The Economic and Social Review, Vol. 49, No. 4, Winter 2018, pp. 489-514

POLICY PAPER

A Contingent Valuation Analysis of the Galway City Museum: Welfare Estimates for Attendance in the Absence of an Admission Fee

Vincent G. Munley*
Lehigh University, Bethlehem Pennsylvania

Abstract: This paper provides empirical evidence about the demand for museum attendance in the absence of an admission fee based upon a survey of visitors to the Galway City Museum. The contingent valuation model results provide estimates of the total value (consumer surplus) of annual museum visits. Using these results it is possible to determine the welfare effects of predicted reductions in the number of visits at various levels for an admission fee. The results also provide insight about the impact of fees on the demand for subsequent versus initial museum visits, a focus of continuing interest within the cultural economics literature.

I INTRODUCTION

While the question of how, and by whom, museum services should be financed is of long-standing and continuing interest within the cultural economics literature, there exists surprisingly scant evidence about the actual demand for museum attendance at point of entry. There are several potential reasons why this is the case. First, many museums offer free admission, limiting the availability of

Acknowledgements: Earlier versions of this paper were presented at seminars at the National University of Ireland, Galway Department of Economics and the Economic and Social Research Institute (ESRI) in Dublin and also included in the programme for the 2018 Meetings of the Public Choice Society in Charleston, South Carolina. Extensive, helpful comments by two anonymous referees motivated revisions that improved the paper substantially. The author is solely responsible for the content and the views expressed.

* Corresponding author: vincent.munley@lehigh.edu

data relating to attendance and admission fee level. Second, museums that do impose an admission fee typically do not change the level of the fee with sufficient frequency to provide adequate data for a time-series analysis. Third, in the case of general interest museums there is sufficient variation in the foci of exhibits across museums to limit the ability to conduct a comparable cross-section analysis. Fourth, even in the case of museums of the same genre, the size, scope and location differentials across museums present a challenge to identifying the ceteris paribus control measures necessary to isolate the underlying relationship between attendance and admission fee level.

To help fill this void, this paper presents the results of a contingent valuation demand analysis for the Galway City Museum based upon survey data derived during the month of June over the period 2007 through 2010 and then again in 2017 following a six-year hiatus. The structure of the paper is as follows. The next section provides a thumbnail summary of previous research that provides a foundation for the analysis presented here. Section III explains the institutional context for the Galway City Museum and includes a description of the survey used to obtain the data that serve as the basis for this analysis. Section IV specifies the empirical model used to estimate the demand relationship, with Section V presenting the empirical results of this estimation. Section VI presents the methodology to calculate economic welfare measures for consumer surplus and total revenue generated at a series of hypothetical admission fee levels, and the deadweight loss associated with a reduction in attendance resulting from the imposition of an admission fee, all based on the demand estimates presented in the previous section. Finally, Section VII offers some concluding comments.

II PREVIOUS RESEARCH

Economists have been interested in museums as a topic of inquiry going back at least to Jevons (Johnson and Thomas, 1998). In the modern literature such notable scholars as Martin Feldstein (1991), Bruno Frey (1994) and Alan Peacock (1995) have focused attention on museums within the broader context of cultural economics. While the production and cost of providing museum services has attracted limited attention (see, for example, Bishop and Brand, 2003, and Jackson, 1988) the question of how, and by whom, museum services should be financed has been the most prominent focus of economic inquiry. This focus, in turn, derives from a popular conviction that the intrinsic nature of the services that museums provide requires that they be afforded universal public access.

At a conference convened in 1998 at Durham University, Anderson (1998 p.179) representing The British Museum, London summarised the sentiment of the curatorial and museological profession by opining that:

> *Those museums which do not charge declare their implacable opposition to the concept, not surprisingly. Of those which do, some say that they would rather not, but that financial issues make it a necessary evil; others are quiet on the matter.*

Also focusing on the UK where debate within the public policy arena as to whether or not museums should charge admission fees has a long and active history, Bailey and Falconer (1998, p.169) cite the conclusion of research conducted under the auspices of the Museums and Galleries Commission (MGC) that

> *... whether or not museums charge for admission (and at whatever level), their governing bodies overwhelmingly believe that admission charges should not be levied as a matter of principle. In many cases, however, adherence to that principle has had to give way to financial necessity.*

A not unreasonable interpretation of this perspective is that museums at their core are not providers of a leisure service activity intended to compete with popular entertainment and sporting events for consumers but rather are the repositories of society's heritage whose mission is to provide venues for the public to view, learn about, and ultimately appreciate more fully the curated assets *which belong to them*.

O'Hagan (1995, 1996) provides an excellent analysis of the challenges involved in defining and measuring the extent to which museums are able to achieve equitable public access to their services. Strategies to accomplish this in the presence of admission fees include concessionary pricing for targeted groups such as children, retirees, individuals with disabilities and members of low income groups; a reduced admission fee at certain time of day or day of week; annual memberships; and bundled (multi-facility) passes. Frey and Steiner (2012) propose the intriguing idea of pricing museum visits based on the duration of visit.

The economics literature addressing the appropriateness of charging an admission fee for museum attendance has identified a number of salient dimensions of museum services and adopted practices of particular interest that deserve explicit mention in any discussion of this topic. Among these are: (1) the potential impact on government funding and philanthropic donation levels that instituting an admission fee may have; (2) differences in museum types: national versus local and general interest versus specialised; (3) the practice of actively soliciting voluntary donations in the absence of an admission fee; (4) the practice of charging a separate fee for special exhibits in the absence of a general admission fee; and (5) the distinction between visits and visitors. This final issue relates to subsequent versus initial visits to a particular museum and how the demand for each may differ. This is an important dimension in considering memberships that provide annual passes.

Given the substantial attention that has been devoted to accommodating the goal of achieving breadth and equity in public access to museum services in the presence of an admission fee, there is surprisingly scant empirical evidence available about the nature of the demand for museum attendance. Bailey and Falconer (1998, p.171) note that conventional wisdom suggests that "in general it appears that demand for museum visits is price inelastic and income elastic", consistent with the more robust empirical evidence that is available for the performing arts such as orchestral music and theater (Zieba, 2009; O'Hagan and Zieba, 2010; and Zieba and O'Hagan, 2013). The frequently cited empirical estimates of price elasticity for museum attendance provided by Luksetich and Partridge (1997) are indeed inelastic, though some care is necessary in interpreting these results given the strategy that the authors employ to include within the estimating sample a large number of museums that do not have an admission fee under a constant elasticity empirical demand function specification.[1]

Another notable nuance regarding the financing of museum services is that it is not uncommon both within and across countries and within and across genres of museums for some museums to charge an admission fee while others do not. Given this status quo Bailey and Falconer (1998, p.168) argue: "that decisions of whether to charge (at what levels) can only be determined at the level of the individual museum." To this end Johnson and Thomas (1998, p.82) note: "Where museum entry is free or subsidised, estimates of visitors' valuation of their visits, through, for example, contingent valuation studies, would be valuable."

