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Participation, Expenditure and Regressivity in the Irish Lottery: Evidence from *Irish Household Budget Survey 2004/2005*

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Abstract: This paper estimates, using the most recent *Irish Household Budget Survey* of *2004/2005*, a double hurdle model to determine the socio-economic and socio-demographic factors affecting participation and expenditure of Irish households on the national lottery. Of particular interest is the effect of income on the decisions of how much participants spend on the lottery. The paper also determines the extent to which the tax inherent in lottery purchases is regressive in its incidence on purchasers. It is found that gender, social class, marital status, the presence of children in the home and household size significantly effect lottery participation. Lottery expenditures are affected by income, location of the household, gender, age, education, social class and whether the household has positive betting expenditures. Furthermore, there is evidence that the implicit lottery tax is regressive and that the allocation of lottery proceeds does not compensate for this regressivity.

I INTRODUCTION

This paper estimates a double hurdle model to determine the socio-economic and socio- demographic factors affecting lottery participation and expenditure in Ireland. Further, it estimates the extent to which the implicit lottery tax is regressive with respect to income. The Irish public finance system has come under greater scrutiny in recent years due to the dramatic deterioration in the fiscal balance. Nolan (2009) argues that the current fiscal crisis may facilitate changes to the Irish tax system that make it more efficient and more equitable. A neglected element of government

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financing in the current debate about public finances is receipts from the National Lottery.

It has been argued that the lottery is different from other forms of taxation, due to it being a voluntary decision for an individual to participate in the lottery, and thus lotteries are perceived to be a less harmful means of raising revenue for governments (Livernois, 1986). However, a proportion of the price of every ticket is associated with raising revenues for 'good causes'. For example, 32 per cent of the cost of each lottery ticket sold in Ireland goes directly to the Irish exchequer (National Lottery Annual Report, 2010). The profit on the sale of lottery tickets is equivalent to an implicit tax. Consequently, the lottery is no more a voluntary tax than that of Value Added Tax (VAT) on goods and services and excise duty on tobacco goods and alcohol. As is the case in all of these goods, the only way to avoid the tax is to not purchase/consume the good (Livernois, 1986).

Much of the concern about lotteries is that those who play are from lower socio-economic backgrounds and participation is motivated by the hope of a large win. Further, the expected return from buying a lottery ticket is negative and therefore, lottery playing cannot be a feature of risk-aversion behaviour and does not conform to conventional rational utility models in economics (Purfield and Waldron, 2007). If individuals are not playing for entertainment and if the true odds are misperceived, it could give rise to a social cost (Walker, 1998). Data limitations mean that this paper cannot explore these social costs through the use of a behavioural model, and thus instead concentrates on the regressivity of the implicit lottery tax. To do this the paper identifies the types of individuals that play the lottery and whether it is a regressive method of collecting taxes.

Researchers have modelled lottery expenditures and lottery tax incidence in some detail in the United States (Sawkins and Dickie, 2002). Evidence from the literature suggests that despite a wide demographic of lottery gamblers taking part, the majority of players come from poorer, undereducated and older groups (Clotfelter and Cook, 1987). Another issue in the literature on lottery participation is that lottery expenditures may represent a regressive tax, its incidence falling more heavily on individuals in lower socio-economic groups (Abdel-Ghany and Sharpe, 2001). This paper explores whether this regressivity is present in Ireland and analyses the implications of using the Irish national lottery for tax revenue purposes.

This is the first Irish paper to examine the determinants of lottery participation and expenditure and the incidence of the implicit lottery tax. A double hurdle model of various socio-economic and socio-demographic indicators is used to identify the determinants of Irish households' participation in and expenditure on the lottery using data from the most

recent *Irish Household Budget Survey* of *2004/2005*. The purpose of the double hurdle model is to determine whether the factors affecting participation in the lottery are similar to those affecting the amount of expenditure on the lottery. The extent to which the implicit lottery tax is regressive is estimated using income elasticities and the Suits Index.

The Commission on Taxation (2009, p. 39) states "… a lack of progressivity in one area of the [taxation] system may be compensated for by having a high degree of progressivity in other areas, or by focused direct expenditure". If the lottery represents a regressive tax, its effects may be offset by expenditure of lottery proceeds on areas most beneficial to poorer households. This paper explores the extent to which regressivity in the implicit lottery tax is compensated for in the allocation of lottery receipts by government.

The next section contains a description of the Irish lottery system, in particular addressing the motivation for having a lottery and the extent of public revenue generated by lottery participation. A description of the data and choice of variables for empirical analysis from the *Irish Household Budget Survey* of *2004/2005* is provided in Section III. Section IV outlines the double hurdle model on lottery expenditures and Section V reports the results. In Section VI the regressivity of the implicit lottery tax is presented. The extent to which the regressivity in the implicit lottery tax is compensated for in lottery proceeds allocation is then considered in Section VII. The final section summarises and presents conclusions.

II THE IRISH LOTTERY

The Irish National Lottery has grown substantially in the number of games available to play and consumer expenditure on it since its establishment in 1986 and the first game in March 1987. Initially, the National Lottery comprised of scratch card games but has since expanded to include Lotto, Lotto 5-4-3-2-1, Lotto Plus, Millionaire Raffle, Monday Millions, television bingo, televised game shows and participation in the international Euromillions lottery (National Lottery Annual Report, 2008, p. 6). In 2010, €430.6 million (56 per cent) of the National Lottery's revenue came from Lotto related games, €153.1 million (20 per cent) came from scratch cards, €131.7 million (17 per cent) came from Euromillions games and €56.4 million (7 per cent) from other games. Operating costs were €108.4 million in 2010 (National Lottery Annual Report, 2010, p. 55). All cash prizes in National Lottery games are tax-free lump sums.

