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# From Battery Cages to Barns: A Cost-Benefit Analysis of a National Standard for Cage-Free Egg Production

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# From Battery Cages to Barns

## A Cost-Benefit Analysis of a National Standard for Cage-Free Egg Production

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May 1, 2014

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## **Abstract**

Legislation concerning the well being of farm animals has become a major focus in the animal rights movement, especially as it pertains to intensive confinement systems, such as housing egg-laying hens in battery cages. Informational asymmetries in the market for eggs represent a market failure, as producers have few incentives to inform consumers on modern egg production methods, which they may perceive as cruel. This study uses cost-benefit analysis to examine the effects of a hypothetical U.S. ban on caged egg production to assess whether such a standard would produce use and non-use benefits in excess of producer and consumer costs. Newly available data on the value of human altruism towards layers is considered, in addition to changes to consumer and producer surplus, as well as producer transition costs. I find that \$57 billion in benefits compared \$38 billion in costs is realized as a result of a cage-free mandate. The findings, however, show that 95% of the benefits arise from the high values for altruism that are enjoyed by only a small portion of the U.S. population with very strong preferences for farm animal welfare. Further, higher egg prices may disproportionately affect the poor, as eggs are an inexpensive source of high-quality protein. In the short term, instead of outlawing battery cages, animal advocacy groups should focus on legislation mandating producers to label egg cartons with information on housing systems in order to better inform consumers on the matter and help narrow the wide gap in consumer preferences.

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## Introduction

As new legislation relating to protections for farm animals continues to be submitted to legislatures around the country, by what means should it be evaluated? Cost-benefit analysis is frequently used, and often required, to determine whether a proposed law or regulation would create an economic benefit for society, or not. Bills often become laws on ethical or moral grounds, too, perhaps even when creating an economic loss. Such a loss, however, may be the result an inability to appropriately value the benefits, or disproportionate focus on the costs. Recently, economists F. Bailey Norwood and Jayson L. Lusk collected and published data on the results of an innovative auction experiment designed to illicit willingness to pay for improvements in the welfare of farm animals. This data consists of both values related to premiums on cage-free eggs that we might consume ourselves (i.e. median of \$0.44 per dozen), as well as what we might pay to transition all U.S. egg production to cage-free systems, an altruistic or non-use value (i.e. median of \$1.50 and mean of \$200.84 per person annually). These data permit an analysis that not only addresses the transition and increased production costs typically fixated on by the egg industry, but also considers benefits related to human altruism, which are not often factored into the economic analysis of animal protection legislation. Here, I assume that most people do not want farm animals to suffer, but people are also limited by their ability and willingness to pay for improved welfare conditions. A majority of people is assumed to have small willingness-to-pay values. Some people (i.e. one-third of the population in the analysis), though, are not willing to pay anything for welfare improvements. But, what should happen when the small remaining group is willing to pay a lot?

Many species of domesticated animals are raised for food on farms in the United States, from cows and pigs to turkeys and chickens. Chickens that are raised for meat, or broilers, are almost exclusively raised without cages in the United States. On the other hand, the vast majority of chickens kept to lay eggs, or layers, are housed in cages. The conditions under which laying hens are kept are often said to be of the cruelest. Here, a hypothetical ban on battery cages is considered, in favor of a national standard for cage-free egg production. Battery cages currently house almost 95%, or 276 million, of the nation's laying hens. This paper focuses on layers, among all the species of farm animals, due to the high level of attention these hens receive today from animal advocacy organizations. Legislative language prohibiting the use of battery cages in egg production is increasingly common at the state level, and even passed in 2008 in California as Proposition 2. Such a law is even proposed in the Massachusetts legislature now as House Bill 1456. Further, the largest animal protection organization, The Humane Society of the United States, and the egg industry, represented by the United Egg Producers, are now working towards legislation regarding layer-housing conditions at the federal level. It, therefore, appears relevant to evaluate how federal mandate requiring universal cage-free egg production would be examined through cost-benefit analysis, as would be required by

law. Would such a law produce net benefits for society, and how would they be distributed amongst groups with varying preferences for farm animal welfare?

Specifically, the research question is, “Would a national cage-free standard for egg production produce use and non-use benefits in excess of producer and consumer costs?” The major analytical framework is cost-benefit analysis, and the data used (ex. willingness-to-pay, production costs, egg industry statistics, and so on) was collected from secondary sources, including peer-reviewed literature by agricultural economists, egg production and consumption from the USDA, statistics from the egg industry, and other sources. Aside from performing the cost-benefit analysis, select issues, such as equity between groups of U.S. consumers with heterogeneous preferences, as well as the effects of higher egg prices on low-income consumers, will also be discussed.

## **Background**

### **Farm Animal Suffering as a Market Failure**

A significant disconnection appears to exist between how layers are actually raised in the U.S. and how people believe they are raised. While almost 95% of layers are actually raised in battery cages, consumers think that only 37% are housed in these systems (“Compassion, by the Pound”, 330). This stark difference between consumer perceptions and production realities shows an informational asymmetry in the market for eggs, where producers appear to hold much more knowledge on the realities of modern animal agriculture, with little desire to close this gap. Certainly, the market for most any good includes some degree of informational asymmetry. Producers often engage in fairly complex production processes, and information gathering by consumers is rarely costless. Still, the consequence in the egg industry for the informational asymmetry is the vast suffering of millions of hens. Adding to the problem, producers face a negative incentive to reveal their use of battery cages, as polls have continuously indicated a consumer preference against the use of intensive confinement in livestock farming.

Some consumers likely suffer themselves from the cognitive dissonance associated with the guilt of eating meat, and, therefore, deliberately choose not to become informed on growing practices. Bastian (2012) found an increase in mind denial following the immediate consumption of meat, and other efforts by meat eaters to “deny minds to food animals.” Still, the growth of the cage-free egg market and the cascade of successful ballot initiatives for farm animal protections over the last decade reveal that consumers, in general, are becoming increasingly aware of intensive confinement in some portions of the livestock industry, and looking to change what they view as an unfavorable practice. There is little coincidence that The HSUS’s “No Battery Eggs Campaign” also began about a decade ago in 2005, and, since then, the organization has expended great resources in its efforts to ban battery cages, most of which have had at least a side effect of increasing the amount of

information in the market relating to growing practices, especially housing conditions.<sup>1</sup> I think for your presentation a table with important dates in protection for chicks would help to show the change in awareness

Asymmetrical information in the egg market could be a sound reason for government to intervene in an attempt to correct a market failure. Here, cost-benefit analysis is used to determine whether such a policy change would realize a net benefit for society in the United States. Certainly, a ban on the use of certain production practices (i.e. battery cages) is more severe than other potential forms of intervention, such as the provision of information to consumers. Education could be provided directly by the government, for example through television commercials, or through a mandate on the private sector to label eggs with a statement on the housing conditions used for layers.

### **Use and Non-Use Valuations for the Benefits of a National Cage-Free Standard**

The major benefits of a national cage-free standard for egg production in the analysis related to personal consumption (i.e. use valuation) and human altruism towards egg-laying hens (i.e. non-use valuation). The non-use valuations place a monetary value on the good feelings a majority of people would enjoy simply from knowing that egg-laying hens in the United States are raised outside of cages, as opposed to in intensive confinement. The use valuations relate to premiums placed by some consumers on cage-free eggs that they personally consume. Under some scenarios, included what is presented as the most likely scenario, the non-use valuations dwarf the use-valuations by a factor of ten. The magnitude of these benefits, though, is assumed to vary enormously across the U.S. population, with the value placed on a national cage-free standard by “Conscientious Consumers” assumed to be less than 1% of the value placed on the same standard by “Animal Advocates.” “Cost-Driven Consumers,” on the other hand, are assumed to realize no benefit, either personally or related to altruism, from a switch to cage-free production systems.

### **The Egg Industry**

Americans, on average, consume 250 eggs each year.<sup>2</sup> For many Americans, eggs are an inexpensive source of high-quality, and tasty protein. There are almost 300M egg-laying hens, or layers, in the United States today, producing roughly 80B eggs, or over 6.5B dozens annually.<sup>3</sup> The industry is heavily consolidated. The American Egg Board states, “presently,

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<sup>1</sup> The Humane Society of the United States. “Progress for Egg-Laying Hens.” Accessed April 20, 2014. [http://www.humanesociety.org/issues/confinement\\_farm/timelines/eggs\\_timeline.html](http://www.humanesociety.org/issues/confinement_farm/timelines/eggs_timeline.html).

<sup>2</sup> American Egg Board. “Egg Industry Facts Sheet.” Accessed April 20, 2014. <http://www.aeb.org/egg-industry/industry-facts/egg-industry-facts-sheet>.

<sup>3</sup> USDA. “USDA AMS Weekly Shell Egg Demand Indicator.” Accessed April 20, 2014. <http://usda.mannlib.cornell.edu/usda/ams/PYWSEDI.pdf>.

there are approximately 59 egg producing companies with 1 million-plus layers that represents approximately 87 percent of total production and 16 companies with greater than 5 million layers.”<sup>4</sup> At the beginning of 2013, the top ten egg producers represented 53% of the entire U.S. flock.<sup>5</sup> The largest producer, Cal-Maine Foods, owns over 10% of the flock. The egg industry has also gone through significant vertical integration as it has industrialized with the major companies owning most of their supply chains, from breeding and production to packing and marketing. Until the eggs are provided to food distributors and retailers, they generally remain under the control of the egg companies.

### **Housing Conditions for Laying Hens**

About 95% of the country’s flock, or 276 million hens, are housed in what are typically called “battery” or “conventional” cages. These wire cages generally afford 67 square inches of space per bird, which is less area than a single sheet of 8.5x 11-inch paper. Commercial caged-egg production typically occurs in large enclosed barns with rows of stacked cages, each filled with three or more chickens. Hens are provided with access to food and water in the cage, and their droppings fall through the mesh below them. The bottom of the cage is usually slanted, so that eggs, once laid, roll down for collection or onto a moving belt. Battery cage production arose during the second half of the 20<sup>th</sup> century, when animal agriculture trended towards mass-production. While chickens had been traditionally kept outside in small flocks, bringing the birds inside in cages provided many advantages to farmers. First, the eggs were easier to collect. Sanitation also improved, due to separate pathways for the eggs and the droppings, making eggs easier to clean and reducing disease. Feed could be rationed, too, and sick or dead birds could be found easily and removed. Additionally, taking the birds inside protected them from adverse weather and prevented attacks from other animals. As generations of selective breeding weakened the bones and immune systems of layers, in favor of devoting bodily energy towards egg production, the adoption of battery cages did present some advantages. Now confined to living with only a few other hens, and with their waste falling below their feet, the birds were less likely to get sick. The benefits of battery cages, though, certainly came with downsides for the layers. The worst restriction for the hens is often said to be the inability of the birds to find a private space to lay their eggs. Other limitations include the inability to perch, roost, scratch, forage, and, often, even spread their wings. Certainly, tradeoffs exist between animal welfare and efficiency in all housing systems. The welfare of hens living in battery cages is so terrible, though, due to restrictions on basic behavior, a consensus now exists among industry, advocates, veterinarians, and the public that the

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<sup>4</sup> American Egg Board. “Egg Industry Facts Sheet.” Accessed April 20, 2014. <http://www.aeb.org/egg-industry/industry-facts/egg-industry-facts-sheet>.

