

An Econometric Analysis of Charitable Donations in the Republic of Ireland

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Abstract: This paper explores the variables that affect the probability of donating to charity and those that affect the size of donations by Irish households. The dataset employed is the Irish Household Budget Survey (HBS) 1999/2000, which is analysed using a tobit model and double-hurdle model with an inverse hyperbolic sine transformation of the dependent variable. To date, there has been no prior econometric analysis of charitable donations in the Republic of Ireland.

I INTRODUCTION

Evidence on charitable giving in Ireland and abroad has found that the level of donations has failed to keep pace with rising incomes over the last decade (Ruddle and Mulvihill, 1999). In the Irish case, while the level of charitable donations has increased slightly in absolute terms (18 per cent between 1994/1995 and 1999/2000), the average household donation as a percentage of disposable income has decreased from 0.79 per cent in 1994/1995 to 0.54 per cent in 1999/2000 (Central Statistics Office, 1996; 2001). As households became wealthier over the 1990s, they donated relatively less of their income to charity. Similar results have been found for the United Kingdom with British charitable organisations now facing a long-term decline in the number of donors, in particular by younger generations (Pharoah and Tanner, 1997). The relative decline in charitable giving coupled with the failure of donations to keep pace with income growth is a potential long-run

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problem for charitable organisations. Given the scope of the sector in Ireland, the needs of Irish charities may in fact have increased with economic growth. With evidence of an increase in relative poverty and a widening of the income distribution over the 1990s, it is possible that the budget needs of home-based charities is greater now than before the economic boom (Whelan *et al.*, 2003). Furthermore, as our relative international economic position has improved dramatically, the wealthier Irish population can better address the needs of poorer nations. Through gaining some insight into the factors that determine charitable giving a better understanding of the factors contributing to the relative decline in donor generosity can be gained. This will prove useful to charitable organisations in designing strategies aimed at increasing the number of donors and level of donations in the future.

The theoretical literature on why individuals choose to give is plentiful. For a normal economic good, an integral determinant of demand is price. Intuitively, donating to charity appears to have no price. In fact, donating to charity lacks many of the usual components of a normal economic transaction making it more difficult to model within a standard economic framework. Becker (1976) offers some insight into why individuals give. His model of 'pure altruism' is based on the idea that the consumption of others is a determinant of personal utility. This model has been extended to include the additional utility gained through the very act of giving, described as the 'warm-glow' associated with giving (Arrow, 1974; Steinberg, 1987). It has been suggested that the warm-glow effects may even be stronger than the pure altruistic and therefore makes private gifts imperfect substitutes for gifts from public sources (Andreoni, 1989). An alternative view is that individuals are motivated more by guilt than pure altruism (Lazear, Malmendier and Weber, 2005). The personal motivations underlying individual's decisions to donate to charity are not explored in this paper. Since household level data is used, factors such as income, socio-economic characteristics and observed household behaviour in relation to other consumption items are considered in attempting to explain the motivations of household units to donate to charity.

Over the last thirty years, there have been a number of international econometric studies that have modelled the determinants of charitable donations.¹ Common findings are that age, education and income have positive effects on charitable giving. The effects of marital status, employment status, gender, the presence of children and the importance of religion vary from study to study. In addition to these common variables, this paper also

¹ The foremost recent studies being from Kitchen (1992) in Canada; Schervish and Havens (1997) in the USA; Pharoah and Tanner (1997) in the UK; Chua and Ming Wong (1999) in Singapore; Bekkers (2002) in the Netherlands, and Brooks (2002) in Russia. The majority of earlier studies focused on the responsiveness of charitable donations to tax deductibility.

explores the effects of social status, town size, smoking, household wealth, economic category and expenditure on reading material and the arts.

II DATA

This paper uses household expenditure data from 1999/2000.² There are three different types of charitable donations in the 1999/2000 Household Budget Survey (HBS): donations to churches, donations to schools and all other charitable donations. In this paper only the 'other' category is explored.³ The range of charitable organisations that could potentially fall under this category is extensive. Donoghue, Anheier and Salamon (1999) use the Structural/Operational definition of the Johns Hopkins Comparative Non-profit Sector Project (Salamon and Anheier, 1997) to define the activities of non-profit organisations in the Republic of Ireland. As outlined in their analysis, the 'voluntary and community' sector comprises of organisations involved in culture and arts; sports and recreation; education; research; nursing homes; mental and other health; social services; emergency and relief; income support and maintenance; community development; housing; employment and training; civic and advocacy; legal; foundations; international activities and religion.⁴ It is expected that organisations within this sector (excluding religious organisations) are the types of organisations to which donations are made in the HBS.

As previously mentioned, we explore the variables found to be significant in prior research such as age, education, income, marital status, the presence of children, the gender of the head of household and the importance of religion.⁵ In line with previous research, we expect to find that a household's

² The HBS is a random sample of all private households in the Republic of Ireland which has been carried out six times since 1951. The 1999/2000 survey comprises of 7,644 households. The main purpose of the HBS is to determine the expenditure patterns of Irish households for the purpose of updating the Irish Consumer Price Index. In addition to expenditure items, detailed information on income and demographics can be obtained.