The sections that follow present a framework that can inform individual museum administrators about the likely impact on visitor attendance and consumer welfare measures that will result at alternative admission fee levels.

III INSTITUTIONAL SETTING

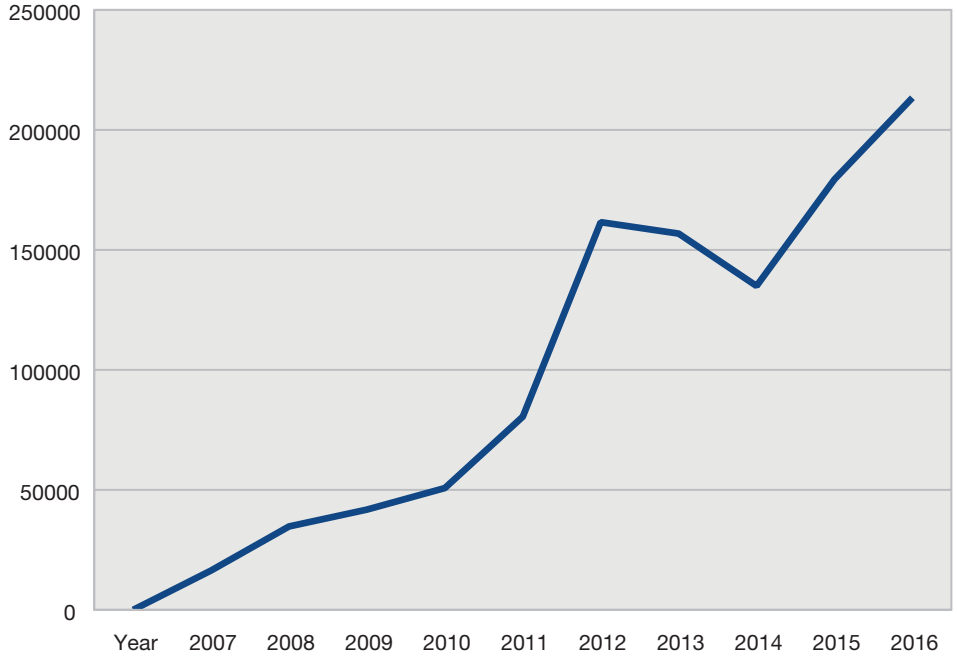
The empirical framework utilised here is a contingent valuation model based on the stated willingness to pay of visitors to the Galway Museum in Galway City, Ireland.

The National Museum of Ireland has four locations. Three (Archeology, Decorative Arts and History, and Natural History) are located in Dublin. The Museum of Country Life is located in county Mayo. Admission to the National Museum is free. In addition to the National Museum, the Republic of Ireland hosts 12 local museums, operated by local government at city and/or county level. About half of these charge an admission fee, the others are free.

[1] "The own-price measure is the natural log of adult general admission price measured in cents.… A significant share of the museums have no charge. Since the log of zero is undefined, the admission was set equal to one cent in cases where there was no admission charge. This means that the lower bound for log admission fee is zero." (William A. Luksetich and Mark D. Partridge, 1997, p. 1554)

The Galway City Museum is one of Ireland's local museums and is best classified as a 'General Museum'. Admission to this museum has always been free. In 2006-2007 the museum moved into a new building with significantly expanded facilities and space. Figure 1 shows the growth in annual attendance since then.

Figure 1: 2007-2016 Visitor Numbers Galway City Museum



Source: Courtesy of the Galway City Museum.

During the summers of 2007 through 2010, and then again – following a six year hiatus – in 2017, the museum conducted surveys of visitors exiting the museum over a week to ten-day period in mid-June. This week is during the transition period between (1) the off-season months of September through May when Galway City with a population of about 75,000 residents is also the home of over 18,000 university students and (2) the tourist high season during the summer months. The survey results in this sense provide a reasonable snapshot of annual visitors. The main focus of this survey was on visitor perceptions of the different exhibits in place at the time of each survey and items such as how the visitor had learned about the museum, if he or she had anticipated an admission fee, the helpfulness of museum staff, mode of transport to the museum, and advice about daily opening should the museum need to scale back from its seven day a week schedule. In addition the survey asked visitors to provide classification data for the purpose of analysing the survey results. Items included among the classification questions were

occupation, gender, age (in ten-year brackets), and group size. Only visitors 18 years and older where asked to complete the survey. A final question asked: "Would you have visited the Galway Museum today if there had been an admission fee of ***X*** Euro?" where ***X*** was randomly assigned values of €2, €4, €6, €8 and €10.

The distinguishing feature of the contingent valuation (CV) methodology is that the values for the price measure utilised are not actual values observed in market transactions but rather the values that participants in CV studies state that they would be willing to pay, or demand as compensation for, the consequences of an economic activity or event. The contingent valuation methodology has received its widest application in the areas of environmental and resource economics. Well known examples are the Exxon Valdez oil spill (Carson *et al.*, 2003) off the coastline of Alaska and the Deepwater Horizon (BP) oil spill (Bishop *et al.*, 2017) in the Gulf of Mexico. The companion papers by Portney (1994), Hanamann (1994) and Diamond and Hausman (1994) provide an excellent overview of the advantages and disadvantages of the contingent valuation methodology.

Confidence about the appropriateness of applying the contingent valuation methodology in this instance arises from two sources.

Firstly, in a study that compared the stated preferences based on a contingent valuation analysis at a time previous to the introduction of an admission fee at the Museum of World Culture in Sweden, and the observed effects of visitors to the museum after an admission fee was introduced, Lampi and Orth (2009, p.98) found that

> *the shares of men, young people, students, pensioners, employed people, and visitors who often consume cultural activities do not differ statistically between the sub sample from the fall 2006 (those who had WTP of at least 40 SEK) and the sample of the spring 2007 after the introduction of the entrance fee* (where the admission fee was set at 40 SEK).