<sup>5</sup> WATTAgNet.com. “Egg Industry – February 2013.” Accessed April 20, 2014. <http://www.eggindustry-digital.com/201302/Default/9/0#&pageSet=9&contentItem=0>.



health and production benefits gained are not worth the costs in the enormous suffering imposed on the hens.<sup>6</sup>

### **Battery Cage Bans So Far**

Battery cage production is banned in the European Union (2012), Austria (2008), Germany (2009), Sweden (2002), and Switzerland (1992), stemming from an increase in public attention to farm animal welfare that resulted from the publication of *Animal Machines* (1964).<sup>7</sup> This public awareness in Europe led to the United Kingdom's establishment of the Farm Animal Welfare Council in 1979, and a EU Directive in 1986 to set a minimum size for battery cages. Additional reports eventually led to the European Union passing a directive in 1999 to phase out the use of battery cages by 2012. In addition to countries through the European Union, the U.S. states of Michigan (2009) and California (2015) also passed legislation to ban battery cages.

Corporate America is also making a statement. Au Bon Pain, Burger King, Carnival Cruise Lines, Compass Group, ConAgra Foods, Costco, Denny's, General Mills, Harris Teeter, Hyatt Hotels, Kraft Foods, Krispy Kreme Doughnuts, Marriott hotels, Norwegian Cruise Lines, Quiznos, Royal Caribbean Cruise Lines, Safeway, Sara Lee, Sonic Drive-In, Starbucks, Subway, Unilever, Walmart, Wendy's, Whataburger, and Wolfgang Puck have all made varying commitments to sourcing cage-free eggs within the last decade.<sup>8</sup>

### **Farm Animal Welfare and the Animal Right Movement**

At the forefront of much recent progress has been The Humane Society of the United States (HSUS), the world's largest animal advocacy organization. Established in 1954, today The HSUS boasts millions of members and has revenues of well over \$100 million.<sup>9</sup> Four years after its inception, The HSUS helped pass the Humane Slaughter Act, the second of

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<sup>6</sup> See:

- **Industry & Advocates:** The Huffington Post. "Humane Society, United Egg Producers Team Up To Support Historic Chicken Welfare Legislation." Accessed April 20, 2014. [http://www.huffingtonpost.com/2011/07/07/humane-society-united-egg\\_n\\_892682.html](http://www.huffingtonpost.com/2011/07/07/humane-society-united-egg_n_892682.html).
- **Veterinarians:** American Veterinary Medical Association. "Welfare Implications of Layer Hen Housing." Accessed April 20, 2014. [https://www.avma.org/KB/Resources/Backgrounders/Documents/laying\\_hen\\_housing\\_bgnd.pdf](https://www.avma.org/KB/Resources/Backgrounders/Documents/laying_hen_housing_bgnd.pdf).
- **European Union:** LayWel. WP 7: Integrated welfare assessment." Accessed April 20, 2014. <http://www.laywel.eu/web/xmlappservlet60ef.html>.
- **Public:** See "Farm Animal (i.e. Laying Hen) Welfare Awareness" section below.

<sup>7</sup> See "Table Egg Production and Hen Welfare: The UEP-HSUS Agreement and H.R. 3798," (Greene 2012)

<sup>8</sup> The Humane Society of the United States. "Barren, Cramped Cages." Accessed April 20, 2014. [http://www.humanesociety.org/issues/confinement\\_farm/facts/battery\\_cages.html](http://www.humanesociety.org/issues/confinement_farm/facts/battery_cages.html).

<sup>9</sup> Charity Navigator. "The Humane Society of the United States." Accessed April 20, 2014. <http://www.charitynavigator.org/index.cfm?bay=search.summary&orgid=3848>.

only two federal animal-protection laws.<sup>10</sup> Although ethical concerns relating to the treatment of animals have existed for millennia, the American animal rights movement has existed for only 150 years, with the modern thrust occurring over the last 60 years. Founded in 1866, the ASPCA became the “first humane organization in the Western Hemisphere.”<sup>11</sup> Early humane societies, though, largely focused on companion animals (i.e. dogs and cats), as it was not until the widespread adoption of intensive-confinement systems in the mid-20<sup>th</sup> Century that large-scale farm animal welfare issues emerged.<sup>12</sup> In fact, the United Nations describes the rise of “factory farming” in the United Kingdom as being seen as “as the road to national food security and a better diet.” Nevertheless, intensive farming, despite the productivity gains realized, came at the expense of animal welfare, and increasingly drew public criticism as details emerged. Today, in the United States, there is almost twice the number of egg-laying hens raised in battery cages than all the cats and dogs owned by households combined (i.e. 83.3M dogs, 95.6M cats, and 294M egg-laying hens).<sup>13</sup>

In 1980, the animal-rights movement was significantly impacted by Peter Singer’s “Animal Liberation,” which made the case for simply leaving animals alone. Singer’s book popularized the term “speciesism,” or, simply put, giving animals different considerations than humans. He explained that since humans differ widely in mental and physical abilities, yet we, as a society, believe that all humans should be afforded the same rights and considerations. He concluded that it is, therefore, irrational to not extend the same rights and considerations to animals, some of which have intelligence and faculties surpassing certain humans, such as people with intellectual disabilities. The timing of Singer’s published writings and coincided with a period of radicalism for the animal-rights movement, with organizations, like the Animal Liberation Front (ALF) and People for the Ethical Treatment of Animals (PETA), using extreme tactics to garner media attention and create social awareness for issues of animal cruelty.

Today, the U.S. animal rights movement is institutionalized, politically influential, and more moderate in nature. The HSUS acts as the movement’s chief lobbyist for legislative action. The mission of HSUS’s “Protect Farm Animals” campaign is stated as “working to reduce the suffering of animals raised for meat, eggs, and milk.”<sup>14</sup> The organization has been largely concentrating its efforts on what it perceives to be the most egregious of farm animal abuses: gestation stalls for breeding sows, crates for veal calves,

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<sup>10</sup> The other is 49 USC §80502, commonly known as the “28 Hour Law,” which required livestock in transport to be able to rest, eat, and drink every twenty-eight hours while in transport.

<sup>11</sup> ASPCA. “About Us.” Accessed April 20, 2014. <http://www.aspc.org/about-us>.

<sup>12</sup> United Nations System. “Nutrition and the Environment.” Accessed April 20, 2014. <http://www.unsystem.org/SCN/archives/scnnews21/ch04.htm>.

<sup>13</sup> The Humane Society of the United States. “U.S. Pet Ownership and Shelter Population Estimates.” Accessed April 20, 2014.

[http://www.humanesociety.org/issues/pet\\_overpopulation/facts/pet\\_ownership\\_statistics.html](http://www.humanesociety.org/issues/pet_overpopulation/facts/pet_ownership_statistics.html).

<sup>14</sup> The Humane Society of the United States. “Protect Farm Animals.” Accessed April 20, 2014.

[http://www.humanesociety.org/issues/campaigns/factory\\_farming/](http://www.humanesociety.org/issues/campaigns/factory_farming/).

and battery cages for laying hens. For over a decade, the HSUS has been advocating for state legislation, primarily through ballot initiatives, to ban the use of these growing practices. All along, the standard legislative language pursued is “to prohibit the confinement of farm animals in a manner that does not allow them to turn around freely, lie down, stand up, and fully extend their limbs.”<sup>15</sup> While not explicitly calling for a ban on battery cages or other methods, the practical effect of the text is to prohibit these practices, and most other methods of intensive confinement for farm animals. Broiler chickens, beef cattle, and many other farm animals, however, are not affected by this legislation, as they are not conventionally raised in intensive confinement in the United States. Still, the egg, pork, and veal industries are greatly affected by this legislation, where it does exist. The most prominent legislative victory for the HSUS occurred in 2008 with the passage of Proposition 2 in California. This ballot initiative effectively banned the use of cages for egg production in the state as of 2015. As California is fifth in the U.S. for egg production, the predicted impact of the legislation is enormous. The effects on California’s egg industry resulting from the law have been expected to be quite perverse, as nearby states were assumed to ramp up imports of eggs from caged hens into California, effectively making it impossible for California producers to be cost competitive (Sumner, 2010 & Promar International’s “Economic Impact on California of the Treatment of Farm Animals Act”). Although the government of California continues to make adjustments to policy to mitigate some of these effects citation needed, such as in setting requirements for imported eggs to be grown cage free as well, the future is uncertain. This particular solution, for example, is said to be unconstitutional, as it may violate principles of interstate commerce cite lawsuit. The size of California’s egg industry, coupled with the odd consequences of state-based housing bans, will likely again shift attention to a national referendum.

Similarly, the patchwork of laws that the HSUS was helping to enact around the country had become a growing threat for the U.S. egg industry. The United Egg Producers (UEP), a Capper-Volstead cooperative representing ownership of 95% of the country’s flock, embodies this industry for legislative and lobbying purposes. During the summer of 2010, with state legislation pending in Oregon and Washington, the UEP and the HSUS reached an unlikely agreement to work together on passing federal legislation to set standards for national egg production. The terms of the agreement mandated HSUS to cease state-based campaigns for legislation related to the egg industry, in favor of creating a federal requirement for eggs to be produced in enriched cages and requiring labels on all eggs denoting housing conditions (ex. Eggs from Caged Hens, Eggs from Cage-Free Hens,

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<sup>15</sup> See:

- The 188<sup>th</sup> General Court of The Commonwealth of Massachusetts. “Bill H.1456.” Accessed April 20, 2014. <https://malegislature.gov/Bills/188/House/H1456>.
- California Secretary of State. “Official Voter Information Guide.” Accessed April 20, 2014. <http://voterguide.sos.ca.gov/past/2008/general/text-proposed-laws/text-of-proposed-laws.pdf>.
- Animal Law Resource Center. “Cruel and Inhumane Confinement of Sows Act.” Accessed April 20, 2014. <http://www.animallaw.com/Gestationcrates.htm>.

etc.), in addition to other, less notable terms.<sup>16</sup> It is interesting, too, that the HSUS-UEP agreement regarding caged-egg production pursues both labeling and a ban on battery cages, rather than focusing on consumer education. While the HSUS has pursued bans on caged-egg production for over a decade, the attention to information provision as a matter of policy is unique to this proposed federal legislation. A contemporary parallel—the use of genetically modified organisms, or GMOs, in human food products—has spurred the creation of a powerful advocacy group in the “Just Label It” campaign with its “We have the right to know” tagline.<sup>17</sup> This national organization, in addition to many state-based entities representing the same cause, are targeting a private-sector mandate for information delivery on the basis that it should be a right of the consumer to know the specifics of what food products they are purchasing.

