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Animal welfare as a public good¹

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Abstract

We study a simple model of consumption of animals in which consumers exhibit altruism towards animals. Consumers can choose both the quantity and the quality of animal lives. This model gives rise to a public good problem: at the market equilibrium, quality is too low, and quantity is too high when animal lives are not worth living. We discuss some implications of our results and the significance of our modeling choices for the future landscape of economic research on animal welfare.

JEL classification: Q18, H41

Keywords: Animal welfare, public good, altruism, meat, life worth living.

1 Introduction

Animal welfare has become an important concern in our society. For instance, a large majority of Europeans (91%) agree that it is important to protect the welfare of farmed animals, and 84% agree that the welfare of farmed animals should be better protected than it is now (Eurobarometer 2023). Despite the growing recognition of the importance of animal welfare in policy-making, there is a lack of well-developed economic tools to study animal welfare. Hence, it becomes important to delve deeper into how existing tools, particularly those already employed in environmental and ecological economics, can be harnessed to advance our understanding of animal welfare.

Several economists have argued that animal welfare can be viewed as a public good (Cowen 2006, Norwood and Lusk 2011, Lusk and Norwood 2012, Johansson-Stenman 2018). In this paper, we introduce the simplest model we can think of that formalizes this idea. Consumers can choose the quantity as well as the quality of animal lives they consume. By “quantity” we mean the number of animals and

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by “quality” we mean the level of animal welfare. A more animal-friendly product is more costly. Crucially, consumers have an altruistic preference for animal welfare.

In this model, we show that the optimal quality at the equilibrium is always too low from a social point of view. This corresponds to the classical result of under-provision of a public good. We also show that the quantity consumed is either too high when animal lives are not worth living, or too low when animal lives are worth living. Hence, this analysis justifies the regulation of both the quality and quantity of animal lives consumed because of animal welfare considerations (Espinosa and Treich 2021, 2023, Eichner and Runkel 2022).⁴

Although our public good model is fairly standard, it possesses distinct and noteworthy characteristics. Most importantly, it contains two decision choices: consumers or social planners choose both the number of farmed animals brought into existence and their welfare. Hence, whether the socially optimal number of animals brought into existence is higher or lower than the market equilibrium crucially depends on whether those animals have positive or negative lives. The concept of life worth living thus emerges from that analysis. This two-choice model, coupled with the concept of life worth living, distinguishes our public good model of animal welfare from other public good models in the literature. While our model has several applications such as animal testing, we envision meat consumption as its canonical application.⁵ Our work is closely related to a recent working paper by Eichner and Runkel (2022). At the end of Section 2, we explain the formal relationship between our paper and theirs, both of which were developed independently.

In the last section, we discuss some implications of our findings and the pivotal role our modeling choices play regarding both private and social objectives. The model assumes an anthropocentric social objective, and pure altruism for the private objective. While this modeling choice may be viewed as a natural starting point, it drives our analysis. Consequently, we engage in a discussion of alternative modeling approaches, recognizing their significance in paving the way for the future economic research on animal welfare.

2 Theory

2.1 A simple model

There are $N > 1$ identical consumers. Each consumer i chooses the quantity of meat, i.e. the number $n_i \geq 0$ of (identical) animals consumed, as well as its quality in

⁴ Espinosa and Treich (2021, 2023) consider a non-anthropocentric model where animals hold intrinsic value, independently from humans. These papers consider a representative agent model and do not consider the public good aspect that we study here.

⁵ See Funke et al. (2022) for a broader discussion of meat regulation for health, environmental and animal welfare considerations.

terms of animal welfare level $d_i \geq 0$. We assume that consumer i 's utility is given by:

$$u(n_i) - (c + d_i)n_i + \alpha(\sum_{j=1}^{j=N} n_j v(d_j)) \quad (1)$$

where:

- $u(\cdot)$ is the consumer's utility of meat, assumed to be increasing and concave;
- $v(\cdot)$ is the farm animal utility level, assumed to be increasing and concave;
- $c > 0$ is the baseline cost to produce an animal;
- and $\alpha > 0$ is the altruism level.