³ In the Irish context it may seem illogical to exclude the church donations variable as a considerable amount of charitable activity in The Republic of Ireland flows through organisations with religious affiliations. However, the religious donations variable in the HBS only accounts for donations towards general church upkeep (contributions for church dues, payments for candles, payments to priests for baptisms and weddings etc.). Donations to charities with religious affiliations will fall under the 'other' category.

⁴ The definition of the 'voluntary and community' sector is narrower than the more general 'non-profit sector'. The 'voluntary and community' sector excludes hospitals, hospices, primary, secondary and tertiary educational institutions as these organisations are not deemed typical to the sector (Donoghue, Anheier and Salamon, 1999).

⁵ In this paper we use disposable weekly income which is comprised of wages and salaries; pensions; allowances; investment income; property income; annuities; trusts; covenants; benefits; grants; state transfer payments and income in kind, minus any direct taxation. This figure is then adjusted for household size using the European Union adjustment for equivalent adults.

income level, education level and age, will positively influence how much it gives to charity. In addition and also in line with previous research, we expect that married households, households with dependent children, households headed by a female and households who consider religion to be important will give more to charity.⁶

This paper also explores the effects of social status; town size; smoking; household wealth; economic category of head of household; artistic expenditure and whether the household purchases newspapers, books and magazines, on charitable giving.⁷ The measure of artistic expenditure is acquired from the HBS and comprises of weekly expenditure on theatre, dancing and cinema. The logic for using artistic expenditure comes from the idea that those who attend local productions, for example, are likely to be more involved and knowledgeable about their community and thus in tune with its needs. It is hypothesised that this will lead to a higher level of charitable donations.

Expenditure on books, newspapers and magazines is used as a measure of whether household members read on a regular basis. It is expected that those who do may have a greater awareness of social conditions and problems. It is therefore expected that households who spend on reading material will contribute more to charitable organisations. In addition, such households may be more exposed to advertisements and appeals from charitable organisations.

The relationship between the importance of religion and the level of charitable donations is well documented (Schervish and Havens, 1997; Bekkers, 2002; Independent Sector, 2002). The higher an individual's regard for religion, the more morally aware and caring he or she is expected to be. Such individuals are expected to give more to charitable organisations. Unfortunately, the HBS does not record religious affiliations. The variable used to approximate the importance of religion to a household is whether or not it made a church donation. However, the assumption must be made that households who donate to religious organisations are in fact religious themselves or that religion is important to them. A complete description of the variables explored is presented in Appendix A, Table I.

⁶ Pharoah and Tanner (1997) find that more females in a household increases the probability of donating while Brooks (2002) finds that females donate more. Feldstein and Taylor (1976) and Lankford and Wyckoff (1991) find that married couples are more charitable.

⁷ Household wealth comprises of the household's tenure (owned outright, owned by mortgage, owned through a tenant purchase scheme or rented), the presence of investments/savings and the relative size of the house (number of rooms divided by the number of equivalent adults). Investment and saving are divided into stocks, government loans, building society accounts, commercial bank accounts, trustee accounts and post office accounts. Economic categories are divided into manual workers in the industry and service sector, non-manual workers, the self-employed, farmers, agricultural workers, fishermen/foresters and the non-economically active.

III ECONOMETRIC METHODOLOGY

The econometric model is complicated by the presence of zero observations in the dependent variable. Seventy-seven per cent of households reported that they made no charitable donation during the two-week survey period. When the dependent variable is limited in such a way, standard OLS econometric techniques are biased, even asymptotically. Simply omitting these zero observations also creates bias and would discard a great deal of valuable information.

The majority of research in the area has employed the univariate tobit model.⁸ There are a number of potential shortcomings in the model's underlying assumptions. The tobit model assumes that the same stochastic process determines both the value of continuous observations on the dependent variable and the discrete switch at zero (Blundell and Meghir, 1987). This is a very restrictive assumption. It is quite reasonable to assume that the factors that affect whether or not a household gives to charity are significantly different from the factors that affect how much it gives. Furthermore, the tobit model assumes that all zero observations are in fact standard corner solutions and that households who do not donate do so because they are restrained by relative prices and their income. This is again a very restrictive assumption as it is possible that some households do not give to charity because they do not believe it is their responsibility to take care of the disadvantaged in society. It is also possible that many households do not give to charity because they believe that their donation is unlikely to make any real difference. It is for these reasons that we also consider a bivariate double-hurdle model as suggested by Cragg (1971).

The double-hurdle model generalises the standard tobit model by introducing an additional hurdle which must be passed for positive observations to be observed. Generalisations of the tobit model fall primarily under two categories depending upon the assumptions made about the source of zero observations. If it is expected that zero observations are due to misreporting or that the survey is too short to capture the expenditure, then an 'infrequency of purchase' model or 'p-tobit' model should be employed.⁹

⁸ The tobit model was created by James Tobin (Tobin, 1958) in his analysis of household expenditure on durable goods and has since been applied to a large number of econometric models concerning censored data. With regard to charitable donations, the tobit model has been used by Reece (1979); Schiff (1985); Kitchen and Dalton (1990); Lankford and Wyckoff (1991); Kitchen (1992) and Auten and Joulfaian (1996).

