REVIEWING THE COSTS

The economics of moving to higher welfare farming

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Animals are farmed industrially (left) to maximise profit margins: this paper suggests that in some cases higher welfare systems add little to farm-level costs and in other cases improved welfare can be economically beneficial.

About the author
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THE ECONOMICS OF MOVING TO HIGHER WELFARE FARMING

EXECUTIVE SUMMARY

Industrial animal farming – factory farming – might appear to be the most hard-nosed but business-savvy response to food industry demand, forcing up production, yield, size, supply rate and turnover in livestock. However, this paper shows that in certain cases, farming to higher standards of animal welfare adds relatively little to on-farm production costs.

Indeed in some cases improved welfare produces economic benefits. In better welfare systems, animals will tend to be healthier. This can lead to reduced expenditure on veterinary medicines and lower mortality rates. The provision of straw and/or additional space for finishing pigs can result in improved growth rates.

Similarly, compared with high yielding dairy cows, lower yielding but healthier cows with better fertility and longevity can increase margins for the farmer due to lower heifer replacement costs and higher sale prices for the calves and cull cows.

Reality check
A round-up of the latest figures shows clearly that in a number of cases higher welfare adds relatively little to farm-level production costs.

- Producing a free-range egg costs 2.3 cents (2.1p) more than a battery egg (references to cents in this Summary are references to eurocents)
- Adding straw and additional space for fattening pigs costs 5.8 cents (5p) more per kilo of pork produced
- Housing sows in groups rather than in sow stalls adds at most 2.2 cents (2p) per kilo of pork produced.

These surprisingly low costs indicate that improved welfare can in certain cases be achieved with a modest increase in prices. Based on the above production costs and the average per-person consumption, this paper calculates that, in the UK:

- Switching to free-range eggs should cost 8.6 cents (7.5p) per person per week
- Switching to humanely reared pork should cost just 3.8 cents (3.3p) per person per week.

Economic drivers that could stimulate higher welfare

- Mandatory labelling would mean consumers could choose to pay higher prices, allowing the market to pay for animal welfare improvements and pass on a premium to farmers
- The Common Agricultural Policy (CAP) should be used to incentivise farmers to introduce practices valued by society which the market will not automatically reward (carbon sequestration, biodiversity-rich environments, higher animal welfare, preventing pollution and waste)
- The CAP, which already allows payment of farmers who use high welfare standards, should retain and enhance this policy instrument in its 2013 reforms
- Taxation measures could reduce the cost of good animal welfare:
  - To farmers e.g. by offering more generous capital allowances for investments in high welfare farming
  - To consumers by placing, in those countries that charge VAT on food, a lower or nil rate of VAT on high welfare food.

Recalculating the cost
Livestock production, in particular factory farming, is associated with 'negative externalities' including environmental degradation, greenhouse gas emissions (from growing feed), water pollution, loss of biodiversity, human disease and poor health. These negative externalities represent a market failure in that the costs associated with them are borne by third parties or society as a whole and are not included in the costs incurred by farmers or the prices paid by consumers of meat and dairy products.

Bodies such as the World Bank and the UN Food and Agriculture Organization argue that, in order to reduce detrimental impacts and encourage efficient use of scarce resources, ways must be found to internalise these external costs into the costs of meat and dairy production and thus into the price paid by consumers. If all the costs to society of industrial farming were included in retail prices, and the benefits of higher welfare farming were rewarded, then factory-farmed meat and produce would be far more expensive than the market could bear.

A Dutch study recently concluded that the 'true cost' of producing conventionally farmed pork was at least €1.12 (97p) per kg greater than the true cost of organic pork, and probably more.

"There needs to be much greater realisation that market failures exist in the food system that, if not corrected, will lead to irreversible environmental damage and long term threats to the viability of the food system. Moves to internalise the costs of these negative environmental externalities are critical to provide incentives for their reduction."

Foresight report: the future of food and farming, 2011.

ABSTRACT

There is a widespread assumption that moving to higher welfare systems and outcomes for farm animals invariably entails a substantial increase in production costs. However, analysis of industry data shows that in certain cases, such as changing from battery to free-range eggs or from sow stalls to group housing, higher welfare farming adds little to the costs of production. In addition, higher welfare farming practices can achieve economic benefits as compared with intensive production. In better welfare systems, animals will tend to be healthier. This can lead to savings in terms of reduced expenditure on veterinary medicines and lower mortality rates. The provision of straw and/or additional space for finishing pigs can result in better feed conversion ratios and improved growth rates. Similarly, compared with high-yielding dairy cows, lower yielding but healthier cows with better fertility and longevity can deliver higher net margins due to lower heifer replacement costs and higher sale prices for the calves and cull cows. Economic drivers that could stimulate higher welfare include:
(i) the mandatory labelling of meat and dairy products as to farming method to enable consumers to make informed choices;
(ii) more ambitious use of those measures in the CAP Rural Development Regulation that enable farmers to be given financial support for improved welfare; and
(iii) the use of fiscal measures to reduce the cost for farmers of implementing higher welfare production or to reduce the price paid by consumers for higher welfare food.

Livestock production, in particular industrial production, produces negative externalities including environmental degradation, greenhouse gas emissions and loss of biodiversity. These negative externalities represent a market failure in that the costs associated with them are borne by third parties or society as a whole and are not included in the costs paid by farmers or the prices paid by consumers of livestock products. The negative externalities of livestock production should be internalised in order to avoid market distortions and provide incentives for their reduction.

I. PRODUCTION COST DIFFERENCES BETWEEN INDUSTRIAL LIVESTOCK PRODUCTION AND HIGHER WELFARE SYSTEMS ARE IN SOME CASES QUITE LOW

There is a widespread assumption that moving to higher welfare systems and better outcomes for farm animals invariably entails a substantial increase in production costs. However, analysis of industry data shows that in certain cases changing to higher welfare systems adds relatively little to on-farm production costs.

Figures showing the difference in production costs between different farming systems are often expressed in percentage terms. These can appear large and can give an exaggerated impression of the cost implications of changing to alternative systems. It is more helpful to express the production cost differences in actual monetary terms; this is the approach generally adopted by this paper.

