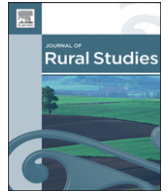


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Modifying and commodifying farm animal welfare: The economisation of layer chickens

Henry Buller^{a,*}, Emma Roe^{b,1}^a *Geography, College of Life and Environmental Sciences, University of Exeter, Amory Building, Rennes Drive, Exeter EX4 4RJ, UK*^b *Geography and Environment, Faculty of Human and Social Sciences, Shackleton Building 44, University of Southampton, University Road, Southampton SO17 1BJ, UK*

A B S T R A C T

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As the profile of farm animal welfare rises within food production chains, in response both to greater consumer ethical engagement with the lives of animals and to the market opportunities afforded to supply chain actors by this engagement, farm animal welfare (which we might define as the qualities of life of sentient beings) is increasingly being modified under the processes of 'economisation' (Caliskan and Callon, 2009) and marketisation (Caliskan and Callon, 2010) from a basic condition of legitimation and productivity to a calculable commodity in itself, subject to assessment, scoring and qualification. Over and above regulatory or assurance scheme compliance, welfare conditions and criteria are being used as a component or distinctive selling point for food products, brands or even particular manufacturers and retailers within 'value-added' marketing technologies. To make our argument we focus entirely on the case of industrialised free-range laying chicken production practices and the retailing practices that have developed to create a market for eggs produced under this farming method. We argue that economisation and marketisation processes have major implications for the meaning, assessment and communication of farm animal welfare and, consequently, for the way in which consumption practices become pre-defined. We maintain that recent developments and shifts in the economisation of animals through food chain actors' interpretations of consumer concern for 'good' welfare, coupled with advances in the reach of veterinary science, are leading to a co-shaping and co-modification – through an assemblage of procedures, technologies, performances and forms of assessments – of farm animal welfare as an economic 'good', and its materialisation in animal-derived food products. This has significant implications for the nature and communication of welfare 'evidence' and the manner in which it is articulated within an increasingly market oriented delivery framework.

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"There's no chickeny equivalent of Greyfriars Bobby or Black Bess. No cockerel ever dragged its master from a burning hay-rick, or risked its life to deliver a message behind enemy lines" (Sweet, 2004).

1. Introduction: what shapes animal welfare?

Farm animal welfare is a concept that emerged from scientific findings and civil anxieties about industrialised farm animal production through the second half of the 20th century (Harrison,

1964) to become what is now an active component in food animal supply chains. There is a scientific history of ongoing debate, discussion and re-framing of the concept of animal welfare (Ohl and van der Staay, 2012). Yet, although science is accepted as an important reference point for understanding the welfare of animals, science alone cannot define what is good, or acceptable or poor as welfare, in the same way that rational economic principles cannot alone define how concern for animal welfare acts as an economic behavioural stimulus for consumers and other market actors. In agreement with Ohl and van der Staay (2012) we support the point that 'interpretation of welfare status and its translation into the active management of perceived welfare issues are both strongly influenced by context and, especially by cultural and social values' (p. 1). However rather than locating this within a discussion of society's moral culture, as they do, situated somewhere

* Corresponding author. Tel.: +44 01392 263846; fax: +44 01392 263342.

E-mail addresses: H.Buller@Exeter.ac.uk (H. Buller), E.J.Roe@soton.ac.uk (E. Roe).¹ Tel.: +44 023 8059 9222; fax: +44 023 8059 3295.

between biological functionality and economic consequence (Bailey Norwood and Lusk, 2011), we instead turn to the 'economy' as a cultural phenomenon and specifically the notion of 'economisation' (which we define below) as an active process involving various market-based technologies that enrolls farm animal welfare and farm animal bodies together into consumer lifestyles. This, we argue, shapes, how animal welfare performs or 'what it becomes' within the food market context. In short, we ask, borrowing from Haraway (2007); what happens when the market and farm animal welfare meet?

As Swedberg (2008, p. 57) observes, 'economic life is anchored in materiality'. The egg economy, for example, is anchored in animal bodies that are generated (selectively and artificially bred), qualified (assessed, certified) and mobilised (integrated into supply chains, sold through auction to processors, labelled/unlabelled as welfare-friendly meat). These various practices are constantly changing and innovating through such practices as the proliferation of industrial scale free-range egg production, through stockperson practices, and through adaptation to the growing integration of animal welfare values into the industrialised egg production systems. As a result, the animal bodies, as well as animal behaviour, are being 'modified' as the grip of animal welfare on egg marketization, and its growing profile as a commercial requirement, becomes stronger. Moreover, we might argue too that animal welfare is equally being 'modified' as animal welfare science-making practices themselves change in response to the entry of welfare into the 'economy', which includes commercial pressures, legislation and consumer concerns. In this way, technoscience and the market co-produce specific technologies which are shaping the animal body. Moreover, the animal body gives culturally-specific potentialities for the success or failure of the uptake of various market-based technologies.

To grasp the profundity of the implications of this entanglement between scientific knowledge-making practices, civil anxieties and the integration of farm animal welfare values into how the market performs we introduce the term 'co-modifying'. The processes and practices of 'co-modifying' animal welfare accepts that the practices of turning the concept of animal welfare as a set of abstract values into material practices are not homogenous or static but are context dependent, species-specific and market-suitable, none more so than in developing a higher welfare food product. To conceive this as modification, rather than 'co-construction' (Jasanoff, 2004) evokes the plasticity, modifiability of the animal body, the directionality of the concept of animal welfare and the level of public concern through entanglements with technologies of the market. The welfare-friendly chicken body is an achievement between the market, the animal and publics. We choose to not use 'co-construction' because we foreground an agentive matter along with concepts and knowledges that are modified as contingencies assemble and perform differently, as opposed to a merely social matter, built or constructed through the imaginaries of humans.

