the DSM-IV scale or the PGSI scale<sup>29</sup>) compared to the group of non-problem gamblers. There is a large overlap between the group of problem gamblers and the group of non-problem gamblers.

**Figure 5. Groups of problem and non-problem gamblers**



<sup>28</sup> Note that this result is not in conflict with the BGPS 2007 regarding drinking. Section 5.3 of the BGPS report states that a higher level of drinking is correlated with a higher frequency of problem gambling. This does not control, however, for all the other variables correlated with drinking behaviour. The report did not include drinking behaviour in the regression analyses (p. 100) due to its high correlation with other variables. Our results simply indicate that when controlling for other factors, drinking per se does not appear to be positively correlated with problem gambling.

<sup>29</sup> This is the definition used in the BGPS 2007 report.

For this reason, it is clear that while the discriminant analysis allows us to find factors discriminating between the two groups, it is far from being able to fully discriminate between the two groups.<sup>30</sup>

### Frequency as a relevant covariate in determining problem gambling

**3.5** We have run a series of discriminant analyses including progressively more variables: participation variables, attitude variables, and finally frequency variables. Most of the results tend to give the same result. Of particular interest is the link between frequency of participation in each activity and problem gambling, which was not studied in the BGPS 2007 report. Table 6 shows that, on primary inspection, frequent (ie at least twice a week) engagement with horse racing, scratchcards and slot machines seems to be most closely associated with problem gambling. Nevertheless, these findings must be interpreted with great caution. In particular, our estimation technique does not allow us to say if these gambling activities are significantly more closely linked with problem gambling than, say, online gambling. However, this result indicates that when studying the link between gambling activities and problem gambling, the frequency of participation in each activity should be considered.

**Table 6. Link between gambling activities frequency and problem gambling (factor loadings of the first dimension of the discriminant analysis)**

Factors	Link with problem gambling
Horse racing twice a week	0.23044
Scratchcards twice a week	0.1963681
Slot machines twice a week	0.1629639
Slot machines monthly	0.1471737
Online gambling twice a week	0.145611
Slot machines weekly	0.1267924
Football pools monthly	0.1140343
Online bookmaker monthly	0.1097302
Online bookmaker twice a week	0.1070632
Dog racing twice a week	0.0975212
Spread betting monthly*	0.0941006
Scratchcards weekly	0.0872886
Casino gambling weekly*	0.0707173
Horse racing weekly	0.0707173
Dog racing monthly	0.0627668
Online bookmaker weekly	0.0595183
Spread betting twice a week*	0.0539458
FOBTs weekly*	0.0225029
FOBTs twice a week*	0.0052232
No online gambling	-0.0664115
No scratchcards	-0.1248873
No bingo	-0.13024
No slot machines	-0.1464242
No private betting	-0.2177398

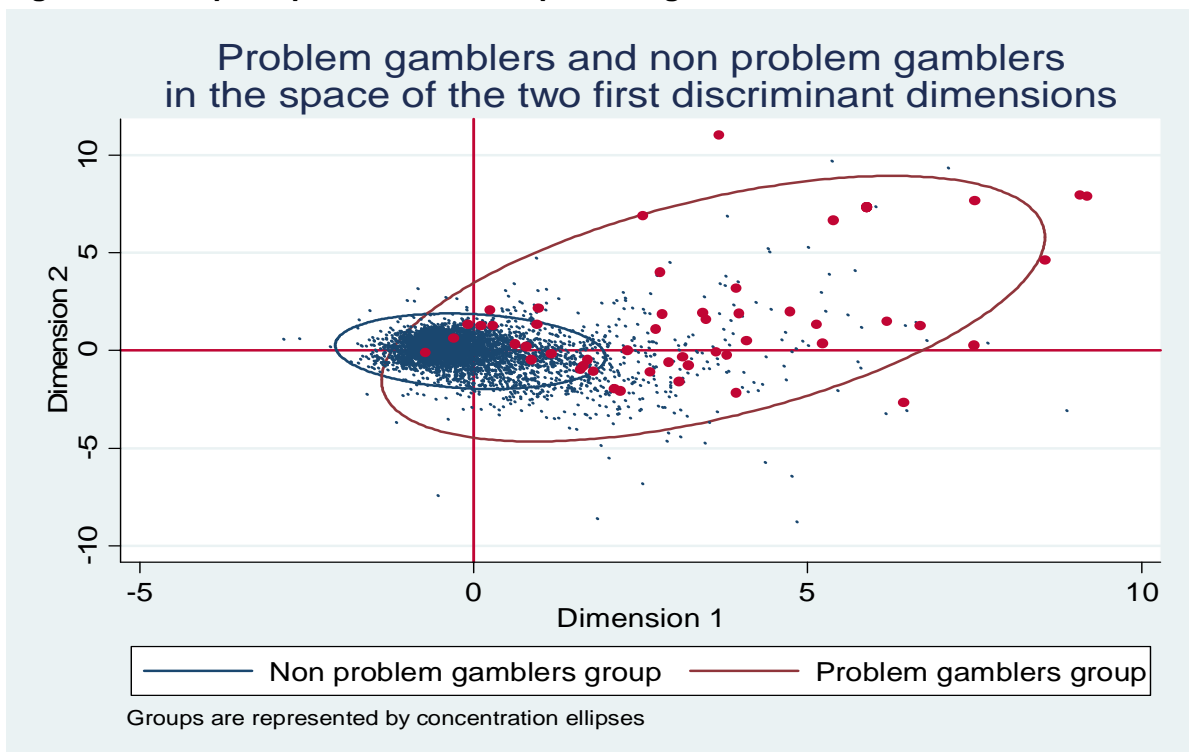
\* Number must be taken with caution due to a small number of observations. These categories are included for information only

<sup>30</sup> Technical note: The dimensions of Figure 4 are the two dimensions of the discriminant analysis. They are statistical constructs which do not have a meaning a priori, they are the best linear combinations of variables which discriminate between problem gamblers and non-problem gamblers. The interest of Figure 4 and 5 is not in the meaning of these dimensions, it is mainly in the graphical representation of problem gambling and non-problem gambling and of the groups predicted by the discriminant analysis. Figures 4 and 5 show that it is not possible to strictly discriminate problem gambling and non-problem gambling based simply on their personal characteristics (and on their gambling practice in the case of Figure 5).



- 3.6 Figure 6 shows that when including all these variables the quality of this discriminant analysis is better in that the additional information helps us to determine if a gambler is more likely to be a problem gambler.
- 3.7 The linear discriminant analysis is better suited than the MCA for discriminating the group of problem gamblers from the group of non-problem gamblers. In Figure 6, the first two dimensions are positively correlated with problem gambling. The first dimension contrasts the gamblers who play at least twice a week on horse racing, scratchcards, slot machines and online gambling (on the right of the graph) with the gamblers who do not. It also contrasts males and poorer individuals (more on the right) with females and richer individuals (more on the left). The second dimension contrasts those who play at least twice a week with online bookmakers, casino and slot machines (on the top) with those who do not. It also contrasts those who play the National Lottery more than once a month (on the bottom) with those who do not.

**Figure 6. Groups of problem and non-problem gamblers**



- 3.8 These different discriminant analyses provide results quite similar to the MCA analysis in the first part. In each discriminant analysis one or two dimensions tend to discriminate between non-problem gamblers and problem gamblers. We are able to find variables positively associated with problem gambling. However the analyses do not clearly separate the groups and there is an important overlap. As with the MCA, the group of problem gamblers presents notable heterogeneity which is visible in the larger size of the confidence ellipse.
- 3.9 When running the discriminant analyses with the level of frequencies, we noted that the pattern of gambling, which seems on primary inspection, to be most associated with problem gambling, was playing at least twice a week on the following activities: horse racing, scratchcards and slot machines, but we must be very careful not to over-interpret these particular findings. More generally, the link between gambling activities and problem gambling can be somewhat hidden when only participation is taken into account. The results of the first report on the BGPS 2007 tended to suggest that a higher level of problem gambling is linked with spread betting, FOBTs and betting exchanges (p. 94). Our analysis essentially provides a check of their result on gambling participation using a technique which is more robust to small observations and a large number of covariates. What is important here is that the ranking is not the same. This should be interpreted as inviting caution about the order of activities found in the 2007 prevalence survey rather than as suggesting an alternative ranking.