Egg production costs

The on-farm cost of producing a free-range egg is only slightly higher than the cost of producing a barn or battery egg.[i] Data in a socio-economic report prepared for the European Commission show that a free-range egg costs just 2.6 eurocents (cents) more to produce than a battery egg, and a barn egg costs only 1.3 cents more to produce than a battery egg.[1]

Figures published for December 2010 by the National Farmers Union (England and Wales) show that a dozen free-range eggs cost 94.31 pence to produce while the cost of producing a dozen cage eggs is 69.34 pence.[2] Turning to the cost of producing one egg, one free-range egg costs 7.86 pence to produce and one cage egg 5.78 pence. This means that a free-range egg costs just 2.08 pence more to produce than a cage egg.

Farmers should not be left to bear the increased production costs themselves. These must be borne by consumers; for individual consumers the extra price of eggs should amount to just a few pence each per week. The average per capita consumption in the UK is 187 eggs per year.[3] This means that UK consumers could change from battery to free-range eggs for only 7.48 pence each per week, provided that retailers charged no more extra for free-range eggs than is needed to cover the additional cost of producing them.

Pig production costs

Sow stalls versus group housing

In a 2001 report, the European Commission pointed out that, as regards investment, some forms of group housing are cheaper than sow stalls (referred to as gestation crates in the U.S.).[4] The Commission added that overall pig production costs (including both building and running costs) are also lower in some group housing systems than with sow stalls.

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Sow stalls – also known as sow gestation crates – are used to confine sows while they are pregnant. Housing sows in groups rather than stalls adds relatively little to on-farm production costs.

[i] Barren battery cages have been banned in the EU from 1 January 2012 though they remain in widespread use in many other countries.

Lammers *et al* (2008) compared construction and operating costs for two sow housing systems – individual indoor gestation stalls with slatted floors and group pens in deep-bedded naturally ventilated hoop barns.[5] The costs, calculated in terms of the cost of producing a weaned pig, were found to be up to 10% lower in group housing. This calculation took into account the higher prolificacy rates (the number of healthy young produced) found in group housing, backed up by a number of studies.[6, 7] However, even when prolificacy was assumed to be equal for the two systems, total cost per weaned pig was still 3% lower in the hoop barn system as a result of lower construction costs (which were 30% lower) and lower fixed costs (which were 16% lower) in the group housing system.

Figures from France (Institut Technique du Porc),[8] the Netherlands (Rosmalen Institute) [9] and the UK (Meat and Livestock Commission and CEAS) [10, 11] show that, looking at both capital and running costs, even in the better group housing systems – ones giving reasonable space and ample straw – a kilo of pigmeat costs less than 2 pence (3 cents) more to produce than in sow stalls. Indeed, recent research that looks at the Netherlands, France, Italy, Denmark, Belgium, Germany and Spain indicates that the increase in production costs due to group housing of sows are on average just 1.06 cents per kilo of pigmeat.[12]

To sum up, the data indicate that as regards investment, some forms of group housing are cheaper than sow stalls and that, looking at both capital and running costs, group housing is sometimes cheaper than sow stalls and in other cases it is only slightly more expensive.

It is also important to note that a number of studies indicate that reproductive performance can be as good or even better in group housing systems that are well-designed and well-managed compared with confinement of sows in individual stalls.[6, 13, 14]

Outdoor versus indoor production

Figures from the British Pig Executive (BPEX) show that the economics of outdoor and indoor production are finely balanced.[15] A comparison of outdoor and indoor breeding herds shows sow mortality is slightly lower in outdoor herds (3.83% outdoors and 3.85% indoors) and that feed costs per pig reared are lower in outdoor herds (£9.39 outdoors and £10.74 indoors). Set against this, numbers of pigs reared per sow per year are higher indoors (22.81 indoors and 21.55 outdoors).

BPEX also compares outdoor and indoor rearing herds; the outdoor herds comprise pigs born and reared outdoors, while the indoor herds include pigs born outdoors or indoors but reared indoors. The BPEX data show that mortality is lower in outdoor herds (2.1% outdoors and 2.6% indoors), food conversion is better outdoors (1.69 outdoors compared with 1.77 indoors) and daily weight gain is slightly better outdoors (490 grammes outdoors and 486 grammes indoors).

However, feed costs per kilo gained are higher for outdoor rearing herds (50.14 pence outdoors and 46.37 indoors). Interestingly, feed costs per kilo gained are lower for the top one third of outdoor herds than for average indoor herds (45.12 pence for the top one third of outdoor herds and 46.37 for average indoor herds). This suggests that the farmer's skill and efficiency may have more impact on costs than whether the herd is kept indoors or outdoors.

Study comparing four pig production systems

A 2011 U.S. study compared four pig production systems: sow stalls (gestation crates); group housing of sows; a higher welfare indoor system in which sows are group housed and farrow in pens not crates, bedding is provided for both sows and growing pigs and antibiotics are not used; and a free-range system.[16] The table on page 7 shows the farm level cost of producing one pound (0.45kg) of pigmeat in each of the four systems investigated by the study.

Table 1: Production costs of four pig production systems

Source Seibert & Norwood, 2011

PRODUCTION SYSTEM	$ per pound of finished pig
Sow stalls	$0.45
Group housing of sows	$0.486 - $0.489*
High welfare indoor system	$0.53 - $0.65**
Free-range	$0.53

* The lower figure applies when the facility is built from scratch, the higher figure when it is converted from a sow stall system
** Range results from varying welfare benefits on different farms

The study found that the cost of changing U.S. pork production from sow stalls to group housing *"would be modest – increasing costs at the farm level by 9% and the retail level by 2% – if all costs were passed on to the consumer"*. The authors point out that this means that the retail price of pork would increase by a maximum of 6.5 cents per pound. They add that consumer surveys have shown that the average American is willing to pay 34 cents per pound more for pork produced in sow group housing systems than in a sow stall system. The authors conclude that *"banning gestation crates creates an average value of $0.34 per pound but only costs an extra $0.065 per pound"*.

The study also reports that the cost of changing U.S. pork production from sow stalls to free-range would increase pig production costs by 18% at the farm level and 5% at the retail level if costs were passed on to consumers in full.

We will consider the difference between the increase in farm level and retail costs in more detail at a later stage of this paper.

