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Gambling and the use of credit:
an individual and household level analysis

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Abstract:

We explore the relationship between gambling and other forms of risk-taking behaviour, i.e. exposure to debt and the use of credit, at the individual and household level using representative pooled cross-section data drawn from the UK *Expenditure and Food Surveys* (*EFS*), 2001 to 2007. Gambling and the use of credit are shown to be positively correlated at the household level. While both the incidence and amount of gambling vary according to household income, the positive association between gambling and the use of credit is remarkably stable across household income. In addition to our household level analysis, we also explore the prevalence of intra-household gambling, which has attracted relatively limited attention in the existing literature. It is apparent that there is strong intra-household correlation in both gambling activity and in the use of credit, with somewhat stronger relationships in lower income households.

Key Words: Risk-taking, Gambling, Credit, Debt

JEL Classification: D14, D81, L83

GAMBLING AND THE USE OF CREDIT: A HOUSEHOLD LEVEL ANALYSIS

1.   Introduction and Background

According to the 2007 *British Gambling Prevalence Survey* (Wardle et al., 2007) gambling activity in the UK is widespread, with almost 70% of the population claiming to have taken part in some form of gambling in the previous 12 months. Although the National Lottery was found to be the most popular form of gambling activity, almost half of the population had engaged in at least one other form of gambling. Gambling expenditure in Britain has also been increasing rapidly in recent years; turnover in the gambling industry was £84 billion in 2006/07 compared to just £53 billion in 2003/04, (Gambling Commission, 2008), during a period in which progressive liberalisation, deregulation and innovation in the industry have stimulated new forms of gambling (e.g. spread-betting and online gambling) and raised its availability and accessibility.[1]

Somewhat surprisingly, there has been relatively little systematic, detailed research on the determinants of gambling and its association with other forms of risk-taking behaviour by individuals or households. This paper aims to contribute to our understanding of these important issues. In particular, we explore the relationship between gambling and the use of credit at the household level in order to place gambling activity within the wider context of household finances and financial risk-taking (see also Wärneryd, 1996; Tokunaga, 1993; Ida and Goto, 2009; and Fellner and Maciejovsky, 2007). Given the rapid expansion in the use of credit over the past

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[1] The 2005 Gambling Act came into effect on 1 September 2007, replacing the Betting, Gaming and Lotteries Act 1963, the Gaming Act 1968 and the Lotteries and Amusements Act 1976. While the new act tightened some regulations relating to gambling activity it also brought about a significant relaxation in some other areas of regulation (e.g. by allowing TV and radio advertising of gambling along with permitting more regional casinos and bigger slot machine payouts).

decade and the potential financial vulnerability that debt can engender, we examine this relationship across different levels of household income. In addition, to further our understanding of gambling and debt at the household level, we also explore the prevalence of intra-household gambling in order to investigate the extent to which gambling activity is correlated across household members.

The gambling literature is diverse, with contributions from a variety of social science disciplines, including psychology, sociology and economics. In the existing literature, a number of studies have identified specific socio-economic groups as being at increased risk from gambling, including the less-educated and those with low income (e.g. Shepherd et al., 1998), some ethnic minorities (e.g. Welte et al., 2001) and youths (e.g. Stinchfield and Winters, 1998). The statistical summaries by Sproston et al. (2000) and Wardle et al. (2007) of the two British Gambling Prevalence Surveys also report activity varying noticeably by education, income, ethnicity and age, but also by gender, economic activity and social group. Moreover, Clotfelter and Cook (1989) find that gambling acts as a regressive tax on the poor, adding to pre-existing socio-economic inequalities. There is some UK-based evidence to suggest that the proportion of income spent on gambling is inversely related to income (e.g. Shepherd et al., 1998). Indeed, Grun and McKeigue (2000), in a 'pre' and 'post' study of the introduction of the UK National Lottery, found those with a weekly income below £200 to have had the greatest increase in gambling expenditure as a proportion of income over the period of their study.

Within the wider context of household finances, there has been a significant increase in consumer debt in the UK over the last decade or so, as well as a rapid increase in

gambling expenditure. According to May et al. (2004), total lending to the UK household sector has recently been growing faster than household income, and the latest (January 2010) Bank of England statistics reveal that total UK personal debt at the end of November 2009 stood at £1.46 trillion.[2] Despite Government concern over debt accumulation, there is a relative scarcity of research into the determinants of debt at the household level.[3] However, some existing studies have identified an association between financial insecurity and gambling. For example, Lesieur (1998) who explores the nature and social costs of pathological gambling in the US examines the costs of gambling in terms of indebtedness for the gambler. According to Fisher (1996), in a study of British casino gambling, over half of problem gamblers had been forced, through gambling, to turn to others for financial support, whereas approaching a half had been forced to sell possessions to service gambling debts. There has been some interest in establishing the costs and benefits of gambling, where indebtedness has been highlighted as a potential financial cost. For example, a NORC (1999) report[4] indicated a rate of bankruptcy amongst pathological gamblers in the US to be approximately four times higher than for 'low risk' gamblers (5%) and non-gamblers (4%). This is consistent with the findings of the National Gambling Impact Study Commission (1999) which reported bankruptcy rates in the US amongst Gamblers Anonymous members to be around 20%. Furthermore, according to the GamCare Services Report (2003), the average unsecured debt of gamblers receiving treatment from GamCare in the UK was just under £30,000 in 2003.

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[2] This is now at a level in excess of UK annual GDP and, while the majority (85%) of UK personal debt is secured on property, just how secure this is given the volatility in the housing market in the UK in recent years is an open question.
[3] Recent contributions in this area have been made by Brown et al. (2008) and Brown and Taylor (2008) focusing on financial expectations and financial pressure at the household level.
[4] National Opinion Research Centre (NORC) at the University of Chicago.