Although the HSUS-UEP legislation has not yet passed, at the time of this writing, the HSUS and the UEP continue to work together in pursuit of this goal. Additionally, some animal-advocacy organizations are critical of endorsing the continued use of cages, and the European Union chose cage-free production as their standard. At this point, it seems likely that future regulations for U.S. egg production will occur at the federal level, although it is more ambiguous whether enriched cages, or cage-free production will be chosen.

Next, I elaborate on the information problems in the market for eggs that could justify a national standard for cage-free egg production. Then, I present data on consumer opinions towards farm animal welfare, along with findings from a relevant auction experiment that allows for the benefits resulting from a cage-free mandate to be estimated for inclusion in the cost-benefit analysis.

## Literature Review

### Informational Asymmetries in the Market for Eggs

With the exception of the National Cattlemen’s Beef Association and the National Pork Producers Council, lobbying groups representing beef and pork producers, in addition to the American Farm Bureau Federation, a trade group for farmers founded on free-market principles, no one is defending the continued use of battery cages.<sup>18</sup> Further, even if some people are not willing to pay anything for improvements in farm animal welfare (i.e. “Cost-Driven Consumers,” as described later), they likely do not have positive values for farm animal suffering. Nevertheless, the vast majority of egg-laying hens in the U.S. are housed in battery cages. An oft-cited poll conducted by Zogby Analytics in 2000 found that

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<sup>16</sup> Enriched cages are larger cages with enough square inches of space per bird to allow basic movement, and also include “enrichments,” such as a private area set aside in the cage for laying eggs, as well as perches.

<sup>17</sup> Just Label It! “Genetically Engineered Foods/Tell FDA to Label.” Accessed April 20, 2014. <http://justlabelit.org>.

<sup>18</sup> The New York Times. “More Humane Egg Production,” Accessed April 20, 2014. <http://www.nytimes.com/2012/02/15/opinion/more-humane-egg-production.html>.

86.2% of respondents thought the use of battery cages in egg production was unacceptable.<sup>19</sup> Data collected from an earlier 1995 poll by Caravan Opinion Research Corporation showed that 90% of respondents strongly disapproved of keeping hens in cages where they could not spread their wings.<sup>20</sup> Still, a 1998 industry-conducted poll captured “warm feelings” for farmers and ranchers, in addition to 80% of respondents believing that these groups currently treated their animals humanely.<sup>21</sup> How, then, can public sentiment towards farmers be so positive, while the same public overwhelmingly condemns the predominant technologies employed by the livestock industry in the housing of animals? Is it possible that they are simply unaware of where their food comes from?

One possible explanation is the perpetuation of the agrarian myth, or the “idyllic scene” many of us think about when we ponder the nature of farming, images of “fresh air; lush pastures; quaint, rustic buildings; and happy, carefree animals.”<sup>22</sup> Renck (2002) describes a general American perception of the “moral superiority” held by farmers, who are often seen as a “symbol of honesty, integrity, democracy and statesmanship.” From a political perspective, Kelsey (1994) argues that the agrarian myth “sustains support for federal farm programs despite high program costs and the relatively small number of farmers in the voting population.” While it may be that the myth has obscured the true, industrialized nature of how most livestock farming in the United States is conducted, the intensity of public sentiment against farm animal suffering implies an eventual reckoning between fact and fiction.

Logically, though, it seems foolish to expect the industry to come forward with truthful representations of current growing practices, like the use of cages in egg production. Further, if an individual does become aware, perhaps through a viewing of a YouTube video clip or news article high enough in the headlines, they might still feel helpless against the magnitude of the problem. Non-vegetarians, especially, who may have just finished a steak for dinner, or polished off a heap of eggs and bacon, might take more pleasure in simply forgetting about the matter. What remains, however, is the unfortunate reality that hundreds of millions of farm animals live and die in cages, crates, and stalls each year in the United States alone. Here, I argue, as do many animal-advocacy groups, that an informational asymmetry exists in the market for eggs, as it likely does in the markets for many animal products, with producers intentionally keeping consumers uninformed about housing conditions, and other growing practices.<sup>23 24 25</sup>

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<sup>19</sup> Swanson (2000)

<sup>20</sup> *Ibid.*

<sup>21</sup> *Ibid.*

<sup>22</sup> Philly.com. “The agrarian myth and industrial reality of animal agriculture.” Accessed April 20, 2014. [http://www.philly.com/philly/blogs/public\\_health/The-agrarian-myth-and-industrial-reality-of-animal-agriculture.html](http://www.philly.com/philly/blogs/public_health/The-agrarian-myth-and-industrial-reality-of-animal-agriculture.html).

<sup>23</sup> Farm Forward. “Our Work.” Accessed April 20, 2014. <http://www.farmforward.com/about-us/our-work>.

<sup>24</sup> The Humane Society of the United States. “Anti-Whistleblower Bills | Ag-Gag Bills.” Accessed April 20, 2014. [http://www.humanesociety.org/issues/campaigns/factory\\_farming/fact-sheets/ag\\_gag.html](http://www.humanesociety.org/issues/campaigns/factory_farming/fact-sheets/ag_gag.html).

## Consumer Opinions on Farm Animal Welfare

In a telephone survey of 1,019 randomly selected U.S. households, Prickett (2010) found that 49.25% of Americans consider the well-being of farm animals when making purchasing decisions about meat, and 77.01% disagreed with low meat prices being more important than the well-being of farm animals. Further, 69.42% of households agreed “The government should take an active role in promoting farm animal welfare.” Nevertheless, there are currently no federal laws, and limited state laws, regulating the welfare of farm animals, and even fewer pertain to laying hens. The apparent preferences held by Americans for at least some protections for farm animals, when practically none exist, further demonstrates the informational asymmetries existing in the market for eggs.

Vanhonacker et al. (2007) found that 11.1% of Flemish people, based on a sample of 459 individuals, to have a “very high commitment and a very high willingness to pay” for high-welfare animal products. Further, the authors find that another 36.1% of people consider animal welfare in their food purchasing decisions, although they may not consistently purchase only high-welfare products. Lusk and Norwood (2010) argue that the replies of individuals differ when responding to direct questioning (ex. “I consider the well-being of farm animals when I make decisions about purchasing meat”) versus indirect questioning (ex. “The average American considers the well-being of farm animals when they make decisions about purchasing meat”). The authors argue that indirect questioning is more effective at soliciting true responses than direct questioning. Lusk and Norwood find that whereas through direct questioning 48.66% of respondents agree that they consider the well being of farm animals in their purchasing decisions, only 20.98% agree when asked about the same concept indirectly. Their study provides evidence that almost half of Americans would likely agree to paying for minimal protections to farm animals, but only less than a quarter of Americans, at most, would have a significant willingness to pay for improvements in farm animal welfare.

## Informed Versus Experienced Effects

In *Compassion By the Pound*, economists Bailey Norwood and Jayson Lusk note, “people do not know much about the way farm animals are raised” (327). The authors continue by separating the “informed” versus “experienced” effects of policy relating to farm animal protections. “Informed” consumers are described as those aware of modern livestock growing practices, and are assumed in the following analysis to exclusively realize the personal-use benefits of a ban on caged production. The experienced effect, on the other hand, relates to those consumers who are unaware of the use of battery cages in modern egg farming. Thus, a ban on caged egg production would only serve to raise the price of eggs at the grocery store for those consumers, without contributing any benefits

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<sup>25</sup> ASPCA. “Ag-Gag Whistleblower Suppression Legislation.” Accessed April 20, 2014.  
<http://www.asPCA.org/fight-cruelty/advocacy-center/ag-gag-whistleblower-suppression-legislation>.

related to human altruism or premiums related to cage-free production, due to a lack of education. Therefore, in valuing the economic impacts of welfare legislation, the proportion of consumers assumed to be “informed” and “experienced” has an enormous effect on benefit calculations. In fact, the very existence of the information problem related to current farm animal raising practices appears to be a logical focal point in the discussion surrounding what sort of government intervention, if any, may be warranted to better align consumer spending with preferences for layer housing.

### **Own-Price Elasticity of Demand for Eggs**

Understanding how the quantity of eggs demanded responds to a change in price is important in determining how the size of the egg market would change as a result of a national cage-free standard that would certainly raise the retail price of eggs. A number of sources exist for elasticity data on the demand for eggs. Sumner (2008) reports retail demand elasticities for eggs in the literature ranging from -0.15 to -0.3, indicating demand is relatively unresponsive to changes in price. Sumner (2010) and Sumner (2011) use an elasticity of -0.2 for eggs in calculations of economic impacts relating to welfare legislation. For this reason, and because it is in the middle of the range in the literature, a figure of -0.2 was assumed appropriate for the following cost-benefit analysis. Sumner cautions, however, that most elasticity data in the literature is more than 15 years old, and, therefore, encourages newer studies (Sumner 2011, 247). Still, it is important to note that moderate fluctuations in the elasticity do not significantly affect the values or conclusions reached in this analysis. Some of this presumed inelasticity comes from eggs having relatively few substitutes, on both the breakfast plate and as a key ingredient in prepared and processed food products. Although Lusk (2010) finds elasticities to be higher for cage-free eggs (i.e. -0.4 in “Compassion, by the Pound”, 330) than for caged eggs, the elasticity for all eggs after the hypothetical ban on caged production is still assumed to equal -0.2, as eggs will continue to possess the same characteristics that resulted in previously inelastic demand.

### **Lusk and Norwood Auction Experiment Used for Benefit Calculations**

In 2008, food and agricultural economists Jayson Lusk and F. Bailey Norwood engaged in a unique contingent valuation experiment to determine the worth of farm animal welfare to participants in a study. Lusk (2012) and *Compassion, by the Pound* (pgs. 266-301) both describe the study in detail. In summary, though, the desired outcome for each participant in the study was to obtain willingness-to-pay figures for a variety of egg products, each differing by the type of farm on which the laying hens were raised (i.e. auction #1), as well as figures valuing the right to decide on which type of farm the entire U.S. laying flock would be raised (i.e. auction #2). Auction #1 resulted in quantifications of

personal-use benefits relating to premiums on eggs from cage-free systems compared to caged systems for informed consumers. Alternatively, auction #2 produced estimates for non-use benefits, or the public value related to human altruism, realized by individuals as a result of the knowledge that the layers would be raised in improved housing conditions.