Most obviously, our results indicate that one should consider frequency of participation in studying the link between problem gambling and gambling activities.

**Section summary – Exploratory analysis of variables related to problem gambling**

The populations of problem gamblers and non-problem gamblers differed on average on several characteristics: problem gamblers were more likely to be younger, single, have lower qualifications and a low income.

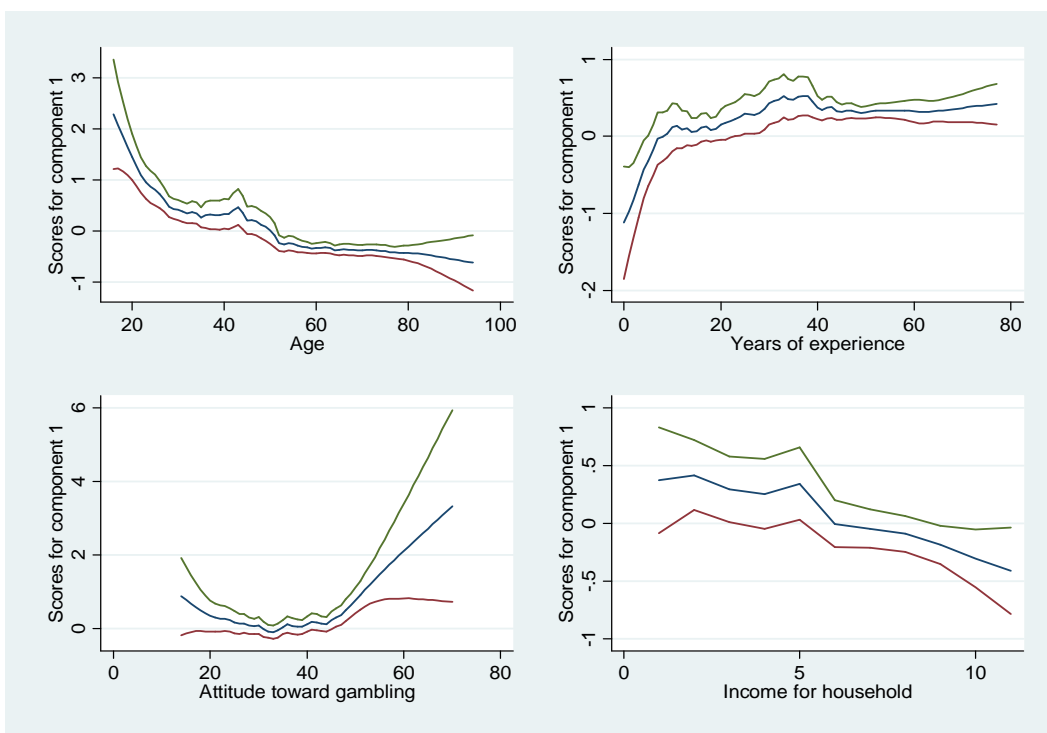
Problem gamblers seem also more likely to engage at least twice a week with horse racing, scratchcards, slot machines, online gaming and online betting. These findings must, however, be interpreted with great caution.

**Inferential analysis**

**3.10** It is clear from the preceding analyses that the variable at our disposal in terms of socio-demographic characteristics and attitudes will not allow us to find a single key to the understanding of problem gambling. Problem gambling is not confined to a specific subset of the population defined through the variables at our disposal. The analysis can help us, however, to understand what factors are correlated with problem gambling, and this may help to form new conjectures for future research.

**Non-parametric analysis**

**Figure 7. Non-parametric estimation of factors linked with the first component of the PCA on the DSM IV and PGSI scales**



**3.11** Initially, we ran several general additive models to estimate as flexibly as possible the effect of several variables on the problem gambling scales. Figure 7 presents the effect of age, years of gambling, gender and household income on the DSM-IV and PGSI scales. Given the low number of problem gambling cases, we ran a PCA on both of these scales and used the first component as a dependent variable.<sup>31</sup>

<sup>31</sup> The 19 items of the scales have a 90% Cronbach alpha taken together. This indicates that they measure clearly a one dimensional construct. This justifies our extraction of the main dimension from these items as an indication of problem gambling.

This new variable is just a weighted average where each positive answer in the PGSI and DSM-IV scales are given a weight depending on their ability to discriminate between problem gamblers and non-problem gamblers. This variable is a composite measure of problem gambling, built from the DSM-IV and PGSI scales.<sup>32</sup>

- 3.12** These analyses provide similar results and suggest that problem gambling is greater at a younger age, for males, and for lower incomes. The number of years of gambling does not seem to have a significant effect except in that recent gamblers seem to be somewhat less likely to be problem gamblers than more experienced gamblers.

### **Parametric analysis**

- 3.13** The main problem we are facing in the analysis of problem gambling is the small number of problem gamblers. The BGPS 2007 report presents a general logit model to study the factors linked with problem gambling but because of the small number of problem gamblers the number of variables included can only be small. To circumvent this problem, we use broader categories. Doing so, our analysis does not focus only on gamblers classified as 'problem gamblers' by the DSM-IV or PGSI scale, it looks instead at the gamblers who have at least some characteristics of problem gamblers. This is the only method of conducting some precise analysis on the variables linked with problem gambling. The number of problem gamblers is too small to conduct meaningful analyses.<sup>33</sup> We therefore built new variables related to problem gambling. First we used the variables 'prob' with the three modalities defined at the beginning of section two. With such a variable, the groups of interest are much larger.
- 3.14** We ran an ordered probit on the 'prob' variable to study with more confidence the factors influencing a higher position on this variable. We also ran a linear regression on the principal component from the PCA on the DSM-IV and PGSI scales.
- 3.15** We used here the three different approaches described in the technical note on p. 25 to make sure that our results are robust. Table 7 presents these results. The first three columns are the results of the ordered probit models with the three different procedures. The dependent variable is the variable 'prob' that we created and which takes three different values depending on the number of items answered positively on the PGSI and DSM-IV scales. The last three columns are the estimations of a linear model on the first component extracted from the scale. This variable is like a weighted sum of the answers to the two scales where the weight given to each question is higher for questions which discriminate more between individuals.
- 3.16** Overall, the results of these regressions indicate that individuals who are younger, male, single, have a lower level of qualifications and lower incomes are likely to score higher on the problem gambling scales. Individuals who have a positive attitude toward gambling are also likely to score more highly. Overall, these results are in line with the logit regression results from BGPS 2007.

---

<sup>32</sup> We ran the same regressions on the DSM-IV and PGSI scales independently and they give a very similar conclusion.

<sup>33</sup> Technically, the importance of having larger groups should not be underestimated. Maximum likelihood estimators like logit, ordered probit, etc are only consistent with a large number of observations. In our case we have a large number of observations overall but a very small number of positive values for the dependent variable. This is problematic for the identification of the effect of each individual variable.