In 2010, National Lottery sales were €772 million. Winners were paid €419.9 million and €243.7 million went to fund 'good causes'. The cumulative

amount of funding to good causes since 1987 is €3.6 billion (National Lottery Annual Report, 2010, p. 11). Since its establishment, the Irish government maintains the purpose of the lottery is to raise money for good causes. The National Lottery Act 1986 sets out the purposes of the National Lottery funds. According to Section 5.1 money paid into the Central Fund shall be applied for:

(a) "The purposes of such one or more of the following, and in such amounts, as the Government may determine from time to time, that is to say, sport and other recreation, national culture (including the Irish language), the arts (within the meaning of the Arts Act, 1951) and the health of the community.
(b) Such (if any) other purposes, and in such amounts, as the Government may determine from time to time."

This purpose was reinforced by Minister O'Keeffe in Dáil Éireann in 1986 where he stated "… the Government have decided that the surplus of the lottery is to be applied to the benefit of sport and recreational facilities, national culture, including the Irish language, the arts and health" (Dáil Éireann, 1986). More recently the Chairman of the National Lottery said, when referring to the amount raised by the lottery for good causes, that "… when you consider that this money has been allocated by the Government, over the last 21 years, to worthwhile projects in the areas of Youth, Sports and Amenities; Health and Welfare; Arts, Culture and National Heritage, and the Irish Language, the ongoing positive impact of the National Lottery on local communities throughout Ireland can really be appreciated" (National Lottery, 2008, p. 2).

The promotion of funding for good causes is important for the operators of the lottery as it increases the social acceptability of this type of gambling and means it generates little opposition and increased participation.

III THE *IRISH HOUSEHOLD BUDGET SURVEY 2004/2005*

This paper uses data from the *Household Budget Survey* (*HBS*) of *2004/2005* (Central Statistics Office (CSO), 2006a). The 2004/2005 survey is the most recent available. A random sample of 6,884 households participated, representing a 47 per cent response rate (CSO, 2006a). The primary purpose of the *HBS* is to determine the pattern of expenditure in Irish households to update the weighting basis of the consumer price index. A detailed diary of each household's expenditure over a two-week period is collected. Respondents

also provide data on variables such as income, facilities and socio-economic characteristics.

Descriptive statistics for the variables used in this paper are reported in Table 1. Variable definitions are provided in Table A1 in the Appendix. Lottery expenditure is the dependent variable and the choice of explanatory variables is based on a review of the literature, which identifies income, age, gender, marital status, education, work status and occupation as the primary factors affecting the demand for the lottery. The lottery expenditure and income variable is adjusted using EU adult equivalence scales.[1] Combined urban/rural and regional discrete variables are included to identify any spatial variations in the demand for the lottery. Household size is also included which has been found to be a determinant of the demand for other consumer goods (Newman, Henchion and Matthews, 2001 and 2003; Keelan, Newman and Henchion, 2005). A household betting indicator is also employed in the study. This is a variable that is new to the literature. It is expected that households that spend more money on betting also tend to spend money on the lotto, relative to a household that does not spend money on betting. Head of household is divided into five separate age categories ranging from 15 years to 65 years plus.

Table 1: *Descriptive Statistics*

Continuous Variables:	*Mean*	*St. Dev.*
Lottery Expenditures	3.21	5.94
Lottery Expenditures > 0 (n = 3,082 , % of sample = 44.77)	7.16	7.10
Number of Persons	2.95	1.59
Income (Proxied by total household expenditure)	851.45	602.36
Binary Variables:	*Percentage of Households*	
Location:		
Rural – Dublin, South & East	18.23	
Rural – Border, Midland & West	15.94	
Urban – Dublin Metropolitan Area	22.02	
Urban – Dublin, all other urban areas	5.29	
Urban – South & East > 20,000 population	7.95	
Urban – South & East 3,000-20,000 population	12.22	
Urban – South & East < 3,000 population	5.00	
Urban – BMW > 20,000 population	1.95	

[1] The scale utilised is the OECD equivalence scale. This assigns a value of 1 to the first household member, of 0.7 to each additional adult and of 0.5 to each child. In addition, the income variable is proxied by per capita total household expenditure and is de-seasonalised.

Table 1: *Descriptive Statistics (contd.)*

Binary Variables:	*Percentage of Households*
Urban – BMW 3,000-20,000 population	7.26
Urban – BMW < 3,000 population	4.14
Sex of HO [a]	
Male	59.89
Female	40.11
Age of HOH:	
Age HOH 15-34 Years	16.69
Age HOH 35-44 Years	24.11
Age HOH 45-54 Years	21.78
Age HOH 55-64 Years	16.44
Age HOH 65 Plus Years	20.98
Education of HOH:	
No education or Primary education	22.33
Secondary education[b]	49.58
Third Level education	28.09
Work Status of HOH:[c]	
Employed full	51.77
Employed part	9.78
Unemployed	2.69
Not available for work	35.76
Social group of HOH:	
Employers, Managers and Professional	29.42
Nonmanual	16.23
Manual skilled and semiskilled	19.02
Unskilled and Other Agricultural workers	6.61
Own Account and Farmers	15.43
Other	13.31
Marital Status:	
Single	51.12
Married	48.88
Children (<18) in the Household:	
Children	43.33
No Children	56.67
Betting:	
Household has positive betting expenditures	23.65
Household has zero betting expenditures	76.35

[a] HOH = Head of household.

[b] Includes HOH's still in education. The assumption would be that these HOH's have at least attained secondary education.

