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Public Preferences for Broiler Chicken Welfare: Evidence from Stated Preference Studies

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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 benefits to people who care about animal welfare status. In enacting welfare legislation and setting regulatory standards, government needs to measure costs and benefits of welfare changes. While costs are generally observable, the nature of market failure means that welfare benefits are not truly observed in welfare related transactions. Accordingly non-market benefits assessment methods are required to measure the total economic value of welfare improvement. This paper compares the results of two stated preference methods to measure the policy benefits of the proposed EU broiler Welfare Directive. Contingent valuation presents the welfare improvement as a policy bundle and elicits willingness to pay in a referendum or one-off purchase decision. Choice experiments break down the welfare good into its constituent attributes, which may be of interest in designing policy. The methods provide divergence aggregate benefit estimates, which are an artefact of the methodology and the payment methods.

Keywords: Broiler welfare, choice experiments, contingent valuation

Introduction

Animal welfare presents particular policy challenges. Good welfare provides private productivity benefits to producers and some level of positive external benefits to people who care about animal welfare status. In this sense, animal welfare has public good properties. This effectively means that if welfare is supplied then everyone can benefit without any payment to the supplying farmer or producers. It is possible for people to free ride on the private supply and this negates the incentives for any individual to supply welfare beyond the level that assures the private productivity benefit to them. They cannot capture the benefits of such efforts through the market. As it happens, the level of farm activity to generate the private return, may typically not deliver the level of public good externality that is demanded more widely. This typically means that welfare will be under-supplied. Meanwhile on the demand side those members of the public who care, typically cannot easily transact with numerous farmers for the supply of welfare they demand. Furthermore, several barriers to purchases of higher welfare meat have been identified including disassociation in which consumer's consciously avoid linking buying and eating meat with the killing of animals, and hence animal welfare (Harper and Henson, 2001). Taken together, this form of public good problem on the demand and supply sides is termed market failure. The market will typically lead to the under provision of animal welfare, and social welfare will not be maximised. This sub optimum outcome provides the rationale for government to intervene by defining regulations that mandate a specific level of welfare related activities.

In moving regulatory standards, government will be interested that the regulatory costs are matched by the social benefits of welfare improvement. While the costs of welfare improvement are relatively straightforward to calculate, the challenge comes in circumventing market failure and measuring the true benefits of animal welfare. There are several categories of benefits deriving from broiler welfare with a broad distinction between market and non-market benefits. Market benefits can be ascertained by measuring any increased productivity or product quality of chickens in response to reduced mortality and morbidity in birds. This productivity gain translates into a direct market gain for producers. Market benefits can also be inferred from purchase decisions made by welfare-inclined consumers. In contrast the non-market benefit is not observed in this way. Non-market benefits can be associated with a range of motives held by the general public (e.g. ethical and existence). Many people may be vaguely aware of the difference between good and bad welfare standards and, once more fully appraised, may have definite preferences in favour of higher welfare. If this is the case then these preferences need to be counted as part of an overall social evaluation of the regulatory change. Such preferences can be measured using revealed preference or stated preference methods. This paper considers the application of two stated preference methods: contingent valuation CV and choice experiments CE to the issue of broiler welfare. The next section describes the policy; context for these applications. This is followed by a description of the methodologies and an application to measure preferences for policy options in England. The final section offers observations and conclusions.

Broiler welfare

The European Union is currently in the process of developing proposals to introduce minimum standards for broiler chicken welfare, which would include legislation on 'stocking density' (bird weight/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[1]. RIA attempts an impartial report on the total costs incurred by both the private and public sectors of complying with agency regulations. In transposing the EU Directive, Defra is still mindful of the need to negotiate a form of the Directive that is consistent with good regulatory practice, will normally attempt to balance benefits and costs or to deliver a net increase in national (social) welfare. 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[2] states that the stocking density of chickens should not exceed 30 kilograms per square metre. 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 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

[1] http://www.cabinetoffice.gov.uk/regulation/ria-guidance/whatsnew.asp
[2] http://europa.eu.int/comm/secretariat_general/impact/docs/ia_2005_2/COM_2005_0221_F_EN.pdf

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 wishes to ascertain whether there is a net social gain delivered by the EU recommendations. That is whether, scientifically valid interventions actually yield an increase in social value. The two methods used in this study do this in different ways.

Socio-economic aspects of animal welfare

Consumer demand for higher animal welfare standards has been reflected in the increasing market share of products considered to be "welfare friendly", most notably free-range eggs. However, there still remain a number of barriers to the more widespread adoption of welfare friendly products across the broader range of animal produce. Harper and Henson (2001) report on the results of a pan-European project looking into consumer concerns about animal welfare and the impact on food choice. A number of important results emanate from this research:

- Consumers are concerned about animal welfare both due to the impact on the animals and a perceived impact on food safety, quality and healthiness. These are seen as being interdependent and policy should address both issues.
- That high reported levels of concern about animal welfare are not translated into purchase decisions is due to a number of perceived barriers to "ethical" choice. These include a lack of information; a perceived lack of availability of higher welfare products; a perception of low influence over welfare standards; disassociation from animal productions and slaughter; and perceived higher cost.
- Consumers prefer a strategic approach favouring both supply and demand side measures to improve animal welfare. On the supply side, there should be minimum welfare standards and reform of agricultural policy. Demand side measures should include compulsory labelling and consumer education.