**Table 7. Regressions on the tendency to answer positively to the problem gambling scales' items**

	Ordered probit			Linear regression		
	(1)	(2)	(3)	(4)	(5)	(6)
	Prob	Prob	Prob	PC1	PC2	PC3
Age	-0.009 (3.58)**	-0.010 (3.31)**	-0.005 (2.07)*	-0.008 (2.98)**	-0.008 (3.06)**	-0.005 (2.27)*
Male	0.270 (5.84)**	0.300 (6.16)**	0.214 (5.70)**	0.306 (6.05)**	0.351 (4.40)**	0.239 (6.79)**
Income	-0.048 (4.46)**	-0.052 (4.83)**	-0.033 (3.80)**	-0.036 (3.08)**	-0.038 (2.81)**	-0.012 (1.46)
Professional qualification or above	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
O or A level	0.077 (1.45)	0.083 (1.54)	0.079 (1.76)	0.102 (1.78)	0.115 (2.02)*	0.080 (1.94)
Lower	0.178 (2.72)**	0.171 (2.32)*	0.167 (3.19)**	0.166 (2.34)*	0.171 (2.17)*	0.106 (2.19)*
Married	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Separated/Divorced	0.187 (2.47)*	0.189 (2.41)*	0.086 (1.38)	0.141 (1.70)	0.191 (1.40)	0.086 (1.48)
Single	0.219 (4.01)**	0.212 (3.40)**	0.130 (2.85)**	0.193 (3.14)**	0.214 (2.80)**	0.153 (3.46)**
Widowed	0.156 (1.54)	0.172 (1.66)	0.035 (0.45)	0.241 (2.32)*	0.268 (2.89)**	0.144 (2.06)*
Civil partnership	0.139 (0.68)	0.145 (0.70)	0.244 (1.43)	0.011 (0.05)	0.015 (0.09)	0.009 (0.05)
White	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Asian	0.444 (2.75)**	0.424 (2.20)*	0.087 (0.86)	0.881 (4.43)**	0.810 (1.92)	0.181 (1.87)
Black	0.079 (0.48)	0.095 (0.75)	0.062 (0.51)	0.046 (0.24)	0.024 (0.17)	0.213 (1.79)
Other ethnicity	0.057 (0.38)	0.064 (0.39)	-0.043 (0.37)	0.546 (3.22)**	0.540 (1.30)	0.184 (1.71)
Experience	-0.000 (0.05)	-0.000 (0.03)	-0.001 (0.30)	0.000 (0.12)	0.001 (0.32)	0.000 (0.05)
Attitude	0.013 (4.89)**	0.013 (3.51)**	0.016 (7.61)**	0.009 (3.06)**	0.007 (1.02)	0.011 (5.77)**
Parents	0.161 (3.42)**	0.150 (3.01)**	0.150 (3.65)**	0.183 (3.47)**	0.206 (2.14)*	0.208 (5.00)**
Observations	4796	4796	9003	4544	4544	9003
R square				0.04	0.04	0.03
* significant at 5% ** significant at 1% Robust z statistics in parentheses. Absolute value of z statistics in parentheses						

### Problem gambling: impact of medium, channel and venue

**3.17** We saw that the medium, channel and venue<sup>34</sup> can be linked with different levels of participation in gambling activities. It is of crucial importance to know if certain modalities are linked with a higher propensity of problem gambling. To answer this question, we took the first component of the PCA and ran it over the two problem gambling scales in order to have a continuous variable measuring the propensity to have problem gambling. The tables below show the results of linear regressions indicating the link between each type of participation and this variable. Once again, these links do not necessarily imply causality from these modalities to the level of problem gambling.

<sup>34</sup> This refers to the part of the BGPS 2007 questionnaire that asked where gambling activities took place.

**Table 8. Regressions on the link with problem gambling**

	<b>Nat Lot</b>	<b>Scr cards</b>	<b>Online</b>	<b>Horses</b>	<b>Dogs</b>	<b>Private</b>
<b>Shop</b>	0.406 (0.062)	1.690 (0.160)				
<b>Internet</b>	0.356 (0.341)	0.142 (0.955)				
<b>Mobile</b>	0.473 (0.829)					
<b>TV</b>	-0.411 (0.878)					
<b>Supermarket</b>		0.989 (0.404)				
<b>Petrol station</b>		2.308 (0.192)				
<b>Numbers</b>			-9.424 (0.058)			
<b>Poker</b>			-4.429 (0.330)			
<b>Card</b>			-0.770 (0.938)			
<b>Roulette</b>			17.86** (0.002)			
<b>Slot</b>			-3.836 (0.697)			
<b>Track</b>				-2.023 (0.570)	3.329 (0.796)	
<b>Betting shop</b>				1.622 (0.615)	11.04 (0.377)	
<b>Telephone</b>				-1.529 (0.629)		-1.837 (0.723)
<b>Sportsground</b>						-0.202 (0.944)
<b>Work</b>						0.817 (0.652)
<b>Home</b>						4.078** (0.009)
<b>Other home</b>						0.763 (0.632)
<b>Pub</b>						4.397** (0.008)
<b>Email</b>						-5.867 (0.553)
<b>Constant</b>	-0.162 (0.428)	-0.422 (0.727)	9.045* (0.041)	1.703 (0.600)	0.178 (0.988)	0.0407 (0.977)
<b>F test</b>	0.468	0.405	0.006	0.348	0.259	0.060
<b>Observations</b>	2996	513	67	222	55	213

### Regressions on the link with problem gambling (continued)

	Slot machines
<b>Pub</b>	-0.414 (0.813)
<b>Betting shop</b>	5.087* (0.031)
<b>Arcade</b>	1.239 (0.557)
<b>Bingo hall</b>	-1.688 (0.494)
<b>Fast food</b>	0.165 (0.957)
<b>Mini cab</b>	-1.302 (0.880)
<b>Railway station</b>	55.64*** (0.000)
<b>Casino</b>	-2.791 (0.454)
<b>Sports centre</b>	-2.951 (0.531)
<b>Fairground</b>	-4.272 (0.512)
<b>Social club</b>	-2.326 (0.306)
<b>Work</b>	-2.289 (0.580)
<b>Constant</b>	3.490* (0.049)
<b>F test</b>	<0.001
<b>Observations</b>	296

*p*- values in parentheses

\* *p* < 0.05    \*\* *p* < 0.01    \*\*\* *p* < 0.001

#### **Section Summary – Variables associated with problem gambling**

Individuals, who are male, single, have lower qualifications, have lower incomes and whose parents have gambled are more likely to exhibit signs of problem gambling. However, while wealthier individuals are more likely to participate in a larger number of activities they are less likely to exhibit signs of problem gambling.

It is relevant to take into account the frequency of participation within each activity to assess the links between gambling activities and problem gambling.

When considering problem gambling in the context of channel, medium or venue by which the game was being accessed, individuals seem more likely to experience gambling problems if they:

1. played roulette through the internet
2. played on gaming machines in a betting shop or at a railway station
3. engaged in private betting at home or in the pub.

However, caution needs to be taken in interpreting these results because of the small numbers involved. Notably, there were only six online roulette players in the sample.