We assume perfect competition and a linear production cost function, so that the price of meat (per animal) is equal to its constant marginal production cost: $c + d_i$. The quality choice d_i is thus determined by the extra cost due to the animal welfare improvement paid by the consumer i on top of the baseline production cost c . Note that there is a lot of evidence that consumers are willing to pay some premium for more animal-friendly products (Lagerkvist and Hess 2011, Norwood and Lusk 2011, Lusk and Norwood 2012).

The key property of this model is that the consumer i cares about the welfare of all animals through the term $\alpha(\sum_{j=1}^{j=N} n_j v(d_j))$, while her choices n_i and d_i only affect the welfare of the animals that she consumes, i.e. $n_i v(d_i)$. Hence, she does not internalize the impact of her choices on the other altruistic consumers. This creates the public good problem that we study in this paper. More precisely, the model exhibits characteristics akin to a private provision of a public good (Bergstrom et al. 1986). Each consumer i makes private decisions regarding meat consumption (quantity and quality) that affect animal welfare, taking as given the decisions of other consumers $j \neq i$. Note though that there are no strategic interactions here (i.e., the choice of a consumer does not depend on other consumers' choices). This is due to the separability of the consumer i 's objective with respect to the actions of the other consumers through the collective term $\alpha(\sum_{j=1}^{j=N} n_j v(d_j))$.

We focus on interior solutions. The first order conditions (FOCs) for the optimal choices at the equilibrium, denoted (\hat{n}, \hat{d}) , are given by:

$$u'(\hat{n}) - (c + \hat{d}) + \alpha v(\hat{d}) = 0 \quad (2)$$

$$-1 + \alpha v'(\hat{d}) = 0 \quad (3)$$

Equation (2) states that the marginal benefit of consuming an animal $u'(\hat{n})$ is equal to its marginal cost $(c + \hat{d})$, plus the altruistic benefit (or cost) associated with bringing an additional animal into existence $\alpha v(\hat{d})$. Equation (3) states that the per animal marginal cost of an investment in animal welfare, i.e., 1, is equal to its marginal altruistic benefit in terms of an increase in animal welfare per animal

$\alpha v'(\hat{d})$. Note that the optimal individual decisions (\hat{n}, \hat{d}) are independent from the number of consumers N .

We now characterize the social optimum denoted (n^*, d^*) . It is given by maximizing over n and d the sum of the utility of all consumers given by

$$N[u(n) - (c + d)n + \alpha n N v(d)] \quad (4)$$

yielding the following FOCs:

$$u'(n^*) - (c + d^*) + \alpha N v(d^*) = 0 \quad (5)$$

$$-1 + \alpha N v'(d^*) = 0 \quad (6)$$

Equations (5) and (6) reflect similar tradeoffs as equations (2) and (3) above except that the altruistic terms now capture the benefits (or costs) for all consumers.

2.2 Comparative static analysis

Our main objective in this paper is to compare (n^*, d^*) to (\hat{n}, \hat{d}) , namely, to study the impact of the market failure that takes the form of a public good problem on the choice variables.

First, we comment on the simpler case where the quality choice d is fixed, i.e. $d = d_0$ and $v_0 \equiv v(d_0)$. In that case, we can simply compare (2) and (5) assuming that $\hat{d} = d^* = d_0$. Since $N > 1$, it is obvious that there is more (resp. less) animal consumption at the social optimum than at the equilibrium if $v_0 > 0$ (resp. $v_0 < 0$), namely if a farm animal life is worth living (resp. not worth living) at the level of animal welfare $d = d_0$. The intuition is that i) when $v_0 > 0$ the existence of a farm animal is a public good and individual consumption is too low, while ii) when $v_0 < 0$ the existence of a farm animal is a public bad and individual consumption is too high. Case i) is related to the “logic of the larder” (Salt 1917, Matheny and Chan 2005, Singer 2011), that reducing the demand for meat causes fewer animals to come into existence, and thus reduces overall animal welfare. We briefly argue in the conclusion that case ii) (i.e., a life not worth living) is more likely for the majority of farmed animals.

