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Estimation of the value the public places on regulations to improve broiler welfare

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Abstract

Animal welfare presents particular policy challenges. Good welfare provides private productivity benefits to producers and some level of positive external benefit to people who care about animal welfare status. But markets for welfare fail, meaning that private producers are unlikely to provide the correct level of external benefit and social welfare will not be maximised. Accordingly, there is a rationale for government to be involved in the provision of animal welfare. The public good nature of animal welfare supply presents policy challenges for government regulators. Specifically, in setting regulatory targets, Defra, as the regulator, aims to maximise social welfare by designing regulation that delivers benefits that are at least equal to regulatory costs at the margin. This means that regulatory targets must be informed by some assessment of benefits of welfare policies. This paper considers this problem in the context of the proposed EU Directive on broiler welfare. The paper describes the application of the contingent valuation method to measure the economic benefits of broiler welfare, and considers how the results inform welfare target setting.

Keywords: *animal welfare, broiler welfare, contingent valuation, economic valuation, non-market valuation, regulatory standards*

Introduction

In setting regulatory targets for any sector, government policy is typically guided by a number of criteria, including the need for economic efficiency. In this regard, animal welfare is no different, and welfare policy must attempt to deliver marginal social benefits at least equal to the marginal cost of their delivery. This objective necessarily requires analysts to consider both the supply (cost) and the demand (value or willingness to pay) for welfare, which in turn presents challenges related to the limited extent to which the market facilitates transactions in, and therefore reveals the value of welfare. In essence, while the supply costs of welfare might be known, few suppliers provide welfare as anything other than an incidental spillover (or externality) to private productivity objectives. The reason for this is largely because of the public good nature of the welfare externality, see McInerney (1993) and Bennett (1995) for fuller discussions of these aspects of the economics of animal welfare. If any farmer provides welfare, then he or she cannot exclude others from consuming it in a passive way. The limited ability to capture revenue from such free-riding behaviour therefore undermines the supply incentive. On the demand side, individual consumers cannot easily transact with producers for individual-specific levels of welfare, or, by extension, express their willingness to pay. Were they to occur, such individual arrangements would incur significant costs in terms of time and effort to broker. In aggregate, such transactions costs would end, representing a significant cost to society. Concerned consumers can then only transact or express their willingness to pay through the route of welfare-friendly niche products. Even then, only a subset of consumers would express value in this way. Many other consumers who do not buy animal products, may nevertheless have preferences over welfare standards that are not expressed in market transactions. Making policy on this limited market demand evidence would therefore understate the true welfare effects of good animal welfare policies.

These demand and supply problems mean that markets fail to deliver any optimal level of welfare. Governments cannot easily observe any optimal point for regulation and must therefore seek information to approximate a second-best target. This paper considers this problem in the context of the EU Broiler Welfare Directive and its transposition onto the poultry industry in England. Specifically, the paper considers the demand for welfare and employs a stated preference method to measure the public's willingness to pay (WTP) for welfare improvement. This benefit information is then considered alongside cost information when considering regulatory efficiency.

In the next section, the issue of market failure is discussed in relation to regulatory target setting. This section is followed by details of the EU Broiler Welfare Directive and the regulatory changes that are the subject of the contingent valuation exercise. This exercise is then explained before the presentation of results. The final section offers remarks and conclusions.

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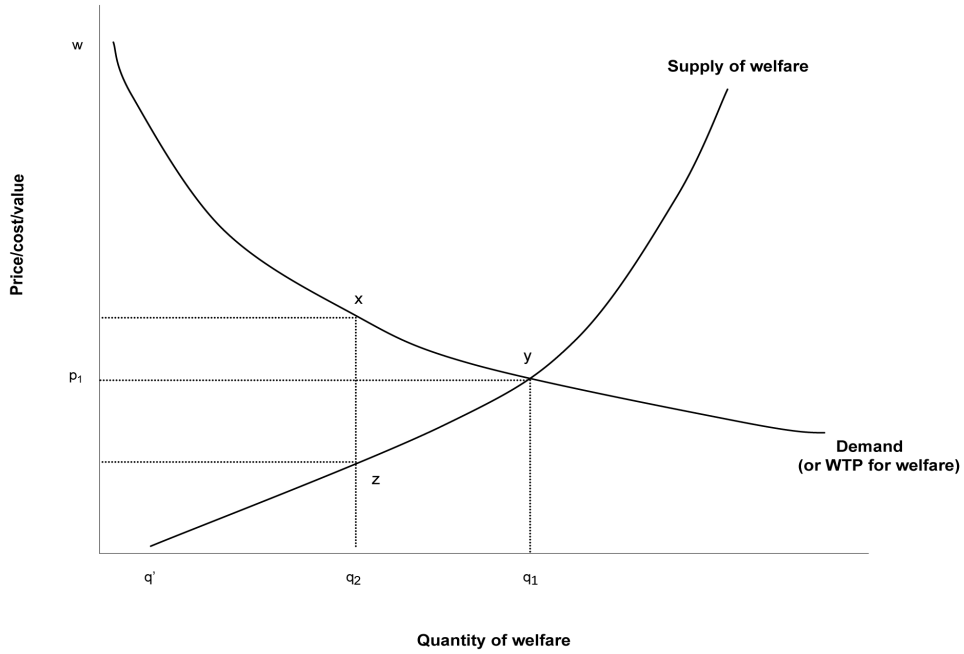
Figure 1

