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Speciesism, altruism and the economics of animal welfare

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Abstract

Economists have long relied on utilitarian principles in carrying out cost–benefit analysis, but such utilitarianism is typically limited to the well-being of humans. Some prominent philosophers have argued such an approach is unjustifiably speciesist, but what are the consequences of including animal well-being in cost–benefit analysis? This paper considers this question in the context of human altruism towards animals in which people's concerns for the well-being of animals create an externality. After uncovering some conceptual challenges involved in carrying out cost–benefit analysis on animal welfare policies, we report the results of a novel experiment used to measure the public-good value of farm animal welfare, and show that although the average value in our sample is quite large, the result is due to the preferences of only a small subset of the subjects.

Keywords: altruism, animal welfare, animal rights, cost–benefit analysis, experimental economics, public good, speciesism, valuation, welfare

JEL classification: D61, D64, C91, Q18

1. Introduction

Did you know that you are equal to 11,500 sheep? That was the claim of a recent *Reason* magazine article which derived the estimate from a nationwide telephone survey (Mangu-Ward, 2007).[1] Although the claim is unusual and based on hypothetical survey responses, many people are beginning to ask similar, real questions. In the ballot box and in the grocery store, consumers

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1 The survey asked people whether they agreed with the statement, 'If a technology were created that could eliminate the suffering of one human or *X* farm animals, it should be used to eliminate the suffering of the one human.' The value of *X* was varied across surveys, and the figure 11,500 roughly corresponds to the value of *X* for which the sample was equally likely to agree and disagree with the statement. See Lusk and Norwood (2008) for more details.

are now confronted with choices in which they must decide whether to spend their money on improved animal well-being.

Farm animal welfare is arguably the most contentious emerging issue in livestock agriculture. The use of gestation stalls and battery cages is particularly controversial and has served as a rallying point for animal advocacy activism. A variety of current events suggest that animal welfare issues are growing in prominence. The use of battery cages in egg production was recently banned in several European countries such as the UK, Sweden and Germany. In the USA, animal activist groups have been successful in banning gestation crates through ballot initiatives in Florida, Arizona and most recently California, and these groups have also been able to achieve the same outcome by pressuring state legislators in Colorado and Oregon to pass comparable bills.

Such changes are the result of growing demand for improved conditions for farm animals. There is a need to better understand what factors influence people's preferences for improved animal well-being, as the efficacy of private and public policies depends on such motivations. On the one hand, demand for improved farm animal well-being is partly driven by self-interest. For example, 78 per cent of the American public believes that animals raised under high standards of care will result in safer and better tasting meat (Norwood *et al*., 2007). Such private concerns could be efficiently accommodated by the market as demands for 'animal compassionate' meat, milk and eggs develop and mature. Indeed, most retail outlets already offer eggs from a variety of production systems that differ in terms of the living conditions for layers.

On the other hand, people are also likely to exhibit empathy and have altruistic preferences for animals aside from any private benefits they might derive from improved animal well-being, leading to a potential market failure (Cowen, 2006). Some people might recognise that their individual purchases have very little impact on the well-being of farm animals, and as such, they might rationally purchase 'inferior' goods and free ride off the small, marginal contribution of others. If such is the case, consumers could be made better off if they could coordinate their efforts to meaningfully affect animal well-being while alleviating free-riding. Moreover, many people might be willing to pay something to improve animal living conditions even if they never consume animal products. That is, when people are concerned about animal treatment in general, and not just how it affects the taste and safety of their food, animal production involves an externality because one consumer's purchase of cage-free eggs can make another consumer (and chicken) happier (see also Bennett, 1995).[2]

2 The externality can also be viewed as a public good. Higher welfare standards provide a good that is both non-rival and non-exclusive. If a sow experiences a more content life, and that pleases certain people, all individuals concerned can experience the pleasure of happier sows regardless of who consumes the meat from the animal. Further, no one can prevent another person from taking pleasure in the reduction of the suffering of sows.

The issue of animal well-being has been addressed by several ethicist philosophers, and much of their writing has direct implications for the economics of cost–benefit analysis involving animal welfare. In particular, some philosophers contend that the welfare of animals should enter the social welfare function directly, not just indirectly through its effect on human utility. Writers such as Peter Singer (2002) and Tom Regan (2004) have argued that because farm animals have the ability to feel pain as humans do, their suffering should be given equal consideration. This idea is not new. The founder of utilitarianism, Jeremy Bentham, argued in relation to the well-being of animals that, 'The question is not, Can they *reason*? nor Can they *talk*? but, Can they *suffer*?' (Bentham, 1907).

Economic welfare analysis usually relies on the utilitarian approach by summing the surplus of all people, but it ignores any direct effect on animals per se. For example, in outlining an economic approach to thinking about animal welfare, McInerney (1993: 4) suggests that, 'animals are no more than resources employed in economic processes which generate benefits for people.' Even when animal welfare is under-supplied because it is not factored into the price of meat and eggs, McInerney suggests (1993: 5), 'Third party effects, however, are only relevant if they are experienced by people; they have no meaning if attributed to resources.'

This view, however, is at odds with the stance of many moral philosophers. Bentham and others argue that there is no logical reason for giving animal suffering a different weight than human suffering. Suffering is suffering regardless of who feels it. They argue that there are no unique criteria that all humans possess that some animals do not, and as such, there is no logical criterion for discriminating against the suffering of animals.[3] According to Singer (2002), to discriminate against the suffering of animals is tantamount to discriminating against people of a particular gender or race – an act Singer refers to as speciesism. Such views have spread beyond the confines of a few philosophers; for example, recent survey results indicate that a majority of Swedes believe animal suffering should count in policy decisions, separate from how animal suffering affects human suffering (Johansson-Stenman, 2006). Johansson-Stenman also noted the difficulty of including animal well-being in benefit–cost analysis, arguing that (1998: 431), 'If people think that the government should also, to some extent, value animals and nature intrinsically, i.e. independently of human well-being, it may appear somewhat problematic to maintain the view that the government should focus exclusively on *human* well-being.'

The point of this paper is not to advocate for (or against) the position of the moral philosophers who argue that animal well-being should directly enter the social welfare function. Rather, we analyse the potential consequences of such an approach, drawing out the challenges involved with utilitarian analysis in the presence of altruism (e.g. see Bergstrom, 2006 or McConnell, 1997). In

3 For example, a factor like intelligence is not a valid demarcation between animal and man, as a mature farm animal is more intelligent than an infant or mentally ill human. Valuing one's own species simply because one prefers his own is not viewed as a valid argument by these ethicists.

addition to the conceptual considerations we take up in this paper, no previous study has attempted to measure the 'public good' component of farm animal welfare using non-hypothetical methods.

