



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*



# Estimating the benefits of farm animal welfare legislation using the contingent valuation method

Richard M. Bennett\*, Ralph J.P. Blaney

*Department of Agricultural and Food Economics, The University of Reading, P.O. Box 237, Reading RG6 6AR, UK*

Received 14 May 2001; received in revised form 13 March 2002; accepted 14 August 2002

## Abstract

This paper presents the method and findings of a contingent valuation (CV) study that aimed to elicit United Kingdom citizens' willingness to pay to support legislation to phase out the use of battery cages for egg production in the European Union (EU). The method takes account of various biases associated with the CV technique, including 'warm glow', 'part-whole' and sample response biases. Estimated mean willingness to pay to support the legislation is used to estimate the annual benefit of the legislation to UK citizens. This is compared with the estimated annual costs of the legislation over a 12-year period, which allows for readjustment by the UK egg industry. The analysis shows that the estimated benefits of the legislation outweigh the costs. The study demonstrates that CV is a potentially useful technique for assessing the likely benefits associated with proposed legislation. However, estimates of CV studies must be treated with caution. It is important that they are derived from carefully designed surveys and that the willingness to pay estimation method allows for various biases.

© 2003 Elsevier Science B.V. All rights reserved.

*JEL classification:* Q18; Q26

*Keywords:* Farm animal welfare; EU legislation; Contingent valuation; Costs and benefits; UK

## 1. Introduction

Farm animal welfare issues are becoming increasingly important within the European Union (EU). This is shown by consumer concerns about animal welfare and reflected by the increasing amount of legislation designed to improve the welfare of farm animals within the EU (see Wilkins, 1999).<sup>1</sup> For example a survey of some 2500 people in the UK, Ire-

land, France, Germany and Italy (Harper and Henson, 2001) found that an average of 66% of people said that they had reduced their consumption of livestock products due to their concerns about the way that the animals were treated and 60% said that they purchased 'farm animal friendly' products (such as free-range eggs and chicken).<sup>2</sup> As well as the general increase

<sup>2</sup> Broome (1998) reports that 33% of consumers in Ireland restricted their consumption of meat (with concerns about animal welfare being the main reason given), whilst 83% of consumers in France stated that concerns over animal welfare affected their consumption of some livestock products (e.g. veal). Of course, concern about farm animal welfare is not only found in EU countries. For example, PETA (2002) report a survey of citizens in the United States of America that found that 90% 'opposed' the confinement of chickens and other animals on 'factory farms'.

\* Corresponding author. Tel.: +44-1189316478.

*E-mail address:* [r.m.bennett@rdg.ac.uk](mailto:r.m.bennett@rdg.ac.uk) (R.M. Bennett).

<sup>1</sup> In the UK, this is also shown by the increase in farm assurance schemes which contain numerous standards designed to improve animal welfare, and which are supported by major food retailers (such as the RSPCA Freedom Food scheme and the Tesco chain of food stores).

in EU legislation to protect and improve farm animal welfare, it was agreed in 1997 that animal welfare considerations become annexed (retrospectively) to the Treaty of Rome establishing the European Community by means of a Protocol on Animal Welfare. The Protocol is important because it states the desire to “ensure improved protection and respect for the welfare of animals as sentient beings” and goes on to state that “in formulating and implementing the Community’s agricultural, transport, internal market and research policies, the Community and the Member States shall pay full regard to the welfare requirements of animals . . .” (the latter statement had already been part of the 1992 Treaty on European Union). This highlights the increasing ethical concerns about the treatment of animals within the EU and, importantly, explicitly recognises animals as beings capable of pleasure and pain rather than as inanimate goods.<sup>3</sup>

The production of eggs from hens kept in battery cages has specifically received attention from consumers,<sup>4</sup> animal welfare groups and policy makers. A UK poll in 1995 (King, 1995) found that 72% of UK citizens thought that the battery-cage system was wrong, whilst Harper and Henson (2001) found that battery-cage systems were thought ‘somewhat unacceptable’ on average by citizens in the UK, Ireland, France and Germany.<sup>5</sup> Organisations such as Compassion in World Farming and Eurogroup for Animal Welfare have campaigned to have cages banned within the EU (CIWF, 2002; Eurogroup, 2002). In July 1999, European Agriculture Ministers agreed to

ban the keeping of laying hens in battery cages from 1 January 2012 (EU Directive 99/74/EC).

However, the banning of battery cages will impose costs on egg producers, consumers and society as a whole. Do the benefits of such a ban outweigh these costs? In an attempt to address this question, this paper presents the method and findings of a contingent valuation (CV) study undertaken in 1996 to estimate the benefits of a ban on cages in the EU for citizens of the UK. The paper considers the desirability of the legislation in the light of the study’s estimates of benefits and the likely costs of the legislation within the UK.