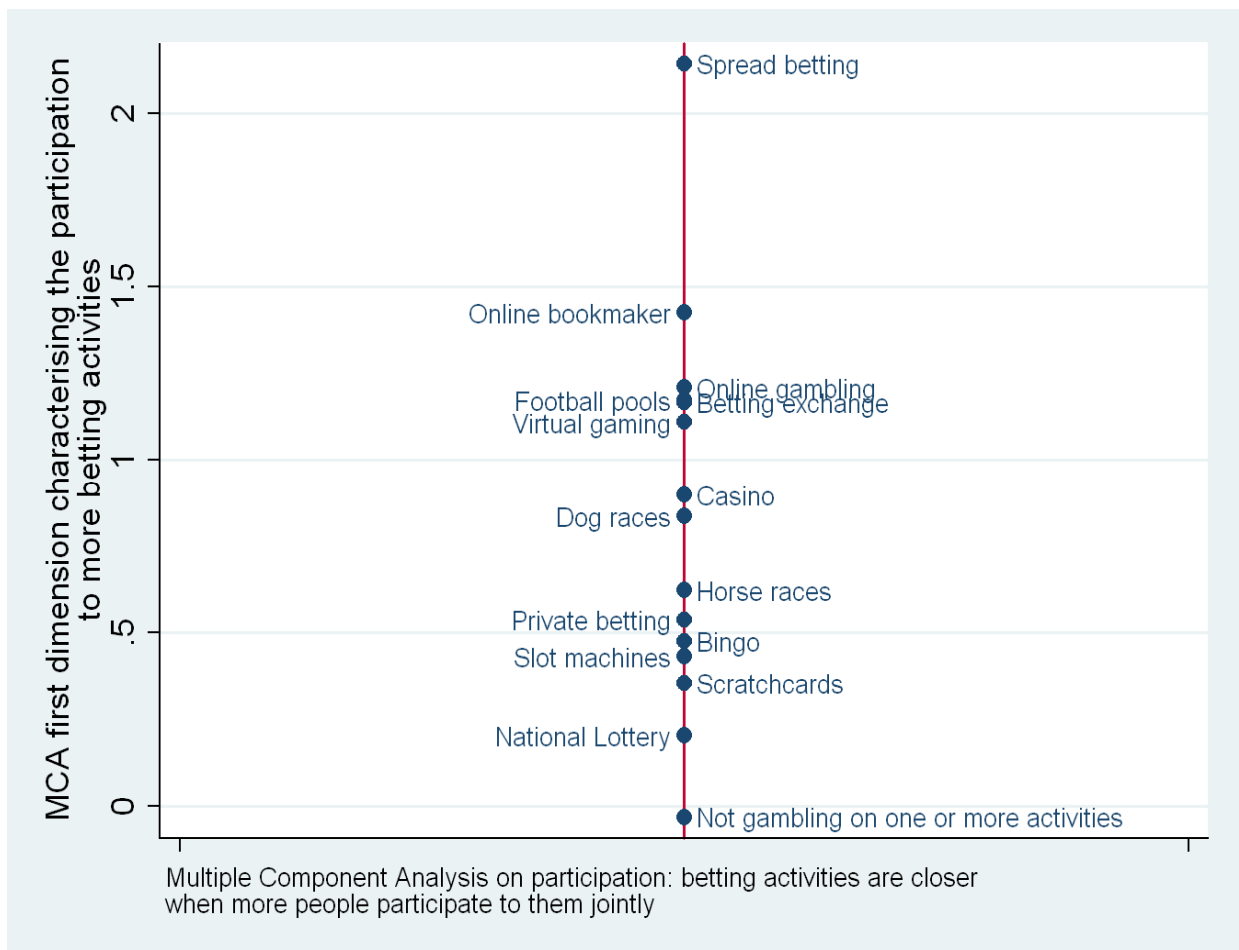
## 4 Young gamblers

- 4.1 The study of young gamblers is of special interest given the concerns present in the public debate over the possibility of an early addiction to gambling activities.
- 4.2 In BGPS 2007, the study of very young gamblers is not easy due to the very small sample of gamblers younger than 18 years old: 245 gamblers are aged between 16 and 17 years old. Such a number limits the possibility of employing within this small sample the set of the techniques we have been using, which most often requires larger samples.

### Specific analysis of young gamblers

- 4.3 We reproduced the exploratory analyses of part one on the subsample of young gamblers. We found no significant differences in the results. This seems to indicate that the way gamblers differ within the group of young gamblers is not dissimilar to the way gamblers differ overall. For young gamblers as for other gamblers the main discriminating variables are the fact of participation (and also the fact of participating frequently) in some specific activities like spread betting, online gambling and online bookmakers, betting exchanges, FOBTs and football pools.
- 4.4 This is for instance represented on Figure 8 which reproduces the MCA of Figure 1 on the subsample of people aged between 16 and 24. There is not any qualitative difference between the two estimations. This suggests that the way gamblers link their participation in different activities is no different between the whole sample and the sample of young gamblers.

**Figure 8. MCA on participation variables (16-24 years old)**



Virtual gaming = FOBTs

### **Section summary – Gambling behaviour and young people**

With only 245 respondents being under 18 years old there were limitations to the range and level of statistical analysis that could be applied to this subpopulation.

Consistent with findings from the general population sample, younger gamblers also tended to be made up of a large group of relatively homogeneous gamblers who gamble in a wide range of activities, within which exists a smaller subgroup participating in more specific/technical/novel types of gambling like online betting, FOBTs, spread betting and betting exchanges.

## **5 Summary and Conclusions**

- 5.1** The central aim of this analysis was to explore the original BGPS 2007 data in more detail, using sophisticated statistical techniques in an attempt to learn more about gambling participation, problem gambling, treatment seeking and gambling behaviour among youth. The findings from this research may play an important role in further understanding gambling and problem gambling behaviour, suggesting improvements in the design and execution of future prevalence surveys in Great Britain and should add to the ongoing debate informing gambling-related policy. In order to help the reader follow the conclusions, page numbers are presented alongside each conclusion identifying the section to which they relate.
- 5.2** **Individuals who were male, single, had a lower level of qualifications, lower incomes and whose parents had gambled were more likely to report gambling problems. However, more generally, any individual, regardless of gender, marital status, education and family background, may be at risk [see pages 31-33].**

For the most part, these findings are consistent with findings from other prevalence surveys and research on demographic variables and research from other jurisdictions (Abbott & Volberg, 1996; Abbott & Volberg, 1999; Ronnberg et al, 1999; Ilkas & Turja, 2003; Ipsos Reid & Gemini Research, 2003; Lund & Norlund, 2003; Fong & Ozorio, 2005).

- 5.3** **When considering the association between type of gambling activity and problem gambling it is important to consider frequency of play rather than simply past-year or past-week participation [see pages 33-35].** When considering the association between type of gambling activity and problem gambling it is relevant to consider the frequency with which gamblers participate in that activity. The results of the first report on the BGPS 2007 tended to suggest, in the absence of a consideration of frequency, that a higher level of problem gambling is linked with spread betting, FOBTs and betting exchanges (p. 94). Our analysis essentially provides a check of their findings on gambling participation using a technique which is more robust to small observations and a large number of covariates. What is important here is that the ranking is not the same. This should be interpreted as inviting caution about the order of activities found in BGPS 2007 rather than as suggesting an alternative ranking. Although frequent engagement with horse racing, slot machines and scratchcards is most closely linked, on primary inspection, with problem gambling, these findings must be interpreted very carefully. In particular, our estimation technique does not allow us to say if these gambling activities are significantly more closely linked with problem gambling than, say, online gambling. However our results do indicate that when studying the link between gambling activities and problem gambling, the frequency of participation in each activity should be considered.
- 5.4** Further research might consider more explicitly the role of certain structural features such as, for example, fast, continuous play (Parke and Griffiths, 2007), the involvement of an element of real or perceived skill (Parke and Griffiths, 2007), or accessibility and convenience of play (Abbott and Volberg, 1999; Abbott, 2007).
- 5.5** **According to participation in various gambling activities gamblers seem to be relatively homogeneous as a group [see pages 22-23].** The majority of gamblers participate in a core set of activities such as the National Lottery, bingo and/or scratchcards. Therefore, with one exception (as discussed below) gamblers in Great Britain do not exist as subgroups according to the different gambling activities that they play.