Secondly, critical features of the survey upon which the analysis presented here is based conform to 'best practices' prescribed by the widely-cited NOAA Report (Arrow *et al.*, 1993) commissioned to evaluate the scientific basis for the contingent valuation methodology. Portney (1994, p.9) summarises "seven of the most important" from the "too numerous to reproduce" guidelines presented in the NOAA Report. While several of these seven guidelines relate specifically to the use of this methodology within the context of environmental and resource economics (e.g., "if respondents are being asked how they would vote on a measure to protect a wilderness area, they should be reminded of other areas that already exist") or in instances where the magnitude of the hypothetical payments greatly exceed the museum admission fee amounts proposed in the present study (e.g., providing "reminders to respondents that a willingness to pay for the program or policy in question would reduce the amount that they would have available to

spend on other things"), three of the seven important guidelines are followed closely in the application presented here. The first is that the survey was administered to visitors as they departed the museum. They therefore had a clear understanding of the museum experience. The second is that the survey was administered as a personal interview rather than a telephone or mail survey. Third, and perhaps most importantly, is that each survey participant was asked whether he or she would have paid a specified (randomised) fee to visit the museum, rather than being asked to state the maximum amount that he or she would have been willing to pay.[2]

Two previous examples of application of the contingent valuation methodology in the area of cultural economics that focus on museums are Santagata and Signorello (2000) and Sanz *et al.* (2003). Both studies are based on local population surveys with inquiry assessments that include the respondents' non-use values – existence and option – as well as direct use value of museum services. The former employs a logit model based upon a bounded range of willingness to pay values among the Naples population for the Napoli Musei Aperti. The latter employs a semiparametric methodology within a double-bounded dichotomous choice framework to estimate the local valuation for the National Museum of Sculpture of Valladolid, Spain. Both obtain mean consumer surplus estimates in the €20-€30 range. Given the nature of the population surveys that serve as the bases for these estimates it is important to note that these values are best interpreted as annual valuations for the operation and maintenance of the museums by local residents, and not the demand for individual visits to a museum by some combination of local residents, visiting friends and relatives, and tourists. The local population bases and sizes of these museums are considerably larger than the Galway museum. The results of these studies do not, therefore, address directly the point of entry demand relationship between the willingness to visit to a museum at a particular level of admission fee and this fee level.

IV EMPIRICAL DEMAND MODEL

The basic empirical demand model specification for visitor attendance at the Galway City Museum employed here is

$$WTP_i = \alpha \cdot Fee_{pi} + x_i'\beta + e_i \tag{1}$$

where WTP_i is a binary variable equal to 1 if the visitor i replied 'yes' to the question: "Would you have visited the Galway Museum today if there had been an

[2] See Delaney and O'Toole (2004) for a contingent valuation study in the context of Irish media that examines anchoring effects for open-ended willingness to pay questions versus the referendum format ('yes' versus 'no' to a specific monetary amount) included in the survey instrument that serves as the basis of the results presented here.

admission fee of ***X*** Euro?" and 0 if the visitor replied 'no'. Fee_{pi} is the randomised proposed fee value (€2, €4, €6, €8 or €10) of **X** for visitor i, x is a vector of personal characteristics of visitor i, α and β are parameters to be estimated, and e_i is the error term. Estimates of this equation are presented for both a linear probability model (OLS) and a probit empirical model specification.[3]

As noted in the review of previous research above, the issue of distinguishing between visitors and visits to a museum has been of continuing interest within the cultural economics literature.[4] In particular, does the demand for subsequent visits differ in a systematic way from the demand for initial visits? Including a measure denoting whether or not a survey participant had visited the museum previously as an exogenous variable within the x vector of visitor personal characteristics may not represent a suitable strategy to investigate this question. An obvious potential selection bias is apparent in this basic model specification. Individuals with a greater demand for museum attendance are more likely to have visited the museum previously, all else the same, and individuals with a greater demand for museum services are also more likely to be willing to pay any specified value of an admission fee. Controlling for this potential selection bias requires a more comprehensive specification of the museum visitor demand model.

To examine the potential presence of this selection bias we adopt a treatment model as described in Greene (2012, pp 930-931).[5] Restating Equation (1) to identify explicitly whether the fact that an individual has visited the museum previously endogenously affects the willingness to pay an admission fee yields:

$$WTP_i = \alpha \cdot Fee_p + x_i'\beta + \delta \cdot PV_i + e_i. \quad (2)$$

If we assume that the likelihood that an individual has visited the museum previously (PV_i) can be explained by an identifying variable that that does not also exert a statistically significant effect on willingness to pay, as well as the control variables in (1), then we can specify:

[3] The potential econometric limitations of OLS linear probability estimation in the presence of a binary dependent variable are well known. They are: (1) the error term, given the binary nature of the dependent variable, is heteroscedastic, and (2) the estimated model can yield predicted values for the probability of an occurrence that are outside the [0-1] range. The first of these limitations is addressed here by obtaining robust estimates of the variance-covariance matrix. The second limitation is not of direct concern here as the model is not used to predict the probability of an individual's choice to visit the museum but rather to estimate a demand curve to serve as the basis for calculating economic welfare measures.

[4] See, for example, Bailey, *et al.* (1997, p. 362 and p. 364); Bailey and Falconer (1998, p. 175 and p. 177); and O'Hagan (1995, p. 38).

[5] The type of potential sample selection bias addressed by the treatment model employed here results in the willing to pay [*WTP* in Equation (1)] being observed by individuals who have visited the museum previously as well as those who have not. Greene (2012, Chapter 9) also presents the well-known Heckman sample selection model where the second stage equation data are observed only for individuals who 'self-select' into the sample, such as the hours worked by individuals who choose to participate in the labour market, but is unobserved for those who 'self-select' not to participate in the labour market.

$$PV_i^* = w_i'\gamma + u_i \text{ as well as } PV_i = 1 \text{ if } PV_i^* > 0, PV_i = 0 \text{ otherwise} \quad (3)$$

where x_i is a subset of w_i. If the error terms from the two equations are normal and are correlated, then

$$E[WTP_i \mid PV_i = 1, x_i, w_i] = x_i'\beta + \delta + \rho\sigma_e\lambda(-w_i\gamma) \quad (4)$$

and

$$E[PV_i \mid PV_i = 0, x_i, w_i] = x_i'\beta + \rho\sigma_e \frac{-\phi(w_i\gamma)}{1 - \Phi(w_i\gamma)}. \quad (5)$$

λ in Equation (4) is the inverse Mills ratio, while the normal distribution and cumulative normal are referenced in the ratio at the end of Equation (5).