The purpose of this paper is three-fold. First, we develop conceptual models deriving human and animal willingness-to-pay (WTP) for improved animal well-being. Second, we consider the consequences of carrying out cost–benefit analysis using a social welfare function that includes animal *and* human preferences for improved animal well-being. The model acknowledges the complexities of utilitarian analysis in the presence of altruism, concentrating on the issue of double-counting. There are other relevant issues related to altruism that are not addressed here – including warm-glow, intrinsic values, distributional issues, the impact of social norms and the like. Finally, using an innovative non-hypothetical experiment, we empirically estimate one portion of the social welfare function: the value that humans place on improving farm animal welfare resulting from altruism among samples of US consumers.

2. Human and animal willingness-to-pay for changes in animal production systems

Before considering cost–benefit analysis of animal welfare issues, it is important to conceptualise human and animal WTP for a change in animal living conditions.

2.1. Animal willingness-to-pay

We begin by assuming that animals have preferences – that they can rank consumption bundles in terms of relative desirability. This assumption is fully supported by research in animal behaviour and physiology (e.g. Appleby and Hughes, 1997) and even by the work of economists (e.g. see Kagel *et al*., 1995). Moreover, such preferences can be measured (Appleby and Hughes, 1997). For example, Matthews and Ladewig (1994) studied how hard pigs were willing to work (by pressing a lever on a nose-plate) to obtain food versus social contact with another pig. By varying the number of presses (i.e. effort) required to obtain the commodity (i.e. food or socialisation), and assuming that effort serves as an analogue for price, one can estimate a demand elasticity for the commodities. Matthews and Ladewig (1994) found that the average elasticity of demand for food was very inelastic at -0.02, whereas the average elasticity of demand for social contact was -0.49.[4]

Assume that preferences can be represented by the animal's utility function given by $U^{AN} = U^{AN}(f, q)$, where f is the quantity of feed (or any other

4 Animal scientists often measure the relative value of one amenity over another, such as the value of food versus social contact, by the ratio of the demand elasticities. For some utility functions (e.g. the Cobb–Douglas), these ratios are meaningful in that they relate to the ratio of marginal utilities.

continuous, variable input) and q is a variable related to animal care and well-being (e.g. pen size, space per pen, access to outdoors). In a typical consumer problem, people choose quantities to maximise utility; however, such factors are exogenous to farm animals. In a very real sense, farm animal welfare is *determined* by the level of f and q decided by the producer.[5] Of course, this does not mean animals do not have preferences. As indicated by the study of Matthews and Ladewig (1994) and others, animals prefer some levels of q to others, and are willing to make tradeoffs between the level of q and the level of f.

Given that animals are willing to make trade-offs between consumption bundles, we can construct a thought experiment, in which we approach a pig and ask: how much corn would you be willing to give up to increase the size of your pen by 1 square metre? To answer this question, the hog would calculate its marginal rate of substitution: $\mathrm{MRS}_{qf} = (\partial U^{\mathrm{AN}}/\partial q)/(\partial U^{\mathrm{AN}}/\partial f)$. This expression shows the rate at which an animal is willing to trade changes for q for changes in f. By totally differentiating the animal's utility function, $\mathrm{d}U^{\mathrm{AN}} = (\partial U^{\mathrm{AN}}/\partial q)\mathrm{d}q + (\partial U^{\mathrm{AN}}/\partial f)\mathrm{d}f$, and by asking what change in f would leave an animal indifferent if the animal was given one extra unit of q, i.e. $\mathrm{d}U^{\mathrm{AN}} = 0$ and $\mathrm{d}q = 1$, we see that $\mathrm{d}f = -(\partial U^{\mathrm{AN}}/\partial q)/(\partial U^{\mathrm{AN}}/\partial f)$. Thus, in order to keep an animal's happiness unchanged, a farmer could reduce the amount of feed given to the animal by an amount equal to their marginal rate of substitution between q and f. This is, of course, just an animal's WTP, except the unit of payment is the quantity of feed – corn being the most widely used animal feed. To convert to monetary units, simply multiply the marginal rate of substitution by the price of the input, p_f. This means an animal's $\mathrm{WTP}^{\mathrm{AN}}$ for a marginal change in q is:

$$\mathrm{WTP}^{\mathrm{AN}} = p_f \mathrm{MRS}_{qf}. \tag{1}$$

Given the empirical research on animal preferences (e.g. Matthews and Ladewig, 1994), values such as that shown in equation (1) can be empirically estimated.

2.2. Human willingness-to-pay

Assume that a human's utility function is given by: $U^{\mathrm{HU}} = U^{\mathrm{HU}}(z, x, q, N^{\mathrm{AN}}, U^{\mathrm{AN}}(f, q))$, where z is a bundle of goods irrelevant to farm animal welfare or food, x is the quantity of animal products consumed, q is a previously defined variable related to animal care and well-being from which people receive a direct private benefit (e.g. due to perceived better tasting meat, higher food safety, warm glow, etc.), N^{AN} is the number of

5 Of course, animals make some decisions that affect their utility, such as deciding whether to root or dust bathe. However, this study is concerned with the amenities provided by the farmer that impact the animals' welfare. By definition, the variables of interest are exogenous to the animal.

farm animals and U^{AN} is previously defined as the animal's utility function.[6] The utility function U^{HU} is increasing in all of its arguments. This formulation captures the essential features that people derive both private benefits/costs from the level of animal living conditions and are also altruistic towards animals.

Let the price of z be normalised to 1 and the price of x be p_x. As it was for the animals, q is exogenous to the consumers' decision problem. The consumer chooses the level of x to consume subject to their income I. Optimal levels of z and x (i.e. the demand curves) derived from optimising U^{HU} subject to a budget constraint can be substituted back into the direct utility function to obtain people's indirect utility function: $V^{\mathrm{HU}} = V^{\mathrm{HU}}(p_x, q, N^{\mathrm{AN}}, U^{\mathrm{AN}}(f, q), I)$. Most people would be willing to pay for an increase in animal living conditions from q_0 to q_1, which affects all N^{AN} animals, and is given by the level of $\mathrm{WTP}^{\mathrm{HU}}$, which satisfies the following equality $V^{\mathrm{HU}} = V^{\mathrm{HU}}(p_x, q_0, N^{\mathrm{AN}}, U^{\mathrm{AN}}(f, q_0), I) = V^{\mathrm{HU}}(p_x, q_1, N^{\mathrm{AN}}, U^{\mathrm{AN}}(f, q_1), I - \mathrm{WTP}^{\mathrm{HU}})$. Taking a linear approximation around this indifference point and re-arranging yield

$$\mathrm{WTP}^{\mathrm{HU}} = \frac{(\partial V^{\mathrm{HU}}/\partial q)(q_1 - q_0)}{(\partial V^{\mathrm{HU}}/\partial I)} + \frac{N^{\mathrm{AN}}(\partial V^{\mathrm{HU}}/\partial U^{\mathrm{AN}})(U^{\mathrm{AN}}(f, q_1) - U^{\mathrm{AN}}(f, q_0))}{(\partial V^{\mathrm{HU}}/\partial I)}. \quad (2)$$