Optimal target setting for welfare.



Regulatory cost-benefit analysis

In theory, socially optimal regulation delivers welfare to the point where the marginal cost and benefit of welfare are equalised. Recall that the costs and benefits in question will notionally consist of private costs (ie those incurred by producers) plus social benefits (ie the spillover or external benefit to wider society). From a social perspective of improving social welfare, the public/private distinction is less important than the overall level of well-being.

Figure 1 shows this position at q1 as the intersection of the upwardly (left to right) sloping supply curve (for welfare), and the downward-sloping demand function. The supply curve is drawn this way to reflect the fact that at low levels of welfare, improvements can most likely be delivered at near zero cost. At some point, the cost of the next (marginal) unit becomes positive; thereafter increasing at faster rate until it is conceivable to think of a flock or herd deriving no welfare from the last unit of spending. The supply or marginal cost function therefore typically demonstrates diminishing marginal returns.

On the demand side, welfare, if it behaves like other goods, and provided some consumers are aware of welfare conditions, will be subject to diminishing marginal utility. That is, consumers, or society as a whole, derives high welfare value or is willing to pay high amounts for initial levels of welfare. But higher levels of welfare spending deliver decreasing marginal levels of utility.

The notional intersection q1, suggests that there is a welfare level at which the marginal supply and demand are equalised. In other words, at that level, the public willingness to pay (or value) of that last unit of supply is exactly equal to its cost. In theory, this is the socially optimal or target level of regulation. A regulatory standard set to the left is inefficient because welfare levels will, at the margin, be delivering benefits greater than supply costs; it pays society to move to the right since every extra unit of welfare cost will be outweighed by social benefit up to the optimum point. Consider an arbitrary welfare standard at q2 for example. At this point demand or willingness to pay for welfare exceeds supply cost by distance xz. By setting a standard at that level, the regulator is sanctioning a social welfare loss equivalent to area xyz. Correspondingly, a point to the right of the optimum level would incur costs greater than benefits delivered to society.

But of course the location and shape of both functions is theoretical. While some approximation of a supply cost function is observable, the demand function, which bounds the total economic value of welfare, is not. True willingness to pay is not expressed in market transactions for welfare-friendly products. In theory, the one way to estimate total value is through stated preferences. Stated preference methods such as contingent valuation can be used to elicit willingness to pay directly.

Proposed EU Broiler Welfare Directive

The European Union is currently in the process of developing proposals to introduce minimum standards for chicken welfare, which would include legislation on 'stocking density' (bird weight per unit area) for birds kept for meat production. The proposed density requirements are potentially lower than those used by some UK producers and the proposal therefore represents a potential increase in the regulatory compliance cost for the industry.

Government is aware of the potential regulatory burden and conducts regulatory impact assessments (RIA) of new regulations. RIA attempts an impartial report on the total costs incurred by both the private and public sectors of complying

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with agency regulations. In transposing the EU Directive, Defra is still mindful of the need to negotiate a form of the Directive that is economically efficient. Good regulatory practice should normally attempt to balance benefits and costs or to deliver outcomes that deliver net benefits to society. The latter is measured by considering the total of private and public costs and benefits that might accrue to a regulatory change.

The proposed Directive states that the stocking density of chickens should not exceed 30 kg m^{-2}. In addition there are standards laid down for: drinkers; feeding; litter; ventilation and heating; noise; light; inspection; cleaning; record keeping and surgical interventions.

Derogation is available for establishments to use stocking densities of up to a maximum of 38 kg m^{-2} subject to more rigorous requirements for documentation relating to production; environmental quality (air quality, temperature, relative humidity); and record keeping. Additionally, for establishments using stocking densities above 30 kg m^{-2} there would be inspections of both the establishment, to ensure compliance with the Directive, and of the chickens at the slaughterhouse. The slaughterhouse monitoring would record levels of mortality and also score the degree of foot pad dermatitis amongst each flock. Both of these are considered to be useful indicators of the existence of wider welfare problems. Failure to meet these standards would result in a requirement to identify and eliminate the likely cause of such failures. Continuing failures could result in a requirement to reduce stocking density to some level between 30 and 38 kg m^{-2} considered adequate to correct the failure.