Our argument in this paper is that what welfare is depends increasingly on how it is enrolled in economisation processes (from production system redesign to marketing campaigns), how it is commodified both as product and as process. In this paper we analyse some of the vast array of scientific and commercial technologies as practices that are enacting multiple farm animal welfare realities through the process of marketisation. We aim through our analysis to offer a critical analytical perspective on what has happened, is happening and may happen so as to remain alert to how animal welfare is being shaped, modified, co-modified by technical, social, material and institutional arrangements in the economisation process.

To better conceptualise the process by which actions, devices and analytical descriptions are assembled, qualified and defined as

'economic' by both social scientists and market actors, Callon, in his writing with Koray Caliskan (Caliskan and Callon, 2009) introduces the concept of 'economization':

the processes that constitute the behaviours, organizations, institutions and, more generally, the objects in a particular society which are tentatively and often controversially qualified, by scholars and/or lay people, as 'economic' (2009, p. 370).

Thus, 'doing animal welfare' becomes a broad array of technics, practices and materialities to meet reasoning present in the 'market', rather than in the sole interest of improving animal welfare. Economization, they argue, consists of three key agents: theories of the economy, established and refined through social and academic practice; the products themselves whose "materiality influences the modes of valuation that are possible and their outcomes" (2009 p. 370) and; institutional and technical arrangements that allow human agents to act within markets.² We find 'economization' a highly valuable conceptual starting point for an examination of the growth of farm animal welfare as an economic concern within the agri-food sector. While our focus in this paper is the shell egg market, our analysis has relevance for other food animal sectors. In this next section we discuss Caliskan and Callon's (2009) first agent, theories of the economy in relation to animal welfare, noting the existence of a substantial body of economic theory applied to the issue of farm animal welfare (for a review see McInerney, 2004; FAWC, 2012; Bailey Norwood and Lusk, 2011), and the influence of Supply Chain Management Theory to contemporary industry thinking in the agri-food sector. This is followed by sections discussing the material and institutional dimensions of economisation. Throughout we interpret empirical findings from a series of interviews with farm assessors, egg producers and processors for higher welfare food products, and from ethnography carried out within supply chain spaces of the higher welfare animal production systems, including farms and abattoirs, for poultry, pigs and cattle. This research formed part of the EU WelfareQuality[®] study on retailing and farm assessment practices. The interviews and ethnography focused on understanding how farm animal products reached supermarket shelves and how the various claims made, through packaging, labelling, branding and logos, that the animal had lived a better quality of life, were developed and constructed. Our analysis has focused not on the opinions or attitudes of personnel in the supply chain, but rather used their knowledge and understanding of how the animal body is grown, assessed, slaughtered, sold, to support our interpretation of how the animal body and animal welfare are co-modified through market-based technologies.

2. Economization and farm animal welfare

In his recent writings, the French sociologist Callon (1998, 1999) has argued for a new understanding of what he refers to as the 'performativity' of markets. Drawing on his previous work on Actor-Network Theory and upon the concept of *agencement* (socio-technical configurations in which agencies and arrangements are no longer separate from each other), Callon, like Granovetter (1985), maintains that the economy and society are successively entangled and disentangled leading to the analytical position of 'rehabilitat[ing] social relations' in the study of markets. He writes:

This substitution of the socio-technical *agencement* for the individual-human-agent embedded in institutions, conventions,

² Caliskan and Callon (2009) introduce these three agents in a slightly different order to that which we employ in this paper.

personal relationships or groups sharing identical values has important consequences, notably on our understanding of economic activities and especially markets (2005, p. 5).

The emergence of farm animal welfare in the market for shell eggs is, we want to argue in this paper, highly illustrative of Callon's process of economisation in that the role of eggs in their various manifestations and the nonhuman hen or chicken can be understood as the materialisation of animal welfare as an economic concern. Our analysis is sympathetic to Callon's insistence on the role of the social and anthropological sciences in revealing the more than-rationally economic in the performance of market behaviour.

Might the honour of the social sciences not, very modestly, be: a) to make visible and explicit the differences and asymmetries constantly being constructed; b) to militate for the establishment of procedures allowing the recognition of these differences, their expression and the realization and testing of the programmes that they defend. (Callon, 2005, p. 18)

In a previous paper (Buller and Roe, 2012), we quoted McInerney's (2004) paper on *Economics and Animal Welfare* in which he presents a neoclassical economic argument:

"So it doesn't matter whether we know what animal welfare actually is; we need only to know how to capture the responses to it within the framework of economic behavior." (McInerney, 2004, p. 11)

For McInerney, the 'framework of economic behaviour' drives the manner in which animal welfare is mobilized as a component of value. But what is 'economic behaviour'? It is here that Callon's *Law of Markets* (1998) offers some insight. Callon "does not believe that individuals are born psychologically endowed like *homo economicus*" the favoured model agent in neoclassical economics according to Whittaker (2006, p. 9) – but argues that "for markets to exist, *homo economicus* has to be created, 'formatted, framed and equipped with prostheses which help him in his calculations and which are, for the most part, produced by economics'" (Callon, 1998, p. 51). A market is therefore a multiple discursive performance, a socio-technical achievement and an assemblage or framing that is neither wholly abstract nor entirely social wherein various characteristics of a product are attached to a 'thing' in order to transform it temporarily into a tradable good in the market (Callon et al., 2002). The 'product' is a variable in the unfolding of this performance.

