EC331

Research in Applied Economics

Gamblers, smokers and their level of debts.

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Section 1: Introduction

Moderate gambling in today's world, similar to reasonable smoking or alcohol use, is an accepted part of our culture and it should not cause any problem. After the full legalization of gambling in 2005 in the UK, there was a significant increase in the number of state-run lotteries and other forms of gambling activities such as casinos and online gambling. This has given the society a wide range of gambling opportunities to participate, no matter whether one is wealthy or poor. Consequently, more and more people gamble. Although accepted by many, excessive gambling is considered by some people to be an activity that may lead to serious problems, ranging from links to organized crime and corruption, to self-destruction and financial hardships. In my research, firstly I would like to layout a theoretical explanation of why one gamble then I will investigate how gambling affects one's debt level and her or his prevalence to smoke. It could be argued that gamblers will have relatively higher debts level, as the more one gambles the more likely one will lose money, and to cover those losses one will have to borrow more money. I would like also to point out that from the data I am only able to show the characteristics of a gambler, and how that affect smoking expenditure and debts but not the reasons for one's gambling behavior.

In the next section, I will introduce a literature review. Then I will review the theoretical basis of why do people gamble also I will try to extend this smoking behavior as I believe both of activities involve risk seeking. In section 4, I will provide the estimation model and my reasoning for choosing such model. I will discuss the results and statistical interferences of Family Expenditure Survey 2000-2001 in Section 5. Lastly, Section 6 will give a conclusion of my results and evaluate further extensions to my work.

Section 2: Literature Review

Brenner and Brenner (1990) "*Speculation and Gambling: A theory, a history and a future of some human decisions"* gives a very good insight into the gambling world. They believe that gambling serves the society well by providing a service that public purchases in hope of becoming wealthier. Moreover, the authors give explanations on why different groups of people have different attitude towards gambling. For example, the difference in lottery expenditure amongst black and white, especially for those who belongs to a lower income category is strikingly high for the black. This might suggest that white people may have the belief that they have other opportunities to get richer not only by means of gambling compared to black people (Brenner and Brenner 1990). The main focus of the book is on state-run lotteries, in which one has a chance for a big win for a relatively cheap price. It has been suggested by Brenner and Brenner that lotteries are not played for the purpose of entertainment but purely for the possibly of economics gain. Moreover, sometime lotteries are the only realistic way to increase or improve substantially one's level of wealth. Therefore, people motivation to gamble is to become richer, and lotteries might be the best way to achieve that. Although, generally this might be true, I believe that the reasons given by Brenner and Brenner are adequate and applicable. However, I think they have missed out to account for some key factors such as one's preferences or one's attitude towards risk, which play a significant role in determining whether one will participate in gambling or not. And though gambling can be part of our society and be for many of us a hope to get richer, in many cases gambling will cause problems.

A more comprehensive overview of why people gamble and some problems that are related to gambling are discussed in the paper by Namrata Raylu, Tian P.S. Oei under *"Pathological Gambling: A comprehensive review*" (2002). They argued that due to a recent legalization of gambling, the participation rate in such activities has increased and led to an increase in the number of pathological gamblers. Pathological gambling is defined as *"a progressive and chronic disorder that encompasses an unrelenting failure*

to resist impulses to gamble and where this maladaptive behavior disrupts, or damages personal, family, or vocational pursuits" (N. Raylu et al 2002). Therefore, a person suffering from such disorder not only will suffer interpersonal problems from physical and mental breakdowns but also could impose unnecessary costs on the society. Some common social costs include financial hardship through higher level of debts and losses in assets as well as substance abuse or overuse, such like drugs or smoking (N. Raylu et al 2002).

Smoking and gambling share a common aspect in economics theory, which is risk seeking and has been described in Tversky and Kahnemann's *Prospect Theory (1979)*. They argued that the theory of expected utility is inconsistent. For example, given two choices of negative prospect, a certainty of a loss of -$500 and lottery that on average will give an expected loss of -$500, some individuals are more inclined to risk seeking by choosing an "in theory" a worse outcome- the lottery. To confirm this result, in the paper by Sato and Ohkusa, they showed that gender and time discount rate significantly affect smoking initiation however risk aversion and information do not (Sato and Ohkusa 2003). Furthermore, the correlation between smoking and gambling was discussed in the paper of Rodda, Brown and Philips (2002). They used a sample of 81 Electronic Gaming Machine players to investigate the relationship beween tobacco dependency and problem gambling. *"The main object of their study was to provide an estimate of smoking rates in non-problem and problem gamblers and to assess the linearity of any relationships between problem gambling, smoking and nicotine addiction amongst Electronic Gaming Machine players."* (Rodda et al 2002). They found confirmation of a high smoking rate in a sample of gamblers and a robust linear relationship between problem gambling and the likelihood of tobacco use and tobacco dependence in Electronic Gaming Machine players (Rodda et al 2002).

The availability of previous literatures on gambling and debt are very scarce and infrequent hence I am not able to list any paper on the above topic. However, through my

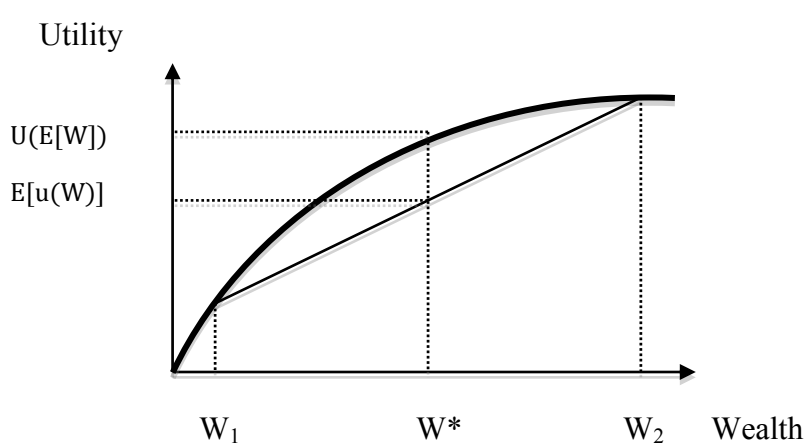
research I have found numbers of services and helplines offering supports and solutions for gambling debts. Therefore, I believe there should be a correlation between those two variables.