The first term is people's selfish or private WTP, which we refer to as $\mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}}$, and the second term is people's altruistic WTP, which we refer to as $\mathrm{WTP}_{\mathrm{U}}^{\mathrm{HU}}$. Consequently, total WTP for the change in q can be written as $\mathrm{WTP}^{\mathrm{HU}} = \mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} + \mathrm{WTP}_{\mathrm{U}}^{\mathrm{HU}}$. The second term $\mathrm{WTP}_{\mathrm{U}}^{\mathrm{HU}}$ is clearly increasing in the number of animals benefited. In a single decision of whether to buy a particular cut of meat or carton of eggs, people may not perceive their individual decision as having much impact on the welfare of many animals, i.e. $N^{\mathrm{AN}} \approx 0$, and in this case, the person's WTP is simply comprised of the 'private' or 'selfish' valuation, $\mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}}$. Previous studies estimating consumer WTP for changes in animal well-being have elicited people's WTP premiums for eggs or pork products the individual will consume, which contain private and possibly some public good components, but not WTP for egg and pork products which other people eat, which contain only public good components (e.g. Dickenson and Bailey, 2002; Carlsson *et al*., 2007a; Liljenstolpe, 2008; Tonsor *et al*., 2009; Norwood and Lusk, 2011).

In the second portion of equation (2), it should be recognised that the term $U^{\mathrm{AN}}(f, q_1) - U^{\mathrm{AN}}(f, q_0)$ is, approximately, the animal's marginal utility of q

6 That this function is increasing in the number of farm animals would seem to contradict the arguments of many animal advocates that there should be fewer – not more animals. However, such people also argue that the animals lead lives of suffering; lives not worth living. Thus, if U^{AN} is negative, human utility is no longer increasing in the number of animals.

multiplied by the change in q, and by equation (1), it can be seen that people's altruistic, $\mathrm{WTP}_{\mathrm{U}}^{\mathrm{HU}}$, can be written as a function of animals' WTP. In particular, equation (2) can be succinctly written as

$$\mathrm{WTP}^{\mathrm{HU}} = \mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} + \lambda\,\mathrm{WTP}^{\mathrm{AN}}, \quad (3)$$

where $\lambda\,\mathrm{WTP}^{\mathrm{AN}} = \mathrm{WTP}_{\mathrm{U}}^{\mathrm{HU}}$. For simplicity in the discussion that follows, we treat λ as a positive constant reflecting considerations such as the importance of animal suffering to the human and the number of animals affected by a policy.

To keep from cluttering notation, individual subscripts were not included in equations (2) and (3); however, this does not mean that all people have identical preferences. In all likelihood, people are heterogeneous with respect to their private and altruistic preferences towards animals. The purpose of our conceptual model, however, is to highlight the implications of utilitarianism (or aggregate cost–benefit analysis) applied to animals. As we discuss more fully in the next section, cost–benefit analysis focuses on *total* benefits and *total* costs. That these totals include heterogeneous people with high and low WTPs is somewhat immaterial to the present inquiry. There are some interesting questions related to the redistribution of costs and benefits among humans with different values, but we leave these to future research.

3. Cost–benefit analysis of animal welfare policies

Having derived the conceptual foundations for human and animal WTP for an improvement in animal living conditions, we now consider how these values might be used in cost–benefit analysis.[7] Economists typically measure social welfare by appealing to a utilitarian framework, where the total benefits of a policy are derived by summing WTP for the policy across all *people* in a society (or by multiplying the average WTP by the size of the affected population). This utilitarian framework does not typically count the WTP of animals, but as argued by philosophers from Jeremy Bentham to Peter Singer, a more complete utilitarianism would consider the well-being of both humans *and* animals (Singer, 2002; Matheny, 2006). This is to say that some argue that the welfare of animals should enter the social welfare function directly in addition to any indirect inclusion via the human utility function.

Traditional cost–benefit analysis of a policy would take a human-centric approach and would calculate the social benefits of a policy that improves q as

$$\text{Social benefit} = \mathrm{WTP}^{\mathrm{HU}} = \mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} + \mathrm{WTP}_{\mathrm{U}}^{\mathrm{HU}} = \mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} + \lambda\,\mathrm{WTP}^{\mathrm{AN}}. \quad (4)$$

7 Some research has suggested that consumers might have option values which influence their support for policies that remove an existing choice option such as cage eggs (e.g. see Hamilton *et al.*, 2003 or Swinnen and Vandemoortele, 2009). In what follows, we ignore the presence of such option values to focus attention on the difficulties that exist with including animal well-being in cost–benefit analysis in the presence of altruism.

In the previous section, we derived WTP at the individual level. In this section on cost–benefit analysis, it is more natural to think of WTP as representing aggregate values derived by summing the individual values over all people (or animals) in society. This link could be made explicit by multiplying the average WTP values by N^{AN} and N^{HU}, but such a move clutters the notation without providing any useful insights. Thus, unless otherwise noted, the WTP values discussed in this section relate to aggregate values for animals or humans, respectively. Obviously, these total WTPs include some people who are willing to pay a great deal to help animals as well as others who are willing to pay nothing, but that does not change the underlying implications of an aggregate cost–benefit analysis, which focuses on totals.

Cost–benefit analysis using equation (4) does not pose any special difficulties, other than the question of how to accurately measure the externality or public value associated with improved animal well-being, $\mathrm{WTP}_{\mathrm{U}}^{\mathrm{HU}}$. This is the issue we take up in the empirical application in the next section. However, greater complexity is introduced when social benefits are defined as the sum of human and animal WTP. The non-speciesist social benefit function, in which farm animals are given equal treatment as humans, is

$$\begin{aligned}\text{Social benefit} &= \mathrm{WTP} = \mathrm{WTP}^{\mathrm{HU}} + \gamma \mathrm{WTP}^{\mathrm{AN}} \\ &= \mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} + (\lambda + \gamma)\mathrm{WTP}^{\mathrm{AN}}. \end{aligned} \tag{5}$$

As is typically the case, the social benefit function in equation (5) measures welfare in dollars; it measures the market value of goods that both humans and animals are willing to forego for the policy. In many cases, WTP is also interpreted as the utility or well-being gained from the policy, but this requires that the marginal utility of money be equal for all parties involved. Such issues are frequently viewed as second-order importance. For example, economists often assume that the marginal utility of money is the same for humans of all income levels, not because they are believed to be the same but because the differences do not justify a more complex welfare function. In the case of humans and animals, this difference in marginal utilities, however, cannot be ignored. USD 100 may be a trifling number to a human, but could make differences between misery or bliss for a hog.