⁹ The infrequency of purchase model has not previously been used for modelling charitable donations. We expect that a double-hurdle approach will better capture the process of donating to charity.

However, if it is expected that zero observations are due partly to non-participation for non-economic reasons, then the ‘market participation’ model should be used. Market participation models assume that zero observations are either corner solutions or consumers who never use the product (in our case, households that never give to charity), while the infrequency of purchase model assumes that zero observations represent either corner solutions or consumption out of storage (Blisard and Blaylock, 1993). In contemporary papers, this market participation model has been commonly called the ‘double-hurdle’ or ‘Cragg’ model.¹⁰ In the double-hurdle model, coefficients in each hurdle are allowed to differ, and a change in a variable that is in both hurdles can affect the probability of participation differently to the way it affects expenditure.

In the standard tobit model, a latent variable is assumed to represent a household’s utility associated with consumption. In the double-hurdle model a second latent variable, or hurdle, associated with the decision to consume is added. Positive levels of expenditure are only observed if both hurdles are positive. Formally, the model can be described as follows:

$$\begin{aligned}
 y_{i1}^* &= w_i' \alpha + v_i && \text{(Participation equation)} \\
 y_{i2}^* &= x_i' \beta + u_i && \text{(Expenditure equation)} \\
 y_i &= x_i' \beta + u_i && \text{if } y_{i1}^* > 0 \text{ and } y_{i2}^* > 0 \\
 y_i &= 0 && \text{otherwise}
 \end{aligned} \tag{1}$$

$$v_i \sim N(0,1) \text{ and } u_i \sim N(0, \sigma^2)$$

where y_{i1}^* is the latent variable describing the household’s decision to give to charity, y_{i2}^* is the latent variable describing the level of donations, y_i is the actual level of charitable donations, w_i is a vector of variables explaining whether a household gives to charity, x_i is a vector of variables explaining how much the household gives v_i and u_i are the error terms. As in the original

¹⁰ Recent applications of the double-hurdle model include Jones (1992) for tobacco; Gould (1992) for cheese consumption; Blisard and Blaycock (1993) for butter; Gao; Wailes and Cramer (1995) for rice; Jenson and Yen (1996) for food expenditures; Yen and Jones (1997) for cheese; Kimhi (1999) for tobacco; Newman, Henchion and Matthews (2003) for prepared meals and Martínez-Espínheira (2004) for wildlife evaluation. For charitable donations, the double-hurdle model has been applied by Jones and Posnett (1991).

Cragg model, we assume independence between the two error terms.¹¹ The likelihood function for the double-hurdle model is written as follows (Cragg, 1971):

$$L(\alpha, \beta, \sigma^2) = \prod_0 \left[1 - \Phi(w_i' \alpha) \Phi\left(\frac{x_i' \beta}{\sigma}\right) \right] \prod_1 \left[\Phi(w_i' \alpha) \sigma^{-1} \phi\left(\frac{y_i - x_i' \beta}{\sigma}\right) \right] \quad (2)$$

where Φ and ϕ are the standard normal cumulative distribution function and density function respectively. When either the assumption of normality or homoskedasticity is violated, maximum likelihood estimation produces inconsistent parameter estimates. To accommodate non-normality we use an inverse hyperbolic sine (IHS) transformation of the dependent variable which is continuously defined over positive, zero and negative values (Reynolds and Shonkwiler, 1991).¹² The form of the transformation is:

$$I(y_i) = \gamma^{-1} \log (\gamma y_i + (\gamma^2 y_i^2 + 1)^{1/2}) \quad (3)$$

where γ is an unknown parameter that controls for kurtosis and is estimated from the data. Multiplicative heteroskedasticity is integrated into the model by assuming that the variance of the error term is a function of a set of exogenous variables, z_i , a subset of x_i .

$$\sigma_i = \exp \{z_i' h\} \quad (4)$$

where h is a conformable parameter vector (Yen and Jones, 1997). Using multiplicative heteroskedasticity guarantees that the variance will be positive (Melenberg and Van Soest, 1996).

To fully understand the magnitude of the effect of the explanatory variables, marginal effects for each significant variable are computed. The computation of marginal effects in the double-hurdle model are based on the McDonald and Moffitt (1980) decomposition. The unconditional mean or expected value for the model can be written as (Jensen and Yen, 1996):

¹¹ Assuming independence is a common feature of the majority of empirical work although, if incorrect, will lead to inconsistent parameter results (Blundell and Meghir, 1987). Jones (1992), Yen and Jones (1997), Kimhi (1999) and Martínez-Espíniera (2004) all modelled dependent double-hurdle models but failed to improve on the independent model. An exception to the trend is from Gould (1992), who found that assuming dependence significantly improved the model. Dependence of the error term is not considered in this analysis.

