

## How best to improve farm animal welfare? Four main approaches viewed from an economic perspective

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### Abstract

Looking at the issues from an economic perspective, we examine four approaches to the improvement of farm animal welfare: legislative initiatives, and initiatives driven by producers, consumer choice (labelling), and food companies (Corporate Social Responsibility; CSR). We take as our starting point the assumption that to obtain the best possible improvements in animal welfare, a combination of all four approaches will be needed. The main focus of the paper is to show that (and how) economics and other social sciences can play an important role in determining how to design and implement these approaches most effectively. We argue that insights from animal welfare science on what constitutes an improvement in animal welfare, and how such improvements are best measured, are a necessary input to the economic analyses. Economic analyses can guide the form and extent of welfare legislation so as to set decent minimum standards of animal welfare. To exploit producer-driven animal welfare opportunities, understanding the relationship between animal welfare, productivity and other product or production characteristics is essential. To make best use of initiatives driven by consumer choice and CSR, the focus needs to be on, not simply aspects of animal welfare for which consumers are known to be willing to pay, but also other welfare dimensions viewed as essential by animal welfare experts. Finally, recent, rapid developments in the marketing of animal welfare-friendly products have demonstrated the need for more knowledge about the ways in which consumers perceive the different kinds of information used in labels and CSR strategies.

**Keywords:** animal welfare, consumers, corporate social responsibility, economics, legislation, stakeholders

### Introduction

It is widely acknowledged that efficient livestock production requires good management practices which include appropriate feeding and healthcare (Food and Agriculture Organisation [FAO] 2018a). In this respect, it is in the producers' interests to preserve at least some elements of farm animal welfare, particularly those related to good animal health. However, over the last two decades, numerous studies have shown that many people care about aspects of animal welfare that are not necessarily safeguarded in profitable methods of production (Eurobarometer 2007, 2016; de Jonge & van Trijp 2013a; Christensen *et al* 2014; Weible *et al* 2016; Denver *et al* 2017; Grunert *et al* 2018). The latest Eurobarometer study (2016), involving 27,672 European citizens in 28 countries, reported that almost all respondents (94%) considered it to be 'very important or somewhat important' to protect the welfare of farm animals. Almost as many (82%), answered 'yes, certainly, or yes, probably' when asked whether they believed the welfare of farmed animals in their respective countries should be given greater protection than it receives currently.

Concerns about the well-being of farm animals date back more than five decades. Beginning in the 1960s, in countries

in north-west Europe, farm animal welfare acquired a political importance it had not had before. The main tool initially devised to protect animal welfare was legislation (Sandøe & Jensen 2013). Animal welfare laws were introduced first at the national level and, later, within the European Union (EU), at the supranational level, binding EU member states (Bennett 1997; Fraser 2008; Christensen *et al* 2012). Currently, there are common EU rules on the transport and slaughter of livestock, and joint minimum requirements have been defined for the housing of a number of farm animals, including pigs, broilers, laying hens and calves (Broom 2017; European Commission 2017).

However, the interest within the EU in further regulating animal welfare through legislation has waned. This development is connected with increasing pressure from global competition in animal production, and also, it would seem, challenges in reaching international agreements on higher animal welfare standards in a considerably expanded EU (Christensen *et al* 2012). Policy papers from the EU have begun to stress the potential of market-driven approaches which help consumers to navigate their way to different types of welfare products through information provision, certification and labelling (European Commission 2006, 2009).

At the EU level, then, initiatives designed to improve farm animal welfare through higher minimum standards now seem to have lower political priority than various instruments designed to support market-driven change (Heerwagen *et al* 2013). Animal product labels guaranteeing animal welfare levels higher than legislation requires (so-called point-of-sale information) have been on the market in Denmark, as well as other European and developed non-European countries, for at least three decades. In Denmark, for example, barn and free-range eggs have been sold with price premiums since the 1980s; the official Danish organic label was initiated in 1989; and Friland A/S has sold free-range pork approved by the main animal protection agency in Denmark, Dyrenes Beskyttelse, since 1992. Moreover, RCPA Certified (formerly Freedom Food) animal products in the United Kingdom and Beter Leven-labelled animal products in The Netherlands are well-established examples of product lines guaranteeing animal welfare levels above legal minimum standards (Christensen *et al* 2014).

Over the past decade, a different type of market-driven animal welfare has developed, where strategies to improve welfare are formulated at company levels to demonstrate corporate social responsibility (CSR). With this development in mind, we suggest that the growing interest in CSR initiatives being shown by retailers and food companies points towards a belief in the benefits of reaching consumers earlier in the shopping process than at the point-of-sale — either by using general in-store information or by branding food production or food marketing companies using out-of-store information.

A consensus seems to be developing that all the above-mentioned ways of improving animal welfare are needed: 1) initiatives driven by the producer's desire for efficient production; 2) legislation; 3) initiatives driven by labelling combined with consumer demand; and 4) CSR-driven initiatives involving retailers and food companies. Thus, our research question is: How can economic analyses best contribute to the design and implementation of the four approaches to the promotion of farm animal welfare?

Throughout the paper, we use Danish regulation of laying hens as a case illustrating the potential strengths and weaknesses of shifting regimes of legislation- and market-based drivers. Thus, early Danish legislation saw a ban on battery cages with disastrous consequences for Danish egg exports; since the 1980s, a mandatory labelling system has encouraged moves toward alternatives to battery cages in Danish egg production; and most recently a CSR-driven initiative involving all of the main Danish retailers has led to a halt in the sale of eggs laid by caged hens. Producer-driven initiatives have also brought beak-trimming in Danish egg production to an end. We believe that the Danish case is part of a wider trend in animal-based food production in Western countries, and we hope that our investigation will serve as a reference point for those seeking to understand the potential and barriers of the four types of initiatives to improve animal welfare in other countries.

The approach of the present study is anthropocentric in as much as the welfare of farm animals is characterised as a good produced *either* directly for the benefit of human welfare *or* indirectly as an unintended (and possibly unnoticed) side-effect of production. It should be noted, though, that the anthropocentric approach in economic analyses is increasingly being challenged by economists (such as Lusk & Norwood 2012; McMullen 2016; and Johansson-Stenman 2018), who provide thought-provoking ideas on how the intrinsic value of animals and animal preferences can, conceptually and practically, be incorporated in economic analyses. We do not dismiss the non-anthropocentric approach to economic analysis. It is simply that it cannot be included in this paper without widening the scope dramatically and moving the focus too far away from the core topic we wish to consider.

### How can producer-driven initiatives improve farm animal welfare?

We define producer-driven improvements in animal welfare as improvements that are made by producers independently of legislative changes and irrespective of whether consumers are willing to pay a price premium for the products. They include improvements brought about when producers individually, or collectively (eg at the national level), raise levels of animal welfare voluntarily in response to what they see as a positive correlation between animal welfare and profitability. This pattern of behaviour is a key element in neoclassical economics.

A classic illustration given by McNerney (2004) captures some of the basic elements of the relationship between animal welfare and productivity at farm level. For low levels of productivity, McNerney suggests a positive relation between productivity and animal welfare. This type of relation relies implicitly on the assumption that the highest attainable level of animal welfare is not necessarily enjoyed by animals living in the wild without human intervention. Spinka (2006) points towards behavioural patterns that are clearly natural but that are also detrimental to animal welfare. Such behaviours include rank- or illness-related aggression during which animals inflict injuries or deprive their mates of resources (Spinka 2006). These views are supported by Mellor (2015), who summarises his review of animal welfare studies as follows:

it is widely considered that providing living circumstances that minimise compromise in nutritional, environmental, health, behavioural and mental domains of welfare, is far more important than keeping animals in replicated natural or wild environments

In more intensive modes of livestock production with higher levels of productivity McNerney suggests there are trade-offs between productivity and animal welfare. Hence, although some might disagree, it is likely that some types of human care that benefit production can result in improved animal welfare (win-win situations) but that some production methods intended to improve productivity may be neutral or even detrimental to animal welfare (trade-off situations).