The marginal utility of money is plausibly greater for the animal than the human, though we remain agnostic about our ability to understand animal thought and emotion. One could, if desired, scale WTP to account for this difference, and that is the role played by the constant γ in equation (5). One dollar paid or received by animals is equivalent to γ dollars received or paid by humans in terms of utility, happiness, well-being, or whatever terminology the reader finds appropriate. When γ is set correctly, it places WTP for both humans and animals on the same cardinal utility scale. However dubious one may feel about stating animal and human happiness in the same units, we remind the reader that such comparisons are at the crux of many farm animal welfare decisions. For example, when discussing the ethics of raising farm animals for food, Matheny (2006: 13) states, 'in order to justify eating animals, we would have to show that the pleasure gained from consuming them *minus* the pleasure gained from eating a vegetarian meal is greater than the pain caused by eating animals.'

Now that a social welfare function has been articulated, a criterion is needed to determine how the interests of the two species are balanced. Two criteria, an efficiency criterion and the Kaldor–Hicks criterion, are discussed below. In terms of animal welfare, the differences in the two criteria are more salient than for issues in which only human benefits are considered. The reason is that the efficiency criterion balances the gains and losses of utility from a policy, while the Kaldor–Hicks criterion balances the gains and losses of monetary value. When marginal utilities of money differ for various parties, the differences between utility and monetary value become increasingly important.

3.1. Efficiency criterion

Total WTP given by equation (5) is the sum of humans' private values, humans' altruistic values and the animals' values. A simple efficiency criterion is that if total social benefits from a policy, WTP, are greater than the cost of the policy, *C*, then the policy should be implemented. But, unlike traditional cost–benefit analysis, the net social surplus (WTP – *C*) depends on whether humans or animals pay for the policy.[8] When humans pay the costs, the costs are simply subtracted from equation (5).

$$\text{Social benefit (humans pay } C) = \text{WTP}_{\text{P}}^{\text{HU}} + \lambda\,\text{WTP}^{\text{AN}} + \gamma\text{WTP}^{\text{AN}} - C. \quad (6)$$

From the standpoint of the efficiency criterion, a policy is desirable if the aggregate benefits exceed the costs: $\text{WTP}_{\text{P}}^{\text{HU}} + \lambda\,\text{WTP}^{\text{AN}} + \gamma\text{WTP}^{\text{AN}} > C$. When animals pay the cost, it is important that the costs enter the welfare function as γC. The reason is that, as stated above, one dollar paid by an animal takes away the same utility as γ dollars paid by a human. A second consideration is that when animals pay for the change, the cost also affects humans because of the altruistic component of humans' utility. Consequently, the social benefit of a policy when animals pay is

$$\begin{aligned}\text{Social benefit (animals pay } C) = {} & \text{WTP}_{\text{P}}^{\text{HU}} + \lambda(\text{WTP}^{\text{AN}} - C) \\ & + \gamma(\text{WTP}^{\text{AN}} - C). \quad (7)\end{aligned}$$

Forcing animals to pay the cost of a policy reduces the likelihood that the policy will pass the efficiency test. That is, for the same policy, the value in

8 However peculiar it may sound, animals could be forced to pay the cost of a policy. An example would be requiring producers to provide nests to layers, but allowing the producer to double group sizes, a change which could leave the producer's (i.e. human's) cost unchanged. In this example, the benefit to the hen of acquiring nests is greater than the cost of larger group sizes, so the bird benefits but pays the cost of the policy. If animal productivity is rising in animal welfare, some of these changes would raise profits and be provided by the market.

equation (7) is always less than the value in equation (6). Assuming animals have a marginal utility of money at least as high a humans, a policy of the same monetary cost yields lower social benefit when animals pay because (i) the animals lose more utility for each dollar spent and (ii) the altruistic benefits for humans are reduced (i.e. the costs, in a sense, get double-counted). Thus, in terms of strict efficiency, total welfare is higher when humans pay the cost of a policy.

3.2. Kaldor–Hicks criterion

A policy could yield total benefits which are greater than the total costs (i.e. the efficiency test is passed), but either humans or animals suffer harm. The efficiency criterion suggests that welfare will be higher if the costs of a policy benefiting farm animals are paid by humans, but what if humans do not benefit from the policy and wish to prevent the policy from being enacted? Typically, if the benefits are greater than the costs, then the winners can compensate the losers, leaving everyone better off. Notice, however, that the altruistic portion of the human utility function acts to double-count gains to animals which can prevent compensation schemes from benefiting everyone. This insight has been previously noted by other researchers in the context of human altruism (e.g. see Jones-Lee, 1992; Johansson, 1993; McConnell, 1997; Bergstrom, 2006), but to our knowledge this is the first application to animal welfare, which differs from some of the preceding models because altruism only runs in one direction – from people to animals but not vice-versa.

This section discusses cost–benefit analysis welfare, using the Kaldor–Hicks criterion, which states that a policy is desirable if some of the benefits to the beneficiaries can be transferred to those harmed by a policy, leaving everyone better off. Because this criterion considers the transfer of economic resources, it is necessary to set the value of γ to 1.[9]

Suppose that the costs of the policy are paid entirely by humans. In this case, the net social benefit of a policy that improves the well-being of animals is

$$\text{Net social benefit (humans pay } C) = \text{WTP}_{\text{P}}^{\text{HU}} + (\lambda + 1)\text{WTP}^{\text{AN}} - C. \qquad (8)$$

The efficiency criterion discussed in Section 3.1 suggests the policy should be implemented if $\text{WTP}_{\text{P}}^{\text{HU}} + (\lambda + 1)\text{WTP}^{\text{AN}} > C$. Consider a policy that passes this efficiency test, but is such that the monetary benefits to humans are less than the cost ($\text{WTP}_{\text{P}}^{\text{HU}} + \lambda\text{WTP}^{\text{AN}} < C$). In this case, humans would not approve the policy unless animals were able to transfer some of their

9 Recall that the value of γ was used to inflate the WTP of animals so that it reflected the humans' marginal utility of money. However, this section asks whether real wealth can be transferred from animal to man or man to animal. To answer this question, it is necessary that a dollar remain a dollar, regardless of which species holds the dollar.

benefit to the humans. Can such redistribution take place? That is, does the policy pass the Kaldor–Hicks test? Suppose that animals could redistribute a fraction, δ, of their gains from the policy to humans. So long as this fraction is greater than zero, the animals still benefit from the policy. The benefit to humans after the redistribution becomes $\mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} + (\delta - \delta\lambda + \lambda)\mathrm{WTP}^{\mathrm{AN}}$. If this figure is greater than the costs, C, humans benefit after the redistribution (as do animals). For humans to be made better off by the policy and its associated redistribution plan, the value of δ would have to satisfy

$$\delta > \frac{C - \mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} - \lambda\mathrm{WTP}^{\mathrm{AN}}}{(1-\lambda)\mathrm{WTP}^{\mathrm{AN}}}. \tag{9}$$

Note, however, that δ cannot exceed the value of 1 (i.e. animals cannot give away more than their total benefits and still find the policy desirable), and as such, benefiting humans is impossible when

$$1 < \frac{C - \mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} - \lambda\mathrm{WTP}^{\mathrm{AN}}}{(1-\lambda)\mathrm{WTP}^{\mathrm{AN}}}, \tag{10}$$

or, re-arranging terms, when

$$\mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} + WTP^{\mathrm{AN}} < C. \tag{11}$$

Equation (11) states that whenever the sum of private benefit to humans and the direct benefit to animals is less than the cost of the policy, it is impossible for the policy to pass the Kaldor–Hicks test *even if* it passes the efficiency test.[10] Thus, although the inclusion of human altruism, $\mathrm{WTP}_{\mathrm{U}}^{\mathrm{HU}}$, in the social benefit function can influence whether total benefits exceed costs (i.e. whether a policy passes the efficiency test), the magnitude of such altruism, no matter how large, cannot make a policy desirable to humans even with benefit redistribution if the sum of private benefit to humans and the direct benefit to animals is less than the cost of the policy.