¹² An alternative transformation to accommodate non-normality is the Box-Cox transformation. This transformation has been used by Lankford and Wyckoff (1991) in their research on charitable giving and more recently by Martínez-Espíniera (2004). Drawbacks include an inherent non-normality unless the Box-Cox parameter equals zero.

$$E[y_i | x_i] = P(y_i > 0)E[y_i | y_i > 0] \quad (5)$$

or

$$E[y_i | x_i] = \left[\Phi(w_i' \alpha) \Phi\left(\frac{x_i' \beta}{\sigma_i}\right) \right] \times \left[\Phi\left(\frac{x_i' \beta}{\sigma_i}\right)^{-1} \int_0^\infty \left(\frac{y_i}{\sigma_i \sqrt{1 + \gamma^2 y_i^2}} \times \phi\left(\frac{I(\gamma y_i) - x_i' \beta}{\sigma_i}\right) \right) dy_i \right] \quad (6)$$

Differentiating (6) with respect to each explanatory variable in turn produces corresponding unconditional marginal effects for each independent variable. Alternatively, these effects can be decomposed to determine the change in probability of participation:

$$P(y_i > 0) = \Phi(w_i' \alpha) \Phi\left(\frac{x_i' \beta}{\sigma_i}\right) \quad (7)$$

and to determine changes in the level of expenditure:

$$E[y_i | y_i > 0] = \Phi\left(\frac{x_i' \beta}{\sigma_i}\right)^{-1} \int_0^\infty \left(\frac{y_i}{\sigma_i \sqrt{1 + \gamma^2 y_i^2}} \times \phi\left(\frac{T(\gamma y_i) - x_i' \beta}{\sigma_i}\right) \right) dy_i \quad (8)$$

Differentiating (7) and (8) with respect to each explanatory variable yields the marginal effect on the probability of participation and the marginal effect on the level of expenditure conditional on participation respectively. These marginal effects are used to calculate elasticities at the sample means for continuous variables. For categorical dummies, discrete effects are calculated as the percentage change in the probability of participation and level of expenditure when the variable moves from zero to one.

IV MODEL RESULTS

As with the majority of previous research on charitable giving, using the logarithm of the dependent variable and of all continuous independent variables increases the log-likelihood value of all models considerably. Appendix A, Table II presents results from a standard tobit model, a heteroskedastic tobit model and an IHS tobit model.¹³ It is apparent that the heteroskedastic tobit model performs no better than the standard tobit model while the tobit model incorporating the IHS transformation performs significantly better than the untransformed model (see Appendix B, Tables I and II). The results of the double-hurdle model are presented in Appendix A,

¹³ All independent variable are initially included and subsequently dropped if individually insignificant.

Table III.¹⁴ For both IHS models, the IHS parameter is significant indicating its importance in adjusting the dependent variable to account for non-normality. To investigate whether the bivariate approach is superior to the univariate, likelihood ratio tests are used against a comparable tobit model (Appendix B, Table III).¹⁵ Donating to charity is captured considerably better by the double-hurdle model. Elasticities for continuous variables and discrete effects for categorical variables from the double-hurdle model are presented in Appendix A, Table IV.

The time of year in which the household is interviewed has a significant effect on the probability and size of donation in Ireland. Compared to December, all month coefficients are negative with January and February being particularly poor months for donating. This result may be due to increased charitable campaigning coming up to Christmas. Compared to households interviewed in December, households interviewed in January and February give on average 13 and 12 per cent less to charity respectively. In addition, such households are around 8 per cent less likely to donate, *ceteris paribus*.

The effects of income are as expected. Income is significant in both the participation and expenditure components of the double-hurdle model. Higher income levels are associated with a higher probability of participation and a higher level of donation. Increasing income by 1 per cent leads to a 7 per cent increase in the probability of participation and a 4 per cent increase in size of donation.

A number of household characteristics are found to be significant. Age of head of household is significant in both the participation and expenditure components. A 1 per cent increase in age is associated with a 14 per cent increase in the probability of participation and a 13 per cent increase in the size of donation. The number of dependent children has a positive effect on participation but no significant effect on expenditure. Gender of head of household has no effect on the size or probability of donation. In addition, it is apparent that marital status also has no effect on charitable donations.

¹⁴ While Blundell and Meghir (1987) found that identification in the double-hurdle model is possible without explicit exclusion restrictions, in this analysis a different set of variables is included in each hurdle. In the absence of *a priori* theoretically based exclusion restrictions an arbitrary method of selecting variables for each hurdle is used (see Newman *et al.* (2003) for example). Variables for the participation equation are selected on the basis of a preliminary probit model with any variables found to be insignificant excluded from the participation equation of the double-hurdle model. Variables subsequently found to be insignificant in the expenditure equation of the double-hurdle model are also excluded.

¹⁵ An IHS tobit model with the same variables as the expenditure component of the double-hurdle model is used in the likelihood test with degrees of freedom equal to the number of variables in the participation component of the double-hurdle model.

The education level of head of household significantly affects an Irish household's decision to donate and how much to donate. Households with a Masters/PhD are 13 per cent more likely to donate than the base category (households with no education or primary education) followed by households with a Diploma/Certificate (11 per cent more likely), households with a degree (9 per cent more likely), households with a Leaving Certificate (6 per cent more likely) and households with a Junior Certificate (1 per cent more likely). The effects on conditional expenditure are similar to the effect on participation. Increases in education are consistently accompanied by increases in the amounts donated. Households with a Masters/PhD give around 11 per cent more to charity than the base category.