Systems for keeping growing pigs

A 2003 UK study investigated the cost of pig rearing (6–95kg) in a fully-slatted system (fulfilling minimum EU space requirements); a partly-slatted system; a higher-welfare, straw-based system (complying with the UK-based RSPCA *Freedom Food* standards) and a free-range system.[17] The total cost of pig rearing in each system was calculated using data on daily liveweight gain, feed conversion ratios and mortality, as well as capital costs including costs of construction, energy and labour requirements for each housing type, machinery use and feed prices. The cost of rearing pigs ranged from 92.0 pence per kilogramme of carcass weight (p/kgcw) and 94.6 p/kgcw for the partly-slatted and fully-slatted systems, to 98.8 p/kgcw and 99.3 p/kgcw for the *Freedom Food* and free-range systems respectively. The authors commented: *"These results suggest that improved pig welfare can be achieved with a modest increase in cost"*.

The study concluded that higher welfare pig farming can be viable as this can be achieved with an additional cost of only 5-6 pence per kg of pigmeat provided that farmers receive a price premium to cover the extra cost. The study shows that rearing pigs in a system which provides them with straw bedding and additional space such as the *Freedom Food* system results in a price increase of only around 5 pence per kilogramme. As UK consumers eat on average 24.6kg of pigmeat per person per year, consumers could change to buying meat from such higher welfare systems for fattening pigs for as little as £1.23 ($2.01) per person per year.[18]

Research in Italy and the Netherlands compared the cost of keeping growing pigs with and without straw. It found that the provision of 0.35kg of straw per pig per week on solid floors overall added just 0.1 eurocent to the cost of producing 1kg of pigmeat.[12] The research reports that the provision of straw would increase production costs by just 0.7% in Italy and 0.9% in the Netherlands. Labour costs would rise and the cost of the straw must be taken into account but – crucially – health care costs would fall as would mortality rates.

II. IMPROVED WELFARE CAN LEAD TO A REDUCTION IN CERTAIN PRODUCTION COSTS

In better welfare systems, animals will tend to be healthier. This can lead to savings in terms of reduced expenditure on veterinary medicines and lower mortality rates. Healthier animals can also produce economic benefits in terms of lower feed conversion ratios, higher growth rates and fewer injuries as well as better immune response and ability to resist disease.

Pigs

A range of studies show that providing enrichment materials and/or more space for growing pigs can produce improved growth rates. A review of the literature concluded that higher-welfare production systems lead, in the majority of studies, to equal or faster growth.[19]

Ruiterkamp (1987) found that high levels of penmate-directed behaviour in barren rearing environments have a negative effect on the productivity of pigs due to disturbances in feeding patterns.[20] Morgan *et al* (1998) also found lower growth rates among pigs in barren rather than enriched environments and suggested this was due to increased energy requirements for heat maintenance in the absence of substrates.[21]

Beattie *et al* (2000) compared the rearing of fattening pigs in either barren or enriched environments.[22] The latter incorporated extra space and an area which contained peat and straw in a rack. During the finishing period (15-21 weeks) mean daily food intakes were higher and food conversion ratios were better for pigs in enriched environments compared with those in barren environments. Growth rates were also higher for the pigs in enriched environments during this period and this resulted in heavier carcass weights. The authors report that environmental enrichment also had a small but significant effect on meat quality, with pork from pigs reared in barren environments being less tender and having greater cooking losses than pork from pigs reared in enriched environments.

A range of studies have produced substantial evidence that increasing the available floor area will benefit the growth rate of finishing pigs.[23, 24, 25] A Swedish study also concluded that giving more space to fattening pigs led to higher growth rates, better feed efficiency and improved health which in turn led to fewer veterinary treatments, lower death rates and fewer rejections at slaughter.[26] This study also found that the economic benefits of providing straw for slaughter pigs outweigh the costs of the straw and the associated additional labour costs. The study also shows that group housing sows rather than keeping them in close confinement leads to economic gains as a result of having a healthier animal.

A Danish study has analysed housing systems for slaughter pigs and shows that the straw-flow system has better profitability than traditional systems with fully or partially slatted flooring.[27] The study reports that the straw-flow system requires 20% less capital and that these lower capital costs outweigh the higher labour input and the straw consumption of the straw-flow system.

A study of 23 pig farms in Scotland collected data on management practices, genotype, feed and housing characteristics.[28] Sixteen attributes of bacon samples were assessed describing appearance, texture, taste and aroma. The main differences were found to be due to housing conditions, floor type and breed type, with pigs reared in straw courts giving rise to bacon of superior eating quality compared to those kept on concrete or slatted floors.

The provision of straw bedding has also been found to reduce the incidence of stomach ulcers to a very low level compared with pigs in barren partly-slatted pens.[29] The authors attributed this to the lower levels of stress when provided with straw bedding and/or a positive effect of straw intake on stomach content firmness.

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Levels of other injuries have been found to be higher in fully-slatted systems. The incidence of foot and limb lesions and adventitious bursitis of the hock were significantly higher in fully-slatted systems than in straw-bedded systems. Ramis *et al* (2005) found that the prevalence of limb lesions was much greater in barren-housed pigs (24% of observations) compared with pigs housed in sawdust-bedded barns (1% of observations).[30] The provision of bedding has been found to be the most important factor in reducing the incidence of bursitis in finishing pigs.[31] A reduced incidence of lesions and bursitis is economically beneficial.

Dairy cows

Intensive milk production is characterised by the use of high-yielding cows. On the face of it, higher yields would be expected to increase profitability. However, selection for high yields has had serious adverse affects on the health, welfare, fertility and longevity of the cow and, as a consequence, is proving to be economically disadvantageous.

There is evidence that higher welfare systems of milk production based on the use of more robust (stronger, healthier with lower yields per lactation but improved longevity) dairy cows are likely to be more economically efficient than systems based solely on the pursuit of higher milk yields.[32] Traditionally dairy farm productivity has been assessed by measuring the conversion of feed into milk. However, this narrow approach ignores several significant components of dairy cow profitability. These include:

- Fertility
- Longevity
- Level of milk yield losses and culling due to health problems such as lameness and mastitis
- Value of cull cows
- Value of calves.

Fertility

A very high proportion of the energy that a high-yielding cow derives from feed is used to produce milk. This can result in depletion of her body reserves and, as a result, reduced health and fertility. A cow that is unable to conceive will of course not be able to produce future lactations.