To incorporate conceptual frameworks, such as McNerney's, into actual decision-making it is necessary to

quantify the relationship between different dimensions of animal welfare, on the one hand and, on the other, not just productivity, but also food quality and safety traits, environmental pollution and climate effects — to mention just a few of the myriad values that are affected intentionally or unintentionally by animal production and may help to optimise the overall value of animal production. Often, these relationships are complex and difficult to measure.

An example of farming where human intervention led to better animal welfare is described in Stott *et al* (2012). This paper assesses the interaction between profits, flock size and animal welfare on 20 extensive sheep farms. The authors found that animal welfare was positively correlated with human labour per ewe. The authors also found that animal welfare was not correlated with profits or flock size, indicating that there are no trade-offs between profit and animal welfare, or between animal welfare and farm size in extensive sheep farming.

A recent example of a win-win situation for farmer and animals is provided in Kudahl *et al* (2017). The authors of this paper identify the most important welfare problems in Danish dairy herds as poor comfort when resting, injuries, lameness and lack of opportunities for grazing. They estimate that reducing these welfare problems by investing in extended cubicles, placing soft mattresses or sand in the cubicles, and improving floor quality and hygiene, would be profitable over a ten-year payback period based on the assumption that milk yield would increase by a minimum of 1 kg per cow per day and that lameness would reduce by 10–20%. Access to pasture, on the other hand, was found to be non-profitable because it was associated with high costs and milk yield losses. Very different results were obtained by Barnes *et al* (2011), who focused on the interaction between lameness in 80 British dairy herds and overall technical efficiency of production. Using data envelopment analysis (DEA), they found that reduced rates of lameness through access to pasture increased technical efficiencies in dairy production. More specifically, they found that farms with low levels of lameness were inefficient with respect to labour and stocking density, but that this was outweighed by the gains in milk yield obtained on these farms. This example demonstrates how the outcome of economic analyses of the relationship between grazing and milk yield might depend on whether intermediate relationships between grazing, lameness and milk yield are also included. The example also demonstrates that such relationships are likely to vary depending upon the specifics of the systems. Hence, more studies of this kind are needed to provide firmer conclusions.

Danish egg production may provide another positive example of win-win (Danish Egg Association, personal communication 2018). Beak-trimming was, until recently, a routine mutilation carried out on day-old chicks in egg production to prevent later feather-pecking and cannibalism. However, in 2013/14, egg producers in Denmark stopped beak-trimming and managed to do so with no overall increase in mortality from feather-pecking and cannibalism. A win-win on animal welfare and profitability (eliminating the costs associated

with beak-trimming and increasing the perceived value of the product) seems to have been achieved.

A rather different situation, in which there is a trade-off between animal welfare and profitability, was identified in Danish egg production. Low welfare of broilers has been associated with high stocking density in broiler production (de Jonge & van Trijp 2013b) and stocking density is one of the main production criteria used to differentiate between cage, barn, free-range and organic egg layers (Council Directive 1999/74/EC). Dawkins and colleagues found that the relationship between the welfare and stocking density is not that simple and that other factors, such as housing environment, nutrition, genetics and management, are equally or more important (Dawkins *et al* 2004; Dawkins 2017, 2018). Nevertheless, all things being equal, it seems to be a reasonable assumption that reducing stocking density in standard broiler or layer hen production will increase animal welfare. As input to the introduction of welfare labels for indoor chickens in Denmark, Pedersen (2017) estimated the costs of reduced stocking density. Pedersen found that reducing the stocking density among laying hens by 5 and 10% in standard production systems with nine hens per m<sup>2</sup> (and thereby presumably increasing animal welfare) led to reduced profits of 5.5 and 11%, respectively.

As a supplement to McNerney (2004), Dawkins (2017) has pointed to a number of financial benefits of improving animal welfare in order to show that potential conflicts between animal welfare and efficient farming can often be resolved, or at least mitigated, by increasing awareness of these benefits. Dawkins summarises that improved farm animal welfare could increase profits through: (i) reduced mortality; (ii) improved health; (iii) improved product quality; (iv) improved disease resistance and reduced medication; (v) lower risk of zoonoses and foodborne diseases; (vi) farmer job satisfaction and contributions to CSR; and (vii) the ability to command higher prices from consumers. She concludes that such financial benefits would reinforce, rather than replace, the ethical arguments for good animal welfare.

The point made by Dawkins (2017) — that improving animal welfare might increase work satisfaction — feeds into the field of behavioural economics that seeks to include drivers other than profit maximisation to understand producers' behaviour (Organisation for Economic Co-operation and Development [OECD] 2017). As an alternative to producers being driven by profit alone, behavioural economics recognises that farmers may be motivated by, amongst other things, a desire to improve their standing in society through efforts to reflect social norms ('obtaining a social license to farm'), the wish to improve yields, or volume, while paying less attention to expenditures (Pedersen *et al* 2012), and the opportunity to spend more time with their families.

In economic analyses of animal welfare, the need to understand the underlying motivations and values of farmers is increasingly acknowledged. Among other things, such knowledge can be used to anticipate the types of information farmers might need if they are to improve animal

welfare, how different economic as well as non-economic instruments will affect farmers' behaviour, and how best to target instruments to different types of farmer and thereby increase the effectiveness of interventions (Austin *et al* 2005; Hansson & Lagerkvist 2015; Schreiner & Hess 2017).

Bock and van Huik (2007) analysed farmers' participation in farm assurance schemes in six European countries (The Netherlands, Italy, France, Norway, Sweden, and the UK), looking at 60 pig farmers from each country. They found that farmers participating in the quality assurance schemes could be split into two groups. One group of farmers were likely to participate in broad schemes where animal welfare was one among several criteria; they were likely to define animal welfare primarily as animal health and biological functioning and were likely to focus on productivity when defining good farming practices. The other group of farmers were likely to participate in schemes focusing explicitly on animal welfare or organic production; they were likely to define animal welfare in terms of natural behaviour, and to adopt a broader spectrum of goals to be optimised — one including not only productivity, but also animal welfare and environmental performance. Bock and van Huik (2007) state that “many pig farmers feel misunderstood and that they are depicted as uncaring and guilty of ignoring animals' needs, while they consider themselves to be closely and naturally engaged with animals and their needs”. They suggest that farmers, retailers and consumers should be engaged together in formulating welfare assurance schemes of a kind that may turn these demotivating attitudes among farmers to positive participation incentives while at the same time highlighting that there is a joint responsibility for improving animal welfare.

Closely related to studies in behavioural economics examining the value of having a social license to farm is the growing literature incorporating reputational functions in analyses of economic optimisation problems. A recent example is Belay (2018). This paper treats public disclosure of pig farms using large amounts of antibiotics in their production as an additional cost of production to those farms. In a similar way, it is likely that reputational costs associated with low animal welfare standards on a farm could be estimated, but that remains a research area to be developed.

### The role of economics in identifying the potential and limitations of producer-driven animal welfare

The role of economics in producer-driven animal welfare can be summarised as:

- Developing holistic multi-criteria models for bio-economic optimisation of production in relation to animal welfare, productivity and other goals of the farmer;
- In particular, ensuring that relevant research information about productivity and animal welfare is disseminated effectively to farmers;
- Estimating the value of societal goodwill (or the possession of a license to farm) based on positive indicators of animal welfare;
- Increased understanding of farmers' perceptions of animal welfare — and drivers/motivations for improving animal welfare.