The results reported by Harper and Henson (2001) demonstrate that there are two particular contradictions in the way consumers think about animal welfare:

- They want more information <u>but</u> they do not want to associate food with the killing of animals;
- They say they do not consider price to be the most important factor in food choice <u>but</u> this is not the case at the point of purchase.

These suggest that animal welfare should be treated as a public good issue in the same sense as environmental issues and that policy interventions in a similar vein to agri-environment policy may be the most appropriate method of meeting public preferences for welfare standards.

Mintel (2001) carried out research into attitudes towards ethical foods, (incorporating fair trade, organic vs. GM, the environment, and animal welfare) found that major drivers are consumer trust in the products and perceived health benefits. However, it was found that purchasers of free-range eggs are more likely to cite animal welfare as a concern than health. This may be due to the greater differentiation between production systems on egg packaging.

Earlier research by Mintel (1999) found that 41% of meat purchasers noted concern about animal welfare with 46% of those claiming that it influenced purchase decisions, i.e. 19% of meat purchasers are influenced by welfare issues. Whereas 32% cited personal health as a concern with 53% of those saying it influenced them to seek meat that was not "factory-farmed", i.e. 17% of all meat purchasers.

Non-market valuation of animal welfare

As mentioned in the introduction, the production or supply of welfare falls under the rubric of market failure[3]. In the absence of a demand backed by a willingness to pay, producers predominantly but not exclusively farmers, may not be motivated to provide the welfare that might match demand. Welfare will not be supplied. Accordingly, government is often mandated to intervene on behalf of the public to regulate welfare levels that are deemed to be in the public interest. While we cannot know the counterfactual of no public intervention, welfare standards can be viewed as meeting public demand by proxy. But government nevertheless needs to compare the extent of the public good supplied relative to costs.

In essence the public cannot easily transact to satisfy a demand for welfare and the previous section has shown that revealed preference or market data, i.e. what consumers actually do, can be conflicting and does not allow us to piece together a case that unambiguously reflects true public welfare from animal welfare. Moreover, the revealed preference route is somewhat limited because consumers are constrained by the welfare limits available in marketed goods, and because non-purchasers of welfare related goods also have preferences for welfare irrespective of their consumption patterns. The demand side picture is therefore incomplete if we are focussed on purchase decisions. In reality, there is more human welfare related to good animal welfare that lies beyond market transactions. Accordingly, to capture this information for policy purposes, other routes need to be found to understand the value of this demand. This is the case when government decides to intervene to alter the supply of a public good like welfare.

Animal welfare has, in economic jargon, public good properties. Given the public good nature of animal welfare it is perhaps appropriate to use the same sort of non-market valuation techniques applied to the evaluation of agri-environment policy to assessing public preferences for animal welfare. While there is some scientific uncertainty surrounding the welfare effects of stocking density reductions, the general public may nevertheless be motivated to hold preferences for this particular welfare improvement in terms of its existence and ethical benefits[4]. These preferences form part of the economic evidence base of any change and need to be evaluated in terms of whether these benefits of the proposal exceed the cost of compliance to producers

Revealed versus stated preference methods

It is possible to value welfare changes using revealed (RP) and stated preference (SP) methods. Economists generally prefer the former because of the real (as opposed to hypothetical) behavioural trail left by market purchases. There is a niche for welfare friendly produce where suppliers and demanders can transact welfare. But as seen above this niche is limited and only provides a partial picture of the wider welfare that society derives from good welfare standards. Moreover, there are several reasons to suppose that only a subset of people will actually transact, while a wider proportion that do not transact, yet still care about welfare and have preferences for policy changes. Accordingly, there is a need to undertake some non-market valuation.

[3] If welfare value was perfectly capitalised in the price of goods then the market could be relied on to deliver an optimal allocation of welfare but markets do fail.

[4] Indeed the slight paradox is that irrespective of the welfare impacts of the stocking proposals, if these are the perceived means of delivering welfare, then they will be valued as such. An important question is to be clear on the disparity on what is valued and its true scientific effect.

Stated preference methods

SP has been developed over the last two decades with applications and innovation in environmental and health economics. There have also been several applications to animal welfare (for example Bennett, 1998; Burgess *et al*, 2001), with mixed results that can be attributed to different design criteria. The stated preference literature covers applications of both contingent valuation (CV) and choice experiments (CE). Contingent valuation is a relatively straightforward method of eliciting willingness to pay (WTP) and is backed by a considerable literature that has refined the design, elicitation and estimation procedure (see Bateman *et al* 2002). CV offers one potential method for this project. But a potential problem in the design of CV scenarios suggests that there is merit in considering two methods to investigate preferences. Specifically CV asks respondents to consider a fixed all encompassing welfare change scenario. It is sometimes difficult to unbundle WTP responses in order to understand the relative value of parts of a whole intervention.

A more recent innovation has applied attribute based choice experiments (CE) to unpick the marginal values associated with specific attributes of particular environmental policies. The main difference between CV and CE then is whether we identify a willingness to pay value for a whole programme or the attributes of interest. The choice here depends on the nature of the policy question and whether there is specific interest in the combination of attributes.

Previous non-market applications

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. The mean WTP was 43p per dozen eggs (£17 per household per annum based on weekly consumption of 9 eggs), with over 75% of respondents stating a WTP in excess of 20p per dozen eggs. 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. A number of welfare improvement programmes were to be considered:

- 50% increase in space;
- 100% increase in space;
- rooting materials;
- rooting materials with straw bedding; and
- research into pig housing.