Nevertheless, there has been relatively little systematic detailed research on the determinants of gambling and its association with other forms of risk-taking behaviour by individuals or households including exposure to debt and the use of credit.

Rather than focussing on pathological or problem gamblers, we are interested in gambling and financial indebtedness across the whole population as a broad indicator of (financial) risk-taking by households. In particular, given the differences in potential financial vulnerability as a consequence of high indebtedness amongst poorer households compared to richer households, we are concerned with how (financial) risk-taking behaviour varies with household income. Haisley et al. (2008), who adopt an experimental approach with low-income participants to analyse the decision to purchase state lottery tickets, highlight the "peanuts effect", i.e. the possibility that individuals may not fully recognise the long-term cumulative costs of gambling with individuals discounting the cost of, for example, one lottery ticket as a "peanut" without realising the extent to which such costs may accumulate over time.

The remainder of the paper is organised as follows. In the following section we describe our data and methodology. Section 3 reports the findings on both the incidence and amount of gambling activity by households and individuals in our sample, and the association between gambling and the use of credit. Section 4 explores how this association varies across household income bands. Finally, section 5 presents our discussion and conclusions.

2. Data and Methodology

2.1 Data

Our data are drawn from the UK Expenditure and Food Survey (EFS), 2001-2007, which is compiled by the ONS and DEFRA. This is an annual cross-section survey of around 6,000 households per year comprising around 15,000 individuals (adults and children). The EFS resulted from a merger of the Family Expenditure Survey (FES) and the National Food Survey (NFS) in 2001/2.[5] Originally constructed on a financial year basis, it moved to a calendar year basis from January 2006 to be consistent with other major ONS surveys. The EFS is used to provide information for the construction of the UK retail price index (RPI) as well as in estimating consumption expenditures for the National Accounts.[6]

We pool data from seven EFS surveys (2001/2, 2002/3, 2003/4, 2004/5, 2005/6, 2006, and 2007), taking care not to include the repeated observations in the first quarter of 2006 when the survey switched from financial to calendar years. There are three main elements to the EFS data collection. First, there is the household questionnaire which gathers key information and characteristics about the household, and is usually completed by the household reference person (i.e. the head of household). Second, there is an income questionnaire which records the key person-level information. Finally, there is the expenditure and food diary which each individual respondent completes every day for a two week period, and which records

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[5] There were a number of significant changes when the FES and NFS were merged into the EFS, and so we do not attempt to utilise data prior to 2001.
[6] Note that while the EFS is ostensibly a household survey, we also have access to the individual expenditure diaries so can make use of the survey data at the individual level as well as at the more aggregated household level.

every single item of expenditure made by each separate individual member of the household.

We utilise data from all three elements of the EFS in the analysis undertaken below. Individuals' gambling expenditures are derived from their individual diary data, and are then merged with their individual and household characteristics drawn from the income and household questionnaires, respectively.[7] Finally, data on individuals' loans and other forms of credit are merged with their gambling expenditures and other characteristics. Where these are not already derived variables provided within the EFS data, household level variables are constructed by aggregating across all household members. The accounting period for all EFS derived variables is on a (averaged) weekly basis, and so the information taken from the two-week diary data is also averaged correspondingly. The EFS is a stratified random sample with clustering, and weights are required in order to ensure that the resulting statistics are representative of the UK population. These weights are employed as appropriate in the analysis undertaken below. All monetary values are deflated to 2005 prices using the monthly RPI index (CHAW, rebased to average 2005 = 100) corresponding to the respondent's month of interview.

Total gambling expenditure is the sum of the stakes placed on a variety of gambling activities, including: football 'pools', bingo, book-makers, lottery (including National Lottery, Irish and other lotteries) and scratch cards. While we note the potential

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[7] Of course, we recognise that there may be underreporting of gambling activity in the EFS in the same way as alcohol and tobacco consumption are known to be underreported in household surveys of this kind. However, the large number of other control variables we include in our analysis should hopefully remove the influence of any systematic underreporting between different groups within the population.

difficulties in collecting data on gambling 'expenditure' in terms of the ambiguity between gross expenditure (stakes) and net expenditure (stakes less winnings) as highlighted by Blaszczynski et al. (1997), we are confident here that respondents are reporting gross expenditures since the information we have is drawn from an explicit expenditure survey (and, moreover, information on income, including gambling winnings is collated separately in the EFS). Gross gambling expenditure is the relevant measure of interest here since we are interested in gambling as a reflection of risk-taking behaviour.

Our key credit variables are loans, hire purchase agreements and credit club payments. For loans and hire-purchase agreements, we have information on both the original purchase price at acquisition as well as the weekly payment. For credit club payments, the weekly equivalent value of the goods purchased is included. A number of other independent variables at the household and individual level are also employed in the analysis presented below. Variable descriptions and summary statistics are provided in Table 1. Panel 1 presents information for all households; Panel 2 for heads of households, and Panel 3 for all adults in these households. Around 54% of all households had engaged in some form of gambling activity in the 2 week diary period, and measured across all households, average (real 2005 prices) stakes were £3.59 per household per week (or equivalently, an average of £6.59 amongst those households where some gambling activity did take place). Across individuals, almost 40% of individuals engaged in some form of gambling[8], with an average across all adults of £1.96 per week (or equivalently, an average of £5.06 for those adults who engaged in some form of gambling activity).

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[8] This compares quite closely to Wardle et al. (2007, p.31) who report that 41% of adults said they participated in gambling in the last week.

2.2   Methodology

In the empirical analysis below, estimation is undertaken separately at three different levels of aggregation: (1) at the household level; (2) for heads of households, and (3) at the individual level for all adults while allowing for intra-household correlation. We pool the data across the seven EFS surveys, but the unit of observation differs across the three specifications.