Longevity

Most dairy cows do not produce their first calf until the age of 24-30 months. Thus farmers have to make a substantial investment in feed and care before receiving any financial return from a dairy cow. However, the pressures on high-yielding cows are so great that many are prematurely culled due to infertility, disease, injuries and severe loss of body condition. Many high-yielding herds average little more than three lactations before cows are culled. This gives very little time for farmers to make a return on the costs involved in bringing the cow to the age where she is able to produce milk. Moreover, the farmer has to incur costs in buying or rearing a replacement cow relatively soon after the culled cow first began producing milk.

Value of cull cows

Farmers can offset the costs involved in replacing cows by reducing culling rates but also by attracting a good price for the cow when she is sold for beef. A healthy cow in good condition will achieve a higher price than a worn-out animal in poor body condition.

Value of calves

Traditionally a dairy farmer would derive a healthy income from the male calves produced by the herd as these would be sold for beef (either reared by the farmer or sold to a beef finisher). However, the male calves produced by high-yielding cows have less ability to lay down flesh and are thus are not as well suited for beef production as the calves of robust breeds that are able to produce both milk and beef.

Greater profitability of robust cows as compared with high milk yielding dairy cows

A recent UK study shows that enhanced profitability can be achieved by dairy herds that have been bred with a balanced approach, allowing the animal to display all of the elements of efficient and sustainable production referred to above.[32]

This study found that although the return from milk is higher for high-yielding cows, a robust dairy herd proves to be more profitable in other respects as it has lower culling rates, lower heifer replacement costs and achieves higher sale prices for its calves and cull cows. The study concluded that the net margin per cow is around 20% higher in the case of a robust herd as compared with a high milk yielding herd.

This study shows that a single-minded focus on high milk yields with insufficient attention being paid to important economic factors such as fertility, longevity and calf value can undermine dairy herd profitability.

It is also important to note that robust cows may be sustained by a lower input system, facilitating a greater contribution from grazing and thereby lower feed costs. Finally, the robust dairy cow requires less veterinary attention to deal with metabolic disorders and lameness and fertility problems, thus further reducing costs.

Chickens reared for meat (broilers)

Intensive broiler chicken production is characterised by the use of fast-growing breeds and high stocking densities. Increasing the growing period and space allowance would be expected to reduce the efficiency of the system. However, there is evidence that this can be offset by the production advantages from improved health and welfare of the birds.

A comparison of production results in standard intensively-reared birds and birds reared to RSPCA *Freedom Food* standards in extensive indoor systems (moderately slower growing birds, increased space allowances with maximum permitted stocking density of 30kg/m^2 and environmental enrichment) indicates lower mortality, fewer transport losses, fewer slaughterhouse rejects and a greater proportion of grade A carcasses in the *Freedom Food* birds.[33]

An analysis of data relating to chickens reared to *Freedom Food* and *Red Tractor* (standard intensive with maximum permitted stocking density of 38kg/m^2, no environmental enrichment and fast growing birds) standards shows that measurably better welfare outcomes were achieved by the *Freedom Food* birds.[34] The average level of hock burn for the *Freedom Food* chickens was 3.5% compared with 19.0% for the *Red Tractor* birds. The *Freedom Food* chickens had an average level of foot pad burn of 3.5% compared with 6.5% for the *Red Tractor* birds. The average mortality rate for the Freedom Food broilers was 1.8%, while that of the *Red Tractor* birds was 5.1%. The average level of *Freedom Food* broilers that were dead on arrival at the slaughterhouse was 0.05% compared with 0.17% for *Red Tractor* birds. The average level of slaughterhouse rejects was 1.6% for the *Freedom Food* birds in contrast to 1.9% for the *Red Tractor* birds. The average level of *Freedom Food* birds graded ‘A’ was 83.4% while the figure for *Red Tractor* birds was 66.2%.

Clearly the higher welfare of the *Freedom Food* birds translates into improved carcass quality and economic performance.

Another study contrasted standard (Cobb 500) and slow growing broilers (Hubbard, JA 957).[35] It found that the slow-growing birds had much lower levels of breast blister, hock burn and foot pad lesions than the standard birds.

Turning to broiler breeders, a study contrasted conventional breeds with slow-growing birds (Hubbard, JA 987 & 957). It reported that the cost of producing chicks was lower with the slow-growing birds than the conventional breeds. This was mainly due to lower feed consumption (and hence lower feed costs), lower mortality and a higher number of chicks per female in the slow growing birds.

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III. NON-WELFARE FACTORS HAVE GREATER IMPACT ON COSTS AND PRICES THAN WELFARE

Any increase in on-farm production costs arising from the use of a higher welfare system will have a proportionately smaller impact on the retail price. For example, a 10% rise in on-farm production costs will lead to a significantly lower than 10% increase in the retail price. This is because on-farm production costs are only one of a range of factors which determine the retail price. Distribution and marketing are also significant components of the final price. For example, a rise in the price of fuel may well have more impact on the retail price of pork than whether sows are kept in stalls or groups.

McInerney (2004) states that in order to determine the impact of a particular improvement in animal welfare on the retail cost of food, one must take an estimated cost increase at farm level and factor it down through the subsequent value-adding processes in the food supply chain (marketing, slaughter, processing, packing, retailing, catering) until it emerges as a price change confronting the final consumer.[36]

He points out that *“A given proportionate rise in farmgate costs inevitably becomes progressively smaller through this process”.*

McInerney adds that any *“given percentage rise in production costs at farm level is likely to emerge on average at about one quarter that magnitude as a proportionate rise in retail food prices – and substantially less as an effect on purchases in the food service sector. (This crude figure is based on the oft-quoted fact that livestock farmers receive on average about one quarter share of final food prices.)”.*

Similar conclusions are reached by the U.S. study on pig production costs referred to above.[16] This calculated that the cost of changing U.S. pork production from sow stalls to group housing would increase costs at the farm level by 9% and the retail level by 2%, while changing U.S. pork production from sow stalls to free-range would increase costs by 18% at the farm level and 5% at the retail level.