- 5.6 Although most gamblers tend to participate in core activities (such as the National Lottery, bingo and scratchcards) there is a distinct subset of gamblers who participate in more ‘procedurally sophisticated’ or ‘technical’ types of gambling such as spread betting, betting exchanges and online gambling [see pages 19-20].** It appears that gamblers who engage in such sophisticated forms of gambling, in addition to playing more traditional forms of gambling, form a distinct subgroup which seems to be subtly different from the rest of the gamblers in Great Britain. These gamblers not only gamble across a wider range of activities, but they also play more frequently. Such a finding may make intuitive sense since gamblers who play more frequently, and have a higher level of involvement, may be more willing to invest more time to learn and master such forms of gambling. Furthermore, such gamblers may also be more aware of the opportunities to get better value for such types of gambling either through playing against weaker opponents (eg betting exchanges or online poker), getting better odds (eg through an awareness of a wider range of suppliers; Vaughan Williams, 2005; Smith, Paton and Vaughan Williams, 2006) or because some cost savings may be involved (eg no need to travel to a betting shop; no need to tip the dealer when playing online). There is support for such claims in the relevant background literature (eg Wood, Williams and Lawton, 2007; Parke, Rigby, Parke, Sjenitzer, Wood, Winder and Vaughan Williams, 2007).
- 5.7 Individuals with higher incomes prefer to gamble on casino-style gambling or online gambling more generally. Lower income groups prefer activities such as FOBTs or bingo [see pages 20-21].** At this stage, we might speculate that such trends to some extent reflect the relationship between location of venue and socio-economic status. We would argue that there are higher concentrations of betting shops (for FOBTs) and bingo venues in working class areas and that they are consequently more likely to attract customers because of their availability, convenience and use of indirect advertising. Impulse gambling is another factor, given customers’ proximity and frequent exposure to betting shops and other gambling venues and their associated window displays. We might also speculate that individuals on lower incomes coming from poorer areas may have a stronger motivation for physical relocation when gambling (ie being somewhere else) both for social reasons and to potentially conceal the extent of their gambling involvement. We would also argue that there is a cultural element to such distinctions in play. Sociological explanations of gambling (eg Downes et al, 1976) posit that the individuals coming from lower socio-economic groups have a greater need for the challenges inherent in social aspects of competition. The potential of online gambling for attracting those on higher incomes in Great Britain, where offline there are relatively lower stakes and prizes being offered (slot machines in particular), might be investigated further using both qualitative and quantitative approaches. We would suggest that all of these tentative explanations are open to empirical investigation.
- 5.8 Younger players tend to prefer to gamble on slot machines or through private betting [see pages 25-31].** One of the most obvious reasons for this particular trend is that these two forms of gambling offer the easiest access for this age group (particularly for the 16-17 age groups where most other forms of gambling are illegal).
- 5.9 Males are more likely to gamble online, on spread betting, on betting exchanges and on FOBTs [see pages 25-31].** This finding is to some extent consistent with other claims (Stinchfield, 2001; Toneatto and Nguyen, 2007) which argue that men tend to prefer gambling activities which require some element of skill whereas women prefer games where the outcomes are determined by luck (eg electronic gaming machines (EGMs) and bingo). Spread betting, betting on exchanges and various forms of online gambling (eg poker, sports betting and racing) do indeed require a certain level of skill for both participation and success. However, this finding is inconsistent with some research that has found support for the claim that the gender gap is actually closing in relation to online gambling. Notably, Parke et al., (2007) found that out of a sample of 10865 online casino and poker players, there were more women playing at online casinos than men. However, even if more women are gambling now than ever before, such sophisticated forms of gambling tend to appeal to the more experienced gamblers, and therefore we might expect a significant lag time before more women start to participate in these forms of gambling.

- 5.10 It could be important to consider the interaction between venue/channel/medium and the type of gambling activity when estimating the potential link with problem gambling [see pages 38-39].** In particular, playing roulette via the Internet seems to be associated with problem gambling but great caution needs to be taken in interpreting this result as the sample size of online roulette players was only six. Perhaps importantly from a research and methodological perspective, there are also concerns about how information is collected and then analysed regarding types of games. For example, it could be important when collecting, analysing or presenting data to further specify the different game structures within one category (eg casino games into dice, blackjack, roulette etc; internet gaming into poker, roulette etc). This may be particularly important when considering and researching FOBTs which may also need to be broken down by type. Given that such terminals offer a platform for potentially structurally different forms of games, it may be the case that some FOBT games are more problematic than others. While admittedly the situational factors between internet roulette and FOBT roulette do differ (one is only offered online while the other is only offered offline in a betting shop) they are both examples of a virtual simulation of roulette which make them similar in structure. The key point is that differences in only a few situational or structural factors may have important implications for player behaviour and problem gambling.

## **6 Limitations**

- 6.1** There are some important limitations to bear in mind when considering the results of this analysis:

### **Low number of cases for key categories**

- 6.2** There were a low number of cases in various important categories including problem gamblers, those seeking treatment and younger players aged 16-17. For this reason, there were limitations on the extent to which more sophisticated analyses were done. This was particularly true for those seeking treatment (N= 12) and for young gamblers aged 16-17 (N= 245). In terms of this report, higher level analysis in these areas was not attempted. There was also a low number of cases for those meeting criteria for problem gambling (N= 59). However, as previously discussed there was some action taken to increase the size of the groups considered (using a broader definition).

### **Limited ability to discriminate between problem and non-problem gamblers**

- 6.3** Information was not collected on certain variables which are normally considered to be important in determining gambling behaviour. Such variables include cognitive variables such as illusion of control (Langer, 1975, Ladouceur and Walker, 1996), use of heuristics and biases (Wagenaar, 1988; Tversky & Kahneman, 1971) and attributions such as the near miss (Strickland and Grote, 1967; Reid, 1986; Griffiths 1994, 1999; Parke and Griffiths, 2004) – see British Columbia Prevalence Survey 2003 (Ipsos Reid & Gemini Research, 2003) for such examples. Situational variables such as location to nearest betting or gaming venue, type of local gambling opportunities, association with sport (Cornish, 1978), access to ATMs or credit, or the occurrence of significant negative life events (eg divorce, losing a job) were also largely excluded. Furthermore, there was no data collected on various possible individual factors such as personality traits (eg sensation-seeking, impulsivity, competitiveness) and motivation (eg arousal, escape, social, profit). We acknowledge that a consideration of such variables may have been beyond the remit of the original investigation and it would not be possible to include all variables of interest in one survey administered in one session. However, we do raise this since the limited selection of variables (mostly demographic variables) limits our ability to develop powerful models to explain aspects of participation and problem gambling.

### **Limitations in cross-sectional research**

- 6.4** One of the main objectives of this analysis was to identify potential differences between gamblers based on where they exist along the problem gambling dimension. It seems that this is difficult to do if we rely only on observing a limited set of socio-demographic and behavioural variables from a cross-section of the population.

Cross-sectional survey data restrict our ability to make causal inferences from the data. For this reason, the design of the survey should be driven more by theoretical considerations. The recording of specific variables identified in the behavioural literature on gambling would allow for a more analytical and informative analysis. Given the size of the survey, the inclusion of theory-driven variables would permit more causal inferences regarding gambling behaviour in the UK.

### **Creating an artificial measure of problem gambling**

- 6.5** In order to overcome the difficulty of analysing data where there were a low number of problem gamblers, the DSM-IV and PGSI scales were combined to create an artificial measure of problem gambling which permitted a larger number of participants to be included in the analysis. As the items of the scales are argued to measure the same one-dimensional construct and there was a high level of internal consistency (Chronbach Alpha = 0.90) we feel that this was justified. However, readers are encouraged to exercise caution when interpreting results involving this artificial scale. This scale has not been properly validated and its psychometric properties remain largely unknown.

The creation of this artificial measure has been improvised to permit at least some initial exploration of factors that may determine or be associated with problem gambling and gambling participation. We would suggest that findings from this analysis using this artificial measure be replicated where possible using a problem gambling scale where the psychometric properties have been more thoroughly tested and in which stakeholders may place a greater degree of confidence.