Initially, we investigate which characteristics at the household and head of household level are associated with the probability of gambling. Defining G_{ht}^{*} as a continuous latent variable ('gambling propensity') and its observed empirical counterpart as G_{ht}, then:

$$G_{ht} = \begin{cases} 1 & \text{if } G_{ht}^{*} = y_1 R_{ht} + \beta_1' \mathbf{X}_{ht} + u_{ht} > 0 \\ 0 & \text{otherwise} \end{cases} \tag{1a}$$

determines if the unit of observation h (household or head of household), pooled over time t, places a stake on any type of gambling activity. With normality assumptions on the error term, u_{ht}, equation (1a) is estimated via a probit specification. R_{ht} is a binary indicator for whether any credit repayments were made, where the key parameter of interest is y_1, which serves to inform us about the relationship between the probability of gambling and the use of credit. Additional covariates are specified in the vector $\mathbf{X}_{ht}$ and are defined below.

For the specifications based upon adult individuals we define G_{iht}^{*} as a continuous latent variable ('gambling propensity') and its observed empirical counterpart as G_{iht}, then:

$$G_{iht} = \begin{cases} 1 & \text{if } G_{iht}^* = y_2 R_{iht} + \beta_2 ' \mathbf{X}_{iht} + \varepsilon_{iht} > 0 \\ 0 & \text{otherwise} \end{cases} \qquad (1b)$$

determines if the unit of observation, adult individuals i within a household h $(i \in h)$, pooled over time t, places a stake on any type of gambling activity. In equation (1b) the error term is decomposed (ignoring time subscripts) as $\varepsilon_{ih} = \alpha_h + \eta_{ih}$ where α_h represents the household-specific unobservable effect and η_{ih} is a random error term, $\eta_{ih} \sim N(0, \sigma_{\eta ih}^2)$. Hence, the correlation between the error terms of individuals within households is a constant given by: $\rho_1 = \text{corr}(\varepsilon_{lh}, \varepsilon_{kh}) = \sigma_{\alpha h}^2 / (\sigma_{\alpha h}^2 + \sigma_{\eta ih}^2)$, $(l \neq k)$ where ρ_1 represents the proportion of the total unexplained variance in the dependent variable contributed by the household variance component. Thus, the magnitude of ρ_1 yields information pertaining to the incidence of intra-household gambling.

Having examined whether an association exists between credit payments and the probability of gambling at the three levels of aggregation, specifications are also estimated to investigate whether the covariates also influence the amount of the stake placed. Given that the level of the gambling stake, S, cannot be negative, it is treated as a censored variable in our econometric analysis. Since the distribution of the weekly stake is highly skewed, we specify a logarithmic dependent variable following Gropp et al. (1997). For units of observation (i.e. households, head of households, or individuals) reporting zero gambling stakes, $\ln(S)$ is recoded to zero, as there are no reported stakes between zero and unity. We employ a tobit specification to identify the determinants of $\ln(S)$ which allows for the censored dependent variable.

We estimate the following pooled tobit model at the household and head of household level, h, for gambling expenditure:

$$\ln(S_{ht}^*) = \theta_1 \ln(C_{ht}) + \pi_1' \mathbf{X}_{ht} + w_{ht}, \tag{2a}$$

$$\ln(S_{ht}) = \ln(S_{ht}^*) \qquad \text{if} \qquad S_{ht}^* > 0, \tag{2b}$$

$$\ln(S_{ht}) = 0 \qquad \text{otherwise}, \tag{2c}$$

where S_{ht} is the stake placed by the household or head of household h at time t, C_{ht} is the total credit repayments of the household, and w_{ht} denotes a stochastic disturbance term, $w_{ht} \sim N(0, \sigma_{wht}^2)$. The key parameter of interest is θ_1 which serves to inform us about the relationship between the level of gambling stakes placed and the amount of credit repayments. When estimating over all adult individuals:

$$\ln(S_{iht}^*) = \theta_2 \ln(C_{iht}) + \pi_2' \mathbf{X}_{iht} + v_{iht}, \tag{3a}$$

$$\ln(S_{iht}) = \ln(S_{iht}^*) \qquad \text{if} \qquad S_{iht}^* > 0, \tag{3b}$$

$$\ln(S_{iht}) = 0 \qquad \text{otherwise}, \tag{3c}$$

where S_{iht} is the stake placed by individual i in household h at time t, C_{iht} is the total credit repayments of the individual, the error term is once again decomposed (ignoring time subscripts) in the same manner as previously, $v_{ih} = \varphi_h + \psi_{ih}$, such that $\rho_2 = \text{corr}(v_{lh}, v_{kh}) = \sigma_{\varphi h}^2 / (\sigma_{\varphi h}^2 + \sigma_{\psi ih}^2)$, $(l \neq k)$ where ρ_2, represents the proportion of the total unexplained variance in the dependent variable contributed by the household variance component. Thus, the magnitude of ρ_2 yields information pertaining to the levels of intra-household gambling.

In our set of covariates, $\mathbf{X}$, in the probit and tobit specifications, controls are included for a number of influences which may affect either the probability of engaging in gambling activity or the level of gambling expenditure. For the models which focus upon household level or head of household analysis, covariates in $\mathbf{X}$ are specified for the head of household where appropriate (e.g. gender), whilst, for the individual level analysis, covariates in $\mathbf{X}$ are defined at the individual level, with the exception of the household level characteristics (see Table 1 for full details). To be specific, we control for the following characteristics: gender; a quadratic in age; ethnicity (only available for the head of household); age left full time education (FTE); being a lone parent; and marital status, i.e. whether cohabiting, single, widowed, separated or divorced. Controls for labour force status are also included: whether full-time employed; part-time employed; unemployed or not in the labour market. Household characteristics include: housing tenure, i.e. whether the accommodation is rented privately, owned on a mortgage or owned outright, and log (real) weekly household income. We also condition upon year and regional dummy variables.