10 Consider a simple example. Let people's private, selfish WTP for a policy be USD 20 and animals' WTP be USD 100, and let $\lambda = 0.5$. This implies that people's total WTP for the policy is $20 + 0.5(100) = 70$. The sum of people's total WTP and animals' total WTP is, therefore, $70 + 100 = 170$. Now, suppose that the actual costs of the policy are only USD 150. The aggregate benefits (170) exceed the costs (150). Total welfare would apparently increase by $170 - 150 = 20$ with the passage of the policy. Should we proceed with the proposal? If the policy is implemented, animals are better off by 100, but humans are worse off by $20 + 0.5(100) - 150 = -80$. Can some of the 100 gain from animals be transferred to people such that both animals and people are better off? The answer is no. Because the sum of people's selfish WTP and animals' selfish WTP is only 120, whereas costs of the policy are 150, there is no redistribution scheme that can make both animals and people better off from passage of the policy. To see that animals cannot compensate people for their losses in our example, imagine a redistribution scheme that takes all animals' benefits (100) and redistributes them to people. The net result is that animals' total welfare is zero and people's total welfare is only $(20 + 100) + 0.5(100 - 100) - 150 = 120 - 150 = -30$. Animals are indifferent, people lose and the redistribution is unsuccessful in creating an outcome where both animals and people are better off than they were prior to the enactment of the policy even though aggregate benefits exceed the costs.

What happens when animals pay the cost of the policy? Since the Kaldor–Hicks criterion requires that γ equal 1, the value of C does not need modifying as it does with the efficiency criterion. However, forcing animals to pay the costs reduces the benefit animals receive from the policy, thereby reducing the altruistic component of human utility,

$$\begin{aligned}\text{Net social welfare (animals pay } C) &= \mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} + \lambda(\mathrm{WTP}^{\mathrm{AN}} - C) + [\mathrm{WTP}^{\mathrm{AN}} - C] \\ &= \mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} + (\lambda + 1)(\mathrm{WTP}^{\mathrm{AN}} - C). \qquad (12)\end{aligned}$$

Thus, aggregate welfare is lower by λC when animals pay the costs as opposed to when humans pay the costs. Another way to state the difference is by noting that the net social welfare is $(1 + \lambda)^{-1}$ times lower when animals pay the cost of a policy instead of humans. So long as the private value of animal welfare to humans, $\mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}}$, is non-decreasing in animal welfare,[11] any policy where $\mathrm{WTP}^{\mathrm{AN}} > C$ has a positive impact for the humans. In this case, the policy is welfare-improving so long as $\mathrm{WTP}^{\mathrm{AN}} > C$. That is, a necessary and sufficient condition for a policy to pass the efficiency test is that the animals are willing to pay the cost of the policy. However, as previously discussed, passage of the efficiency test need not imply passage of the Kaldor–Hicks test. The animal could transfer a fraction of its gain ($\mathrm{WTP}^{\mathrm{AN}} - C$) to compensate the human, but as before, it is impossible for such compensations to improve the welfare of all parties when equation (11) holds.[12]

3.3. Towards empirical speciesist welfare measurements

Although a non-speciesist welfare function is interesting and meets the criteria of some ethical philosophies, it is doubtful that real policies will respond to any species besides the one which possesses political power. For the foreseeable future, animal welfare policies will be judged by the benefits delivered to humans. Measuring the value of animal welfare to humans requires understanding two components of WTP: humans' private values and humans' altruistic values. Humans' private values can be estimated using traditional techniques (e.g. Dickenson and Bailey, 2002; Carlsson *et al*., 2007a; Tonsor *et al*., 2009). An empirical challenge is in the measurement of altruistic or public-good values, denoted $\mathrm{WTP}_{\mathrm{U}}^{\mathrm{HU}}$ above. Previous studies have attempted estimates of these values using contingent valuation (e.g. Bennett and Blaney,

11 One might imagine a scenario, however, where $\mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}}$ declines as animal welfare improves. Forcing hog producers to discontinue the use of farrowing cages and provide outdoor access to hogs may also force them to select fattier sows. Fattier sows are more resilient in outdoor weather and are better at raising offspring outside of crates, but may produce less desirable pork.

12 If the animal transfers δ per cent of the benefit it receives from the policy, $\mathrm{WTP}^{\mathrm{AN}} - C$, to humans, the benefit to humans becomes $\mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} + \lambda(1-\delta)(\mathrm{WTP}^{\mathrm{AN}} - C) + \delta(\mathrm{WTP}^{\mathrm{AN}} - C)$. Substituting the largest possible value of 1 for δ, the human benefit will be negative if $\mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} + \lambda(1-1)(\mathrm{WTP}^{\mathrm{AN}} - C) + (\mathrm{WTP}^{\mathrm{AN}} - C) = \mathrm{WTP}_{\mathrm{P}}^{\mathrm{HU}} + (\mathrm{WTP}^{\mathrm{AN}} - C) < 0$, which is the same condition as in equation (11).

2003) or modified choice experiments (e.g. Carlsson *et al*., 2007b). However, previous approaches have relied on *stated* preferences, meaning that the values are hypothetical and subject to hypothetical bias. *Revealed* preferences or non-hypothetical values are preferred when available. Obtaining non-hypothetical values for the altruistic (or public good) component of farm animal welfare is difficult, but in the next section we describe a novel but simple experiment designed to accomplish this feat.

4. Empirical measurement of the public good value of farm animal welfare

To measure the public good value associated with animal welfare, representative samples of the population of three US cities were recruited to attend research sessions where they were given objective information about factors affecting the well-being of farm animals. Participants were shown two farm systems that differed systematically by a number of attributes related to animal well-being (e.g. space, group sizes, etc.). The public good value of farm animal welfare was measured by eliciting subjects' WTP, in a non-hypothetical auction, to move an animal (or animals) to the farm the individual preferred as opposed to the farm they least preferred, under the condition that the participant will never consume any of the food products from the animal(s). In what follows, we first describe the sample of people recruited to participate in the auction and the information they were provided. Then auction is described, and the results follow.

