promar International

Impacts of Banning Cage Egg Production In the United States

A report prepared for

United Egg Producers

August 2009

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EXECUTIVE SUMMARY

Animal rights activists are campaigning to ban the use of modern cage systems for egg production. Requiring cage-free methods would have a variety of adverse impacts:

- It would require massive investment in new production facilities and conversion of old ones;
- It would drive some egg production to countries like Mexico without such a ban, and result in imports of eggs produced under different food safety, welfare and environmental standards;
- It would raise production costs and consumer prices;
- It would increase federal expenditures on food assistance programs like WIC and school lunch and breakfast, and likely reduce egg consumption under some of these programs;
- It would require additional land to be planted in corn and soybeans to meet the higher feed demand in cage-free systems; and
- It would have an adverse impact on the environment and the industry's carbon footprint.

The US egg industry

The egg industry in the United States has evolved over the decades from backyard henhouses to large, modern facilities that provide a safe and humane environment for the flocks of hens that provide the nation's egg supplies. In the decade after World War II, 10% of the eggs were still consumed on the many small farms where they were produced. Today, almost all eggs enter normal commerce as they make their way from large production facilities to consumers via grocery stores, restaurants and food manufacturers.

The egg industry is an important part of the US food system, and provides a nutritious and economical source of food protein. Eggs are comparatively inexpensive because chickens are very efficient at converting the energy in the feed they consume to eggs.

In 2008, the industry produced 90 billion of those eggs. About 13 billion went to hatcheries to produce chicks for the broiler industry. The remaining 77 billion table eggs went to consumers, 68.5% in shell form and 31.5% as liquid eggs (so-called breakers) incorporated in a variety of food products. Valued at the average retail price of $2.00 per dozen Grade A eggs, the value to consumers in 2008 was approximately $13 billion or about $42 per capita or $168 for a family of four.

The egg industry can also be defined more narrowly, i.e. at the farm level before the eggs are cleaned, graded, packaged, processed, or delivered up the marketing chain to where they are ultimately consumed. The farm value of egg production in 2008 is estimated by USDA at $8.0 billion for all eggs and $6.2 billion for table eggs.

Role in the economy

The Bureau of Economic Analysis in the U.S. Department of Commerce has a Regional Input-Output Multiplier System (RIMS II) that permits one to estimate the broader impacts that an industry has on the national economy. Based on the value of production at the state level, one can calculate the effect on total economic activity, earnings, and employment. In 2008 the $6.2 billion of table egg production at the farm level actually resulted in $14.7 billion of final demand in the economy, produced earnings for individuals and firms of $2.4 billion, and created 97,600 jobs.

Egg production methods

Currently an estimated 95% of all US table eggs are produced in layer houses with cage systems. The young chickens, called pullets, that mature into layers after about 20 weeks are housed in the same system in which they will be housed as layers. Worldwide that percentage is higher. These systems were developed because they provide a safe and sanitary environment for the hens and permit a high degree of automation in delivery of food and water to the birds, collection of the eggs, and removal of droppings.

Animal rights advocates have been seeking a ban on cage systems, arguing that they do not sufficiently permit all natural behaviors, like dust bathing, nesting and perching. Cage-free systems include barns where all the hens are on the floor, and so-called aviaries that in addition have elevated perching areas. Either may also provide access to an outside area that the hens can visit. At the extreme there are true free-range systems where the hens spend most of their time outside but have structures to which they can return at night or when there is adverse weather.

There are pros and cons to all of these production systems. Cage-free systems give hens more room to move around but they result in higher feed costs, lower egg production per bird, increased feather pecking and cannibalism, and increased mortality. Flocks with outside access are also vulnerable to transmission from wild birds of Highly Pathenogenic Avian Flu and other diseases.

In 2008, voters in California passed Proposition 2, which will effectively ban cage systems by 2015. Studies show that this will result in the elimination of most egg production in the state because consumers will just buy lower cost eggs produced in other states. It is possible that such bans will spread, either on a state by state basis or through national legislation.

Economic impacts of banning cage production systems

Taking the extreme case of a national ban, there will be two sets of impacts. One set involves the location and cost of egg production, and will result in higher prices to consumers and higher federal expenditures on food assistance programs. The other is the set of impacts on land use, the environment, and the industry's carbon footprint.

The impacts related to location and cost of egg production are straightforward. First, there will be very large costs involved in converting existing layer houses and investing in the additional houses that will be needed due to lower bird populations per house. Second, there will be higher costs to consumers for eggs that continue to be produced in the United States. Third, there will be a significant increase in imports of eggs from countries that do not prohibit cage systems. Industry experts point to countries like Mexico, Brazil and Argentina as the potential suppliers.

We estimate conversion costs for existing layer and pullet houses at $2.0 billion based on the following assumptions:

- 20% of existing structures will not be converted because they are unsuited, i.e. too big, too small, too old, or the reduction in a company's total production volume makes it unviable.
- Imports rise to 10% of domestic consumption.
- Domestic consumption is reduced by 1.4% due to higher prices.

We estimate the necessary investment in additional layer and pullet houses, land and utilities at $6.0 billion, bringing the total investment burden on the industry to $7.5 billion. Even after allowing for the increased imports and lower consumption, over half of domestic production would have to be in new structures.

Production costs in cage-free systems will be higher due principally to these higher capital costs, lower egg production per hen, higher feed costs, increased mortality, and higher labor costs. These higher costs will necessarily be passed on to consumers.

At the bottom tier of the price structure will be imported cage eggs, slightly more expensive than current US production due to transportation costs. Domestic cage-free eggs will likely cost 25% more than eggs produced under the current system. The total consumer cost impact is estimated at $2,660,000,000 annually. This will fall most heavily on the poor, for whom eggs are currently a low-cost source of protein.

There are significant quantities of eggs used in the school lunch and breakfast programs, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and the Supplemental Nutrition Assistance Program (SNAP – formerly the Food Stamp Program). During the 2008 fiscal year, the Federal government spent $60.7 billion on the various programs, with SNAP being the largest. We estimate that about $677 million was spent on eggs under the various programs. Consequently, a 25% increase in egg prices would result in a $169 million increase in Federal outlays on these programs. It will likely also cause a decline in egg purchases under programs like WIC that are subject to budget constraints.

Cage-free systems require more feed to produce the same quantity of eggs – typically 15-25% more. The additional demand for feed will require that farmers grow more corn and soybeans. Most conversions and new construction of cage-free systems will be aviaries with multiple perching levels. Taking into account the decline in consumption and reduction in imports, aviaries will require 15% more feed – 3 billion pounds more – and an extra 588,000 acres of crop production.

If it were all free-range organic production, 1,037,000 more acres would be needed to produce the additional 5.5 billion pounds of feed. Moreover, at a stocking density of 1,000 hens per acre for free-range production, it would take as much as another 400,000 acres to accommodate the layers and pullets – an area twice as large as the area inside Washington's Capital beltway.

Imports of eggs from Mexico and other countries would increase considerably because they will still be produced in conventional cage systems and will be cheaper. Consumers generally prefer lower cost eggs.

Recent studies on the sustainability of egg production conclude that modern laying-hen facilities have the lowest environmental impacts, followed by aviary or barn systems, and then free-range production methods, which have the greatest environmental impacts. Moreover, factors such as indoor air quality, ambient lighting, temperature, and ventilation, as well as atmospheric dust emissions, are managed more efficiently in modern environmentally controlled cage systems. Cage systems have smaller environmental and carbon footprints. They use less land, less feed, and less energy, and they have lower mortality. They permit better control of air quality and keep hens safe from predators and cannibalism. The additional miles of transportation associated with a rising level of imports in a cage-free industry would also add significantly to the carbon footprint of supplying eggs to the American consumer.

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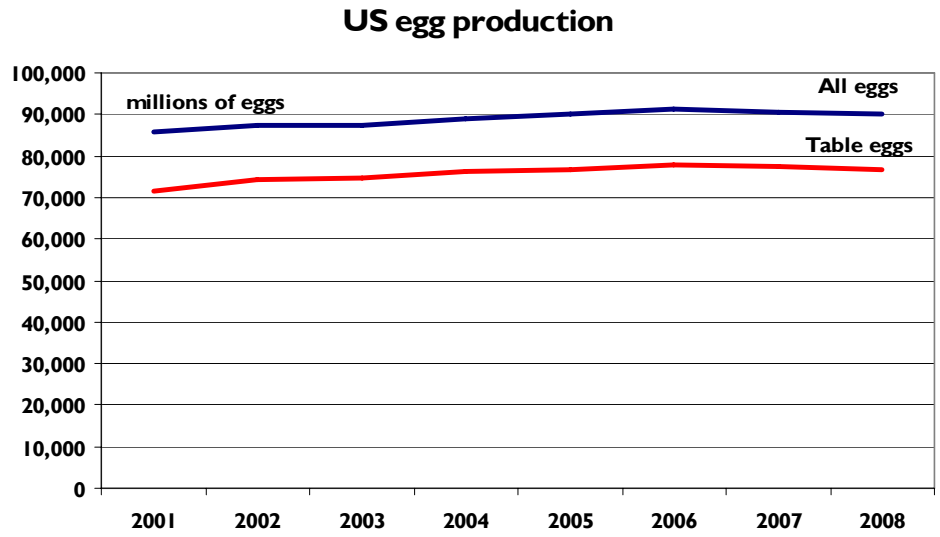
SECTION 1: THE US EGG INDUSTRY

1.1 Overview

The United States egg industry is the world's second largest producer of chicken eggs after China. Combined, US producers collectively care for approximately 340 million layers, which produced 90.2 billion eggs in 2008.