### How can legislation be used most efficiently as a tool to improve animal welfare?

In economic terms, farm animal welfare is not sufficiently factored into the farmers' production decisions. This is because while no costs are attached to the degradation of animal welfare, as long as the welfare level does not affect productivity, costs are often associated with improving animal welfare. Additions to housing space, more handling, food supplements, enrichment tools or materials for the animals — all of these need to be paid for. In other words, low animal welfare can be an unintended side-effect of efficient production (a so-called ‘externality’; see Baumol & Oates 1988). Moreover, there is a public good element of animal welfare that goes beyond the satisfaction (or benefits) the consumer obtains from buying welfare-friendly food and the benefit that farmers receive from producing it. This can be contrasted with the private good of consuming a pork chop, which can only be enjoyed by the person eating the chop. The welfare of farm animals can, thus, be characterised as a public good because everyone, including those not consuming that specific chop, can obtain utility from their awareness, or perception, that the animals have had a good life (and, of course, disutility from an awareness, or perception, that the animals did not have that kind of life). Cows, and sows, on grass illustrate this. Various people might obtain utility by looking at cows, or sows, in the fields, or simply knowing that those animals exist and have a good life. Thus, people's concerns about animal welfare can extend far beyond the private sphere within which the producer supplies animal products to consumers who then enjoy their consumption. This creates a market failure in that the economic incentives in an unregulated economy inevitably lead to the under-appreciation of animal welfare (eg McInerney 2004).

Another market failure involving animal welfare located beyond the private sphere between producers and consumers stems from the invisibility of livestock welfare in food products. This invisibility makes it difficult for consumers to buy food with the level of welfare they prefer. A seemingly simple solution to this problem is to provide information about the differing levels of animal welfare in different products. However, if the information is to have an impact, it needs to be trustworthy, understandable and targeted at consumers who are interested, and also provided at a point in time when they are motivated to use it. Such information is costly, and the benefits of information provision must be weighed against its costs.

In the presence of market failures like those above, legislation and information provision have been resorted to as solutions — ie ways of ensuring that sufficient resources are allocated to improving animal welfare. The use of legislation to secure minimum acceptable standards of farm animal welfare is justified by neoclassical economic theory. Equally driven by market failures, and so also justified by neoclassical economic theory, is the use of legislation-based instruments, such as taxes and subsidies, that rely on economic incentives to increase the relative desirability of animal

welfare-friendly products (Ryland 2015). However, for reasons of space, we will not go into this possibility here.

Costs, as well as benefits, are associated with minimum welfare standards — costs for producers, consumers, and indeed regulators. Economic analyses can be used to estimate these costs, and the corresponding benefits, for the involved stakeholders (including the animals). First of all, the standards benefit the animals. Secondly, such standards provide public as well as private benefits to citizens who value the fact that no farm animals will have to live in conditions below them. These benefits must be weighed against the costs of setting minimum standards.

Minimum standards impose costs on the segment of citizens who view them as excessively strict and would have been content with lower levels of animal welfare, or cheaper food, or preferred the government to spend their resources on things other than implementing and enforcing legislation to improve animal welfare (Norwood & Lusk 2011). For the legislators, there are costs associated with monitoring and enforcing compliance with the minimum standards. And, not least, there are costs to producers if they have to change their production procedures to comply with standards required by law. These additional costs may or may not be compensated for by the higher prices charged for the products, or by governmental subsidies, or possibly by the goodwill of society (something that is more difficult to put an economic value on).

Cost-effectiveness analyses can help identify the cheapest ways to ensure animal welfare through legislation and minimum standards. Analyses have shown that the transition period between adoption and the full implementation of standards has serious impact on costs to farmers (Pedersen & Olsen 2015). Of course, when costs are postponed by delays in the introduction of new, stricter animal welfare standards, the benefits of implementation are also deferred — and the optimal trade-off between these opposing effects needs to be identified. An interesting, and little recognised, consequence of these trade-offs is that delays in the introduction of raised minimum welfare standards may make it possible to obtain greater improvements in the standards at the same cost to farmers. The complex question of whether animals are best served in the long run by animal welfare advocates asking for small, or large, improvements in animal welfare is discussed in detail by Appleby (2019; this issue).

To date, the transition periods in animal welfare legislation have typically been rather long. Examples include the announcement in 2014 in Denmark that sows should be loose in their breeding units in any newly built units from 2015 and in all buildings from 2035 (Danish order 2015/49 of January 21 2015) and a ban on traditional cages for egg-laying hens that was announced in 1999 and in force from 2012 (Council Directive 1999/74/EC). The length of transition periods is important for the costs to farmers of new legislation. It was calculated in Pedersen and Olsen (2015) that a ban on using enriched cages in Denmark would cause substantial costs for egg producers with a transition period of ten years because buildings were assumed to have a productive lifespan of 30 to 40 years. Especially for egg producers that had recently invested in upgrading their cages to

enriched cages due to legislative requirements. A transition period of 20 would reduce costs to farmers by half but would still be of a considerable size (Pedersen & Olsen 2015).

Another potential cost of legislation is the risk of relocation of production and/or consumption. Simply put, when production costs rise in one region, as the result of stricter animal welfare legislation, producers are put at competitive disadvantage with their rivals in other regions. Two reactions are likely. If consumers support the legislation and are willing to pay the increased production costs, the legislation might work as intended and limit the production and consumption of animal products from animals with low welfare. But, if they instead buy other products, or if producers move their production to other countries, or producers in other countries simply take over market shares, there is no real gain in terms of animal welfare.

The Danish experience with the effectiveness of legislation as a tool to improve the welfare of laying hens is a good illustration of the importance of timing and international co-ordination. A ban on cages in Danish egg production in the 1950s ensured that Danish egg production, in the long run, was no longer competitive in export markets. At the same time, the ban provided minimal benefits to the laying hens since production merely increased in other countries with lower welfare standards than those in Denmark, and Denmark went from being a major egg-exporting country to one with egg production that only served the home market (Sørensen 2013). Overall, the stricter legislation was too costly to producers when the anticipated benefits for consumers and birds were factored in. The Danish authorities withdrew the strict ban in 1979 and permitted the use of cages provided they complied with minimum standards. When a similar ban on using traditional cages in egg production was imposed around sixty years later in 2012, making furnished cages mandatory, the law was implemented at the EU level, and consequently the ruling affected Danish and competing European producers equally. No significant loss of market share seemed to be experienced following implementation of the stricter legislation (Danish Egg Association, personal communication 2018).

### The role of economics in identifying the potential and limitations of legislation

To sum up, the role of economic analyses in evaluating the potential and limitations of legislative means of improving farm animal welfare includes:

- identifying minimum standards that deal with public good externalities;
- assessing costs and benefits of enforcing minimum standards;
- assessing risks of relocation of production;
- identifying cost-effective ways for producers to comply with standards;
- determining the optimal levels of subsidies (and potentially taxes) to identify proper incentives for improving animal welfare; and
- identifying economically optimal transition periods.

## How can labelling improve farm animal welfare?

The variety of animal welfare-friendly products available on the market emphasises the potential for using consumer concerns to raise animal welfare beyond the legal minimum. A price premium on these products, paid by a segment of consumers, is the driving force behind improvements to animal welfare in such consumer-driven initiatives. To the extent that there is a market for welfare-friendly products, where consumers pay a price premium for animal welfare, the farmer not only experiences costs associated with improved animal welfare, but also benefits. In differentiated markets for animal welfare-friendly products, animal welfare is no longer merely an unintended side-effect of production. It is also a product quality that the farmer can include in his production decisions.