## 2. Survey methods

A questionnaire divided into four main sections was designed. A specimen version of the questionnaire is shown in Appendix A. The first section contained questions about the extent to which people are concerned about farm animal welfare generally and about specific production practices (including egg production using the battery-cage system). This section also asked people about their consumption expenditure and included questions as to whether their consumption decisions are affected by their animal welfare concerns and their consumption of cage, barn/perchery or free-range eggs. The next section presented information on the battery-cage system generally practised in the EU. This information was checked by animal scientists to ensure that it was scientifically correct and unbiased in its description. The section then presented the proposal to phase out the use of battery cages in the EU and asked people if they supported such legislation. They were then asked if they would be willing to pay a specified amount to support the legislation as a general increase in the price of a dozen eggs. A single-bounded dichotomous choice elicitation method (Bishop and Heberlein, 1979; Mitchell and Carson, 1989, pp. 101–103) was used. Twelve different bid amounts (see Table 1) were used and randomly allocated to people within the sample. These combinations were chosen following an exploratory survey of people using an open-ended willingness to pay (WTP) elicitation format. Prior to the WTP questions, people were reminded of their limited budget and that any payment to support one

<sup>3</sup> In his excellent treatise on economics and animal welfare, McNerney (1993) notes that animal welfare is just another economic commodity for which people have preferences relative to other things they choose to consume with their available income. Thus, the (animal) welfare standards a society pursues are a co-incident outcome of the pursuit of its own (human) welfare.

<sup>4</sup> In response to consumer concerns, some food stores, such as Marks and Spencer in the UK, have ceased selling eggs from cage systems. Fearn and Lavelle (1996) found that consumers of free-range eggs were largely influenced by hen welfare considerations followed by perceived higher egg quality, whilst consumers of cage eggs were largely influenced by the price and size of eggs in their purchasing decisions. Morris (1996) notes that although consumers may be concerned about hen welfare and wish to buy non-cage eggs, some will not be sufficiently motivated to actually do so.

<sup>5</sup> Broome (1998) reports that 70% of French consumers perceived animal welfare problems with the cage egg system and that this influenced their consumption of eggs.

Table 1  
Responses to willingness to pay questions according to bid level (UK pence)<sup>a</sup>

Bid amount	Yes	No	No opinion
15	44	5	5
20	41	10	5
25	38	7	4
30	33	6	4
35	38	7	1
40	36	11	8
45	31	14	7
50	34	10	4
55	33	9	6
60	34	15	7
65	20	13	4
70	22	21	2

<sup>a</sup> Bid is an increase on the current egg price. Respondents were advised of the current egg price (around £1.50 per dozen eggs).

issue will necessarily mean that they have less money available to contribute to other issues or to buy things. Respondents were then asked whether the higher price of eggs indicated by the WTP amount would affect their consumption of eggs and, if so, by how much (i.e. number of eggs per week). Respondents were also asked their maximum WTP to address all of their farm animal welfare concerns using an open-ended format.

Following this section, there was a series of 'de-briefing questions'. In the first of these, respondents were asked (by means of an open-ended question format) to explain their responses to the WTP questions. Then they were asked to score (from 1 to 10) the extent to which each of a series of attitudinal statements reflected their own feelings with regards to the responses that they gave to the WTP questions. These questions were used to explore the rationality of respondents and to test for specific biases of people's responses (the results section gives more detail regarding these questions). The final section of the questionnaire contained background questions on the respondent's sex, age, education, income, occupation and household size.

Following pretesting, the questionnaire, together with a cover letter, was posted to 2000 people in the UK during the latter part of 1996. The sample was selected randomly from all households in the UK but stratified according to the ACORN geodemographic classification system (CACI, 1993) to reflect the socio-economic characteristics of the population.

The ACORN system is based on UK population census data and contains some 54 different categories within the UK population classified according to key socio-economic factors such as age, sex, ethnic group, marital status and family/household structure, occupation, economic position (income, etc.), education and home ownership. The cover letter sent out with the questionnaire not only explained the purpose of the survey but also provided a small incentive by offering to include respondents in a free prize draw. One month after the initial posting, a further letter and copy of the questionnaire were sent to non-respondents urging them to return a completed questionnaire. The response rate was 30%.

### 3. Results

#### 3.1. Concerns about farm animal welfare and support of the cage ban

Eighty-six percent of respondents were 'very concerned' or 'somewhat concerned' that farm animals may suffer or be mistreated (41 and 45%, respectively), whilst only 1% stated that they were 'not at all concerned'. Sixty-one percent acted on their concerns by purchasing/not purchasing farm animal products on animal welfare grounds (free-range eggs and veal were frequently mentioned in this context). Of the three livestock production practices presented to them, respondents scored veal production with calves in confined crates as being most unacceptable, followed closely by cage egg production (both with median scores of 1 = very unacceptable) with transport of animals for up to 24 h (with food and water at 8 h intervals) being less generally unacceptable (with a median score of 2). Over half of the respondents gave other examples of the treatment of farm animals that they were concerned about. On average, respondents' households purchased around nine eggs per week. Sixty-four percent stated that they purchased free-range eggs, 11% barn or perchery eggs and just 9% stated they purchased battery-cage eggs. Fifty-nine percent of respondents were female and 41% male, with a mean age range of 40–59 years. Mean income range of respondents was £15,000–20,000 per annum, whilst mean household size was 2 (with a range of 1–14 and 0–5 children).

Seventy-nine percent of all respondents supported the proposed EU ban on battery-cage egg production and only 7% stated they did not support the ban. Ninety-six percent of all respondents answered the WTP questions put to them. Table 1 shows responses to the WTP questions according to the bid level, with each of the 12 different bid amounts randomly allocated within the sample. The analysis of WTP responses is presented below.