The US egg industry produces table eggs for human consumption and processed breaker egg products, as well as eggs for hatcheries for broiler production, vaccine production and laboratory research. The table egg industry is the dominant component of the US egg industry, and accounts for approximately 80 percent of the national egg layer flock, and 85 percent of egg production. The table egg industry will be our principal focus in the balance of this study.



Source: USDA Chicken & Egg Summary, various editions

1.2 Size and distribution of the national flock

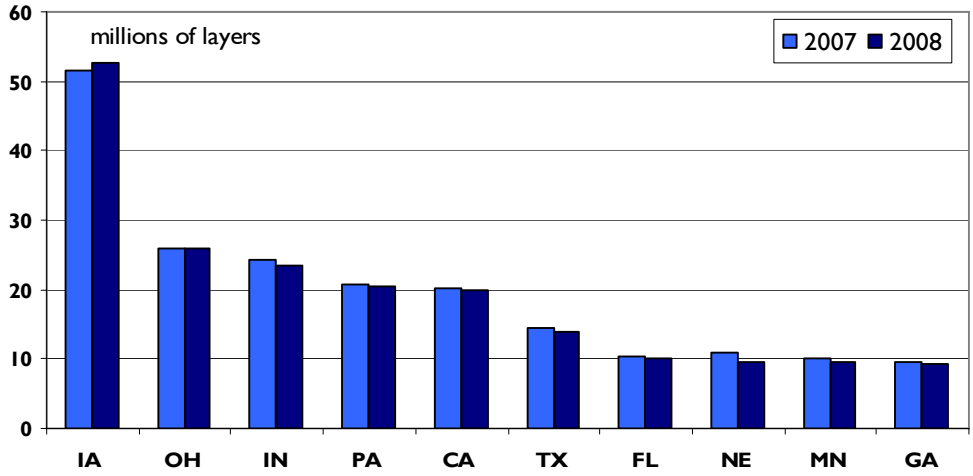
In 2008, the commercial egg farm sector averaged 340 million layers for egg production, of which approximately 280 million layers, or 82 percent, produced table eggs. From 2007 to 2008, the national inventory of table egg layers declined by approximately 2 percent.

Table egg layer inventory and egg production at the national level are concentrated in a handful of states. The top five producing states account for more than 50 percent of the national flock. In 2008, Iowa alone accounted for 19 percent of national table egg layer inventory—more than the second and third next largest producers combined. The next largest producer, Ohio, produced 9.3 percent of national table egg production.

According to the 2007 US Census of Agriculture, there were 146,000 US farms with layers in 2007. The vast majority are small-scale egg producers with no commercial significance at the national or regional

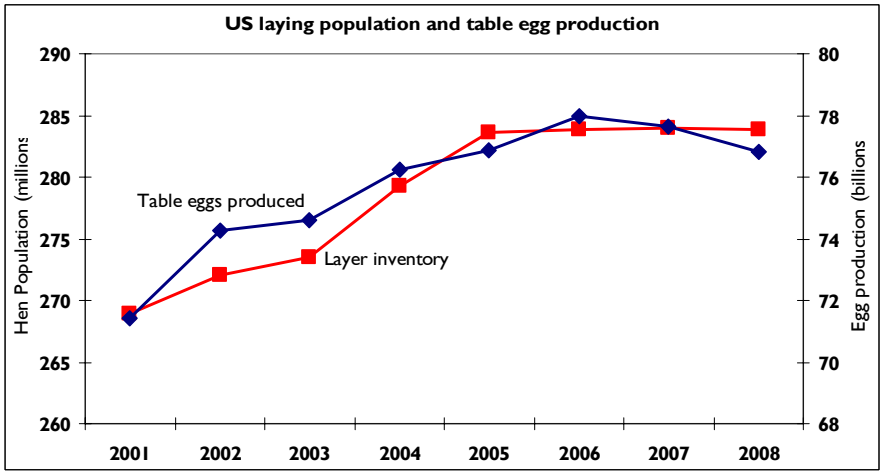
level. There were 1,987 farms with inventories greater than 20,000 layers. However, larger producers provide the bulk of commercially produced table eggs. According to United Egg Producers, approximately 240 egg producing companies with flocks of more than 75,000 layers produce more than 95 percent of national egg production. There are six egg producing companies with 1-5 million layers, and 12 companies with more than 5 million layers.

Top 10 largest table egg layer inventories



Sources: USDA, NASS Chicken & Eggs Summary 2009

At this time, large, independent and integrated producers dominate commercial table egg production in the United States. Previous production models relied on contract-based egg production and marketing. Contractor firms provided contract growers financing, pullets, and production inputs such as feed and supplements, as well as technical management guidance and paid a specified price for egg production output from a contractor. Today, however, integrated egg producers operate and manage the entire production and marketing chain for fresh table eggs and egg products.



Source: USDA Annual Chicken & Egg Summary, 1999 – 2009

1.3 How eggs are produced

Egg production methods vary according to individual needs for growers based on production costs, animal health and welfare regulations, food safety, air and water quality standards, and waste management.

A small share of table eggs is produced for development of breeding and parent stock for future layers. Young laying hens, which have not nested and produced eggs are called pullets. When pullets are mature they are moved to hen houses to begin production as layers.

Egg layer breeds for table eggs are most commonly White Leghorn and Rhode Island Red due to their excellent egg laying characteristics. A White Leghorn hen will lay approximately 280 medium to large, white eggs per year. A Rhode Island Red hen will lay 250 to 300 large, light to dark brown eggs per year. These eggs are infertile and are intended for direct human consumption as shell eggs or for processing into liquid, dried, or frozen forms for human consumption.

1.3.1 Production systems

According to United Egg Producers (UEP), about 95% of commercial egg production in the United States is from modern cage housing, with the other 5% coming from cage-free systems including barn or aviary raised and free range hens. The majority of US egg producers typically house laying flocks in modern, climate controlled facilities with arrangements of caged housing which distribute necessary inputs of food, water, and nutritional supplements to encourage layer production. Caged housing includes conventional or furnished cages.

Conventional cages are the most common form of housing for layer hens in the US table egg industry. Conventional cages are designed to manage animal health and egg production, and feature sloping wire floors to facilitate egg collection as well as the removal of litter and animal waste. Furnished cages, or enriched cages, adopted principally in parts of Europe are larger than conventional cage systems. Furnished cages include features such as a nesting area, perch, and in some cases a dust bathing area with litter material.

1.3.2 Specialty eggs

Cage-free egg production

Of the estimated 77 billion table eggs produced in the United States, approximately 5 percent are specialty eggs. These include production that is from alternative cage-free or free-range production, or is organic, or is nutrient enhanced, e.g. with higher omega-3 fatty acids.

Cage-free layer hens are housed in either floor systems or aviaries. Open floor systems are similar to production methods used to produce chickens for the broiler industry, and feature large structures housing thousands or tens of thousands of laying hens together, with individual nesting boxes placed over automatic egg collection equipment, and dedicated floor space for hens to practice dust bathing and forage. Floor systems are also called single-tier or barn systems, and do not always feature perches. Floor systems pose specific risks for air quality due to dust and ammonia, as well as animal health risks due to animal

waste management issues and parasitic infections. Many floor systems incorporate wire floors, slats, or perforated flooring above manure pits, more commonly found in the pork industry.

Aviaries feature multiple tiers for hens to perch on as well as floor space for hens to practice dust bathing and forage. Each tier is provided with feed and water, as well as a shield system to prevent animal waste from dropping on layer hens at lower levels. Aviaries share similar air quality and animal health risks as floor systems.

Common feed rations for cage-free or free-range flocks are similar to common feed rations for confined flocks, but can also include a combination of conventional and/or organic feed, and/or pasture. Cage-free layers are subject to higher rates of mortality, shorter egg production cycles, and higher production costs for feed, housing, labor, and healthcare than conventional egg production.

Free-range or pastured poultry egg production

Free-range hens are given access outdoors most of the day and are housed in shelters or indoor structures at night and during adverse weather conditions. Feed rations for free-range or pastured poultry are a combination of forage from pastured grassland including vegetation and insects, as well as supplemental rations like those for conventionally raised poultry.

Organic production

Of the estimated 340 million layers in the United States in 2007, less than one percent, or 2,415,056 layers, were classified as certified organic laying hens. This population produced a little over 2 eggs per capita.

According to USDA's National Organic Standards, organic producers must maintain records for certification and audit to ensure organic practices for layer hen hatching and care, egg collection, processing, handling, and distribution. Organic laying hens must be fed independently-certified organic feed rations which are typically at least five cents more per pound than conventional feed. The hens cannot be administered drugs or antibiotics, and are required to have access to the outdoors. For organic producers, a significant share of production cost is attributable to higher input costs for organic feed, higher mortality rates, shorter egg production cycles, and additional labor and capital investment required to account for certified organic practices during the entire product lifecycle of an organic egg.

Omega-3 enriched egg production

Common feed rations for flocks producing omega-3 enriched eggs, which can be either confined or cage-free, conventional or organic, are fed a supplement-enriched diet from a variety of sources such as flax seed, as well as edible vegetable and fish oils rich in omega fatty acids. Omega-3 enriched eggs are marketed as having superior nutrition, due to higher omega-3 fatty acid content and lower cholesterol, in comparison to conventional eggs. However, omega-3 eggs still retain the same calorie, protein, and total fat profile of conventional eggs.