We now study the general problem. It is obvious from the comparison of (3) and (6) that there is more investment in animal welfare at the social optimum: $d^* > \hat{d}$. This is intuitive: the investment in quality d is too low at the equilibrium since each consumer does not internalize that other consumers are better-off when she consumes a more animal-friendly product. This corresponds to the classical result of under-provision of a public good.

But what about animal consumption? A priori, the result is not obvious. On the one hand, the price of meat is higher at the social optimum, i.e., $c + d^* > c + \hat{d}$, providing an incentive to consume less meat. On the other hand, the animal utility level is higher at the social optimum, i.e., $v(d^*) > v(\hat{d})$, providing an incentive to consume more meat.

A simple manipulation helps us to solve the comparative static analysis. Observe indeed that by using (6) the condition (5) can be rewritten as

$$u'(n^*) - c = g(d^*) \quad (7)$$

where $g(d) = d - \frac{v(d)}{v'(d)}$. Similarly, we can rewrite the condition (2) using (3) as follows

$$u'(\hat{n}) - c = g(\hat{d}) \quad (8)$$

Hence, since $d^* > \hat{d}$, we can compare n^* and \hat{n} if we know the sign of $g'(d)$. We have

$$g'(d) = \frac{v(d)v''(d)}{v'(d)^2} \quad (9)$$

which is positive if and only if $v(\cdot) < 0$ (since $v(\cdot)$ is concave). This directly yields the following result:

Proposition 1 *Quality choice: The socially optimal level of animal welfare is always greater than the equilibrium one, i.e. $d^* > \hat{d}$. Quantity choice: The socially optimal level of animal consumption is lower than the equilibrium one, i.e. $n^* < \hat{n}$, if and only if the animal life is not worth living, i.e. $v(\cdot) < 0$.*

An immediate implication is that $n^*v(d^*) > \hat{n}v(\hat{d})$, meaning that animal welfare is always greater at the social optimum.

As we said above, one distinctive aspect of the public good problem we study concerns the two choices under consideration, namely the quantity and quality choices. This suggests another comparative static exercise that may be particularly interesting in this setting. Consider indeed a situation where only one choice is left to the market, the other being controlled by the social planner. This imperfect social control may reflect some economic or political constraints. For instance, that it may be easy to control total meat consumption in a centralized way (through, e.g., the implementation of a tax or subsidy on meat), but too costly to monitor animal welfare on various scattered animal production sites. Alternatively, it may be easy to control quality, but politically infeasible to tax or ration meat consumption for instance.

We consider first the case where there is a social control over quantity alone. In that case, the quality choice is left to the market, and it is easy to understand that consumers choose \hat{d} as given by (3). The social planner then maximizes (4) over n where $d = \hat{d}$. Denoting n^d this constrained social optimum regarding the quantity choice, it is given by $u'(n^d) - (c + \hat{d}) + \alpha N v(\hat{d}) = 0$. Since $d^* > \hat{d}$, the comparison between n^d and n^* is straightforward. It depends on how the expression $-(c + d) + \alpha N v(d)$ varies with d . Now observe that from (3) we have $-1 + \alpha N v'(\hat{d}) > 0$, so that the expression increases with d at \hat{d} and we can conclude that $n^d < n^*$. This is intuitive. The social planner has no control over

quality, which is too low, and optimally responds by restricting the quantity consumed.

We now consider alternatively the case where there is a social control over quality alone. In that case, it is easy to understand that the social planner sets d^* as given by (6). The quantity choice is left to the market and given by n^q defined by $u'(n^q) - (c + d^*) + \alpha v(d^*) = 0$. Since $N > 1$, the comparison between n^q and n^* (as given by (5)) is straightforward. If $v(d^*) > 0$, then $n^q < n^*$ while if $v(d^*) < 0$, then $n^q > n^*$. This is again intuitive. When animal's life is worth living (resp. not worth living), the social planner fully internalizes the public good aspect (resp. the public bad aspect) of meat consumption, leading to greater (resp. lower) consumption at the social optimum than the market consumption under imperfect social control. These results lead to the following Proposition.