[c] 'Employed' categories include full-time and part-time workers who are employed, self-employed and in community employment schemes. 'Unemployed' category includes those seeking work or those out of work due to illness or those not yet at work. 'Not available for work' category includes those who are engaged in home duties, retired, still in education, have a permanent incapacity to work or others.

As with all data sets, there are some shortcomings in the *HBS*. The reliability of the information received from participants is crucial. There is the difficulty of collecting consistent estimates on income data and alcoholic drink and tobacco expenditure (Central Statistics Office, 2006a). There may be similar effects on reported spending on gambling as participants may be reluctant to give information on those aspects. However, despite these shortcomings, the *HBS* is the best available source of information on the income, expenditure and socio-economic characteristics of Irish households.

In this study, the data is cross-sectional and price is therefore, assumed constant as the *HBS* does not record price. Also, since there are several different lottery games which individuals may play and these are all priced differently, it is not possible to control for price in the estimations.

IV DOUBLE HURDLE MODEL OF LOTTERY EXPENDITURES

The presence of zero expenditure in the dependent variable, such as that generated by household expenditure surveys, poses difficulties when analysing micro-data. Excluding these zero observations and running an OLS regression on the positive expenditure creates biased results of the parameter estimates. This would be especially the case when the dependent variable is zero for a substantial proportion of the population.

There are three reasons identified for zero observations (Newman *et al*, 2001): corner solutions, non-consumption or purchase infrequency. Corner solutions specify that a household chooses not to purchase a product at existing prices and income. Non-consumption occurs if a household chooses not to purchase a product due to reasons that are independent of prices and income. Purchase infrequency normally applies to durable goods whose purchasing cycle may be longer than the survey period.

The Tobit Model was the original model developed to analyse the problem of censored dependent variables and has been used in analysing lottery expenditures by Livernois (1986), and Clotfelter and Cook (1987). The model overcomes the problem of censored regressions by attributing the censoring to a standard corner solution. Thus households that do not make lottery purchases do so because they are restrained by relative prices and their income. This may be a restrictive assumption as zeros may come from the individual's deliberate choice to abstain from consuming the good. For example, individuals may not make lottery purchases because they do not believe they have any chance of winning. A further limitation of the Tobit model is that it assumes the same variables affect the probability of a non-zero observation (the participation decision) as well as the level of a positive

observation (the consumption decision) and moreover with the same sign. It may be more reasonable to allow the size and nature of the factors that affect the two decisions to be different. Ignoring this facet of the decision process creates difficulties in understanding the true behavioural patterns of consumer purchasing, potentially resulting in incorrect conclusions (Haines, Guilkey and Popkin, 1988, p. 543).

As a result of these shortcomings, a number of generalisations to the Tobit model have been developed. One generalisation which is popular in the literature is the double hurdle model, originally formulated by Cragg (1971). The model postulates that individuals must pass two separate hurdles before they are observed with a positive level of consumption. The first hurdle corresponds to factors affecting participation in the market for the good and the second to the level of consumption of the good. A different latent variable is used to model each decision process, with a probit determining the participation process and a tobit determining the expenditure level. The double hurdle model can be specified as follows (Blundell and Meghir, 1987, Newman *et al.*, 2003),

$$y^*_{i1} = w_i\alpha + u_i \qquad \text{Participation Decision}$$

$$y^*_{i2} = x_i\beta + v_i \qquad \text{Expenditure Decision}$$

$$y_i = x_i\beta + v_i \qquad \text{if } y^*_{i1} > 0 \text{ and } y^*_{i2} > 0$$

$$y_i = 0 \qquad \text{otherwise}$$

where y^*_{i1} is a latent endogenous variable representing an individual or household's participation decision, y^*_{i2} is a latent endogenous variable representing an individual or household's consumption decision, y_i is the observed dependent variable (lottery expenditures), w_i is a set of individual characteristics explaining the participation decision, x_i is variables explaining the expenditure decision and u_i and v_i are independent, homoscedastic, normally distributed error terms.

The double hurdle model is estimated using maximum likelihood techniques with the log likelihood given as follows:

$$LL = \sum_0 ln\left[1 - \Phi(w_i\alpha)\Phi\left(\frac{x_i\beta}{\sigma_i}\right)\right] + \sum_+ ln\left[\Phi(w_i\alpha)\,\frac{1}{\sigma_i}\,\phi\left(\frac{y_i - x_i\beta}{\sigma_i}\right)\right]$$

where ϕ and Φ are the probability density functions and cumulative distribution function for a standard normal random variable respectively. The

model can be modified[2] to allow for heteroscedasticity by specifying the variance of the errors as a function of a set of continuous variables (Newman *et al.*, 2003 and Aristei and Pieroni, 2008) as follows:

$$\sigma_i = \exp(z_i h)$$

where z_i represents the continuous variables in x_i, the set of variables explaining the expenditure decision. The exponential specification is chosen as it imposes the desirable property that the standard deviation σ_i be strictly positive (Yen and Su, 1995).

To assess the impact of the regressors on the dependent variable, marginal effects can be calculated using the maximum likelihood results obtained from the double hurdle model. Three different marginal effects can be calculated based on three different definitions of the expected value of the dependent variable y_i. Of most interest is the overall effect on the dependent variable, that is, the expected value of y_i for values of the explanatory variables, x. In the Tobit model and its various generalisations, this is more commonly known as the unconditional expectation (or unconditional mean) of y_i and is written as $E[y_i \mid x]$. The unconditional expectation can be decomposed into two parts, the conditional expectation, $E[y_i \mid x, y_i > 0]$ which is the expected value of y_i for values of the explanatory variables, x, conditional of $y_i > 0$ and the probability of a positive value of y_i for values of the explanatory variables, x, $P[y_i > 0 \mid x]$.