1.3.3 Ancillary industries

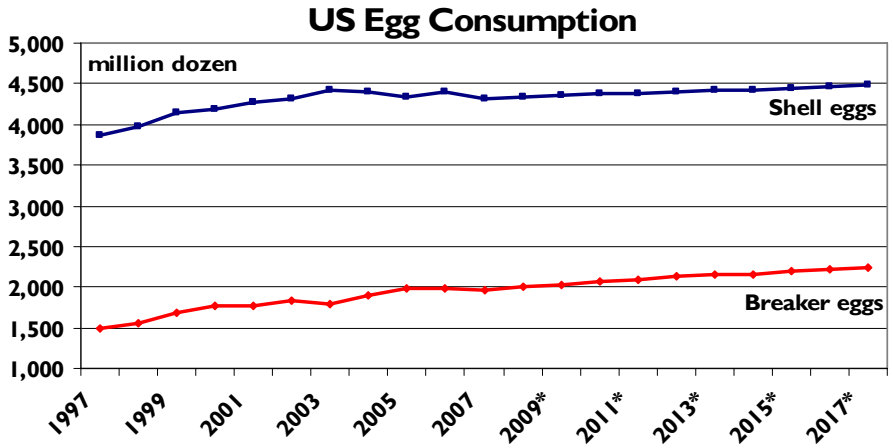
There are three other industries closely associated with egg production. The first is the hatchery industry that produces the chicks that are then raised primarily for meat production. However, about 1.5% of the chicks are destined to be layers. They are raised as pullets until sexual maturity. At that stage the flock is moved into layer houses. Hens in cage systems typically produce eggs for about 60 weeks, although some flocks go through molt and then produce eggs for an additional 35 weeks. Using 80 weeks as an approximate average, about two-thirds of the layers are replaced each year.

The second is the feed industry. Feed represents about half the cost of producing an egg. Some commercial egg producers buy their feed from independent feed manufacturers. Others are vertically integrated, buying the corn, soybean meal and other ingredients, and producing the feed themselves. The egg industry thus has direct linkages back through feed manufacturing to the farmers that produce the required corn and soybeans.

The third is the egg processing industry. As with feed manufacturing, an egg processor may either be independent or part of a vertically integrated company. Processors produce liquid, dried or frozen egg products.

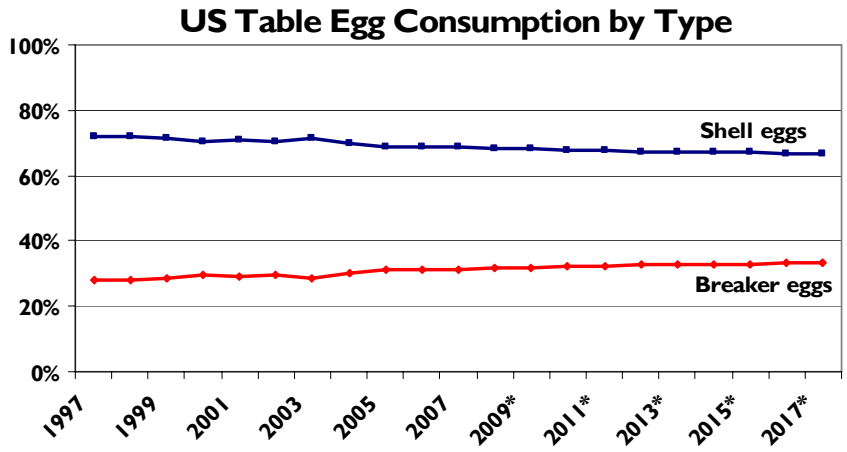
1.4 Egg consumption

US egg consumption trends indicate steady demand growth for shell eggs and egg products over the past decade and going forward into the next decade. The Food and Agricultural Policy Research Institute (FAPRI) projects that shell egg consumption will grow at a marginal rate, rising 3.1 percent over the next decade from 2008 to 2017, while consumption of breaker eggs will grow 11.9 percent over the same period.



Source: Food and Agricultural Policy Research Institute (FAPRI) 2008,
* indicates projected consumption

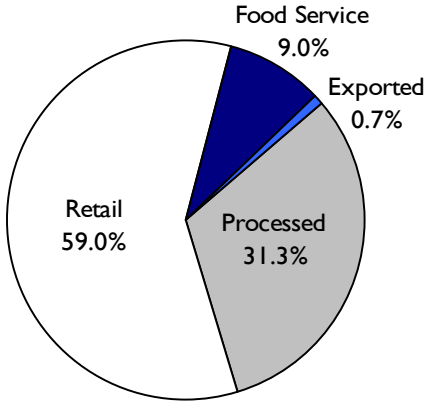
1.4.1 Types—shell, liquid, powdered, frozen



Source: Food and Agricultural Policy Research Institute (FAPRI) 2008,
* indicates projected consumption

Fresh shell table eggs are the principle egg product consumed in the United States. In 2008, the United States consumed 52.6 billion table eggs as shell eggs, nearly 68 percent of all table egg consumption. Breaker egg products such as liquid, powdered, and frozen egg products are also widely available for retail consumer demand as well as industrial processing. In 2008, the United States consumed 25.2 billion table eggs as breaker eggs for processed foods in food service, manufacturing, retail and export, nearly 31.3 percent of all table egg consumption.

Egg consumption and end-use estimates



Source: United Egg Producers website

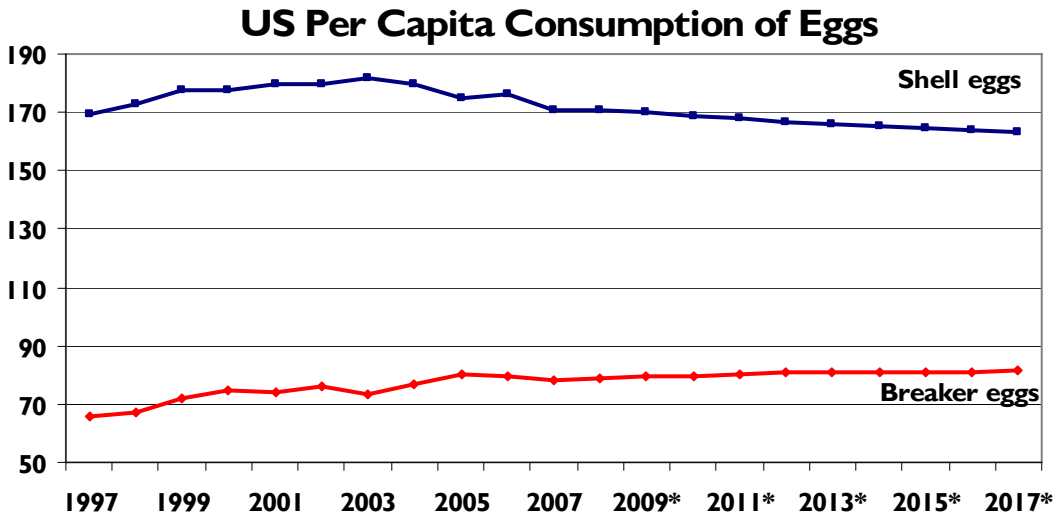
Shell eggs are the most prevalent form of table egg consumption and are a staple for retail household consumption, bakeries, hotels, restaurants, and catering food service operations. However, shell eggs are more difficult to transport over long distances and have a limited shelf life. Canada and East Asia are the main markets for the small volume of shell eggs that are exported.

Liquid eggs are table eggs not in shell, and are a common ingredient for food service operations and industrial processing. Liquid eggs are processed as pasteurized, cooked, preserved, or frozen eggs. Liquid eggs can also be found in their component parts as liquid egg yolks, or liquid egg albumin, also called liquid egg whites. Export destinations include Canada, East Asia, and Western Europe.

Powdered eggs are a dried egg product and are commonly processed into dried, sweetened or unsweetened egg yolks, or dried egg albumin. Powdered egg products are commonly used in food processing and manufacturing, baking products, and nutritional supplements. Powdered egg products are also exported to Canada, Mexico, East Asia, and Western Europe.

1.4.2 Per capita consumption

According to the FAO, the United States was the world's eleventh largest egg consumer in 2003, and consumed approximately 14 kilograms of table eggs or the equivalent of 245 eggs. This number has remained relatively steady at around 250 to 255 table eggs on a per capita basis over the past decade. As indicated in the FAPRI data below, a majority of US eggs consumed are whole shell eggs, and a smaller percentage are breaker eggs. In 2008, the US consumed approximately 171 whole table eggs and 78 breaker eggs on a per capita basis.



Source: Food and Agricultural Policy Research Institute (FAPRI)

However, overall egg consumption is expected to decline over the long run, as the share of shell eggs consumed is expected to decline and the number of breaker eggs consumed is expected to remain relatively constant.

1.4.3 Role in protein supply and nutrition

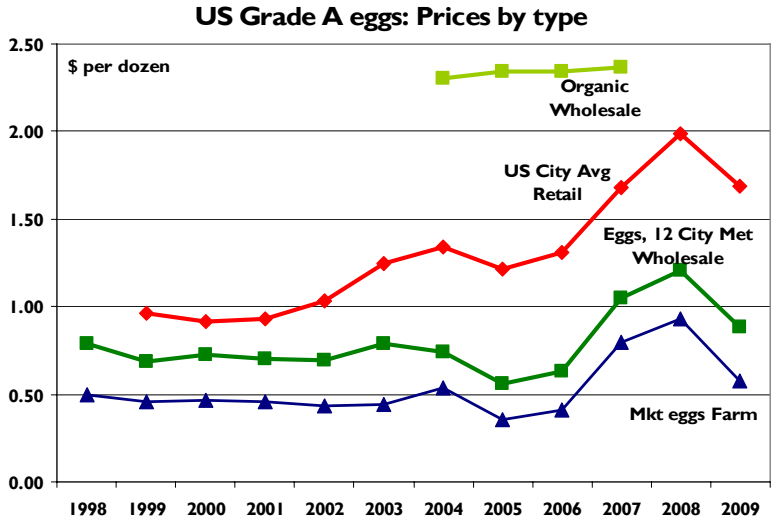
Eggs are an important dietary component as a directly consumed food and as a food ingredient, and they have had the virtue of being a comparatively inexpensive source of protein. Eggs are also an excellent source of choline, a micronutrient whose importance is increasingly recognized by the scientific community; choline is important for fetal brain development, for example.