Responses to the WTP ‘debriefing’ question, which asked respondents to explain their reasoning behind their WTP responses, found that the majority (67%) of respondents gave income/expenditure and/or animal welfare as the main reasons behind their responses (this question was answered by 87% of all respondents). For example a typical response was “20p extra for a dozen eggs is not much to pay to improve hen welfare, especially since I don’t buy many eggs”. A minority of 2% of respondents objected to the legislation scenario presented to them. Table 2 shows a summary of responses to the attitude statements presented to respondents (respondents scored from 1 to 10 depending on the extent of their agreement to each statement). The first statement was specifically designed to test for ‘warm glow’ bias (discussed later) in responses to WTP questions, asking respondents the extent to which they considered their WTP to be like a charitable donation to a worthy cause. The proportion of relatively high scores for this statement shows that this may have indeed influenced many people’s WTP. The second attitude statement was designed to test for ‘part-whole’ bias (discussed later) of people’s responses to the WTP questions, asking them the extent to which they considered their WTP to be not just

for hen welfare but for farm animal welfare generally. The relatively high proportion of respondents giving a high score to this statement suggests that this bias may have indeed influenced people’s WTP. The third statement seeks some further information on people’s attitudes to the proposed legislation to ban battery cages in the EU, as presented in the WTP scenario. Nearly 82% of respondents agreed relatively strongly that such legislation is necessary (i.e. gave a score of 7 or more to the attitude statement). The fourth attitude statement sought to explore the extent to which people’s WTP is for their personal satisfaction from not consuming battery-cage eggs, whilst the fifth attitude statement sought to explore the extent to which people’s WTP reflects the satisfaction they would get from knowing that others would not be reducing hen welfare by consuming battery-cage eggs. This tests the ‘negative externality of animal suffering’ argument considered by Bennett (1995) and the public good nature of the legislation. The scorings would appear to show that people are aware that the proposed egg legislation would provide public good benefits in a way that the market, by itself, cannot and that this may have influenced their WTP.

When asked the maximum that they would be willing to pay (in terms of an increase in their weekly household food bill, due to higher prices) to address all of their farm animal welfare concerns, 79% of respondents gave an amount, with just 5% stating that they found this task too difficult. Ninety-one percent of respondents to this question gave a positive amount ranging from £0.10 to 100. The remainder stated a WTP of zero. The mean WTP given by respondents was £5.50 (with a median value of £5).

Table 2  
Summary of responses to the attitude statements (% of respondents)<sup>a</sup>

Attitude statement	Score					N
	1–2	3–4	5–6	7–8	9–10	
WTP is like a charitable donation	28	9	22	15	26	534
WTP is for welfare generally	12	6	15	22	46	542
Legislation is necessary	6	4	8	16	66	548
WTP for personal satisfaction	19	4	18	15	44	525
WTP to prevent others buying	23	5	21	15	37	504

<sup>a</sup> Respondents were asked to score from 1 (not at all true of my feelings) to 10 (very true of my feelings). Percentages relate to those responding to the questions and may not add to 100% due to rounding. N: number of respondents answering each question (out of a total of 591 respondents).

### 3.2. WTP to support the cage ban

A parametric model was used to estimate mean and median WTP. The procedure chosen is an extension of Cameron's (1988) approach, proposed by Hanemann et al. (1991) and is outlined below.

Let individual  $i$  have an implicit price or WTP for the animal welfare legislation given by

$$WTP_i = x_i' b + su_i, \quad (1)$$

where  $WTP_i$  is the individual's true, but incompletely observed, willingness to pay;  $x_i$  a vector of explanatory factors which can be observed,  $u_i$  a symmetric random error with zero mean and unit variance that arises from the unobserved factors about  $i$ 's WTP,  $b$  a vector and  $s$  is a scalar to be estimated. Each respondent is asked whether they are willing to pay a randomly assigned amount ( $B_i$ ). The probability of observing a positive response to this WTP question is

$$\Pr(\text{Yes}) = \Pr(u_i \leftarrow B_i/s + x_i' b/s). \quad (2)$$

Alternatively, this probability can be written as

$$\Pr(\text{Yes}) = F(cB_i + d' x_i), \quad (3)$$

where  $c = -1/s$  and  $d = b/s$ .  $F(\cdot)$  is the cumulative distribution function of  $u_i$  and its assumed distribution determines the type of binary choice model used. It is the presence of a varying bid level that enables the identification of the scale of the WTP relationship. Thus, the bid ( $B_i$ ) is included in the right-hand set of variables in the binary choice model along with the explanatory variables ( $x_i$ ). The coefficients obtained from the binary choice model can then be used to identify the parameters in Eq. (1). The estimated parameters in the binary choice model are  $c$  and  $d'$  and thus the estimates of  $b'$  and  $s$  (Bennett and Larson, 1996) will be:

$$b' = \frac{-d'}{c}, \quad (4)$$

$$s = \frac{-1}{c}. \quad (5)$$

Once the coefficients of the explanatory variables have been estimated from the model, it is then possible to estimate WTP. In this case, maximum likelihood estimation procedures were used, specifying a logit model (assuming a logistic distribution function)

Table 3  
Willingness-to-pay model for the egg legislation

Variable	Parameter estimate	Standard error	Pr > chi
Intercept	-1.9742	0.6201	0.0015
BID <sup>a</sup>	-0.0307	0.0087	0.0004
AVOID <sup>b</sup>	0.8485	0.3050	0.0054
INCOME <sup>c</sup>	0.1984	0.0644	0.0021
SUPPORT <sup>d</sup>	1.1743	0.1994	0.0001
WARMGLOW <sup>e</sup>	0.0962	0.0464	0.0381
PARTWHOLE <sup>f</sup>	0.1313	0.0422	0.0019

Number of observations: 446;  $-2 \log$  likelihood: 319.198; chi-square for covariates: 145.378 with six degrees of freedom ( $P = 0.001$ ); association of predicted probabilities and observed responses: 86.4% concordant, 13.4% discordant (Yes—350 predicted, 339 actual; No—96 predicted, 107 actual).