There are few differences in the donating patterns of different economic categories. Of all the economic categories, only self-employed heads of households are 7 per cent less likely to donate to charity. However, these households are not likely to give smaller amounts given that they donate. In addition, it is also evident that households headed by someone in full-time education are around 15 per cent more likely to donate than all other households. Again, this variable is significant for participation only.

The majority of the wealth variables are statistically significant for participation. Households holding investments and loans are around 4 per cent more likely to donate to charity than households without but do not give significantly larger amounts. The household tenure variables are also only significant in the participation component. Households who own their house outright or by mortgage are respectively 5 per cent and 8 per cent more likely to donate than households on a tenant purchase scheme or households that rent their accommodation. It is also evident that living in a relatively large house/apartment (number of rooms adjusted for the number of equivalent adults) positively affects participation.

In relation to town size, households residing in the Dublin metropolitan area are 6 per cent more likely to donate to charity than the rest of the country. Such households are not likely to donate larger amounts. This result is likely due to higher levels of charitable activity in the capital.

The expenditure dummies are also primarily significant for participation. Households that purchase newspapers, books and magazines are 7 per cent more likely to donate while households who spend on the arts are 4 per cent more likely to donate than households who do not. As previously mentioned, households who read newspapers might be more charitable because they are more exposed to charitable advertisements and appeals. With regard to tobacco consumption, a significant negative effect is found. Households with at least one smoker are 2 per cent less likely to donate and give around 3 per cent less. In addition, households who give to their church are 13 per cent more likely to donate to charity. This result may be due to charitable

collections at church gates. No significant effect is found for expenditure.

Finally, the discrete effects of the social status variables are explored. The upper middle class are the most likely and generous donors. Such households are 6 per cent more likely to donate and give 11 per cent more.

V CONCLUSIONS

This paper has used the Irish Household Budget Survey to analyse the factors that affect the probability and size of charitable donations in the Republic of Ireland. A tobit model and a double-hurdle model with an inverse hyperbolic sine transformation (IHS) of the dependent variable are applied. The double-hurdle model captures the process of giving to charity significantly better than the univariate tobit approach applied in the majority of previous studies. This implies that zero observations are partly explained by non-economic factors and not just standard corner solutions as suggested by the tobit model. The results suggest that there are many household characteristics and variables which affect whether or not a household donates to charity. In addition, this paper has demonstrated that the IHS transformation is an important and necessary addition to the econometric modelling of charitable donations.

Between 1994/1995 and 1999/2000, the growth in average household charitable donations (18 per cent) was considerably lower than the growth in real GDP (around 93 per cent). This paper has outlined that the majority of independent variables are only significant for participation and therefore only a limited number of recommendations can be made to assist charitable organisations in increasing the level of donations by existing donors. It is evident that households with higher income, age and education appear to give the most and charitable organisations with the ability to target such groups could increase their level of donations by doing so.

To increase charitable income in the future, charitable organisations may have to focus on creating new donors by targeting factors that significantly effect participation. Focusing on older households with higher income and education could also increase donor numbers. Household wealth also has a positive effect on participation. In this context, households with loans, investments and those who own their house outright or with a mortgage are likely donors. It is also evident that focusing on households who spend on the arts (theatre, dancing and cinema) could increase the numbers of donors. In addition, households headed by someone in full-time education, although few in number (less than 1 per cent of the sample), are around 15 per cent more likely to donate than other economic categories. Such households do not donate significantly more (probably due to their income and age), but would be likely to do so upon entering the workforce.

APPENDIX A

Table I: *Description of Variables Explored*

<i>Name</i>	<i>Description</i>	<i>Type</i>	<i>Mean</i>	<i>Std. Dev.</i>
CHARITY	Household Charitable Donations	C ^a	1.1855	6.4890
DISPOSABLE INCOME	Household Disposable Income	C	235.9623	154.5456
NUMBER OF ROOMS	Number of rooms	C	5.6954	1.4354
DEPENDENT CHILDREN	Number of dependent children	C	1.0888	1.3848
AGE	Age of HoH ^b	C	51.6640	15.9755
MANUAL WORKER	HoH is a manual worker in Industry & Service	D ^c	0.2023	0.4018
NON-MANUAL WORKER	HoH is a non-manual worker	D	0.2817	0.4499
SELF-EMPLOYED	HoH is Self-employed in Industry & Service	D	0.0803	0.2718
FARMER	HoH is a Farmers	D	0.0752	0.2637
AGRICULTURAL WORKER	HoH is an Agricultural Workers	D	0.0071	0.0845
FISHERMAN/FORESTER	HoH is a fisherman or Forester	D	0.0011	0.0342
NON-ECONOMICALLY ACTIVE	HoH is not economically active	D	0.3519	0.4775
NO EDUCATION	HoH has no formal education	D	0.0051	0.0712
PRIMARY EDUCATION	HoH has Primary education	D	0.3118	0.4632
JUNIOR CERTIFICATE	HoH has Intermediate/Junior Cert	D	0.2404	0.4273
LEAVING CERTIFICATE	HoH has Leaving Cert	D	0.2260	0.4183
DIPLOMA	HoH has Diploma	D	0.0830	0.2760
DEGREE	HoH has Primary Degree	D	0.0817	0.2740
MASTERS/PHD	HoH has Masters or/and PhD	D	0.0427	0.2023
UPPER MIDDLE CLASS	HoH Social Status: Upper middle class	D	0.0590	0.2356
MIDDLE CLASS	Middle Class	D	0.1810	0.3850
LOWER MIDDLE CLASS	Lower middle class	D	0.0947	0.2928
SKILLED WORKING CLASS	Skilled working class	D	0.1764	0.3812
OTHER WORKING CLASS	Other working class	D	0.1177	0.3223
LOWEST LEVEL OF SUBSISTENCE	Lowest level of subsistence	D	0.2868	0.4523
FARMERS (LARGE)	Farmers with 50+ acres	D	0.0697	0.2547
FARMERS (SMALL)	Farmers with less than 50 acres	D	0.0143	0.1191