A product [...] is an economic good seen from the point of view of its production, circulation and consumption. The concept (*producere*: to bring forward) shows that it consists of a sequence of actions, a series of operations that transform it, move it and cause it to change hands, to cross a series of metamorphoses that end up putting it into a form judged useful by an economic agent who pays for it. During these transformations its characteristics change (Callon et al., 2002, p. 197).

While McInerney sees the economic value of 'welfare' as something that can be captured by the market thus producing a product valued because of buyer preference for a welfare component (an argument continued by Bailey Norwood and Lusk, 2011), Callon and his collaborators would see 'welfare' more in terms of what Whittaker (2006) calls: "a mental construct that actors collectively materialise". In both, however, Callon et al.'s 'product' and McInerney's potentially commodifiable welfare characteristics, we note an elusive praxis. Though McInerney situates his analysis in a 'conceptually clear' (p. 63) understanding of the economic principles of a demand-led, rational, homogenous market for high animal welfare products, he nevertheless acknowledges the practical difficulties of translating those principles into value and price. Callon

and his collaborators muddy the waters too but call upon specific 'market devices' – "the material and discursive assemblages that intervene in the construction of markets" (Callon et al., 2007, p. 2) to guide us through abstraction and away from essentialism into the specificities of what happens to goods, products, practices as a market emerges. So in the example that will follow, we might ask what are the practicalities to translating welfare principles into producing large quantities of eggs from hens and creating a community of consumers who buy them?

The existence of a market implies the circulation of merchandise, that is, the existence of goods transformed into things that can be passed from hand to hand. This circulation is simultaneously a process of production and qualification that transforms products and in so doing qualifies them in such a way that they are attached to users by entering their world and becoming parts of it (Callon, 2005, p. 5).

One possible response is to frame this within Supply Chain Management (SCM), an innovative way 'to think about and perform [...] both economics and technoscience' which, Busch (2007, p. 437) argues, has superseded Neoclassical economic models in offering new ways to theorise the market. SCM shifts the basic unit of analysis from the firm to the supply chain:

'SCM is concerned to maximise or optimise the supply chain as a whole (although often to the optimal benefit of one particular firm), from the production of raw materials all the way to the consumption and even disposal of the final product. This process usually involves a series of firms that handle the product (and all its ancillary components) as it flows from raw materials to consumed product. These firms maybe vertically coordinated but are not necessarily (and empirically not usually) vertically integrated into a single firm under a single ownership structure. Indeed, it is the realisation that such integration is unnecessary and perhaps undesirable that gives SCM its *raison d'être*.' (Busch, 2007, p. 444).

Adopting a supply chain management approach can be useful in examining the contemporary market for higher welfare food products in the agri-food sector (Roe and Higgin, 2007) where close attention to meeting Corporate Social Responsibility commitments in production needs to combine with maximising profitability. Our attention to co-modification places us in a position to update McInerney's work by investigating animal welfare co-modification under Supply Chain Management ideas and practice as a process of economisation (Caliskan and Callon, 2009).

The following section introduces the 'product' and illustrates, in Caliskan and Callon's words, a distinct agent of 'economisation': how "materiality influences the modes of valuation that are possible and their outcomes" (2009, p. 370). This will be followed by attention to Caliskan and Callon's final agent of 'economization'; the mechanisms in the field of farm animal welfare which create 'the institutional and technical arrangements that enhance the capacities of human agents for action and cognition' (2010, p. 2).

3. Materiality and the product

The recent 'animal turn' in the social sciences has largely ignored the chicken. This failing to engage with the specifics of nonhuman animal differences, both by species and how they are valued (culturally or economically or socially), has previously been articulated by Philo (2005), Lulka (2009) and Bear and Eden (2011). Despite its avowed concern to de-essentialise the nonhuman and bring beasts into our accounting of the rural (Jones, 2003), chickens are neither the charismatic species of rural iconography (Lorimer, 2007), nor the

new minutiae of bio-political cosmopolitan geographies (Hinchliffe et al., 2005). As grounded birds they lack the exuberance that flight might bring. With increasingly standardised bodies, chickens lack individuality of colour, shape, size (Dawkins and Layton, 2012). As ‘broilers’ and ‘layers’, they have become defined by different bodies and metabolisms, one that “functions” to flesh and the other “functions” to make eggs, respectively (Foer, 2009). The lexicon is doubly familiar; we might buy a ‘chicken’ or a box of eggs in a supermarket and we might see a ‘chicken’ on a farm. In the UK, around 30 million layers produce some 9 billion eggs per annum, some at an average of well over 200 per year per bird (British Egg Information Service, 2011) Such extreme productivity takes its toll and the average lifespan of an intensively farmed egg-layer is around 2 years, at the end of which most birds are culled or slaughtered, the carcass unfit for human consumption as ‘chicken’ and often of considerably less value than the cost of its disposal. Widely available in a universally standardised form, the Model T Ford of the meat industry, “chickens are thought of just as a commodity” (Jackson et al., 2009). The chicken’s body form and functions has afforded it the possibility to be selectively-bred to create this farm animal fit for the industrialised lifestyle described. Yet, the chicken body, its specific bodily capacities and how they are inclined towards entanglings with biotechnologies and market-based technologies, is central to our analysis. Studies that engage with the affects of biotechnology on bodies (Greenhough and Roe, 2006) are, we maintain, just as relevant for nonhuman animal bodies.