4.1. Description of sample

Subjects from three locations in the USA (Dallas, TX; Wilmington, NC and Chicago, IL) were recruited to attend 90 minute research sessions. The three cities were chosen to attain geographic diversity and because they represent regions of high pork consumption (Davis and Lin, 2005). Marketing research companies were hired to recruit a representative sample of 100 people from each location. People were paid USD 65–85 for participation (depending on location), and were recruited by asking if they would participate in a research study related to food preferences.[13] Subjects were not aware that the study related to animal welfare issues until the research session began.

The farm animal welfare debate has focused largely on egg and pork production, and as such, we focus our experiments on these species.

13 Of course, there is the chance that the size of the show-up fee influenced people's bidding behaviour. However, had we not offered money to attend a research session, we would have had a much less representative sample, and the size of the show-up fee offered is considered the norm in marketing research. To help address any confounds that the money might have introduced, subjects were told repeatedly to do whatever they like with the money, and were under no obligation to act in a certain way in return for the money. Moreover, note that people were recruited to attend the research session with the promise of receiving the money, and as such, they likely already incorporated the funds into their endowment (i.e. they did not view the money as a windfall gain).

Twenty-five people were assigned to each research session, half of which related to egg production and the other half to pork production, with the times of the egg and pork sessions varied to prevent confounding effects due to the time of day. The resulting subject pool is ethnically diverse, containing 24 per cent black or African American, 12 per cent Hispanic and 6 per cent of Asian descent. Roughly half (54 per cent) were male, all ages were well-represented (11, 19, 23, 22, 19 and 7 per cent of the sample had ages 18–24, 25–34, 35–44, 45–54, 55–64 and 65 or older, respectively); almost half had a bachelor's degree, and 36 per cent had an annual household incomes less than USD 40,000, 37 per cent between USD 40,000 and USD 80,000, and the remaining 27 per cent had household incomes greater than USD 80,000. There were a total of 288 subjects who provided usable results.

Upon arrival at a session, subjects were seated in front of a laptop on which they answered questions. In the introductory comments, the moderators informed subjects of a number of facts: that the researchers were not affiliated with animal industry or animal rights groups, that responses were confidential, that all responses provided by the respondents would not be made public to any other participant in the session, that an auction would be held that involved real decisions and real money and that subjects should avoid answering in a way to appear socially acceptable or to please the researchers.

After the introductory comments, subjects were shown a presentation describing the attributes that influence animal well-being on egg or hog farms. For each attribute, subjects were provided information illustrating why the attribute related to animal well-being; moreover, the presentation indicated the differing levels of that attribute in various production facilities. For example, the attribute *space per hen* was discussed, and subjects were provided information on the amount of space required for hens to stand and to spread their wings, and were told that productions systems vary the space per hen from the levels of 67 to 186 square inches or more. Another example is nest availability. After discussing how hens prefer to lay eggs in nests, subjects were informed of the variation in nesting provisions across different types of farms (for more details, see Norwood and Lusk, 2011). The attribute and attributes levels were chosen based on animal science research (Bracke *et al*, 2002; De Mol *et al*., 2006).

Participants were then shown two types of farms illustrated in Figure 1. One farm is generally thought to possess low levels of animal welfare and another to possess high levels of animal welfare. For layers, the cage system represented a lower provision of animal welfare. Well over 90 per cent of eggs produced in the USA come from a cage system similar to that in Figure 1. Scientific models of hen welfare show that hen well-being is significantly improved in the aviary with free-range (AFR) system (De Mol *et al*., 2006) such as the one demonstrated in Figure 1. A similar pair of farms was described for hogs, where the so-called crate system represented a lower

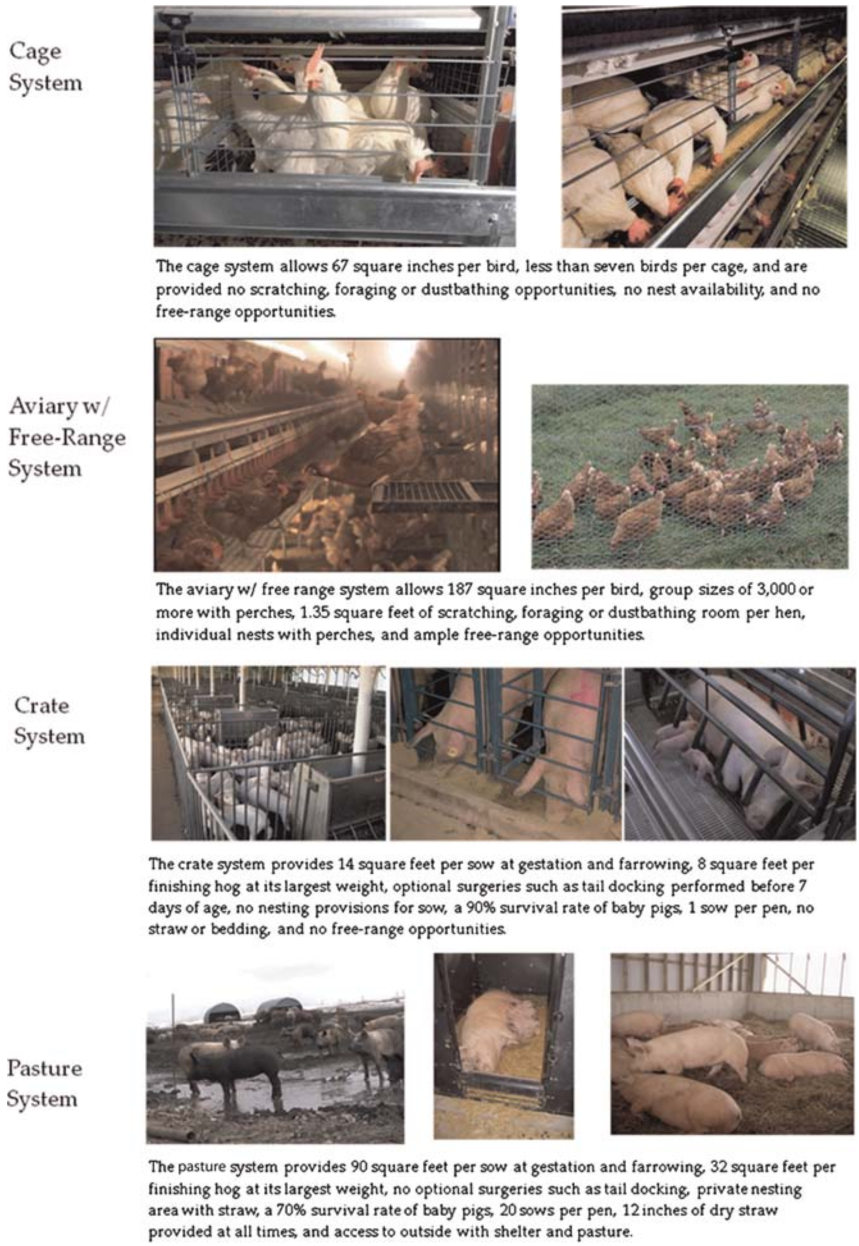

Fig. 1. Farm systems for egg and hog production.

level of animal well-being and the pasture system represented a farm with higher welfare standards (Bracke *et al*., 2002).