1.5 Egg prices

In the United States, a majority of table eggs are produced on a contract basis in which individual growers market eggs to retail vendors, distributors, and industrial consumers at a fixed cost for periodic delivery.

Consumer egg prices are subject to seasonal variation in production and consumption. However, improved transportation and handling technology as well as nationwide price differentials in egg producer prices have encouraged a nationwide market and interstate trade for table eggs. Overall, prices at the farm, wholesale, and retail levels tend to move in close correlation with one another. Cage-free eggs typically sell at retail price premiums of 100% to 200% ($1-3 per dozen) more than standard commercial eggs, which reflects the higher production costs at the farm level, and wider margins at the retail level driven by the economics of marketing specialty eggs.

The chart below provides a comparison among producer prices, wholesale value, and retail prices. The producer prices and wholesale prices are published by USDA's National Agricultural Statistics Service and are measured at first point of sale, so they can represent sales of cage-free and organic as well as modern cage housing eggs. The retail prices are Consumer Price Index data from the Bureau of Labor Statistics for Grade A, large eggs. The behavior of egg prices from 1998 to 2008 reflects the inelasticity of demand for eggs. Consumers are price takers as there are no good substitutes for shell eggs. After several years of steady prices at around $1.00 per dozen, retail egg prices began to strengthen in 2003. From 2005 through 2008, consumer egg prices rose from $1.32 to $1.99 per dozen. With the fading of the 2008 commodity market boom, egg prices fell back to about $1.50 by mid-2009. (The 2009 prices is this and subsequent charts are January-June averages.)



Sources: US Bureau of Labor Statistics, Consumer Price Index; USDA Agricultural Marketing Service, 12-City Metropolitan Average; USDA National Agricultural Statistics Service

U.S. Average farm prices and retail prices, 1983 - 2009

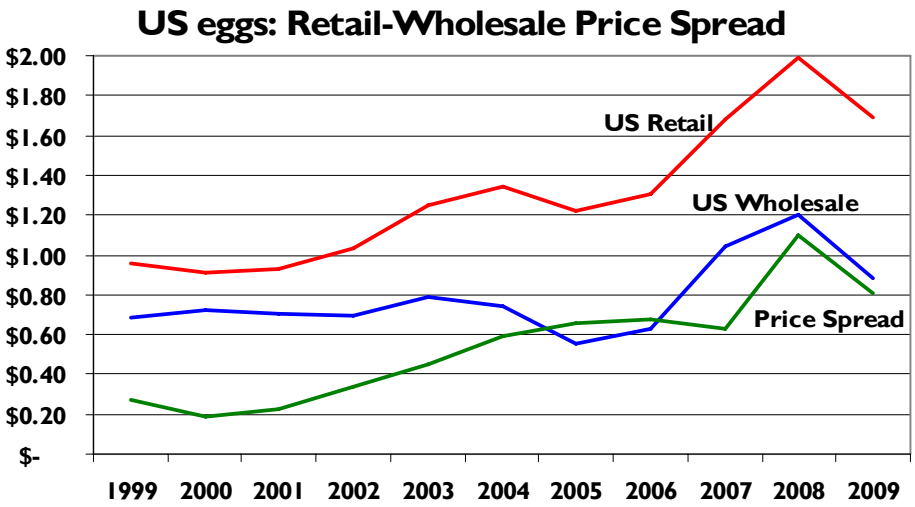
Year	U.S. farm price received for table eggs	US retail price for grade A large	Spread between price received and retail price	Price received as a share of retail price
	(cents per dozen)			(percent)
1983	57.8	89.4	31.6	64.7
1984	64.0	100.5	36.5	63.7
1985	49.9	80.4	30.5	62.1
1986	53.7	87.0	33.3	61.8
1987	44.1	78.3	34.2	56.4
1988	44.4	79.0	34.6	56.2
1989	62.5	99.8	37.3	62.6
1990	62.0	101.4	39.4	61.1
1991	56.7	98.9	42.2	57.3
1992	45.1	86.0	40.9	52.4
1993	51.7	91.1	39.4	56.7
1994	48.5	86.3	37.8	56.2
1995	53.0	92.5	39.5	57.3
1996	66.5	110.6	44.1	60.1
1997	57.8	105.8	48.0	54.6
1998	52.1	103.7	51.6	50.2
1999	43.6	95.9	52.3	45.5
2000	46.9	91.4	44.5	51.3
2001	42.9	92.9	50.0	46.2
2002	42.0	103.2	61.2	40.7
2003	59.4	124.4	65.0	47.7
2004	53.4	134.0	80.6	39.9
2005	35.0	121.8	86.8	28.7
2006	40.7	130.6	89.9	31.2
2007	74.6	167.6	93.0	47.5
2008	97.4	198.7	101.3	49.0
2009 Jan – Jun	71.8	169.0	97.5	47.3

Source: USDA NASS Agricultural Prices and Department of Labor, Bureau of Labor Statistics, "Consumer Price Index - Average Price Data."

The spread between farm and wholesale prices has remained relatively constant over the past decade at about $0.25 per dozen. That reflects costs for cleaning, sorting, and packaging the eggs, and then shipping them to market in the major population centers.

Over time, prices at the wholesale and retail levels tend to follow a similar pattern. Wholesale egg prices for volume buyers steadily rose approximately 91 percent from 2002 to 2008. The US city average wholesale price basket of Grade A eggs also jumped, and exhibited the greatest percentage change from 2006 to 2007, increasing from $0.63 to $1.05 per dozen, or 66 percent. The USDA World Agricultural Supply and Demand Estimates report that wholesale prices for US grade A large eggs in New York rose 43 cents from 2006 to 2007, and 14 cents from 2007 to 2008, but are projected to fall between 17 and 22 cents in 2009.

The spread between retail and wholesale prices steadily increased from $0.20 to $0.68 from 1999 to 2005, as illustrated in the following chart. The price spread narrowed slightly from 2005 to 2007, and then experienced increased volatility from 2007 to 2008. The retail-wholesale price spread declined again in the first half of 2009, but remains wider than the historical norm.



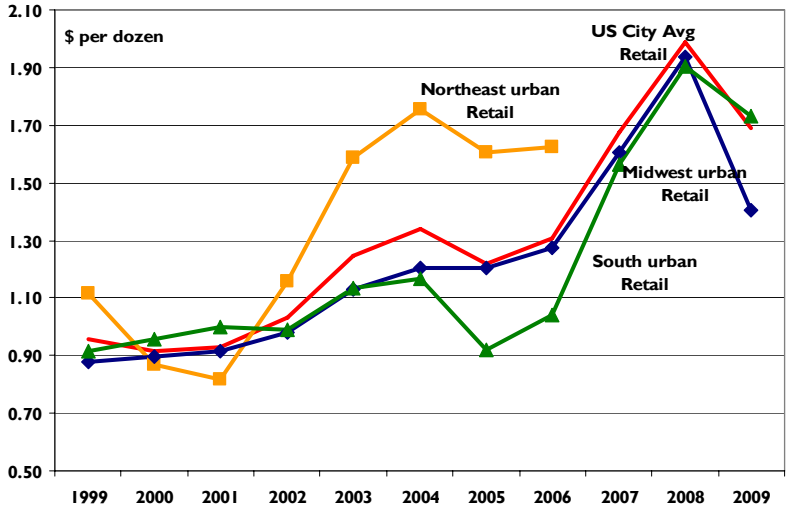
Sources: US Bureau of Labor Statistics, Consumer Price Index; USDA, Agricultural Marketing Service, 12-City Metropolitan Average

The average US city retail and US wholesale price spread reflects several bits of information. First, the retail-wholesale price spread reflects direct costs to transfer wholesale eggs to the retail market, including transportation, distribution, packaging, breakage, and other overhead costs. Secondly, the retail-wholesale price spread indicates the marginal difference between the retail price elasticity of consumer demand and the wholesale price elasticity of volume buyer demand. This measure reflects the relative difference between price "stickiness" for retail consumers, in comparison to price "stickiness" for wholesale buyers.

Due to higher production and distribution costs, organic eggs are typically 100 to 200 percent higher in price than conventionally produced eggs. The USDA Agricultural Marketing Service reported organic

wholesale egg prices only from 2004 to 2007. Despite the small sample, organic eggs appear to have a more stable price level over time, implying that organic eggs have relatively sticky prices in comparison conventional eggs prices, and the price determinants for organic eggs are distinct from conventional egg prices.

US Grade A eggs: Retail prices by region



The chart above provides a comparison of retail prices by region for US Grade A eggs. All annual prices are estimated from Consumer Price Index data from the Bureau of Labor Statistics for Grade A, large eggs per dozen. The Northeast Urban series was discontinued in 2007, but there is clearly considerable regional variability.

1.6 International trade of US eggs and egg products

As with many other perishable agricultural goods, distance, transportation costs, as well as egg supply and demand needs for individual importing trade partners directly influence the comparative advantage of US eggs and egg product exports, and the quality of the product at delivery.