In considering the exact permutation to use in regulating the industry in England, Defra can draw on a limited amount of scientific evidence. The science on broiler welfare suggests conflicting evidence on stocking density and outcome measures such as footpad lesions. Dawkins *et al* (2004) conducted one of the most extensive appraisals to date into the effect of stocking density on chicken welfare. Based on 2.7 million birds and the involvement of ten major chicken producers, they concluded that differences in the environment within the poultry building had more impact on the welfare of the chicken than had stocking density itself. This conclusion is consistent with the findings from an earlier study conducted in France and reported by Martrenchar *et al* (2002). These authors assessed the risk factors for footpad dermatitis in chicken and turkeys.

It seems, therefore, that high stocking densities tend only to contribute to increased leg disorders and other health problems when environmental variables are not carefully controlled (see Scientific Committee on Animal Health and Welfare 2000 for a summary). The derivation of a notional welfare-density trade-off function may therefore be more complex if there are in fact more than two dimensions. Such information is relevant to the hypothetical welfare scenarios used to generate the economic evidence base. Ahead of transposing this regulation, and as part of the RIA process for England, Defra wished to ascertain whether there is a net social gain delivered by the EU recommendations. That is, whether, scientifically valid interventions actually result in an increase in social value.

Stated preference (SP) methods

Recognising the need for better evidence on the economic benefits of animal welfare, economic researchers have considered the merits of revealed versus stated preference methods for measuring non-market impacts. These methods have been applied more commonly to measure the value of environmental changes. Revealed methods are limited to observations on consumer behaviour in markets where welfare may be transacted. As previously noted, there are several reasons why these markets are incomplete (see for example, Harper & Henson 2001). Reliance on revealed preference data therefore most likely underestimates the true economic value of welfare interventions.

In recent years different SP methods have been developed to value non-market impacts. SP methods are based on hypothetical markets rather than the observation of consumer behaviour. Different SP variants have been tested in the UK. Bennett (1998) undertook a contingent valuation study of UK households in which respondents were asked to state their willingness to pay (WTP) to support legislation to phase out cage egg production in the EU by 2005. Glass *et al* (1999) took a more comprehensive approach in a study looking at willingness to pay for improvements in pig welfare in Northern Ireland. Burgess *et al* (2001) also used contingent valuation, as well as paired comparisons, to elicit preference for improved welfare across a number of species/systems, again from respondents in Northern Ireland.

SP methods commonly present a sample of respondents with a policy scenario which in this case will describe the welfare change in terms of input and output measures. Respondents are asked to consider the change and to state their value for having the policy option. In theory this allows researchers to elicit a total economic value for the proposed change. This welfare statement need not bear a relation to any related market good, or be affected by whether the individual subsequently participates in any market related to the welfare attribute in question. This last point is an important one, and something that has not been spelled out clearly in response to criticism of previous attempts to apply stated preference methods to welfare scenarios. Namely, the common criticism of SP results is that welfare statements do not look 'credible' relative to a reasonable market price. But the method is not necessarily trying to mimic any actual product market or purchase decision. Any respondent can have preferences over the policy being proposed, and their WTP need not reflect any intention to buy a related product or be similar to the prevailing market price for a related good. The only reasonable constraint is that an individuals' WTP be constrained by their income and in relation to other things that they can reasonably be expected to be buying other than animal welfare. The confusion often arises because some studies attempt to introduce credibility into their hypothetical scenario by using a market good as the payment vehicle for

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Table 1 Contingent valuation policy scenario.

There is currently a proposed European Directive that aims to improve the welfare of meat chickens, this will:
• Limit stocking density to 30 kilograms per square metre, or 13 or 14 birds.
• Higher stocking densities up to 38 kilograms per square metre, or 17 or 18 birds, will be allowed only if they comply with strict standards on:
– assessment of their production sites and staff training, and
– strict monitoring of welfare indicators including foot pad dermatitis and death rates.
• The Directive also improves the provision of light and dark and ventilation.
• Official inspectors will undertake inspections of meat chicken farms to ensure compliance with the revised welfare standards.
• Further inspections will also take place at the time of slaughter. Inspectors will look for two things:
– The number of chickens that died during production and transport will be recorded. Excessive numbers of deaths indicates that there are welfare problems on the farm where the chickens were produced, or in the conditions during transport.
– The amount of foot pad dermatitis will be assessed.
• In both cases chicken producers will be notified if a welfare problem exists, and will be required to identify the cause of the problem and rectify it.
• Unlike current practices the inspection regime would be legally enforceable.
• If welfare problems continue, producers will be required to reduce stocking density to a level where unacceptable levels of mortality or foot pad lesions do not occur.

