Extended Abstract
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Paper/Poster Title	Animal Welfare Economics: Unintended Transformation Risks to Production

Abstract prepared for presentation at the 98th Annual Conference of The Agricultural Economics Society will be held at The University of Edinburgh, UK, 18th - 20th March 2024.

Abstract	*200 words max*

In the UK, animal welfare is now ingrained within both domestic policy and international trade deals. However, economics has primarily focused on consumer preferences and not production economics, possibly creating an imbalance over who pays (producer) and who benefits (consumer) from regulatory and market settings (standards). Subsequently, understanding how production systems (i.e. technology choices) transform to meet these standards is important for the long-run profitability of alternative systems.

Each technology choice provides different levels of animal welfare outcomes. As decision-makers move from one technology to another, changes to income, fixed and variable costs of production, and risks and uncertainties occur. For example, in poultry production systems, access to the natural environment increases animal welfare, but it comes with greater exposure to increased biosecurity risks (e.g. avian influenza). Depending on the capital nature of animals in a production system it is not just forgone income but in extreme cases a complete loss of the capital base (e.g. the destruction of the reproductive capital base).

This paper provides a methodology to explore the risks and benefits of alternative technologies to meet changes to animal welfare standards. It can logically be expanded to explore any change to regulation.

Keywords	Animal Welfare, Regulation, Decision making under risk and uncertainty
JEL Code	Q180, D81 see: www.aeaweb.org/jel/guide/jel.php?class=Q)

Introduction	*100 – 250 words*

Animal welfare economics is not new (Bennett, 1995; McInerney, 2004) but consistent with the findings by Burstein (2003), society's position on animal welfare is now represented by standards. These standards should reflect the change in the level of harm society is willing to accept for economic growth (Coase, 1960).

When standards change, there are likely to be both winners and losers, and the concept of constrained welfare economics (Randall, 1975) allows for the impact of standards to be explored. Such analysis is important to highlight the pros and cons of

transformation towards social objectives to facilitate ongoing refinements in standards. Understanding the impact, and reviewing standards, is one way to prevent regulatory capture (Laffont &Tirole, 1991), and it helps ensure that standards still reflect social expectations, with caveats (Burstein, 2003).

Economic literature associated with animal welfare has primarily been focused on the consumer and their willingness to pay as a proxy for justifying regulations (Grethe, 2017; Lusk & Norwood, 2011). While there has been recent interest in exploring the proposition of extending economic welfare to include animals (Johansson-Stenman, 2018) all or only sentient animals (Treich, 2022). While work by Bennett (1995) and (McInerney, 2004) provides the frameworks for understanding the impact on the producer, we still find very few practical examples of presenting this transformation nor the changes in risk and uncertainty associated with such transformation. For this analysis, we turn to production economics to explore how decision-makers may adapt.

Methodology	***100 – 250 words***

To explore the constrained welfare set of technology choices and the risk of adoption, the methodology merges the joint-production function into a state-contingent model to illustrate an active decision-maker who adapts to both regulation and unforeseen events. Notes on the model on how to separate those production systems where the animals are the capital and those that are not will be explored.

Färe et al. (2007) work on the joint-production function highlighted that we can model both the desirable (i.e. yield) and non-desirable outputs (i.e. animal welfare) derived by each technology. By extending this thinking we can then describe how each alternative technology requires a set of inputs, produces a set of outputs (desirable and non-desirable), and changes the risks (see next section) to that investment (e.g. biosecurity events).

Building upon the work by Arrow (1953), Chambers and Quiggin (2000) highlight how the state-contingent approach (SCA) can negate uncertainty by having the capacity to describe all possible states of nature (nature is the complete range of outcomes). For each state of nature, the decision maker can reallocate inputs to produce state-described outputs. This separation of the event and the response to that event then negates the ambiguity found in other approaches ((O'Donnell & Griffiths, 2006). This then provides an active decision maker who is proactive to realized events.

Results	***100 – 250 words***

The paper uses illustrative data to highlight the model application and contrasts the decision-making behavior of two different types of farms where livestock is the capital

base or it is not. As Adam Smith (1723) noted breeding livestock needs to be treated as a capital good.

The nature of production systems, multiyear (perennials, breeding stock) and annual (grain crops or layer hens), and the decision-maker response to realized events is anticipated to be different. In modeling behavioural responses to drought, the water market and irrigation systems (Adamson & Loch, 2021; Adamson et al., 2017) highlighted the willingness by decision-makers to absorb short-run losses to keep capital alive, so that they didn't become mired in debt.

In the case, where transformation to improve animal welfare occurs and the underlying risks to the production system alter, we should anticipate that those systems where livestock is the capital base will be slower to transform. We can draw lessons from avian influenza to back this up where although the losses are significant, livestock is a variable cost of production. Provided that stock is available, the reestablishment of the supply chain is quick. However, when we consider Foot and Mouth Disease or BSE, the time and costs associated with re-establishing an industry are not as simple (Perry et al., 2020).

Discussion and Conclusion	***100 – 250 words***

Transformation changes risk, and by adapting Pindyck (2011), if we find that such an analysis can prevent one catastrophic event (unintended animal welfare loses from changing biosecurity risk) it may provide significant public and private benefits.

Society wants improvements in animal welfare, and standards have changed and will continue to evolve, either driven by private standards, domestic policy or international market regulations. For an informed economic debate, we need to explore both sides consumers and producer to determine the net gains from transformation. If the research finds that the burden of costs and risk from transformation fall primarily on one group and not another, we can then have a policy debate concerning the equality of such standards.

The flexibility of this approach rapidly allows for other aspects such as the suitability of alternative technology to still provide animal welfare benefits under climate change to be explored.

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