Trade in eggs and egg products is quite small. The United States currently imports very little, and exports amount to less than one percent of total demand. Major US trading partners are the largest importers of US table eggs and egg products. As expected due to proximity and volumes of trade, Canada and Mexico are among the leading export destinations for fresh eggs in shell and liquid egg products. However, East Asian trading partners are also large importers. Shell eggs do not retain quality and are subject to damage and spoilage over long distances. Canada and Hong Kong (despite the distance) each imported more eggs than all other egg export markets combined.

Japan is also a leading importer of all processed US egg products, including liquid eggs, yolks, and egg whites, dried egg yolks and egg whites, as well as frozen egg products. Other export markets for US processed egg products include Canada, Mexico, Hong Kong, South Korea, and Germany.

Top five importers of US Shell Eggs (HTS 407000040)

Destination	2006	2007	2008	99-08 Average
		---Dozens of eggs---		
Canada	17,244,963	17,482,469	24,742,012	21,154,826
Hong Kong	21,050,195	25,360,721	16,882,046	18,991,073
Japan	731,554	1,961,702	1,032,389	2,157,338
Mexico	5,444,766	2,668,529	464,745	1,580,893
China, PR	2,068,014	3,143,917	1,574,691	1,185,454

1.7 Animal welfare guidelines

Animal welfare has always been a concern of livestock and poultry producers due to their dependence on the ongoing sales of animal products for their livelihood. In recent years, animal welfare issues have also been getting more attention around the world from activist groups and the general public. This has resulted in the development of more definitive government regulations in some countries as well as elaboration of private sector standards.

1.7.1 United Egg Producers guidelines

There are no explicit federal animal welfare regulations for egg production in the United States. However, the UEP is a national federated cooperative whose members are individual egg farmers from across the United States who produce eggs in both modern cage housing and cage-free, free-range and organic systems. As part of its mandate, the organization has taken the lead in establishing animal welfare guidelines for egg production. In 2008, the United Egg Producers fully adopted a set of scientifically recommended guidelines and an auditing program, called the UEP Certified Program, which covers most of the US table-egg laying flock of about 280 million layers nationwide. The UEP Certified Program was developed to promote animal welfare and address public concerns about the health of layer hens.

Today, about 80% of US egg production is independently certified as meeting the UEP standards, which address beak trimming, molting, handling, biosecurity, and housing and space guidelines. For cage production, White Leghorn type hens are required to have a minimum of 67 square inches and brown egg layers 76 square inches under UEP standards. For cage-free production, 1.5 square feet (216 square inches) is required, subject to downward adjustments to 1.0-1.2 square feet (144-173 square inches) if there are additional perching areas above floor level.

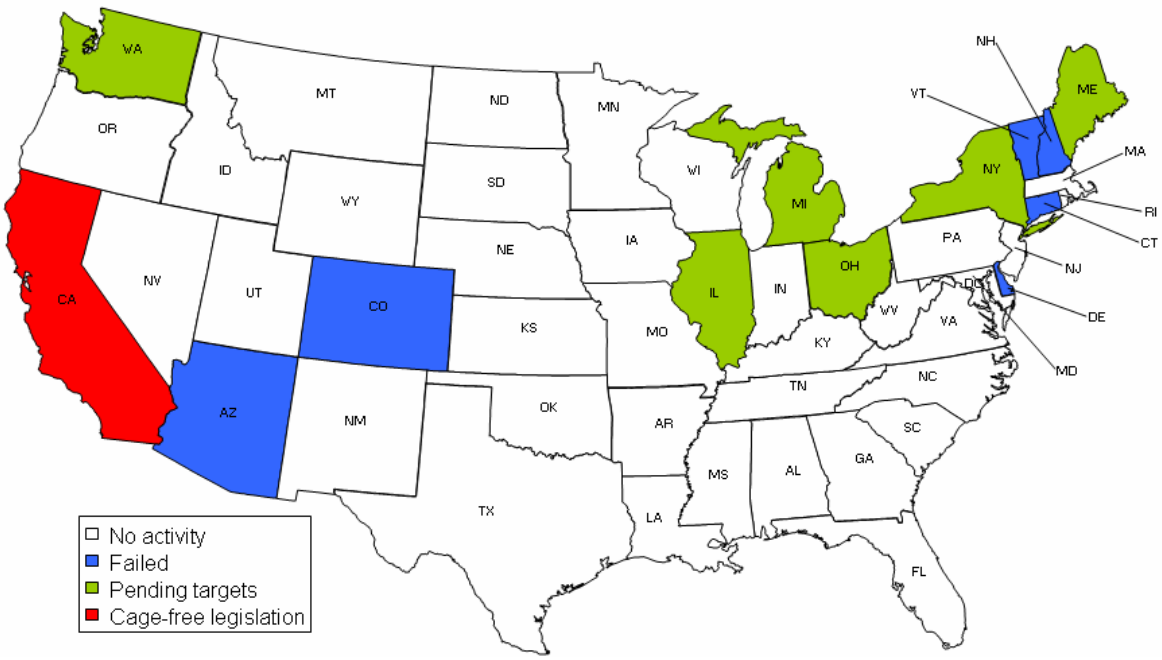
1.7.2 State legislative developments

Animal welfare advocacy groups have introduced legislation, or organized popular ballot initiatives and referenda to promote cage-free egg production. Presently, 23 states have provisions to allow citizens to campaign for state ballot initiatives or referendums; however, legislative initiatives to ban conventional flock management have been less successful.

As indicated in the map below, animal welfare groups have targeted 13 states nationwide to implement cage-free mandates or oppose legislation which codifies animal welfare standards. In 2007 and 2008, campaigns to mandate cage-free standards were defeated or died in committee without a vote in New

Hampshire, Vermont, Connecticut, New Jersey, Delaware, Colorado, Arizona, and Washington (states in blue in the map below).

State activity for cage-free initiatives



In 2008, voters in California passed Proposition 2, which will effectively ban cage systems by 2015. The initiative modified the state's Health and Safety Code by adding the following language:

> "In addition to other applicable provisions of law, a person shall not tether or confine any covered animal, on a farm, for all or the majority of any day, in a manner that prevents such animal from:
> (a) Lying down, standing up, and fully extending his or her limbs: and
> (b) Turning around freely."

Egg-laying hens would be a covered animal under the proposal, and the definitions in the measure state the following:

> "Fully extending his or her limbs" means fully extending all limbs without touching the side of an enclosure, including, in the case of egg-laying hens, fully spreading both wings without touching the side of an enclosure or other egg-laying hens.

Studies show that this will result in the elimination of most egg production in the state because consumers will just buy lower cost eggs produced in other states. The California egg industry has asked state regulators for some interpretation of what the language actually means, i.e. whether some types of cage systems would still be permitted, but nothing had been forthcoming as of mid-2009. Some state legislators have considered the merits of imposing the same requirement on egg producers in other states that

export eggs to California. However, this might violate the U.S. constitution's interstate commerce provisions.

It is possible that such bans will spread, either on a state-by-state basis or through national legislation. At this time, legislative attempts to implement cage-free bans on production are underway in four states, including Illinois (SB 1337), New York (AB 8163), and Michigan (HR 5127/5128), as well as a continuing campaign to reintroduce animal welfare legislation in Washington. Other targets include efforts to bring state ballot initiatives for popular vote in Ohio and Maine. Combined the targeted states (states in green) represent nearly 20 percent of all US table egg production. When considering the passage of pending cage-free legislation in each state above in addition to California, the combined bloc of states represents more than 25 percent of all US table egg production.

Animal welfare groups have also opposed legislation to establish regulatory authority for state departments of agriculture or other agencies in Michigan, Ohio, and Maine.

1.7.3 The European Union experience

European Union Directive 1999/74/EC

In June 1999, the European Agricultural Commission decided to impose a ban on conventional cage housing, and establish spatial allowances for furnished housing systems. According to EU Directive 1999/74/EC, producers were not allowed to build conventional cage systems after January 1, 2003, and are required to convert any remaining cage facilities to cage-free or furnished cages by January 1, 2012. Furnished cages provide more space and perches and may include litter areas for dust bathing. Current EU regulations specify spatial allowances for caged layer confinement of at least 85 square inches (550 square centimeters). By 2012, the EU Directive specifies a furnished cage spatial allowance of 116 square inches (750 square centimeters) of living space per hen and a minimum height of 17 inches (45 centimeters).

The EU commissioned a cost analysis of the directive, which concluded that the program will cost EU-25 egg producers €354 million (approximately $500 million). EU egg producers report that government mandates on egg production practices threaten to increase costs of production, require significant financial investment, and impose additional constraints on the industry that will force it to consolidate and relocate to areas with less stringent regulations. Imports of shell eggs from Turkey, Ukraine and Belarus are expected to rise as the 2012 deadline approaches, as are imports of processed eggs from Argentina, India or other countries. The degree to which import dependency will eventually increase is still uncertain.

Early analysis from the Agricultural Economics Research Institute in the Netherlands (LEI-Wageningen-UR) indicates that production costs per kilogram for EU egg producers will increase by 7.8 percent for enriched cages under the guideline for at least 85 square inches (550 square centimeters), in comparison to conventional production, and by 21.4 percent for aviary houses. A separate 2004 study commissioned by the European Commission and conducted by consultancy Agra CEAS reported that a transition to barn production would increase production costs by 12 percent, and a free-range production would increase production costs by 20 percent.

Under the current provisions of EU governance, EU nations are required to meet the minimum requirements of an EU Directive; however, individual nations maintain state autonomy to impose additional regulations, including spatial allowances for layer hen confinement. For example, Germany has already banned conventional cages and Austria will take a similar step in 2010. Therefore, EU economy-wide impacts for conventional cage-free layer housing have the potential for far greater producer cost and consumer retail cost effects than estimated by existing research studies.