## **7 Implications and future directions**

- 7.1** Despite the limitations with this data set and analysis, there are several important issues which should be considered when planning future research, considering gambling and problem gambling research more generally and when making decisions for forming gambling-related policy.

### **Policy and understanding behaviour**

#### **Play frequency is vital in understanding the link between type of gambling activity and level of problem gambling.**

- 7.2** A consideration of the association between various forms of gambling and the level and the prevalence of problem gambling has obvious policy implications for shaping and informing legislation. In doing so, it is important to bear in mind that identifying the 'extent' of participation is crucial when making claims about the relationship between types of gambling games and problem gambling. For example, in BGPS 2007 results are presented on gambling type and prevalence of problem gambling according to past-week and past-year participation. The danger in interpreting these findings is that we may, for example, be putting someone who plays slot machines once a year in the same category as someone who plays slot machines every day. In other words, just because someone has played slot machines at least once in the past week or the past year, this does not necessarily make them a 'gaming machine player'. Therefore, associations with problem gambling become more meaningful when we can claim that gamblers are involved in that activity on a regular and frequent basis. Of course, frequency of session is only one dimension of time spent playing and hence it will also be important to consider length of play session also. Ultimately, to the extent that frequency of play is a covariate of type of activity in determining problem gambling, priority might initially be given to collecting and analysing information in relation to length of time spent playing per session.

#### **There is much work to do in understanding gambling and problem gambling among young people and the nature and impact of private betting among all ages.**

- 7.3** What we can conclude from this study is that young people are more likely to gamble on slot machines or through private betting. Such findings are intuitive in that these are more accessible to this age range. However, a less obvious factor could be that younger individuals could have larger social networks and live with friends rather than family, and such environments often foster private betting in social settings including 'house games' of poker, betting on video games and other informal and unconventional gambling forms (Parke, Wood, Griffiths and Rigbye, 2006).

In the context of youth gambling, research must also consider the potential importance of private betting as a young person's entry point into gambling. This may be particularly relevant in school environments where there may be various consequences for their play in addition to simply losing money (eg time loss, discipline issues at school, conflict with other students).

Games such as poker which have enjoyed a recent growth in popularity and which can potentially be carried out in a 'private' setting may well have an important role in advertising and normalising gambling among younger players. At this early stage, we cannot conclude whether this could have a net negative impact on gambling behaviour. It may introduce more individuals to gambling which could in turn lead to an increase in problem gambling or conversely private betting may actually foster a healthy attitude to gambling and promote the social side of gambling. Therefore, future research which investigates the nature and impact of private betting generally, and among younger players specifically, could usefully be placed on the agenda or given a higher priority.

## Methodological implications

**We recommend that future prevalence surveys include theory-driven variables.**

- 7.4 Typically, cross-sectional survey data restrict our ability to make causal inferences from the data. For this reason, the design of the survey should be driven more by theoretical considerations. The recording of specific variables identified in the behavioural literature on gambling would allow for a more informative analysis. Given the size of the survey, the inclusion of theory-driven variables would permit more causal inferences regarding gambling behaviour in Great Britain.

**There may be value in using 'case comparison' research.**

- 7.5 One of the main objectives of this analysis was to identify potential differences between gamblers based on where they exist along the problem gambling dimension. It seems that this is difficult to achieve if we only rely on observing a limited set of socio-demographic and behavioural variables from a cross-section of the population. Furthermore, small sample sizes for key categories limit the level of analysis that can be performed and hence, how much we can learn from that analysis. It is not suitable to go out and 'seek' more problem gamblers for designs that enable multivariate parametric 'stats' like multiple regression because that will reduce validity and reliability as a result of sampling bias. Furthermore, recruiting treatment-seeking problem gamblers would not be an effective strategy to increase the sample of problem gamblers since there is a strong possibility that they are not representative of problem gamblers more generally. As a rule of thumb in clinical psychology it is accepted that less than one in ten people with a disorder seek help.
- 7.6 One option may be to engage in 'case comparison' research (or a cohort study might be used). Very simply, this involves recruiting two groups, one with the disorder and one without, and measuring them across a very large number of variables including individual, cognitive and situational factors.

**We recommend that future prevalence surveys include 'historical' variables.**

- 7.7 In addition to variables driven by theoretical considerations, future surveys could circumvent the cross-sectional nature of the questionnaire by asking questions about the history of individuals' gambling behaviour. While such questions are not always reliable (due to memory and recall bias in particular), they would still be useful in introducing a dynamic perspective to the survey. This would be important in obtaining a better understanding of gambling as a process, providing researchers with an entry point and information at various points along the development of the behaviour. For example:
- Before last year, what were the activities you had participated in?
  - Has your gambling activity increased in the last 12 months?
  - Has your income changed significantly in the last 12 months?
- 7.8 Despite concerns about reliability, such questions introduce a 'pseudo-panel' dimension to the research which improves the researcher's ability to identify causal links between variables.

## 8 References

- Abbott, M.W. (2007). Situational factors that affect gambling behaviour. In G. Smith, D. Hodgins & R. Williams (Eds.), *Research and Measurement Issues in Gambling Studies*. New York: Elsevier.
- Abbott, M.W., & Volberg, R.A. (1996) The New Zealand national survey of problem and pathological gambling. *Journal of Gambling Studies* 12 (2): 143-160
- Abbott, M.W., & Volberg, R.A. (1999). *Gambling and problem gambling in the community: An international overview and critique*. Report No. 1 of the New Zealand Gaming Survey. Wellington: Department of Internal Affairs.
- Abbott, M.W. & Volberg, R.A. (2000). *Taking the Pulse on Gambling and Problem Gambling in New Zealand: Phase One of the 1999 National Prevalence Survey*. Report Number Three of the New Zealand Gaming Survey. Wellington: Department of Internal Affairs.
- Abbott, M.W., & Volberg, R.A. (2006). The measurement of adult problem and pathological gambling. *International Gambling Studies*, 6 (2), 175-200.
- British Gambling Prevalence Survey (BGPS). (2007). See Wardle et al
- Caron, A. & Ladouceur, R. (2003). *Erroneous verbalizations and risk taking at video lotteries*. British Journal of Psychology, 94, 189–194.
- Clarke, D. & Rossen, F. (2000). Adolescent gambling and problem gambling: A New Zealand study. *New Zealand Journal of Psychology*, 29, (1), 10-16
- Cornish, D. B. (1978). *Gambling: A review of the literature and its implications for policy and research*. London: Her Majesty's Stationery Office
- Downes, D. M., Davies, B. D., David, M.E., & Stone, P. (1976). *Gambling, work and leisure: A study across three areas*. London, UK: Routledge Kegan Paul.
- Faraone, S. V., & Tsuang, M. T. (1994). Measuring diagnostic accuracy in the absence of a "gold standard." *American Journal of Psychiatry*, 151, 650–657
- Fong, D. & Ozorio, B. (2005). Gambling participation and prevalence estimates of pathological gambling in a Far East ancient gambling city: Macau. *UNLV Gaming Research and Review Journal*, Vol. 9 (2), 15-28.
- Greenacre, M., & Blasius, J. (2006). *Multiple Correspondance Analysis and Related Methods*. Boca-Raton: Chapman & Hall.
- Griffiths, M.D. (1994). The role of cognitive bias and skill in fruit machine gambling. *British Journal of Psychology*, 85, 351-369
- Griffiths, M.D. (1999). The psychology of the near miss (revisited): A comment on Delfabbro and Winefield. *British Journal of Psychology*, 90, 441-445.
- Ibanez, A., Blanco, C., Moreryra, P., & Saiz-Ruiz, J. (2003). Gender differences in pathological gambling. *Journal of Clinical Psychiatry*, 64, 295–301.
- Ilkas, H., & Turja, T. (2003). *Penningspelsundersökning (Study of gambling)*. Helsinki, Finland: Ministry of Social Affairs and Health.
- Ipsos Reid & Gemini Research (2003). *British Columbia Problem Gambling Prevalence Study: Final Report*. Victoria: British Columbia Ministry of Public Safety and Solicitor General.