IV. ECONOMIC DRIVERS THAT COULD STIMULATE HIGHER WELFARE

A: Mandatory labelling as to farming method

Labelling enables consumers to make informed choices. Lack of clear labelling is a significant barrier to ethical purchasing and consumer choice. If a market is to work effectively, consumers must be able to judge the differences in quality between similar products that are on sale. If they are unable to assess the difference in quality, for example between two pork fillets, they will tend to buy the cheaper.[37]

Egg labelling

Since 2004, EU law has required egg cartons to be labelled ‘eggs from caged hens’, ‘barn eggs’ or ‘free-range eggs’.[38] Examination of the trends in non-cage egg production and sales in a number of EU Member States suggests that the introduction of mandatory method of production labelling for retail shell eggs in 2004 has had a significant impact on consumer purchasing behaviour and supermarket policy decisions. The clear rise in sales of cage-free eggs in many countries suggests that consumers are reacting positively to the greater choice and information available.

Compulsory labelling not only enables consumers to make informed choices but also ensures transparency which makes retailers more accountable for the way the eggs they sell are produced. Compulsory labelling is therefore likely to be an important factor influencing retailer policy decisions in relation to the sale of cage eggs.

Labelling of meat and dairy products

The time has come, following the clearly successful precedent with eggs, to put in place mandatory labelling as to farming method for meat and dairy products. The following principles should underpin EU policy on the labelling of farm animal products:

- Animal welfare labelling should be mandatory not voluntary
- Labelling should refer to the farming method of production in a way that is transparent, meaningful and resonant with consumers
- Outcome-based assessments of farms should be used to ensure that products using labelling terms associated with higher welfare (e.g. free-range) are derived from animals that have indeed experienced good welfare
- Labelling should extend to imports into the EU as well as to domestically-produced food.

B: Subsidies

The core principle that should determine strategic thinking about subsidies is that farmers should be rewarded by the market for outputs, with the taxpayers' role being to provide funding for public goods, i.e. factors that are valued by society but cannot be assured by the market alone. Later in the paper we will consider how to deal with the 'negative externalities' (e.g. pollution and biodiversity erosion) of livestock production. However, animal farming can also produces 'positive externalities' (e.g. carbon sequestration and the maintenance of biodiversity-rich environments). Subsidies should reward farmers for the provision of positive externalities and assist them in preventing negative externalities.

Animal welfare can, in part, be delivered by the market. Consumers are showing themselves to be increasingly willing to pay more for welfare friendly products. However, the delivery of good standards of animal welfare cannot be left to the market alone. Farmers should be assisted by the Common Agricultural Policy (CAP) to adopt high welfare standards.

Support for animal welfare under the EU Common Agricultural Policy

Under the EU Rural Development Regulation (RDR), financial support can be given to farmers to help them improve animal welfare. Such support can be given under a number of the RDR's measures.[39] One of these measures is specifically aimed at improving animal welfare (Article 40, RDR). This authorises the making of 'Animal Welfare Payments' and is of particular importance as it is: i) the only measure that specifically focuses on animal welfare; and (ii) designed to aid farmers who make animal welfare commitments that go beyond mandatory legislative requirements. A number of other RDR measures, such as those on training, the modernisation of holdings and support for farmers who participate in food quality schemes can be used to improve standards of animal welfare.

Article 68 of the main CAP Regulation (73/2009) permits support to be given to farmers for practising enhanced animal welfare standards. Article 43 of the Commission implementing Regulation provides that enhanced animal welfare practices are those which go beyond the minimum requirements laid down in the applicable Community and national legislation.[40]

It is crucial that after the 2013 reform, the CAP continues to include the above measures that allow support to be provided for animal

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welfare and that the Member States make more ambitious use of them than at present (see next section).

Use of the RDR measures to improve animal welfare

Use of the RDR measures to improve animal welfare has been rather low. Nonetheless there are some promising signs. Eight Member States have proposed the 'animal welfare payments' measure in 23 rural development programmes (RDP) for 2007-2013.[41] In a number of these RDPs, the use of the 'animal welfare payments' measure covers pigs and meat chickens. The improvements foreseen are very variable, but generally they include increased space and access to the outdoors and in some cases the provision of straw/nesting material for sows. Valuable examples of the use of public funding to improve animal welfare are provided by the Republic of Ireland and Scotland.

<u>Republic of Ireland</u>

The aim of Ireland's *Suckler Cow Welfare Scheme* is to improve the genetic quality of Irish cattle with particular emphasis on welfare-related traits, such as easy calving bulls. The Scheme sets a minimum calving age, establishes a weaning procedure, requires disbudding rather than dehorning and includes training on welfare aspects. The Irish Farmers' Association reports that welfare and weaning practices have improved significantly with improved performance and quality and a major reduction in disease problems and treatments.[ii]

<u>Scotland</u>

In 2005, Scotland introduced the Animal Health and Welfare Management Programme. Regrettably, the scheme does not extend to pigs and poultry. However, in 2007, when the scheme was closed to new entrants, 28% of Scotland's dairy cattle, 26.5% of suckler cows and 15% of sheep were covered by the scheme.

An analysis of the scheme undertaken in 2007, just three years after it came into operation, reported that 60% of participating farmers provided positive feedback.[iii] Reduced calf and lamb mortality and reduced lameness and mastitis were identified as positive impacts due to better targeted treatments. The programme appears to have brought about a closer collaboration between farmers and veterinarians that has helped farms focus on disease prevention rather than disease treatment. Most of the participating veterinary practices stated that the undertaking to prepare and deliver a health plan focused farmers on better timing of vaccinations, recording and analysing data and having a more open relationship with the veterinarian.

C: Internalising the externalities

Earlier we looked at production costs, which are relatively easy to measure. However, in order to obtain a true picture of total costs, one must also take into account what are sometimes referred to as 'negative externalities'.

These are the very real indirect costs associated with industrial livestock production, such as environmental pollution and loss of biodiversity as well as the poor welfare experienced by intensively reared farm animals. In general, these negative externalities (which are examined in detail below) are not given a value in the market and therefore remain as hidden costs. A number of studies indicate that industrial livestock production has damaging impacts on the environment and biodiversity and is wasteful in its use of resources.[42, 43] In addition, all forms of livestock production are responsible

[ii] Ireland's Suckler Cow Welfare Scheme is not established under the RDR but is included here as its scope and objectives are akin to schemes that can be supported under the RDR.