Section 3: Theoretical Analysis

In this section, I will present some theories that will help to explain why do some people gamble. I will start with a simple theory, which is the expected utility theory. The model is used to analyse one's decision making under uncertainties. The model assumes that individuals are rational, their utility function are concave and that individuals always want to maximize their expected utility, which is computed by the weighted probabilities of utilities associated with each outcomes. In the paper by Von-Neumann and Morgenstern (1947), it was shown that the utility of a lottery *L(a,b;p)* could be calculated as followed.

$$U(L(a,b;p) = E[u(a,b)] = pu(a) + (1-p)u(b)$$

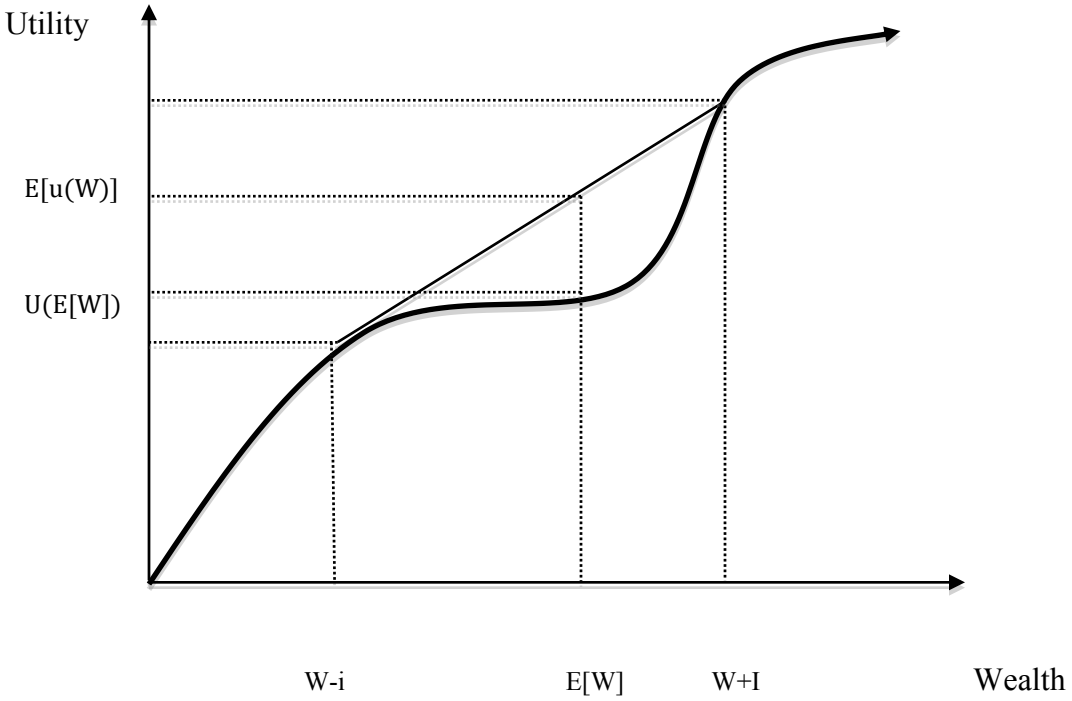
where *a* and *b* are the two possible outcome, and *p* is the probability associated with outcome *a*. As the utility function is assumed to have properties of concavity, then we can claim that a certain level of wealth is preferred to expected outcome that gives the same level of wealth. Mathematically $U(E[W]) > E[u(W)]$ and the graph below depicts this idea.



The expected value of most gambles is usually less then the value of one's initial wealth. This means that one's utility level is lower with uncertainties one faces when involves in

gambling activities. Such activities contradict with utility maximization, nevertheless people still are willing to engage in those kind of games.

To explain this phenomenon, Friedman and Savage (1948) has modified the expected utility theory. They have assumed that at a low and high level of wealth the utility function exhibits a decreasing marginal utility of wealth. While in the middle, the marginal utility of wealth increases. This is depicted as below.



Compare to the earlier graph, notice that this function has two concave fragments and a convex one in the middle. With this specification of utility function, we can explain why some people gamble. Let take an individual whose wealth lie in the middle segment and assumed that there is a lottery has a low probability of winning a large amount of money (W+I) and a high probability of losing a small amount of money (W-i). From the graph, the expected utility of lottery is higher than the certain wealth level of W. However, this case is not true for individuals who are relatively wealthier. Those individuals are risk-averse and would rather buy insurance to avoid uncertain outcomes. The prediction of this model is that poorer individuals are more likely to gamble, as gambling could be the only mean for them to shift out of their present social class. Richer people, though, are

more likely to insure to protect themselves against losses of their wealth.

Another theory that helps to explain gambling behavior was initiated by Kahneman and Tversky (1979), in which they showed that individuals more often than not over exaggerate their chances of winning. The prospect theory by Kahneman and Tversky (1979) differs in many ways from the expected utility theory. In the prospect theory, the authors have replaced the utility function with a function of values, which is concave for gains and convex for losses. They also have replaced probabilities with decision weights, which are normally lower than the associated probabilities except in region of low probabilities where weights are higher. This explain why people are attracted to gambling as they tend to overweight the low probabilities of winning. An example in case is when facing a lottery people make their decisions base on the subjective assessment of probabilities of winning which might be somewhat different from the true probabilities.

Moreover, a different approach in explaining gambling was taken by Brenner and Brenner. They have suggested the following model:

$$U(W_0, \alpha(W > \overline{W}_0 \mid W_0 \in I_0)$$

where W_0 is one's wealth, I_0 an interval in distribution of wealth, which defines a class with mean wealth equal to $\overline{W_0}$, α(.) is the percentage of people who are richer than $\overline{W_0}$ in the society and $\partial U / dW_0 > 0; \partial U / \partial \alpha < 0$.

Suppose that there is a lottery that cost h and there is a probability p of winning the considerable prize H that can lift to the next social class. Then we can mathematically represent the above situation as following:

$$(1-p)U(W_0 - h, \alpha(W > \overline{W_0} \mid W_0 \in I_0) + pU(W_0 - h + H, \alpha(W > \overline{W_1} \mid W_0 \in I_0)$$
$$> U(W_0, \alpha(W > \overline{W_0} \mid W_0 \in I_0)$$

They have suggested to consider an utility function which is linear in W_0 and α:

$U = aW_0 + b\alpha(W > \overline{W_0}), a > 0, b < 0$. Such that the above equation could be rewritten as:

$(1-p)a(W_0 - h) + (1-p)b\alpha(W > \overline{W_0}) + pa(W_0 - h + H) + pb\alpha(W > \overline{W_1}) > aW_0 + b\alpha(W > \overline{W_0})$

and given that the lottery is fair $(1-p)h = p(H-h)$ then we will get the above inequality is reduced to:

$\alpha(W > W_1) < \alpha(W > W_0)$ as *b<0* this condition is always true. Then one would always choose to buy a lottery ticket.

However, most gambles are unfair that is $(1-p)h > p(H-h)$, after a few step of mathematical translation the following inequality can be achieve:

$$\frac{a}{b}(pH - h) - p\alpha(\overline{W}_1 > W > \overline{W}_0) < 0$$

where $\alpha(\overline{W}_1 > W > \overline{W}_0)$ is the percentage of population that the winner of the lottery would jump if one won the lottery. For a more rigorous derivation of the model please refer to the Appendix I of Brenner and Brenner (1990). The left hand side term is the subjective cost of gambling, whereas the right side is the perceived benefits. Hence, we can make a very similar conclusion as before, individuals who are relatively poor have a greater incentive to gamble than the rich because they want to move up to a higher social class.