These improvements were considered in isolation and in various combinations of 12 possible combined programmes. Survey respondents were asked a number of contingent valuation questions covering the five individual programmes listed above as well as a further five combined programmes (the full 12 combinations were not presented to each respondent to reduce burden). The analysis allowed the calculation of the total economic value across Northern Irish households of 17 programmes (5 individual and 12 combinations) which ranged from £0.96m for a 50% space increase only to £1.58m for the “Pig Palace” of 100% more space, rooting material, straw and further research.

Burgess *et al.* (2001) also used the contingent valuation, as well as paired comparisons, to elicit values for improved welfare across a number of species/systems, again from respondents in Northern Ireland. The proposed welfare improvements were:

Laying hens – change from battery cages to free-range or barn systems;
Broilers – reduced leg weakness through use of slower growing chickens, growth time increased from 43 days to between 70 and 90 days;
Dairy cows – change to straw yard housing;
Pigs – increased space allowance and provision of straw.

The results of the valuation exercise are presented in Table 1 together with the benefits, costs and net benefits of the improvement schemes, which have been aggregated to the UK level. Of interest is the preference order of laying hens, dairy cows, broilers and lastly pigs. A priori we might have expected pigs and dairy cattle to have been placed higher in preference ordering as it can be argued that they are more closely related to humans: mammals, intelligent (particularly pigs) and possibly more communicative. Alternatively, it may simply be the case that welfare issues that effect poultry are more widely appreciated and are of greater concern.

Table 1: Benefits of welfare improvement schemes in Northern Ireland. Source: Burgess *et al*. (2001).

	CVM estimated WTP £/week.	Aggregate benefits £m/annum.	Costs £m/annum.	Net benefit £m/annum
Laying hens	2.95	73.3	13.2	60.1
Broilers	2.63	65.6	26.0	39.6
Dairy cows	2.89	71.7	42.5	26.2
Pigs	2.10	52.0	30.8	21.2

Animal welfare is of concern to the public, not just in terms of the animals themselves, but also its perceived relationship with food safety, quality and healthiness. Research into consumer attitudes has highlighted a number of reasons why stated concern over animal welfare does not translate into purchase decisions. These suggest that the public act as citizens in terms of their stated preferences and that dissonance occurs when they act as consumers. Responsibility for animal welfare standards lies with the government and retailers rather than consumers. Farmers are considered to be subject to the constraints of the "system", whilst consumers have little individual market power. Consequently, there is a public good element in the provision of animal welfare.

Stated preference (SP) methods

Recognising the need for more of an evidence base on the demand for animal welfare, economic researchers have considered the merits of revealed versus stated preference methods for measuring non-market impacts. These methods have more commonly been applied 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 . Reliance on revealed preference data therefore most likely under estimates the true economic value of welfare interventions.

In recent years different SP methods have been developed to value non-market impacts. SP are based on hypothetical markets. These are constructed to present a sample of respondents with a policy scenario, which in this case will describe the welfare change in terms of 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 irrespective of whether the respondent does or does not proceed to engage in market-related welfare purchases. 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 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 willingness to pay (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 comes here because some studies attempt to introduce credibility into their hypothetical scenario by using a market good as the payment vehicle for the welfare increment – e.g. 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.

In methodological terms the main distinction among SP methods is between contingent valuation (CV) and choice experiments (CE). Contingent valuation is a relatively straightforward method of eliciting willingness to pay and is backed by a considerable literature that has refined the design, elicitation and estimation procedure (see Bateman *et al.,* 2002). CV offers one potential method for this project. But a potential problem in the design of CV scenarios suggests that there is merit in considering two methods to investigate preferences. Specifically CV asks respondents to consider a fixed all encompassing welfare change scenario. It is sometimes difficult to untangle WTP responses in order to understand the relative value of parts of a whole policy intervention.

A more recent innovation has applied attribute based choice experiments to unpick the marginal values associated with specific attributes of particular environmental policies. The main difference between CV and CE then, is whether we identify a willingness to pay value for a whole programme or the attributes of interest. In the case of a broiler welfare intervention, these might be stocking density, ventilation and hours of daylight. The choice here depends on the nature of the policy question and whether there is specific interest in the combination of attributes. The downside of the approach is that many attributes taking on many levels leads to a rather complex task for respondents, who are required to consider sequences of pair wise policy bundles.

Choice experiments require considerable thought to be given to experimental design, particularly when the number of attributes is large (Bullock *et al*., 1998, Moran *et al*., 2004). There is often a tendency to shrink complex changes to unrealistic subsets of so-called main effects, with few possibilities for exploring interactions between attributes. Even the most limited set of attributes can present respondents with complex and cognitively taxing sets of tradeoffs. In such situations many respondents adopt heuristic strategies referring only to the price attribute, discarding the subtle differences offered in the other attributes.

Different SP variants have been tested in the UK with respect to animal welfare. 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. We are unaware of any studies that have undertaken choice experiments or that has compared results from the application of both methods to welfare.

An application to the EU Broiler Directive

To inform government decision making a split sample valuation exercise was undertaken applying separate contingent valuation and choice experiment surveys to elicit stated preferences for the provisions of the EU Directive. As part of the study design, two focus groups where 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 markets in both survey variants. For the CE method, the groups helped to define the relevant policy attributes to describe the policy change.