A review of existing labels for pork in six European countries (Christensen *et al* 2014) indicated that three levels of animal welfare products were available: standard, medium and premium. In all countries, organic and other forms of premium pork production was very limited, at below 2% of production for the domestic market. In The Netherlands and the UK, animal welfare labels covered a significant proportion of production. In the UK, the most successful label was RSPCA Assured, which certified 30% of British pig production. In The Netherlands, 36% of pork sold was Beter Leven certified. Both of these brands certified enhanced indoor production systems as well as several sorts of outdoor production system. In Denmark, in 2014, the Society for the Prevention of Cruelty to Animals owned the only nationwide welfare label, Anbefalet af Dyrenes Beskyttelse (Recommended by the Danish Animal Welfare Society). The label certified a premium level of welfare attainable for free-range pork or beef from Friland (a pork and beef brand certifying free-range production) and organic pork and beef. In Germany, the market share for welfare-labelled pork was small, constituting only 1% of pork consumption in 2014. Two German animal welfare labels (Für mehr Tierwohl and Vier Pfoten) were implemented in 2012 certifying medium as well as premium levels of animal welfare. After that, an innovative food-chain initiative to increase market-based animal welfare called Initiative Tierwohl was marketed in 2015 (Initiative Tierwohl 2018). A national state-owned label is scheduled to be implemented in Germany in 2020/21 (Frankfurter Allgemeine 2018). In 2017, two new animal welfare labels were introduced in Denmark. One was a national state-owned label for pork, which is expected to be extended to beef and poultry in the future (Ministry of Environment and Food of Denmark 2018). The other was a private label from one of the leading Danish retailers (Euro Coop 2017). All of these new labels certified medium as well as premium levels of animal welfare.

Thus, in some countries, there seems to be growing consumer interest in animal welfare schemes that certify improved indoor conditions as well as outdoor productions. Along with a rising interest in animal welfare, the trend seems to be towards a wider focus on the ethical values covered by the labels, where animal welfare is just one of

several approved qualities (Heerwagen *et al* 2015). This tendency can also be seen in the growing markets for organic products (Willer & Lernoud 2018).

In Denmark, there is lively debate over whether consumers can actually distinguish between three levels of animal welfare (standard, medium and premium). Stakeholders favouring the premium levels, such as organically produced products, fear that increased market shares of medium level products might, as it were, eat into the markets for premium goods (Brandt 2014). Another fear concerns the possibility that medium welfare improvements are merely greenwashing and do not represent real improvements for the animals (Dyrenes Beskyttelse 2016). In Zanasi *et al* (2017) greenwashing is defined as “the presence of distorted or false information.” Other stakeholders, who advocate an increased focus on marketing medium levels of animal welfare products, argue that such products will attract consumers from the standard markets, and that a graduated labelling scheme will ensure that the welfare of as many animals as possible is improved through consumer purchasing activity (Ministry of Environment and Food in Denmark 2018). It is argued that consumers from the standard markets have a willingness to pay (WTP) for animal welfare which is positive but lower than that required to meet the price premiums associated with premium products.

A recent study by Denver *et al* (2017) attempted to identify Danish consumer WTP for medium and premium levels of welfare pork in addition to the standard choice. It found that a segment consisting of 80% of respondents stated a positive WTP for medium products as compared with standard products. However, this segment showed no additional WTP for high level welfare products as compared with medium level welfare pork — even in the hypothetical settings of the choice experiment. In contrast, the remaining 20% of respondents exhibited a higher WTP for farm animal welfare *and* displayed a slightly higher WTP for high levels of animal welfare as opposed to medium levels of animal welfare. Denver and colleagues concluded that the Danish market could accommodate three levels of welfare-labelled pork (standard, medium and premium). However, the risk that Danish consumers will abandon free-range and organic pork if less-expensive products with an animal welfare label become available is certainly real: this change in purchasing behaviour may well take place if the price differential separating medium and high levels of welfare in pork products is too large. It was found that respondents had a limited understanding of the animal welfare traits associated with high-level welfare products presently being sold and were often unable to recall which brands they bought. This suggests that measures designed to raise the visibility and intelligibility of welfare attributes will be as important in attracting consumers to medium/high-level welfare products as price differentials.

A review study by Thorslund *et al* (2017) identified a number of studies in which consumers are segmented according to how they prioritise animal welfare. The reviewed studies found that between 5 and 15% of

consumers consider animal welfare to be an important product attribute. They also conclude that consumers associate animal welfare with naturalness and, thus, attach importance to housing space and access to outdoor settings. Given this, stories about natural living fit in better in the labelling environment than stories about the prevalence of injuries and infections, and mortality rates. Weary and Robbins (2019; this issue) provide a wider discussion of the different conceptions of animal welfare applied by experts as well as lay people.

An interesting twist in the question as to why consumers regard animal welfare as an important food attribute, first emerged in Eurobarometer (2007). In this survey of European citizens, when respondents were asked about their reasons for preferring welfare-enhanced products, they indicated that the happiness of the animals was not the most important reason for buying the products. In descending order, healthier products (for the consumer), better quality of product, the animals being healthier, and improved taste of the product were found to be more important reasons (Eurobarometer 2007).

In Eurobarometer (2016), 51% of respondents were prepared to pay up to 10% more for products sourced from animal welfare-friendly production systems, and 8% were ready to pay more than 11% more. Regarding animal welfare labelling, Eurobarometer (2016) found that 52% of the respondents look for these identifying labels (some or most of the time) when buying food, while 37% of respondents stated that they never or very rarely look for the identifying labels. One in ten Europeans were unaware that the labels even existed. Eurobarometer (2016) also saw 64% of respondents stating they would like to have more information about the conditions under which farmed animals are treated in their country, while 33% were ‘certainly not’ or ‘probably not’ interested. It is worth noting that as many as 40% stated that they were not willing to pay for animal welfare-friendly food. This apparent limit to market-driven animal welfare is supported by the finding that around one-third of the respondents were not looking at welfare labels and were not interested in more information about farm animal welfare. Similar results were found in a survey of 2,500 Danish consumers, where 30% stated that they would not pay a price premium for sows being loose (Christensen 2015). Of course, there are significant national differences as well as differences between types of animal and types of product, but the results highlight the potential for increasing consumer-driven animal welfare — and also the limitations.

For many producers, there seems to be a close relationship between animal welfare and animal *health*, but little is known about consumer perceptions of the links between health and welfare in livestock. A recent review article by Clark *et al* (2017) identified very few studies investigating consumer perceptions of, and WTP for, reductions in the incidence of production-related disease. The authors concluded that there is a need for more research on consumers’ WTP for animal health and on perceptions of the links between animal health and welfare.

The EU legislation on the welfare of laying hens is distinctive in that it uses four well-defined categories (cage, barn, free-range and organic) defined at the EU level (described in Appleby 2003). Hence, not only is there a clear labelling of eggs, but the standard eggs also bear a label with the unappealing term ‘cage’. This may have contributed to the success with which the alternative eggs (barn, free-range and organic) were marketed in Denmark. Developments in the market shares of different types of table egg in Denmark are unique: in 2016 alternatives to cage eggs represented 62% of the Danish market (The Danish Poultry Council 2017). Another interesting case is Switzerland where negative animal welfare labelling was used to restrict imports. There, in 2000, the authorities introduced mandatory labelling of all imported table eggs as “Produced in battery cages, which are not permitted in Switzerland”. This strongly negative labelling policy — referring to battery cages and unlawfulness in Swiss production — has not been challenged by WTO (Farm Animal Welfare Committee [FAWC] 2011).