Although we ended up with the same prediction, the model used by Brenner and Brenner is significantly different from the one suggested by Kahneman and Tversky. In the former model, we cannot reproduce the same results in the laboratory experiment. As there is no way an individual can be made significantly poorer or richer in the laboratory environment. Hence with Brenner and Brenner model we can only use data obtain in the real world.

Now, I would like to look at a psychological and empirical studies to explain gambling behavior. The literatures imply more than one answer to a question of "why does one gamble?". Reasons such as hoping to win, way to spend time and have fun, proving one's

worth, trying to get social acceptance, experiencing excitement, easing painful experiences or emotions such as anger, disappointment or anxiety were mentioned by Blaszczynski (1995) and Cotte (1997). Studies done by Volberg and Steadman (1998) have suggested that males are more likely to be gamblers than females, however studies done by Hing and Breen (2001) have not found such relationship. In addition, some studies have found that there is a strong correlation between rates of gambling and one ethnics group such as Chinese (Blaszczynski, Huynh, Dumlao and Farrell, 1998). Similar features of gamblers and smokers includes risk seeking behavior and addictive behavior from individuals. Gambling and other types of addictions such as smoking or alcohols use have a condition of significant arousal. These activities let individuals to escape from their problems and also have similar symptoms such as craving, tolerance and withdrawal. Addict shares a similar psychological profile N.Raylu et al (2001).

Section 4. Data analysis and methodology

In this section I will briefly discuss the dataset that I used to obtain my results and then I will discuss the appropriateness of the model that I chose to use.

The dataset I used for my research is the Family Expenditure Survey 2000-2001, which is the continuous survey of household expenditure. Data are collected from the private households in the UK, where individuals over 16 are asked to keep a personal expenditure diary for 2 weeks. The dataset has a great number of observations and availability of the data is also an advantage, nevertheless a lot of my effort was put into transforming and deriving the correct set of variables from the raw data collected from the survey. Table 1 in the appendix contain a list of variables with a brief description that I have used for my research.

Now I will present some preliminary statistics. In my sample of 15925 individuals, 5940 individuals who have reported a positive gambling expenditure. Out of those 5940

individuals, roughly 51% were male.

Figure 1: Age of individuals

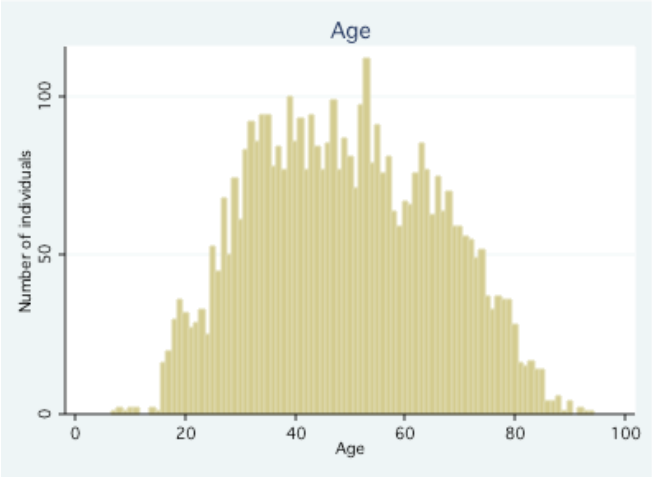


Figure 1 shows the distribution of age amongst gamblers those 5940 individuals. The youngest gamblers are of age 16 whereas the oldest gambler in the sample is reported at 94. Individuals who belongs age group of 30-55 were the one most likely to gamble.

Figure 2: Employment status of individuals

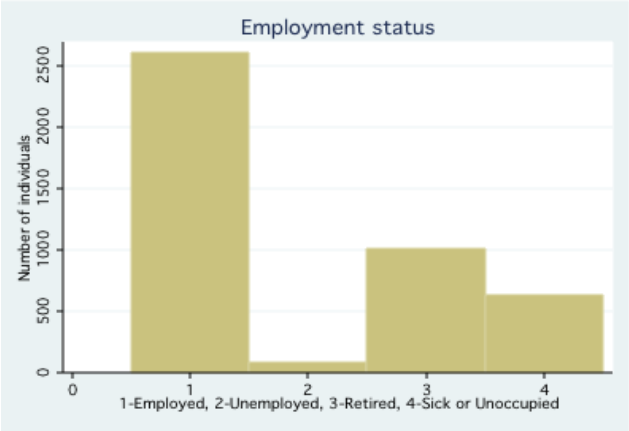
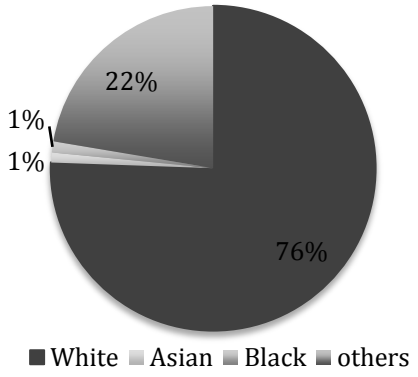


Figure 2 shows that most gamblers are individuals who are employed or retired, and the least likely group to spend money on gambling are unemployed individuals. Generally, this is what we could have expected. Being employed gives you the income that you could spend on gambling, while being retired give you the time to spend on those activities.

Chart 1: Ethnics group by percentage



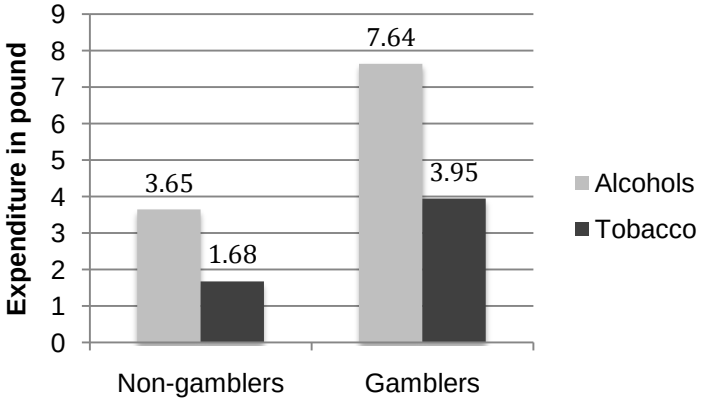
As the survey contains a large population of white ethnics individuals and with a smaller sample size of other ethnic groups, hence comparing in absolute numbers would not provide any insight. Therefore, I have computed the following table, which shows the percentage of gamblers in each ethnic groups.

Table 1: Percentage of gamblers

Ethnicity	Percentage
White	33.6%
Asian	10.3%
Black	22.4%
Others	6.9%

In my sample, 33.6% of white ethnics individuals were gamblers compared to only 10.3% and 22.4% of Asian and black ethnics origin, respectively.

Chart 2: Expenditure level of gamblers and non-gamblers



On average, individuals, who spent a positive amount on gambling, spent also an average of £3.95 on tobacco compared to £1.68 of those who did not gamble. This is a significant difference of £2.26. Moreover, similar conclusion is derived when comparing expenditure on alcohols beverage. Gamblers spent weekly on average £7.64, whereas non-gamblers only £3.65. When comparing the debt level of the two groups, one can also find that on average gamblers have more debts than non-gamblers, £1361 compared to £821 respectively. The above discussion is simply used for a descriptive purpose. A more formal econometrics approach will be discussed.