<sup>a</sup> BID is the presented bid amount (i.e. from £0.15 to 0.70).

<sup>b</sup> AVOID is a dummy variable (0: no, 1: yes) denoting whether the respondent stated that they avoided purchasing any products due to concerns about the welfare of animals involved.

<sup>c</sup> INCOME is the income category score of 1–12 for amounts of 0–£5000 to >£55,000 in steps of £5000.

<sup>d</sup> SUPPORT is the level of support given by respondents to the proposed legislation to ban battery cages (where 0: no, 1: no opinion and 2: yes).

<sup>e</sup> WARMGLOW is the combination of two variables: (i) a dummy variable (0: no, 10: yes) indicating whether the respondent had stated that their WTP was a payment towards a 'cause' in the open debriefing question and (ii) the score (1–10) given to the attitude question that their WTP is like a charitable donation to a worthy cause.

<sup>f</sup> PARTWHOLE is also a combination of two variables: (i) a dummy variable (0: no, 10: yes) indicating whether the respondent had stated that their WTP was a payment toward animal welfare in the open debriefing question and (ii) the score (1–10) given to the attitude question that their WTP is not just for hen welfare but for farm animal welfare generally.

and using standard procedures available in the SAS software package (SAS, 2000).

Table 3 shows results for the preferred model following extensive model testing. A large number of test models were used with all demographic and other variables being included. Economic theory suggests that price (i.e. BID), income and preference variables (i.e. AVOID and SUPPORT) should be determinants of WTP, and thus it was considered important that such variables be included within the model. The preferred model had the best individual variable significance and the highest coincidence of predicted and observed responses. Nearly 10% of the sample stated they had no opinion concerning the WTP question or

did not state a WTP preference and these respondents were assumed to have a zero WTP.

All of the explanatory variables have a high level of statistical significance associated with them. BID is the presented bid value and the parameter estimate shows the expected negative relationship between the size of the bid presented to respondents and the probability of them giving a 'Yes' response. AVOID is a dummy variable indicating whether the respondent stated that they avoided purchasing any livestock products due to concerns about farm animal welfare. The positive sign indicates that those avoiding products on farm animal welfare grounds were more likely to say 'Yes' to WTP questions. INCOME is the income category score (1–12) and is used as a proxy variable for disposable income. The coefficient is positive, meaning that the higher people's income the more likely they were to say 'Yes' to WTP questions. SUPPORT denotes whether respondents did or did not support the proposed legislation or had no opinion. The coefficient is positive, meaning that those who stated that they supported the legislation were more likely to say 'Yes' to WTP questions. WARMGLOW is a variable that denotes the extent to which respondents considered their WTP to be like a charitable donation to a worthy cause. The positive sign means that the more respondents agreed with this statement the more likely they were to say 'Yes' to WTP questions. PARTWHOLE reflects the extent to which respondents considered their WTP to be not just for hen welfare but for farm animal welfare generally. Again, it has a positive sign meaning that the more respondents agreed with this view, the more likely they were to say 'Yes' to WTP questions. Thus, each of the model's variables, apart from BID, had a positive upward influence on WTP.

Using this model, and including zero WTP values, mean WTP was estimated at £0.90 (per dozen eggs) and median WTP at £0.45. The model allowed for negative WTP values and had a 'correct percentage' predictive ability of over 86%. However, there are a number of potential biases of WTP estimates, which may need to be taken into account. These include warm glow, part-whole, and non-response biases.

Warm glow bias is where respondents' WTP is for the purchase of moral satisfaction associated with giving for a good cause (like a charitable donation) rather than for the good itself, leading to an upward-biased estimate of WTP (see Andreoni, 1990; Kahneman and

Knetsch, 1992). Part-whole bias is where respondents' WTP is for a larger class of goods than the good being offered, again, resulting in an over-statement of WTP (Mitchell and Carson, 1989, pp. 250–252; Carson and Mitchell, 1995). In this context, respondents may feel that they are paying to improve animal welfare more generally rather than just to improve the welfare of caged hens. In the survey results, there was a strong correlation between respondents who gave high scores to the 'warm glow' and 'part-whole' attitude statements and those who had higher WTP values. In addition, the model presented above shows a strong statistical influence of the WARMGLOW and PARTWHOLE variables, suggesting an upward bias of WTP due to both warm glow and part-whole effects. This was corrected by setting these variables to their lowest level for each respondent within the model and re-estimating WTP. The resultant revised mean WTP is £0.47, nearly half of the original estimate. Correction for part-whole bias reduced mean WTP by around 33% and correction for warm glow bias reduced it by around 15%.

Censoring of WTP values at both the upper and lower tails of the distribution was also undertaken. The reason for this is that WTP should be limited by income (Hanemann and Kanninen, 1999). Individual respondent's maximum WTP to address all of their farm animal welfare concerns (obtained from an open-ended WTP question) was used as a basis for censoring. Clearly, a respondent's WTP for the egg legislation should be somewhat less than their WTP to address all of their farm animal welfare concerns. On the broad assumption (based on the findings of this and previous surveys that identified a number of farm animal welfare issues that UK citizens are concerned about) that there will be several other farm animal welfare issues that people may have a WTP to address, an upper censoring point was used based on 20% of the WTP for all farm animal welfare concerns (i.e. the assumption is that WTP for one issue—to support cage legislation—should not exceed 20% of WTP for all farm animal welfare issues). Following censoring, the WTP model increased its 'correct percentage' predictive ability to 90%, whilst mean WTP fell to £0.43 (i.e. censoring only reduced WTP by £0.04).