Choice experiment survey

In addition to the two focus groups, both CE and CV scenarios were refined with reference to the scientific literature and input from a Defra steering group. The CE attribute set was finally defined to include stocking density, ventilation and period of darkness, together with an attribute based on the welfare outcomes arising from the proposed Directive. The welfare outcome attribute was the percentage of flocks failing the maximum score for foot pad dermatitis. Each of the attributes took three levels, one of which approximated the current (without policy) situation, as presented in

In addition to the welfare attributes there was a price attribute, specified as an additional price per kilogram, which took six levels. The price levels were based on the typically retail price of fresh whole chicken, i.e. without value added elements such as portioning or processing.

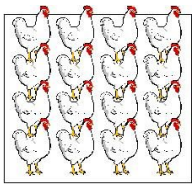
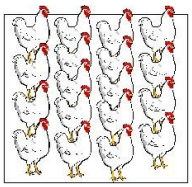
The stocking density attribute took the levels 38, 34 and 30 kg/m^2 to represent the levels allowed by the current Assured Chicken Production standards and the derogation available under the Directive (38); the current Defra welfare codes (34); and the non-derogation level under the Directive (30). The ventilation attribute took qualitative levels, ranging from low to high. The period of darkness[5] took levels ranging from 4 hours continuous darkness, through 8 hours with at least 4 hours continuous as required by the Directive, to 8 hours continuous darkness. The current percentage of UK flocks exceeding the maximum score for footpad lesions under the Directive is estimated to be 15% (University of Bristol, 2005), this attribute took the further levels of 10% and 5% of flocks failing the standard.

[5] Light intensity was also considered as an attribute but was felt to be less important for welfare than period of darkness. The design of the choice experiment precluded using both attributes.

Table 2: Attributes and levels used in the choice experiment.

	Level 1		Level 2		Level 3	
Stocking density	38 kg/m^2		34 kg/m^2		30 kg/m^2	
Ventilation	Low		Intermediate		High	
Period of darkness	4 hours		8 hours (at least 4 hours continuous)		8 hours continuous	
% of flocks failing foot pad lesion standard	15		10		5	
Price (£/kg)	2.05 (5p/kg extra)	2.10 (10p/kg extra)	2.20 (20p/kg extra)	2.40 (40p/kg extra)	2.70 (70p/kg extra)	3.00 (£1/kg extra)

We used a CE design that was fully efficient for the estimation of main effects, meaning that the level of each policy attribute differed between options in each choice set. The total number of such choice sets is 6^6 and so presenting all of these would require 46656 questions. And choosing to give each respondent six questions would require 7776 respondents. In order to reduce this to a more realistic size, we sifted the set of questions by a factor of 36, resulting in 1296 questions. This would require a sample of 216 respondents, however a one and half times replication of the design was used requiring 324 respondents to ensure full coverage of the CE design. The choice experiment was administered in the home to a sample of English households stratified by age and social grade. After a description of the policy scenario each respondent to the choice experiment was presented with six choice sets, each offering a pairwise choice between to policy options, as illustrated in Figure 1. The choice experiment was administered to 53 pilot respondents to determine whether the attribute levels were eliciting significant results. Analysis of the pilot data revealed no problems with the attributes, and the choice experiment was then administered to a main sample of 283 respondents. In total this gave a sample of 336 respondents, completing a total of 2016 choice sets.

	A	B
Stocking Density	**34 kg per square metre** 	**38 kg per square metre** 
Ventilation	**Intermediate**	**Low**
Period of darkness	**8 hours continuous**	**4 hours continuous**
Foot pad lesions	**10% of flocks fail standard**	**15% of flocks fail standard**
Price per kg	**£3.00 (£1 per kg more)**	**£2.20 (20 pence per kg more)**

Which option do you prefer?	A	☐
	B	☐
	Neither	☐
If **neither**, which option did you **least** prefer?	A	☐
	B	☐

Figure 1: Example choice set.

Contingent valuation survey

In contrast to the choice experiment the contingent valuation method is not suited to assessing the value of specific policy attributes and features. Instead, 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 Box 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 Box 1 formed part of a larger policy choice scenario that culminated in the respondent having the choice to accept or reject a policy change to deliver benefits described. The exact wording of the scenario was set out 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 choice 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. A pilot survey of 55 respondents was undertaken to determine whether the range of bids adequately covered the willingness to pay distribution. Analysis of the pilot survey indicated that the highest initial bid level was being accepted on two-thirds of the occasions it was offered. Consequently the initial bid range was increased for the main survey of 318 respondents. The bid levels for both pilot and main CV surveys are presented in Table 3. As with the CE, the sample for the CV survey was stratified according to age and social grade and was administered in the home using face-to-face interviews.

Table 3: Contingent valuation pilot and main survey bid levels

Pilot survey			Main survey		
Initial bid (£)	2nd higher bid (£)	2nd lower bid (£)	Initial bid (£)	2nd higher bid (£)	2nd 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

Box 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 light and dark periods 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.

Results

The contingent valuation survey

The survey respondents were faced with one policy scenario that they were asked to accept or reject. This 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 boiler 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, in which respondents objected to the payment vehicle or did not feel responsible for broiler welfare (but otherwise may have had preferences for higher welfare), accounted for 55% of the zero responses (22% of the sample). Protest bids were excluded from further analysis. With respect to the differences between respondents stating a non-zero WTP and genuine zeros, the was a greater representation of respondents from higher social grade (A, B and C1) and higher income groups amongst the non-zero WTP respondents.