The contemporary chicken *gallus domesticus* became a highly significant commodity over the changing cultural economy of the twentieth century, to stand today as one of the most numerous farmed animals in the Western World (Striffler, 2005), supplying the vast amount of eggs consumed worldwide (British Egg Information Service, 2011). The chicken has become, in Watts’ (2000) words “a site of accumulation”; the body of the egg-layer designed both by and for commodification has become an efficient feed consumption and egg producing living entity. In our alternative take on laying hens/eggs as an economic concern, we discuss the bird/egg not only as a ‘good’ supplied, or a ‘thing’ to which value is added, in the supply chain, but rather, as we will show, a living material being whose bodily forms as hen (or egg), functions and behaviour shape and are shaped by the socio-technical and cultural arrangements that perform the market. Our argument is that the materialisation of the economic is impacting directly on how the concept of animal welfare is being idealised and actualised in the higher welfare egg market through the growing movement towards free-range eggs and the development of new practices to support hens to freely roam outdoors ‘as they prefer’ (Dawkins, 1977), albeit on an industrial scale.

In the 1960s, the intensity of industrialised egg production systems and the move away from more traditional free-range housing began to attract the attention of those concerned for the welfare of farm animals. One might argue that bird welfare has always been a concern for those whose economic livelihood depends upon the egg-layers and broilers ‘performing’ at a particular rate of body mass accumulation or egg production: “producers did well if and only if animals did well”, (Rollin, 1995, p. 7). Additionally, it might be remembered that arguments for the early development of battery systems for laying hens were partly wrapped up in a justification of improved animal health (Arndt, 1931). Yet, despite these economic and health preoccupations, a distinctly different approach to concern for farm animal welfare emerged in the 1960s in the UK with the publication of Ruth Harrison’s book *Animal Machines* in 1964. Harrison’s compassionate approach, arguing for improving farm animal welfare, quickly led to the UK Government’s *Brambell Committee Report in 1965*. They both approached the techniques and practices of modern, market-driven intensive husbandry as

largely incompatible with socially acceptable levels of farm animal welfare. The *Brambell Committee Report (1965)*, acknowledged that many people found such systems ‘repugnant’ (page 18) and argued for substantial modifications to existing battery systems (including increased cage size, maximum bird numbers per cage and the introduction of ‘deep litter’). Yet it fought shy of an actual ban:

Our conclusion is that, in the light of present knowledge, a modified battery system may be as good as or better than loose housing. This is a decision which we make with some reluctance; but the facts at our disposal do not justify the conclusion that at this moment in time the battery cage should be prohibited” (para 53, p. 20).

Despite this reluctant endorsement, public and NGO concern for battery egg-laying systems greatly intensified in the decades following the publication of the Brambell Report, leading ultimately, some forty-eight years after Brambell to the European Union ban on battery cages, effective in 2012. This most recent legislation has already started to have a significant impact. Not only are many caged systems being removed but shell egg product innovations, in the run up to the enforcement, have begun to dramatically alter the appearance of the egg market, leading to a new diversification of egg products on supermarket shelves (Roe and Higgin, 2007).

The critical point for us is that growing scientific and popular concern for the welfare of egg-laying hens over the last 30 years has gradually exposed significant shortcomings in the hen’s experience as an egg-layer within an industrialised production system. This ‘overflowing’, in Callon’s terms (1998; 2007) has driven changes in the design and the maintenance of the market and the welfare science that supports it.

Let us take the example of a contemporary free-range barn where specific chicken–human practices have evolved through the many complex histories of animal–human entanglements (Haraway, 2007) of which commercial industrial free-range hen production is a very recent phenomenon. Intensive free-range poultry houses are dimly lit to reduce pecking damage (Prescott et al., 2003). A poultry assessor speaks about the practicalities of ‘stepped lighting’ and hen welfare. This is a common practice because egg-laying hens need light changes as ‘day lengths’ to stimulate daily egg production. However there are notable poor welfare problems associated with hen welfare when changes in light levels occur; if light levels suddenly fall it can create smothering, and at the other end of the light spectrum high intensity light is linked to increased onset of injurious pecking in flocks.

Assessor	‘Stepped lighting system or automatic dimming system we insist on in the laying house’
Interviewer	How long does that dimming process last for?
Assessor [...]	A minimum of 15 min, so they [the hens] have time to prepare themselves. Now I’m sure we [accreditation body] will have arguments on that but there is a danger of [hen] smothering issues.
Interviewer	Why?
Assessor	Because they [the hens] panic. They think they are going to panic if the lights go straight off like that. [...] and they think oh yes they just sort of squat down and that’s it. (Poultry Assessor)

Not all hens respond the same to light levels either. So welfare and breed selection and egg productivity are weighed up against each other. From what the assessor describes there is still much they are learning about how to successfully rear free-range hens intensively, notably very different from the flock size in a traditional, backyard environment. In this example, the economisation

of hen welfare is generating and innovating new care practices, new hens, different science that can support the industrial experimentation with higher welfare in large scale production units. This is not the idealised and often romanticised 'happy hen' welfare of a singular or small flock of hens that might appear on food packaging (Miele, 2011; Miele and Evans, 2012) but rather an illustration of how the materiality of hen biology and behaviour actively participates (if we can use that term) in constructing high welfare as an area of economic concern.

4. Marketisation and the performed economy

For Caliskan and Callon (2009), a further critical element in the process of 'economisation' consists of the various institutional and technical arrangements that allow humans to constitute and act within markets.

While the legislative and regulatory base for farm animal welfare has grown significantly in many States within Europe and elsewhere over the last 20 years, the most dramatic developments have arguably been in the expanding role and place of farm animal welfare as a component of food marketing and product, range or brand segmentation strategies. If the common phrase 'as sure as eggs is eggs' denotes certainty and uniformity, the market in reality combines differentiated and standardised avian egg categories. The European Union Class system, based upon shell quality, freshness and size, identifies Class A eggs as fit for human consumption as shell eggs (Class AA and A in the US), Class B eggs which are pasteurised and used in food processing and 'Industrial' eggs which are not permitted to enter the human food chain.