3. Results

3.1 The probability of gambling and the use of credit

We first present the results where equations (1a) and (1b) are estimated via a probit specification to investigate whether there is any association between those

households who have to make any regular credit repayments and the probability of gambling. The results are shown in Specification A of Table 2 where the analysis is conducted at the household level (Panel 1), head of household level (Panel 2) and individual level (Panel 3). Marginal effects on the probability of gambling are reported in each case. It is apparent that, across all three levels of aggregation, the influence of whether a household or individual makes any weekly credit repayment on the probability of gambling is positive and statistically significant, and also very similar for all three levels of aggregation. Thus, for example, focussing on households (Panel 1), making current credit repayments is associated with a 5 percentage point higher probability of gambling. This effect is large as compared to the mean probability of gambling shown in Table 1.

Other findings common across the different levels of aggregation and which are consistent with the existing empirical evidence (see, for example, Sproston et al., 2000; Wardle et al., 2007), are that males and lone parents are more likely to gamble. The probability of gambling is also increasing in age, albeit at a decreasing rate and reaching a peak at around age 55. Factors that lower the probability of gambling are the number of years of education, being non-white, all labour market states relative to being in paid employment, a higher number of children in the household, and housing tenure relative to living in accommodation owned by a local authority (LA) or housing association (HA). The association of gambling with household income is insignificantly different from zero at the mean household income, *ceteris paribus*, for both households (Panel 1), and for head of households (Panel 2). However, at the individual level (as reported in Panel 3), the relationship between gambling and income is more complex – higher household income is

associated with significantly lower individual gambling propensity, although this effect is offset to a degree by higher individual income. We explore this in greater detail in Section 4 below.

The final column in Table 2 which presents the individual level analysis, allows for intra-household correlation in gambling propensity. This appears to be important since the estimated correlation coefficient $\rho_1 = 0.2441$ is positive and statistically significant. Hence around one quarter of the unexplained variation in individuals' gambling propensity can be accounted for by the (unobserved) predilection of others in the household to engage in gambling.

In order to explore whether gambling is associated with particular types of credit, the dummy variable indicating whether any credit repayments are currently being made is decomposed into three types: loans; hire purchase (HP) agreements; and credit clubs. Individuals and households may have more than one type of credit. Making payments on loans is by far the most common form of credit repayment as shown in the summary statistics in Table 1. The results obtained for the different types of credit are reported in Specification B of Table 2 (the other covariates in Specification A are also included in these regressions but are not reported since their marginal effects are little changed). It is apparent that the existence of credit club repayments is most strongly associated with the probability of gambling, with an 8.4 percentage point increase in the probability of gambling at the household level and a 9.5 percentage point increase in the probability of gambling for individuals when this form of credit is utilised. However, relatively few households or individuals access this form of credit

as shown in Table 1. In contrast, households and individuals with HP agreements are no more or less likely to gamble than those without this form of credit.[9]

3.2   *The level of gambling expenditure and the amount of credit repayments*

Specification A of Table 3 presents the results from the tobit analysis, where we investigate the relationship between the amount of current credit repayments and the amount of the gambling stakes. To evaluate the impact of a covariate on the level of gambling expenditure, we derive the marginal effects for the censored variable from the estimated coefficients. These are calculated by multiplying the estimated coefficient, θ, by the scaling factor (ignoring subscripts): $\phi(\{\theta \ln(C) + \pi' \mathbf{X}\} / \sigma)$, where ϕ denotes the cumulative distribution of the standard normal and σ is the standard error of the regression equation.

Since monetary values are in log units, estimating the association between gambling stakes and the amount of credit repayment is effectively evaluating an elasticity. To be specific, a one per cent increase in credit repayments is associated with around 0.03 per cent higher total household gambling expenditure and also a 0.03 per cent higher gambling expenditure by adult individuals. As with the probability of any gambling, the elasticity of gambling stakes with respect to credit repayment is almost the same for all three levels of disaggregation. In general, the factors that were seen to determine the incidence of any gambling as reported in Table 2 are also seen to impact upon the amount of gambling as presented in Table 3. Thus males who are

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[9] There is also some information available in the EFS on credit card interest payments, and this is clearly an important source of credit for some households and individuals. Unfortunately, this data is reliably available only at the household level but not at the individual level, and hence we cannot include it in all three levels of aggregation examined here. However, for the household level equation, the results obtained when this additional source of credit is included show that household credit card interest payments have a similar impact on the probability of gambling as loan repayments, and the other coefficients are robust to its inclusion. Hence its omission would not appear to affect the substantive findings.

older, white, less educated, in work and living in public housing are more likely to gamble, and to gamble more. Interestingly, the elasticity of gambling stakes is equally as large in terms of magnitude as the income elasticity at the individual level. Once again, the individual level analysis in Panel 3 allows for intra-household correlation in gambling stakes. The correlation coefficient $\rho_2 = 0.2042$ is positive and statistically significant, suggesting that gambling expenditures are positively correlated across individuals within households.

Specification B of Table 3 reports the results when credit repayments are distinguished by type: loan repayments, HP repayments and credit club repayments. Loan repayments dominate total credit payments as shown in Table 1. The estimated elasticities of gambling stakes with respect to loans and, especially, credit club payments are rather larger than for HP agreements. For example, for credit club payments, the elasticity is about 0.05 for all three levels of aggregation (households, heads of households and individuals), whereas for HP agreements, the elasticity is only 0.01 for individuals and is insignificantly different from zero for households and for heads of households.[10]

4.   Variation in gambling and the use of credit by household income

A key question of interest is how the relationship between gambling and the use of credit as indicators of financial risk-taking varies across household income. In particular, do poorer households who may be more vulnerable to income uncertainty

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[10] As explained above, we can also include the amount of credit card interest payments in the household level equation as an additional credit repayment commitment. The results of this exercise reveal that, as with the probability of gambling, credit card interest repayments have a similar relationship to the level of gambling stakes as loan repayments, while the other coefficients are little affected by its omission/inclusion.

and volatility reveal rather different financial risk-taking behaviours? Tables 4 and 5 repeat the analysis in Tables 2 and 3 respectively, separately for households in the bottom quartile and top quartile of household income. For ease of comparison, the results for all households as obtained previously are also presented in the tables. Only the variables of immediate interest are reported, but in each case, the other covariates as in Table 2 and Table 3 are also included in each regression.