In creating the sample, Lusk and Norwood hired a market research company to construct representative samples of 100 people from the U.S. cities of Wilmington, North Carolina, Chicago, Illinois, and Dallas, Texas. The authors indicated that these cities were chosen due to their geographical separation, as well as diverse preferences in demographics and food consumption habits, among other factors. Half of the sample in each city was used to assess values for eggs, while the other was used in a similar study for preferences relating to pork production. To conduct the experiment, the authors created a computer program that aided participants in putting together their preferences for various elements of layer housing into a single WTP figure. There were six steps in the process that culminated with an auction. First, participants were also given a 30-minute information session on different types of layer housing (i.e. battery cages, cage-free systems, free-range systems, etc.), including scientific information on layer welfare in each. Then, they used a scale of 1-10 to rank numerous housing attributes (i.e. the availability of a perch). Next, they were asked to rank those attributes relative to one another by distributing 100 points between them. Following the ratings and rankings, participants were presented with egg products from layers in different housing systems. The computer program then automatically generated auction bids based on their ratings and rankings. Participants could make adjustments until the desired values were obtained. Finally, these bids were entered into a real auction, where a secret price was generated, and, if their individual bids were higher than the secret price, then they would win the auction. The experiment was designed to elicit bids precisely equal to their maximum willingness to pay, and were constantly reminded that a winning bid would require a real payment. They were alerted of a variety of payment options throughout the experiment.

Auction #1 produced mean and median personal-use values for the premiums related to eggs from cage-free systems. While auction #1 collected data on both premiums related to cage-free and free-range production, auction #2 only captured valuations for free-range systems. Since a national cage-free standard, as opposed to free-range, is considered in this analysis, the ratio of free-range to cage-free values from auction #1 was used to adjust the values obtained through auction #2 to reflect cage-free production.

Stepping forward with this new data from the literature, a model is constructed that leverages these estimations for personal-use and altruistic benefits, in addition to the readily available data on costs, to compose a cost-benefit analysis useful in determining whether these benefits would exceed the producer and consumer costs also incurred with a national standard for cage-free egg production.



## Methods

The cost-benefit analysis conducted in this paper uses data collected from relevant literature, including books written by academics in the field, as well as U.S. egg industry publications.

<b>Table 1: Source for frequencies, costs, and benefits</b>	
<b>Description</b>	<b>Source of estimates</b>
<i>Demographics</i>	
U.S. population, projections (2015-2029)	United States Census Bureau
Per capita egg consumption, 2013	American Egg Board
<i>U.S. egg industry</i>	
Table egg layer flock, total	USDA AMS Weekly Shell Egg Demand Indicator
Eggs laid per layer per year	Discovery Education & American Egg Board
Market share, cage-free eggs	American Egg Board
Market share growth trend, cage-free eggs	World Society for the Protection of Animals
Projected farm-level cost differential, caged to cage-free system	Sumner 2010, 433
% , projected farm-level costs increase, caged to cage-free system	Sumner 2011, 245
% , farm-level costs passing through to retail price	Promar International
Projected retail price increase, caged to cage-free system	<i>Compassion, By the Pound</i> , 334
Retail-cost-to-price adjustment factor	<i>Compassion, By the Pound</i> , 351
<i>Egg prices and elasticities</i>	
Cage-free eggs, dozen	American Farm Bureau Federation
Caged eggs, dozen	Bureau of Labor Statistics
Own-price elasticity of demand, eggs	Sumner 2011, 247
<i>Willingness-to-pay, human altruism</i>	
Raise all layers in U.S. cage free	Lusk 2012, 38
% , zero WTP value	Lusk 2012, 38
<i>Willingness-to-pay, personal consumption</i>	
Premiums for cage-free relative to eggs from cage systems	<i>Compassion, By the Pound</i> , 284
<i>Producer transition costs</i>	
Renovation cost per layer	Agralytica, 16
New construction cost per layer	Agralytica, 17
% , new construction versus renovation	Agralytica, 15

## Overview

The cost-benefit analysis first addresses the use and non-use benefits of a national cage-free standard for egg production. The use benefits are calculated as the change in consumer surplus for informed consumers, or those who are aware of modern egg production practices, and are based on data collected in the Lusk and Norwood auction experiments. Similarly, additional non-use benefits for human altruism towards egg-laying hens, a public good, are based on the auction data. Unfortunately, the presumed increases in utility by the hens themselves cannot be readily valued, and is therefore omitted from the cost-benefit analysis. Willingness-to-pay data on premiums related to personal cage-free egg consumption is uncommon in the literature, and valuations of human altruism are even more rare. The benefit side of the analysis leans heavily on the Lusk and Norwood auction data, which is highly valued for its recency and quality.

The frequency of allocation for use and non-use benefits follows a division of the U.S. population into three groups: Cost-Driven Consumers, Animal Advocates, and Conscientious Consumers. The proportion of the population in each group results is based on the current market share of cage-free eggs and zero bidders from the Lusk and Norwood auction experiments, and supported with consumer opinions on farm animal welfare found in the literature. Only Animal Advocates are assumed to be able to enjoy the personal-use benefits relating to a national ban across all scenarios, while both Animal Advocates and Conscientious Consumers generally realize non-use benefits, albeit with the values for the latter a mere fraction of those for the former.

On the other side, three costs are included in the cost-benefit analysis: producer transition costs, change in consumer surplus for uninformed consumers (i.e. experienced effect), and the change in producer surplus. Producer transition costs are calculated entirely with industry data, both obtained through economic impact reports commissioned by the UEP and other affiliated entities and from scholarly articles citing industry data. Thus, the cost estimates reached in this analysis are all similar to results found in the literature and in industry reports. Still, it is probable that estimated transition costs are conservative over-estimates, as they likely ignore innovation in cost-cutting technologies.

Finally, this analysis does not attempt to quantify all of the potential economic impacts of a ban on caged egg production (ex. comparative public-health tradeoffs between caged and cage-free systems are ignored). Instead, the analysis seeks to both egg industry's accounting of costs related to a mandated transition, and inject consideration of potential benefits into the conversation.

## Farm Animal Welfare Awareness

For the purposes of analysis, the U.S. population was fully divided into three mutually exclusive groups:

- *Group #1: “Cost-Driven Consumers,”* or people who do not consider farm animal welfare in their purchasing decisions, and/or believe it is not important.
- *Group #2: “Animal Advocates,”* or people who are very aware of modern egg production methods, consider farm animal welfare to a significant extent in their purchasing decisions, and believe it is very important issue.
- *Group #3: “Conscientious Consumers,”* or people who are somewhat aware of modern egg production methods, consider farm animal welfare to a limited extent in their purchasing decisions, and believe layer welfare is somewhat important.

As discussed previously, the proportion of consumers that are informed on modern egg production practices is a major factor in determining the benefits realized by a national cage-free egg standard. Although a number of scenarios are presented in the cost-benefit analysis, Cost-Driven Consumers typically enjoy no benefits, Animal Advocates enjoy significant benefits, and Conscientious Consumers enjoy small individual benefits.

Cost-Driven Consumers are assumed to equal about 33% of the U.S. population, consistent with the percentage of individuals bidding nothing for improvements in farm animal welfare in the Lusk and Norwood auction experiments (Lusk 2012, 38). This is also a similar proportion to those in Lusk (2010) that disagreed with the indirect questions, “The average American thinks that farm animal welfare is important” and “The average American thinks that low meat prices are more important than the well-being of farm animals” (36.75% and 23.51%, respectively). Animal Advocates are originally assumed to equal the current proportion of cage-free market share, or 5.9%, which is intended as a conservative baseline.<sup>26</sup> The percentage of people in Animal Advocates is referred to in the cost-benefit analysis as the farm animal welfare awareness rate. Similarly, Lusk (2010) found 9.05% of Americans strongly agreed with the indirect statement regarding the consideration of farm animal welfare in purchasing decision, with Vanhonacker (2007) also estimating a similar group of the Flemish people at 11%. Conscientious Consumers, then, are assumed to be the remainder of all Americans, less the proportions of Cost-Driven Consumers and Animal Advocates. Again, the literature presented in the “Consumer Opinions on Farm Animal Welfare” section indicates that it is reasonable to assume that ~60% of Americans somewhat consider farm-animal welfare in their purchasing decisions.

When projecting the farm animal welfare awareness rate out over many years, the percentage of people in Cost-Driven Consumers is assumed constant, with the proportion of people in the Animal Advocates group increasing at a constant rate of 5% per year,

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<sup>26</sup> American Egg Board. “Egg Industry Facts Sheet.” Accessed April 20, 2014. <http://www.aeb.org/egg-industry/industry-facts/egg-industry-facts-sheet>.

roughly the same rate of increase in the market share of cage-free eggs, which existed at 1% in 2004 and was at almost 6% in 2013.<sup>27</sup> Using these assumptions, in 15 years, the assumed transition time for producers to switch to cage-free production, the farm animal awareness rate will have increased from 5.9% to 12.27%, in line with 2004-2013 industry trends. These assumptions are also consistent with industry projections for the cage-free market. A Promar International study commissioned by the UEP in 2009 assumes that without any legislation, cage-free egg production will rise to 10% by 2023, or a 5% annual growth rate.

## Consumer Surplus Calculations

The formulas for calculating the change in consumer surplus from the informed effect ( $\Delta CS$  Informed) and the change in consumer surplus from the experienced effect ( $\Delta CS$  Experienced) are as follows:

*Change in Consumer Surplus from Informed Effect:*

**$\Delta CS$  Informed, Year 1 = -(Original Quantity, Egg Consumption by Animal Advocates)\*(Original Retail Price)\*(%  $\Delta$  in Retail Price)\*(1+0.5\*(%  $\Delta$  in Quantity))**

**$\Delta CS$  Informed, Years 2-15 = -(Quantity, Egg Consumption by Animal Advocates, Current Year)\*(Mean Willingness-to-Pay, Premiums for Cage-Free Relative to Eggs from Cage Systems)**

*Change in Consumer Surplus from Experienced Effect:*

**$\Delta CS$  Experienced, Year 0 = -(Original Quantity, Egg Consumption by Non-Animal Advocates)\*(Original Retail Price)\*(%  $\Delta$  in Retail Price)\*(1+0.5\*(%  $\Delta$  in Quantity))**

**$\Delta CS$  Experienced, Years 2-15 = (Quantity, Egg Consumption by Non-Animal Advocates, Current Year)\*(Original Retail Price - New Retail Price)**

The formulas for consumer surplus above were adapted from those provided by the authors of *Compassion, by the Pound* (351). The change in consumer surplus relating to the informed effect is always positive, as it relates to the benefit realized by consumers who would already buy cage-free eggs at pre-ban prices, but now pay a lower price due to the complete transition of the industry to cage-free egg production. This proportion of the U.S. population represented by these consumers in a given year is assumed to equal the level of farm animal welfare awareness. Mean and median willingness-to-pay premiums for cage-free eggs relative to eggs from cage systems found in the Lusk and Norwood auction

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<sup>27</sup> World Society for the Protection of Animals. "Market Potential for Cage-Free Eggs." Accessed April 20, 2014. [http://www.choosecagefree.org/sites/default/files/pdfs/CFreportday2\\_4%209.pdf](http://www.choosecagefree.org/sites/default/files/pdfs/CFreportday2_4%209.pdf).

experiments are shown in the table below. The mean figure, rather than the median, was used in this cost-benefit analysis, although it is likely conservative, as Animal Advocates represent the high WTP figures, and the mean includes figures from both Cost-Driven Consumers and Conscientious Consumers.