Following the growth of public concern since 1960s for the welfare of battery egg-laying hens as well as the emergence of other considerations such as dietary health, there has been, in recent years, a significant increase in segmentation of the once fairly standardised egg market. From the 1980s onwards, new categories of eggs have appeared on supermarket shelves; 'free range eggs', 'free-run eggs', 'barn eggs', 'organic eggs', 'omega 3 enhanced eggs', 'vegetarian eggs', 'pasteurised eggs' and so on. What we see here is a process by which new qualities, considerations and qualifications are added to the formally standard chicken egg as increased attention has created space for culturally-specific innovations. New markets are being created, new categories developed and new criteria of value and justice mobilised. Such strategic economic activity within a supply chain stimulates innovation and segmentation as the standard egg ventures out from being just a homogenised, undifferentiated product (Busch, 2007, p. 451–2). Adding animal welfare to production criteria has therefore been a route for egg sector innovation to occur, bringing with it, new performative economic practices.

It is clear from any review of recent improvements in the welfare of farm animals across Europe that, in a number of countries (such as the UK and the Netherlands), competitive market behaviour has played a key role in selectively driving up, rather than down, standards, in many cases well beyond regulatory minima (Kjaernes et al., 2007; Roe and Higgin, 2007; Buller, 2012). Putting aside the contentious area of religious slaughter, which offers a counter indication of how the cultural/economic energies that generate the market are not all uni-directional on animal welfare (see Lever and Miele, 2012), it is fair to say that mainstream meat and animal product supply chain actors, and particularly, major retail groups, have employed animal welfare criteria to create additional value on a growing range of animal products.

For our purposes, this process of 'marketisation' (Caliskan and Callon, 2010) of animal welfare involves three distinct elements; first, the management of production and supply chains to structurally incorporate and thereby 'pacify' (to use Caliskan and Callon's

term) welfare concerns in chain design; second, the regulatory framework which reflects, to a point, the social and political framing of market operation and; third, the specific 'devices' of market encounter, which help to create economic performance. It is to each of these that we turn in this final section.

4.1. The management and 'pacification' of supply chains

The development of egg production in the UK as a major agro-industrial sector has been achieved not only through increasing flock size and stocking density, coupled with selectively-breeding for efficient food/weight conversion, but also through strategies of corporate investment and concentration. Accompanying the 'pacification' of the hens themselves, into the assembled and increasingly concentrated components and technologies of an industrialised egg production industry, there has been a similar process of 'pacification', in the Callonian sense of reducing controversy, within the industry itself.

Described by Defra (2011) as "perhaps the most advanced livestock sector in terms of self reliance, independence from Government intervention, supply chain integration and marketing of products", the UK egg industry is comprised of a very small number of major companies (such as Stonegate and Noble Foods) supplying over 70% of the retail market and a larger number of more independent smaller producers. These large companies operate high levels of direction and control from their central offices over management practices including type of birds, welfare standards and practices as well as additional technologies used and production-output monitoring across a vast number of contracted supply farms. For example, Noble Foods Ltd, the largest egg producing company in the UK who produce some 60 million eggs per week from over 500 contract farms, have 2 types of farms in their supply base receiving different levels of management instruction from the parent company. Owned farms have area managers prescribing the types of feeder, drinker or lighting systems that should be used. Contracted farms have a greater flexibility, but not complete autonomy about how they manage their farms. For companies like Stonegate and Noble Foods, animal welfare is closely integrated both into production standards and corporate social responsibility. Not only are minimal regulatory standards met, but may be exceeded through their producers' involvement in schemes such as 'Freedom Foods' and 'Happy Egg'. In this way, particular social relations of production (including the human–non-human relations) are rendered visible through both the objective criteria of scientific and technical welfare standards and the more affective characteristics of a 'good life' on which consumer attachment can be constructed. Demand and supply become assembled together through the positioning of products within a world in which the preferences inherent in economic practice are performed.

4.2. Market regulation

The European Commission has been active in designing the market of segmentation in eggs, and the coming ban of caged eggs can be seen as part of its ongoing maintenance of this market in Europe. Responding to what they identified as misleading and ambiguous labelling of free-range systems and to their perception of consumer preference for farm system information, the European Commission introduced in 2001 the mandatory labelling system that is in place today, identifying 'free-range', 'barn' and 'caged eggs' as well as certified organic eggs. Since the introduction of compulsory system labelling for shell eggs, consumer behaviour has revealed a strong preference for non-caged systems in the UK (Table 1). The UK produces well over 8 billion eggs per annum today. The latest figures from Defra suggest that around 45% of eggs

Table 1
Supermarket egg sales 2002 and 2007 (as % of total volume).

	% in volume of non-cage eggs sold in 2002	% in volume of non-cage eggs sold in 2007	% in volume of battery eggs sold in 2002	% in volume of battery eggs sold in 2007
Asda	31	57	69	43
Marks and Spencer	100	100	0	0
Sainsbury's	38	70	62	30
Tesco	55	70	54	30
Co-Op	50	71	50	29

Source: Extracted from CIWF (2003, 2007).

currently sold in the UK are from free-range and organic systems while over 85% of all UK eggs are part of the 'Lion' standard.

'right from the breeder level through the hatcheries, the rearers, the producers, feed, packing centres – yes, all the way through the chain and even the processors, the eggs processors have their own what they call British BEPA British Egg Products Association – Lion code of practice as well, so it is way to integrate products as well. It has done wonderfully well in terms of restoring confidence back into eggs' (British Egg Industry Council interview 2006).