the welfare increment, eg how much more would you be willing to pay for laying hen welfare in terms of an increment on egg prices? This attempt to add credibility to the hypothetical scenario is often misinterpreted by commentators to mean that the resulting state preferences should correspond with market prices of the associated goods. In actual fact, there is no reason why a respondent's general value of welfare associated with a specific policy should necessarily bear any correspondence with the price of a market good. Equally, if possible, an appropriate payment vehicle should reflect the social nature of welfare improvement. If welfare is a pure public good then the appropriate vehicle is general income tax.

An application to the EU Broiler Directive

To inform government decision-making a contingent valuation survey was designed to elicit stated preferences for the provisions of the EU Directive. As part of the study design, two focus groups were held in July 2005 with the aim of determining the level of public awareness of broiler production. The groups served to highlight the generally low level of awareness amongst the general public and therefore the necessary design criteria to include in setting up a credible hypothetical market to value the change.

The contingent valuation survey sought to elicit willingness to pay additional annual taxation for the welfare changes implied by the introduction of the Directive as described in Table 1. The standard survey format for CVM questionnaires included a section on general attitudinal questions, followed by more specific questions on welfare-related issues. The information in Table 1 formed part of a larger policy choice scenario that included photographic information on output measures (ie foot pad dermatitis) and culminated in the respondent having the choice to accept or reject a policy change to deliver benefits described (full details of the survey plus photographic show cards are available from the authors). The specific payment question used a closed-ended variant, the wording of which is as follows:

> "Imagine that the only way of providing this welfare policy of improved housing conditions and an inspection regime was through an increase in annual taxation paid by all households including yours. Any increase in taxation would only be used to pay for this welfare policy.
>
> I want you to think about how important this change is to you relative to all other things your household can spend money on. You should also consider that there are other animal welfare issues that the government can spend money addressing.
>
> Suppose that the cost of providing the welfare policy has been estimated as equivalent to additional taxation of £1.50 each year per household. If this was the cost that all households had to pay in order to ensure continued provision of the welfare policy, would you be willing to pay this amount?"

A double-bounded dichotomous format was used in which respondents were offered an initial payment amount (bid), if that bid was accepted then a second higher bid was offered. If the initial bid was rejected then a lower second bid was offered.

The survey used six starting bid levels, which were allocated over the respondent sample roughly mimicking a log-normal distribution. In other words, each respondent faced one of the six bid values to start the WTP question process.

A pilot survey of 55 respondents was undertaken to determine whether the range of bids adequately covered the willingness to pay distribution, which was initially informed from evidence from a Eurobarometer survey (Eurobarometer 2005). Analysis of the pilot survey indicated that the highest initial bid level was being accepted on two-thirds of the occasions it was offered. This potentially created a problem with estimating the expected mean WTP. Consequently the initial bid range was increased for the main survey of 318 respondents stratified

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Table 2 Contingent valuation pilot amd main survey did levels.

Pilot survey			Main survey		
Initial bid	**Second higher bid**	**Second lower bid**	**Initial bid**	**Second higher bid**	**Second lower bid**
1	1.50	0.75	1.50	2	1
2	3	1.50	3	4	2
4	6	3	6	8	4
8	12	6	12	16	8
16	24	12	24	32	16
32	48	24	48	64	32

Table 3 Sample summary statistics.

	Frequency	**Percent**
Gender		
Male	104	32.7
Female	214	67.3
Age		
16–24	50	15.7
25–34	59	18.6
35–44	57	17.9
45–54	70	22.0
55–64	48	15.1
65–74	25	7.9
75+	8	2.5
Refused	1	0.3
Social grade		
AB	67	21.1
C1	99	31.1
C2	55	17.3
DE	92	28.9
Refused	5	1.6

according to age and social grade. The bid levels for both pilot and main CV surveys are presented in Table 2. Summary descriptive statistics for gender, age and social grade of the sample are presented in Table 3. As can be seen approximately two-thirds of respondents were female. But this is not of concern as the sampling point was the household and subsequent regression analysis can typically test for the influence of respondent gender on WTP.

Surveys were administered by a market research company using face-to-face interviews conducted in the respondents' homes.