In my sample a vast majority of individuals have reported zero expenditure on gambling, which indicates either that gambling does not enter into one's economics decision or it is part of the utility function but the solution is the corner solution. That latter case assumes that every individual is a consumer of gambling but some of them choose to consume 0.

In choosing an econometrics model, I have disregarded OLS regression as having such a huge sample of population with zero expenditure on gambling would cause the coefficients to be biased and inconsistent. The degree of biasedness would increase as the number of individuals, who expenditure on gambling is 0, increases. This is illustrated in figure 3 below, some individuals with lower income would like to be given

money to participate in gambling. Then the true relationship between income and expenditure on gambling is that bold line. But in reality we cannot observe negative expenditure, what we observed is an individual spending 0 on gambling. In this way, we observed the data in figure 4. The bold line represent the true relationship, where the thinner line in the OLS estimation. Hence, it is evident that OLS is biased.

Figure 3

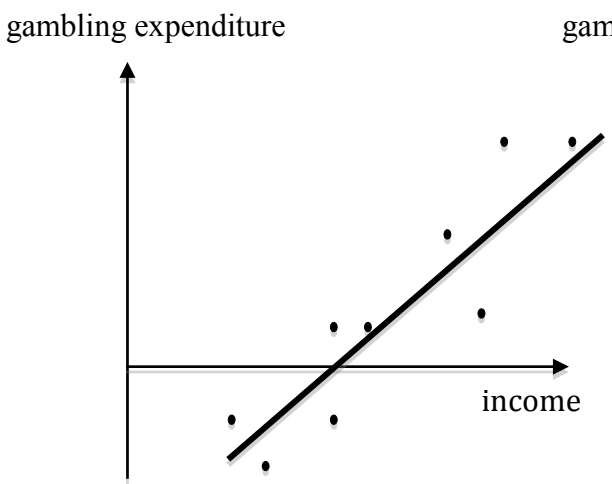
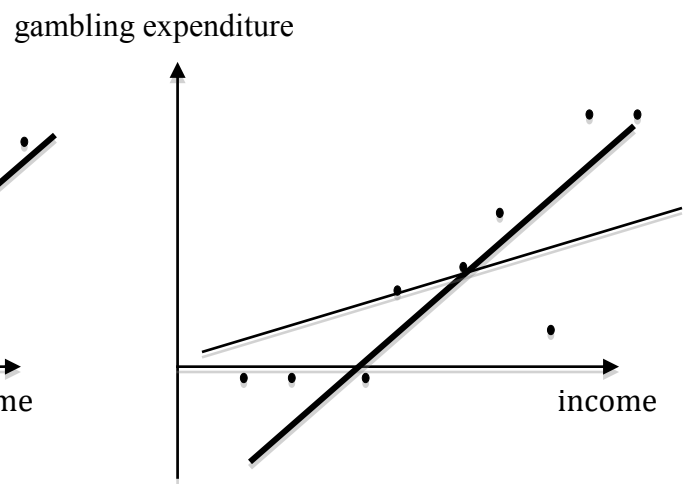


Figure 4



A more suitable model for this type of variables, which is able to censor for the zero expenditure in my sample, is the Tobit model. Using this definition, my model can be define as below:

$$y_i = \begin{cases} y_i^* \, if \, y_i^* > 0 \\ 0 \, if \, y_i^* \leq 0 \end{cases}$$

where

$$y_i^* = \beta_0 + \beta_1 inc + \beta_2 tobex + \beta_3 alco + \beta_4 gender + \beta_5 mstmarried + \beta_4 mstwi + \beta_5 mstdiv + \beta_6 msto + \\ + \beta_7 debt + \beta_8 black + \beta_9 asian + \beta_{10} otheretn + \beta_{11} esrit + \beta_{12} esunem + \beta_{13} esot + \beta_{14} age + \varepsilon_i$$

which is a latent variable.

In this model all negative values will be mapped to zero, hence if an individual would

like to spend a negative amount of y_i^*, then he or she would report zero expenditure. Hence, the Tobit model assumes that every individual is a consumer of gambling. To test for the appropriateness of the Tobit model, I have ran two specification tests using the Lagrange multiplier framework. First, a test for heteroscedasticity on the dependent variables: *gamexp* was computed. Second, I tested for the non-normality in my sample. If those conditions are violated then estimators for β and σ will be inconsistent and biased. The results of both tests are summarize below and for the methods please refer to the appendix.

<u>Heteroscedasticity with respect to *gamexp:*</u>

$$\xi_{LM} = NR^2 = N - RSS = 15925 - 15816.97 = 108.03 > \chi^2_{1,5\%} = 3.84$$

The null hypothesis of homoscedasticity was rejected at 5% significance level. Hence the model is heteroscedastic with respect to the variable *gamexp*.

<u>Non-normality test:</u>

$$\xi_{LM} = NR^2 = N - RSS = 15925 - 15492.97 = 408.03 > \chi^2_{2,5\%} = 5.99$$

Here we also have to reject the null hypothesis of normality with 5% significance level. Both tests suggested that estimators of the Tobit model will be inconsistent and biased. However, I will assume the Tobit model but I will correct my model by using the heteroskedastic errors and suppose that for the sample size approaching infinity the errors are normally distributed. In addition to a Tobit model, I also ran an OLS model for comparison purposes.

Section 5. Results

The table 2 summarises the results of my two regressions and also reports the associated unconditional marginal effects, and the marginal effects conditional on positive gambling expenditure.

Table 2

Tobit maximum likelihood estimation results and marginal effects for gambling expenditure

	Tobit			*OLS*				
Variables	*Coefficient*	*robust s.e.*	*t-ratio*	*Coefficient*	*robust s.e.*	*t-ratio*	*Marginal effects unconditional;*	*Marginal effects conditional ; E(y|x,*
inc	-0.0035	0.0007	***	-0.0007	0.0002	***	-0.0009	-0.0009
tobex	0.1136	0.0195	***	0.0550	0.0054	***	0.0289	0.0277
alco	0.0994	0.0141	***	0.0547	0.0037	***	0.0253	0.0242
gender	0.7323	0.1823	**	0.3624	0.0800	***	0.1869	0.1787
	0.2777	0.3338	***	0.3446	0.1417	***	0.0709	0.0678
mstwi	1.4039	0.4668	**	0.0807	0.2307		0.3907	0.3574
mstdiv	0.2105	0.4508	***	0.2347	0.2288		0.0543	0.0516
msto	1.3181	0.3658	***	0.3306	0.1697	**	0.3627	0.3337
debt	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000
black	-1.6004	0.7258		-0.1657	0.3672		-0.3631	-0.3698
asian	-4.8310	1.1120	***	-0.8445	0.3879	***	-0.8630	-1.0060
otheretn	-0.2445	0.3314	***	0.0554	0.1208		-0.0616	-0.0593
esrit	-1.0763	0.3891	***	-0.5468	0.1826	***	-0.2601	-0.2560
esunem	-2.3408	0.5156	***	-0.8810	0.2574	***	-0.5055	-0.5290
esot	-2.9646	0.3800	***	-0.3199	0.1181	***	-0.7167	-0.7051
age	0.6321	0.0546	***	0.0543	0.0097	***	0.1609	0.1541
agesq	-0.0055	0.0005	***	-0.0003	0.0001	**	-0.0014	-0.0013
constant	-18.2603	1.7120	***	-0.3828	0.1987	*		