At this time, five EU members and one other European country have enacted additional requirements for alternative housing methods – Sweden, Germany, Netherlands, Denmark, Austria and Switzerland. Each of these national standards is discussed below.

Sweden

In 1988, the Swedish Animal Protection Act was amended to prohibit beak trimming, provide perches and claw scratching areas by 1994, and ban all cage systems for layer housing by 1999. However, by 1997 with about 20 percent compliance to remove caged housing, it was apparent that an absolute ban on cage-free housing would be difficult to establish before the 1999 deadline. Swedish producers who converted to cage-free production with untrimmed layers witnessed unacceptably high mortality rates due to low stocking in cold temperatures, and incidences of feather pecking and cannibalism. Consequently, following the 1995 accession of Sweden to the European Union, a second measure was proposed to re-amend the Swedish Animal Protection Act to mitigate the effects of harmful natural behavior among untrimmed layer hens, and allow furnished cages in accordance with the proposed EU Directive 1999/74/EC. In 1998, the Swedish parliament revised the ban on all cage systems to permit furnished cage housing. The Swedish measure precedes the European Union directive by three years. In 2000, Sweden was the first nation to introduce furnished cage housing on a commercial scale.

Germany

The German parliament first introduced a cage-free ban in 2002, and eventually enacted a ban on conventional cages in 2006. The protracted legislative process likely discouraged many producers from investing in new housing facilities due to uncertainty about the requirements for caged housing. The German legislation specifies spatial allowances for "Kleingruppenhaltung", a form of "enriched colony cages" at 124 to 138 square inches (800 to 890 square centimeters) to be implemented after December 31, 2009, and a further reaching requirement for producers with respect to time for implementation as well as the spatial allowances required by law. The measure precedes the European Union directive by three years. The program is expected to cost the German egg industry approximately $814 million. Conversion costs to enriched cages will also lead to significant industry restructuring and consolidation, and potential lower overall national self-sufficiency for eggs and egg products.

The Netherlands

In 1994, the Dutch government committed to phasing-out conventional cage housing for layers. However, protracted government discussion limited government implementation of a measure until 2007. In 2004, Dutch supermarkets and other retailers agreed to a voluntary private ban on stocking eggs from

conventional cage production. However, producers continue to raise layers in enriched colonies, and conventionally produced eggs are still available from direct marketers and farmers.

A consumer survey by GFK commissioned by the Dutch agricultural watchdog, Product Board for Livestock, Meat & Eggs (PVE), concluded that following the ban, alternative production systems accounted for 90% of retail egg sales in comparison to 10% of retail egg sales from conventional, free-range, and organic egg production.

As a member state of the European Union, the Netherlands has adopted measures to comply with the enriched housing standards in EU Directive 1999/74/EC, as well as other stricter measures. In a similar outcome to the Swedish model, the Netherlands implemented a ban on beak trimming in 2007, and required adoption of enriched cages by 2012 according to the EU Directive enacted in 1999 as well as the voluntary standards adopted in 2004. Moreover, the Dutch government is also offering a 10-year grace period on the beak-trimming ban to early adopters who comply with the enriched cage standards of the EU Directive. Analysis from the Agricultural Economics Research Institute (LEI-Wageningen-UR) suggests that egg prices in the Netherlands will increase 10 percent from current levels under the 2012 EU Directive.

Proposals to allow laying hens to occupy a minimum area of at least 172 square inches (1,111 square centimeters) per bird would effectively establish commercial aviary systems or enriched colonies as the primary production methods allowed. The Agricultural Economics Research Institute (LEI-Wageningen-UR) estimates that such a standard will increase consumer prices by 20 percent in comparison to conventional cage production (93 square inches), and 10 percent in comparison to the cost of eggs in the rest of the EU. Moreover, the report suggest that in the case of a requirement of 172 square inches, other producers in Spain, Italy, France, and Eastern Europe would be able to offer more price competitive egg products, and in an extreme case, multinational firms would relocate production from the Netherlands to the countries with lower production costs.

Denmark

In 1981, Denmark implemented enlarged spatial allowances for conventional cage housing for layers to 93 square inches (600 square centimeters), and mandated review for conventional by the Regional Veterinary and Food Control Authorities before use, and each year. Authorities also inspect a sample of 5%, or at least 50 sites, of alternative housing systems each year.

There are approximately 300 commercial egg producers in Denmark, of which approximately 23 percent continue to use conventional cage housing, 23 percent use alternative housing systems, 9 percent use free-range housing, and a small percentage use organic production. Starting January 1, 2012 conventional cages will be prohibited in accordance with EU Directive1999/74/EC.

Austria

In 2004, Austria enacted a measure which bans the use of all cage systems and requires free-range methods starting by 2009, and recently installed caged housing systems by 2020. The law also prohibits the retail sale of confined chicken products, effectively limiting consumer choice to free-range products.

Switzerland

In 1981, Switzerland enacted the Swiss Animal Welfare Ordinance, which established clear and measurable guidelines for animal welfare and production methods. The measure implemented a 10-year program to introduce spatial allowances for enriched cages at 124 square inches (800 square centimeters) featuring designated nesting areas, perches, and slatted floors—effectively eliminating conventional cage housing in Switzerland by 1991. The government also required oversight for constructing cages for more than 40 layers. According to a 1990 Australian Senate report on intensive agriculture, despite measurable standards for enriched cages, a majority of Swiss egg producers opted for commercial aviary systems by 1990, rather than enriched cages specified by mandated housing requirements.

Layer housing system constraints contribute to high production costs already associated with Swiss egg production, which is characterized by high labor and feed input costs. The introduction of alternative housing systems initially led to higher production costs as producers adjusted to new production methods. Afterwards, egg production costs declined from 1991 to 2000. Nonetheless, Swiss eggs remained significantly higher than eggs produced in neighboring countries. In 2003, the average Swiss egg cost more than double eggs produced in neighboring EU nations.

A study by Amgarten and Mettler indicates that nine years after government policy implementation, Swiss egg producers adopted approximately 50 percent alternative housing systems, 35 percent conventional housing systems, and 15 percent free-range systems. In 2006, the International Egg Commission reported that Swiss egg production was distributed by approximately 40 percent aviary, and 60 percent barn or free-range production.

SECTION 2: ECONOMIC IMPACTS OF CAGE-FREE REQUIREMENT

Requiring that all eggs produced in the United States be produced in cage-free systems would have a wide range of economic effects. The US egg industry generates a significant amount of economic activity and employment. How that might change would depend on the extent to which domestic production is replaced by imported eggs and egg products. In addition to the macro level impacts, there would be a number of other important effects:

- Very high conversion and investment costs for the existing industry;
- Higher egg production costs;
- Higher egg prices to consumers;
- Increased costs for school meal programs, the WIC program, and other food assistance programs and a likely reduction in egg purchases.
- A need for increased plantings of corn and soybeans to meet the higher feed requirements of cage-free production, with resulting negative impacts on the environment and the industry's carbon footprint.

Below we discuss each of these economic impacts.

2.1 The impact of the egg industry on the economy

The US egg industry is a significant component of animal agriculture in the United States. Total production value at the farm level for all eggs was $6.7 billion in 2007 and $8.2 billion in 2008 on slightly lower production but higher prices. Production value for table eggs was $4.8 billion in 2007, and $6.2 billion in 2008. In 2008, table eggs accounted for approximately 75 percent of national egg production revenue.

To estimate the impact of egg production on the overall economy of any given geographic area, it is necessary to quantify the relationship between the egg industry and each of the other major components of the area's economy. So-called input-output (I-O) models are commonly used for this purpose. Given the great amount of detailed information that is required to build and maintain a national I-O model, there are comparatively few of them in operation. One of the most elaborate of these models is the Regional Industrial Multiplier System (RIMS II) operated by the Bureau of Economic Analysis (BEA) in the US Department of Commerce. This is the model used in this analysis.

RIMS II is based on a benchmark I-O table developed by BEA in 1997 and it is updated annually. It is comprised of approximately 500 industries. The model traces the interactions among these industries so that the effect of a given level of output in one industry on all other industries can be measured. These measures take the form of multipliers or factors that can be applied to output measured in dollars. They indicate the total economic activity in the state associated with a dollar of sales in that industry. In addition to measuring the value of output, multipliers are also derived for measuring impacts on earnings and employment. The employment multiplier is the number of total jobs in the state associated with one million dollars of sales in that industry.

Given the complexity of tracing these effects throughout the economy, some simplification in methodology is required to keep the task manageable. The first simplifying step in constructing RIMS II was to collapse the nearly 1,200 industries identified in the Census Bureau's North American Industry Classification System (NAICS) to a smaller number of industries. (NAICS replaced the old Standard Industrial Classification system). As a result, poultry and egg production are combined as a single industry.

A second important step in estimating multipliers is in defining the geographic region of interest. The RIMS II model permits the region of inquiry to be as small as an individual county or as large as a regional aggregation of several states. The choice of region can have an important effect on the outcome, depending on whether the associated industries are located within the region. As a general rule, the more broadly the region is defined the greater the likelihood that associated industries are represented within the region and the larger the multipliers. For this analysis, we have calculated the impacts on a state by state basis, which tends to provide a more conservative estimate.

The table below presents the RIMS-II state level multipliers for poultry and egg production. Output multipliers range from 1.4 for Hawaii and Wyoming to more than 2.8 for Missouri. The earnings multipliers range from 0.20 to 0.47. The employment multipliers range from 6.8 in Delaware to 23.2 in Indiana.