V ESTIMATION RESULTS

Table 1 presents summary statistics for the variables included in the model. The data source is the set of classification questions from the museum survey. Other than Admission Fee, with randomised values of €2, €4, €6, €8 and €10 and hence a mean value very close to €6, the remaining classification data variables are all binary.

Table 2 presents estimates of Equation (1), the basic demand relationship. Columns 1 to 3 are the linear probability (OLS) estimates and Columns 4 to 6 the probit estimates, respectively. Columns 1 and 4 include all of the survey classification information as right-hand-side variables in Equation (1). Most of the binary variables derive from categorical classifications.[6] The omitted categories for these are 'County Galway' for location of residence, 'Student' for occupation, 'Age 19-25' for age, 'Tuesday' for day of the week of the visit, and '2007' for year that the survey was administered, respectively. The remaining self-contained binary variables indicate whether or not the individual had visited the Galway Museum previously, whether or not the visitor had anticipated that the museum would charge an admission fee, and the individual's gender.

Inspection of the results presented in Columns 1 and 4 of Table 2 reveals that most classification data variables are not statistically different than zero in explaining whether or not an individual would have visited the museum at any of the randomised values for admission fee. While the magnitudes of the respective estimated coefficients differ between the OLS estimates in Column 1 and the probit estimates in Column 4 due to the fundamental structural difference in the two empirical models, note that the pattern of statistical significance across the

[6] Appendix A presents the survey instrument questions that define these categorical measures.

Table 1: Summary Statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Would Attend	833	0.55	0.50	0	1
Admission Fee	833	6.09	2.83	2	10
Previous Visit	833	0.19	0.40	0	1
Expected Adm. Fee	833	0.49	0.50	0	1
Galway Resident	833	0.20	0.40	0	1
Other Ireland	833	0.16	0.37	0	1
International	833	0.64	0.48	0	1
Female	833	0.47	0.50	0	1
Stay at Home	833	0.03	0.15	0	1
Student	833	0.20	0.40	0	1
Employed	833	0.55	0.50	0	1
Retired	833	0.21	0.41	0	1
Age 19-24	833	0.19	0.40	0	1
Age 25-34	833	0.18	0.38	0	1
Age 35-44	833	0.12	0.33	0	1
Age 45-54	833	0.16	0.36	0	1
Age 55-64	833	0.17	0.37	0	1
Age 65 plus	833	0.18	0.38	0	1
Saturday	833	0.18	0.38	0	1
Sunday	833	0.11	0.32	0	1
Monday	833	0.13	0.34	0	1
Tuesday	833	0.18	0.38	0	1
Wednesday	833	0.13	0.33	0	1
Thursday	833	0.13	0.34	0	1
Friday	833	0.15	0.35	0	1
Year 2007	833	0.19	0.39	0	1
Year 2008	833	0.20	0.40	0	1
Year 2009	833	0.25	0.43	0	1
Year 2010	833	0.20	0.40	0	1
Year 2017	833	0.16	0.37	0	1

Source: Author's analysis.

explanatory variables in Columns 1 and 4, respectively, is quite consistent. The admission fee, importantly for the purposes of the economic welfare measure calculations below, is highly significant under either the OLS or probit estimation procedure.

The binary variable indicating whether or not the survey respondent had visited the Galway Museum previously does not exhibit statistical significance in explaining whether or not an individual would be willing to pay to gain admission at the randomised admission fee levels. Because the distinction between initial and subsequent visits has been of continuing interest within the cultural economics

Table 2: P(Would Attend) at Designated Admission Fee

	Linear Probability Model (OLS)			*Probit Model*		
Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Admission Fee	–0.0736***	–0.0731***	–0.0739***	–0.233***	–0.225***	–0.208***
	(–14.68)	(–14.57)	(–14.38)	(–12.22)	(–12.34)	(–12.06)
Previous Visit	–0.0313	–0.0217		–0.108	–0.0879	
	(–0.666)	(–0.462)		(–0.695)	(–0.590)	
Expected Fee	0.182***	0.184***		0.607***	0.599***	
	(5.885)	(5.981)		(5.881)	(5.932)	
Other Ireland	0.182***	0.164***		0.592***	0.518***	
	(3.263)	(2.957)		(3.340)	(3.024)	
International	0.104**	0.104**		0.344**	0.325**	
	(2.042)	(2.092)		(2.154)	(2.162)	
Female	0.0127			0.0155		
	(0.419)			(0.151)		
Stay at Home	0.195	0.184*		0.593	0.544*	
	(1.570)	(1.669)		(1.620)	(1.760)	
Employed	0.0390			0.146		
	(0.699)			(0.825)		
Retired	0.119	0.0970**		0.388	0.320**	
	(1.598)	(2.383)		(1.532)	(2.246)	
Age 25-34	0.0904			0.298		
	(1.558)			(1.580)		
Age 35-44	0.0563			0.213		
	(0.794)			(0.953)		
Age 45-54	0.115*			0.370*		
	(1.721)			(1.681)		
Age 55-64	0.128*			0.420*		
	(1.942)			(1.868)		
Age 65 plus	0.153**			0.541**		
	(2.099)			(2.062)		

Table 2: P(Would Attend) at Designated Admission Fee (contd.)

	Linear Probability Model (OLS)			*Probit Model*		
Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Age 45 plus		0.102***			0.330***	
		(3.032)			(2.899)	
Saturday	–0.0744			–0.263		
	(–1.470)			(–1.519)		
Sunday	–0.0356			–0.116		
	(–0.575)			(–0.600)		
Monday	–0.0154			–0.0365		
	(–0.269)			(–0.194)		
Wednesday	0.0349			0.149		
	(0.673)			(0.777)		
Thursday	–0.0632			–0.202		
	(–1.181)			(–1.103)		
Friday	–0.0424			–0.0953		
	(–0.774)			(–0.539)		
Year 2008	0.0798			0.249		
	(1.545)			(1.544)		
Year 2009	–0.0465			–0.162		
	(–0.954)			(–0.998)		
Year 2010	0.0622			0.190		
	(1.249)			(1.125)		
Year 2017	0.228***	0.208***	0.212***	0.760***	0.672***	0.631***
	(4.318)	(5.055)	(4.994)	(4.128)	(4.835)	(4.784)
Constant	0.648***	0.706***	0.965***	0.424	0.616***	1.318***
	(7.649)	(11.48)	(28.00)	(1.622)	(3.348)	(11.14)
Observations	833	833	833	833	833	833
R-squared	0.300	0.284	0.202			

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Author's analysis.

literature focused on the appropriateness of charging an admission fee for museum attendance, we will examine this result more closely in the treatment model estimates below. The binary variable indicating that a visitor to the museum had prior anticipation of the need to pay an admission fee is positive and statistically significant at the 1 per cent level. This result appears intuitive: a visitor who had expected to pay an admission fee would be more likely to express a willingness to do so at any of the randomised fee's five proposed levels than a visitor who had anticipated no admission fee.