Table I: *Continued*

<i>Name</i>	<i>Description</i>	<i>Type</i>	<i>Mean</i>	<i>Std. Dev.</i>
DUBLIN	Household resides in Dublin Metropolitan area	D	0.2340	0.4234
LARGE TOWN	Household resides in a town with more than 20,000	D	0.1384	0.3453
MEDIUM TOWN	Household resides in a town with 3,000-20,000	D	0.1480	0.3552
SMALL TOWN	Household resides in a town with less than 3,000	D	0.0257	0.1584
RURAL AREA	Household resides in a rural area	D	0.4536	0.4978
OWN HOUSE OUTRIGHT	House is owned outright	D	0.4857	0.4998
OWN HOUSE MORTGAGE	House is owned through a mortgage	D	0.3309	0.4705
TENANT PURCHASE SCHEME	House is owned through 'Tenant purchase scheme'	D	0.0185	0.1350
RENTED	House is rented	D	0.1647	0.3709
READER	Household purchased reading material	D	0.8991	0.3011
ARTISTIC	Household purchased Artistic products	D	0.2995	0.4581
SMOKER	Household purchased tobacco product	D	0.4425	0.4967
INVESTMENTS/SAVINGS	The Household has Investments and/or Savings	D	0.3453	0.4755
LOAN	The Household has a loan	D	0.4532	0.4978
RELIGIOUS DONATION	Household donates to religious organisations	D	0.6134	0.4869
MARRIED	HoH is Married	D	0.7157	0.4510
FEMALE	HoH is Female	D	0.2919	0.4547
FULL-TIME EDUCATED	HoH is in full-time education	D	0.0083	0.0911
JANUARY	Household was interviewed in January	D	0.0542	0.2266
FEBRUARY	Household was interviewed in February	D	0.0655	0.2474
MARCH	Household was interviewed in March	D	0.0790	0.2697
APRIL	Household was interviewed in April	D	0.0733	0.2607
MAY	Household was interviewed in May	D	0.0808	0.2726
JUNE	Household was interviewed in June	D	0.1407	0.3478
JULY	Household was interviewed in July	D	0.1440	0.3511
AUGUST	Household was interviewed in Aug	D	0.0801	0.2716
SEPTEMBER	Household was interviewed in September	D	0.0794	0.2703
OCTOBER	Household was interviewed in October	D	0.0719	0.2584
NOVEMBER	Household was interviewed in November	D	0.0728	0.2599

^a 'C' meaning the variable is a continuous variable.

^b 'HoH' refers to Head of Household.

^c 'D' meaning the variable is a Dummy variable.