Table 4 reports the probit results for the incidence of any gambling and its association with any credit repayments. The first column repeats the results from Table 2 for all households, while the second and third columns report the results for the low income and high income households respectively. Results are reported for the three levels of aggregation as before in the three Panels of the table. The first point to note is that the relationship between gambling and income is non-linear. The overall effect measured across all households in Column 1 is estimated to be insignificantly different from zero, but this serves to obscure an important non-linear relationship. For low income households, there is a small but positive relationship between household income and the probability of gambling, but for high income households, there is a large and negative impact of increasing income on the probability of gambling. However, the positive association between gambling and the use of credit is approximately the same at all levels of household income, with the use of credit associated with a 4-5% higher probability of gambling.

Similar patterns are observed for heads of households as presented in Panel 2 and for individuals as in Panel 3, although for low income households, the positive relationship observed between household income and gambling propensity is smaller

and not statistically significant. Individual income in high income households partly offsets the negative relationship between higher household income and the probability of gambling activity. The intra-household correlation (i.e. co-determination) in gambling is stronger for low income households than for high income households. Of most interest to this study, however, is that the positive relationship between gambling and the use of credit is around 4-5% for all levels of aggregation and across all household income levels. This constancy in the estimated relationship suggests attitudes to financial risk-taking – at least with regard to the use of credit and gambling – are rather similar across household types.

Table 5 reports the tobit results by household income. Similar patterns are observed as in Table 4 above. The relationship between household income and gambling stakes is non-linear, and is positive for low income households (so gambling is a normal good) but negative for high income households (so gambling is an inferior good). But the elasticity of gambling stakes with respect to credit repayments is significantly positive and equal to 0.03 irrespective of household income. For heads of households (Panel 2), and all individuals (Panel 3), similar findings are apparent, with gambling highly inferior in high income households. Once again, there is a stronger co-determination of the amount that individuals gamble in low income households as compared to high income households. However, the relationship between gambling expenditure and credit repayment is invariant to household income.[11]

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[11] We also investigated defining high and low income households by quartiles of equivalised household income rather than simply household income, in order to account for the income of households relative to their size. None of the results presented above are qualitatively affected by this alternative definition of 'poor' and 'rich' households. However, the differences in the intrahousehold correlations

The number of observations and the degree of censoring shown at the bottom of each Panel in Table 5 indicates that high income households are larger, on average. Moreover, a greater proportion of both heads of household and individuals in high income households do not gamble, consistent with the strong negative income elasticity producing a lower level of gambling in high income households.[12] However, the attitudes to financial risk-taking overall seems little different by household income bands.

5.   Discussion and Conclusions

Given the recent policy changes relating to gambling in the UK along with innovations in the gambling industry and the underlying trends towards increased gambling activity, it is surprising that as yet there has been relatively little detailed research regarding gambling and its determinants in the UK. Given the existence of 'problem' gambling as well as financial pressures at the household level, it is not surprising that the recent changes in gambling legislation and gambling accessibility have attracted public debate. In order to understand the potential impact of these changes at the individual and household level, as well as on society more generally, we need to be better informed regarding which individuals engage in gambling, the intensity with which they gamble and, in particular, the degree to which gambling is associated with financial vulnerability. Our empirical findings suggest a positive association between

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between low and high income households are even larger when using equivalised income to define relative household income, since the intrahousehold correlations are larger in poor households and smaller in rich households than those presented in Panel 3 in Tables 4 and 5.

[12] Wardle et al. (2007) report declining individual gambling propensity for the top quintile of household income as compared to the 4th quintile, although the probability of gambling is still greater than for the bottom quintile.

the propensity to engage in gambling activity and the use of credit at both the individual and the household level. In addition, we reveal a positive relationship between the amount spent on gambling and the level of credit repayments. Furthermore, we find evidence supporting a positive correlation between gambling activity across household members thereby highlighting the possibility that financial vulnerability may be concentrated within particular types of household.

Focussing separately on poorer and richer households, we show that the relationship between gambling and household income is non-linear. However, the propensity of households and individuals to engage in gambling and their willingness to expose themselves to financial vulnerability through the use of credit appears to be little influenced or affected by household income. While richer households may be able to better protect themselves against financial uncertainty, those in poorer households are less able to do so. Given the current unease amongst policy makers regarding the levels of secured and unsecured debt at the household level, the similar attitude to financial risk-taking in terms of their propensity to gamble for given levels of indebtedness may be a cause for concern. It would certainly merit further investigation beyond the reduced form associations presented in this paper.