A set of three binary variables are equal to one if the visitor is a resident of (a) county Galway, (b) Ireland outside of county Galway, or (c) or an international visitor, respectively. The latter two of these are included in Columns (1) and (4) of Table 2 where native Galwegians serve as the omitted base category. The results suggest that visitors to county Galway, both domestic and international, would be more willing to pay an admission fee than residents of the county, even controlling for whether or not the visitor anticipated an admission fee.[7] This result will also be examined in greater detail below in the estimation of the treatment model.

The visitor's gender exhibits no statistically significant effect in explaining a willingness to pay an admission fee.

As noted above, the 18-24 age bracket serves as the omitted category for the age classification data. The binary variables for the two lower included brackets are not significantly different than the omitted bracket, while the binary variables representing the three higher brackets are all positive and statistically different than zero at either the 5 per cent or the 10 per cent level. The estimated coefficients for these three higher age brackets are also quite close to each other in magnitude. This may reflect an increase in preference for the cultural experience of visiting a museum as one grows older. It may also be, though, that these variables are capturing in part an income effect, as a direct measure of income is not included in the model.[8] Age-earnings profiles typically indicate that, all else equal, an individual's earnings increase from the point of leaving school through the earlier work years and then level off (in real terms) in the later years leading to retirement. Interpreting the pattern of statistical significance for the age classification data as representing, at least in part, an income effect is consistent with this phenomenon.

Within the occupational classification categories, stay-at-home parents and retirees appear to exhibit a greater willingness to pay an admission fee than do individuals in the other groupings. The day of the week on which the survey was

[7] There is an extensive literature on the importance of 'cultural tourism' as an economic phenomenon. Noonan and Rizzo (2017) have recently edited a special edition of the *Journal of Cultural Economics* focusing on various dimensions of this topic to which they contribute a helpful introductory overview article.
[8] The classification data questions on the survey instrument did not include inquiry as to the visitor's income level. This may be due to an expectation that visitors may not wish to reveal this type of private information, but it also may be that because of the large percentage of international visitors, interpretation of an income measure would be complicated by required adjustments to take into account variations in exchange rates and differentials in purchasing power parity across the large number of countries that send visitors to Ireland.

administered exhibits no statistical significance in explaining willingness to pay an admission fee. While there is no statistical difference in explaining willingness to pay an admission fee between the base year, 2007, and any of the following three years during which the survey was administered, visitors in the year 2017, following a six-year hiatus in survey administration, exhibited a greater than 20 per cent increased willingness to pay an admission fee, significant at the 1 per cent level.

Columns (2) and (5) of Table 2 present the results of OLS and probit estimation of the model, excluding all the classification variables that do not exhibit statistical significance in Columns (1) and (4), other than whether or not the individual had visited the museum previously, a principal focus of the treatment model presented below. In light of the statistical significance across the set of age cohort dummy variables and the extreme closeness in magnitude of the estimated coefficients for the top three cohorts, these are collapsed into a single binary variable equal to 1 if the visitor is 45 years or older and zero otherwise. Making this adjustment increases the statistical significance of this variable to the 1 per cent level.

Columns (3) and (6) of Table 2 present estimates of the demand curve for willingness to pay as a function of Admission Fee excluding all classification variables other than 'Year 2017', for both OLS and probit models. An important result to be gleaned from the aggregate results presented in Table 2 for the calculation of welfare measures below is that the estimated coefficients for Admission Fee, under both OLS and probit estimation procedures, are nearly identical regardless of whether all the classification variables are included, only the statistically significant classification variables are included, or the simple demand curve for the year 2017 is putatively specified.

We turn now to estimation of the treatment model defined by Equations (2) through (5) above. Critical to estimating the treatment model is identifying a variable that affects the likelihood that a survey respondent had visited the museum previously but does not affect her or his willingness to pay any survey-specified value for the admission fee. Recall from the results presented in Columns (1) and (4) of Table 2 that the day of the week on which the survey was administered exhibits no statistically significant effect in explaining whether or not an individual expressed willingness to pay the randomised admission fee. Examination of the data suggests, though, that the day of the week on which the survey was administered does statistically significantly affect the probability that an individual had visited the museum previously. Probit estimation[9] of Equation (3) reveals that visitors to the museum on Mondays and Fridays are, at a statistically significant level, equally less likely to have visited the museum previously than visitors on all other days of the week. A binary variable representing that the survey was administered to a visitor on a Monday or a Friday thus satisfies the criterion required for identification of the treatment model.

[9] While the full results of this estimation are not presented here, the salient content of these results is captured fully in the first column of estimates presented in Table 3.

Table 3 presents the results of maximum likelihood estimation of the treatment model parameters. Column (1) presents probit estimates for the first stage equation that explains whether or not the survey respondent had visited the Galway Museum previously as described in Equation (3) above. Column (2) of the table presents estimates for the second stage equation that explains whether or not the visitor indicated positively a willingness to pay the randomised, survey-specified value for an admission fee conditioned upon whether or not he or she had visited the museum previously, as described in Equations (4) and (5) above.

Table 3: Treatment Model

DEPENDENT VARIABLE *EXPLANATORY VARIABLES*	*(1)* *Previous Visit* *Equation (3)*	*(2)* *Would Attend* *Equations (4) & (5)*
Admission Fee	–0.0138	–0.0736***
	(–0.619)	(–13.74)
Expected Fee	–0.294**	0.163***
	(–2.356)	(4.887)
Other Ireland	–1.184***	0.0158
	(–7.431)	(0.162)
International	–1.966***	–0.0936
	(–13.93)	(–0.797)
Stay at Home	–0.462	0.141
	(–1.379)	(1.369)
Retired	–0.153	0.0903**
	(–0.903)	(2.077)
Age 45 plus	0.198	0.115***
	(1.472)	(3.209)
Year 2017	–0.208	0.201***
	(–1.127)	(4.809)
Monday OR Friday	–0.314**	
	(–2.372)	
Previous Visit		–0.371*
		(–1.902)
Constant	0.615***	0.934***
	(3.354)	(6.824)
Selection Test Statistic†	0.482*	
	(1.713)	
Observations	833	833

z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
† This test statistic is the parameter ρ in Equations (4) and (5).
Source: Author's analysis.