Table II: Tobit Results

Variable	Standard Tobit		Hetero Tobit		IHS Tobit	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
CONSTANT	-11.1380***	-12.7270	-11.4945***	-7.9100	-4.6648***	-12.3150
LOG OF DISPOSABLE INCOME	0.5430***	6.2700	0.6163***	4.8570	0.2400***	6.3450
LOG OF AGE	1.1632***	7.2450	1.1732***	4.3240	0.4616***	6.6860
LOG OF DEPENDENT CHILDREN	0.2895***	3.3640	0.2286	1.5790	0.1361***	3.6320
LOG OF NUMBER OF ROOMS	0.3600***	3.2760	0.2800	1.5440	0.1722***	3.6020
SELF-EMPLOYED	-0.4294***	-3.1430	-0.4245**	-2.4530	-0.1878***	-3.1810
JUNIOR CERTIFICATE	0.4091***	3.9490	0.403***	2.9260	0.1578***	3.5300
LEAVING CERTIFICATE	0.4381***	3.9370	0.4429***	2.9990	0.1693***	3.5220
DIPLOMA	0.7165***	5.1140	0.7166***	3.7520	0.2852***	4.6940
DEGREE	0.8444***	5.7010	0.8375***	4.2250	0.3421***	5.3280
MASTERS/PHD	0.9120***	4.8870	0.8836***	3.5580	0.3679***	4.5470
UPPER MIDDLE CLASS	0.2352	1.5620	0.2183	1.0330	0.0976	1.4970
MIDDLE CLASS	0.3551***	3.3420	0.3336**	2.3430	0.1496***	3.2450
LOWER MIDDLE CLASS	0.2684**	2.2480	0.2577	1.5590	0.1100**	2.1240
SKILLED WORKING CLASS	0.2494**	2.4790	0.2425*	1.7920	0.0999**	2.2960
DUBLIN	0.3456***	4.3430	0.3477***	3.0890	0.1533***	4.4320
MEDIUM TOWN	0.2352***	2.5490	0.2359*	1.8050	0.1025***	2.5610
OWN HOUSE OUTRIGHT	0.4450***	3.3850	0.4251**	2.5470	0.1796***	3.1920
OWN HOUSE MORTGAGE	0.5366***	4.1710	0.5139***	3.1280	0.2128***	3.8680
INVESTMENTS/SAVINGS	0.2587***	3.7570	0.2522***	2.6350	0.1128***	3.7700
LOAN	0.1718**	2.3110	0.1602*	1.6060	0.0702**	2.1760
RELIGIOUS DONATION	0.8109***	9.9960	0.7979***	7.2400	0.3522***	10.0350
READER	0.5748***	3.8390	0.5749***	2.9860	0.2447***	3.7440
ARTISTIC	0.2760***	3.6560	0.2652***	2.5760	0.1272***	3.8850
SMOKER	-0.2192***	-3.1070	-0.2213**	-2.3140	-0.0967***	-3.1540
FULL-TIME EDUCATED	1.2351***	2.9390	1.2073**	2.0160	—	—
JANUARY	-1.0659***	-5.2690	-1.0584***	-4.0090	-0.4683***	-5.3320
FEBRUARY	-0.9879***	-5.2640	-0.9933***	-4.0130	-0.4309***	-5.2990

Table II: *Continued*

<i>Variable</i>	<i>Standard Tobit</i>		<i>Hetero Tobit</i>		<i>IHS Tobit</i>	
	<i>Coefficient</i>	<i>t-value</i>	<i>Coefficient</i>	<i>t-value</i>	<i>Coefficient</i>	<i>t-value</i>
MARCH	-0.5091***	-3.1170	-0.4891**	-2.1710	-0.2296***	-3.2390
APRIL	-0.5548***	-3.1580	-0.5399**	-2.3330	-0.2409***	-3.1480
MAY	-0.5890***	-3.4900	-0.5817**	-2.5580	-0.2633***	-3.5920
JUNE	-0.5762***	-3.7070	-0.5645***	-2.7460	-0.2555***	-3.7850
JULY	-0.8444***	-5.3450	-0.8394***	-4.0330	-0.3696***	-5.3780
AUGUST	-0.7963***	-4.6330	-0.7855***	-3.3960	-0.3535***	-4.7360
SEPTEMBER	-0.7383***	-3.9930	-0.7227***	-3.0320	-0.3274***	-4.0750
OCTOBER	-0.8262***	-4.6720	-0.8084***	-3.3650	-0.3653***	-4.7610
NOVEMBER	-0.5027***	-2.9560	-0.4860**	-2.0850	-0.2250***	-3.0470
Sigma	2.4022***	52.6820	0.9177**	1.9770	1.0428***	52.6810
γ					0.0026***	19.0670
LOG DISPOSABLE (HET)			-0.0205	-0.6260		
LOG AGE (HET)			-0.0006	-0.0060		
LOG DEPENDENT (HET)			0.0474	0.7340		
Log ROOMS (HET)			0.0732	0.9700		
N	7,644		7,644		7,644	
Log-likelihood	-2,890.11		-2,889.28		-2,253.25	

Where *** means the variable is significant at the 1 per cent level, ** at the 5 per cent level and * at the 10 per cent level. Variables with no reference are significant at a level higher than 10 per cent. (HET) refers to variables included in z , the exogenous variables causing heteroskedasticity. γ is the parameter created by the IHS transformation.