Most recently, the dramatic growth of 'free-range' and organic egg sales, and their apparent market sustainability, have been instrumental in underwriting the adoption by the EU of the Union-wide ban on intensive battery housing systems. In 1999, Directive 1999/74/EC proposed that conventional cages should be phased-out by 2012, subject to an interim review of the scientific evidence. In January 2008, a communication from the European Commission (Commission of the European Communities, 2008) to the European Parliament and Council directed that the ban on conventional cages should be implemented as planned. Furnished or 'enriched' cages will still be permitted and so many farmers are at a crossroads and need to decide whether to invest in these modified cages or to move towards non-cage egg production. Their decisions will have profound implications for the welfare of the hens.

4.3. Market devices

Callon uses the term 'market devices' (Callon et al., 2007) as the collective agentive noun for various institutional and technical arrangements, they are in effect agents of economization that configure and condition market behaviour. Or, as McFall (2009) puts it; "the fixtures and fittings" (p. 272) "that produce or 'render' markets through processes of attachment and detachment, entanglement and disentanglement" (p. 275). These become, she goes on, the: "devices which equip people with the tools and skills necessary to operate as producers and consumers in free markets" (p. 279). There are three devices in this enrolment that we wish to consider: the qualification, the brand and the label.

4.3.1. Qualifying the welfare of layers: the accreditation certificate

Typically, a farm will have the certificate framed somewhere, often in the Office where visitors are shown. A single sheet with the logo of the accreditation organisation as well as that of UK Accreditation Service (UKAS) where appropriate, it will state that the farm, or the relevant part of the farm, or the herd or flock is approved under that assurance or certification scheme for a given period of time; that it has been inspected and considered to be in conformity with the prescriptions and requirements (themselves contained in often voluminous files elsewhere in the office) of the scheme.

Quality assurance and certification have become widespread in the UK food sector, driven largely by producers and retailers eager

to reassure consumers that production standards are being met but partly also by the legal requirement under the Food Safety Act that providers demonstrate 'due diligence' in food safety. Although initially spurred by issues of safety and falling consumer trust following the food scares of the 1990s, assurance and certification schemes are increasingly taking on board the welfare of farm animals both to demonstrate legal conformity but also, increasingly, to allow the development of market opportunities. Today, producers are being required by retailers or by their own voluntary participation in such assurance schemes as the RSPCA's 'Freedom Food' to meet ever-higher welfare conditions often merely to gain competitive access to abattoirs, manufacturers, exporters, importers or retailers. The product may gain little additional price premium for the producer, rather if criteria are not met it cannot travel into certain competitive spaces in the supply chain.

The requirements of the RSPCA's *Freedom Food* scheme for producers of Free Range Eggs cover a wide range of animal welfare criteria from the sourcing of chicks to the slaughter of birds in the abattoir (RSPCA, 2011). Farms are regularly inspected by the RSPCA's own 'Livestock Officers' and certification is awarded annually. Producers and manufacturers may sum up the value of accreditation in different ways. One major egg producing company, for example, draws attention to the natural behaviour of their accredited free-range hens, reflecting the increasingly prevalent use of behavioural and outcome-based measure of farm animal welfare, rather than more traditional resource-based indicators:

"These eggs come from hens reared on farms approved by the RSPCA Freedom Food scheme. The hens must have the ability to perch, preen, nest, forage and have access to the outdoors during daylight hours" (sales brochure of major egg supplier to leading UK supermarkets, 2008).

As a 'market device', the process and performance of accreditation, which we have explored in detail elsewhere (Buller and Roe, 2010; Roe et al., 2011), assembles, as Stassart has observed for quality beef accreditation schemes in Belgium, the materiality of the animals, their corporeality and behaviour as well as their welfare, with defined 'rules' and practices of 'engagement' (Stassart, 2005, p. 287) into collective agency. These, and the knowledges and practices behind them, become combined in the form of a set of standards and a certificate which thereby renders this particular 'quality' – the welfare of the individual birds – economic. It contributes to the creation of an economic 'world' in which the welfare of egg-laying hens becomes an attachment of importance to consumers. Hence, if to be economic is the outcome of a particular effort or performance, "a process that is historical, contingent and disputable" (Callon et al., 2007, p. 3), then we might begin to interpret the accreditation of free-range egg production as a key mechanism for "configuring economic calculative capacities and in qualifying market objects" (ibid, p. 5).

4.3.2. Branding eggs

Retail brands support the economization process through creating technologies that mediate the encounter between consumer and free-range egg. Responding both to the exhibited consumer preference as well as their own 'ethical' branding, a number of major food retailers have stopped selling cage eggs at all, (particularly as shell eggs though a few are moving towards the interdiction of cage eggs in their own processed brand items too). Hence we move from an early situation of 'choice facilitation' to one of 'choice editing' and what is, in effect, a removal of consumer choice within individual stores. It is the retail brand and the values it performs (Lury, 2004) between consumer and retailer that is the technology that drives this choice editing behaviour. In this manner the growing use of 'free-range' as a criteria has shifted from being

an element of niche segmentation to being increasingly a component of brand responsibility. As a recent Agricultural Manager for the supermarket chain Tesco's explains:

"Everyone understands (or at least has an idea of) what "free-range" means when applied to eggs or meat chicken. It means birds that have access to the outdoors so that they have grass, and natural daylight and fresh air. We can show pictures and explain the welfare benefits relatively easily. For this reason, companies that specialize in top of the range products can sell themselves on being "all free-range" or "all organic" and have higher cost structures by appealing their relative welfare (or at least ethically) knowledgeable customers." (Waterman, Agricultural Manager of Tesco's, 2008:114)

Egg displays in supermarkets are becoming increasingly complex spaces. Simple size categories have been replaced by an array of different egg types, each differentiated by distinctive quality claims and production standards, each constituting a distinct element of consumer attachment or concern. Free range eggs, barn eggs, cage eggs, enriched omega 3 eggs, organic eggs, vegetarian eggs, vitamin enhanced eggs and so on, are arranged to "equip consumer cognition" (Cochoy, 2007, p. 109). Yet as most shell eggs are used in the preparation of food, rather than being eaten as eggs, such differentiation is rarely driven by taste or substantive organoleptic variation.