A different approach to labelling is suggested by Vanhonacker and Verbeke (2014). It has origins in the work of Kahneman and Tversky (1979). Kahneman and Tversky found that people were risk-averse in the specific sense that they were more interested in avoiding a negative experience than in seeking a positive experience. They also found that people have a preference for the *status quo*, which is taken as a reference point when evaluating gains and losses. This finding could be harnessed to beneficial effect in animal welfare labelling by changing the reference point in labelling schemes so that it is no longer given by the standard conventional products but is attached to premium welfare products instead. In most animal welfare labelling schemes, consumers are essentially asked to decide whether they are willing to meet the additional cost of animal welfare. In a reversal of this scheme, they would instead be asked to decide whether they are willing to accept lower animal welfare and, in return, pay a lower price for a product. Roughly speaking, the idea is that although consumers may resist paying, say, an additional 10% for a product guaranteeing a medium level of welfare (a *positive* experience), they may not be willing to settle for a standard product (a *negative* experience) in return for a 10% discount. Thereby, the WTP would depend on the labelling scheme’s reference point. Studies of the potential of reversed reference points in animal welfare labelling schemes have not yet been conducted, however.

Vanhonacker and Verbeke (2014) see consumers’ reluctance to be reminded that meat comes from living animals as a barrier to market-driven animal welfare. This separation of animal and meat has become more complete over the past few decades (Vialles 1984; Norwood & Lusk 2011; Olynk 2012) with the increased availability of packaged meat in supermarkets, and with very few consumers coming into contact with livestock, abattoirs being situated well away from the city centres, and so forth. Illustrating the consequences of this trend, Widmar *et al* (2013) found in an

online survey involving 798 US residents that up to 40% of respondents were willing to pay a price premium to ensure that they did not have to touch or handle raw pork, beef, chicken and seafood. While this development might have been good for the convenience of consumers, it obviously hampers efforts to relate meat products with animal welfare. Hence, strategies to increase the consumer's focus on animal welfare-friendly food production will require not only the provision of information about production systems, but also efforts to reverse norms of alienation from the animal origins of food products.

Another potentially important trend over the past decade with an impact on market-driven animal welfare is the increasing public interest in the virtues of reduced meat consumption — a trend created by various factors including concerns about human health, climate change and animal welfare (Palomo-Vélez *et al* 2018). There is little doubt that this debate will continue in the future. Beyond the basic fact of lowered demand, there is no simple relationship between reduced meat consumption and increased animal welfare, but there certainly seems to be scope here to exploit the new focus on minimising meat consumption and connect it with improved animal welfare. Economic analyses can help us to understand the potential of this mechanism by studying the underlying values and priorities of consumers, and how these affect market behaviour.

### The role of economics in identifying the potential and limitations of consumer-driven animal welfare (product-based)

To sum up, the role of economics in relation to consumer-driven animal welfare includes:

- Estimating the costs of, and WTP for, animal welfare improvements across different segments of producers and consumers using newer as well as traditional economic theories;
- Improving our understanding of consumer perceptions of different labelling schemes and different types of information; and
- Improving our understanding of a potential substitution mechanism connecting reduced meat consumption with increased welfare of production animals.

### How can initiatives driven by retailers and food companies improve animal welfare?

Consumers rarely come into direct contact with producers. Instead, it is retailers and food companies which seek to represent consumer preferences. Supermarkets seem to be acquiring increasing power, both as major buyers of quality brands and through the design of their own labels (Rabobank 2012). Relatively speaking, the UK supermarket chains seem to be more active in profiling themselves as outlets with sound animal welfare policies than is typical elsewhere across the continent (Christensen *et al* 2014).

In the remainder of the paper, retailers and food companies will be treated as though they are essentially one and the same thing. We define CSR-driven improvements in animal

welfare as animal welfare improvements that are dictated, or supported, at company level, in such a way that all customers of the company are affected by the CSR policy. Retailers might be involved in CSR for several reasons, and these reasons may carry different weights for different stakeholders. Basically, a company will be interested in CSR either because it has ethical concerns ('we owe it to society') or out of self-interest ('it is advantageous for us'). We will focus on strategies involving the self-interest of retailers — strategies, in other words, which harness the company's expectation of a direct or indirect increase in profits. To the extent that consumers agree with the values that the company represents, CSR increases consumer trust and, potentially at least, promotes intentions to buy (Dierks 2007; Porral & Levy-Mangin 2016). However, to the authors' knowledge, little is known about the economic value of including animal welfare issues in CSR strategies.

The retailer might focus on promoting animal welfare as a societally desirable food characteristic. This can be done in a number of ways, including labelling, reducing the selection of animal products on sale to include only products with an enhanced animal welfare standard, altering the relative desirability of different products through pricing, increasing the visibility in store of animal welfare-friendly products, providing customer information, and so on.

Some interesting British initiatives are mentioned in Christensen *et al* (2014). The first is that in April 2013 McDonald's decided to use only RSPCA-certified pork in Britain. The second is that Sainsbury's, which is the largest buyer of RSPCA-certified pork in the UK, announced that they will shift entirely to RSPCA-certified pork from 2020. Another special feature of the British market is that Waitrose has a special contract with its producers which guarantees a price premium for the whole pig and not just the products sold in Waitrose stores if the production complies with certain animal welfare standards.

In Denmark, the past decade has seen retailers making increasing use of animal welfare statements to brand themselves. The main focus has been on showing that eggs produced in cage systems are no longer tolerated. As a consequence, all the main retail chains operating in Denmark (from hard discount operators to high-end supermarkets) have announced that they will not sell eggs from hens kept in cages. Specific strategies vary, depending on how quickly the stores intend to cease selling the products, whether the policy applies only to own products or also to brand products, and whether the ban relates to table eggs only or extends to the use of eggs in processed foods, such as cakes, bread and mayonnaise (sometimes referred to as 'hidden eggs'). In 2017, a Danish supermarket announced that it had stopped selling barn eggs (CPH 2017). In time, this may start a new wave of branding.

A similar trend is seen in the use of sustainability statements as part a CSR strategy. In 2017, a large Danish meat company launched a new CSR strategy called 'Feeding the world'. The present focus is on environmental sustainability, and the challenge will be to

**Table 1 Economic analyses at play in improving animal welfare through legislation or initiatives driven by producers, consumers or retailers.**

Type of activity	Description	Relevant economic analyses
Producer-driven	Defined as improvements in animal welfare driven by producers' desire to increase productivity without depending on consumer WTP or legislation	<ul style="list-style-type: none"> <li>• Multi-criteria bio-economic optimisation of production (including productivity, animal welfare, GHG emissions etc)</li> <li>• Information to farmers about productivity and its relation to animal welfare</li> <li>• Value of 'social licence to farm' for farmers</li> <li>• Farmers' perceptions and motivations for improving animal welfare</li> </ul>
Legislation	Laws designed to restrict supply or demand by imposing enforceable restrictions. Reduction in availability of food with low levels of animal welfare for all consumers	<ul style="list-style-type: none"> <li>• Setting minimum animal welfare standards</li> <li>• Cost-effective ways to achieve standards</li> <li>• Estimating costs and benefits of enforcing standards</li> <li>• Assessing risks of relocation of production</li> <li>• Optimal subsidies and taxes</li> <li>• Optimal transition periods</li> </ul>
Driven by labels and consumer choice	Defined as improvements in animal welfare driven by consumer WTP	<ul style="list-style-type: none"> <li>• Costs of and WTP for animal welfare improvements across producer and consumer segments</li> <li>• Consumer perceptions of labelling and information in relation to animal welfare</li> <li>• Substitution mechanisms connecting reduced meat consumption with increased animal welfare</li> </ul>
Retailer-driven (CSR)	Defined as improvements in animal welfare dictated or supported at company level	<ul style="list-style-type: none"> <li>• Value of branding for retailers (costs and benefits)</li> <li>• Animal welfare implications of various information strategies (point-of-sale, in-store, out-of-store)</li> <li>• Consumer behaviour in relation to CSR-driven animal welfare relative to product-labelling and legislation</li> </ul>

advocate for the inclusion of animal welfare as part of the sustainability concept (Stern *et al* 2005; Galioto *et al* 2017; FAO 2018b).