Analytical method for closed-ended data

The survey respondents were faced with one policy scenario that they were asked to accept or reject. These responses generate a dependent variable that is binary categorical (1 = yes; 0 = no). A suitable regression method such as a logistic can then be used to relate these responses to a number of variables that describe the respondent and, importantly, the amount of money (or bid value) they were asked to consider. This model needs to be probabilistic; ie be capable of generating predictions in the 1/0 space. The coefficients of the predicted model can then used to derive the mean or median mean willingness to pay.

While the use of the logistic regression is common in the life sciences, Hanemann (1984) suggested that its use in modelling CV data needs to be consistent with the economic theory of choice. Specifically, this could be reflected in the functional form given to the predictors (or index function) in the logistic model, which should be consistent with a correct form of the utility function that economists use to describe choice. The analytics of this is described in Bateman *et al* (2004).

The utility-theoretic framework uses an indirect utility function to depict the choice decision; a 'yes' response to the DC question "are you willing to pay £A?" reveals equation one:

$$v(1,Y–A;S) + \varepsilon_1 > v(0,Y;S) + \varepsilon_0$$

In other words, the utility on the left-hand side (having the good ie increased welfare = 1, but WTP amount A of income Y) is greater than the right-hand side (not having the good and keeping full income Y). Note that S is a vector of socio-economic characteristics of respondents, and that the reason some people make the choice either way is essentially uncertain. In this framework the decision between these options is represented with a random component which is represented by the distributional assumption chosen for the link function in the logistic regression.

Using common economic notion this can be expressed as equation two:

$$v(1,Y–A;S) – v(0,Y;S) > \varepsilon_0 – \varepsilon_1$$

In other words, the random WTP probability depends on a utility difference part or index function (ΔV) and a stochastic error link function component represented by some distribution function $F\eta$, where $\eta = \varepsilon_0 – \varepsilon_1$. In parametric analysis, if the latter is assumed to be logistically distributed (and using the cumulative form), yields a common logit model wherein the probability of an event taking place (in this case a WTP = yes response or P_{yes}), is monotonically linked to the selected utility difference index function, which can be given a range of forms to accommodate the supposed form of the utility function as seen in equation three:

$$P_{yes} = (1 + e^{-\Delta V})^{-1}$$

Alternatively $P_{yes} = F\eta\ (\Delta V)$ and $P_{no} = 1 – P_{yes}$

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Table 4 Consumption frequencies.

	Weekly or more	Every 2 weeks	Once a month	Once every 3 months	Rarely/only on special occasions	Never	Don't know
Type of meat							
Beef	34.0	21.4	12.6	6.6	11.0	14.2	0.3
Lamb or mutton	17.9	16.7	19.5	10.7	16.4	18.6	0.3
Pork and bacon	50.6	20.8	9.7	4.1	3.5	11.3	0.0
Chicken	70.1	15.1	6.3	1.9	1.9	4.7	0.0
Other poultry	8.5	8.2	10.7	6.3	44.3	20.1	1.9
Type of chicken							
Whole chicken	24.2	21.7	19.5	7.2	11.6	14.5	1.3
Chicken portions	58.2	19.2	7.9	2.8	3.1	7.9	0.9
Processed chicken	21.4	16.0	11.3	3.8	10.1	36.2	1.3
Free range	21.7	6.9	11.0	2.2	12.3	29.6	11.6
Organic	6.3	3.1	8.8	1.3	13.8	52.2	9.7

Different functional forms (eg linear or log) can be assumed for the utility difference part of the model with some debate about the interpretation of the welfare measures predicted by these forms (Boyle *et al* 1988; Johansson *et al* 1989). Assuming a linear utility difference, the simplest logit model requires the estimation of the alpha intercept and beta (coefficient on the bid variable) in equation four:

$$P_{yes} = 1/1 + e^{-\alpha + \beta A}$$

The mean WTP can then be shown to be equal to alpha/beta (Hanemann 1984). Confidence intervals can be estimated from bootstrapping off the standard errors.

Results

Table 4 presents the frequencies of consumption for different types of meat and also different types of chicken. As can be seen, 70% of respondents consumed chicken meat on a weekly basis, with 58% consuming chicken portions on a weekly basis. A subsequent question revealed a convenience attribute in that 91 and 87% of respondents agreed that they purchased chicken because it was versatile or quick and easy to cook. Healthiness and value for money were also reasons noted by a high percentage of respondents for purchasing chicken, 80 and 78% respectively. However, price was only important for 38% of respondents. The 22% of respondents who said they consumed free-range chicken on a weekly basis may seem overly high, and could be suggestive of some confusion between consuming chicken meat and eggs on the part of some respondents.