"The alternative segmentations, like free-range, organic and so on are growing certainly but they are nevertheless marginal compared with basic low price standard eggs. Our clientele understands that the brand or the method of production brings no real added value to the product, making the price differential more apparent" (French supermarket buyer, 2008).

Traditionally, for most supermarkets, profits on egg sales have been made on the highly competitive high volume, lower cost products – often cage eggs – subject to frequent promotions and special offers. Free range eggs, seen as a more specialised product, have been used differently; to establish and develop a durable quality and ethical profile or connivance between retailer and clientele – even at the expense of immediate profit. As one major egg supply company said of retailers, in 2007 before the EU ban on cage eggs:

From the shelf efficiency point of view they are not being as efficient as they should be at the moment in terms of the sale. They are over-facing on free range to envisage sales, so you will see more on the shelves than you actually should do... You might see 50% on the shelf that might be free range eggs but only 30% of the sales, so they're actually, they are trying to drive it in that way (Interview: UK, egg company sales manager, 2007).

Although meeting higher welfare standards can involve a higher cost to producers and to retailers, this can be met by higher product prices. However, this is far from always the case and it is not certain that the higher prices obtained at point of sale will necessarily be shifted down the food chain. In certain circumstances, retailers will themselves absorb the higher costs in order to promote brand allegiance and thereby create a market amongst their customers. Consequently they become active promoters of farm animal welfare as a thing for consumer's to care about in selected retail encounters, thus supporting and generating more interest in the growth of compassionate interest in animal welfare by the food consuming public.

Some such products – now a growing majority – will be sold under the retailer's own brand, usually supplied by a major food company following strict assurance criteria. Others will be national

or (increasingly) local brands, offering either low-cost alternatives or distinct high-value niche products. The spatial management of this product array has been identified by Cochoy (2007) and Barrey (2007) as a critical 'market device' in its own right.

The place assigned to a product indices an implicit judgement about this product as does the height and the breadth of the display space devoted to it. The upper, lower side or centred positioning of a product in the supermarket shelf works as a podium, or rather as a target, whose centre is generally reserved for the product the shop managers try to highlight. Most of the time, this is occupied by the retailer's private brand (Cochoy, 2007, p. 120)

As McFall observes "something more than language and discourse is involved in making the worlds in which certain *agencements* succeed or fail" (2009, p. 275). The position of free-range eggs, both materially and semiotically, within the brand range and within the physical supermarket space, not only actively creates strategies of consumption but it also sets the stage for market action. Moreover, in this way, the regulatory and technical arrangements of retailing and current society is generating spaces for innovation in the market for animal welfare products.

4.3.3. Labelling and pricing eggs

Across Europe, there are remarkably few animal product labels that explicitly refer to the welfare of the animals concerned, unless in very general and unspecific terms. One major UK supermarket refers, on each free-range egg box, to the fact that the eggs were: "laid by hens free to roam on British farms in the fresh air from dusk to dawn". Although a significant proportion of the free-range eggs sold in the UK are now *Freedom Food* accredited, the scheme's logo appears only rarely on the individual product packaging for despite the social scientific illustrations of consumer and retail activity in relation to animal welfare, few retailers believe that 'welfare sells' alone – other than to a very limited niche group of consumers – and reject almost unanimously the notion of a specific and stand-alone 'welfare label' (Roe and Higgin, 2007; Buller, 2012). Yet, at the same time, many animal welfare considerations, such as those relating to stocking densities, have nonetheless become commonplace in retailer statements of Corporate Social Responsibility, both to legitimate retailer roles as responsible economic actors and distinguish their particular 'brand' as a reputable site of consumption. Our argument here, perhaps rather perversely, is that the absence of a distinctive 'welfare-friendly' label is, in itself, a market device (defined, we might remind ourselves, as the "material and discursive assemblages that intervene in the construction of markets" Callon et al., 2007, p. 2) and this for two principal reasons.

First, as many recent commentators have shown, consumer perceptions of what constitutes farm animal welfare and its assessment can differ significantly from what animal welfare science might tell us. For the bulk of non-specialist consumers (i.e. those who do not specifically and consistently seek higher welfare products), higher welfare is associated with better animal health and therefore, and critically for purchasing choice, with better human health (Kjaernes et al., 2007; Eurobarometer, 2007). As one survey shows: "Although few consumers think about how the welfare standards contribute to a healthier product, they still perceive the benefit" (IGD, 2009, p. 37). Critical areas of 'scientific' assessment of welfare, such as for example, lameness or biting speak less to consumers than more anthropomorphic concerns such as 'freedom', being outdoors and 'acting naturally' all of which are considerably more difficult to 'quantify' and thereby translate into standards appropriate to formal, comparative labelling. This ambiguity, we argue, is essential to the marketisation of animal

welfare as it facilitates the play of consumers' own knowledges and preferences in food purchasing and in doing so: "take the consumer out of the realm of pure price economics and immediate satisfaction" allowing them to "connect to other values, to other concerns" (Cochoy, 2007, p. 124).