<b>Willingness-to-Pay Premiums for Cage-Free Eggs Relative to Eggs from Cage Systems</b>	<b>Value per Dozen</b>
<i>Mean</i>	\$0.55
<i>Median</i>	\$0.44

**Alternatively, the change in consumer surplus relating to the experienced effect is always negative, as it relates to the cost incurred by consumers who were not assumed to buy cage-free eggs before the hypothetical ban. Those consumers who are not counted in calculating the change in consumer surplus from the informed affect in a given year are considered when calculating the change from the experienced effect.**

#### **Willingness-to-Pay for Raising All U.S. Laying Hens to be Raised Cage Free**

One of the main benefits of a national ban on caged-egg production is associated with a public good related to human altruism towards layers. Simply put, this is the value of the good feelings some people get from the knowledge that farm animals are raised under higher welfare conditions. In *Compassion, by the Pound*, Lusk and Norwood describe this public good as “the satisfaction of knowing that the hen experiences a more pleasant life, regardless of whether they purchase eggs” (294). This human altruism is non-excludable, as those who do not pay are not excluded from these good feelings, and non-rival, as one person’s enjoyment of these good feelings does not preclude another’s own satisfaction. The situation is analogous to one where people are asked what they would be willing to pay to conserve an endangered species, even though they might never come into contact with a specimen and may only take pleasure in the knowledge of its continued existence. It is important to remember that this non-use benefit is additive to the personal-use benefits related to the premiums for cage-free eggs that individuals consume themselves.

Lusk and Norwood (2012) advocate for the inclusion of this public good in analyses related to the economic impacts of farm animal welfare legislation. They argue that since cost-benefit analysis is traditionally anthropocentric, it is important to include human altruism in benefit calculations, as methods do not readily exist to obtain benefits realized by the animals themselves. Since this potentially significant benefit for animals is effectively removed from the cost-benefit analysis, human altruism is appropriate to stand in its absence. Similarly, although Kaldor-Hicks efficiency, regarding potential compensation of benefits, is impossible as a transfer from farm animals to humans,

inclusion of human altruism allows for the existence of net positive benefits and a potential source of payment.

Measures for human altruism regarding housing improvements for layers were only obtainable for this analysis through the Lusk and Norwood auction experiments. The values used are as follows:

<b>Willingness-to-Pay for Raising All U.S. Laying Hens to be Raised Cage Free</b>	<b>Value per Person per Year</b>
<i>Mean</i>	\$200.84
<i>Median</i>	\$1.50

It is important to note that the figures calculated for raising the entire U.S. flock cage free were obtained from adjusting figures relating to a cage to free-range system, as only figures for a move to free-range systems were collected in the auctions. The mean and median values for premiums related to personal consumption of eggs from free-range systems were approximately 93% higher than the premiums for cage-free systems. This relationship was used to calculate a mean and median WTP for the non-use benefit of moving all U.S. laying hens to cage-free systems. The mean and median values for free-range systems were \$387.07 and \$2.90, respectively. It should also be noted that the auction bids ranged from -\$5.00 to \$3,820 for a move to free-range systems, depicting a distribution skewed heavily to the right. Again, the auction was non-hypothetical and designed as if a payment for winning bids would be actually collected from participants. The high values placed by some participants on moving layers to cage-free systems reflect the extreme preferences for farm animal welfare held by some members of society. The negative values were deemed erroneous by Lusk and Norwood, and excluded from the analysis.

Again, the change in consumer surplus from the informed effect (i.e. personal-use benefit), and human altruism (i.e. non-use benefit) are the potential benefits of a national cage-free standard discussed in this analysis. Next, the potential costs are considered in order of their magnitude. The change in consumer surplus from the experienced effect represents that majority of the total costs.

### **Cage-Free Versus Conventional Production Costs and Effects on Retail Prices**

A national cage-free standard for egg production would incur both producer and consumer costs. Consumer costs are due to a loss in surplus resulting from higher egg prices for people who are not aware of modern egg production practices or do not care much or at all about farm animal welfare. Producer costs are incurred from both the capital expense relating to the transition to cage-free systems, which often requires new construction of the egg-production facilities, or, at least, renovation. Producers are also

negatively affected by a surplus loss consequential to increased farm-level production costs that are higher than the accompanying increase in retail prices.

Numerous sources in the literature and in industry reports have informed the figures used in this analysis. Sumner (2008, 2010, & 2011), Allender (2010), and Bell (2005) were used as the primary sources for cost figures in the literature. *Compassion, by the Pound* also provided necessary data on the effects of a ban on retail costs and prices. The main industry reports used were “Economic Impacts of Converting US Egg Production to Enriched Cage Systems” (Agralytica Consulting 2012), “Impacts of Banning Cage Egg Production In the United States” (Promar International 2009), and “Economic Impact on California of the Treatment of Farm Animals Act” (Promar International 2008). The United Egg Producers (UEP) commissioned all industry reports. As a rule, the most conservative available figures from the literature and industry reports were used in this analysis.

## Producer Surplus Calculations

The formula for calculating the change in producer surplus ( $\Delta PS$ ) is as follows:

*Change in Producer Surplus:*

$$\Delta PS = (\Delta \text{Retail Price} - \Delta \text{Retail Costs}) * (\text{Original Quantity, Total Egg Consumption}) * (1 + 0.5 * (\% \Delta \text{ in Quantity}))$$

This formula is identical to the formula provided by the authors of *Compassion, by the Pound* (351). The change in retail costs is driven by the change in farm-level costs. Sandiford (1985) describes the primary non-capital cost drivers for egg production on the farm as:

- Quantity and price of feed consumed
- Number of days for which the laying house is empty
- Space allotment per bird
- Flock mortality rate
- Annual egg yield per bird, including breed considerations
- Number of birds on site and in laying house
- Type of housing

Bell (2005) describes feed and labor, as well as interest and depreciation on housing and equipment as the primary cost drivers. The following cost-benefit analysis, however, only considers the increase in total production costs, which range from 18% to 70% and higher in the literature (Elson 1985 and Sumner 2010, respectively). Higher production costs lead to greater retail prices for consumers at the grocery store. The cost-benefit analysis assumes a 25% increase in retail prices (Promar 2009, 3). Similarly, the authors in *Compassion, by the Pound* use a 21.18% increase. Further, they estimate that the change in

retail costs will exceed the change in retail prices by approximately 10% (“Compassion, by the Pound, 351). Therefore, a 25% increase in retail prices would raise current egg prices from \$2.01 (U.S. City Average, March 2014, Bureau of Labor Statistics) to \$2.51, or \$0.50 more, per dozen. At the same time, retail costs are expected to increase by \$0.55 per dozen.<sup>28</sup> The -0.2 elasticity of demand assumed results in an expected 5% decrease in the quantity of eggs demanded.

Although data on current retail costs could not be obtained for this report, the literature can provide some insight on the magnitude of expected cost increases at the farm-level, which, eventually, determines the effect on retail costs and prices. Elson (1985) presents detailed information on cost indexes for various housing systems. Using 100 as a pricing index for battery cages, a deep-litter barn system (i.e. the most common U.S. cage-free system) is given an index of 118, or an 18% increase in production costs over the conventional method at the farm level. Twenty years later, in a report to the UEP in 2005, Don Bell, a poultry specialist from the University of California Riverside, estimated a 27.2% increase in the total costs of production. Similarly, Mench (2008) found 26% and 12% farm-level increases in total and variable costs, respectively (238). A Promar International industry report on the economic impacts of mandatory cage-free conversion, commissioned by the United Egg Producers, reported an International Egg Commission finding of a 21% cost increase at the farm level.

Sumner (2008 and 2011), which are specific to egg production in California, find a much higher farm-level production cost increase of 41% to 70%, growing from \$0.745 and \$1.05 per dozen for caged and cage-free systems, respectively. Ambiguities relating to the upcoming implementation of the law in 2015, in addition to political motivations, may account for the more conservative estimates. In *Compassion, by the Pound*, the authors hold that a 21.18% increase in retail egg prices is associated with a 23.33% increase in retail egg production costs, again showing an incremental increase in retail costs slightly greater than that of retail prices. Therefore, the assumed 25% higher retail prices in the model would be associated with a 27.54% increase in retail egg production costs. The \$0.50 increase in retail prices per dozen, coupled with a \$0.55 increase in retail costs, resulting from these assumptions, causes the calculation of the change in producer surplus to be negative.

## **Producer Transition Costs**

The largest anticipated capital expenditure relating to a ban on caged egg production is the cost for existing egg producers to transition their facilities to cage-free production. As a way to mitigate the impact on farmers, the federal HSUS-UEP legislative language, in general, does not require existing battery cages to be dismantled before the end of their useful life (U.S. H.R. 1731; 113<sup>th</sup> Congress, 1<sup>st</sup> Session). A battery cage is

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<sup>28</sup> Bureau of Labor Statistics. “Average retail food and energy prices, U.S. city average and Midwest region.” Accessed April 20, 2014. <http://www.bls.gov/ro3/apmw.htm>.



typically expected to have a useful life of up to 25 years, which requires a 4% of a farm's existing capital to be replaced annually.<sup>29</sup> Recent purchases of battery cages are therefore granted special exemptions under the proposed law. Still, a transition period of 15 years is assumed in the analysis, since the federal HSUS-UEP legislative language requires that most U.S. egg production be cage free within that time period once enacted. The total producer transition costs are spread out evenly over this timeframe, and discounted back to present values.

Regarding the cost of transition, a Promar International study on the effects of Proposition 2 in California used \$25 per hen as an estimate for the costs of existing producers to switch to cage-free production. An Agralytica study citing industry sources assumes per hen transition costs of \$15 and \$32 for renovation and new construction, respectively. This study also noted that battery cages are often part of the structural supports of an egg barn, particularly in high-rise structures. As 60-70% of caged facilities use high-rise structures, the majority of construction would need to be new. In the analysis, the Agralytica figures were used with the assumption that 75% of egg barns would need to be rebuilt to serve as cage-free systems. Lastly, with a ban on caged egg production, it is initially expected that roughly three hundred million less eggs will be produced annually, or the output from almost 15 million hens.<sup>30</sup> No transition costs were associated with these hens, as the average lifespan of a commercial layer rarely exceeds two years, and thus would be culled within the transition period.<sup>31</sup>

## **Cost-Benefit Analysis of a National Cage-Free Standard**

### **Overview**

The cost-benefit analysis involves the presentation of the model using data that I consider to be most realistic and appropriate for the model (i.e. Scenario 1). Then, the sensitivity of the model is tested relating to the calculation of human altruism. First, four additional scenarios are presented where the mean, median, and zero values for willingness-to-pay to raise all U.S. layers cage free are variably assigned to the three groups of consumers assumed to exist in the U.S. population: "Cost-Driven Consumers," "Animal Advocates," and "Conscientious Consumers" (i.e. Scenarios 2-5).