The decomposition of the unconditional expectation into the probability of participation and the conditional expectation is based on the work by McDonald and Moffitt (1980) in their decomposition of the unconditional mean of the dependent variable in the Tobit model and can be summarised by the following equation:

$$E[y_i \mid x] = P[y_i > 0 \mid x]^* E[y_i \mid x, y_i > 0]$$

In the double hurdle model the probability of participation and the level of expenditure conditional on participation are (Yen and Su, 1995, Mutlu and Garcia, 2006):

[2] The double hurdle model can also be modified to allow for non-normality of the error terms using either an inverse hyperbolic sine (IHS) or Box-Cox transformation to the dependent variable. Both IHS and Box Cox versions of the heteroscedastic double hurdle were estimated but neither model produced plausible results. The IHS heteroscedastic Double Hurdle model returned a highly insignificant IHS parameter and in addition, the Wald chi-statistic for the model was also highly insignificant. Convergence of the log likelihood for the Box Cox heteroscedastic DH model could not be achieved despite several attempts at introducing exclusion restrictions to identify the parameters of the model.

$$P[y_i > 0 \mid x] = \Phi(w_i\alpha)\Phi\left(\frac{x_i\beta}{\sigma_i}\right)$$

$$E[y_i \mid y_i > 0,\ x] = x_i\beta + \sigma_i\left(\frac{\phi\left(\frac{x_i\beta}{\sigma_i}\right)}{\Phi\left(\frac{x_i\beta}{\sigma_i}\right)}\right)$$

Marginal effects can be calculated by differentiating each of the above equations with respect to each explanatory variable.[3] For the continuous explanatory variables such as income, these marginal effects can be used to calculate elasticities at the sample means.

The majority of applications of the double hurdle model have been in household expenditure modelling. The model is particularly popular for analysing tobacco and alcohol household expenditures, mainly due to Atkinson, Gomulka and Stern (1984) and Jones (1989).[4] The double hurdle model has also been applied to analyse household food expenditures including meat expenditures and expenditure on prepared meals for Irish households (Newman *et al.*, 2001 and 2003), food expenditure away from the home for Spanish households (Mutlu and Garcia, 2006) and US household consumption of cheese (Yen and Jones, 1997). A non-food and non-drink application has been Carroll, McCarthy and Newman (2005) who studied the determinants of charitable donations by Irish households. Abdel-Ghany and Sharpe (2001) and Humphreys, Lee and Soebbing (2010) appear to be the only two articles which use the double hurdle model to analyse lottery expenditures, both using Canadian household survey data. Stranahan and Borg (1998) and Sawkins and Dickie (2002) use two part models incorporating a probit and truncated tobit in the two stages while Farrell and Walker (1999) and Scott and Garen (1994) use Heckman's sample selectivity models in their analysis of lottery expenditures. The application of the double hurdle model to Irish lottery expenditures in this paper thus represents a significant addition to the existing literature in the area.

[3] Details of the derivations of the marginal effects can be obtained from the first author.
[4] Other studies on tobacco and alcohol household expenditures include Yen (2005), Jones (1992), Garcia and Labeaga (1996) and Aristei and Pieroni (2008) on US, UK, Spanish and Italian household tobacco expenditures respectively and Blaylock and Blisard (1993) and Yen and Jensen (1996) on US household alcohol expenditures.

V PARTICIPATION AND EXPENDITURE ON THE IRISH LOTTERY

The maximum likelihood estimates of the heteroscedastic double hurdle[5] model for lottery participation and expenditure are presented in Table 2. The participation hurdle estimates the factors that influence the decision of households to take part in the lottery. The expenditure hurdle estimates the factors influencing the amount a household spends on the lottery.

Table 2: *Heteroscedastic Double Hurdle Maximum Likelihood Estimates – Lottery Expenditures*

	Participation	*Expenditure*	*Hetero-scedastic*
Explanatory Variables (Continuous):			
Number of Persons	0.724***	–0.066***	–0.216***
Income		0.007***	0.000***
Income squared		–0.000***	
Explanatory Variables (Binary):			
Location:			
Rural – Dublin, South and East (ref)			
Rural – Border, Midland and West	–0.266	0.202	
Urban – Dublin Metropolitan Area	0.245	0.542***	
Urban – Dublin, all other urban areas	0.164	0.640**	
Urban – South and East >20,000 population	0.397	0.052	
Urban – South and East 3,000-20,000 population	0.397	0.324	
Urban – South and East <3,000 population	0.482	0.192	
Urban – BMW >20,000 population	–0.457	0.282	
Urban – BMW 3,000-20,000 population	–0.165	0.035	
Urban – BMW <3,000 population	0.502	0.599*	
Sex of HOH:			
Male (ref)			
Female	0.503**	–0.283*	
Age of HOH:			
Age HOH 15-34 Years	–0.529	–0.474**	
Age HOH 35-44 (ref) Years			
Age HOH 45-54 Years	–0.051	0.418**	
Age HOH 55-64 Years	0.157	0.842**	
Age HOH 65 plus Years	–0.184	0.636*	
Education of HOH:			
No education or Primary education (ref)			
Secondary education	0.228	–0.092	
Third Level education	–0.298	–1.078***	

[5] Likelihood ratio tests reject the use of the double hurdle model in favour of the heteroscedastic double hurdle model (See Table A2).