To avoid disclosing information on individual operations, USDA estimates do not release production values for each state. However, by using publicly available data on broiler production to estimate hatching egg production and by calculating the difference between hatching eggs and total egg production, we were able to approximate the total number of table eggs produced in 36 states. The remaining unallocated portions of table egg production for each state are estimates based on proportional shares of total egg production. Data for table egg production in Alaska, Arizona, Delaware, Kansas, Nevada, New Mexico, North Dakota, and Rhode Island are combined to avoid disclosing individual state production, and no further inferences can be made to determine production of table eggs in these seven states.

Using the US Bureau of Economic Analysis, Regional Input-Output Multipliers (RIMS II), and 2008 production values derived from the USDA National Agricultural Statistics Survey sample of all egg producers, the estimated economic impacts on GDP output, earnings and employment can be calculated for the US egg industry. The table egg sector of the industry accounts for the majority of those economic impacts. In 2008, table egg production resulted in $14.7 billion of overall economic activity in the US economy, $2.4 billion of earnings, and over 97,600 jobs.

Estimated Economic Impact of US Table Egg Industry

		US BEA --RIMS II Multipliers			Economic Impacts		
	Value of Production	Final Demand	Multiplier Direct Effect	Employment	Final Demand	Multiplier Direct Effect	Employment
STATE	2008	Output	Earnings		Output	Earnings	
	$ million				$ million	$ million	jobs
AL	32.1	2.35	0.38	12.65	75	12	406
AR	83.9	2.63	0.41	15.22	221	34	1,277
CA	410.1	2.13	0.36	10.56	872	148	4,329
CO	89.4	2.22	0.38	17.57	198	34	1,571
CT	55.6	1.59	0.24	8.97	88	13	499
FL	223.8	1.64	0.26	10.10	366	59	2,259
GA	214.2	2.54	0.43	12.78	545	92	2,739
HI	8.7	1.39	0.21	12.86	12	2	112
IA	1,087.8	2.54	0.40	15.61	2,761	432	16,982
ID	12.4	2.18	0.35	16.42	27	4	203
IL	113.9	2.79	0.47	21.54	318	54	2,453
IN	523.4	2.76	0.44	23.18	1,446	229	12,133
KY	56.3	2.65	0.41	21.09	149	23	1,187
LA	38.4	2.15	0.34	16.99	82	13	652
MA	104.5	1.50	0.23	14.37	157	24	1,502
MD	60.1	2.23	0.34	12.27	134	20	738
ME	3.7	1.99	0.32	15.27	7	1	57
MI	197.3	1.78	0.29	13.50	350	57	2,663
MN	226.8	2.74	0.45	16.60	622	102	3,764
MO	36.7	2.83	0.43	16.83	104	16	617
MS	135.5	2.44	0.37	15.67	330	51	2,123
MT	9.6	2.14	0.34	21.00	20	3	201
NC	225.2	2.51	0.41	13.18	565	93	2,967
NE	7.0	2.50	0.39	15.90	17	3	111
NH	41.7	1.60	0.23	15.51	67	10	648
NJ	90.0	1.74	0.27	11.27	157	24	1,014
NY	115.8	1.66	0.24	10.41	192	28	1,206
OH	572.7	2.70	0.44	21.46	1,545	255	12,292
OK	35.0	2.50	0.40	16.23	88	14	569
OR	61.2	2.04	0.32	11.62	124	20	711
PA	454.5	2.46	0.40	15.08	1,118	183	6,854
SC	66.8	1.83	0.29	12.81	122	19	856
SD	55.7	2.29	0.34	18.54	127	19	1,033
TN	5.1	2.23	0.36	14.03	11	2	72
TX	329.1	2.31	0.40	15.09	761	130	4,965
UT	72.4	2.36	0.40	19.66	171	29	1,424
VA	4.6	1.78	0.26	16.40	8	1	76
VT	29.2	2.11	0.32	19.71	61	9	575
WA	127.6	2.23	0.37	11.57	285	47	1,476
WI	10.8	2.30	0.38	15.29	25	4	165
WV	93.7	1.51	0.21	10.41	142	20	976
WY	0.2	1.41	0.20	9.69	0	0	2
Oth Sts	111.4	1.63	0.22	10.42	182	24	1,160
US	**6,234.5**				**14,658**	**2,358**	**97,618**

2.2 Conversion costs and investment requirements

Each of the various egg production systems has some pluses and minuses. Cage systems provide a safe and sanitary environment for the hens and result in production of very clean eggs and low production costs due to high feed conversion ratios. On the negative side they constrain the birds' ability to engage in normal activities like nesting, dust bathing and perching. Cage-free systems give hens more room to move around but they result in higher feed costs, lower egg production per bird, problems due to feather pecking and cannibalism, and increased mortality. And nothing good can happen when birds and eggs are in contact with manure. Flocks with outside access are also vulnerable to transmission from wild birds of Highly Pathenogenic Avian Flu and other diseases.

In 2008, voters in California passed Proposition 2, which will effectively ban cage systems by 2015. Studies show that this will result in the elimination of most egg production in the state because consumers will just buy lower cost eggs produced in other states. It is possible that such bans will spread, either on a state by state basis or through national legislation.

2.2.1 Industry adjustment to a cage-free mandate

Taking the extreme case of a national ban, there will be three sets of impacts. First, there will be very large costs involved in converting existing layer and pullet houses and investing in the additional houses that will be needed due to lower bird populations per house. Second, there will be higher costs to consumers for eggs that continue to be produced in the United States. Third, there will be a significant increase in imports of eggs from countries that do not prohibit cage systems. Industry experts point to countries like Mexico, Brazil and Argentina as the potential suppliers.

Implementation of any ban would have to be spread over a number of years due to the significant challenges involved. A change of the magnitude of a cage-free mandate is difficult to model but we can expect the main impacts to be as follows:

- Most but not all of the existing layer houses will be gradually converted to either floor or aviary systems, with lower bird populations and higher production costs. We assume 20% of current houses will not be converted because they are either too small, too big, too old, or would leave a firm with too little volume to be economically viable.
- Pullet houses for layers are currently 94% cage systems and will need to be converted as well.
- Major investments in new layer houses and associated land and infrastructure will be required due to the reduced capacity of both the existing and the new houses.
- As production costs rise and are passed through to the retail level, there will be a small decline in egg consumption. Demand is relatively price inelastic, so a 25% retail price increase might result in a 1.4% decline in consumption.
- Imports of eggs from countries that continue to permit the use of cage systems will rise. For purposes of our analysis we assume imports of shell and breaker eggs will rise to 10% of total use, i.e. imports per capita will be about 25 eggs. Those eggs will be priced below cage-free eggs but above the current cost of US-produced cage eggs.

The 77 billion eggs currently consumed would fall by about 1.4% to 75.9 billion due to higher prices. If we assume that imports capture 10% of that market, domestic egg farms would have to supply about 68.3 billion eggs. Average egg production per hen is currently 265 per year. That would fall 6.5% to 248 eggs in a cage-free environment. We would therefore need 276 million layers to produce the required eggs. About half of that could come from existing facilities after renovation. The other half would require construction of additional facilities.

Chicks raised to be layers grow up for about 20 weeks in pullet houses. Pullets destined for barn or aviary systems are raised in that system. Pullets headed for cage systems are raised in cage systems. About 250 million layers are raised each year. Total pullet capacity is currently 105 million birds. The reduction in capacity needed after conversion of everything to cage free is the same as the reduction in the number of layers needed. Therefore capacity for 103.4 million birds would be necessary.

2.2.2 Conversion costs

The cost of current cage-free production methods in the United States is higher than for modern cage housing production. As discussed further below, that is because of higher costs for pullets, housing, feed and labor. Existing modern cage system layer and pullet houses could be converted to conventional cage-free systems but the capacity of each house would be reduced by 50-80%, depending on how much one is willing to spend, and on the system adopted.

Equipment manufacturers provided various cost estimates for converting cage to cage-free and for building new cage-free facilities. Conversion costs are estimated by industry sources at anywhere from $10 per hen to $30 per hen, depending on the type of building one is starting with and the cage-free system adopted. For layers, renovation averages $14 per hen for aviary systems and new construction averages $28. For pullets, the costs are lower at $12 and $17 per hen, respectively, because one does not need egg collection systems.

Building & Equipment Costs		
	Layer	Pullet
	$ per bird	
Renovation	14	12
New construction	28	17

In the absence of a mandate there is no rationale for making that investment. The market demand for cage-free eggs is already being met so the additional eggs would have to be sold as commodity eggs and an egg farm would not recover its additional costs.

The table on the next page traces our calculation of the costs involved in converting cage systems to cage-free systems, and the investment in new buildings, equipment, land, and utilities needed to meet market demand. Egg production facilities vary widely in size. Most are between 20,000 and 400,000 layers. We use 100,000 as an average size, and estimate that these houses would hold an average of 50,000 birds after conversion to aviary systems. We assume that new construction will involve bigger houses with populations of 100,000 to achieve necessary efficiencies.