Log pseudolikelihood = -25140.197

F(16, 15909) = 14.74 F(16, 15908) = 67.83

Pseudo R2 = 0.0672 R-squared = 0.0676

Number of obs = 15925 Number of obs = 15925

*Significant at 10%; **significant at 5%; ***significant

I have run regression on the two models using robust standard errors to correct for the heteroscedasticity. Comparing coefficients between Tobit and OLS show that they all but *otheretn* have the same signs. Moreover both models are significant, however Tobit yields more significant estimators. To make any interpretation of the estimators between

the two models in the form above is meaningless, in order for sensible comparison we need to examine the marginal effects of each variables. In OLS, there is only one conditional mean function $E(y) = x'\beta$, which make the interpretation of the results straightforward. As β measures the marginal effect of x_k on y. Whereas, in Tobit model there is more than one conditional means. In my research, I am interested in the conditional mean on observed dependent variable and on the uncensored observed dependent variable y|y>0. The former condition will help me to examine determinants of actual expenditure on gambling by gamblers and non-gamblers, whereas the latter condition helps to examine the amount of gambling expenditure by gamblers only. The marginal effects are evaluated at the mean value of each variables. Now, I will examine the interpretation of the marginal effects of the estimators in order of appearance.

The first explanatory variable is income. It has a highly significant estimated coefficient of -0.0035 and its marginal effects conditional on positive spending is -0.0007, ceteri paribus. For every pound of additional income the expenditure on gambling will decrease by -0.0007 pound, which confirms the Friedman and Savage (1948) hypothesis and the prediction by Brenner and Brenner (1990). The higher your income the lower the probability that you will gamble. Though the estimator is highly significant, I need to point out that the magnitude of effect of income is very small. It takes 1000 pounds of increase in income per week, to decrease the expenditure by only 70 pence. It is unlikely that anyone will get their income raise by such enormous amount unless one wins the lottery. In that case, people who have won lottery will be incline to gamble significantly less, instead they will seek insurance for their wealth.

Individual's expenditure on tobacco and alcoholic products are positively correlated to amount spent on gambling. Given that an individual is a gambler, on every additional pound spend on tobacco and alcohols on average he or she spends 0.0289 and 0.0253 pound on gambling, respectively. This shows that gamblers tend to consume more of the two goods than non-gamblers. Results confirm with previous research done by Rodda et.

al. (2002).

As expected the male group spend about 0.18 pound on average more on gambling that their counterpart female, ceteri paribus. In my research, independent variable was define as the sum of expenditure spend on all gambling activities including lottery, bingo or sporting betting. This finding then is consistent with the results found by Hraba and Lee (1996), where they have found that women reported less gambling behaviour, however that was mainly due to the differences in gender scope of gambling. Meaning that men were involved in more types of gambling activities than women, and that have contributed towards the difference spending pattern between the two genders.

Next, we have group of dummy variables controlling for the marital status, one's ethnic origin and employment status. Notice that I have excluded the *mst1*, *white, esemp* from the regression to avoid the problem of multicollinearity. Hence, we should interpret the dummy variables in the regression in comparison to *mst, white and esemp* respectively. Compared to individuals who are single, individuals from different marital status spends significantly more on gambling. For example, given that you are divorced your consumption of gambling increase on average by 0.0678, whereas being a widow increase you spending by 0.3574 pound, ceteri paribus. This might be explain by psychological and social reasoning that often those individuals to tackle problem of depression, anxiety or anger, which might have been due to losing someone, use the mean of gambling to escape and relieve those painful feelings (Brown and Coventry, 1997). Moreover, a lost of someone means also a lost in income for the household, hence in a way you become poorer and being consistent with the previous prediction about income, you would be more prone to gamble.

From my results, I found that Asian spends considerably less on gambling by more than 1 pound than individuals from a white ethnic background, this is contradictory to the finding of Blaszczynski et. al. (1998), where they found that spending amongst Asian and Jewish ethnic groups are generally higher. The coefficient on variable black is negative but insignificant, hence there are no difference observed in the spending pattern between

black and white individuals. Comparing now individuals according to their employment status, we can conclude that individuals who were in labour on average have spent on gambling more than those who were unemployed, retired or sick by roughly 0.53, 0.25, 0.71 pounds respectively. Interestingly, this is contradictory to the results found by Abbot and Volberg (1996). They have found in their research that employment status was a strong predictor for gambling involvement. However in their sample it was the unemployed who was more prone to gambling activities.

From my original regression, we can conclude that the debt level of gamblers and non-gamblers are the same, as the estimators is highly insignificant. That is not to say that debt does not affect gambling expenditure. The irrelevance of this variable was most likely due to its measurement and large magnitude compared to gambling expenditure. More precisely, the mean of gambling expenditure was 1.56 pounds whereas the mean for debts was 1022 pounds. The large difference between the two magnitudes could have contributed towards its insignificance. One way of solving this problem is presenting the debt level in the logarithmic form. The results from the new regression indicate positive significant effect of debt level on gambling (Appendix: Table 5 and 6). As debt level is in logarithmic form, a 1% increase in debt would increase gambling spending by 0.35 pounds. Finally, individuals age and age-squared are both statistically significant with positive and negative signs, respectively. This imply that gambling spending increase with age but at a decreasing rate.

6. Conclusions

This paper examines the determinants of gambling expenditure using the data from FES 2000-2001 and how does smoking and the level of debt affect one's spending on gambling. The Tobit model was used to assess the marginal impact on explanatory variables. My two main questions in this research was why do people gamble and how does smoking and level of debts affect your expenditure on gambling? The first question was addressed in theoretical section. Model suggested by Friedman and Savage (1948) has given an insight in explaining reasons behind gambling. They have modified the expected utility function to incorporate the risk seeking behavior amongst individuals. Whereas in Prospect theory by Kahnemann and Tversky (1979), we can conclude that the reason why people might be involve in gambling activities is because often individuals overweight their probability of winning. Although the two approaches give good theoretical intuition behind gambling behavior, it is hard to apply those theories using data obtained from the survey. A more applicable model was proposed by Brenner and Brenner (1990), in which they have redefined the utility function to incorporate for the effect of the change in the social class if one wins the lottery. They concluded that individuals who are relatively poor have a greater incentive to gamble than the rich, as they want to move up to a higher social class. From my empirical research, I have found that there was a significant negative correlation between income and gambling spending, which is supported by the above theories. Secondly, after changing the specification to my original model by including the logarithm of debt, I found that both expenditure on tobacco and the level of debt have a significant and positive effects on the amount of gambling spending. Generally, gamblers will have a higher level of spending on tobacco products and debt compared to non-gamblers.