Table 2: *Heteroscedastic Double Hurdle Maximum Likelihood Estimates – Lottery Expenditures (contd.)*

	Participation	*Expenditure*	*Hetero-scedastic*
Work Status of HOH:			
Employed full (ref)			
Employed part	0.575	–0.094	
Unemployed	–0.638	0.361	
Not available for work	–0.397	0.066	
Social group of HOH:			
Employers, Managers and Professional	–0.072	–1.023***	
Nonmanual	–0.162	–0.426**	
Manual skilled and semiskilled (ref)			
Unskilled and Other Agricultural workers	–0.779**	0.074	
Own Account and Farmers	–0.860***	–1.190***	
Other	–0.527*	–1.184***	
Marital Status:			
Single	–0.498*	–0.095	
Married (ref)			
Children (<18) in the Household:			
Children	–1.001**	–0.094	
No Children (ref)			
Betting:			
Household has positive betting expenditures	5.359	1.615***	
Household has zero betting expenditures (ref)			

*** p-value < 0.01, **p-value < 0.05, *p-value <0.10

The results indicate that the age of the head of household (HOH) has a significant effect on lottery expenditures with younger HOH spending less and older HOH spending more with reference to the age category of 35-44 years. This result differs to that of Clotfelter and Cook (1991) who find lottery participation by age takes an inverted-U shape; those aged 18 to 25 and 65 and older play less than the middle-aged. However, Abdel-Ghany and Sharpe (2001) find that lottery expenditure in many provinces of Canada increases with the age of players. Turning to educational effects, we find that HOH's with a third level education spend significantly less money on the lottery than those HOH's who have a primary education or less. This finding is consistent with the literature. Clotfelter and Cook (1987), Abdel-Ghany and Sharpe (2001) and Hansen (1995) also indicate that lottery play declines at higher levels of formal education attainment.

In this paper, social class variables are used to proxy for occupational status. The results indicate that HOH's in higher social classifications (employers, managers, professional and non-manual professions) spend less

on the lottery than HOH's in lower social classification (manual skilled and semi-skilled professions). The finding here is consistent with Clotfelter and Cook (1991) who find advanced professionals play the lottery the least and skilled and unskilled labourers play the most. Own account workers (self-employed) and farmers also spend less on the lottery than HOH's in manual skilled and semi-skilled professions. We also include dummy variables on the work status of the HOH on the basis that the scale of a lottery prize may be worth more to unemployed people that those in employment. However none of these variables were significant in either the participation or expenditure equations. Perez and Humphreys (2011) use an employed indicator and also did not find a significant relationship between employment status and lottery expenditure. Further research, perhaps incorporating a behavioural model, may be worthwhile to shed further light on this effect.

A single HOH is less likely to participate in lottery spending, a result which is consistent with findings from Perez and Humphreys (2011). A household that has children is also less likely to participate in lottery spending than a household without children, a finding which is not surprising as families with children tend to divert expenditures toward necessity items rather than luxuries. Female HOH's are less likely to participate in lotto purchases, relative to male HOH's, but once they participate they spend more relative to male HOH's. Household size has a significantly positive effect on lottery participation but has no effect on lottery expenditures. This suggests that larger households have a higher probability of spending on the lottery but do not spend significantly more or less than smaller households. A household living in an urban area of the Dublin region spends more on the lottery, relative to a household living in a rural area in Dublin, the South or the East of Ireland. The significance of urban regions (and primarily those located in Dublin) is contrary to findings from Abdel-Ghany and Sharpe (2001) where, in two regions in Canada, rural households spent significantly more on the lottery than urban households. The significant urban result in this study may suggest that convenience to shops provides greater opportunities for people to spend on the lottery. The hypothesis that lottery and betting expenditures are complementary to one another is supported by the finding that households that spend money on betting tend to spend more on the lottery than households that do not make betting expenditures.

Finally, the income variable in the expenditure part of the model is significant and positive. The income squared variable is also significant but negative suggesting a non-linear relationship between lottery expenditures and total household expenditures. The size of the income elasticity and the non-linear relationship between income and lottery expenditure sheds light on the regressivity of the implicit lottery tax, which is discussed in more detail in the next section.

VI REGRESSIVITY OF IMPLICIT LOTTERY TAX

The extent to which the implicit lottery tax is regressive can be estimated by examining income elasticity of lottery expenditure. Clotfelter and Cook say "… tax is called regressive if, as a percentage of income, it falls as income increases, and a progressive tax is one that increases as a percentage of income as one moves up the income scale" (1991, p. 223). Table 3 shows the estimated income elasticities for the probability of participation, the conditional expectation and the unconditional expectation. The unconditional, or total, elasticity of income on the dependent variable is 0.4. This finding implies regressivity in the implicit lottery tax.

Table 3: *Estimated Income Elasticities*

Prob	*Cond*	*Uncond*
0.169***	0.231***	0.401***

Note: Elasticities are calculated including the income squared term.
'Prob' refers to effect on the probability of participation.
'Cond' refers to the effect on the level of expenditure conditional on participation.
'Uncond' refers to the unconditional effect on the level of expenditure, i.e. the total effect.
*** p-value < 0.01, **p-value < 0.05, *p-value <0.10

This result is consistent with the general findings in the literature. Abdel-Ghany and Sharpe (2001), in a survey of the literature, indicate that the majority of studies find households in lower income categories spend a greater fraction of their income on lotteries. Clotfelter and Cook (1991) identify a similar pattern in the American literature. Furthermore, Livernois (1986) calculates an income elasticity of 0.72, which, though significantly higher than that estimated in this paper, also indicates implicit lottery tax regressivity. However, Perez and Humphreys (2011) find a strong relationship between lottery expenditures and income, with estimated income elasticities greater than one.