- Ipsos-Reid & Gemini Research (2008). *British Columbia Problem Gambling Prevalence Study*. Victoria: British Columbia Ministry of Public Safety and Solicitor General
- Jacobs, D.F. (2000). Juvenile Gambling in North America: An analysis of long-term trends and future prospects. *Journal of Gambling Studies*, 16, 119-152.
- Langer, E.J. (1975) The Illusion of Control. *Journal of Personality and Social Psychology* 32:311-328,
- Ladouceur, R. & Walker, M., (1996). A cognitive perspective on gambling. In: Salkovskis, P.M., Editor, 1996. Trends in cognitive therapy, Wiley, Oxford
- Ladouceur, R. (1991). Prevalence estimates of pathological gambling in Quebec, Canada. *Canadian Journal of Psychiatry*, 36, 732-734.
- Ladd, G.T. & Petry, N.M. (2003). A comparison of pathological gamblers with and without substance abuse treatment histories. *Experimental and Clinical Psychopharmacology*, 11, 202-209.
- Lund, I., & Norlund, S. (2003). *Pengespill og pengespillproblemer I Norge. Rapport nr. 2/2003*. Oslo, Norway: SIRUS.
- MCD (Ministry of Community Development), 2005. Report of Survey on Participation in Gambling Activities among Singapore Residents. Ministry of Community Development, Youth and Sports: Government of Singapore
- National Research Council (1999). *Pathological Gambling a Critical Review*. New York: National Academy Press.
- Nower, L., Derevensky, J., & Gupta, R. (2004). The relationship of impulsivity, sensation seeking, coping and substance use in youth gamblers. *Psychology of Addictive Behaviours*, 18 (1), 49-55.
- Ólason, D. T., Bárudóttir, S. K., & Gretarsson, S. J. (2005). *Prevalence of pathological gambling among adults in Iceland*. Paper presented at the 6th Conference on Research in Social Sciences, Reykjavík, Iceland
- Parke, J. & Griffiths, M.D. (2004). Gambling addiction and the evolution of the 'near miss'. *Addiction Theory and Research*, 12, 407-411
- Parke, J. & Griffiths, M.D. (2007). The role of structural characteristics in gambling. In G. Smith, D. Hodgins & R. Williams (Eds.), *Research and Measurement Issues in Gambling Studies*. New York: Elsevier.
- Parke, J., Rigbye, J. L., Parke, A., L., Sjenitzer, J., Wood R. T. A., Winder, B., & Vaughan Williams, L. (2007). *eCOGRA Global Online Gamblers Survey*. Report prepared for e-Commerce Online Gaming Regulation and Assurance.
- Parke, J., Wood, R.T.A., Griffiths, M.D. & Rigbye, J.L. (2006). *Net Poker Behaviour: Findings from an Online Student Survey*. Paper presented at the 1<sup>st</sup> Global remote and E-Gambling Research Institute (GREGRI) conference, Amsterdam.
- Reid, R.L. (1986). The psychology of the near miss. *Journal of Gambling Behavior*, 2, 32–39.
- Ronnberg, S., Volberg, R., Abbott, M., Moore, L., Andren, A., Munck, I., Jonsson, J., Nilsson, T., & Svensson, O. (1999). *Gambling and problem gambling in Sweden . (Report No. 2 of the National Public Health series on gambling)*. Stockholm, SN: National Institute of Public Health.
- Saporta, G. (2006). *Probabilites, analyses des donnees et statistiques*. Paris : Editions Technip.

- Shaffer, H. J., Hall, M. N., & Vander Bilt, J. (1997). Estimating the prevalence of disordered gambling behavior in the United States and Canada: A meta-analysis. Boston: Presidents and Fellows of Harvard College
- Smith, M.A., Paton, D. & Vaughan Williams, L. (2006). Market Efficiency in Person-to-Person Betting. *Economica*, 73 (292), 673-689.
- Sproston K, Erens B, & Orford J. (2000) *Gambling behaviour in Britain: results from the gambling prevalence survey*. London: National Centre for Social Research.
- Stinchfield, R. (2000). Gambling and correlates of gambling among Minnesota public school students. *Journal of Gambling Studies*, 16, 153-173.
- Stinchfield, R. (2001). A comparison of gambling among Minnesota public school students in 1992, 1995, 1998. *Journal of Gambling Studies* 17, 273-196.
- Strickland, L. H., & Grote, F. W. (1967). Temporal presentation of winning symbols and slot-machine playing. *Journal of Experimental Psychology*, 74(1), 10-13
- Stucki & Rihs-Middel (2005) Prevalence of adult problem and pathological gambling between 2000 and 2005: An update. *Journal of Gambling Studies*. 23:3. 245-257
- Tversky, A., & Kahneman, D. (1971). Belief in the law of small numbers. *Psychological Bulletin*, 76, 105-110.
- Toneatto, T. & Nguyen, L. (2007). Individual characteristics and problem gambling behaviour. In G. Smith, D. Hodgins & R. Williams (Eds.), *Research and Measurement Issues in Gambling Studies*. New York: Elsevier.
- Vaughan Williams, L. (2005). Information Efficiency in Financial and Betting Markets, Cambridge: Cambridge University Press, pp. 109-115.
- Volberg, R. & Steadman, H. (1989). Prevalence estimates of pathological gambling in New Jersey and Maryland. *American Journal of Psychiatry*, 146, 1618-1619
- Volberg, R. (1994). The prevalence and demographics of pathological gamblers: Implications for public health. *American Journal of Public Health*, 84, 237-241.
- Volberg, R.A. (2002) The epidemiology of pathological gambling. *Psychiatric Annals* 32 (3): 171-178
- Volberg, RA. (2003) Has there been a 'feminization' of gambling and problem gambling in America? *Journal of Gambling Issues* 8: Feature Article.
- Volberg, R. (2004). Fifteen years of problem gambling prevalence research: What do we know? Where do we go? *The Journal of Gambling Issues*, 10, 1-19.
- Wagenaar, W. (1988). Paradoxes of gambling behavior. London: Erlbaum Publishers
- Wardle H, Sproston K, Orford J, Erens, B, Griffiths, M., Constantine, R., Piggot, S., (2007) British Gambling Prevalence Survey 2007. London: UK National Centre for Social Research
- Wynne, H.J. (2003). *Introducing the Canadian problem gambling index*. Edmonton: Wynne
- Wong, I. L. K., & So, E. M. T. (2003). Prevalence estimates of problem and pathological gambling in Hong Kong. *American Journal of Psychiatry*, 160, 1353-4.
- Wood, R. T., Williams, R. J., & Lawton, P.K. (2007). Why do Internet gamblers prefer online versus land-based casinos? *Journal of Gambling Issues*, 20, 235-252.

## 9 Appendices

### Appendix 1 - Types of gambling explained

Below is the summary table which explains in basic terms the advanced or less common forms of gambling that have been included in this report.