Next, I return to the assignments for willingness to pay used in Scenario 1, but test different changes in the year-over-year rate of increase in farm animal welfare awareness

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<sup>29</sup> Agralytica (2012)

<sup>30</sup> The U.S. table layer flock of caged hens is estimated at approximately 276M, or the total flock less the share of hens living in various cage-free systems. A reduction in egg production of approximately 300M eggs is predicted as a result of increased prices, or the eggs laid by almost 15M hens, as commercial layers produce 250 eggs per year on average.

<sup>31</sup> RSPCA. "Layer Hens." Accessed April 20, 2014. <http://www.rspca.org.au/shophumane/farming-facts/layer-hens/layer-hens-lifecycle/>.

in two additional scenarios (i.e. Scenarios 6-7). Whereas Scenario 1 assumes a 5% increase annually, a 10% increase is used in Scenario 6, and no increase is used in Scenario 7. In every calculation examined, the net present value costs and benefits over 15 years is discounted at an annual rate of 7%, as is recommended by the Office of Management and Budget (OMB) for cost-benefit analyses of public investments and regulatory programs.<sup>32</sup>

<b>Key Assumptions Varying in Sensitivity Analysis</b>	<b>Values</b>
<i>Year-over-year rate of increase in farm animal welfare awareness</i>	+5%, +10%, +0%
<i>Assignment of mean, median, and zero values for human altruism to “Cost-Driven Consumers,” “Animal Advocates,” and “Conscientious Consumers”</i>	Mean: \$200.84 Median: \$1.50

### **Scenario 1**

When constrained to the costs and benefits described above, the net present value of benefits less costs benefits over 15 years is about \$19.5 billion. Again, Scenario 1 assumes that the proportion of those in the U.S. population assumed to be aware of modern farm animal welfare conditions begins at 5.9% and increases at 5% per year. For valuing human altruism, the mean WTP value for raising all U.S. chicks cage-free is assigned to Animal Advocates, the median WTP is assigned to Conscientious Consumers, and zero WTP is assigned to Cost-Driven Consumers.

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<sup>32</sup> Office of Management and Budget. “CIRCULAR A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs.” Accessed April 20, 2014.  
<http://www.whitehouse.gov/sites/default/files/omb/assets/a94/a094.pdf>.

## Scenario 1:

### *Net Present Values Over 15-Year Transition Period*

#### **Benefits**

Human Altruism (Public Good; Non-Use Benefit)	\$54,739,083,460
Change in Consumer Surplus from the Informed Effect (Personal-Use Benefit)	\$3,101,518,011
<b>Total Benefits</b>	<b>\$57,840,601,471</b>

#### **Costs**

Change in Consumer Surplus from the Experienced Effect	\$(30,300,220,188)
Change in Producer Surplus	\$(3,119,964,760)
Producer Transition Costs	\$(4,921,942,692)
<b>Total Costs</b>	<b>\$(38,342,127,640)</b>

**Net** **\$19,498,473,831**

The costs in Scenario 1 are typical of values found in the literature and in industry reports. Due to time limitations, sensitivity analysis was not conducted on changes in retail prices, retail costs, and the elasticity of demand for eggs, although these assumptions are highly consequential. The valuation of human altruism, however, as well as its impact on net benefits, is ignored in much of the literature, and so it serves here as the major focal point. Its estimated value can be enormous, and significantly influences the net present value of the model. Thus, this cost-benefit analysis attempts to contribute to the literature on the basis of examining the calculation and distribution of benefits related to human altruism.

## **Sensitivity Analysis**

### ***Human Altruism Valuations***

Four scenarios alternative to Scenario 1 are developed, under which the benefits of human altruism will be evaluated. Human altruism, as a public good, is largely included in the analysis to offset the welfare gains by the hens themselves, which cannot be included in traditional, human-focused cost-benefit analysis. The value of human altruism depends chiefly on what people would be willing to pay each year for all layers to be raised cage free, in addition to the percentage of the population that would be informed enough on egg production to realize the benefit (i.e. farm animal welfare awareness, which determines the proportions of consumers included as Animal Advocates and Conscientious Consumers. Cost-Driven Consumers are assumed always represent 33% of the population).

The value for human altruism is determined separately for the three groups of the population described previously. Cost-Driven Consumers does not care about farm animal welfare, Conscientious Consumers cares somewhat, and Animal Advocates cares significantly. Each scenario involves assigning either the adjusted median and mean values, from the Lusk and Norwood auction experiments to the proportion of the population contained within each group, in different combinations as follows:

- **Scenario 2:** Median Value for Animal Advocates Only
- **Scenario 3:** Median Value for Animal Advocates and Conscientious Consumers
- **Scenario 4:** Median Value for All Groups, including Cost-Driven Consumers
- **Scenario 5:** Mean Value for Animal Advocates Only

Again, in Scenario 1, which is presented as the top row in the table below, the mean value was assigned to Animal Advocates and median value was assigned to Conscientious Consumers. The value determined for human altruism, and, therefore, the result of the cost-benefit analyses as constructed here, varies enormously across scenarios. The magnitude of the benefits increases in ascending order with each scenario.

<b>Human Altruism Scenarios:</b>	<b>Benefits, Human Altruism</b>	<b>Estimated Net, Total Benefits &amp; Costs</b>	<b>Human Altruism as % of Total Benefits</b>	<b>Human Altruism as % of Total Costs</b>
<b>1</b> (from above): Median Value for Conscientious Consumers; Mean Value for Animal Advocates	\$54,739,083,460	<b>\$19,498,473,831</b>	95%	143%
<b>2:</b> Median Value for Animal Advocates Only	\$388,335,676	<b>\$(34,852,273,953)</b>	11%	1%
<b>3:</b> Median Value for Conscientious Consumers & Animal Advocates	\$3,173,073,539	<b>\$(32,067,536,090)</b>	51%	8%
<b>4:</b> Median Value for All Groups	\$4,735,930,655	<b>\$(30,504,678,974)</b>	60%	12%
<b>5:</b> Mean Value for Animal Advocates Only	\$51,954,345,597	<b>\$16,713,735,968</b>	94%	136%

As stated previously, Scenario 1 appears as the most valid pairing, with no benefit assigned to Cost-Driven Consumers, the median benefit assigned to Conscientious Consumers, and the mean benefit assigned to Animal Advocates. Scenario 1 best matches the preferences assumed for each group, as Animal Advocates’s animal advocates express intense preferences, Conscientious Consumers’s balance welfare with cost, and Cost-Driven Consumers’s cost-driven consumers only consider cost. Still, it is the use of the mean benefit for Animal Advocates alone that results in a net positive impact for this analysis. Scenario 1 results in benefits from human altruism of more than \$54B over 15 years, or about 1.5x the total cost of mandating a national cage-free standard.

Scenario 2 is the most conservative estimate of the benefits related to human altruism. Additionally, this is the only scenario where human altruism represents less than half of total benefits. This scenario assigns the median WTP for raising all chicks cage free (i.e. \$1.50 per person annually) to only Animal Advocates, where the preferences for animal welfare are deemed most intense. No benefits are counted for Groups A and B. The percentage of the U.S. population in Animal Advocates begins at 5.9%, the current market share of cage-free eggs, and increases by 5% annually to 12.27% in 2029, under an assumed 5% year-over-year increase in farm animal welfare awareness. While it is

somewhat illogical to pair the median benefit with the group that is skewing the distribution of WTP values to the right, the result is a lower bound for the benefits of a ban on cage-free egg production related to human altruism of \$388M over 15 years.

Scenario 3 extends the median benefit to the largest group, Conscientious Consumers, with 61% of the U.S. population in 2014, decreasing to 55% in 2029, as the share of Animal Advocates grows (again, under an assumed 5% year-over-year increase in farm animal welfare awareness.) This extension adds nearly \$3B to human altruism benefits over 15 years. Nevertheless, in this scenario, total benefits still only represent 8% of total costs. This pairing is more realistic than Scenario 1, as both Groups B and C are assumed to at least somewhat consider farm animal welfare in purchasing decisions. Still, it is likely that those in Animal Advocates would be willing to pay more than Conscientious Consumers, a concern addressed in Scenario 1.

Scenario 4 assumes that the entire U.S. population realizes the median benefit, tallying almost \$5B in human altruism. This pairing reflects how the median benefit was calculated, with roughly one-third of the study participants indicating zero WTP for improved layer welfare (i.e. Cost-Driven Consumers). Thus, the low median WTP, incorporating the downward pressure from Cost-Driven Consumers, is factored into the calculation of human altruism benefits through extending the median WTP to the entire population, including Cost-Driven Consumers.

Scenario 5 reveals a massive increase in benefits with human altruism over 15 years valued at a staggering \$51B+. This is due to the use of the mean WTP (\$200.84 per person annually) being assigned to Animal Advocates. A key finding of the sensitivity analysis is that *only when the mean WTP is used does the net impact of the cost-benefit analysis become positive*. Even though the use of the mean WTP is limited to only 5.9% of the population in 2014, this proportion represents over 18M individuals in 2014, which yields very high public good estimates for this group when WTP values in the hundreds of dollars are used per person.

### ***Year-Over-Year Rate of Increase in Farm Animal Welfare Awareness***

Next, I evaluated the net surplus effects under two additional scenarios, where the year-over-year rate of increase in farm animal welfare awareness is varied. Although an annual 5% rate of increase appears in line with the growth in market share for cage-free eggs, Lusk (2010) considered an information shock in California, as a result of the campaign that passed a state cage-free standard, in affecting consumer demand. This increased level of information in the market for eggs, if it exists, could inform Americans on modern egg-production practices at a faster rate. Alternatively, it is conceivable that Americans might simply entrench their current preferences as a form of cognitive dissonance, as described previously.

Each scenario presented is only concerned with the changes in consumer and producer surplus, not human altruism. The current market share of cage-free eggs, 5.9%, is always used as the starting point. Again, the values for Scenario 1 are presented at the top of the table below for convenience.