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Table 1: Summary Statistics

Variable description	Panel 1 HOUSEHOLD LEVEL		Panel 2 HEAD OF HOUSEHOLD		Panel 3 INDIVIDUAL LEVEL	
DEPENDENT VARIABLES	Mean	*sd*	Mean	*sd*	Mean	*sd*
Whether any gambling expenditure	0.54	0.50	0.41	0.49	0.39	0.49
Gambling stakes (£)	3.59	14.78	2.22	13.63	1.96	10.71
INDEPENDENT VARIABLES						
Whether any credit repayments	0.37	0.48	0.29	0.45	0.24	0.42
Whether any loan repayments	0.29	0.45	0.23	0.42	0.18	0.38
Whether any HP repayments	0.08	0.28	0.06	0.24	0.05	0.22
Whether any credit club repayments	0.05	0.23	0.03	0.17	0.03	0.17
Total payments (£)	18.45	43.62	13.10	37.62	10.24	31.48
Loan payments (£)	14.49	33.35	10.50	27.74	8.04	23.99
HP payments (£)	2.45	24.24	1.74	22.95	1.36	17.75
Credit club payments (£)	1.51	11.98	0.86	9.89	0.83	8.90
Male	0.62	0.48	0.62	0.48	0.47	0.50
Age	51.37	16.66	51.37	16.66	47.83	17.43
Age^2/1000	2.92	1.78	2.92	1.78	2.59	1.75
Age left FTE	16.98	3.77	16.98	3.77	16.96	4.14
Lone-parent	0.07	0.25	0.07	0.25	0.04	0.19
White (*base: omitted category*)	0.94	0.23	0.94	0.23	0.94	0.24
Non-white	0.06	0.23	0.06	0.23	0.06	0.24
Log(individual income) (£)	–	–	10.04	1.67	9.51	2.24
Log(household income) (£)	10.52	1.18	10.52	1.18	10.69	1.12
Employee (*base: omitted category*)	0.51	0.50	0.51	0.50	0.52	0.50
Self-employed	0.08	0.27	0.08	0.27	0.07	0.25
Unemployed	0.02	0.14	0.02	0.14	0.03	0.16
Sick	0.06	0.24	0.06	0.24	0.06	0.23
Retired	0.27	0.44	0.27	0.44	0.23	0.42
Unoccupied	0.06	0.24	0.06	0.24	0.10	0.30
Disability	0.06	0.23	0.06	0.23	0.05	0.22
Number of adults in household	1.80	0.73	1.80	0.73	2.10	0.85
Number of children household	0.59	1.00	0.59	1.00	0.64	1.02
Number of workers in household	1.09	1.00	1.09	1.00	1.33	1.10
Workless household	0.36	0.48	0.36	0.48	0.29	0.45
Married (*base: omitted category*)	0.51	0.50	0.51	0.50	0.57	0.50
Cohabiting	0.09	0.29	0.09	0.29	0.10	0.30
Single	0.15	0.35	0.15	0.35	0.18	0.38
Widowed	0.12	0.33	0.12	0.33	0.07	0.26
Separated/divorced	0.14	0.34	0.14	0.34	0.08	0.27
LA/HA (*base: omitted category*)	0.19	0.39	0.19	0.39	0.16	0.37
Privately rented	0.09	0.28	0.09	0.28	0.09	0.28
Owned on a mortgage	0.40	0.49	0.40	0.49	0.44	0.50
Owned outright	0.32	0.47	0.32	0.47	0.31	0.46
Observations	45,349		45,349		80,573	

Note: Expenditure and income variables are expressed in real 2005 prices.

Table 2: Probit analysis of the probability of gambling

	Panel 1		Panel 2		Panel 3	
	HOUSEHOLD LEVEL		**HEAD OF HOUSEHOLD**		**INDIVIDUAL LEVEL**	
Specification A TOTAL CREDIT	M.E.	z-ratio	M.E.	z-ratio	M.E.	z-ratio
Whether any credit repayments$	0.0510	9.21	0.0441	7.93	0.0521	10.65
Male$	0.0148	2.48	0.0238	4.11	0.0211	5.30
Age	0.0240	20.86	0.0216	18.98	0.0251	28.20
Age squared/1000	−0.2133	18.55	−0.1934	17.07	-0.2258	24.39
Age left full time education	−0.0270	29.65	−0.0251	27.34	-0.0197	27.76
Lone parent$	0.0574	4.82	0.0532	4.45	0.0513	4.16
Non-white$	−0.1652	14.03	−0.1030	8.98	-0.1487	15.08
Log individual current income	–	–	0.0002	0.10	0.0065	5.45
Log household current income	−0.0012	0.48	−0.0031	0.90	-0.0168	6.60
Self-employed$	−0.0891	9.49	−0.0779	8.66	-0.0835	10.48
Unemployed$	−0.0282	1.35	−0.0100	0.49	-0.0253	1.79
Sick$	−0.0470	2.82	−0.0562	3.58	-0.0649	5.71
Retired$	0.0224	1.48	0.0117	0.80	0.0057	0.53
Unoccupied$	−0.0419	2.65	−0.0417	2.71	-0.0626	6.84
Disability$	0.0117	0.98	−0.0069	0.60	0.0000	0.00
Number adults in household	0.0532	8.79	−0.0031	0.53	-0.0012	0.28
Number children in household	−0.0135	4.41	−0.0176	5.84	-0.0144	5.58
Number workers in household	0.0348	6.05	0.0103	1.87	0.0188	4.10
Workless household$	−0.0174	1.34	−0.0177	1.42	-0.0093	1.00
Cohabiting$	0.0067	0.70	0.0240	2.57	0.0274	3.50
Single$	−0.1086	10.96	−0.0045	0.46	-0.0055	0.74
Widowed$	−0.0924	8.41	0.0214	2.00	0.0282	2.93
Separated/divorced$	−0.1067	10.78	0.0089	0.93	0.0029	0.34
Privately rent$	−0.0635	5.99	−0.0713	7.01	-0.0991	10.81
Owned on a mortgage$	−0.0215	2.62	−0.0243	3.08	-0.0539	7.66
Owned outright$	−0.0660	8.20	−0.0615	8.01	-0.0812	11.62
ρ_1	–	–	–	–	0.2441	29.73
χ^2(43:44:44) [p value]	5236.1 [p=0.00]		2886.2 [p=0.00]		4174.1 [p=0.00]	
Specification B: TYPES OF CREDIT	M.E.	z-ratio	M.E.	z-ratio	M.E.	z-ratio
Whether any loan repayments$	0.0430	7.41	0.0398	6.72	0.0417	7.76
Whether any HP repayments$	0.0014	0.16	0.0089	0.91	0.0166	1.84
Whether any credit club rep's$	0.0846	7.69	0.0821	5.76	0.0949	8.23
ρ_1	–	–	–	–	0.2435	29.64
χ^2(45:46:46) [p value]	5271.6 [p=0.00]		2905.1 [p=0.00]		4194.6 [p=0.00]	
Observations	45,349		45,349		80,573	

Notes to Table 2:

1. Coefficients reported are marginal effects (M.E.) on the probability that the household (Panel 1), head of household (Panel 2) or adult individuals within the household (Panel 3) engages in any form of gambling activity. For dummy variables, denoted $, the coefficient reported is for the discrete change of the dummy from 0 to 1. The 'z-ratio' reports the test that the underlying coefficient is equal to zero.