Note first that the selection test statistic [ρ in Equations (4) and (5) above] is statistically significant at better than the 10 per cent implied probability level. This result, together with the statistical significance at almost the 1 per cent level for the identifying binary variable being equal to 1 if the survey administration day of the week was a Monday or a Friday [see Column (1) of Table 3], provides support for controlling for potential selection bias using the treatment model.

The initial interesting result of treatment model estimation for the basic museum services demand equation involves the impact that having visited the museum previously has on an individual's willingness to pay the survey-specified value for the admission fee when the potential endogeneity of this right-hand side variable is controlled for empirically. Under both OLS and probit estimation of the single equation model presented in Table 2, this variable failed to exhibit statistical significance. When the potential selection bias arising from the endogeneity of this measure is controlled for within the treatment model, the fact that an individual has previously visited the museum decreases the likelihood that he or she would be willing to pay an admission fee by nearly 40 per cent.

A second interesting result of the treatment model estimation is the pattern of statistical significance for the place of visitor origin classifications: county Galway, Ireland outside county Galway, and International. In the single equation model estimates presented in Table 2, visitors from the latter two places of origin demonstrate a positive and statistically significant greater willingness to pay the survey-specified value for admission fee than do native Galwegians. In the treatment model, however, the statistical significance of the variables representing visitors from greater distances is limited to the first stage equation that explains whether or not a surveyed visitor had visited the museum previously. Unsurprisingly the results suggest that visitors from more distant places of origin are less likely to have visited the museum previously than native Galwegians at a very high level of statistical significance. When this effect is controlled for in the treatment model there is no difference in the second stage willingness to pay equation across places of visitor origin. This suggests that the underlying phenomenon may not so much be that Irish visitors from outside county Galway and international visitors have an intrinsically greater demand for museum services than native Galwegians but rather that the opportunity to visit the Galway museum represents a more unique cultural experience for citizens of other counties in Ireland and international visitors than native Galwegians, and hence, in the single equation specification that fails to control for the endogeneity of having visited the museum previously, they appear to exhibit a greater willingness to pay an admission fee to do so. This result may prove informative to future inquiry into the topic of 'cultural tourism'.

The pattern of coefficient estimates and significance levels in the basic museum services demand equation for the classification variables: "Retired", "Age 45 Plus", and "Year 2017" remain quite consistent in the treatment model second stage results as in the single equation estimation. The classification variable representing stay-

at-home parents, however, ceases to exhibit statistical significance in the treatment model. In the first stage equation where having visited the museum previously is the dependent variable, none of these classification data measures exhibit a statistically significant effect. The estimated coefficient indicating that a visitor anticipated having to pay an admission fee is also similar in magnitude and statistical significance in the second stage willingness to pay equation in the treatment model as in the single equation estimation. Unlike the other classification data measures, however, its estimated coefficient is statistically significant, with a negative sign, in the treatment model first stage equation. This result appears intuitive inasmuch as having visited the museum previously absent an admission fee would likely lead to the anticipation of no admission fee as a survey response.

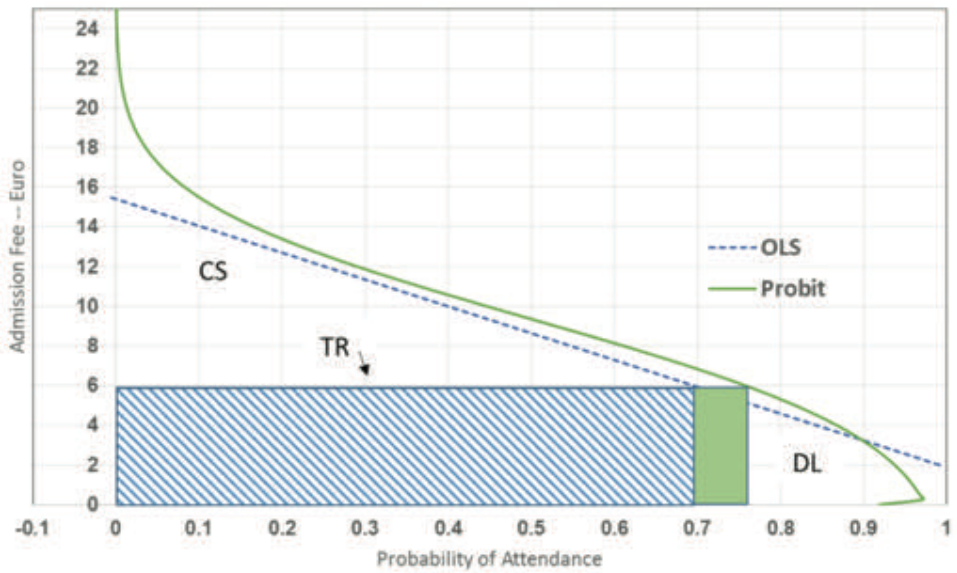
While the treatment model results regarding the interrelationship between visitor place of origin, having visited the museum previously, and willingness to pay an admission fee – and particularly the result that willingness to pay an admission fee appears to decline substantially for subsequent relative to initial visits – may be the most interesting results derived from specifying and estimating the treatment model, the most important result obtained from the perspective of calculating welfare measures associated with museum attendance below is the magnitude of the coefficient for the survey-specified level of the admission fee in the second stage willingness to pay equation. Note that this estimate is nearly identical to the estimates obtained for all three specifications of the OLS demand equation presented in Columns 1 to 3 of Table 2. Since this estimated coefficient, together with the estimated coefficient for Year 2017, serve as the basis for generating the linear demand curve used to derive the welfare effect calculations that are a central focus of this paper, we now proceed with confidence to presenting these calculations.