In conducting the research, I have identified a few problems. Firstly, though there are advantages of using Family Expenditure Survey 2000-2001, there are also disadvantages. The data for survey was collected over 2 weeks, which might be not long enough gather

information about one's spending pattern, especially goods and services like gambling that one's often buy on the weekly basis. Hence a longer period of survey would provide more accurate results. Moreover, often with survey data we need to be reserved about the reliability of the data, as frequently individuals might understate or overstate the actual amount.

Further to the issue with the data survey, I encountered a problem of reverse causality in my model. It might be also true that smokers are more prone to gambling, not vice versa. I have attempted to solve this problem using instrumental variables, but unfortunately I was not able to identify in the data variables that would affect gambling but not smoking or debt level. Nevertheless, I conducted my research based on previous findings by Rodda et al. (2004), in which they provided evidence of a high smoking rate among gamblers and found a linear relationship between gambling and tobacco dependence.

Lastly, there are also problems related to using a Tobit model because I assumed that the data was censored. The standard assumption of Tobit model is that the dependent variables is censored at zero, however if no censoring occurred then the Tobit specification of the model would be unsuitable. This has been pointed out by Maddala (1992), he said that if the observed zero values are due not to censoring, but due to the decision of individuals then it would be inappropriate to use the Tobit. An extension to my research would be to compare results obtained from Poisson regression suggested by Sigelman and Zeng (1999). If time allows and data available, I would like to also study the behavior and spending patterns of individuals over time using panel data.

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Appendix:

Table 1

Variable	Description
	Continuous Variables
gamexp	Total expenditure on gambling activities per week. That is the sum of expenditure on lotteries, all national lotteries, bingo, all kind of bettings.
tobexp	Total expenditure on tobacco per week. That is the sum of expenditure on cigarettes, cigars and pipe tobacco.
alco	Total expenditure on alcohols beverage per week. That is the sum of expenditure on beer and lager, cider, wines, spirits, liqueurs, champagne and other alcoholics soft drinks.
inc	Personal weekly gross income less taxes and national insurance.
debt	The total loan taken out by individual.
	Personal characteristics variables
age	Age of an individual at the time of conducting the survey.
agesq	Age of an individual at the time of conducting the survey squared.
gender	A dummy variable which takes value of 1 for male and 0 for female.
mstmarried	A dummy variable which takes value of 1 for individuals who are married, 0 otherwise.
mst1	A dummy variable which takes value of 1 for individuals who are single, 0 otherwise.
mstwi	A dummy variable which takes value of 1 for individuals who are widowed, 0 otherwise.
mstdiv	A dummy variable which takes value of 1 for individuals who are divorved, 0 otherwise.
msto	A dummy variable which takes value of 1 for individuals who marital status is either cohabite or separated.
black	A dummy variable which takes value of 1 for individuals who ethnicity is black, 0 otherwise.
white	A dummy variable which takes value of 1 for individuals who ethnicity is white, 0 otherwise.
asian	A dummy variable which takes value of 1 for individuals who ethnicity is Asian, 0 otherwise.
otherethn	A dummy variable which takes value of 1 for individuals who ethnicity either was not identified or was non-applicable, 0 otherwise.
esemp	A dummy variable which takes value of 1 for individuals who were

	employed or self-employed, 0 otherwise.
esunem	A dummy variable which takes value of 1 for individuals who were unemployed, 0 otherwise.
esrit	A dummy variable which takes value of 1 for individuals who were retired, 0 otherwise.
esot	A dummy variable which takes value of 1 for individuals who were either sick or unoccupied or were not recorded, 0 otherwise.

Table 2: Tobit Regression with gamexp as dependable variable

```
Tobit regression                                  Number of obs   =      15925
                                                  F(  17,  15908) =      14.74
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -25140.197                 Pseudo R2       =     0.0672
```

gamexp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
inc	-.0035402	.0007214	-4.91	0.000	-.0049543	-.0021262
tobex	.1136397	.0194668	5.84	0.000	.0754826	.1517968
alco	.0994272	.0140587	7.07	0.000	.0718707	.1269838
gender	.7322624	.182258	4.02	0.000	.375016	1.089509
mstmarried	.277686	.3338143	0.83	0.406	-.3766279	.9319999
mstwi	1.403874	.4667916	3.01	0.003	.4889101	2.318839
mstdiv	.2104707	.4507684	0.47	0.641	-.6730864	1.094028
msto	1.318085	.365786	3.60	0.000	.6011027	2.035067
debt	.0000241	.0000256	0.94	0.346	-.000026	.0000742
black	-1.60036	.7258319	-2.20	0.027	-3.023073	-.1776477
asian	-4.830987	1.112013	-4.34	0.000	-7.010658	-2.651315
otheretn	-.2444947	.3313651	-0.74	0.461	-.8940077	.4050184
esrit	-1.076269	.389101	-2.77	0.006	-1.838951	-.3135869
esunem	-2.340844	.5155755	-4.54	0.000	-3.35143	-1.330258
esot	-2.964623	.3800489	-7.80	0.000	-3.709562	-2.219685
age	.632123	.0545994	11.58	0.000	.525102	.7391439
agesq	-.0054919	.0005096	-10.78	0.000	-.0064907	-.0044931
_cons	-18.26028	1.711999	-10.67	0.000	-21.61599	-14.90456
/sigma	8.697122	.827388			7.075348	10.3189

```
Obs. summary:       9985  left-censored observations at gamexp<=0
                    5940     uncensored observations
                       0 right-censored observations
```

Table 3: OLS regression with gamexp as dependable variable

Source	SS	df	MS
Model	26430.6074	17	1554.74161
Residual	364623.393	15907	22.9221973
Total	391054	15924	24.5575232

Number of obs =	15925
F(17, 15907) =	67.83
Prob > F =	0.0000
R-squared =	0.0676
Adj R-squared =	0.0666
Root MSE =	4.7877

gamexp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
inc	-.0006859	.0002068	-3.32	0.001	-.0010913	-.0002805
tobex	.0549773	.0054035	10.17	0.000	.0443859	.0655688
alco	.0547308	.0036845	14.85	0.000	.0475088	.0619527
gender	.3624125	.0799908	4.53	0.000	.2056215	.5192035
mstmarried	.3445736	.1417139	2.43	0.015	.0667984	.6223489
mstwi	.0806696	.2307064	0.35	0.727	-.3715409	.5328802
mstdiv	.2346885	.228798	1.03	0.305	-.2137815	.6831586
msto	.3305611	.1696861	1.95	0.051	-.0020429	.663165
debt	.0000196	8.14e-06	2.41	0.016	3.69e-06	.0000356
black	-.165723	.3672432	-0.45	0.652	-.8855613	.5541152
asian	-.8445047	.3878804	-2.18	0.029	-1.604794	-.0842153
otheretn	.0553986	.1207794	0.46	0.646	-.1813428	.2921399
esrit	-.5467523	.1825707	-2.99	0.003	-.9046116	-.1888931
esunem	-.8809624	.2574103	-3.42	0.001	-1.385516	-.376409
esot	-.3198502	.1181332	-2.71	0.007	-.5514047	-.0882958
age	.0543075	.0097182	5.59	0.000	.0352588	.0733562
agesq	-.0002787	.0001146	-2.43	0.015	-.0005032	-.0000541
_cons	-.3827591	.1986737	-1.93	0.054	-.772182	.0066638