Further correction for survey non-respondents and any sample selection bias was undertaken. Responses were adjusted by weights reflecting the national

socio-economic profile according to ACORN category. Correction for response imbalance between genders was also carried out. In fact, response rates were relatively consistent across geodemographic groupings. Response rates from ethnic groups and those living in multiple dwelling units (i.e. small, low cost accommodation grouped together in larger buildings) were noticeably lower, and these groupings had lower incomes associated with them. Correction for sample bias reduced mean WTP by just £0.02 to 0.041.

#### 4. Discussion and conclusions

The results of the survey have showed that the vast majority of respondents are concerned about animal welfare and supported the proposed legislation to phase out the use of battery cages for egg production within the EU. Moreover, most respondents would be willing to pay an additional amount on the price of eggs to support the legislation. The mean WTP was initially estimated at £0.90 but after correction for warm glow, whole-part and non-response/survey sample biases, mean WTP fell to £0.41 as an increase in the price of a dozen eggs to support the legislation.

The main issue related to WTP estimates is whether they provide a reasonable measure of people's true WTP. Carson et al. (2000a,b) provide a useful review of the current debate concerning the CV method. There are clearly a number of possible biases that can influence WTP estimates. These may be related to the way people interpret and respond to WTP questions (which are related to the way in which WTP questions are asked, the scenario presented to respondents,<sup>6</sup> etc.), sample selection and the design and conduct of the survey and the WTP estimation methods used. For example Bateman et al. (1999) found a variation in WTP of 40% depending upon the elicitation/estimation method used. Such variation may be due, at least in part, to

<sup>6</sup> Carson et al. (2000a,b) noted that CV elicitation scenarios should be 'consequential' (i.e. be perceived by respondents as being able to influence policy) if they are to be taken seriously by respondents, and not hypothetical in the sense of being 'imaginary'. With the benefit of hindsight, it would have been better not to have used the word 'imagine' in the scenario presented to respondents in this survey. However, evidence presented suggests that respondents gave serious consideration to their responses and that the 'face value' of the scenario was not compromised.

poor survey design in some studies, different information being presented to respondents or the presence of various biases, such as those identified and corrected for in this survey. The dichotomous choice elicitation method used in this survey is the recommended one (Arrow et al., 1993) for CV surveys, whilst the general estimation method has been commonly used to analyse discrete-response CV data and is compatible with economic theory (see Hanemann and Kanninen, 1999 for a comprehensive review of statistical/economic analysis of discrete-response CV data). The use of 'warm glow' and 'part-whole' variables to adjust WTP estimates is an extension of the standard analysis.

This study has endeavoured to test for a number of possible biases and to correct for them—but other, perhaps unrecognised biases may have existed and not been accounted for.<sup>7</sup> Warm glow and part-whole biases appeared to result in a relatively large upward bias to WTP. Very few contingent valuation studies have tested for these biases and even fewer have corrected WTP estimates to take account of them. It is recognised that the adjustment for warm glow and part-whole biases undertaken in this study may be questioned.<sup>8</sup> Responses to the warm glow and part-whole bias debriefing questions may not accurately reflect these biases, and the simple method of adjustment within the parametric model may be seen as a rather crude correction of WTP. Nonetheless, it is important that CV studies test for the presence of such biases, and that their effects on WTP be taken into account, otherwise WTP estimates may be misleading.

The study used a socio-economic classification system to ensure a representative sample of UK citizens. Variables in the parametric model used to estimate WTP were all highly significant and the model had a high predictive ability. The rationality and consistency of respondents' responses to WTP questions was tested by means of 'debriefing' questions. Most respondents gave clear reasoning for their WTP responses. Also, there were strong correlations between people's concerns about farm animal welfare, their purchasing behaviour, their income and their WTP.

<sup>7</sup> For example the survey was undertaken during the period when the numbers of cattle affected by BSE was still relatively high. The BSE 'crisis' is likely to have influenced people's attitudes to livestock production/animal welfare issues.

<sup>8</sup> Indeed, there is debate as to whether 'warm glow' is a relevant issue for CV studies (see Carson et al., 2000a,b, p. 6).



Moreover, a mean WTP of £0.41 for hen welfare compares reasonably with a mean of £5.50 to address all of people's farm animal welfare concerns.

However, a few questions concerning the validity of the findings of the survey remain. First, some 75% of respondents said they purchased free-range eggs, yet only around 20% of retail eggs purchased nationally are free-range (Corporate Intelligence, 1998). It is likely that some respondents wrongly perceived the eggs that they purchased as free-range. This likelihood is supported by a national poll of consumers in the UK (Market and Opinion Research International Limited, 1999) which found that over 80% of consumers did not realise that eggs labelled as 'farm fresh' and 'good country eggs' were from hens kept in battery cages. This information problem has been recognised by the European Commission, with compulsory labelling of eggs according to method of production being required from 1 January 2004. It may also be the case that those who purchased non-cage eggs were more likely to respond to the survey.