The analytical method of deriving a mean WTP from closed-ended or dichotomous choice data is described in (Bateman *et al*., 2002). This literature reconciles economic utility theory, which explains choice decisions with basic probability modelling. Responses to the referendum-type question provide qualitative data (yes =1/no =0) censoring the respondent's true WTP within bounds and can be modelled using a variety of probability models such as a standard logit model that conditions the probability of a yes response to any given bid value on that value, plus the socio economic characteristics of the respondent. Unobservable factors driving a repondents yes or no response is accommodated by a distributional assumption for an error term.

, the simplest logit model requires the estimation of the alpha intercept and beta (coefficient on the bid variable) in:

$$P_i = \frac{1}{1 + e^{-\alpha + \beta A}} \qquad (1)$$

where P_i is the probability of acceptance of bid i, α is the estimated constant term and β is the estimated coefficient of the bid level X. The mean WTP is then alpha/beta and confidence intervals can be estimated from bootstrapping off the standard errors.

Table 4 reports the results from the unrestricted double-bounded model. This provided the most conservative mean and the tightest confidence interval. Implicitly, the follow up question allowed respondents to revise their bids downwards. 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 the study the WTP estimates are per household per year. The bid function is presented in **Figure 2**, this indicates the probability of accepting each of the bid levels, the mean WTP being the level at which probability of acceptance is 0.5. The function is calculated for each bid level using the estimated coefficients using the following binary logit function (1).

As a validity test, Table 5 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.

Table 4: Results of unrestricted double-bounded estimate of annual household willingness to pay.

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

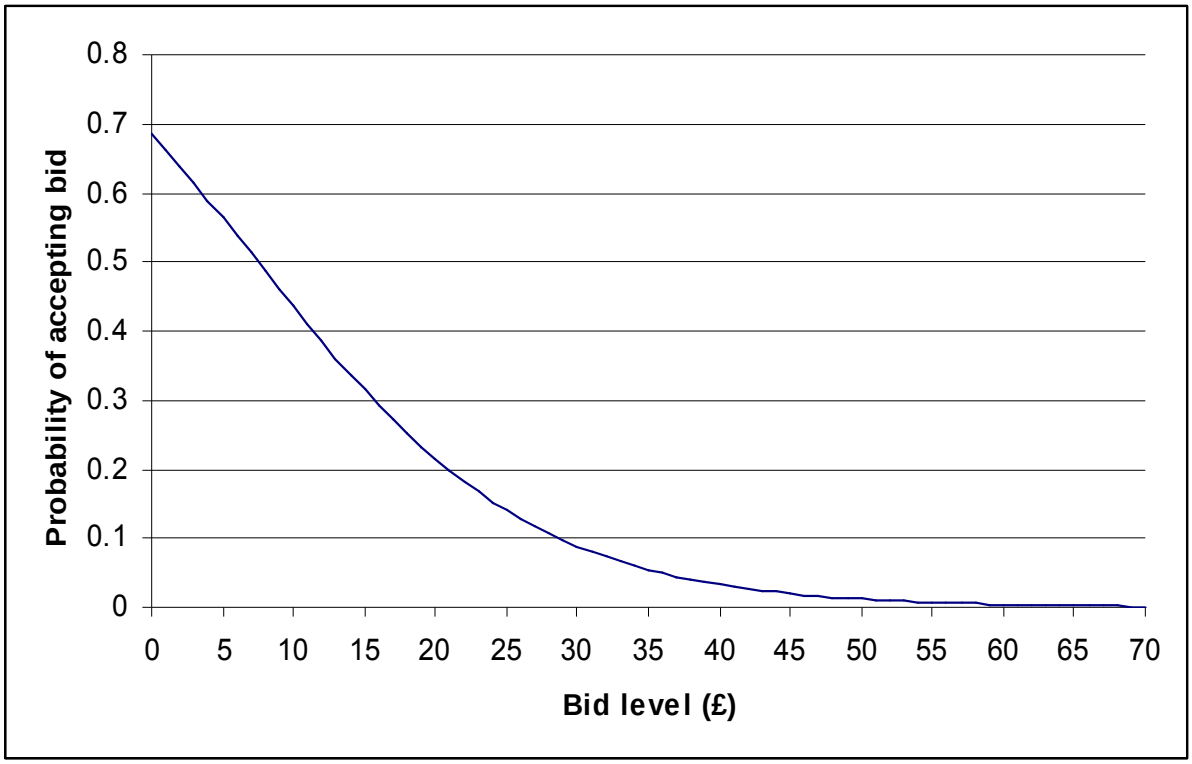


Figure 2: **Contingent valuation bid function for first bid.**

Table 5: Binary logit analysis of contingent valuation first bid response with covariates

	Coefficient	t statistic
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 (dummy)	0.585**	1.950
Is concerned about chicken welfare (dummy)	0.361	1.135
Is aware about chicken production (dummy)	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 (dummy)	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
Educational attainment	0.259*	2.355

* Significant at the 5% level ** Significant at the 10% level

Choice experiment results

The pilot and main survey samples were combined to create a single set of 336 responses with each respondent making 6 pairwise comparisons between different attribute options. Hence, there were a total of 2016 choice occasions, each representing a dependent variable observation. The data were analysed using a multinomial logit model, which relates choice to attribute combinations. Initial results are presented in Table 6. The results presented are for a model that was estimated using only the welfare attributes in the choice set, and a model that also includes a set of respondent characteristics that were found to have a significant effect on the choices being made. In both cases a dummy variable specification has been used for the attribute levels that allows direct comparisons of preferences for the welfare improving levels as compared to the "worst" reference level. For example, in the case of stocking density the estimated coefficient for 34kg/m^2, 0.4160, represents the utility gained for changing stocking density from 38 to 34 kg/m^2.