Table 4: Marginal effects unconditional; E(y|x)

Marginal effects after tobit
y = E(gamexp*|gamexp>0) (predict, ystar(0,.))
= 1.3287433

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
inc	-.0009013	.00017	-5.16	0.000	-.001244	-.000559	165.208
tobex	.0289314	.00454	6.37	0.000	.020036	.037826	2.52716
alco	.025313	.00338	7.49	0.000	.018691	.031935	5.14318
gender*	.1869095	.04568	4.09	0.000	.097381	.276438	.477865
mstmar~d*	.0709053	.08529	0.83	0.406	-.096268	.238078	.427253
mstwi*	.3907052	.138	2.83	0.005	.120236	.661174	.056452
mstdiv*	.0543374	.11807	0.46	0.645	-.177066	.285741	.040942
msto*	.3627034	.10741	3.38	0.001	.152184	.573223	.088854
debt	6.13e-06	.00001	0.95	0.340	-6.5e-06	.000019	1022.93
black*	-.3631399	.1447	-2.51	0.012	-.646755	-.079525	.010926
asian*	-.8629717	.12987	-6.64	0.000	-1.11751	-.608432	.009796
otheretn*	-.0616338	.08251	-0.75	0.455	-.223342	.100074	.221099
esrit*	-.2600816	.08802	-2.95	0.003	-.432602	-.087561	.166028
esunem*	-.5055238	.09153	-5.52	0.000	-.684925	-.326123	.023799
esot*	-.7166998	.07788	-9.20	0.000	-.869335	-.564064	.371052
age	.1609313	.01071	15.03	0.000	.139939	.181924	37.4368
agesq	-.0013982	.0001	-13.50	0.000	-.001601	-.001195	1930.86

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Table 5: Marginal effects conditional on E[y|x, y>0] with ldebt

Marginal effects after tobit
y = E(gamexp|gamexp>0) (predict, e(0,.))
= 5.2133599

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
inc	-.0009117	.00017	-5.29	0.000	-.001249	-.000574	165.208
tobex	.027418	.0045	6.10	0.000	.018605	.036231	2.52716
alco	.0241503	.00331	7.30	0.000	.017669	.030631	5.14318
gender*	.1562029	.04368	3.58	0.000	.070596	.24181	.477865
mstmar~d*	.0626005	.0812	0.77	0.441	-.096542	.221743	.427253
mstwi*	.3336003	.12123	2.75	0.006	.095995	.571206	.056452
mstdiv*	.0242064	.11088	0.22	0.827	-.193109	.241522	.040942
msto*	.3145124	.09512	3.31	0.001	.128079	.500945	.088854
ldebt	.0353914	.00948	3.73	0.000	.016812	.053971	1.22869
black*	-.389532	.15846	-2.46	0.014	-.700112	-.078952	.010926
asian*	-.9836874	.19663	-5.00	0.000	-1.36908	-.598294	.009796
otheretn*	-.036432	.07957	-0.46	0.647	-.192381	.119517	.221099
esrit*	-.2297992	.08981	-2.56	0.011	-.405817	-.053782	.166028
esunem*	-.5020551	.10717	-4.68	0.000	-.712103	-.292007	.023799
esot*	-.6756959	.08167	-8.27	0.000	-.835757	-.515634	.371052
age	.152684	.01158	13.18	0.000	.129982	.175386	37.4368
agesq	-.0013162	.00011	-12.08	0.000	-.00153	-.001103	1930.86

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Table 6: Tobit with ldebt

```
Tobit regression                                  Number of obs   =      15925
                                                  F(  17,  15908) =      13.14
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -25128.224                 Pseudo R2       =     0.0676
```

gamexp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
inc	-.0037421	.0007256	-5.16	0.000	-.0051643	-.00232
tobex	.112545	.0192641	5.84	0.000	.0747852	.1503048
alco	.0991319	.0140017	7.08	0.000	.0716871	.1265768
gender	.6404934	.1803489	3.55	0.000	.2869891	.9939978
mstmarried	.2566259	.3328193	0.77	0.441	-.3957376	.9089894
mstwi	1.314595	.4642494	2.83	0.005	.4046134	2.224576
mstdiv	.0990495	.4521791	0.22	0.827	-.7872727	.9853716
msto	1.245548	.3653622	3.41	0.001	.5293972	1.9617
ldebt	.145274	.0400702	3.63	0.000	.066732	.2238161
black	-1.691925	.7309628	-2.31	0.021	-3.124695	-.2591557
asian	-4.708432	1.0992	-4.28	0.000	-6.862988	-2.553877
otheretn	-.1499787	.3286582	-0.46	0.648	-.7941859	.4942284
esrit	-.9643332	.3871139	-2.49	0.013	-1.72312	-.2055461
esunem	-2.21398	.5113547	-4.33	0.000	-3.216293	-1.211667
esot	-2.839749	.3696624	-7.68	0.000	-3.564329	-2.115169
age	.6267353	.053788	11.65	0.000	.5213048	.7321659
agesq	-.0054026	.000498	-10.85	0.000	-.0063788	-.0044264
_cons	-18.36982	1.732237	-10.60	0.000	-21.7652	-14.97444
/sigma	8.69024	.8255837			7.072003	10.30848

```
  Obs. summary:       9985  left-censored observations at gamexp<=0
                      5940     uncensored observations
                         0 right-censored observations
```