VI WELFARE EFFECTS OF ALTERNATIVE ADMISSION FEE LEVELS

Figure 2 presents a diagrammatic illustration of the welfare measures – total revenue (TR), consumer surplus (CS), and deadweight loss (DL) – to be calculated based upon the Galway Museum demand curve for the year 2017, employing the estimated coefficients in Columns 3 and 6 of Table 2, for the linear probability model (OLS) and Probit estimates respectively. Remember that the estimated coefficients for the admission fee term and the binary variable indicating Year 2017 are quite consistent across all three specifications of the demand relationship for both the linear probability (OLS) model and the probit model presented in Table 2. Visual inspection of Figure 2 suggests that the demand curves derived using the linear probability model (OLS) and probit estimates, respectively, are reasonably similar over the data range (€2 through €10) for the survey-specified hypothetical admission fee, with the probit estimates yielding a slightly higher demand at low

values for the probability of attendance [P(A) < 0.1], and a slightly lower demand curve at high values for the probability of attendance [P(A) > 0.9]. This is due, of course, to the shape of the standard normal cumulative distribution function that serves as the basis for probit model estimation.

Figure 2: Welfare Effects of implementing Admissions Fee



Source: Author's analysis.

Note: For either the OLS- or the Probit-estimated demand curve illustrated in Figure 2, Total Value (TV) – calculated by Equations 6 and 7, respectively, in the text – is the area under the demand curve between the origin and any value for the Probability of Attendance {P(A)} along the horizontal axis. At P(A) = 1.0, the entire Total Value is Consumer Surplus (since Total Revenue equals zero when Admission Fee equals zero). At any value for P(A) < 1.0, Total Value comprises the sum of Total Revenue plus Consumer Surplus (TV = TR + CS) where Total Revenue is the product of Admission Fee and Probability of Attendance (Equation 8) and Consumer Surplus is the area under the demand curve above the value of Admission Fee (Equation 9). Deadweight Loss (DL) is the foregone Total Value resulting from a reduction in attendance due to the presence of an Admission Fee (Equation 10).

The first step in calculating the welfare measures illustrated in Figure 2 for the Galway City Museum in the year 2017 is to compute the Total Value (TV) of attendance, measured in Euro, as the area under the respective OLS and probit demand curves between the origin and the value of probability of attendance [$P(A)$]

along the horizontal axis for various hypothetical values of an admission fee (f) on the vertical axis. For the linear probability model (OLS) Total Value is

$$\mathrm{TV}\{\mathrm{OLS}, f^*\} = \int_0^{P(A)@f^*} [\hat{\alpha}_0 + \hat{\alpha}_1 P(A)] \cdot dP(A). \tag{6}$$

for $f^* = 0, 2, 4, 6, 8, 10$ (admission fee)

and, from Column 3 of Table 2,

$$\hat{\alpha}_0 = (0.965 + 0.212) = 1.177 \text{ and } \hat{\alpha}_1 = -0.0739 \quad .$$

For the probit estimated demand curve Total Value is[10]

$$\mathrm{TV}\{\mathrm{Probit}, f^*\} = \int_0^c \left(\frac{\Phi^{-1}(\pi) - \hat{\beta}_0}{\hat{\beta}_1}\right) d\pi, \tag{7}$$

where $$c = \Phi(\hat{\beta}_0 + \hat{\beta}_1 f^*), \tag{7a}$$

for $f^* = 0, 2, 4, 6, 8, 10$ (admission fee)

and $$\Phi(d) = \int_{-\infty}^{d} \left(\frac{1}{\sqrt{2\pi}}\right) e^{-\frac{t^2}{2}}\, dt, \qquad d \in R \tag{7b}$$

and, from Column 6 of Table 2,

$$\hat{\beta}_0 = (1.318 + 0.631) \text{ and } \hat{\beta}_1 = -0.208$$

In the absence of an admission fee ($f = 0$) the calculation of total value for both the OLS and probit demand curves represents the entire area under the respective demand curves illustrated in Figure 2 and provides the valuation of consumer surplus with no revenue derived under free entry and no deadweight loss resulting from a reduction in attendance due to an admission fee. At admission fee values of €2, €4, €6, €8 and €10, the total value is calculated for the OLS and probit demand curves using Equations (6) and (7) respectively. The total revenue generated from an admission fee is equal to the respective level of the fee multiplied by the probability of attendance at that fee level, or:

$$TR(f^*) = f^* \cdot P(A \mid f^*) \tag{8}$$

[10] I gratefully acknowledge the guidance of my Lehigh University Department of Mathematics colleague Ping-Shi Wu in the joint specification of Equations (7), (7a) and (7b) and especially for composing the MATLAB code used to calculate Total Value as the area under the probit-estimated demand curve at attendance levels corresponding to different values for an admission fee.

and the consumer surplus is the excess of Total Value at that fee level over revenue generated, or:

$$CS(f^*) = TV(f^*) - TR(f^*). \tag{9}$$

The deadweight loss is the foregone Total Value resulting from a reduction in attendance due to the presence of an admission fee, or:

$$DL(f^*) = TV(f = 0) - TV(f^*) \tag{10}$$

with calculation for all these welfare measures at values of the admission fee: $f^* = €2, €4, €6, €8, €10$.

Table 4 presents these welfare measure calculations based on the museum's annual visitor count for the year 2017 of 216,000[11] as well as the predicted probability of attendance for both the OLS- and probit-estimated demand curves at admission fee values of €0, €2, €4, €6, €8 and €10, corresponding to the actual (free) admission fee and the hypothetical values randomly included in the museum survey. The first row of the table indicates that in the absence of an admission fee, the calculated value of consumer surplus – the entire area under the demand curve – derived by visitors to the museum during the year 2017 is slightly under €2 million using the linear probability model (OLS) estimates, and slightly over €2 million using the probit model estimates. The remaining rows of the table present calculations for the total revenue raised at €2 increments in the survey-specified value for the admission fee, together with the corresponding value of consumer surplus derived by visitors as well as the deadweight loss attributable to lower estimated visitor numbers associated with higher levels of the admission fee.

Note that the calculated values for total revenue in Table 4 at any stipulated level for an admission fee are reasonably similar (never differing by more than 7 per cent) using either the OLS or the probit estimate-derived demand curve. The values of consumer surplus are slightly higher (though never more than 20 per cent) for the probit estimate-derived demand curve than the OLS estimate-derived demand curve, due to the 'bending' of the probit curve to asymptotically approach the vertical axis, while the deadweight loss estimates for the probit curve are somewhat lower (never more than 33 per cent even though this percentage difference is calculated off a much smaller base value) than the OLS curve[12] for

[11] "Visitor numbers are gathered via a counter above the revolving (entrance) doors. This effectively counts heads, so provides raw figures of how many enter the museum. The numbers gathered this way are used in final yearly reports and sent onto Galway City Council." (Source: private correspondence from Damien Donnelan, Education and Exhibitions Assistant, Galway City Museum).