Given the considerable power that retailers have over their suppliers, we believe that their interest in including animal welfare, directly or as part of a general focus on sustainability, in CSR strategies has real potential to raise standards of animal welfare. At the same time, however, there is a risk the strategy is more about improving consumer 'welfare' by helping shoppers to feel good about themselves than it is about improving animal welfare, as such. Here the shift *away* from enriched cage eggs might serve as an example. While consumers tend to value the welfare criteria freedom of movement and natural behaviour and tend to associate these criteria with cage-free production systems (see, for example, an American study by Ochs *et al* 2018), the literature on welfare in laying hens indicates that in terms of measures, such as mortality, stress hormone, parasite infestation and wounds, hens in enriched cages have a better welfare than hens from alternative systems (Sherwin *et al* 2010).

Increased transparency, and possibly national or international labelling regulations governing the conditions under

which a retailer can call itself 'animal friendly', could offer a way to ensure that market-driven initiatives deliver genuine welfare benefits to affected animals. Zanasi *et al* (2017) have proposed that a greenwashing indicator should be developed as a monitoring tool which assists food companies in defining effective green marketing strategies, reducing the risk of greenwashing and supporting other food system stakeholders in their efforts to analyse the communications (eg information and advertisements) put out by food companies.

#### The role of economics in identifying the potential and limitations of CSR-driven animal welfare

To sum up, the role of economics in relation to CSR-driven animal welfare includes:

- Estimating the economic value of company brands foregrounding animal welfare, including costs as well as benefits; and
- Improving our understanding of the ways in which different methods of providing information about animal welfare, such as product labelling (point-of-sale information) and CSR (in-store or out-of-store information), affect consumer food purchasing behaviour.

## Animal welfare implications

Looking at matters from an economic perspective, we have consulted the international literature in order to assess the potential and limitations of four approaches to the task of improving animal welfare: we have examined producer-driven, legislative, consumer-driven, and CSR-driven strategies. First, we took, as our starting point, the assumption that to achieve the best possible outcome in terms of animal welfare, a combination of all four approaches will be needed, owing to (i) the extreme heterogeneity in perceptions of, and priorities given to, animal welfare by stakeholders, and (ii) the complex relationship between animal welfare and other desirable sustainability issues. Second, we have concluded that economics could have an important role in determining the best way to design and optimise the individual approaches and that more knowledge is needed on how to combine them. We have highlighted that economic analyses can contribute to the improvement of animal welfare in various ways — by quantifying costs and identifying cost-effective ways to obtain given animal welfare improvements, quantifying also the synergies as well as trade-offs between animal welfare and productivity, valuing consumer willingness to pay for various animal welfare traits, and so on.

The third point we wish to emphasise is that economic analysis can be seen as a straitjacket if economic input is limited to include only estimations of the cost of animal welfare, and if the market and non-market benefits of improved animal welfare for producers, consumers, citizens and animals are overlooked. To this end, it is important to distinguish between limitations of the economic approach as such, in its ability to improve animal welfare, and limitations of the specific economic analyses carried out. Economic analyses are continually being refined so as to incorporate animal welfare in economically sound decision-making. It is possible, but not yet common, to take a non-anthropocentric approach and include animal preferences in them. Last, but not least, we wish to emphasise the need for interdisciplinary collaboration in the pursuit of appropriate animal welfare measures.

Table 1 summarises the economic analyses at play in improvements to farm animal welfare brought about by a better understanding of the efficiency and scope of legislation or initiatives driven by producers, consumers or retailers.

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## References

- Appleby MC** 2003 The EU ban on battery cages: History and prospects. In: Salem DJ and Rowan AN (eds). *The State of the Animals II* pp 159-174. Humane Society Press: Washington DC, USA
- Appleby MC** 2019 We demand compromise: which achieves more, asking for small or large changes? *Animal Welfare* 28: 83-93. <https://doi.org/10.7120/09627286.28.1.083>
- Austin EJ, Deary IJ, Edwards-Jones G and Arey D** 2005 Attitudes to farm animal welfare. *Journal of Individual Differences* 26: 107-120. <https://doi.org/10.1027/1614-0001.26.3.107>
- Barnes AP, Rutherford KMD, Langford FM and Haskell MJ** 2011 The effect of lameness prevalence on technical efficiency at the dairy farm level: An adjusted data envelopment analysis approach. *Journal of Dairy Science* 94: 5449-5457. <https://doi.org/10.3168/jds.2011-4262>
- Baumol WJ and Oates WE** 1988 *The Theory of Environmental Policy, Second Edition*. Cambridge University Press: Cambridge, UK. <https://doi.org/10.1017/CBO9781139173513>
- Belay D** 2018 *Economics of information and incentives in regulation of market failure: Information disclosure, impact evaluation, market design, antibiotics and commodity markets*. PhD thesis, University of Copenhagen, Denmark
- Bennett RM** 1997 Farm animal welfare and food policy. *Food Policy* 22: 281-288. [https://doi.org/10.1016/S0306-9192\(97\)00019-5](https://doi.org/10.1016/S0306-9192(97)00019-5)
- Bock BB and van Huik MM** 2007 Animal welfare: the attitudes and behaviour of European pig farmers. *British Food Journal* 109(11): 931-944. <https://doi.org/10.1108/00070700710835732>
- Brandt I** 2014 So-called 'welfare products' harm the sales of organic meat. *Organic and Business* 554(4): 4. <http://okologi.dk/media/635431/554-okt-l.pdf>
- Broom DM** 2017 Animal welfare in the European Union. *European Parliament. Directorate General for Internal Policies Policy Department C: Citizens' Rights and Constitutional Affairs Petitions*. <http://www.europarl.europa.eu/supporting-analyses>
- Christensen T** 2015 *Questionnaire about consumer perceptions of pork and pig production focusing on loose sows*. University of Copenhagen, Department of Food and Resource Economics (IFRO), Documentation 648 2015/1. [https://curis.ku.dk/ws/files/131999243/IFRO\\_Dokumentation\\_2015\\_1.pdf](https://curis.ku.dk/ws/files/131999243/IFRO_Dokumentation_2015_1.pdf)
- Christensen T, Denver S, Hansen HO, Lassen J and Sandøe P** 2014 *Animal welfare labels: A comparison of experiences from six EU-countries*. University of Copenhagen, Department of Food and Resource Economics (IFRO) Commissioned work 2014/10. [https://curis.ku.dk/ws/files/130202208/IFRO\\_Udredning\\_2014\\_10.pdf](https://curis.ku.dk/ws/files/130202208/IFRO_Udredning_2014_10.pdf)
- Christensen T, Lawrence A, Lund M, Stott A and Sandøe P** 2012 What can economists do to help improve animal welfare? *Animal Welfare* 21: 1-10. <https://doi.org/10.7120/096272812X13345905673449>
- Clark B, Stewart GB, Panzone LA, Kyriazakis I and Frewer LJ** 2017 Citizens, consumers and farm animal welfare: A meta-analysis of willingness-to-pay studies. *Food Policy* 68: 112-127. <https://doi.org/10.1016/j.foodpol.2017.01.006>