Second, the absence of a product label specifying the welfare conditions at production represents an important, and, for shoppers, largely welcome transfer of responsibility from consumer to retailer. Again, as a number of surveys have demonstrated, most consumers of animal products prefer not to have to think about the specifics of welfare and conditions of farm animals at all (Eurobarometer, 2005). Rather, they wish the responsibility of assuring welfare to be the task of the commercial food chain actors. This allows the latter to effectively construct both the scientific and the affective components of farm animal lives and thereby constitute the materialisation of their welfare as economic.

The translation of values into pricing figures in the free-range egg industry is complex. An interview with a UK egg manufacturer describes the rationale for price promotions on free range eggs.

'Where we have good availability, we would try and undertake price promotions on free range. In the long run it raises awareness for those who would not normally search out free range'.

Roe and Higgin (2007) argue that the higher margins on free range eggs for retailers, suppliers and farmers, are in a sense reliant on a 'value' product. In the UK this value product has to date been 'caged eggs'. Within the UK market, this is the commodity product that all retailers compete on for lowest price offer. The egg industry is keen to keep a full range of 'choice' for the consumer and thereby maintain margins of free range eggs. Here the Tesco agricultural manager explains the rationale for higher costs for higher animal welfare.

'In some cases, for our "premium" ranges, where people have enough disposable income to be able to pay for higher welfare standards, the product costs more and people pay more accordingly. For them, good animal welfare is enough of a priority that they will pay more and we can justify the higher costs of these product. In fact we are often responding to the demands of our customers' (Waterman, 2008, p. 114).

These negotiations and strategies over the price of higher welfare standard products imply, in Callon's words. "a peculiar anthropology", one that assumes "calculative agencies" operating within cultural frames (1998, p. 3).

5. Conclusion

Our analytical framing has given us the opportunity to be privy to a wider set of actors, socio-(including animal)-technical devices, strategies that are shaping the economization of the free-range egg, welfare-friendlier product sector. Within this specific sector we have indicated possible choices that may influence how the market could develop as part of our accepted role as participating in its transformation and future development (Caliskan and Callon, 2010).

In this paper we have shown how recent developments and shifts in the economization of animals through food chain actors' interpretations of consumer concern for 'good' welfare, coupled with advances in the reach of veterinary science, are leading to a re-shaping and re-construction - through an assemblage of market-based technologies that includes procedures, biotechnologies, and new forms of assessments - of the 'object' of farm animal welfare,

and through this, the (market-able) capacities of the animal itself. These market-based technologies, in contrast to those considered by other papers in this special issue, offer a more diverse take on the form of animal-technology relations relevant for study; everything from technologies of farm certification procedures, product labelling and branding, biotechnologies for reproducing standardised animal bodies, through to dimmer light switches in animal housing. Crucially, we have shown how this varied sweep of technologies work with and modify the animal to foster, shape and pacify the market-able capacities of the animal in the higher welfare food product market. The assemblage of these diverse technologies are impossible to ignore in any attempt to understand the innovation and maintenance of this market, because, as we demonstrate, the market is ultimately achieved through these multiple animal-technological fixes and ongoing adaptations, across many sites including the biotechnological reproduction of the animal, its life on a farm, how it is killed, turned into pieces of meat, packaged and marketed.

As we look to the future, animal welfare science is paying far greater attention to the living animal, its preferences, its body, its 'feelings' and so on (Roe, 2010) as a contribution to economic value. And yet, marketisation implies an emphasis placed on those welfare elements that lend themselves more immediately to calculability, creating an implicit tension with those that do not so lend themselves. The current re-qualification of that calculability - drawing in an extended, adaptable, socio-technical network of new actors - has significant implications for the nature and communication of welfare 'evidence' and the manner in which it is articulated within an increasingly market oriented delivery framework.

The focus of attention on these particular, consumer-friendly, aspects of farm animal welfare, risk obfuscating at the consumption end, what many welfare scientists and others regard as more pressing welfare issues within animal farming such as, for example, lameness in sheep and dairy herds, tail biting in pigs or, alternatively, welfare at slaughter.

Finally, we come back to where we started and the debate within welfare science over the relative weight given to input and animal based assessment methods for farm animal welfare. Growing reference to, and advocacy of, system-based labelling schemes such as are used for shell eggs throws the shoe back on the foot of input-based welfare assessment, leaving a questionable place for the new range of output-based measures currently being experimented in a number of different situations. We feel that there is the danger here of a missed opportunity. The recent report from the Farm Animal Welfare Forum (2010) on 'Labelling Food from Farm Animals', while promoting the principle of production system labelling, makes the clear point that outcome measures should be introduced "to provide assurance that the welfare potential of the various production systems proposed for labelling is being realised in practice" (2010, p. 18). This, we regard as essential.

Caliskan and Callon's marketization approach that we have mobilized as an analytical framework in this paper has given us new purchase on not just the production process but the different agencies and technologies at work in assembling the animal welfare market. We have tried to indicate why being sensitive to animal welfare's co-modification, that it is an ever-ongoing negotiated, contingent socio-technical achievement in the market place is of value to all those active participants in its creation, innovation and ongoing development (and we include ourselves in this). Indeed this study is an insight on species-specific, bodily-specific and value-specific nonhuman animal - technology relations through analysis of the co-modification of chicken bodies and body-products, thus contributing to a wider literature on nonhuman animal difference and embodiment, and animal-technology relations. With the politics of animal consumption dominant in the

contemporary economization of animal welfare, for example production system labelling, and particularly the use of the outdoor and 'free-range' cues, this must guard against generating its own particular welfare fetishes in the name of keeping the customer satisfied, that conceal, ignore different ways of moving forward with animal welfare.

'As consumers we cannot have everything we want because we face a binding budget constraint; our happiness is not as high as it could be if we were richer. So too is it for animals' (Bailey Norwood and Lusk, 2011, p. 3).

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