For the welfare attributes only model, the estimated coefficients for the stocking density, ventilation and foot pad lesion attributes are positive and significant at the 5% level. This confirms preferences for improvements in broiler welfare, and these increase as the levels of the attributes get "better". The coefficient for a change in the period of darkness to 8 hours with at least 4 hours continuous is not significant, although the coefficient for a change from 4 hours to b hours continuous is significant at the 10% level. Again this confirms higher preferences for "better" levels of the attribute. But the price attribute is insignificant suggesting that respondents are insensitive to price levels and are making choices based purely on the levels of the welfare attributes. In other words they appear to be ignoring the price levels when choosing between options. The choice experiment design varied the order in which the welfare attributes were presented to respondents to test for anchoring effects, i.e. did the order in which attributes were presented infer some for of priority or importance? There were no significant differences in the preference for each attribute across the different orderings.

Table 6: Multinomial logit results for attributes only and attributes and covariates models (t statistics in brackets).

	Attributes only	Attributes and covariates
Price	-0.0533	-0.0321
	(-1.2371)	(-0.4838)
Stocking density		
Change from 38 kg/m^2 to:		
34 kg/m^2	0.4160*	0.4162*
	(5.8183)	(5.6682)
30 kg/m^2	0.8586*	0.8792*
	(11.9516)	(11.9074)
Ventilation		
Change from low to:		
Intermediate	0.3536*	0.3582*
	(4.9553)	(4.8933)
High	0.5762*	0.5974*
	(8.0886)	(8.1592)
Period of darkness		
Change from 4 hours to:		
8 hours (at least 4 continuous)	0.1040	0.1239**
	(1.4694)	(1.7069)
8 hours continuous	0.1535*	0.1949*
	(2.1722)	(2.6830)
Foot pad lesions		
Change from 15% of flocks failing to:		
10%	0.2925*	0.2925*
	(4.1019)	(3.9985)
5%	0.6731*	0.6709*
	(9.4495)	(9.1724)
Covariates interacted with neither option		
Social grade A, B or C1 (dummy)	-	0.6259*
		(4.4195)
Weekly household spending on food	-	-0.0116*
		(-4.9783)
Concerned about broiler welfare (dummy)	-	0.3796*
		(2.4624)
Regularly eats free range chicken (dummy)	-	0.3710*
		(2.1913)
Regularly eats organic chicken (dummy)	-	0.6725*
		(3.0162)
Regularly eats beef (dummy)	-	0.3941*
		(2.7954)
Log likelihood	-1882.410	-1767.841
Adjusted ρ^2	0.148	0.169

* Significant at the 5% level ** Significant at the 10% level

The second estimated model includes respondent characteristics that were found to have a significant effect on whether respondents' chose neither of the choice options A or B. Such covariates can be interacted with any of the options. In this case, as A and B are essentially different offerings of the same product or policy. Interaction of the covariates with the choice of "neither" is equivalent, but opposite, to interacting them with choosing either A or B. Two socio-economic characteristics of the respondents were found to be significant. Whether the

respondent was a member of social grades A, B or C1. This is used as a proxy for income as 37% of respondents refused or were unable to state their household income. The positive coefficient for higher social grades indicates that these respondents were more likely to choose "neither", indicating a possible substitution effect away from broiler chicken. Weekly household spending on food was significant and negative (preference for option A or B over "neither") indicating that households with higher food budgets are prepared to pay more for higher welfare chicken.

Other covariates found to have a significant and positive effect on choosing "neither", were whether the respondent reported a high level of concern for broiler welfare, and whether they regularly ate free-range or organic chicken, or ate beef. It might be expected that people who are concerned about broiler welfare would opt for welfare improving attributes rather than neither. However, these respondents might also express this concern through not consuming broiler chicken as no combination of welfare improving attributes is sufficient to compensate for their perception of broiler welfare. Similarly, respondents who regularly consume substitute products (free range and organic chicken and beef) will opt not to consume broiler chicken rather than accept a package of welfare improvements. 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 a 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).

The price insensitivity indicated by the insignificant price coefficients prompted a further investigation of whether heterogeneity, or distinct sub-samples, exists within the sample in respect of price. According to Akçura *et al* (2004), this can be a worthwhile exercise to understand the price insignificance across the whole sample. The sample was partitioned based on social grade to determine whether preferences vary of different social grades as a proxy for other characteristics such as income and educational attainment. The results of the partitioned models are presented in Table 7. The estimated coefficients for the welfare attributes are correctly signed and increasing as levels get "better", however several of these coefficients are not significant. This may be due to a lack of balance in the choice experiment design within the sub-samples, that meant that the full range of trade-offs were not explored, which was not controlled for.

Of particular interest is the variation in the price attribute across the different social grades. For both the AB and C1 groups (15.8% and 31.5% of the sample) the price coefficient is negative and significant at the 5% level. This indicates that these respondents are sensitive to price and are making trade-offs between price and welfare improvements. For respondents in the C2 group (25.3%) price is still negative but is insignificant, indicating price insensitivity. Respondents in the DE group (26.5%) have a positive price coefficient that is significant at the 10% level. A positive price coefficient can be interpreted as an indication of a "price as a sign of quality effect" (Akçura *et al*, 2004), in this case higher prices may be seen by respondents as indicative of higher welfare. In effect the DE group are treating higher welfare chicken as a luxury good for which price signals higher welfare standards. Alternatively, these respondents may simply be signalling their preferences for higher welfare standards by choosing higher priced alternatives. In other words they acting not as consumers but as citizens and are in effect acting strategically to try and ensure provision of the welfare improvements. Nevertheless, a positive price coefficient precludes the estimation of valid implicit prices as the implication is that consumption will increase as prices rise.