- Council Directive** 1999 1999/74/EC of 19 July 1999 on laying down minimum standards for the protection of laying hens. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31999L0074&from=EN>
- CPH** 2017 Danish supermarket chain dropping barn eggs from its shelves, May 29 2017. <http://cphpost.dk/news/danish-supermarket-chain-dropping-barn-eggs-from-its-shelves.html>
- Danish Order** 2015 Danish Order 49 of January 11 2017 on the indoor keeping of gilts and sows. <https://www.retsinformation.dk/Forms/R0710.aspx?id=186206>
- Dawkins MS** 2017 Animal welfare and efficient farming: is conflict inevitable? *Animal Production Science* 57: 201-208. <https://doi.org/10.1071/ANI15383>
- Dawkins MS** 2018 Stocking density: Can we judge how much space poultry need? In: Mench JM (ed) *Advances in Poultry Welfare – Food Technology and Nutrition* pp 227-242. Woodhead Publishing: UK. <https://doi.org/10.1016/B978-0-08-100915-4.00011-7>
- Dawkins MS, Donnelly CA and Jones TA** 2004 Chicken welfare is influenced more by housing than by stocking density. *Nature* 427: 342-344. <https://doi.org/10.1038/nature02226>
- de Jonge J and van Trijp HCM** 2013a Meeting heterogeneity in consumer demand for animal welfare: A reflection of existing knowledge and implication for the meat sector. *Journal of Agricultural and Environmental Ethics* 26: 629-661. <https://doi.org/10.1007/s10806-012-9426-7>
- de Jonge J and van Trijp HCM** 2013b The impact of broiler production system practices on consumer perceptions of animal welfare. *Poultry Science* 92: 3080-3095. <https://doi.org/10.3382/ps.2013-03334>
- Denver S, Sandøe P and Christensen T** 2017 Consumer preferences for pig welfare: can the market accommodate more than one level of welfare pork? *Meat Science* 129: 140-146. <https://doi.org/10.1016/j.meatsci.2017.02.018>
- Dierks LH** 2007 Does trust influence consumer behaviour? *Agrarwirtschaft* 56(2): 106-111
- Dyrenes Beskyttelse** 2016 *Pork labelled with stars is unambitious*. Dyrenes Beskyttelse, May 10 2016. <https://www.dyrenesbeskyttelse.dk/artikler/svinekod-maerket-med-stjerner-er-uambitiost>
- Euro Coop** 2017 *Euro Coop Position Paper on Animal Welfare*. Euro Coop, February 2017. [http://www.eurocoop.coop/uploads/Euro%20Coop%20Position%20Paper%20on%20Animal%20welfare%20\(2\).pdf](http://www.eurocoop.coop/uploads/Euro%20Coop%20Position%20Paper%20on%20Animal%20welfare%20(2).pdf)
- Eurobarometer** 2007 Attitudes of EU citizens towards animal welfare. *Special Eurobarometer* 270. [http://ec.europa.eu/public\\_opinion/archives/ebs/ebs\\_270\\_en.pdf](http://ec.europa.eu/public_opinion/archives/ebs/ebs_270_en.pdf)
- Eurobarometer** 2016 Attitudes of EU citizens towards animal welfare. *Special Eurobarometer* 442. <http://ec.europa.eu/COMMFrontOffice/publicopinion/index.cfm/Survey/getSurveyDetail/instruments/SPECIAL/surveyKy/2096>
- European Commission** 2006 *Labelling: competitiveness, consumer information and better regulation for the EU*. [http://ec.europa.eu/food/food/labellingnutrition/betterregulation/competitiveness\\_consumer\\_info.pdf](http://ec.europa.eu/food/food/labellingnutrition/betterregulation/competitiveness_consumer_info.pdf)
- European Commission** 2009 *Options for animal welfare labelling and the establishment of a European Network of Reference Centres for the protection and welfare of animals*. COM/2009/584, final. EC: Brussels, Belgium
- European Commission** 2017 *Welfare of cattle on dairy farms*. European Commission – DG Health and Food Safety. An overview Report. Publications Office of the European Union: Luxembourg. <https://publications.europa.eu/en/publication-detail/-/publication/8950fa88-d651-11e7-a506-01aa75ed71a1/language-en>
- FAO** 2018a *Animal production*. Food and Agriculture Organization of United Nations. <http://www.fao.org/animal-production/en/>
- FAO** 2018b *Animal welfare at the heart of sustainability*. Food and Agriculture Organization of United Nations. [http://www.fao.org/ag/againfo/home/en/news\\_archive/2014\\_Animal\\_Welfare\\_at\\_the\\_Heart\\_of\\_Sustainability.html](http://www.fao.org/ag/againfo/home/en/news_archive/2014_Animal_Welfare_at_the_Heart_of_Sustainability.html)
- FAWC** 2011 *Economics and Farm animal welfare*. Farm Animal Welfare Committee: London, UK
- Frankfurter Allgemeine** 2018 *In drei Stufen zu mehr Tierwohl*, May 5 2018. <http://www.faz.net/aktuell/politik/inland/staatliche-label-in-drei-stufen-zu-mehr-tierwohl-15575850.html>
- Fraser D** 2008 Toward a global perspective on farm animal welfare. *Applied Animal Behaviour Science* 113: 330-339. <https://doi.org/10.1016/j.applanim.2008.01.011>
- Galioto F, Paffarini C, Chiorri M, Torquati B and Cecchini L** 2017 Economic, environmental, and animal welfare performance on livestock farms: conceptual model and application to some case studies in Italy. *Sustainability* 9: 1615. <https://doi.org/10.3390/su9091615>
- Grunert KG, Sonntag WI, Glanz-Chanosa V and Forum S** 2018 Consumer interest in environmental impact, safety, health and animal welfare aspects of modern pig production: Results of a cross-national choice experiment. *Meat Science* 137: 123-129. <https://doi.org/10.1016/j.meatsci.2017.11.022>
- Hansson H and Lagerkvist CJ** 2015 Identifying use and non-use values of animal welfare: Evidence from Swedish dairy agriculture. *Food Policy* 50: 35-42. <https://doi.org/10.1016/j.foodpol.2014.10.012>
- Heerwagen LR, Christensen T and Sandøe P** 2013 The prospect of market-driven improvements in animal welfare: lessons from the case of grass milk in Denmark. *Animals* 3: 499-512 <https://doi.org/10.3390/ani3020499>
- Heerwagen LR, Mørkbak MR, Denver S, Sandøe P and Christensen T** 2015 The role of quality labels in market-driven animal welfare. *Journal of Agriculture and Environmental Ethics* 28: 67-84. <https://doi.org/10.1007/s10806-014-9521-z>
- Initiative Tierwohl** 2018 *Einordnung und Ausblick der Initiative Tierwohl 2018*. <https://initiative-tierwohl.de/wp-content/uploads/2018/05/20180503-ITW-Rechenschaftsbericht.pdf>
- Johansson-Stenman O** 2018 Animal welfare and social decisions: Is it time to take Bentham seriously? *Ecological Economics* 145: 90-103. <https://doi.org/10.1016/j.ecolecon.2017.08.019>
- Kahneman D and Tversky A** 1979 Prospect theory: Analysis of decision under risk. *Econometrica* 47: 263-291. <https://doi.org/10.2307/1914185>
- Kudahl AB, Kirchner MK, Denwood M, Houe H, Forkman B, Nielsen SS, Østergaard S and Sørensen JT** 2017 Investing in cow welfare – a cost-effective initiative? *Proceedings from Animal Welfare Conference*. 3-4 October 2017, Copenhagen, Denmark. [https://ivh.ku.dk/english/aboutthedeptment/animal-welfare-conference/Abstracts\\_book\\_-\\_FINAL.pdf](https://ivh.ku.dk/english/aboutthedeptment/animal-welfare-conference/Abstracts_book_-_FINAL.pdf)