[iii] For more details about Scotland's programme, see *Targeted Help: Improving farm animal welfare in Scotland under the rural development programmes* published by the RSPCA and Eurogroup for Animals, 2008.

for greenhouse gas (GHG) emissions and can lead to foodborne disease. Moreover, excess consumption of meat results in an increased incidence of certain forms of heart disease and cancer.

A key factor in the detrimental impact of industrial livestock production is its dependence on feeding substantial quantities of cereals and soy to animals. A wide range of studies shows this to be an inefficient use of resources as the nutritional value consumed by animals in eating a given quantity of cereals is much greater than that delivered for human consumption by the resultant meat.[44, 45] Using cereals and soy as animal feed is a wasteful use not just of these crops, but of the land, water and fossil fuel energy used to grow them. The literature also shows that, through its dependence on cereals and soy for feed, industrial livestock production is responsible for overuse and pollution of water, soil degradation and air pollution.[43]

The World Bank has stressed that: *"Unregulated, livestock generates significant negative externalities. It contributes to land degradation and water pollution and to the erosion of biodiversity, and it is a major source of greenhouse gas emissions. It poses serious risks to public health, including diseases such as highly pathogenic avian influenza (HPAI) and bovine spongiform encephalopathy (BSE)"*.[42]

These various impacts are referred to as 'externalities' in that they have a damaging effect on society (including in some cases future generations) or third parties or natural resources. However, the costs arising from these adverse effects are borne by others and are not reflected in the costs paid by farmers or the price paid by the end consumer. When such externalities are not included in prices, they distort the market by encouraging activities that are costly to society, even if the private benefits are substantial.[46]

Need to internalise externalities is widely recognised

There is increasing recognition that, in order to reduce detrimental impacts and encourage efficient use of scarce resources, these externalities should be internalised in the costs of meat and dairy production and thus in the price paid by consumers.

The UK Foresight report has said that *"the food system today is not sustainable because of its negative externalities. These are not included in the cost of food and hence there are relatively few market incentives to reduce them"*.[47]

Similarly, the World Bank has argued that: *"Generally, there should be a stricter application of the 'Polluter Pays' principle, internalising the costs of the environmental externalities into the price of the products"*.[42]

The Foresight report has stressed that *"There needs to be much greater realisation that market failures exist in the food system that, if not corrected, will lead to irreversible environmental damage and long term threats to the viability of the food system. Moves to internalise the costs of these negative environmental externalities are critical to provide incentives for their reduction"*.

The Foresight report added that *"a major though challenging imperative for the governance system is to include the costs of externalities in food prices so that more sustainable production, whether local or more distant, is incentivised"*.

The UN Food and Agriculture Organization (FAO) has taken a similar approach, arguing that *"A top priority is to achieve prices and fees that reflect the full environmental costs [of livestock production], including all externalities …economic and environmental externalities should be built into prices by selective taxing and/or fees for resource use, inputs and wastes"*.[48]

V. PUTTING A COST ON EXTERNALITIES

A number of studies have calculated the costs that result from the externalities of agriculture. Pretty *et al* (2001) examined data on negative environmental and health externalities in the UK, the US and Germany.[46] As can be seen from Table 2, the researchers used a range of cost categories to assess negative environmental costs. The figures date from 1996 and the researchers point out that there are large gaps and uncertainties in the data; nonetheless they give a broad picture of the costs entailed in certain important externalities.

A detailed study has been made of the costs of freshwater eutrophication in England and Wales.[49] The authors stressed that their *"findings indicate the severe effects of nutrient enrichment and eutrophication on many sectors of the economy"*.

The study distinguished between two types of cost category:
(i) damage costs arising from reduced value of clean or non-nutrient enriched water and
(ii) policy response costs which are a measure of how much is being spent to address this damage.

The most costly items among the damage costs are reduced value of waterfront dwellings; drinking water treatment costs for nitrogen removal; reduced recreational and amenity value of water bodies; drinking water treatment costs for removal of algal toxins and decomposition products; reduced value of non-polluted atmosphere (via greenhouse and acidifying gases); negative ecological effects on biota and ecosystems by nutrient enrichment (this includes loss of biodiversity); and net economic losses from the tourist industry.

The study estimated the annual damage costs of freshwater eutrophication in England and Wales to be £75.0-£114.3 million ($122.9-$187.3 million; €85.4-€130.2 million). The policy response costs were estimated to amount to £54.8 million ($89.8 million; €62.4 million) per year. This study only examined the cost of eutrophication in freshwaters; additional costs are incurred in marine and estuarine waters.

Table 2: The annual external environmental and health costs of modern agriculture in the UK, the US and Germany.

COST CATEGORY	UK (£million)	US (£million)	Germany (£million)
Damage to natural capital: water – including pesticides, nitrate, phosphorus & soil in drinking water	231	1576	91
Damage to natural capital: air – including emissions of ammonia, methane, nitrous oxide & carbon dioxide	1113	10,936	1125
Damage to natural capital: soil – including erosion & flooding	96	8052	No estimate calculated
Damage to natural capital: biodiversity & landscape – including losses of biodiversity/wildlife, losses of hedgerows & drystone walls and losses of bee colonies	126	370	5
Damage to human health: including bacterial & viral outbreaks in food and, in UK, BSE & new variant CJD	777	88	9
Total annual external environmental & health costs	2342	21,022	1230

Source: Pretty *et al*, 2001

Nitrogen pollution

The European Nitrogen Assessment (ENA) estimates that the overall reactive nitrogen-related damage in the EU-27 results in costs of €70-€320 billion per year, of which 75% is related to air pollution effects and 60% to human health.[50]

The ENA points out that 75% of industrial production of reactive nitrogen (Nr) in Europe is used for fertiliser (2008 figure). The primary use of Nr in crops is not directly to feed people: 80% of the Nr harvest in European crops provides feeds to support livestock (8.7 million tonnes per year) plus 3.1 million tonnes per year in imported feeds, giving a total of 11.8 million tonnes per year. The ENA states that: *"Human use of livestock in Europe, and the consequent need for large amounts of animal feed, is therefore the dominant human driver altering the nitrogen cycle in Europe".*

The ENA estimates that environmental damage related to Nr effects from agriculture in the EU-27 is €20-€150 billion per year. A cost-benefit analysis shows that this outweighs the benefit of N-fertiliser for farmers of €10-€100 billion per year. The ENA identifies five key threats associated with excess Nr in the environment: damage to water quality, air quality, the greenhouse balance, ecosystems and biodiversity, and soil quality.