Table 5 presents the responses to questions regarding animal welfare in general and broiler welfare in particular. Animal welfare is of concern to three-quarters of respondents, although knowledge of production systems and the effect of this concern on purchase decisions is lower at around 50%. Indeed, only 38% of respondents look for production information on product labels, whilst 23% agreed that such information was easy to find. A further question asked respondents to rank those responsible for broiler welfare. Farmers were ranked first most frequently, followed by government then supermarkets, with consumers ranked least responsible most frequently. Somewhat contradictory to this is the agreement of 58% of respondents that buying higher welfare meat has a positive impact on animal welfare. These responses serve to illustrate the dissonance between consumers' stated concern about animal welfare and its translation into purchasing activity, which highlights the public good nature of welfare regulations.

The closed-ended WTP question was framed in terms of an overall increase in household taxation to pay for the change. The yes/no responses provide several options for deriving mean WTP and for checking the statistical validity of the responses using multivariate regression. Zero WTP responses were recorded for 39.5% of the sample. The reasons why respondents did not accept any of the bid levels were then probed to determine whether their response could be classified as either a genuine zero or protest bid. Genuine zero bids include respondents who stated that they were unable to afford the bid levels offered to them or did not consider broiler welfare to be important, 45% of zero responses (18% of the sample) were classified as genuine zero and included in the analysis of WTP. Protest bids occur in cases where respondents object to the payment vehicle or simply do not feel responsible for broiler welfare. These respondents may well have an underlying value for welfare changes, but these are not revealed by the particular means of inquiry. In our sample, these accounted for 55% of the zero responses (22% of the sample). In contrast to genuine zeros, protest bids are typically excluded from further analysis. With respect to the differences between respondents stating a non-zero WTP and genuine zeros, there was a greater representation of respondents from higher social grade (A, B and C1) and higher income groups amongst the non-zero WTP respondents.

Table 6 reports mean results from the single-bounded and double-bounded (DB) models; the latter being an extension of the single bid estimation process

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Table 5 Responses to statements regarding animal welfare.

	Disagree	Neither/nor	Agree	Don't know
I am concerned about farm animal welfare	9.7	16.4	73.0	0.9
I am aware of how all the meat I eat is produced	34.6	13.8	45.3	6.3
I am concerned about chicken meat welfare	10.4	14.5	73.3	1.9
I am aware of how chicken meat is produced	28.9	17.0	50.6	3.5
Concern for animal welfare affects my purchase decisions	29.6	19.2	49.1	2.2
I look for information on how chicken is produced on labels	44.7	16.0	38.4	0.9
Information about how chicken is produced is easy to find on labels	46.2	21.4	22.6	9.7
Buying higher welfare meat has a positive impact on the welfare of animals	11.9	17.3	58.2	12.6
Meat from higher welfare chicken is healthier for me	11.9	22.0	50.3	15.7
Meat from higher welfare chicken tastes better	7.9	23.9	51.3	17.0
Meat from higher welfare chicken is too expensive	16.4	24.2	45.0	14.5

Table 6 Results of unrestricted, double-bounded estimate of annual household willingness to pay.

	Per household (£ per annum)	Aggregate (£ per annum)
Mean WTP	7.53	158.13
Median WTP	7.49	157.29
Lower 95% CL	5.33	111.93
Upper 95% CL	9.94	208.74

(Hanemann *et al* 1991). The DB provided the most conservative mean WTP and the tightest confidence interval. Implicitly, the ability to reject offered bids twice provides a downward bias on the willingness to pay distribution relative to an estimator based on one rejection opportunity. The bid variable was highly significant in both specifications. The WTP estimates can be used to estimate the aggregate value of the welfare policy. For the contingent valuation study the WTP estimates are per household per year. The aggregate value of the policy change for England can therefore be calculated by multiplication of the WTP estimates by the number of households, approximately 21 million (Office for National Statistics 2005), also presented in Table 6, gives a conservative estimate of £158 million.

As a validity test, Table 7 details a multivariate regression of further explanatory variables on the WTP (1/0) dependent variable. Beyond the all-important bid variable, other significant variables were educational level, whether the respondent consumes free-range chicken, whether the respondent accepts consumer responsibility for welfare and whether they had seen any media broadcast on welfare issues in the last three months. Income was not included because 43% of the sample refused to, or were unable to state their household income.

The predicted bid function is presented in Figure 2, this indicates the probability of accepting each of the bid levels, the median WTP being the level at which probability of acceptance is 0.5. The function is calculated across the range of bid levels by entering the estimated coefficients (alpha and beta) into the binary logit function (equation 4). It is then possible to vary the bid range values (A) to plot the associated probabilities of acceptance for any bid level. The shape of this function provides a basic indicator of response sensitivity to bid levels.