The degree of progressivity of taxes may also be estimated using a Suits Index (Suits, 1977). The Suits Index allows the progressivity of taxes to be compared with other types of taxes across countries. It is calculated in a similar way to a Gini Ratio and Lorenz Curve. The Suits Index is calculated as 1- (R/S) where R is the area below the Lorenz Curve and S is the area below the 45-degree line.

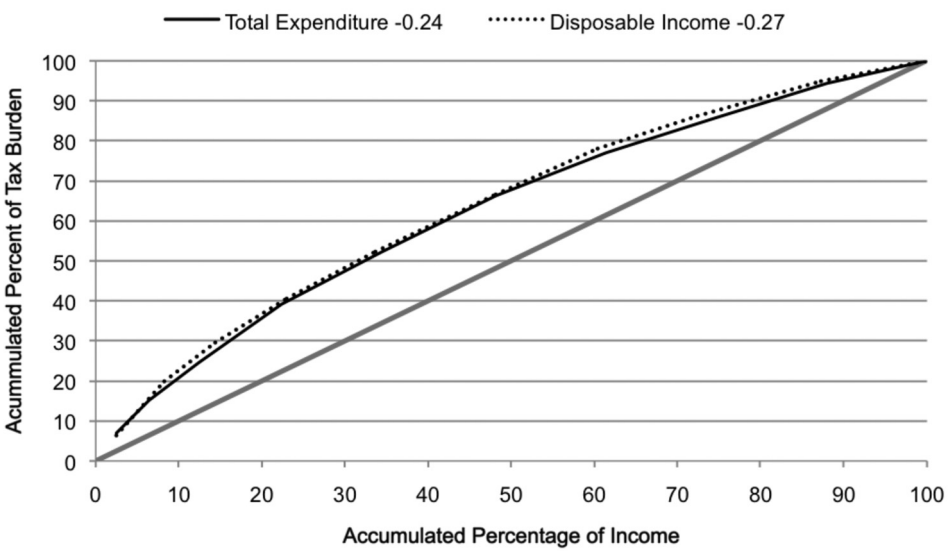
Like the Gini Ratio, the Suits Index varies from –1 to +1, where –1 indicates perfect regressivity and +1 indicates perfect progressivity. In the

Suits Index the cumulative percentage of the tax burden is plotted against the cumulative percentage of income. Where the Lorenz Curve lies on the 45-degree line the tax is neither progressive nor regressive. In this case the lower 50 per cent of the population in terms of income pay exactly 50 per cent of total tax. If the Lorenz Curve lies above the 45-degree line a tax is regressive. The further the Lorenz Curve is above the 45-degree line, the more regressive is the tax. The opposite is the case if the Lorenz Curve lies below the 45-degree line, indicating that the tax is progressive.

The Suits Index has been used to estimate the progressivity of several types of tax. Nolan, Maître, O'Neill and Sweetman (2000) estimate a Suits Index value of 0.282 for income tax and 0.147 for PRSI contributions in Ireland for the tax year 1994/1995. Suits (1977) estimates an index of 0.19, 0.32 and 0.18 for income tax, corporate tax and property tax respectively in the US Suits (1977) also calculates index values for sales and excise taxes and payroll taxes of –0.15 and –0.13 respectively, suggesting these two taxes are regressive.

It was noted in the data description section that the accuracy and reliability of income data in the household budget survey is uncertain. As a result, total expenditure was used in the previous regression analysis. For ease of comparison, a Suits Index is calculated for two different income variables; total expenditure and disposable income, and these are shown in Figure 1.

Figure 1: *Suits Index of Progressivity for Implicit Lottery Tax*



Irrespective of the income indicator used, the implicit lottery tax is found to be regressive.[6] The Suits Index value using disposable income is –0.27 and the index value using total expenditure is –0.24.[7] This is consistent with measures of regressivity in other lottery studies. For example, Suits (1977) estimates an index value of –0.31 for State Lotteries, Clotfelter (1979) estimates an index value of –0.24 for the Maryland lottery, Livernois (1986) calculates an index value of –0.10 for Canadian lotteries and Beckert and Lutter (2009) estimates an index of –0.23 for German lotteries. However, comparisons of the Suits Index between studies needs to be interpreted with caution as the index calculations are influenced by how the data is originally scaled, which differs from study to study in the literature.

VII COMPENSATING FOR REGRESSIVITY IN THE IMPLICIT LOTTERY TAX

These findings have implications for the equity of the National Lottery, particularly since the Irish government uses revenue from lottery participation to fund projects in the areas of Health and Welfare, Sports, Culture and the Arts, which may otherwise have been funded from central exchequer funds.

The regressivity characterising the implicit lottery tax may be compensated for in the allocation of lottery receipts. This compensation would take the form of disbursement of lottery funds to 'good causes' which favour those on lower incomes. Since lottery grants are provided to organisations rather than households it is not possible to fully identify whether lower income households receive greater shares. However, there is significant evidence to question whether the allocation of lottery funds compensates for the regressivity of the implicit lottery tax.

Table 4 presents the allocation of national lottery funding for 2004 and 2005, which corresponds to the *Household Budget Survey* used in this paper. It shows that the majority of funding from the National Lottery was allocated to Arts, Sports and Tourism. Of this, 84 per cent in 2004 and 58 per cent in 2005 was allocated to sports capital grants and the Irish Sports Council. There is strong evidence that the allocation of sports grants from National Lottery funding was determined by political considerations rather than an intention to compensate for regressivity.

[6] For the Suits analysis, the total expenditure and the disposable income measures are adjusted using equivalence scales. The chosen income category levels were guided by the equivalised income deciles used in the 2005 EU survey on *Income and Living Conditions* (*EU-SILC*) in Ireland (Central Statistics Office, 2006b).