A 30% response rate to the postal questionnaire was achieved. This may seem low but is within the range reported by Thistlethwaite and Finlay (1993) who found response rates to mail surveys ranging from 18 to 47%. However, the response rate could have been improved by further reminder letters or, if resources had allowed, by carrying out face-to-face interviews. The problem remains that the survey was unable to obtain direct information on the WTP of non-responders. Those responding to the survey could have had a greater interest in hen welfare (as suggested above in terms of those purchasing non-cage eggs), and thus a higher WTP for the legislation. An extreme assumption would be that all those who did not respond to the survey had no interest in the issue and had a zero WTP. This is unlikely, but is a useful assumption for the purposes of the cost-benefit analysis outlined below. Under this assumption, estimated mean WTP would fall to just over £0.12 per dozen eggs.

Carson (2000) provides a list of factors to be considered when assessing the quality of a CV study. The first he labels 'face validity', which is a clearly and accurately described scenario, which is plausible to respondents. Specifically, Carson states that a CV questionnaire should contain (a) an introduction outlining the general context, (b) a detailed description of

the good, (c) a description of the institutional setting, (d) a clear statement about how the good will be paid for, (e) a method to elicit respondents' preferences (the dichotomous choice format is recommended), (f) debriefing questions which ask respondents to explain their responses and (g) questions to obtain information on respondent characteristics including attitudes and demographics. The questionnaire used in this study (Appendix A) contains each of these elements. The second and third factors listed by Carson are (i) that the relevant population must be sampled and (ii) that the sample size should be at least several hundred and each member of the population should have a positive and known probability of being sampled. For this survey, the relevant population (i.e. all UK citizens) was sampled and a representative sample of this population was invited to participate in the survey by means of a weighted demographic sampling method. The sample size was over 500. The fourth factor is the survey method. Carson accepts that mail surveys are cheaper but warns of sample selection bias. Sample selection bias has been acknowledged in this survey and has been corrected for in two, different ways. Finally, Carson mentions a number of other considerations in assessing the quality of a study. Concerning the analysis of results he states that an equation with reasonable explanatory power and coefficients with the expected signs (as provided by the model used to estimate WTP in this study) provides evidence in support of the proposition that the survey has measured the intended construct. He also states that studies should take income constraints on WTP into account, which this study undertook through censoring of WTP responses and inclusion of an income variable in the WTP model.

The estimated WTP value can be used to derive an estimate of the benefits of the proposed legislation to citizens in the UK. In 2000, UK consumers purchased 6080 million shell eggs (MAFF, 2001a; over 98% of these were produced domestically). Sixteen percent of the respondents to the WTP questions stated that an increase in egg price by the bid amount presented to them would result in an average reduction in their consumption of eggs of 18%. Assuming that the remaining respondents would not reduce their consumption of eggs due to a change in price, UK consumption of eggs is estimated to fall to around 5905 million per annum. In addition, around 80% of eggs currently

purchased are from battery-cage production systems. Thus, the proposed legislation would affect consumption of some 4724 million eggs per annum (393.6 million dozen eggs). Given a mean WTP of £0.41 per dozen eggs, the estimated benefit of the legislation would be approximately £161 million per annum. If the extreme assumption of zero WTP for the legislation for all non-responders to the survey is applied, and mean WTP is just £0.12 per dozen eggs, then the estimated benefit of the legislation falls to just over £48 million per annum.

This can be compared to an estimated cost of the legislation to producers of £466 million quoted by the Ministry of Agriculture, Fisheries and Food (MAFF)<sup>9</sup> in the UK (MAFF, 2001b). This estimate considers a 12-year adjustment period and includes both adjustment costs for the industry (capital costs of equipment and buildings replacement, etc.) and ongoing production costs due to the different production systems used, giving an average annual cost of around £39 million over the 12-year period. This MAFF estimate allows for the use of larger, 'enriched' cages by egg producers as well as barn and free-range systems and so provides an underestimate of the full costs of the legislation presented to respondents. Nonetheless, it gives some idea of the likely scale of the costs compared to the benefits estimated by the contingent valuation survey. This seems to suggest that the benefits of the proposed legislation outweigh the costs, even under the extreme assumption that non-responders to the survey had a zero WTP.

Although there is likely to be a net gain in welfare in the UK resulting from the implementation of the

EU battery-cage ban, the costs and benefits will not be spread evenly throughout society. Analysis of WTP by socio-economic group indicates that WTP is nearly twice as much amongst those with high incomes as compared to those with low incomes. The latter also buy more battery-cage eggs than those with high incomes (Corporate Intelligence, 1998). Thus, it appears that those benefiting most from the ban will be on higher incomes. The amount of the adjustment costs borne by consumers and/or battery egg producers will depend upon the pricing strategy of retailers. If egg prices rise significantly then consumers in the low-income group will face a net cost.

Legislation to protect and improve the welfare of farm animals is essential. The market cannot be left to safeguard animal welfare any more than it can be left to safeguard the environment (Mishan, 1993). Before implementing legislation it is important that some cost–benefit assessment is carried out. Contingent valuation is a useful technique for helping to assess the benefits of legislation, for example to improve hen welfare by phasing out the use of battery cages. Estimates of WTP from contingent valuation studies need to be treated with caution, however. It is important that such estimates are derived from carefully designed surveys and that the estimation method allows for various biases.

### Acknowledgements

We would like to thank the anonymous referees for their valuable comments and suggestions.

<sup>9</sup> Now the Department for Environment, Food and Rural Affairs.

**Appendix A. Specimen example of questionnaire**

All answers that you give will be treated **in strictest confidence**. Thank you for your help.