It is possible to investigate the WTP for different subgroups of the data, and the most policy-relevant groups are those on lower incomes and people who do not eat meat. Social grade did not seem to be significant in Table 7, although it would be of some interest to partition this data set to see if this holds for subgroups.

There are several income sub-groups in the data, but a problem in estimating the mean for each is that the number of data points in some groups is extremely low. In the case of income groupings this is exacerbated by the fact that a percentage of respondents were unwilling to indicate an income group. Moreover, our sample only contained a small percentage of those who did not eat meat. This lack of datapoints would greatly reduce the reliability of the estimation process used here, and instead, we decided to make one partition of the data based on social grade, which is a proxy for income. We therefore estimated the mean WTP for respondents in social grades A, B and C1, and a mean for all other groups combined. Table 8 shows that there is a significant difference between the mean estimates of the respective groups. These results are as would be expected as social grade can be considered a reasonable proxy for ability to pay.

Comparing costs and benefits

Sheppard and Edge (2005) have considered the possible cost implications of the proposed EU Directive on the broiler industry. Their results allow us to undertake a cost-benefit analysis to determine whether the benefits of regulation exceed the likely costs. Based on a survey of broiler producers, Sheppard and Edge estimated the costs to the industry for both a 'worst case' scenario of all broiler production reducing stocking density to 30 kg m^{-2} and for compliance with the maximum of 38 kg m^{-2}. Twenty per cent of producers responding to the survey stated that they currently operate at stocking densities above 38 kg m^{-2}.

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Table 7 Binary logit analysis of contingent valuation first bid response with covariates.

	Coefficient	t-statistic
Constant	*–0.870*	*1.17*
Initial bid level	–0.055*	–3.929
Eats whole chicken regularly (dummy)	0.311	1.119
Eats chicken portions regularly (dummy)	0.064	0.195
Eats free-range chicken regularly (dummy)	0.813*	2.479
Eats organic chicken regularly (dummy)	0.875	1.449
Has seen or heard a media report on animal welfare in past three months	0.585**	1.950
Is concerned about chicken welfare	0.361	1.135
Is aware about chicken production	0.404	1.351
Ranks consumers as most responsible for animal welfare	2.701*	2.365
Male (dummy)	–0.006	–0.019
Age	–0.103	–1.170
Social grade A, B or C1	0.322	1.134
Household size	–0.136	–1.162
Weekly spending on food	–0.001	–0.009
Frequency that respondents buys food for household	0.222	1.298
Highest educational attainment	0.259*	2.355

n = 318. * Significant at the 5% level, ** Significant at the 10% level. –2 log likelihood = 349.426. Model chi-squared = 70.111, df = 16 (significance = 0.00). Adjusted ρ^2 = 0.275.
The adjusted ρ^2 figures are a goodness of fit measure based on the comparison of the log likelihoods of the estimated model and a model with no parameters adjusted for the number of variables in the model. It is not a percentage explained measure in a way that would be analogous to the R^2, for least squares regression. However ρ^2 figures between 0.2 and 0.4 can be considered equivalent to R^2 figures of between 0.7 and 0.9 (Louviere *et al* 2000).

Figure 2

Contingent valuation bid function for first bid.

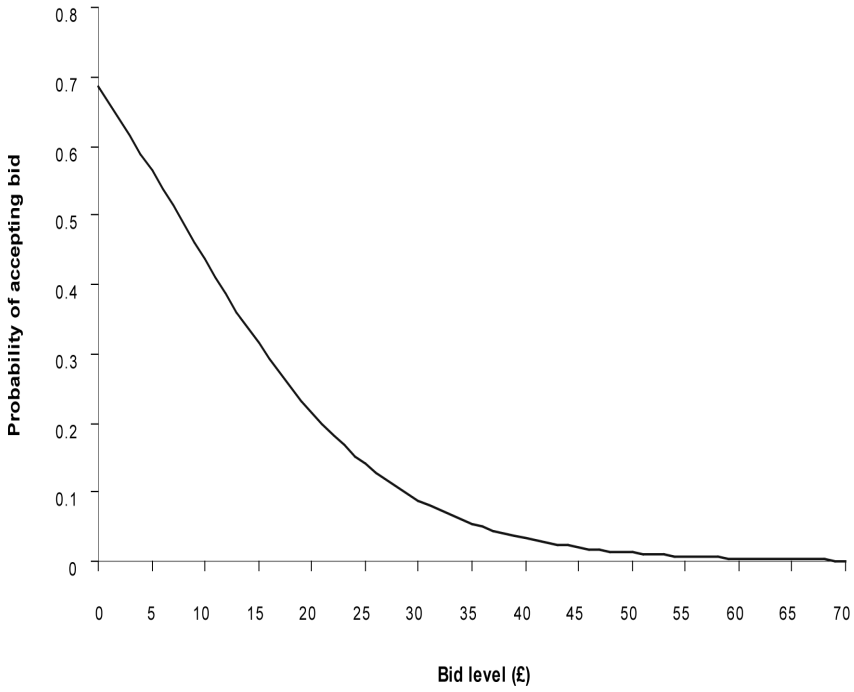

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Table 8 WTP estimates based on sample partitioned by social grade.