[7] For more information on the Suits Index calculation see Tables A3 and A4 in the Appendix.

Table 4: *Allocation of National Lottery Funding 2004 and 2005*

	2004		*2005*	
	€000	*Percentage of Total*	*€000*	*Percentage of Total*
Office of the Minister for Finance	7,618	3	7,730	2
Environment, Heritage and Local Government	20,768	9	23,175	7
Education and Skills	30,915	13	36,190	11
Community, Rural and Gaeltacht Affairs	32,705	14	87,748	27
Arts, Sports and Tourism	130,212	55	157,440	48
Defence	693	0	1,123	0
Health and Children	3,536	1	3,722	1
Health Service Executive	9,481	4	9,557	3
	237,932		328,690	

Source: Department of Finance (2005 and 2006).
Note: In 2005 total expenditure was part-funded by €210.5 million from the National Lottery. A breakdown of lottery-only financing is not available. The 2004 expenditure was fully funded from the National Lottery.

Considine, Crowley, Foley and O'Connor (2008) analyse the allocation of Irish National Lottery Sports Capital Grants between 1999 and 2007 and find a clear bias towards the geographical areas represented by the Minister for Arts, Sports and Tourism and the Minister for Finance. They state "the money follows the ministers" (2008, p. 43). Considine, Coffey and Kiely (2004) find that the county that elects the Minister with responsibility for allocating National Lottery grants receives the highest per capita funding from the National Lottery. Given political influence on lottery funds dispersal there is no reason to expect poorer households accrue a greater proportion of the benefits of that dispersal.

The sizeable proportion of lottery funding that is allocated to sport is also notable in terms of compensating for the regressivity of the implicit lottery tax. Fahey, Layte and Gannon (2004) in a study of sports participation in Ireland find higher socio-economic groups had higher levels of participation. This suggests that, while lower socio-economic groups spend a higher proportion of income on the lottery, at least a large portion of the lottery funding goes to activities in which they are less likely to participate. It is also unlikely that the provision of sporting facilities as part of the capital programme funded by the National Lottery is addressing lower participation among lower socio-economic groups, as Lunn and Layte (2011, p. 59) argue that increasing participation will come "… not from providing more sporting facilities, but from organising and marketing sporting opportunities that use existing facilities and are convenient and easy to take". Lunn (2007) in a study of sports participation using data from 3,000 Irish adults finds that those with

low incomes or low education levels are much less likely to participate in sport. He states "… public spending on sport is very likely to be regressive with the less well-off subsidising the activities of the better off" (2007, p. vii).

It is also a stylised fact from international literature on arts participation that there is a positive relationship between participation, including attendance at art events, and income (Ateca-Amestoy, 2008). There is some evidence of a similar relationship in Ireland. The Arts Council (2006:70) notes that "… people on lower incomes take part to a much lesser extent in cultural activities that are the norm for those on higher income levels". This is further evidence that lottery funding is not focused on areas benefiting lower socio-economic groups which spend more on lottery tickets.

While not related to the issue of compensating for regressivity, it is also notable in the context of this paper's findings that the second highest category for National Lottery funding is Community, Rural and Gaeltacht Affairs. The analysis of determinants of lottery participation and expenditure presented in Section V indicates that households in urban locations (primarily Dublin areas) are more likely to participate in and spend more on the lottery. The sizeable portion of lottery grants allocated to rural and Gaeltacht projects suggest there is a redistribution of income within the lottery from urban areas to rural areas. This implies that there is not a mechanism within the lottery proceeds allocation models to ensure those who spend on the lottery are favoured in the allocation of lottery funding, and this may also apply in relation to socio-economic category.

Finally, it is also notable that, though lottery play declines at higher levels of formal education attainment, the third highest category of funding from lottery proceeds in 2004 and 2005 was education and skills. If this funding is directed at addressing educational disadvantage among lower socio-economic groups there will be compensation for the regressivity in the implicit lottery tax. However, since the allocation of lottery funds, including in the area of education and skills, is at the discretion of the responsible Minister it may be expected that political influences will be as strong as a desire to compensate for regressivity. Since the evidence suggests that political patronage may be the primary motivation for lottery funds allocation it would seem that where lower income households benefit, this may be coincidental rather than designed.

VIII SUMMARY AND CONCLUSION

This paper, using a double-hurdle model of lottery participation and expenditure, finds that income, age, gender, education, social class, household size, urban location and positive betting expenditures are significant

variables. These findings are generally consistent with the international literature that explores the characteristics of lottery players. The paper goes on to test for the regressivity of the implied lottery tax, estimating both income elasticity and a Suits Index. Both measures demonstrate that lottery expenditure is regressive, indicating that poorer households spend larger proportions of their income on the lottery.

The paper explores the extent to which the regressivity in the implicit lottery tax is compensated for through the allocation of lottery proceeds. Evidence is presented that casts doubt on the use of lottery proceeds to favour lower socio-economic households. Greater transparency in the allocation of lottery funds to 'good causes' would enable a more precise analysis of the extent to which lower socio-economic households may or may not benefit from their greater proportionate spending on the lottery. The paper is further evidence of the need to remove political influence on lottery funds dispersal and the adoption of an explicit objective of supporting projects that benefit poorer households to a greater extent. For example, the introduction of a scheme similar to that used in the UK described by Bailey and Connolly (1997) where distribution boards are responsible for each good cause, may reduce political influence on fund distribution elements of the lottery.