2. In the household level equation (Panel 1), the individual characteristics are those of the head of household. Reference categories are: female; head of household white; employee; no disability; at least one adult in work; married; local authority or housing association.

3. In Panel 3, ρ_1 is the proportion of the total variance accounted for by the intra-household variation in gambling propensity.

4. The χ^2 test is a test for the joint significance of the explanatory variables.

5. The regression in Specification B which differentiates between different types of credit also includes all of the other independent variables reported in Specification A. Their coefficient estimates are little different from those in Specification A and so are not reported here but are available on request.

6. All regressions also include 6 calendar year dummy variables and 12 regional dummy variables.

Table 3: Tobit analysis of gambling stakes

	Panel 1		Panel 2		Panel 3	
	HOUSEHOLD LEVEL		**HEAD OF HOUSEHOLD**		**INDIVIDUAL LEVEL**	
Specification A: TOTAL CREDIT	M.E.	*z-ratio*	M.E.	*z-ratio*	M.E.	*z-ratio*
Log total credit repayments	0.0297	10.09	0.0257	8.42	0.0262	11.12
Male$	0.0883	3.38	0.1486	5.72	0.1208	7.66
Age	0.1177	22.67	0.1037	19.99	0.1070	30.24
Age squared/1000	−1.0422	20.14	−0.9232	17.93	−0.9585	26.03
Age left full time education	−0.1407	33.31	−0.1253	29.13	−0.0860	29.45
Lone parent$	0.2175	3.88	0.2419	4.39	0.2047	4.14
Non-white$	−0.7725	15.64	−0.5055	9.83	−0.6579	16.53
Log individual current income	–	–	−0.0017	0.18	0.0266	5.63
Log household current income	0.0024	0.21	−0.0071	0.45	−0.0664	6.53
Self-employed$	−0.3649	9.25	−0.3340	8.32	−0.3274	10.32
Unemployed$	−0.1239	1.37	−0.0482	0.53	−0.1237	2.21
Sick$	−0.2023	2.91	−0.2502	3.63	−0.2625	5.93
Retired$	0.1257	1.93	0.0617	0.94	0.0248	0.59
Unoccupied$	−0.1933	2.86	−0.1814	2.64	−0.2567	7.06
Disability$	0.0764	1.45	−0.0070	0.14	0.0214	0.55
Number adults in household	0.2629	10.23	−0.0125	0.47	−0.0080	0.45
Number children in household	−0.0578	4.31	−0.0796	5.84	−0.0575	5.55
Number workers in household	0.1030	4.25	0.0406	1.66	0.0733	4.01
Workless household$	−0.1789	3.26	−0.1053	1.89	−0.0494	1.35
Cohabiting$	0.0870	2.09	0.1349	3.17	0.1286	4.09
Single$	−0.5073	12.16	−0.0108	0.25	−0.0176	0.58
Widowed$	−0.4296	9.35	0.1042	2.16	0.1084	2.85
Separated/divorced$	−0.4889	11.88	0.0390	0.90	−0.0024	0.07
Privately rent$	−0.3305	7.23	−0.3342	7.38	−0.4143	11.37
Owned on a mortgage$	−0.1396	3.94	−0.1180	3.36	−0.2245	8.10
Owned outright$	−0.3416	9.90	−0.2995	8.84	−0.3473	12.69
ρ_2	–	–	–	–	0.2042	30.12
χ^2(43:44:44) [p value]	6279.8 [p=0.00]		3211.0 [p=0.00]		4987.2 [p=0.00]	
Specification B: TYPES OF CREDIT	M.E.	*z-ratio*	M.E.	*z-ratio*	M.E.	*z-ratio*
Log loan repayments	0.0251	8.18	0.0231	7.11	0.0210	8.16
Log HP repayments	0.0012	0.23	0.0066	1.13	0.0102	2.16
Log credit club repayments	0.0480	7.75	0.0511	6.21	0.0501	8.61
ρ_2	–	–	–	–	0.2036	30.03
χ^2(45:46:46) [p value]	6311.3 [p=0.00]		3233.0 [p=0.00]		5013.4 [p=0.00]	
Censored observations	20,578		26,589		48,987	
Observations	45,349		45,349		80,573	

Notes to Table 3:

1. Coefficients reported are marginal effects (M.E.) on the gambling stakes of the household (Panel 1), head of household (Panel 2) or adult individuals within the household (Panel 3). For dummy variables, denoted $, the coefficient reported is for the discrete change of the dummy from 0 to 1. The 'z-ratio' reports the test that the underlying coefficient is equal to zero.
2. In the household level equation (Panel 1), the individual characteristics are those of the head of household. Reference categories are: female; head of household white; employee; no disability; at least one adult in work; married; local authority or housing association.
3. In Panel 3, ρ_2 is the proportion of the total variance accounted for by the intra-household variation in gambling stakes.
4. The χ^2 test is a test for the joint significance of the explanatory variables.
5. The regression in Specification B which differentiates between different types of credit also includes all of the other independent variables reported in Specification A. Their coefficient estimates are little different from those in Specification A, and so are not reported here but are available on request.
6. All regressions also include 6 calendar year dummy variables and 12 regional dummy variables.