Proposition 2 *Suppose that only quantity is controlled by the social planner. Then, both quality and quantity are lower than at the social optimum. Suppose alternatively that only quality is controlled by the social planner. Then, the level of quality is socially optimal, but quantity is too high if and only if the animal life is not worth living.*

We now briefly discuss the impact of other model's parameters. Note first that an increase in the level of altruism α always increases quality both at the equilibrium and at the social optimum. Moreover, it decreases the number of animals consumed if and only if the animal life is not worth living. This implies that both \hat{n} and n^* are U-shaped in α . This result is shown in Espinosa and Treich (2021) in a (nonanthropocentric) model where α has another interpretation but where the FOCs are similar formally. We note also that an increase in the number of consumers N has no effect on equilibrium choices (\hat{n}, \hat{d}) , but increases the socially optimal quality level d^* , thus increasing the inefficiency gap in the quality dimension. Note finally that the effect of N on n^* is also U-shaped since it is the same as that of α as can be seen from the FOCs (5) and (6).

Finally, it is important to note that our model is a special case of the recent general equilibrium model proposed by Eichner and Runkel (2022). Indeed, if one assumes in their model that i) there is no Kantian morality, ii) the production function is linear in both labor and land demands, and iii) the consumption utility function is quasi-linear with no individual taste for meat quality, then both models are identical.⁶ While Eichner and Runkel's model is very comprehensive and encompasses various aspects pertinent to animal welfare regulation (as further discussed in Section 3), it however requires a significant volume of notations and computations. In contrast, our model may be more user-friendly and focuses solely on the specific public good aspect of animal welfare.⁷

⁶ The proof is available upon request. We thank a reviewer for pointing this out.

⁷ Additionally, we would like to stress a link with one specific result in Eichner and Runkel (2022). In their Proposition 3i), they consider a particular case with a linear production function and a CES-type consumption utility function and show that quality is too low at the equilibrium as in our Proposition 1. Unlike our Proposition 1 however, they

3 Discussion

3.1 Policy implications

In this paper, we have introduced a simple model of animal consumption in which consumers are altruistic towards animals. Our results have four main policy implications.

First, we found that the consumer's investment in animal welfare improvement is always too low at the equilibrium. Hence, the government must regulate animal welfare, for instance through command-and-control measures regarding animal rearing conditions. Note that imposing labels about animal welfare, while useful for dealing with issues of asymmetric information, cannot solve this public good problem.

Second, we also found that the quantity of meat consumed at the equilibrium is in general suboptimal. Hence, there is a need to also regulate the quantity of meat. This stands in contrast with standard regulatory practices which usually focus on animal rearing conditions, but not on the quantity of meat consumed.

Third, we found that meat consumption is too low at the equilibrium when a farmed animal's life is worth living and that it is too high when it is not worth living. In industrialized countries, a large majority of animals are raised under intensive conditions (about 99% of them in the United States, Norwood and Lusk 2011). Matheny and Chan (2003), Bruers (2022a) and Espinosa and Treich (2021, 2023) provide support to the idea that the lives of animals in intensive conditions are not worth living. This in turn gives support to apply a tax on the meat produced in these farms (Funke et al. 2022).

Fourth, we add a general observation. Given various economic and political constraints, it is recognized that animal welfare is largely under-regulated. Opinion polls regularly show for instance that the public would like that farm animals be better protected (Eurobarometer 2015). Given that consumers cannot well express their demand for animal welfare through the food markets (as we have seen), this is not surprising to see various extra-market activities such as litigation or protest in favor of more animal protection (Lusk 2011).

find that quantity is always too high; but this is because they assume that the utility of animals is always negative. Moreover, Eichner and Runkel (2022) assume that the impact of a single consumer's meat consumption on animal welfare is negligible so that the consumer takes animal welfare as given. Hence, our Proposition 1 complements their specific finding, providing a shorter proof for a similar insight, using different functional forms and a different assumption on consumers' behavior. Moreover, our Proposition 2 about the analysis of imperfect social control is a novel result along with our other comparative static results about the effect of the altruism level α and the number of consumers N .