<b>Form</b>	<b>Explanation</b>
<b>Fixed Odds Betting Terminal</b>	This is a form of gaming machine (sometimes referred to as 'virtual gaming') which permits customers to place bets on computer simulated events (e.g. roulette spins) at 'fixed odds'. This type of machine is normally found in licensed betting offices.
<b>Spread betting</b>	Rather than simply involving an outright win or loss, this type of betting involves a range of possible outcomes whereby the bettor chooses whether the outcome will be above or below a 'spread' (a narrow range of outcomes which acts as a house edge). The payout is directly related to the accuracy of the bet; if the bettor, say, selects the outcome to be above the spread, more money will be made the higher it is above the spread and more money will be lost the lower it is below the spread. Therefore, the stake size is not determined until after the bet, which makes this potentially a very risky type of bet.
<b>Football pools</b>	This comprises a pari-mutuel or 'lottery-style' game in which players typically select football games they think will end in draws from a list of football fixtures. The prize money or 'pool' is shared among those whose entry is correct with lesser pools for those who are nearly correct.
<b>Betting exchange</b>	This involves person-to-person betting using technology whereby clients are able to either 'back' or 'lay' an outcome, ie to bet that it will happen or will not happen. In this scenario there is no bookmaker, only a broker who takes a commission from the winning client for providing the marketplace to broker these bets.

### Appendix 2 - Figure 2 Label keys

Spread:	Spread betting
Exch:	Betting exchanges
OnlGamb:	Online gambling
Virtual:	FOBTs
OnlBook:	Online booking
OthBook:	Other bookmakers
Dog:	Dog racing
Pool:	Football pools
Priv:	Private betting
Gaming:	Slot machines
Horse:	Horse racing
Bingo:	Bingo
Scratch:	Scratchcards
NatLot:	National Lottery
OthLot:	Other lotteries
Other:	Other gambling activities

The same keys are used with the following suffixes:

- no: no participation in the gambling activity
- yr: once per year
- mth: once per month
- wk: once per week
- biwk: twice a week or more



## Appendix 3

<b>Table 9. McFadden choice model over the set of gambling participation variables (base alternative: National Lottery)</b>													
	Scratch cards	Football pools	Bingo	Slot machines	Horse racing	Dog racing	FOBTs	Online bookmaker	Online gaming	Casino	Betting exchange	Spread betting	Private betting
Age	-0.055 (6.09)**	-0.012 (0.98)	-0.041 (3.81)**	-0.101 (8.33)**	-0.053 (5.33)**	-0.064 (4.13)**	-0.093 (5.04)**	-0.052 (3.56)**	-0.080 (3.77)**	-0.071 (4.97)**	-0.057 (1.71)	-0.033 (1.60)	-0.104 (6.19)**
Male	-0.098 (0.83)	1.403 (6.43)**	-1.122 (6.31)**	1.047 (7.15)**	0.451 (3.32)**	0.539 (2.91)**	1.193 (5.04)**	1.486 (6.90)**	0.866 (3.77)**	1.198 (5.72)**	1.382 (3.47)**	2.039 (4.03)**	1.036 (6.44)**
Income for household	-0.075 (2.65)**	-0.073 (1.48)	-0.095 (2.31)*	-0.091 (2.55)*	0.051 (1.55)	0.076 (1.72)	-0.119 (2.30)*	0.091 (1.83)	-0.010 (0.18)	0.069 (1.32)	-0.120 (1.39)	-0.044 (0.55)	-0.087 (2.22)*
Professional qualification	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
A or O level	-0.159 (1.19)	-0.223 (0.91)	0.186 (0.89)	-0.194 (1.16)	-0.562 (3.72)**	-0.507 (2.49)*	-0.038 (0.14)	-0.896 (3.96)**	-0.500 (1.91)	-0.848 (3.79)**	-0.632 (1.43)	-0.514 (1.29)	-0.580 (3.28)**
Low qualification	-0.079 (0.46)	-0.610 (2.05)*	0.781 (3.18)**	-0.403 (1.87)	-0.860 (4.47)**	-0.640 (2.47)*	0.224 (0.66)	-1.461 (4.69)**	-1.015 (2.76)**	-1.304 (4.12)**	-0.264 (0.50)	-0.584 (1.09)	-1.021 (4.38)**
Attitude toward gambling	0.007 (0.93)	-0.008 (0.69)	0.010 (0.92)	0.022 (2.43)*	0.031 (3.59)**	0.025 (2.13)*	0.042 (2.70)**	0.025 (2.05)*	0.050 (3.38)**	0.040 (3.36)**	0.039 (1.48)	0.024 (1.08)	0.016 (1.64)
Married	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Separated/divorced	0.329 (1.68)	-0.223 (0.57)	0.322 (1.21)	0.200 (0.83)	0.197 (0.91)	0.633 (2.02)*	0.881 (2.26)*	0.267 (0.70)	0.220 (0.49)	0.358 (1.03)	-0.054 (0.09)	0.215 (0.37)	0.694 (2.69)**
Single	0.305 (2.23)*	0.827 (3.66)**	0.421 (2.08)*	0.409 (2.50)*	0.402 (2.53)*	0.771 (3.77)**	0.841 (3.12)**	0.965 (4.23)**	0.573 (2.25)*	0.881 (3.93)**	0.446 (1.09)	0.301 (0.65)	0.851 (4.76)**
Widowed	0.637 (2.20)*	0.327 (0.74)	0.652 (1.71)	0.242 (0.63)	0.211 (0.62)	0.720 (1.42)	0.293 (0.25)	0.061 (0.10)	-0.158 (0.19)	0.369 (0.57)	-15.275 (23.55)**	-14.941 (23.48)**	0.766 (1.87)
Civil partnership	-0.239 (0.40)	0.010 (0.01)	-0.726 (0.91)	-0.827 (1.08)	-1.521 (2.03)*	-0.909 (1.10)	-16.402 (21.33)**	-1.546 (1.57)	0.272 (0.28)	-1.694 (1.53)	0.459 (0.44)	-0.756 (0.64)	-0.614 (0.74)
Years of gambling	0.014 (1.60)	0.030 (2.55)*	0.028 (2.65)**	0.048 (4.04)**	0.056 (5.83)**	0.049 (3.24)**	0.033 (1.73)	0.025 (1.62)	0.022 (1.00)	0.029 (1.96)*	0.023 (0.66)	-0.022 (0.84)	0.069 (4.23)**
White	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Asian	0.156 (0.30)	-2.263 (1.60)	-1.366 (1.11)	-1.161 (1.73)	-2.290 (2.96)**	-0.794 (0.82)	-0.125 (0.16)	-1.727 (1.87)	-1.691 (1.65)	-1.440 (1.52)	-15.897 (21.24)**	-0.520 (0.40)	-0.927 (1.59)
Black	-1.296 (1.96)	-1.921 (1.95)	-0.956 (1.13)	-1.451 (1.78)	-2.001 (2.47)*	-1.056 (1.25)	-0.962 (0.99)	-2.611 (1.99)*	-2.281 (1.57)	-1.552 (1.58)	-16.693 (16.35)**	-0.433 (0.49)	-2.794 (2.73)**
Other ethnicity	-0.521 (1.21)	-0.660 (0.97)	-1.937 (2.29)*	-0.893 (1.74)	-1.362 (2.61)**	-0.997 (1.67)	-1.122 (1.58)	-1.490 (2.02)*	-1.020 (1.38)	-0.808 (1.26)	-16.614 (30.37)**	-0.839 (0.78)	-0.574 (1.01)
Constant	-0.338 (0.83)	-5.334 (7.39)**	-2.837 (5.00)**	-0.731 (1.40)	-2.988 (6.17)**	-4.385 (6.35)**	-4.544 (5.81)**	-5.097 (7.12)**	-4.740 (5.78)**	-4.777 (6.62)**	-6.091 (3.70)**	-6.806 (5.97)**	-1.245 (2.10)*
Observations	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140

## Keeping gambling fair and safe for all

Copies of this document are available in alternative formats on request.

Gambling Commission  
Victoria Square House  
Victoria Square  
Birmingham B2 4BP

T 0121 230 6500  
F 0121 230 6720  
E [info@gamblingcommission.gov.uk](mailto:info@gamblingcommission.gov.uk)

INFO 08/28