Foodborne diseases

A U.S. study estimates the cost of foodborne illness in the U.S. is $152 billion a year. This figure includes medical costs (hospital services, physician services and drugs) and quality-of-life losses (deaths, pain, suffering and functional disability).[51]

A University of Florida study estimated the disease burden in the U.S. for 14 leading pathogens across 12 food categories.[52] For each pathogen the study estimated the health impacts in monetary cost of illness and loss of Quality Adjusted Life Years (QALYs), a measure of health-related quality of life. The study estimated that the 14 foodborne pathogens cause $14.1 billion (2009 dollars) in cost of illness annually and loss of over 61,000 QALYs per year. An important reason for the higher figure in the study referred to in the previous paragraph is that the first study places a monetary cost on quality of life losses and lost life expectancy whereas the University of Florida study measures loss of QALYs but does not cost them.

The University of Florida study ranked the top 10 pathogen-food combinations and concluded that campylobacter in poultry was the most damaging in terms of both cost of illness and loss of QALYs. Salmonella in poultry was the fourth most damaging in terms of the combined impact of cost of illness and loss of QALYs. The study found that contaminated poultry has the greatest public health impact among foods. It is responsible for over $2.4 billion in estimated costs of illness annually and loss of 15,000 QALYs a year. Nearly all U.S. chickens are produced industrially.

Concerns about the high level of foodborne disease are highlighted by the fact that reduction of foodborne disease – and in particular tackling campylobacter in chicken – is a priority in the strategy for 2010-2015 of the UK Food Standards Agency.[53]

Campylobacter

Campylobacters are the most frequent cause of acute bacterial diarrhoea in the UK and other industrialised countries.[52] Campylobacteriosis is a debilitating and painful disease that has an enormous economic impact in terms of treatment costs, lost days at work and human welfare.

The European Food Safety Authority (EFSA) estimates that there are approximately nine million cases of human campylobacteriosis per year in the EU27. The disease burden of campylobacteriosis and its sequelae in the EU is 0.35 million disability adjusted life years (DALYs) per year and total annual costs are €2.4 billion.[55] EFSA reports that in 2009 campylobacter continued to be the most commonly reported gastrointestinal bacterial pathogen in humans in the EU. The number of reported confirmed human campylobacteriosis cases in the EU increased by 4% in 2009 compared to 2008.

There is no doubt that poultry is a major source of campylobacters.[54] A detailed study states that *"The importance of chicken as a source and vehicle of human infection with campylobacter cannot be over-emphasised"*.[54] EFSA identifies poultry meat as a major source of campylobacteriosis and states that broiler meat may account for 20% to 30% of cases of human campylobacteriosis, while 50% to 80% may be attributed to the chicken reservoir as a whole (broilers as well as laying hens).[55] Over 90% of EU broilers are reared industrially.

Salmonella

Salmonella is an important cause of foodborne disease in humans and is a significant cause of morbidity, mortality and economic loss.[56] An EU study of laying hen flocks detected salmonella in 30.8% of the laying hen holdings in the EU. It found that cage production was associated with a higher risk of a positive reading than for the other investigated laying hen production types. However, compared to the other production types, cage production was characterised by larger flock sizes. Consequently, both cage production and a larger flock size were associated with a higher risk of positivity. But it was not possible to determine which of these two factors was a true risk factor for positivity.[56]

A study of salmonella incidence in British laying hen flocks found that non-cage systems were associated with a reduced risk. There was a significantly lower risk of Salmonella Enteritidis in non-caged birds (barn and free-range) than in caged birds.[57]

Conclusion

Poultry are a major source of campylobacters and salmonella and industrial production of both chicken meat and eggs are responsible for a substantial proportion of these pathogens.

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The European Food Safety Authority estimates there are approximately nine million cases of human campylobacteriosis per year in the 27 member states of the EU. Broilers or meat chickens, above, along with laying hens, are thought to account for up to 50-80% of these.

Non-communicable disease

Diets high in meat and saturated fat increase the risk for heart disease, stroke, certain types of cancer and diabetes.[58] The costs in the U.S. due to poor diet for just these four diseases are estimated to exceed $33 billion per annum.[58]

A study published in *The Lancet* concluded that a 30% decrease in intake of saturated fats from animal sources in the UK could reduce the total burden from ischaemic heart disease by 15% in disability-adjusted life-years (DALYs), by 16% in years of life lost, and by 17% in number of premature deaths.[59] Similarly, in São Paulo city, a 30% reduction in intake of saturated fat from animal sources could reduce the total burden from ischaemic heart disease by 16% in DALYs, by 17% in years of life lost, and by 17% in number of premature deaths.

A study carried out by the Health Economics Research Centre at the University of Oxford found that cardiovascular disease costs the UK economy £29 billion a year in healthcare expenditure and lost productivity.[60] As a 30% decrease in intake of saturated fats from animal sources could reduce the total burden from ischaemic heart disease by 15% in the UK, it would appear that such a decrease could save the UK economy around £4.35 billion per annum. This suggests that the heart disease related externalities of high consumption levels of livestock products in the UK amount annually to around £4.35 billion.

Dutch study: The true cost of meat

A Dutch study has estimated the true cost of producing pork in the Netherlands by looking at: the *market price + externalities + subsidies.*[61]

Global warming

The Dutch study calculates that the production of 1kg of fresh pork including the land-use change resulting from growing the animal feed (mainly deforestation) results in greenhouse gas (GHG) emissions of 5.4kg CO_2-eq for conventionally (intensively) produced pork and 6.6kg CO_2-eq. for organic pork. The study estimates that the damage caused by the emission of 1kg of CO_2 leads to an average cost of €0.031. The authors calculate that the climate-related costs of producing 1kg of fresh pork are €0.18 for conventionally produced pork and €0.22 for organic pork.

Animal welfare

The Dutch study seeks to quantify and value the adverse impact of pork production on pig welfare. Based on willingness-to-pay research, the Dutch study suggests that the animal welfare-related costs of producing 1kg of fresh pork are between €1.10 and €4.60 for conventionally produced pork and between €0 and €3.50 for organic pork.