Table 7: Multinomial logit model results for sample split according to social grade (t statistics in brackets).

	Social grade			
	AB 15.8%	C1 31.5%	C2 25.3%	DE 26.5%
Price	-0.2384*	-0.1492*	-0.0050	0.1368**
	(-2.1435)	(-2.0147)	(-0.0549)	(1.6624)
Stocking density				
Change from 38 kg/m^2 to:				
34 kg/m^2	0.6998*	0.5409*	0.5069*	0.0864
	(3.8247)	(4.1964)	(3.5963)	(0.6486)
30 kg/m^2	0.8225*	0.8819*	0.9104*	0.8338*
	(4.4282)	(6.8575)	(6.4317)	(6.1762)
Ventilation				
Change from low to:				
Intermediate	0.4679*	0.2640*	0.4894*	0.2531**
	(2.6123)	(2.0314)	(3.4642)	(1.8942)
High	0.7322*	0.5604*	0.6524*	0.4608*
	(4.0330)	(4.4880)	(4.5907)	(3.3755)
Period of darkness				
Change from 4 hours to:				
8 hours (at least 4 continuous)	0.1775	0.0551	0.0528	0.1176
	(0.9872)	(0.4294)	(0.3776)	(0.8868)
8 hours continuous	0.3757*	0.1934	0.0399	0.0771
	(2.1063)	(1.5375)	(0.2870)	(0.5671)
Foot pad lesions				
Change from 15% of flocks failing to:				
10%	0.1055	0.2401**	0.4821*	0.3790*
	(0.5859)	(1.8678)	(3.4317)	(2.8167)
5%	0.5249*	0.6805*	0.8137*	0.7051*
	(2.9091)	(5.3418)	(5.7102)	(5.2238)
Log likelihood	-325.0434	-627.5345	-463.0852	-491.5910
Adjusted ρ^2	0.1075	0.1205	0.1948	0.1827

* Significant at the 5% level ** Significant at the 10% level

These models indicate that there is a degree of variation across the sample with respect to prices. This creates a problem when it comes to calculating population implicit prices and therefore producing an estimate of the benefits of improvements in the welfare attributes. We can interpret the insensitivity to price and the positive price coefficient of the C2 and DE groups as an indication that the welfare attributes are of greater importance to these groups. However, in reality we would expect either declining chicken consumption and/or substitution to occur in response to higher prices. Despite preferences for welfare, households will still face budget constraints. In order to estimate implicit prices it was assumed that the price coefficient of the AB group more closely represents the true trade-offs that would be made. As such we re-estimated the attributes and covariates model using the AB group price coefficient as a fixed value. The results of the re-estimation and the implicit prices are presented in Table 8. The implicit prices are calculated by:

$$P_x = -\frac{\beta_x}{\beta_p} \qquad (2)$$

where P_x is the implicit price of attribute x, β_x is the estimated coefficient for attribute x and β_p is the price coefficient.

The implicit prices confirm that a change in stocking density from 38 kg/m^2 to 30 kg/m^2 with an implicit price of £3.98, is the most preferred welfare change. This means the respondents are willing to pay an additional £3.98 per kilogram for stocking density to be reduced from 38 to 30 kg/m^2. This is followed by a reduction in the percentage of flocks failing the proposed foot pad lesion standard from 15% to 5% with an implicit price of £3.01. The least preferred welfare changes are to the period of darkness, this may reflect a less obvious connection between this attribute and welfare outcomes in the minds of respondents. It would be expected that the differences between the implicit prices (and estimated coefficients) for the attributes would decline as the levels increase, as evidence of diminishing marginal utility. This is the case for the ventilation and period darkness attributes where the difference in implicit prices for the second and third levels are smaller (£1.01 and £0.30 respectively) than implicit prices for moving from the first to the second level. This is not the case for both the stocking density and foot pad lesion attributes, indicating that there remains further scope for improvements in these attributes.

Aggregation of results

For the CV results, the aggregate value of the policy change for England can be calculated by multiplication of the mean WTP estimates of £7.53 per household by the number of households. There are approximately 21 million households in England (ONS, 2005), giving an aggregate value of £158 million per annum. For the CE, the implicit prices are estimated in terms of additional £ per kg and suggest that the aggregate benefits would be very large. The aggregate benefit of a change in any of the attributes would be calculated as follows:

Implicit price (£/kg)	x	Consumption (kg/week/capita)	x	52 weeks	x	Population (49.2 million)	=	Policy benefit (£/annum)

Given an average weekly per person consumption of 170 grams (Defra, 2005), and an English population of 49.2 million, the aggregate benefit of a change in stocking density from 38 to 30 kg/m^2 would be £1.73bn; i.e.:

3.98	x	0.170	x	52	x	49.2	=	£1731m

However, given the evidence of price insensitivity across the combined sample, it is likely that price coefficient has been underestimated and caution must be urged in aggregating these benefits. For example the pilot survey for the choice experiment estimated the price coefficient as –0.446. The aggregation function above also assumes that consumption would remain constant regardless of increased prices. Defra (2001) estimated that the own price elasticity of chicken ranged from –0.52 to –0.77 for poultry, 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 that mean 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. At the limit, the implicit prices should be considered as a useful numeraire for comparing preferences for the welfare attributes, which are otherwise in differing qualitative and quantitative units.