1. To what extent are you concerned that farm animals may be mistreated or that they may suffer in the process of producing our food and other agricultural products? Please circle

Very Concerned	Somewhat concerned	Neither concerned nor unconcerned	Not really concerned	Not at all concerned
-------------------	-----------------------	--------------------------------------	-------------------------	-------------------------

2. Do you purchase or avoid purchasing any particular farm animal products because of your concerns about the welfare of the animals involved?

YES NO

If YES, which products .....

3. To what extent are the following acceptable to you? Please score on a scale from 1 to 10 ranging from: **1 = Very unacceptable to 10 = Completely acceptable.**

**Score**

Veal production with calves kept in separate confined 'crates'. .....

Battery egg production where hens are kept in small wire cages. ....

Transport of farm animals for up to 24 hours  
(with food and water at 8 hr intervals) .....

4. Are you concerned about any other aspects of the treatment of farm animals? Please circle.

YES NO

If YES please briefly state which aspects .....

5. On average, how many eggs does your household purchase each week? .....

**Of this** roughly how many are: (1) battery-cage eggs? .....

(If you have no idea, please put "don't know") (2) barn or perchery eggs? .....

(3) free-range eggs? .....

6. How much would you estimate that your household spends on food in total Each week for consumption at home and in restaurants, take-aways etc.?

£.....

7. Of this, how much do you spend each week on meat, dairy products and eggs?

£.....

Most egg production in the European Union (EU) involves housing hens indoors in wire-meshed cages. Cage sizes vary but usually hold up to six hens with up to six levels of cages in a building. Because of the degree of confinement, birds commonly have difficulty in moving, for example, to stretch their wings, make a nest or display certain other 'natural' behaviours. Hens remain in these cages for about 12 months before they are slaughtered. Around 320 million hens are kept in this way in the EU (15 countries including the UK) and 32 million in the UK.

While considering your answers to the following questions, please bear in mind that **there may be many issues that you feel strongly about and, in principle, might be willing to pay something toward. However, your budget is limited and any payment toward one issue means that there is less money available to you to contribute to other issues or to buy the things that you would like to.**

Please imagine that the European Parliament is considering legislation to phase out the use of battery cages for egg production within the EU (including the UK) by the year 2005. From that date, no egg producer will be allowed to use battery cages to produce eggs. (Note that the legislation relates only to the use of battery cages and not directly to any other aspects of hen welfare). It is realised that this will involve some cost and that people in EU countries will ultimately have to pay in some way.

8. Would you support legislation which ensured that hens could no longer be kept in battery cages in the European Union from 2005? Please circle one only.

YES NO NO OPINION

9. Would you be willing to pay ...50... pence extra per dozen as a general increase in the current price of eggs so that battery egg production could be banned in the EU from the year 2005? (Note that eggs currently cost around £1-50 per dozen in the shops). Please circle.

YES NO NO OPINION

10. If you are willing to pay a higher price per dozen eggs, would this affect your consumption of eggs generally? Please circle.

YES NO

11. **IMPORTANT:** In order for us to interpret your responses correctly, **please briefly give your reasoning behind why you answered the way you have to the willingness to pay questions above.....**

.....

12. To what extent do the following statements reflect your own feelings with regards to the responses that you have given to the willingness to pay questions. Please score below on a scale from 1 to 10 ranging from: **1 = Not at all true of my feelings to 10 = Very true of my feelings.**

	Score
The willingness to pay questions required very careful thought.	.....
My willingness to pay is like a charitable donation to a worthy cause.	.....
My willingness to pay is not just for hen welfare but for farm animal welfare generally.	.....
Legislation is necessary to ensure that no hens are kept in battery cages.	.....
People should not have to pay more taxes to ban battery cages.	.....
My willingness to pay reflects my personal satisfaction from not consuming battery hens.	.....
My willingness to pay reflects the satisfaction I would get from knowing that others would not be reducing hen welfare by consuming battery eggs.	.....

13. What is the maximum you would be willing to pay in terms of a weekly increase in your household food bill (due to higher prices) to address all your farm animal welfare concerns?

.....

In order for us to see how representative of the general population our survey is, please answer the following questions **about yourself**. Please remember that this survey is **completely confidential**.

14. Are you? Please circle MALE FEMALE
15. What is your age? Please circle.  
 under 18 18-29 30-39 40-49 50-59 59-65 over 65
16. At what age did you finish full-time education? ..... years

17. What is your approximate average household income (before taxes) for 1994/95? Please circle.
- |            |            |            |            |            |
|------------|------------|------------|------------|------------|
| £0-£5,000  | £5-10,000  | £10-15,000 | £15-20,000 | £20-20,000 |
| £25-30,000 | £30-35,000 | £35-40,000 | £40-45,000 | £45-50,000 |
| £50-55,000 | £55,000 +  |            |            |            |
18. What is your occupation? (e.g. sales assistant, retired, student etc.).....
19. How many people in your household?
- ..... adults                      ..... children under 16