- Lusk JL and Norwood FB** 2012 Speciesism, altruism and the economics of animal welfare. *European Review of Agricultural Economics* 39(2): 189-212. <https://doi.org/10.1093/erae/jbr015>
- McInerney J** 2004 *Animal welfare, economics and policy* pp 1-21. DEFRA: London, UK
- McMullen S** 2016 *Animals and the Economy*. The Palgrave Macmillan: London, UK. <https://doi.org/10.1057/978-1-137-43474-6>
- Mellor DJ** 2015 Positive animal welfare states and reference standards for welfare assessment. *New Zealand Veterinary Journal* 63(1): 17-23. <https://doi.org/10.1080/00480169.2014.926802>
- Ministry of Environment and Food in Denmark** 2018 *New government animal welfare label*. [https://www.foedevarestyrelsen.dk/SiteCollectionDocuments/26\\_Kampagne/Dyrevelf%c3%a6rdsom%c3%a6rket/Factsheet\\_animal-welfare\\_label.pdf](https://www.foedevarestyrelsen.dk/SiteCollectionDocuments/26_Kampagne/Dyrevelf%c3%a6rdsom%c3%a6rket/Factsheet_animal-welfare_label.pdf)
- Norwood FB and Lusk JL** 2011 *Compassion by the Pound: The Economics of Farm Animal Welfare*. Oxford University Press: Oxford, UK. <https://doi.org/10.1093/acprof:osobl/9780199551163.001.0001>
- Ochs DS, Wolf CA, Widmar NJO and Bir C** 2018 Consumer perceptions of egg-laying hen housing systems. *Poultry Science* 97: 3390-3396. <https://doi.org/10.3382/ps/pey205>
- OECD** 2017 *Producer incentives in livestock disease management*. <https://doi.org/10.1787/9789264279483-en>
- Olynk NJ** 2012 Assessing changing consumer preferences for livestock production processes. *Animal Frontiers* 2(3): 32-38. <https://doi.org/10.2527/af.2012-0046>
- Palomo-Vélez G, Tybur JM and van Vugt M** 2018 Unsustainable, unhealthy, or disgusting? Comparing different persuasive messages against meat consumption. *Journal of Environmental Psychology* 58: 63-71. <https://doi.org/10.1016/j.jenvp.2018.08.002>
- Pedersen AB, Nielsen HO, Christensen T and Hasler B** 2012 Optimising the effect of policy instruments: a study of farmers' decision rationales and how they match the incentives in Danish pesticide policy. *Journal of Environment and Planning* 55(8): 1094-1110. <https://doi.org/10.1080/09640568.2011.636568>
- Pedersen MF** 2017 *Production economic effects of reduced stocking density in egg production*. Department of Food and Resource Economics, IFRO Commissioned work 2017/20. [https://curis.ku.dk/ws/files/184846479/IFRO\\_Udredning\\_2017\\_20.pdf](https://curis.ku.dk/ws/files/184846479/IFRO_Udredning_2017_20.pdf)
- Pedersen MF and Olsen JV** 2015 *Sector-level scenarios for out phasing egg production in enriched cages in Denmark*. Department of Food and Resource Economics, IFRO Commissioned work 2015/15. [https://curis.ku.dk/ws/files/138220732/IFRO\\_Udredning\\_2015\\_15.pdf](https://curis.ku.dk/ws/files/138220732/IFRO_Udredning_2015_15.pdf)
- Porral CC and Levy-Mangin JP** 2016 Food private label brands: the role of consumer trust on loyalty and purchase intention. *British Food Journal* 118(3): 679-696. <https://doi.org/10.1108/BFJ-08-2015-0299>
- Rabobank** 2012 *Producing both brands and private labels*. Rabobank Industry Note # 322, May 2012. [https://www.foodnavigator.com/Article/2012/06/28/Rabobank-Private-Label-and-Brands-report?utm\\_source=copyright&utm\\_medium=OnSite&utm\\_campaign=copyright](https://www.foodnavigator.com/Article/2012/06/28/Rabobank-Private-Label-and-Brands-report?utm_source=copyright&utm_medium=OnSite&utm_campaign=copyright)
- Ryland D** 2015 Animal welfare in the reformed Common Agricultural Policy: Wherefore art thou? *Environmental Law Review* 17(1): 22-43. <https://doi.org/10.1177/1461452914563218>
- Sandøe P and Jensen KK** 2013 The idea of animal welfare: developments and tensions. In: Wathes CM, Corr SA, May SA, McCulloch SP and Whiting MC (eds) *Proceedings of the First International Conference on Veterinary and Animal Ethics* pp 19-31. September 2011, London, UK
- Schreiner JA and Hess S** 2017 The role of non-use values in dairy farmers' willingness to accept a farm animal welfare programme. *Journal of Agricultural Economics* 68(2): 553-578. <https://doi.org/10.1111/1477-9552.12203>
- Sherwin CM, Richards GJ and Nicol CJ** 2010 Comparison of the welfare of layer hens in 4 housing systems in the UK. *British Poultry Science* 51: 488-499. <https://doi.org/10.1080/00071668.2010.502518>
- Sørensen LY** 2013 *Poultry Sector in the 1900s, Second Volume 1950-2005*. Danish Agriculture and Food Council: Copenhagen, Denmark
- Spinka M** 2006 How important is natural behaviour in animal farming systems? *Applied Animal Behaviour Science* 100: 117-128. <https://doi.org/10.1016/j.applanim.2006.04.006>
- Stern S, Sonesson U, Gunnarsson S, Öborn I, Kummand KI and Nybrant T** 2005 Sustainable development of food production: A case study on scenarios for pig production. *Ambio* 34(4/5): 402-407. <https://doi.org/10.1579/0044-7447-34.4.402>
- Stott AW, Vosough AB, Dwyer CM, Kupiec B, Morgan-Davies C, Milne E, Ringrose S, Goddard P, Phillips K and Waterhouse A** 2012 Interactions between profit and welfare on extensive sheep farms. *Animal Welfare* 21(S1): 57-64. <https://doi.org/10.7120/096272812X13345905673683>
- The Danish Poultry Council** 2017 *Annual report 2016*. The Danish Poultry Council. <https://danskfjerkrae.dk/%C3%A5rsberetning/aarsberetning-2016>
- Thorslund CAH, Aaslyng MD and Lassen J** 2017 Perceived importance and responsibility for market-driven pig welfare: Literature review. *Meat Science* 125: 37-45. <https://doi.org/10.1016/j.meatsci.2016.11.008>
- Vanhonacker F and Verbeke W** 2014 Public and consumer policies for higher welfare food products: challenges and opportunities. *Journal of Agriculture and Environmental Ethics* 27: 153-171. <https://doi.org/10.1007/s10806-013-9479-2>
- Vialles N** 1984 *Animal to Edible*. Cambridge University Press: Cambridge, UK
- Weary D and Robbins J** 2019 Understanding the multiple conceptions of animal welfare. *Animal Welfare* 28: 33-40. <https://doi.org/10.7120/09627286.28.1.033>
- Weible D, Christoph-Schulz I, Salamon P and Zander K** 2016 Citizens' perception of modern pig production in Germany: a mixed-method research approach. *British Food Journal* 118 (8): 2014-2032. <https://doi.org/10.1108/BFJ-12-2015-0458>
- Widmar NJO, McKendree MGS and Croney CC** 2013 Consumer preferences for and perceptions of livestock production process attributes: animal welfare and food safety attributes. *Proceedings of the American Meat Science Association 66th Reciprocal Meat Conference* 16-19 June 2013, Alabama, USA
- Willer H and Lernoud J** 2018 *The world of organic agriculture, statistics and emerging trends 2017*. Research Institute of Organic Agriculture (FiBL), Frick, and IFOAM (Organics International): Bonn, Germany
- Zanasi C, Rota C, Trerè S and Falciator S** 2017 An assessment of the food companies sustainability policies through a greenwashing indicator. *International Journal on Food System Dynamics Proceedings in System Dynamics and Innovation in Food Networks 2017*: 61-81. <http://dx.doi.org/10.18461/pfsd.2017.1707>