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APPENDIX

Table A1: *Variable Definitions*

Dependent Variable	
Lottery Expenditure	Household weekly expenditure on the lottery and adjusted by OECD equivalence scales
Independent Variables	
Explanatory Variables (continuous)	
Income	Proxied by total weekly household expenditure and adjusted by OECD equivalence scales
Income squared	Proxied by total weekly household expenditure and adjusted by OECD equivalence scales
HHsize	Number of persons in the household
Explanatory Variables (binary)	
Location	
Rural – Dublin, South and East	=1 if household is located in a rural location in Dublin, South and East of Ireland, 0 otherwise
Rural – Border, Midland and West	=1 if household is located in a rural location in Border, Midland &West, 0 otherwise
Urban – Dublin Metropolitan Area	=1 if household is located in an urban area in the Dublin Metropolitan Area, 0 otherwise
Urban – Dublin, other urban areas	=1 if household is located in an urban area in Dublin (other than Dublin metropolitan), 0 otherwise
Urban – South and East >20,000 population	=1 if household is located in an urban area with a population >20,000, 0 otherwise
Urban – South and East 3,000-20,000 population	=1 if household is located in an urban area with a population 3,000-20,000, 0 otherwise.
Urban – South and East <3,000 population	=1 if household is located in an urban area with a population <3,000, 0 otherwise
Urban – Border Midlands and Western >20,000 population	=1 if household is located in an urban area with population >20,000, 0 otherwise

Table A1: *Variable Definitions (contd.)*

Independent Variable	
Urban – Border, Midlands and Western 3,000-20,000 pop	=1 if household is located in an urban area with population 3,000-20,000, 0 otherwise
Urban – Border, Midlands and Western <3,000	=1 if household is located in an urban area with population <3,000, 0 otherwise
Sex of HOH	
Female	=1 if HOH is female, 0 otherwise
Age of HOH	
AgeHOH 15-24 Years	=1 if head of household (HOH) is aged between 15-34, 0 otherwise
AgeHOH 35-44 Years	=1 if HOH is aged between 35-44, 0 otherwise
AgeHOH 45-54 Years	=1 if HOH is aged between 45-54, 0 otherwise
AgeHOH 55-64 Years	=1 if HOH is aged between 55-64, 0 otherwise
AgeHOH 65 plus Years	=1 if HOH is aged 65 or more, 0 otherwise
Education of HOH	
No education or primary education	=1 if HOH has no education or has primary education, 0 otherwise
Secondary education	=1 if HOH has a secondary education, 0 otherwise
Third level education	=1 if HOH has a third level education, 0 otherwise
Working status of HOH	
Employed Full	=1 if HOH is in full time employment, 0 otherwise
Employed Part	=1 if HOH is in part time employment, 0 otherwise
Unemployed	=1 if the HOH is unemployed, 0 otherwise
Not available for work	=1 if the HOH is retired or not available for work, 0 otherwise
Social Group of HOH	
Employers, Managers and Professional	=1 if HOH is an employer, manager or professional, 0 otherwise
Non-manual	=1 if the HOH has a non-manual occupation, 0 otherwise
Manual skilled and semiskilled	=1 if the HOH has a manual skilled or semi-skilled occupation, 0 otherwise
Unskilled and Other Agricultural workers	=1 if the HOH has an unskilled or other is an agricultural worker, 0 otherwise
Own Account and farmers	=1 if the HOH is self-employed or is a farmer, 0 otherwise
Other	=1 if the HOH has an occupation other than that already stated, 0 otherwise

Table A1: *Variable Definitions (contd.)*

Independent Variable	
Marital status	
Single	=1 if single, 0 if married
Children	
Children	=1 if children are present, 0 otherwise
Betting	
Household Bets	=1 if household has positive betting expenditures, 0 otherwise

Source: Irish Household Budget Survey 2004/2005.

Table A2: *Likelihood Ratio Test, Double Hurdle Versus Heteroscedastic Double Hurdle Model*

Restricted (H_0):	
Double Hurdle Log-likelihood	–11,542.32
Unrestricted (H_1):	
Hetero Double Hurdle Log-likelihood	–11,243.16
Test statistic:	
(2*(Unrestricted-Restricted))	598.33
Critical value 1% (chi-squared with df = number of variables in heteroscedasticity equation)	6.63
P-value	0.000
Result	Reject H_0

Table A3: *Cumulative Percentages of Implicit Lottery Tax Paid and Cumulative Percentage Income by Income Category (Total Household Expenditure as a Proxy for Income)*

Weekly Income	*Cumulative % Lottery Taxes*	*Cumulative % Income*
€0–€163.99	6.96	2.48
€164–€204.99	15.19	6.45
€205–€252.99	24.65	12.47
€253–€313.99	39.05	22.48
€314–€375.99	52.27	34.43
€376–€458.99	66.08	48.18
€459–€540.99	76.92	61.48
€541–€652.99	85.63	74.60
€653–€870.99	94.21	88.12
€871>	100.00	100.00

Source: Irish Household Budget Survey 2004/2005.

Table A4: *Cumulative Percentages of Implicit Lottery Tax Paid and Cumulative Percentage Income by Income Category (Disposable Income as a Proxy for Income)*

Weekly Income	*Cumulative % Lottery Taxes*	*Cumulative % Income*
€0–€163.99	6.37	2.48
€164–€204.99	20.02	8.22
€205–€252.99	29.70	14.33
€253–€313.99	40.64	23.04
€314–€375.99	52.20	33.67
€376–€458.99	66.52	48.10
€459–€540.99	78.10	60.40
€541–€652.99	86.25	72.46
€653–€870.99	94.94	87.35
€871>	100.00	100.00

Source: Irish Household Budget Survey 2004/2005.