Table III: *Double-Hurdle Model Results*

<i>Variable</i>	<i>Participation</i>		<i>Expenditure</i>	
	<i>Coefficient</i>	<i>Standard Error</i>	<i>Coefficient</i>	<i>Standard Error</i>
CONSTANT	-5.3791***	0.6446	-1.9978***	0.3214
LOG OF DISPOSABLE INCOME	0.2838***	0.0518	0.1173***	0.0245
LOG OF AGE	0.4037***	0.1366	0.3588***	0.0603
LOG OF DEPENDENT CHILDREN	0.3481***	0.0786	—	—
LOG OF NUMBER OF ROOMS	0.3976***	0.0908	—	—
JUNIOR CERTIFICATE	—	—	0.0420	0.0346
LEAVING CERTIFICATE	0.1533*	0.0875	0.1654***	0.0408
DIPLOMA	0.3789***	0.1241	0.1380***	0.0483
DEGREE	0.2536*	0.1366	0.1764***	0.0567
MASTERS/PHD	0.3021*	0.1625	0.2838***	0.0616
DUBLIN	0.2990***	0.0694	—	—
UPPER MIDDLE CLASS	—	—	0.2904***	0.0807
MIDDLE CLASS	—	—	0.0776	0.0563
LOWER MIDDLE CLASS	—	—	0.0999***	0.0356
OWN HOUSE OUTRIGHT	0.2641***	0.0887	—	—
OWN HOUSE MORTGAGE	0.4126***	0.0885	—	—
SMOKER	—	—	-0.0854***	0.0281
ARTISTIC	0.1969**	0.0798	—	—
READER	0.4082***	0.0966	—	—
RELIGIOUS DONATION	0.7061***	0.0633	—	—
INVESTMENTS/SAVINGS	0.2279***	0.0619	—	—
LOAN	0.2423***	0.0624	—	—
SELF-EMPLOYED	-0.4064***	0.1030	—	—
FULL-TIME EDUCATED	0.8785**	0.3540	—	—
JANUARY	—	—	-0.4215***	0.0808
FEBRUARY	—	—	-0.3917***	0.0748
MARCH	—	—	-0.2137***	0.0646
APRIL	—	—	-0.2065***	0.0709
MAY	—	—	-0.2244***	0.0659
JUNE	—	—	-0.2231***	0.0616
JULY	—	—	-0.3129***	0.0635
AUGUST	—	—	-0.3225***	0.0684
SEPTEMBER	—	—	-0.2519***	0.0766
OCTOBER	—	—	-0.3502***	0.0704
NOVEMBER	—	—	-0.2221***	0.0686
γ	—	—	0.1490***	0.0571
Log-likelihood	-2101.86			

Where *** means the variable is significant at the 1 per cent level, ** at the 5 per cent level and * at the 10 per cent level. Variables with no reference are significant at a level higher than ten per cent. (HET) refers to variables included in z , the exogenous variables causing heteroskedasticity. γ is the parameter created by the IHS transformation

Table IV: *Marginal Effects for Double-Hurdle Model*

<i>Variable</i>	<i>Probability</i>	<i>Condition Expenditure</i>
<i>Elasticity estimates:</i>		
LOG OF DISPOSABLE INCOME	0.0732	0.0412
LOG OF AGE	0.1379	0.1260
LOG OF DEPENDENT CHILDREN	0.0644	—
LOG OF NUMBER OF ROOMS	0.0736	—
<i>Discreet effects:</i>		
JUNIOR CERTIFICATE	0.0084	0.0149
LEAVING CERTIFICATE	0.0641	0.0600
DIPLOMA	0.1058	0.0504
DEGREE	0.0893	0.0652
MASTERS/PHD	0.1268	0.1091
SELF-EMPLOYED	-0.0719	—
UPPER MIDDLE CLASS	0.0578	0.1115
MIDDLE CLASS	0.0155	0.0277
LOWER MIDDLE CLASS	0.0200	0.0361
DUBLIN	0.0556	—
OWN HOUSE OUTRIGHT	0.0488	—
OWN HOUSE MORTGAGE	0.0764	—
INVESTMENTS/SAVINGS	0.0423	—
LOAN	0.0448	—
FULL-TIME EDUCATED	0.1530	—
READER	0.0724	—
ARTISTIC	0.0365	—
RELIGIOUS DONATION	0.1263	—
SMOKER	-0.0170	-0.0299
JANUARY	-0.0802	-0.1304
FEBRUARY	-0.0751	-0.1226
MARCH	-0.0420	-0.0706
APRIL	-0.0406	-0.0683
MAY	-0.0441	-0.0739
JUNE	-0.0439	-0.0742
JULY	-0.0611	-0.1019
AUGUST	-0.0626	-0.1033
SEPTEMBER	-0.0493	-0.0823
OCTOBER	-0.0676	-0.1111
NOVEMBER	-0.0436	-0.0731

APPENDIX B

Table 1: *Likelihood Ratio Test of Homoskedasticity Restriction*

$H_0 = \text{Restricted (Homoskedastic tobit)}$ $H_1 = \text{Unrestricted (Heteroskedastic tobit)}$		
Restricted:	Log-likelihood Homoskedastic tobit	-2890.11
Unrestricted:	Log-likelihood Heteroskedastic tobit	-2889.28
Critical value 1% (chi-squared with df = number of variables in heteroskedasticity equation)		13.28
Test statistic (2*(Unrestricted-Restricted))		1.66
Result		Cannot Reject H_0

Table II: *Likelihood Ratio Test of Normality Restriction*

$H_0 = \text{Restricted (Tobit)}$ $H_1 = \text{Unrestricted (IHS Tobit)}$		
Restricted:	Tobit Log-likelihood	-2889.28
Unrestricted:	IHS Tobit Log-likelihood	-2253.25
Critical value 1% (chi-squared with df = 1)		6.63
Test statistic (2*(Unrestricted-Restricted))		1272.06
Result		Reject H_0

Table III: *Likelihood Ratio Test of Univariate Restriction*

$H_0 = \text{Restricted (IHS Tobit)}$ $H_1 = \text{Unrestricted (IHS Double-Hurdle)}$		
Restricted:	IHS Tobit Log-likelihood	-2323.51
Unrestricted:	IHS Double-Hurdle Log-likelihood	-2101.86
Critical value 1% (chi-squared with df = no of variables in Probit equation)		34.8
Test statistic (2*(Unrestricted-Restricted))		443.3
Result		Reject H_0

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