Table 7: Tobit Unconditional Marginal effects

```
Marginal effects after tobit
      y  = E(gamexp*|gamexp>0) (predict, ystar(0,.))
         =  1.3287433
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
inc	-.0009013	.00017	-5.16	0.000	-.001244	-.000559		165.208
tobex	.0289314	.00454	6.37	0.000	.020036	.037826		2.52716
alco	.025313	.00338	7.49	0.000	.018691	.031935		5.14318
gender*	.1869095	.04568	4.09	0.000	.097381	.276438		.477865
mstmar~d*	.0709053	.08529	0.83	0.406	-.096268	.238078		.427253
mstwi*	.3907052	.138	2.83	0.005	.120236	.661174		.056452
mstdiv*	.0543374	.11807	0.46	0.645	-.177066	.285741		.040942
msto*	.3627034	.10741	3.38	0.001	.152184	.573223		.088854
debt	6.13e-06	.00001	0.95	0.340	-6.5e-06	.000019		1022.93
black*	-.3631399	.1447	-2.51	0.012	-.646755	-.079525		.010926
asian*	-.8629717	.12987	-6.64	0.000	-1.11751	-.608432		.009796
otheretn*	-.0616338	.08251	-0.75	0.455	-.223342	.100074		.221099
esrit*	-.2600816	.08802	-2.95	0.003	-.432602	-.087561		.166028
esunem*	-.5055238	.09153	-5.52	0.000	-.684925	-.326123		.023799
esot*	-.7166998	.07788	-9.20	0.000	-.869335	-.564064		.371052
age	.1609313	.01071	15.03	0.000	.139939	.181924		37.4368
agesq	-.0013982	.0001	-13.50	0.000	-.001601	-.001195		1930.86

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Table 8: Summary statistics of variables

Variable	Obs	Mean	Std. Dev.	Min	Max
gender	15925	.477865	.4995255	0	1
age	15925	37.4368	23.0082	0	96
tobex	15925	2.527162	7.260531	0	91.435
alco	15925	5.143178	11.13067	0	226.225
gamexp	15925	1.57516	4.955555	0	242.84
mstmarried	15925	.4272527	.4946951	0	1
mst1	15925	.3864992	.4869625	0	1
mstwi	15925	.0564521	.2308	0	1
mstdiv	15925	.0409419	.1981619	0	1
msto	15925	.088854	.2845418	0	1
inc	15925	165.208	227.6561	-388.984	8076.98
debt	15925	1022.927	4880.66	0	180000
black	15925	.0109262	.1039592	0	1
asian	15925	.0097959	.0984915	0	1
otheretn	15925	.2210989	.415	0	1
white	15925	.7475039	.4344579	0	1
esrit	15925	.1660283	.3721177	0	1
esunem	15925	.0237991	.1524274	0	1
esemp	15925	.4391209	.4962955	0	1
esot	15925	.3710518	.4831015	0	1

Table 9: Summary statistics of key variables if positive gambling expenditure

Variable	Obs	Mean	Std. Dev.	Min	Max
alco	5940	7.646561	12.8966	0	150.23
tobex	5940	3.956435	8.972377	0	91.435
debt	5940	1361.164	4544.558	0	117000

Table 10: Summary statistics of key variables if zero expenditure on gambling

Variable	Obs	Mean	Std. Dev.	Min	Max
alco	9985	3.653935	9.629007	0	226.225
tobex	9985	1.676898	5.852547	0	78.13
debt	9985	821.7133	5059.552	0	180000

Test for heteroscedatiscity wrt gamexp:

$V\{e_i\}=\sigma^2 h(z'\alpha)$, where h is an unknown differentiable function.

Auxiliary regression of a constant upon $\hat{\varepsilon}_i^G x_i', \hat{\varepsilon}_i^{G(2)} and \hat{\varepsilon}_i^{G(2)} z_i'$ to obtain the uncentered R^2. The LM test is obtained by N times the uncentered R^2.

Source	SS	df	MS
Model	108.028902	17	6.35464127
Residual	15816.9711	15908	.994277791
Total	15925	15925	1

Number of obs =	15925
F(17, 15908) =	6.39
Prob > F =	0.0000
R-squared =	0.0068
Adj R-squared =	0.0057
Root MSE =	.99713

constant	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
tgres	.0068129	.0474297	0.14	0.886	-.0861547	.0997805
tgresinc	-.0000218	.0000528	-0.41	0.680	-.0001252	.0000817
tgrestobex	-.0044705	.0010474	-4.27	0.000	-.0065235	-.0024176
tgresalco	.0004863	.0005044	0.96	0.335	-.0005023	.0014749
tgresmstma~d	-.057637	.0296652	-1.94	0.052	-.1157841	.0005101
tgresmstwi	-.0890351	.0562122	-1.58	0.113	-.1992174	.0211472
tgresmsto	-.0017	.0393469	-0.04	0.966	-.0788244	.0754243
tgresdeb	-2.03e-06	1.78e-06	-1.14	0.254	-5.51e-06	1.46e-06
tgresblack	-.0438226	.1259703	-0.35	0.728	-.2907387	.2030934
tgresasian	.0139933	.1369417	0.10	0.919	-.2544279	.2824145
tgresother~n	.0442279	.0420744	1.05	0.293	-.0382426	.1266984
tgresesrit	-.0264582	.0387917	-0.68	0.495	-.1024943	.0495779
tgresesunem	-.0353725	.0780253	-0.45	0.650	-.188311	.117566
tgresesot	.0197335	.0308835	0.64	0.523	-.0408017	.0802686
tgresage	.0020092	.0009615	2.09	0.037	.0001245	.0038938
tgres2nd	-.0478834	.0048969	-9.78	0.000	-.0574818	-.038285
tgres2ndgam	.0002415	.0000232	10.42	0.000	.0001961	.0002869

Test for non-normality:

Auxiliary regression of a constant upon $\hat{\varepsilon}_i^G x_i', \hat{\varepsilon}_i^{G(2)}, \hat{\varepsilon}_i^{G(3)} and \hat{\varepsilon}_i^{G(4)}$ to obtain the uncentered R^2. The LM test is obtained by N times the uncentered R^2.

Source	SS	df	MS
Model	408.126545	18	22.6736969
Residual	15516.8735	15907	.975474537
Total	15925	15925	1

Number of obs	=	15925
F(18, 15907)	=	23.24
Prob > F	=	0.0000
R-squared	=	0.0256
Adj R-squared	=	0.0245
Root MSE	=	.98766

constant	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
tgres	.0554731	.047066	1.18	0.239	-.0367817	.1477279
tgresinc	.0002345	.0000541	4.33	0.000	.0001284	.0003406
tgrestobex	.0033103	.0011114	2.98	0.003	.0011318	.0054887
tgresalco	-.0003647	.0005021	-0.73	0.468	-.0013488	.0006194
tgresmstma~d	-.0382151	.029369	-1.30	0.193	-.0957816	.0193515
tgresmstwi	-.0693102	.0556637	-1.25	0.213	-.1784174	.0397971
tgresmsto	.0512716	.0390763	1.31	0.190	-.0253224	.1278656
tgresdeb	-.0000134	1.87e-06	-7.17	0.000	-.0000171	-9.75e-06
tgresblack	-.022993	.1247751	-0.18	0.854	-.2675662	.2215803
tgresasian	.0815552	.1356942	0.60	0.548	-.1844207	.3475311
tgresother~n	.0626947	.0416967	1.50	0.133	-.0190354	.1444249
tgresesrit	.1577558	.0397229	3.97	0.000	.0798945	.235617
tgresesunem	-.0257565	.0772875	-0.33	0.739	-.1772488	.1257357
tgresesot	.0883454	.030838	2.86	0.004	.0278994	.1487913
tgresage	-.0019807	.0009752	-2.03	0.042	-.0038922	-.0000692
tgres2nd	-.1769701	.0088376	-20.02	0.000	-.1942927	-.1596475
tgressq	.0208765	.0010651	19.60	0.000	.0187888	.0229641
tgrescu	-.0005305	.0000293	-18.10	0.000	-.000588	-.0004731