- **Scenario 1** (from above): +5% year-over-year Increase in farm animal welfare awareness (i.e. 12.27% of consumers are Animal Advocates in 2030, the end of the transition period)
- **Scenario 6:** +10% year-over-year Increase in farm animal welfare awareness (i.e. 24.65% of consumers are Animal Advocates in 2030)
- **Scenario 7:** No (i.e. 0%) year-over-year Increase in farm animal welfare awareness (i.e. 5.9% of consumers are Animal Advocates in 2030)

<b>Distribution of Human Altruism Benefits</b>	
<b>Scenario 1 (from above): +5%</b>	
<b>Total Benefits from Human Altruism</b>	<b>\$54,739,083,460</b>
<i>Cost-Driven Consumers</i>	\$-
<i>Conscientious Consumers</i>	\$2,784,737,863
<i>Animal Advocates</i>	\$51,954,345,597
<b>Scenario 6: +10%</b>	
<b>Total Benefits from Human Altruism, +41%</b>	<b>\$77,127,490,707</b>
<i>Cost-Driven Consumers</i>	\$-
<i>Conscientious Consumers</i>	\$2,616,134,217
<i>Animal Advocates</i>	\$74,511,356,490
<b>Scenario 7: +0%</b>	
<b>Total Benefits from Human Altruism, -26%</b>	<b>\$40,276,462,850</b>
<i>Cost-Driven Consumers</i>	\$-
<i>Conscientious Consumers</i>	\$2,893,653,630
<i>Animal Advocates</i>	\$37,382,809,219

Ultimately, the variation in human altruism that results from changing the year-over-year rate of increase in farm animal welfare awareness is dramatic. Almost \$20B in

additional net benefits is realized by adjusting the annual rate of increase from 5% to 10%. Similar in scale, over \$14B in net benefits is lost when the proportion of Animal Advocates in the U.S. population is held constant at 5.9%. Therefore, the effect of an information shock on the market for eggs, stemming from the publicity of federal legislation affecting the egg industry, has the potential to either greatly add to net societal benefits, or practically eliminate their existence. Still, it is important to note that the vast majority of the adjustment occurs only for Animal Advocates, with the human altruism benefits varying only slightly, relative to the scale of these calculations. This effect will be discussed later in the “Equity Considerations” section, after first considering a break-even analysis.

### **Break-Even Analysis**

The mean willingness-to-pay value related to human altruism, assigned exclusively to Animal Advocates, is hugely significant in determining when a ban would have a positive or negative economic impact from a societal perspective. Therefore, it is important to test what level of benefit would produce benefits equal to costs, or break even, as a form of sensitivity analysis for the model. Using the assumptions in Scenario 1, and only adjusting the mean willingness-to-pay value for raising all U.S. layers cage free, the model breaks at a mean value of \$125.45 per person. At this level, total benefits are equal to the approximately \$38B in total costs over the 15-year transition period.

It is important to note that the figures calculated for raising the entire U.S. flock cage free, as opposed to only 1,000 layers, are of a lesser, but not dramatically unlike, magnitude. Data on raising only 1,000 hens cage free was also collected in the Lusk and Norwood auction experiments. Humans have a tendency to relate to and comprehend impacts on fewer animals more easily than a large number of beings (“Compassion, by the Pound,” 208). This phenomenon helps to explain why the increase from 1,000 hens to the entire U.S. caged flock does not have a huge effect on the willingness-to-pay values. Adjusted mean and median willingness-to-pay values for moving only 1,000 layers from a cage to a free-range system, were found to be \$40.10 and \$1.04, respectively. Thus, as the egg industry gradually transitions to cage-free production, the willingness-to-pay values might be less than \$200.84, although probably by only a small percentage. Assuming a 15-year transition period, and that every year an additional 6.67% of all U.S. layers are raised cage free (i.e. 1/15<sup>th</sup> of the U.S. flock per year), about 19M birds would be moved to cage-free systems annually. 1,000 layers is such a small fraction of this amount that it is likely the mean WTP is very close to \$200.84 per person annually during the transition. Nevertheless, reducing the mean WTP from \$200.84 to \$40.10 would have significant implications for the model, switching a strongly net positive impact to a negative one.

The \$125.45 break-even mean value exists between the \$40.10 mean willingness-to-pay value calculated for raising 1,000 layers in a cage-free system, and the \$200.84 value for raising all U.S. layers cage free. Recall that the number of hens transitioned to cage-free



systems per year is likely to be thousands of times greater than 1,000 layers. Thus, it is likely that the mean WTP is at least \$125.45, and probably very close to \$200.84, if not equal to that figure, for the Animal Advocates group. At the same time, it is unclear how the state of limited awareness of modern animal agriculture, including housing conditions, affects this conclusion, as it is possible that many people do not understand how many times greater the U.S. layer flock is than 1,000 hens.

## **Discussion**

### **Equity Considerations**

This analysis reveals what should be a key topic of discussion when considering the economic impact of farm animal welfare legislation: equity between groupings of the U.S. population with heterogeneous preferences for farm animal welfare. Further, whether a ban on U.S. caged-egg production could yield a positive economic impact under certain pairings of mean and median willingness-to-pay values must be considered in light of how these benefits are distributed across different groups of people. Below, data from Scenarios 1-5 in the model are presented, with the intention of describing how altruistic benefits for raising all U.S. layers cage free are distributed between Cost-Driven Consumers, Conscientious Consumers, and Animal Advocates.

<b>Scenario 1: Median Value for Conscientious Consumers; Mean Value for Animal Advocates</b>	
<b>Total Benefits from Human Altruism</b>	<b>\$54,739,083,460</b>
<i>Cost-Driven Consumers: WTP for Cage-Free U.S. Flock</i>	\$-
<i>Conscientious Consumers: WTP for Cage-Free U.S. Flock</i>	\$2,784,737,863
<i>Animal Advocates: WTP for Cage-Free U.S. Flock</i>	\$51,954,345,597
<b>Net Benefits less Costs</b>	<b>\$19,498,473,831</b>
<b>Scenario 2: Median Value for Animal Advocates Only</b>	
<b>Total Benefits from Human Altruism</b>	<b>\$388,335,676</b>
<i>Cost-Driven Consumers: WTP for Cage-Free U.S. Flock</i>	\$-
<i>Conscientious Consumers: WTP for Cage-Free U.S. Flock</i>	\$-
<i>Animal Advocates: WTP for Cage-Free U.S. Flock</i>	\$388,335,676
<b>Net Benefits less Costs</b>	<b>\$(34,852,273,953)</b>
<b>Scenario 3: Median Value for Conscientious Consumers &amp; Animal Advocates</b>	
<b>Total Benefits from Human Altruism</b>	<b>\$3,173,073,539</b>
<i>Cost-Driven Consumers: WTP for Cage-Free U.S. Flock</i>	\$-
<i>Conscientious Consumers: WTP for Cage-Free U.S. Flock</i>	\$2,784,737,863
<i>Animal Advocates: WTP for Cage-Free U.S. Flock</i>	\$388,335,676
<b>Net Benefits less Costs</b>	<b>\$(32,067,536,090)</b>
<b>Scenario 4: Median Value for All Groups</b>	
<b>Total Benefits from Human Altruism</b>	<b>\$4,735,930,655</b>
<i>Cost-Driven Consumers: WTP for Cage-Free U.S. Flock</i>	\$1,562,857,116
<i>Conscientious Consumers: WTP for Cage-Free U.S. Flock</i>	\$2,784,737,863
<i>Animal Advocates: WTP for Cage-Free U.S. Flock</i>	\$388,335,676
<b>Net Benefits less Costs</b>	<b>\$(30,504,678,974)</b>
<b>Scenario 5: Mean Value for Animal Advocates Only</b>	
<b>Total Benefits from Human Altruism</b>	<b>\$51,954,345,597</b>
<i>Cost-Driven Consumers: WTP for Cage-Free U.S. Flock</i>	\$-
<i>Conscientious Consumers: WTP for Cage-Free U.S. Flock</i>	\$-
<i>Animal Advocates: WTP for Cage-Free U.S. Flock</i>	\$51,954,345,597
<b>Net Benefits less Costs</b>	<b>\$16,713,735,968</b>

As mentioned previously, only when the mean willingness-to-pay value of \$200.84 is used in the calculation of human altruism do the total benefits exceed total costs. In

Scenario 1, which is thought to be most realistic, the total benefits related to human altruism for Animal Advocates are over seventeen times, or almost \$50B, greater than those of Conscientious Consumers. Still, the percentage of the U.S. population assumed Animal Advocates in Scenario 1 only ranges from 5.9% in 2014 to 12.27% in 2030, whereas the number of people represented by Conscientious Consumers is much larger, ranging from 61% to 55% during the same timespan. This creates a dynamic where a small portion of the U.S. population realizes tremendous benefits while the rest of the population gains benefits that are only a fraction of total costs. While it is conceivable that the Animal Advocates could repay the Conscientious and Cost-Driven Consumers for their losses, thus supporting Kaldor-Hicks efficiency, it seems practically illogical to assume that those who care most about animal welfare would redistribute their altruistic gains to those caring less. The table below adds to the discussion by presenting the average benefits realized and costs incurred by individuals in the defined consumer groups.

<i>Data from Year 1</i>	<b>Avg. Benefits per Person</b>	<b>Avg. Costs per Person</b>	<b>Diff.</b>
<b>Scenario 1: Median Value for Conscientious Consumers; Mean Value for Animal Advocates</b>			
<i>Cost-Driven Consumers: WTP for Cage-Free U.S. Flock</i>	\$-	\$(35.13)	\$(35.13)
<i>Conscientious Consumers: WTP for Cage-Free U.S. Flock</i>	\$1.40	\$(35.13)	\$(33.73)
<i>Animal Advocates: WTP for Cage-Free U.S. Flock</i>	\$205.33	\$(35.13)	\$170.19
<b>Scenario 2: Median Value for Animal Advocates Only</b>			
<i>Cost-Driven Consumers: WTP for Cage-Free U.S. Flock</i>	\$-	\$(35.13)	\$(35.13)
<i>Conscientious Consumers: WTP for Cage-Free U.S. Flock</i>	\$-	\$(35.13)	\$(35.13)
<i>Animal Advocates: WTP for Cage-Free U.S. Flock</i>	\$19.03	\$(35.13)	\$(16.10)
<b>Scenario 3: Median Value for Conscientious Consumers &amp; Animal Advocates</b>			
<i>Cost-Driven Consumers: WTP for Cage-Free U.S. Flock</i>	\$-	\$(35.13)	\$(35.13)
<i>Conscientious Consumers: WTP for Cage-Free U.S. Flock</i>	\$1.40	\$(35.13)	\$(33.73)
<i>Animal Advocates: WTP for Cage-Free U.S. Flock</i>	\$19.03	\$(35.13)	\$(16.10)
<b>Scenario 4: Median Value for All Groups</b>			
<i>Cost-Driven Consumers: WTP for Cage-Free U.S. Flock</i>	\$1.40	\$(35.13)	\$(33.73)
<i>Conscientious Consumers: WTP for Cage-Free U.S. Flock</i>	\$1.40	\$(35.13)	\$(33.73)
<i>Animal Advocates: WTP for Cage-Free U.S. Flock</i>	\$19.03	\$(35.13)	\$(16.10)
<b>Scenario 5: Mean Value for Animal Advocates Only</b>			
<i>Cost-Driven Consumers: WTP for Cage-Free U.S. Flock</i>	\$-	\$(35.13)	\$(35.13)
<i>Conscientious Consumers: WTP for Cage-Free U.S. Flock</i>	\$-	\$(35.13)	\$(35.13)
<i>Animal Advocates: WTP for Cage-Free U.S. Flock</i>	\$205.33	\$(35.13)	\$170.19

Using current population figures, the average total costs incurred by U.S. consumers are \$35.13 per person in Year 1. As the Animal Advocates group was exclusively assigned benefits relating to the change in consumer surplus from the informed effect, as well as the only group assigned the mean willingness-to-pay value for raising all U.S. layers cage free (i.e. \$200.84), net benefits are only positive for this group of consumers. All other groups incur losses of at least \$30 in Year 1 across Scenarios 1-5, and even Animal Advocates incur losses of about \$16 when the median value for human altruism is assigned to them in Scenarios 2-4. Still, under Scenario 1, the preferred construction of the model, Animal Advocates realize an impressive \$170.19 of net benefits in the first year. Recall that Scenario 1 provides net societal benefits of more than \$19B over the 15-year transition period. Animal Advocates enjoy over 95% of total benefits in this scenario, although their share of the U.S. population only reaches a maximum of 12.27% by 2030. The extremely

lopsided nature of the benefit distribution poses challenging equity concerns for policymakers faced with a U.S. population with such disparate preferences for farm animal welfare.