Biodiversity erosion

The Dutch study examines the costs resulting from two aspects of pork production that lead to loss of biodiversity. These are the cultivation of soy as feed which can involve the destruction of biodiversity-rich rain forests and ammonia emissions which lead to eutrophication and acidification and hence to reduced aquatic and terrestrial biodiversity. The study estimates that the biodiversity-related costs of producing 1kg of fresh pork are at least €0.44 for conventionally produced pork and at least approximately €0.38 for organic pork.

Animal disease

The Dutch study points out that animal disease entails costs in terms of food poisoning, antibiotic resistance and large outbreaks of disease such as foot-and-mouth disease and classical swine fever; some of these diseases such as bird flu are zoonotic (transmissible to humans). The cost of such diseases includes economic losses in the sector (e.g. culling animals and loss of turnover) and, in the case of zoonoses, the impact on public health. The Dutch study estimates the costs due to animal disease to be at least €0.32 per kg for both conventional and organic pork. The authors point out that this is likely to be a conservative estimate as they were unable to quantify and value global issues with regard to resistance to antibiotics and flu epidemics. They add that organic farms are likely to make a much smaller contribution to these two cost categories than conventional farms.

Conclusion

The study concluded that the external costs related to GHG emissions, animal welfare, biodiversity erosion and animal disease of producing 1kg of fresh pork are at least €2.06 for conventionally-produced pork and at least approximately €0.94 for organic pork. The authors point out that this is likely to be an underestimation of the costs incurred by externalities.

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VI. POLICY INSTRUMENTS FOR INTERNALISING EXTERNALITIES

Legislation, codes of practice and standards set by food businesses can all internalise external costs. For example, regulations can limit the discharge of a pollutant and impose penalties on those who breach the regulation. In addition, subsidies can be used to incentivise positive externalities or assist those who wish to reduce negative externalities. Of particular interest for this paper is the use of taxes to internalise external costs.

Taxation measures

Environmental taxes are in operation in certain countries, for example, carbon/energy taxes, sulphur taxes, leaded and unleaded petrol tax differentials, landfill taxes, pesticide taxes and fertiliser taxes. Such measures are designed to internalise the external costs of certain activities.

Tax allowances can be used to assist farmers to move away from intensive indoor farming (above) and its associated negative externalities, by supporting investment in higher welfare practices.

Similar approaches could be taken in the field of livestock production. The Dutch study referred to earlier suggests that a method to internalise the externalities of meat production – i.e. including them in the price of meat – is the introduction of a Pigouvian Tax[iv] equal to the cost of the negative externalities.Such a tax would correct the market failure due to externalities. The study states that the average rate of the Pigouvian Tax should be at least €2.06 for 1kg of conventionally-produced pork which is 31% of the consumer price in the Netherlands at the time of the study.

Tax measures can also be used to promote higher welfare practices e.g. by reducing the cost for farmers of implementing higher welfare production. For example, when calculating net profits for tax purposes, more generous capital allowances could be given to investments for higher welfare farming. Governments already use differential capital allowances to reward activities that they wish to encourage; for example, enhanced capital allowances are given in some countries for businesses that use environmentally beneficial technologies.

Tax measures could also be used to alter consumption patterns. Research shows that a tax on unhealthy foods, combined with the appropriate amount of subsidy on fruits and vegetables, could lead to significant health gains.[62] A Danish study concluded that taxes on "unhealthy" and subsidies for "healthy" food products can improve public nutrition.[63] Analogous fiscal instruments could be used to help a move from industrial livestock production to welfare-friendly husbandry. In countries which charge VAT on food, the price paid by consumers for higher welfare products could be reduced by placing a lower or nil rate of VAT on such food.

[iv] Wikipedia describes a Pigouvian tax as a tax levied on a market activity that generates negative externalities. The tax is intended to correct the market outcome. In the presence of negative externalities, the social cost of a market activity is not covered by the private cost of the activity. In such a case, the market outcome is not efficient and may lead to over-consumption of the product. A Pigouvian tax equal to the negative externality is thought to correct the market outcome back to efficiency.

VII. CONCLUSIONS

The additional farm level costs of producing food to higher standards of animal welfare than those of industrial production are overestimated in certain cases. For example, a free-range egg costs just over 2 pence more to produce than a battery egg and housing sows in groups rather than stalls adds just 1-2 eurocents to the cost of producing 1kg of pork.

In some cases better welfare can lead to healthier animals, enhanced productivity, lower veterinary costs, reduced mortality and improved net margins.

Any increase in on-farm production costs arising from the use of a higher welfare system will have a proportionately smaller impact on the retail price. This is because on-farm costs are only one of a range of factors which determine the retail price. Distribution, marketing and other value-adding processes in the food supply chain are also significant components of the final retail price.

Livestock production, in particular industrial production with its dependence on feeding large quantities of cereals and soy to animals, produces a wide range of negative externalities. These include pollution and overuse of water, soil degradation, greenhouse gas emissions, loss of biodiversity and increased levels of disease in humans. These negative externalities represent a market failure in that the costs associated with them are borne by third parties or society as a whole and are not included in the costs paid by farmers or the prices paid by consumers of livestock products.

A number of studies, including reports by the World Bank and the UN Food and Agriculture Organization and the UK Foresight report, have stressed the importance of internalising the negative externalities of livestock production in order to avoid market distortions and provide incentives for their reduction.

A considerable amount of work has already been carried out to quantify and value the negative externalities; much, however, remains to be done.

Legislation, codes of practice and standards set by food businesses can all internalise external costs. For example, regulations can limit the discharge of a pollutant and impose penalties on those who breach the regulation. In addition, subsidies can be used to incentivise positive externalities or assist those who wish to reduce negative externalities.

Taxation measures can be used to internalise the externalities of the production of meat and dairy products – i.e. including them in the price of the product. This would involve the introduction of a Pigouvian Tax equal to the cost of the negative externalities.
Taxation measures can also be used to reduce the cost of good animal welfare:

- To farmers e.g. by offering more generous capital allowances for investments in higher welfare farming
- To consumers by placing, in those countries that charge VAT on food, a lower or nil rate of VAT on higher welfare food.

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REVIEWING THE COSTS

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