Sheppard and Edge (2005) in a survey of broiler producers found that 19% currently operate at maximum stocking densities at or above 40 kg/m^2. The choice experiment only considered densities at or below the current Assured Chicken Production maximum of 38 kg/m^2, which

coincides with the maximum proposed by the Directive. As a result there will be additional utility gains to the public from the required reduction in stocking density by those producers. However, we are unable to quantify this utility gain as although the estimated utility functions are linear the changes in utility associated with movements between stocking densities is not. For instance, there is a larger utility gain in moving from 34 to 30 kg/m^2 than from 38 to 34 kg/m^2.

Table 8: Multinomial logit model with fixed price coefficient and implicit prices.

	Model coefficients (t statistics)	Implicit prices, £/kg (95% confidence intervals)
Price	-0.2384	
Stocking density		
Change from 38 kg/m^2 to:		
34 kg/m^2	0.4557*	£1.91
	(6.2276)	(£1.31-£2.51)
30 kg/m^2	0.9264*	£3.89
	(12.6562)	(£3.28-£4.49)
Ventilation		
Change from low to:		
Intermediate	0.3971*	£1.67
	(5.4412)	(£1.07-£2.27)
High	0.6401*	£2.68
	(8.7930)	(£2.09-£3.28)
Period of darkness		
Change from 4 hours to:		
8 hours (at least 4 continuous)	0.1587*	£0.67
	(2.1889)	(£0.07-£1.26)
8 hours continuous	0.2309*	£0.97
	(3.1836)	(£0.37-£1.56)
Foot pad lesions		
Change from 15% of flocks failing to:		
10%	0.3295*	£1.38
	(4.5157)	(£0.78-£1.98)
5%	0.7164*	£3.01
	(9.8726)	(£2.41-£3.60)
Covariates interacted with neither option		
Social grade A, B or C1 (dummy)	0.5821*	
	(4.2018)	
Weekly household spending on food	-0.0153*	
	(-7.6529)	
Concerned about broiler welfare (dummy)	0.3462*	
	(2.2569)	
Regularly eats free range chicken (dummy)	0.3453*	
	(2.0412)	
Regularly eats organic chicken (dummy)	0.6515*	
	(2.9040)	
Regularly eats beef (dummy)	0.3161*	
	(2.3292)	
Log likelihood	-1772.690	
Adjusted ρ^2	0.167	

* Significant at the 5% level ** Significant at the 10% level

Conclusions

The contingent valuation and choice experiment studies demonstrate that the general public has observable preferences for improvements in the welfare of broiler chickens. These methods were used to examine these preferences in two ways: the choice experiment considered preferences for specific changes in the attributes of chicken welfare, whereas the contingent valuation study consider preferences more broadly for the welfare improvements that might arise from the introduction of the proposed directive.

The contingent valuation study used a different approach that estimated willingness to pay additional annual taxation for the provision of the proposed Directive. The average willingness to pay was estimated as £7.53 per household per year, which gives an aggregate value for England of £158 million.

The choice experiment framed the valuation exercise in terms of increased prices for different combinations of welfare attributes. An ordering in preferences for different welfare attributes was observed in the choice experiment, each with associated implicit prices:

1. Reduce stocking density from 38 to 30 kg/m^2: £3.89/kg;
2. Reduce percentage of flocks failing foot pad lesion standard from 15% to 5%: £3.01/kg;
3. Change quality of ventilation from low to high: £2.68/kg;
4. Reduce stocking density from 38 to 34 kg/m^2: £1.91/kg;
5. Change ventilation from low to intermediate: £1.67kg;
6. Reduce percentage of flocks failing foot pad lesion standard from 15% to 10%: £1.38/kg;
7. Change period of darkness from 4 hours to 8 hours: £0.97/kg; and
8. Change period of darkness from 4 hours to 8 hours with at least 4 hours continuous: £0.67/kg.

The implicit prices can be aggregated either singly or in combination to provide estimates of the total non-market value of changes in individual welfare attributes or combinations of policy outcomes. Caution is required though in using such aggregation as it assumes a constant level of consumption. In reality we would expect consumers to substitute into other products such as free-range or organic chicken as the price of conventional broiler meat increased.

In view of these issues regarding aggregation of the choice experiment results, we recommend that the contingent valuation estimates be considered as the more reliable indicators of the aggregate benefits of the proposed Directive. The choice experiment is more useful in allow comparisons of the relative benefits of the different policy attributes.

A comparison of chicken prices in leading UK supermarkets indicates that standard fresh whole chickens are available at cost of between £1.78 and £2.99 per kg, where the price depends on the size of the finished bird. Free-range chickens are available at prices between £3.17 and £5.99 per kg (compared to prices for organic chicken between £4.24 and £6.25 per kg). This indicates a welfare related premium of between 6 and 250%. It is not clear to what extent welfare is an issue in the purchase of organic products, where consumers may also be motivated by environmental and health concerns. Another important factor is the current size of the UK market for high welfare chicken. Sales of Freedom Food meat and poultry (including eggs) were £105m in 2002, whilst those for organic meat and poultry were £92m (Mintel, 2004a). This compares to total retail market for chicken of £2.24bn in the same year (Mintel, 2004b).

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