3.2 (Non)anthropocentrism

Our model adopts an anthropocentric perspective, where the social objective defined in (4) exclusively accounts for the welfare of humans. Animal welfare is only considered indirectly due to humans' concern for animals. Although anthropocentrism is pervasive in economics, it is morally problematic (Johansson-Stenman 2019, Fleurbaey and Leppanen 2021). In a notable early contribution, Blackorby and Donaldson (1992) introduce a model in which animal welfare holds intrinsic value. In such a nonanthropocentric model, the justification for public intervention exists even if humans do not inherently care about animals, as human choices generate externalities on animals (Espinosa and Treich 2021). Espinosa and Treich (2023) and Eichner and Runkel (2022) study the optimal animal welfare regulation when the social objective is nonanthropocentric.

However, the nonanthropocentric approach gives rise to several noteworthy concerns. First, it introduces a population ethics dilemma. This stems from the fact that social choices can impact the number of animals brought into existence, consequently altering the count of morally significant individuals. Various moral questions come to the forefront under variable populations such as the "repugnant conclusion"; see Parfit (1984), Greaves (2017), and the recent paper by Bruers (2022b) for its application to animal welfare.

Another issue raised by the nonanthropocentric approach is its limited political feasibility. In a world where humans wield power, any nonanthropocentric approach seems to lack political traction (Donaldson and Kymlicka 2011). An additional issue is then raised when both anthropocentric (with altruism) and nonanthropocentric approaches are combined: Double counting. Animal welfare is indeed accounted for twice in the social welfare function—once directly and again indirectly through consumers' preferences. This issue is reminiscent to longstanding issues regarding existence values in environmental and ecological economics (Johansson-Stenman 1998, Boyd and Banzhaf 2007).

3.3 Proanimal concerns

Our analysis hinges on a specific—albeit standard—behavioral hypothesis: the pure altruism of consumers. At first sight, this assumption seems legitimate. As we already said, WTP studies reveal that many people are willing to pay a significant amount for animal welfare (Lagerkvist and Hess 2011, Norwood and Lusk 2011). However, the alignment of humans' WTP with animals' interests remains uncertain (Espinosa 2023). For instance, humans could have impure altruistic concerns (e.g., self-image, warm-glow, moral licensing) which might lead them to care about something else than the overall impact on animals (Andreoni 1990, Blanken et al. 2015). Nevertheless, as soon as humans care at least a bit about the effective welfare of animals (pure altruistic component), the actions of others on animals induce a public good problem. In any case, there is a need for more research about the nature of proanimal concerns.

Interestingly, research in psychology has shown that people's attitudes towards animals can have a positive correlation with their attitudes towards humans (Caviola et al. 2019), suggesting that proanimal concerns may be linked to broader prosocial or proenvironmental values. However, there is also evidence of anthropomorphism, attributing human traits to animals, and anthropodenial, denying such traits, as influential factors in human-animal attitudes (Burghardt 2004, Leach et al. 2023). Empathy and compassion for different species often wane with increasing evolutionary distance (Miralles et al. 2019). Additionally, individuals may prioritize animals based on interactions (e.g., pets). Notably, the "meat paradox" literature highlights that people often downplay negative consequences of meat consumption on animals to alleviate psychological discomfort (Bastian et al. 2012). Importantly, food choices and more generally proanimal decisions are not isolated decisions but are influenced by social norms (Nyborg et al. 2016).

When designing policies, it is also important to take into account the diverse ethical frameworks that people may hold. Policies based solely on utilitarian principles may not be acceptable to those who hold deontological views, and vice versa. Eichner and Runkel (2023) underscore the importance of this factor in their model, allowing for the inclusion of consumers with Kantian preferences. Interestingly, recent research in psychology suggests that people may be more utilitarians for animals and more deontological for humans (Caviola et al. 2021). Another pivotal consideration in this context pertains to consumers' perceptions of what constitutes a life worth living. To formally account for this, a critical level can be introduced (Blackorby and Donaldson 1992), reflecting an individual's population ethical preferences regarding the value of an animal's existence.

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