It is possible that some people preferred the cage/crate systems over the alternatives, and our approach permitted people to display such preferences.

For example, one drawback to the aviary and pasture systems is that they provide less protection from injury from other animals, and in the case of swine, less protection for nursing pigs. The moderators never articulated which systems were believed to generate higher or lower levels of animal well-being, only how various production attributes affect animal well-being and how those attributes vary across the two systems. The purpose of the experiment was to measure people's preferences, and as such, subjects discovered these preferences for themselves.

4.2. Animal welfare auction

As previously mentioned, subjects were presented two farm systems and were asked to indicate in which farm type they preferred the animal to be raised. Then, subjects were asked to bid to move 1, 100 and 1,000 animals to the subject's more preferred farm, as opposed to their lesser preferred farm. The exact question to which the subjects responded is shown in Figure 2. To illustrate the procedures, consider the egg layer treatment, and suppose that an individual indicated a preference for the AFR to the cage system (as the vast majority in fact preferred). The individual submitted three bids for 1, 100 and 1,000 hens using the drop-down boxes shown in Figure 2. The last drop-down box in Figure 2 represented a hypothetical question related to all hens (because it is hypothetical and is likely influenced by hypothetical bias, those results should be interpreted with caution). If the bids were not weakly increasing in the number of hens, the computer prompted the subjects and asked if they wished to alter their bids. Subjects were asked to submit bids for each number of animals (1, 100 and 1,000), indicating their maximum WTP to ensure the hen(s) were raised on the AFR farm instead of the cage farm.

After the bids were submitted, one of the three auctions was randomly chosen as the binding auction (either 1, 100 or 1,000 hens), and then one of the subjects from the group was randomly chosen as the binding participant. At the conclusion of the experiment, and in private, the randomly selected participant's bid was compared to a secret price that was randomly determined.[14] If the bid exceeded the secret price, the person won the auction, the animals were raised on the AFR farm and the participant paid the secret price. If the bid was less than the secret price, the person lost the auction, meaning they paid nothing and the animal was raised on the cage farm.

14 The saliency of the decision task might have been higher had one of each person's bids been selected as binding. Our instructions, however, were quite clear that there was a chance that one person's bid would be binding, and there was no mistake that the participants knew this to be true (frequent comments were: You mean we'd *really* have to pay? Answer: Yes. Do you take credit cards? Answer: Yes. And so on). The primary advantage of our method (versus hypothetical surveys) is that if an individual wanted to respond strategically by stating a high value, at least there was some non-zero expected cost to doing so in our experiment.

Fig. 2. Valuation instrument.

The monitors emphatically stressed that the auction was real and that if a person won the auction, they would pay the secret price and the animals would indeed be moved from a cage to an AFR farm. To increase credibility, the monitors indicated that the auction winner would be provided information throughout the life of the hens (or hogs) to prove they were raised on the chosen farm, such as videos posted on YouTube.com. Further, we emphasised that any bid was acceptable, including bids of zero. Subjects were told that the monitors would accept cheques or credit cards for payment if sufficient cash was unavailable. However, we stressed that subjects should not bid more than what they were actually willing and able to pay, as there is some chance that the secret price could take on a high amount (up to the maximum value in the drop-down box). This auction mechanism is the familiar Becker–DeGroot–Marschak (BDM) auction, which provides incentives for participants to submit bids equal to their maximum WTP for the good.[15] Before the animal

15 An advantage of the BDM mechanism, over discrete choice experiments, is that it provides a precise number representing the subjects' WTP. It should be noted that Horowitz (2006) has argued that if people have a particular type of non-expected utility preferences (where they have local utility functions), bids from a BDM may not provide the same information as discrete choices at posted prices.

auction took place, subjects were extensively trained on the mechanics and incentives of the BDM mechanism.[16]

As previously indicated, a few people preferred the crate/cage systems to the AFR/pasture systems, and as such they submit bids for animals to be raised under the crate/cage instead of the AFR/pasture system. In the data analysis that follows, their bids were multiplied by -1 (meaning that they would require compensation for a policy to move hens from a cage to an AFR system). Some participants indicate indifference between the two farm systems, either because they believe they provide comparable levels of care or because the participant does not place a value on animal welfare. For these individuals, their bids equal zero. A few bids were deleted from the analysis in cases where bids were decreasing in the number of animals auctioned, the participant fell asleep or the participant began answering questions before the moderator discussed them.

The bids offered in this auction are made with the knowledge that the researchers were recording subjects' behaviour and using the behaviour to draw conclusions about humans' desire to improve the well-being of farm animals. As such, it is possible that subjects might alter their behaviour because they knew they were being observed. We implemented several precautions to help minimise such social desirability bias. For instance, the instructions emphatically stressed that we were not promoting animal welfare and that the subjects should answer according to their own preference without deference to what they believed the researchers wished to find. We also ensured that all bids and payments were completely anonymous. Following Lusk and Norwood (2009), we also asked some inferred valuation questions regarding how subjects thought others would bid to attempt to detect whether bids were strongly influenced by social desirability bias, and our analysis of these data suggest that people's bids were similar to the inferred values, suggesting that bids were not much influenced by social desirability bias.

4.3. Results

Descriptive statistics for the auction bids are provided in Table 1. Most individuals submitted a positive bid, indicating that they value animal welfare even if it does not alter the food they eat. A non-trivial portion of individuals, however, indicated no concern by submitting bids equal to zero. Although the average total bid is increasing in the number of animals benefited, the per-animal bid declined as the number of animals affected increased. The stark

16 The training exercise first entailed a hypothetical auction for a single candy bar, where the rules of the auction mechanism were outlined, including justifications for why it was in the subjects' interest to submit a bid exactly equal to their true WTP. Then, the subjects were trained to bid simultaneously on four candy bars, where one of the candy bars was chosen as the binding candy bar, one person was chosen as the binding bidder and the auction proceeds as before. Finally, the four-candy-bar auction was held for real, where real money was exchanged for the candy bar.

Table 1. Auction bids for layer and hog animal welfare

	Willingness-to-pay for farm animal to be raised on preferred farm (USD)					
	Mean	Average per animal	Median	Minimum, maximum	Standard deviation	Percentage of zero bids
Number of layers ($N = 126$)						
1	0.98	1.080	0.50	−2.20, 10.00	1.86	33
100	14.69	0.195	1.00	−4.30, 1205	115.05	29
1,000	57.18	0.077	2.00	−4.90, 3719	391.88	29
All in the USA	341.53	1.363E−06	2.25	−5.00, 3820	1102.67	33
Number of sows and offspring ($N = 134$)						
1	2.85	2.850	0.10	−5.40, 99	11.58	40
100	7.72	0.077	0.30	−5.40, 399	36.69	38
1,000	23.34	0.023	1.00	−6.00, 1000	128.83	37
All in the USA	345.09	5.752E−05	1.75	−3788, 3820	1161.42	36

difference between the average and the median bid indicates the presence of a right-skewed distribution of bids.