### **Concerns for Low-Income Consumers**

It is also important to recognize that higher egg prices could disproportionately affect lower income consumers. In fact, the inexpensive nature of the eggs has been called “the very source of their strength.”<sup>33</sup> Eggs also represent a nutritious source of high-quality protein.<sup>34</sup> A policy that results in 25% higher retail egg prices may adversely affect low-income individuals and families with no or low willingness-to-pay for improved animal welfare. In this situation, lawmakers could be faced with the prospect of comparing the relative welfare of the poor, in terms of purchasing power and food security, with the well being of farm animals. This is not a conversation that animal advocates should want to step into uninformed with policymakers. The ability for animal advocacy organizations, like The Humane Society of the United States, to respond to such allegations, may turn out to be hugely significant in determining the success or failure of legal restrictions on methods of egg production.

### **Kaldor-Hicks Efficiency and Farm Animal Welfare Legislation**

Regarding this situation as it relates to public policy, Lusk and Norwood (2012), conclude, “The question, in this case, is whether the Kaldor-Hicks principle can practically be implemented.” In other words, while a ban on caged-egg production could be recommended from a utilitarian standpoint, under certain assumptions, as it increases utility for society as a whole, it is necessary to consider whether those benefiting greatly in Animal Advocates would be able to offset Conscientious and Cost-Driven Consumers for their losses in utility. For obvious reasons, the laying hens, if moved to a cage-free system, would be unable to compensate these groups for the costs incurred in relieving their suffering. But, would it be possible for those in Animal Advocates to do so in their place, or in exchange for the extremely positive feelings they have gained from the ban? The question of compensation from groups that would benefit the most from farm animal welfare legislation, to those who would incur net losses should be a topic of further research for animal advocates and economists in the field of farm animal welfare economics.

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<sup>33</sup> Star Tribune. “A miracle food: the egg.” Accessed April 20, 2014.  
<http://www.startribune.com/lifestyle/taste/255704441.html>.

<sup>34</sup> The Huffington Post. “5 Smart Reasons To Eat Eggs.” Accessed April 20, 2014.  
[http://www.huffingtonpost.com/2014/04/13/eggs-health-benefits\\_n\\_5126337.html](http://www.huffingtonpost.com/2014/04/13/eggs-health-benefits_n_5126337.html).

## **Recommendation**

While the purpose of this analysis was to determine if a ban on caged egg production would produce benefits in excess of costs, the equity considerations revealed in the findings raise questions about the merits of animal advocacy organizations pursuing legislation to ban housing systems, like battery cages. While a wide consensus seems to exist against these cages from an ethical standpoint, there is practically no dispute that their retirement would raise the prices of eggs and incur large transition costs for producers. In the short term, a better use of resources for animal advocacy organizations to focus on addressing the informational asymmetries in the egg market through consumer-education initiatives, like mandating the labeling of housing conditions. Presumably, due to positive consumer opinions on farm animal welfare discussed before in conjunction with the lack of information on modern egg production methods consumers seem to possess, labeling could promote a cage-free standard with less government intervention.

The success, or failure, of the contemporary effort to mandate the labeling of food products containing GMOs should inform animal advocacy organizations on the political feasibility of this strategy. Nevertheless, pursuing labeling requirements, instead of housing prohibitions, could help to frame the argument as a pro-consumer initiative, instead of a movement that is against farmers. The enduring strength of the agrarian myth supports this strategy, as do growing food-security concerns, which, again, present the unfavorable comparison of farm animal welfare with the well being of the poor. Until a majority of American consumers, or better, become fully aware of the dominance of intensive confinement systems in the egg industry, restricting the options available for farmers, as the debate can sometimes be framed by others in the livestock industry, does not appear to be a feasible or sustainable path for the animal rights movement.

## **Conclusion**

Cost-benefit analysis is a useful and thought-provoking method for valuing the economic impacts of regulatory programs, such as national standard for cage-free egg production. The model discussed here concludes that over \$19B in net benefits would be realized by society as the result of a federal law prohibiting the use of battery cages. Still, considering aggregate costs and benefits at the societal level, though, can obscure equity considerations between various groups affected differently by these programs. While Kaldor-Hicks efficiency, or the ability for the 'winners,' realizing positive net benefits, to compensate the 'losers,' incurring a net loss, is a helpful measure for justifying public policy, it seems insufficient as a rationale for a cage-free mandate, especially due to the anticipated effects of a cage-free mandate on the poor. Over 95% of the \$19B in net benefits would be realized by a small group of the U.S. population that holds strong preferences for farm animal welfare. The data obtained in the Lusk and Norwood auction experiments revealed that some consumers would actually be willing to spend over \$3,000 per year to

transition the entire U.S. laying flock to cage-free systems. Animal advocates are assumed to realize net benefits of over \$170 annually, while most people would incur a net loss of at least \$30.

This vast separation in net benefits is likely due to the information asymmetry in the market for eggs relating to their production. Simply put, most people do not know that 95% of eggs are produced by chickens that spend the entirety of their lives in wire cages too small for them to even spread their wings. If they did, then, perhaps, the mean and median willingness-to-pay values for raising all U.S. chicks cage free would be much closer than what was found by Lusk and Norwood, and, therefore, the benefits would be distributed more evenly across the population. While efforts of animal advocacy groups, like The Humane Society of the United States, amongst others, have been instrumental in informing consumers of the use of battery cages, there is clearly still much more educational work to be done. Until the majority of consumers highly value welfare improvements for laying hens, advocating for public policy to mandate the use of certain production methods may not be an effective or sustainable course of action.

## Bibliography

- Agralytica Consulting. 2012. "Economic Impacts of Converting US Egg Production to Enriched Cage Systems." United Egg Producers.
- Allender, William J. and Timothy J. Richards. 2010. "Consumer Impact of Animal Welfare Regulation in the California Poultry Industry." *Journal of Agricultural and Resource Economics*: 424-442.
- Bastian, B., S. Loughnan, N. Haslam, and H. R. Radke. 2012. "Don't Mind Meat? the Denial of Mind to Animals used for Human Consumption." *Personality & Social Psychology Bulletin* 38 (2): 247-256.
- Bell, Don. 2005. "A Review of Recent Publications on Animal Welfare Issues for Table Egg Laying Hens."
- Chang, Jae Bong, Jayson L. Lusk, and F. Bailey Norwood. 2010. "The Price of Happy Hens: A Hedonic Analysis of Retail Egg Prices." *Journal of Agricultural and Resource Economics*: 406-423.
- Elson, HA. 1985. "The Economics of Poultry Welfare."
- Greene, J. and Tadlock Cowan. 2012. "Table Egg Production and Hen Welfare: The UEP-HSUS Agreement and HR 3798." *Congressional Research Service*.
- Kelsey, T. W. 1994. "The Agrarian Myth and Policy Responses to Farm Safety." *American Journal of Public Health* 84 (7): 1171-1177.
- Lusk, Jayson L. 2010. "The Effect of Proposition 2 on the Demand for Eggs in California." *Journal of Agricultural & Food Industrial Organization* 8 (1).
- Lusk, Jayson L. and F. Bailey Norwood. 2011. "Animal Welfare Economics." *Applied Economic Perspectives and Policy* 33 (4): 463-483.
- Lusk, Jayson L. and F. Bailey Norwood. 2010. "Direct Versus Indirect Questioning: An Application to the Well-being of Farm Animals." *Social Indicators Research* 96 (3): 551-565.
- Lusk, Jayson L. and F. Bailey Norwood. 2012. "Speciesism, Altruism and the Economics of Animal Welfare." *European Review of Agricultural Economics* 39 (2): 189-212.



- Lusk, Jayson L. 2008. "A Survey to Determine Public Opinion about the Ethics and Governance of Farm Animal Welfare." *Journal of the American Veterinary Medical Association* 233 (7): 1121-1126.
- Mench, J. A., D. A. Sumner, and J. T. Rosen-Molina. 2011. "Sustainability of Egg Production in the United States--the Policy and Market Context." *Poultry Science* 90 (1): 229-240.
- Norwood, F. Bailey and Jayson L. Lusk. 2011. "Compassion, by the Pound: The Economics of Farm Animal Welfare." *OUP Catalogue*.
- Prickett, Robert W. 2008. *Consumer Preferences for Farm Animal Welfare: Results from a Telephone Survey of US Households* ProQuest.
- Promar International. 2008. *Economic Impact on California of the Treatment of Farm Animals Act*. United Egg Producers.
- Promar International. 2009. *Impacts of Banning Cage Egg Production in the United States*. United Egg Producers.
- Renck, Ashley Wood. 2002. "The Agrarian Myth; how has it Affected Agricultural Policy?".
- Sandiford, Frances. 1985. *An Economic Analysis of the Introduction of Legislation Governing the Welfare of Farm Animals* University of Manchester, Department of Agricultural economics.
- Schröder, Monika JA and Morven G. McEachern. 2004. "Consumer Value Conflicts Surrounding Ethical Food Purchase Decisions: A Focus on Animal Welfare." *International Journal of Consumer Studies* 28 (2): 168-177.
- Sumner, D. A. 2008. *Economic Effects of Proposed Restrictions on Egg-Laying Hen Housing in California*.
- Sumner, D. A., H. Gow, D. Hayes, W. Matthews, B. Norwood, J. T. Rosen-Molina, and W. Thurman. 2011. "Economic and Market Issues on the Sustainability of Egg Production in the United States: Analysis of Alternative Production Systems." *Poultry Science* 90 (1): 241-250.
- Swanson, JC and JA Mench. 2000. "Animal Welfare: Consumer Viewpoints."

Vanhonacker, Filiep, Wim Verbeke, Els Van Poucke, and F. Tuyttens. 2007. "Segmentation Based on Consumers' Perceived Importance and Attitude Toward Farm Animal Welfare." *International Journal of Sociology of Agriculture and Food* 15 (3): 91-107.