	Social grades A, B & C1 per household WTP (£ per annum)	Other social groups WTP (£ per annum)
Mean WTP	11.09	4.70
Median WTP	11.13	4.72
Lower 95% CL	7.52	1.89
Upper 95% CL	16.28	7.32

Table 9 Estimated costs and benefits of proposed EU Directive.

	Production costs (£m)	Annualised capital costs (£m)*	Total costs (£m)	Aggregate benefits (£m)	Benefit/cost ratio
Worst case scenario					
5 years	41	40.5	81.5	158.3	1.9
10 years		23.3	64.3		2.5
Reduce to 38 kg m^{-2}					
5 years	7.3	5.4	12.7		12.5
10 years		3.1	10.4		15.2

* Assumes capital borrowed at 6% interest rate.

Under the 'worst case' scenario production costs would increase by an estimated £41m annually, and capital costs of £171m would be incurred to maintain production at current levels. Moving to a maximum stocking density of 38 kg m^{-2}, and maintaining production levels would cost £7.3m annually and £22.6m for production and capital costs respectively. Table 9 summarises these costs, with capital costs annualised over both 5 and 10 years, together with estimated annual benefits and benefit/cost ratios.

The comparison of costs and benefits indicates that even in the 'worst case' scenario the benefits are almost double the estimated costs. This can be illustrated theoretically in Figure 1; in theory, government seeks to implement the Directive efficiently such that welfare increases from q2 to q1. The increased benefit to society is represented by the area under the demand curve, xyq1q2, whilst the cost to the industry is represented by the area under the supply curve, zyq1q2.

It should be noted that the cost-benefit analysis does not proceed to consider the mechanisms by which producers can be compensated for the additional costs they face for complying with the Directive. This is a typical abstraction in cost-benefit analysis, which essentially indicates a state of the world where overall social benefits are increased and everyone could be potentially better off. But it stops short of determining how the gainers can actually compensate the losers.

It is also not clear how the inspection regime associated with the higher stocking density of 38 kg m^{-2} will be funded. The estimated 'worst case' scenario costs of up to £81.5m represent 3.6% of the UK retail chicken meat market of £2.24bn in 2002 (Mintel 2004), indicating that there is scope for increased prices. However, it should be remembered that increasing prices would result in reduced consumption. Defra (2001) estimated that the own price elasticity of chicken ranged from –0.52 to –0.77, indicating that for every 1% increase in price, consumption would fall by between 0.52 and 0.77%. Furthermore, all products are subject to cross-price elasticities. This means that as the price of chicken increases relative to the price of substitute goods (for example, beef or free-range chicken) then again consumption would fall. As the CVM estimated the social benefits of the welfare improvement then there is justification for public money to provide some level of compensation.

Conclusion

The contingent valuation exercise in this study has attempted to quantify public preferences for broiler welfare improvements implied by the proposed EU Directive. Although it would not be appropriate to anchor the mean estimate on market evidence of purchases of higher welfare chicken (free-range or organic), the figure of £7.53 per household per year is not excessive relative to the price of other welfare-friendly products. The aggregated benefit of £158 million for households in England indicates that the societal benefits of improved broiler welfare are substantial. This aggregate benefit exceeds the cost to the broiler industry of complying with the Directive by 2-to-1, under the most pessimistic scenario. However, the precise means by which this societal benefit can be used to compensate broiler producers is unclear due to the often non-market nature of animal welfare benefits. In other words, people acting as citizens may demand higher welfare but this does not necessarily translate to purchase behaviour when they act as consumers. In a policy context there is a debate as to whether this matters. The strength of stated preference methods is that they are a theoretically neat step to reveal welfare effects that need not be substantiated by action in the market. This information may be

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sufficient for policy choices. But the gap between stated preferences and actual behaviour is a problem for suppliers deciding to target public preferences. For them public preferences must be more than a theoretical abstraction or cheap talk. From a research perspective there is a need for more work that combines stated and revealed preference information; see for example Verhoef and Franses (2002). Such research can explore when, how and why stated intentions translated into actual behaviour.

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