**Thank you for completing this questionnaire. Your help is much appreciated.**

**Please return your completed questionnaire using the Reply Paid envelope provided.**

## References

- Andreoni, J., 1990. Impure altruism and donations to public goods: a theory of warm glow giving. *The Econ. J.* 100, 464–477.
- Arrow, K., Solow, R., Portney, P.R., Leamer, E.E., Radner, R., Schuman, H., 1993. Report of the US National Oceanic and Atmospheric Administration Panel on Contingent Valuation. Resources for the Future, Washington, DC, 11 January.
- Bateman, I.J., Langford, I.H., Rasbash, J., 1999. Willingness-to-pay question format effects in contingent valuation studies. In: Bateman, I.J., Willis, K.G. (Eds.), *Valuing Environmental Preferences: Theory and Practice of the Contingent Valuation Method in the US, EU, and Developing Countries*. Oxford University press, Oxford, pp. 511–539.
- Bennett, R.M., 1995. The value of farm animal welfare. *J. Agric. Econ.* 46, 46–60.
- Bennett, R.M., Larson, D., 1996. Contingent valuation of the perceived benefits of farm animal welfare legislation: an exploratory survey. *J. Agric. Econ.* 47, 224–235.
- Bishop, R.C., Heberlein, T.A., 1979. Measuring values of extra-market goods: are indirect methods biased? *Am. J. Agric. Econ.* 61, 926–930.
- Broome, D.M., 1998. Relationships between farmers' attitudes, retailers' actions, legislation and welfare research. In: *Proceedings of the Paper Given at the International Society for Applied Ethology Winter Meeting, 2 December 1998*. Royal Veterinary College, London.
- CACI, 1993. ACORN User Guide. CACI Ltd., London.
- Cameron, T.A., 1988. A new paradigm for valuing non-market goods using referendum data: maximum likelihood estimation by censored logistic regression. *J. Environ. Econ. Manage.* 27, 218–234.
- Carson, R.T., 2000. Contingent valuation: a user's guide. *Environ. Sci. Technol.* 34, 1413–1418.
- Carson, R.T., Mitchell, R.C., 1995. Sequencing and nesting in contingent valuation surveys. *J. Environ. Econ. Manage.* 28, 155–173.
- Carson, R.T., Flores, N.E., Meade, N.F., 2000a. Contingent Valuation: Controversy and Evidence. Discussion Paper 96-36R. University of California, San Diego, USA.
- Carson, R.T., Groves, T., Machina, M.J., 2000b. Incentive and Information Properties of Preference Questions. Department of Economics. University of California, San Diego, USA, p. 508. <http://www.econ.ucsd.edu/rcarson/cgm>.
- CIWF, Compassion in World Farming, 2002. <http://www.ciwf.co.uk/Pubs/Briefings/BR6303.htm>.
- Corporate Intelligence, 1998. Market Survey. 2. Eggs. Retail Business 479, 33–56.
- Eurogroup, 2002. <http://www.eurogroupanimalwelfare.org/>.
- Fearne, A., Lavelle, D., 1996. Segmenting the UK egg market: results of a survey of consumers attitudes and perceptions. *Brit. Food J.* 98, 7–12.
- Harper, G.C., Henson, S.J., 2001. The Extent of Consumer Concerns about Animal Welfare—The Comparative Representative Sample Survey. Centre for Food Economics Research, The University of Reading, UK.
- Hanemann, M., Kanninen, B., 1999. The statistical analysis of discrete-response CV data. In: Bateman, I.J., Willis, K.G. (Eds.), *Valuing Environmental Preferences: Theory and Practice of the*

- Contingent Valuation Method in the US, EU, and Developing Countries. Oxford University press, Oxford, pp. 302–441.
- Hanemann, M., Loomis, J., Kanninen, B., 1991. Statistical efficiency of double-bounded dichotomous choice contingent valuation. *Am. J. Agric. Econ.* 73, 1255–1263.
- Kahneman, D., Knetsch, J.L., 1992. Valuing public goods: the purchase of moral satisfaction. *J. Environ. Econ. Manage.* 22, 57–70.
- King, A., 1995. Sorry, But in the End We Will Eat You. *The Daily Telegraph*, 21 August, p. 4.
- Market and Opinion Research International Ltd., 1999. Polls and Surveys. <http://www.mori.com/polls/1998/eurogrup.htm>.
- McInerney, J.P., 1993. Animal welfare: an economic perspective. In: *Proceedings of the Paper Presented at the Agricultural Economics Society Conference*, Oxford, UK.
- MAFF, 2001a. Index of Statistics. Eggs. [http://www.maff.gov.uk/esg/m\\_index.htm](http://www.maff.gov.uk/esg/m_index.htm).
- MAFF, 2001b. The Welfare of Farmed Animals (England) Amendment Regulations 2001—Partial Regulatory Impact Assessment. Ministry of Agriculture, Fisheries and Food, London.
- Mishan, E.J., 1993. Economists versus the Greens: an exposition and critique. *The Pol. Q.* 64, 222–242.
- Mitchell, R.C., Carson, R.T., 1989. *Using Surveys to Value Public Goods: the Contingent Valuation Method*. Resources for the Future. Washington, DC, 463 pp.
- Morris, L., 1996. *The Ethical Consumer: A New Force in the Food Sector?* Leatherhead Research Association, Leatherhead, UK.
- PETA, People for the Ethical Treatment of Animals, 2002. <http://www.peta.org/>.
- SAS Procedures Guide, 2000. Version 8, vol. 1 and 2. SAS Institute Inc. Cary, NC, USA.
- Thistlethwaite, P.C., Finlay, J., 1993. The impact of selected mail response enhancement techniques on surveys of the mature market: some new evidence. *J. Professional Serv. Market.* 8, 269–276.
- Wilkins, D.B. (Ed.), 1999. *Animal Welfare in Europe. European Legislation and Concerns*. Kluwer Law International, London, 423 pp.