[12] Note that the deadweight loss (DL) calculation for the OLS estimate-derived demand curve in Figure 2 includes most of the solid green area as well as the unshaded area in the bottom right segment, that is the entire area under the linear demand curve to the right of the total revenue (blue cross-hatched area).

Table 4: Welfare Effects of Implementing an Admission Fee

	Limited Probability Model (OLS)				*Probit Model*			
Price	*Probability Would Attend*	*Total Revenue*	*Consumer Surplus*	*Deadweight Loss*	*Probability Would Attend*	*Total Revenue*	*Consumer Surplus*	*Deadweight Loss*
No Fee	1.0		€1,977,500		0.97		€2,041,200	
€2.00	1.0	€432.000	€1,545,500	€0	0.94	€405,000	€1,621,000	€15,000
€4.00	0.88	€761,500	€1,134,200	€81,800	0.87	€750,000	€1,228,600	€62,600
€6.00	0.73	€950,800	€785,500	€241,200	0.76	€982,800	€877,000	€181,400
€8.00	0.59	€1,012,300	€500,700	€464,500	0.61	€1,057,900	€579,400	€403,900
€10.00	0.44	€946.000	€279,800	€751,700	0.45	€967.500	€350,100	€723,600

Source: Author's analysis.

the same reason. Overall this suggests that the welfare value calculation results obtained here from either the linear probability model (OLS) or the probit model are largely consistent, while the computation of these results is much more straightforward for the linear probability model [Equation (6)] than the probit model [Equation (7)].

The calculated deadweight loss at an admission fee of €5 (€110,000 for Probit and €154,000 for OLS, respectively) ranges between 5 per cent and 8 per cent of the 'no admission fee' calculated value of consumer surplus derived by museum visitors. These results suggest that, at least in the case of the Galway Museum, the imposition of a moderate level admission fee is likely to lead to only a modest decrease in visitors with a correspondingly not unacceptably high welfare measure of deadweight loss arising, though this is a judgment best reserved for principals of the Galway Museum and the Galway City Council.

VII CONCLUDING REMARKS

Given the longstanding and ongoing interest within both the academic community and the cultural policy arena in the question of whether or not museums should charge an admission fee and, if so, at what level and with what type of concessionary relief mechanism(s) in place, the paucity of empirical evidence about the responsiveness of museum patron visits to a point-of-admission fee is more than somewhat surprising. The results presented here help to fill this void. Perhaps more importantly, this paper presents a framework within the contingent valuation methodology that should prove reasonable to implement in instances where individual museum boards of directors or other administrative oversight bodies wish to obtain estimates of potential reductions in visits when considering the option of instituting an admission fee in the absence of one or raising the level of an existing fee. Predicated upon the acquisition of suitable survey data, the application of straightforward econometric estimation appears, at least in the case of the analysis presented here, capable of obtaining robust estimates upon which to calculate standard economic welfare measures that can comprise a useful input for the execution of informed public policy decision-making.

A finding of potentially particular interest regarding the welfare measure calculation analysis presented here is that the results based upon both a linear probability model (OLS) estimation and a probit model estimation of the basic demand equation provide reasonably similar welfare measure estimates. This is no doubt at least in part due to the sample size (n = 883) resulting from a survey administered by the Galway City Museum over a multi-year period. The reason why this result may prove helpful to applied researchers wishing to perform a

similar analysis for other museums is that calculation of the total value for the probability of museum attendance at various levels of an admission fee as the area beneath a demand curve which serves as the basis for the derived welfare calculations is more straightforward to compute on the basis of OLS estimates than probit estimates.

In addition to providing estimates of the economic welfare measures resulting from a reduction in attendance at higher levels for an admission fee, the empirical results obtained through estimation of the contingent value demand model provide useful insights into personal characteristics that may affect visitor demand for museum services. Retirees and stay-at-home mothers and fathers appear to exhibit a higher demand for museum services than other occupational groups. The results also suggest that individuals over the age of 45 appear to exhibit a higher demand than younger visitors. However for reasons explained in the discussion of results section above, this result may be capturing in part an income effect, as a direct measure of visitor income is not included in the analysis. A result of the analysis that appears to provide the first empirical evidence regarding measuring museum attendance in terms of visits versus visitors suggests that willingness to pay an admission fee is nearly 40 per cent lower for subsequent than for initial visits. Finally, the results presented here based upon the specification of a treatment model that is more comprehensive than the basic contingent value demand model regarding the interrelationship between visitor place of origin, having visited the museum previously, and willingness to pay an admission fee, may prove especially informative for future contributions within the literature on cultural tourism.

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APPENDIX A: SURVEY INSTRUMENT QUESTIONS

As described in the text the data which serve as the basis for the empirical estimation of the contingent valuation model were obtained by a survey of Galway City Museum visitors during mid-June over the years 2007, 2008, 2009, 2010 and 2017. The following are the survey instrument questions used to obtain these data. Other than the final question that asked visitors if they would have been willing to pay an admission fee of ***X*** Euro, where ***X*** was randomly assigned values of €2, €4, €6, €8 and €10, to visit the museum, all of the questions are categorical in nature, with the number of categories ranging from two (e.g. 'yes' versus 'no' or 'male' versus 'female') to seven in the case of the day of the week on which the survey was administered. For measures that appear in the model as right-hand-side variables in the estimating equations this results in a binary variable or a set of dummy variables in all cases. The category that serves as the omitted base case value in the estimated equations is indicated in bold, italicised letters in the presentation of the questions below.

Have you been to the Galway Museum before? ____ ***No*** ____ Yes
Did you expect to pay an admission fee? ____ ***No*** ____ Yes

Where do you live?
____ ***COUNTY GALWAY*** ____ IRELAND (outside Galway)
____OUTSIDE IRELAND
Gender: _____ ***Male*** _____ Female
Occupation: _____ ***Student*** _____ Stay at Home Mom/Dad
_____ Employed _____ Retired
Age: _____ ***18 – 24*** _____ 25 – 34 _____ 35 – 44
_____ 45 – 54 _____ 55 – 65 _____ 65 plus

Day of Survey Administration:
____ ***Tuesday*** ____ Wednesday ____ Thursday
____ Friday ____ Saturday ____ Sunday
Year of Survey Administration: ____ ***2007*** ____ 2008 ____ 2009
____ 2010 ____ 2017

Would you have visited the Galway Museum today if there had been an admission fee of ***X*** Euro?
_____ Yes _____ No
(With ***X*** randomly assigned values of €2, €4, €6, €8 and €10)