Table 4: Probit analysis of the probability of gambling by household income

	Column 1		Column 2		Column 3	
	Panel 1: HOUSEHOLD LEVEL					
	All households		Low income households		High income households	
	M.E.	*z-ratio*	M.E.	*z-ratio*	M.E.	*z-ratio*
Whether any credit repayments$	0.0510	9.21	0.0418	3.27	0.0487	4.74
Log individual current income	–	–	–	–	–	–
Log household current income	−0.0012	0.48	0.0094	2.58	−0.1127	7.06
$\chi^2(43)$ [p value]	5236.1 [p=0.00]		983.3 [p=0.00]		1516.9 [p=0.00]	
Observations	45,349		11,337		11,337	
	Panel 2: HEAD OF HOUSEHOLD					
	All households		Low income households		High income households	
Whether any credit repayments$	0.0441	7.93	0.0520	4.02	0.0422	4.29
Log individual current income	0.0002	0.10	0.0007	0.19	−0.0016	0.20
Log household current income	−0.0031	0.90	0.0085	1.76	−0.0892	4.97
$\chi^2(44)$ [p value]	2886.2 [p=0.00]		677.7 [p=0.00]		876.8 [p=0.00]	
Observations	45,349		11,337		11,337	
	Panel 3: INDIVIDUAL LEVEL					
	All households		Low income households		High income households	
Whether any credit repayments$	0.0521	10.65	0.0580	4.24	0.0503	6.56
Log individual current income	0.0065	5.45	0.0044	1.75	0.0054	2.09
Log household current income	−0.0168	6.60	0.0058	1.37	−0.1277	10.35
ρ_1	0.2441	29.73	0.3011	11.13	0.2174	16.20
$\chi^2(44)$ [p value]	4174.1 [p=0.00]		654.1 [p=0.00]		1405.0 [p=0.00]	
Observations	80,573		14,670		24,994	
Households	45,349		11,337		11,337	

Notes to Table 4:
1. Coefficients reported are marginal effects (M.E.) on the probability that the household (Panel 1), head of household (Panel 2) or adult individuals within the household (Panel 3) engages in any form of gambling activity. For dummy variables, denoted $, the coefficient reported is for the discrete change of the dummy from 0 to 1. The 'z-ratio' reports the test that the underlying coefficient is equal to zero.
2. In the household level equation (Panel 1), the individual characteristics are those of the head of household. Reference categories are: female; head of household white; employee; no disability; at least one adult in work; married; local authority or housing association.
3. In Panel 3, ρ_1 is the proportion of the total variance accounted for by the intra-household variation in gambling propensity.
4. The χ^2 test is a test for the joint significance of the explanatory variables.
5. All regressions also include the control variable reported in Table 2, plus 6 calendar year dummy variables and 12 regional dummy variables.
6. Low/High income households are those that have a household income in the bottom/top quartile of the distribution of real household (equivalised) incomes.

Table 5: Tobit analysis of gambling stakes by household income

	Column 1		Column 2		Column 3	
	Panel 1: HOUSEHOLD LEVEL					
	All households		Low income households		High income households	
	M.E.	z-ratio	M.E.	z-ratio	M.E.	z-ratio
Whether any credit repayments$	0.0297	10.09	0.0284	3.92	0.0277	5.29
Log individual current income	–	–	–	–	–	–
Log household current income	0.0024	0.21	0.0384	2.42	–0.5244	7.27
$\chi^2(43)$ [p value]	6279.8 [p=0.00]		1125.9 [p=0.00]		1780.2 [p=0.00]	
Censored observations	20,578		6,074		5,001	
Observations	45,349		11,337		11,337	
	Panel 2: HEAD OF HOUSEHOLD					
	All households		Low income households		High income households	
Whether any credit repayments$	0.0257	8.42	0.0340	4.51	0.0230	4.31
Log individual current income	–0.0017	0.18	0.0004	0.02	–0.0070	0.18
Log household current income	–0.0071	0.45	0.0396	1.83	–0.4169	4.96
$\chi^2(44)$ [p value]	3211.0 [p=0.00]		752.8 [p=0.00]		939.4 [p=0.00]	
Censored observations	26,589		6,638		7,274	
Observations	45,349		11,337		11,337	
	Panel 3: INDIVIDUAL LEVEL					
	All households		Low income households		High income households	
Whether any credit repayments$	0.0262	11.12	0.0314	4.71	0.0253	6.66
Log individual current income	0.0266	5.63	0.0156	1.66	0.0234	2.11
Log household current income	–0.0664	6.53	0.0211	1.33	–0.5549	10.55
ρ_2	0.2042	30.12	0.2476	11.21	0.1907	16.56
$\chi^2(44)$ [p value]	4987.2 [p=0.00]		908.0 [p=0.00]		1600.9 [p=0.00]	
Censored observations	48,987		8,758		16,441	
Observations	80,573		14,670		24,994	
Households	45,349		11,337		11,337	

Notes to Table 5:
1. Coefficients reported are marginal effects (M.E.) on the gambling stakes of the household (Panel 1), head of household (Panel 2) or adult individuals within the household (Panel 3). For dummy variables, denoted $, the coefficient reported is for the discrete change of the dummy from 0 to 1. The 'z-ratio' reports the test that the underlying coefficient is equal to zero.
2. In the household level equation (Panel 1), the individual characteristics are those of the head of household.
3. In Panel 3, ρ_2 is the proportion of the total variance accounted for by the intra-household variation in gambling stakes.
4. The χ^2 test is a test for the joint significance of the explanatory variables.
5. All regressions also include the control variable reported in Table 2, plus 6 calendar year dummy variables and 12 regional dummy variables.
6. Low/High income households are those that have a household income in the bottom/top quartile of the distribution of real household (equivalised) incomes.