The values reported in Table 1 are economically significant. Consider the following thought experiment. Assume a policy is proposed in which 1,000 layers are moved from a cage system to an AFR system. Such a policy would provide a public good (non-rival and non-exclusive), such that the benefit is shared by all consumers. Table 1 indicates that, on average, the subjects are willing to pay USD 57.18 for such a policy. The US population over the age of 18 is approximately 221,868,077. Multiplying the average bid by the population size yields a total value of USD 12.7 billion. A policy ensuring that 1,000 sows and all of their offspring are raised on a pasture system as opposed to a crate system generates values of USD 23.34 per person on average, or USD 5 billion total for the US population.

In one sense, these numbers are astoundingly large. Contrast the USD 12.7 billion value for enhancing the lives of 1,000 hens with the total value of US egg production, which is only USD 7 billion, representing egg production from 284 million laying hens (U.S. Poultry and Egg Association, 2008). Despite the magnitude of these figures, it is important to keep in mind that they are obtained in a real market, with people really paying money for the outcomes.

In another sense, the statistics reported in Table 1 suggest small values for the public good value of animal welfare. For both eggs and pork, the median subject will only forego USD 1 to 2 to improve the lives of 1,000 or more animals. Even when asked for a hypothetical bid to improve the lives of *all* farm animals, the median bid did not exceed USD 3. Moreover, roughly one-third of all subjects submitted a bid of zero, indicating that they either show no concern for the well-being of the animal or that they only feel responsible for animals producing the food products that they consume. Thus, although the aggregate (or average) WTP is large, it is driven by a small subset of the sample. Most of the subjects exhibit little concern for the well-being of layers and hogs, although the readers are at liberty to assign their own meaning to the words 'large' and 'small'.

There are some interesting differences between the bids for hogs and layers. First, the policy for hogs impacts more than the 1,000 sows; it impacts all the sows' offspring as well. The subjects were informed that a sow will have around 22 offspring each year of their adult life and will live for about four years. Conversely, the policy for 1,000 hens only affects 1,000 hens, so the two auctions affect different numbers of farm animals. Second, subjects may be more inclined to extend empathy towards one farm animal over another, and third, the change in welfare from moving a hen from a cage to an AFR system may be a larger or smaller change than moving a sow and her offspring from a cage to a pasture system. The point is that the differences in the bids from the two auctions are the result of a number of complex factors.

Overall, the bids suggest that the average value of animal welfare is profoundly impacted by a few unique individuals. In the auction for 1,000 sows, only 5 per cent of subjects reported a bid larger than the average bid. For the 1,000 egg layer auction, only 8 per cent submitted a bid higher than the average bid. One might be tempted to dismiss these unique individuals, but remember that the auction was binding and respondents were repeatedly told they may have to pay their bid. If we remove those few individuals whose bids exceed the average, the mean bid for the 1,000 layer auction falls from USD 57.18 to 4.92. Doing the same for the 1,000 sow auction reduces the mean bid from USD 23.34 to 2.84. This large heterogeneity presents difficulties for the practical formation of policies. Policies which appear to generate large gains for the population as a whole may be highly inequitable, causing losses for the large majority of the population. The results suggest that public choice economics are likely to significantly influence the actual policies that arise. The question, in this case, is whether the Kaldor–Hicks principle can practically be implemented.

5. Conclusions

Humans and livestock have lived together for thousands of years, co-evolving in ways generally benefiting both species. In the last 50 years, however, humans have discovered alternative methods of raising animals that provide a number of human benefits, but which arguably reduce the quality of animal life. The relationship between man and livestock has changed in such a way that some people are beginning to ask how the benefits to one species should be balanced against the costs to another. How these benefits and costs are weighed and measured is the focus of the present article.

Ingrid Newkirk, founder and president of PETA, is known for stating, ‘a rat, is a fish, is a dog, is a boy’.[17] The idea that animals should receive the same consideration as humans is a mantra for animal rights advocates; those who disagree are labelled speciesists.[18] While the term speciesism is not well-known, what is well-known is that many humans care about the well-being of the animals they raise for food. The first contribution of this research was to consider the consequences of modifying the conventional social welfare function to accommodate non-speciesism and humans' altruistic concern for animals. Our results indicate that when such a modified social welfare function is used, there can be situations in which the aggregate benefits of an animal welfare improvement policy exceed the costs, but for which the gains to animals are insufficient to offset the losses to humans. To determine whether a policy passes both the efficiency and redistributive tests, one should ignore the altruism humans exhibit towards animals. However, if traditional human-centric benefit analysis is conducted, the altruistic WTP remains an important part of cost–benefit analysis.

The second contribution of this research is to empirically estimate consumers' altruistic values for higher welfare standards using non-hypothetical experimental methods. When given the chance to pay money to improve the lives of 1,000 or more farm animals, about one-third of subjects were not willing to pay any money, placing no value on improved animal well-being. Of those who were willing to pay, most were not willing to part with more than USD 3.

This suggests that, ignoring any benefits received from better or safer tasting meat (or warm glow), humans generally place a low value on animal welfare as a result of altruism. However, there are a few individuals, less than 10 per cent of the subjects we studied, who are willing to forego large sums of money. These few individuals dramatically increased the average WTP, which was USD 57 per individual to improve the lives of 1,000 layers. To the extent that the subjects studied represent the population as a whole, this implies that American consumers are willing to pay up to USD 12.7 billion in aggregate to improve the lives of 1,000 layers; however, these benefits are concentrated among a very small minority of the population. This presents challenges for farm animal welfare policies. Policymakers may find themselves deciding siding with a loud minority or a passive majority.

17 This quote is thought to have originated in a Vogue Magazine interview in 1989, but has been repeated many times.

18 The term speciesist was coined by Richard Ryder in 1970 (Phelps, 2007).

The present study considered only a few issues of relevance in the farm animal welfare debate; many additional issues merit investigation. For example, our study revealed significant heterogeneity in people's altruistic values towards animals. Such findings have implications for modelling the policy making and implementation process (e.g. the public choice economics of animal welfare) and suggest the potential need to consider distributional issues of animal welfare policies among humans. Our conceptual analysis also revealed that in non-speciest cost–benefit analysis, an analyst may only need to measure animal WTP to know whether a policy passes the efficiency test. Collaborative efforts between economists and animal scientists may one day make turn the conceptual construct of animal WTP into a measurable statistic. Finally, this research considered the cost–benefit analysis of animal welfare policies, but there are market responses as well. Meat, egg and dairy products are increasingly differentiated along lines related to animal well-being, and it is possible that such market responses might partially solve the externality problem as consumers face social pressure and experience warm glow when buying such products.

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