Layer Capacity Required for Cage-Free Production

Item	Unit	Amount	Factor
Current table egg consumption	billion eggs	77.0	
Price increase	percent	25.0	
Consumption decline, price elasticity	percent	-1.425	-0.057
New consumption	billion eggs	75.9	
Import displacement	billion eggs	7.6	10%
Production requirement	billion eggs	68.3	
Current eggs per layer	number	265	
Reduction for cage-free	number	248	6.5%
Layer capacity required	million birds	275.7	

Building and Equipment Costs for Conversion to Cage-Free

Item	Unit	Amount	Factor
Layer capacity in 2009	million birds	280.0	
Current cage free	million birds	14.0	5%
Current cage	million birds	266.0	
Not suited for renovation	million birds	53.2	20%
To renovate	million birds	212.8	
Houses @100,000	number	2,128.0	
New capacity @50,000	million birds	106.4	
Renovation cost	$ million	1,489.6	$14/hen
Renovated + existing cage free	million birds	120.4	
New capacity needed	million birds	155.3	
New houses needed @100,000	number	1,553.0	
Construction cost	$ million	4,348.5	$28/hen
Land, roads, utilities for new capacity	$ million	139.8	$90,000
Total cost for layer houses	**$ million**	**5,977.9**	
Pullet capacity in 2009	million birds	105.0	
Current cage free	million birds	6.3	6%
Current cage	million birds	98.7	
Pullet capacity required	million birds	103.4	
Not suited for renovation	million birds	19.7	20%
To renovate	million birds	79.0	
Houses @100,000	number	789.6	
New capacity @50,000	million birds	39.5	
Renovation cost	$ million	473.8	$12/hen
Renovated + existing cage free	million birds	45.8	
New capacity needed	million birds	57.6	
New houses needed @100,000	number	576.5	
Construction cost	$ million	980.0	$17/hen
Land, roads, utilities for new capacity	$ million	51.9	$90,000
Total cost for pullet houses	**$ million**	**1,505.6**	
Total cost	**$ million**	**7,483.5**	

Renovation of existing layer houses to achieve additional cage-free capacity of about 106 million birds would cost almost $1.5 billion. Construction of houses for the additional 155 million hens needed would cost almost $4.5 billion. The total cost for buildings and equipment is estimated at $5.65 billion. In addition, companies would need to purchase additional land, get permits, pour foundations, and put in roads, wells and utilities. These costs are estimated at $90,000 per building, or $140 million for the 1,553 new layer houses, bringing the total investment required to $6.0 billion.

Renovation of the existing pullet capacity would cost $0.5 billion and construction of 577 new houses would cost another $1.0 billion. Altogether, even after losing 10% of the market to imports, the industry would have to invest $7.5 billion to convert to 100% cage-free egg production systems.

2.3 Effect on egg production costs per dozen

There is ample evidence that the cost of cage-free production is significantly higher than in modern cage housing systems. In the European Union, where that change has been taking place for some time, various studies have documented the cost differentials. The International Egg Commission has reported that barn systems have 21% higher costs and free-range has 50% higher costs.

In California, a university poultry specialist published a comparison of selected 2005 production costs under different systems. That study estimated that producer costs in California were 27% higher for eggs produced in conventional cage-free housing and 66% higher for free-range egg systems compared to eggs produced in modern cage housing systems.

Production costs for eggs in cage-free systems are significantly higher than in cage systems for a number of reasons. For reasons that should be clear from the preceding discussion, housing costs are higher. Lower density, the lower number of eggs produced per hen (partly due to higher mortality), and the need for auxiliary heating all contribute to much higher costs per dozen for housing.

Feed costs are higher in cage-free systems because with additional space the hens are more physically active and also consume more just to maintain body temperature. Pullet costs, spread over lifetime production of the hen, will be higher because they are conventionally raised in the same system that they will live in as hens. Thus the higher housing and feed costs, spread over lower egg production, result in a higher pullet cost per dozen eggs from cage-free systems.

Finally, labor costs are higher for barn floor or aviary systems. One worker can manage about three times as many layers in cages as he can in cage-free systems. In the latter, some of the eggs are laid outside the nest box and must be collected by hand. These "floor eggs" also tend to be dirty, damaged, or contaminated with bacteria, resulting in a certain percentage of production that is downgraded or unmarketable.

A 2008 University of California study estimated costs for the two different systems based on producer records for three preceding years. Costs for each system vary by producer, by flock, and by time period so the study showed the range of costs. The relevant table from the study is reproduced below.

Comparing the mid-points of the cost ranges, the $1.05 per dozen cost for cage-free eggs exceeded cage egg costs of $0.745 per dozen by 41%. Comparing the low ends of each range, the cage-free costs were 70% higher. These comparisons do not take into account the fact that eggs from cage-free system are 3-5% smaller on average. European studies show that the total weight of eggs produced per hen is about 10% lower in cage-free systems.

Comparison of production costs between cage production system and non-cage production system in cost per dozen

Production factor	Cage production system range and median (dollars per dozen)	Non-Cage production system range and median (dollars per dozen)	Cost Differential Non-Cage minus Cage System using mid-points	Cost differential Non-Cage minus Cage System using low costs
Pullets	0.09 - 0.11 0.10	0.14 - 0.17 0.155	0.55	0.05
Feed	0.28 - 0.45 0.365	0.35 - 0.50 0.425	0.06	0.07
Housing	0.05 - 0.14 0.095	0.09 - 0.37 0.23	0.135	0.04
Labor	0.03 – 0.04 0.035	0.07 – 0.19 0.13	0.095	0.04
Sum of the itemized costs and difference at the mid-points	0.595	0.94	0.345	
Sum of the itemized costs and differences at the low costs	0.45	0.65		0.20
Percentage cost difference based on the sum of items			0.345/0.595= 58%	0.20/0.45= 44%
Total Cost	0.57 - 0.92 0.745	0.97 – 1.13 1.05	0.305	0.40
Percentage cost difference			0.305/0.745 = 41%	0.40/0.57 = 70%

Source: Sumner, Daniel A. et al, "Economic Effects of Proposed Restrictions on Egg Laying Hen Housing in California", University of California Agricultural Issues Center, July 2008, page 99.

2.4 Impacts on egg prices and US consumers

How do these higher costs at the farm level translate into consumer price impact? This is not something that can easily be derived from existing econometric models. The structural change that the industry would go through in transitioning from cage to cage-free would be dramatic. Such models reflect only the existing structure. However, the general magnitude of the impact can be estimated based on cost structure.

As discussed earlier, the margin between producer and retail prices varies. For the 1999-2008 period, the producer price averaged 42.5% of the retail price. If that portion rises 41% and the producer-to-retail margin is constant, the retail price rises 17.4% (0.41 times 42.5). If that portion rises 70%, the retail price rises 29.8% (0.7 times 42.5). However, the producer to retail margin would likely rise due to greater expenses for breakage or spoilage of the higher cost eggs. We therefore estimate that the retail price to consumers would rise about 25%.

During the first half of 2009, retail prices averaged $1.69 per dozen. A 25% increase would be $0.42 per dozen, bringing the total price to $2.11 per dozen, 5 percent higher than the record levels of 2008. On consumption of 76 billion eggs, a price increase of $0.42 per dozen would add up to a $2,660,000,000 increase in costs to consumers.

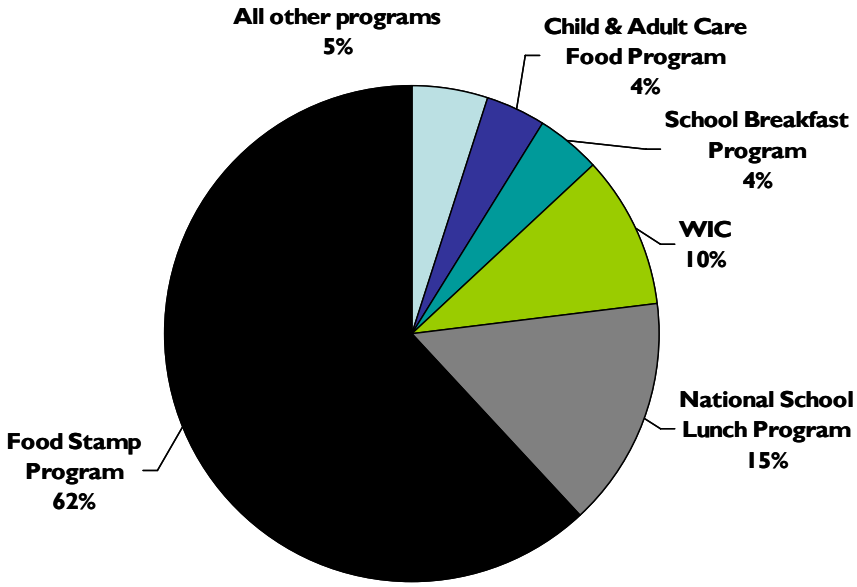
2.5 Impacts on Federal food assistance programs

A national requirement for cage-free egg production would also result in increased federal outlays on food and nutrition assistance programs due to the increased egg prices discussed above. There are significant quantities of eggs used in the school lunch and breakfast programs, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and the Supplemental Nutrition Assistance Program (SNAP – formerly the Food Stamp Program). During the 2008 fiscal year, the Federal government spent $60.7 billion on the various programs, with SNAP being the largest, as illustrated in the following chart.

We estimate that about $677 million was spent on eggs under the various programs. Consequently, a 25% increase in egg prices would result in a $169 million increase in Federal outlays on these programs. (This is a subset of the total consumer cost impact discussed above.)

In the case of the school lunch and breakfast programs, the most recent data available on the types of foods purchased for these programs is from a USDA study covering the 1997/98 school year – School Food Purchase Study II. The study was a sample survey and recorded both the pounds and the cost of each type of food purchased. The items purchased included eggs in various forms and egg entrees. While some of the egg entrees include other ingredients, eggs are also ingredients in other food items not tabulated, such as baked goods and mayonnaise.

USDA Expenditures for Food and Nutrition Assistance Programs, FY 2008



In the table below we have adjusted the 1997/98 data for the 39% inflation since that year and the 28% increase in school enrollment. This results in estimated current purchases of $47 million annually.

Egg Purchases for School Lunch & Breakfast Programs

Expenditures	Total acquisitions
Acquisitions - ALL FOODS	$ 8,285,046,272
Eggs, fresh	$ 9,880,907
Eggs, raw, no shells	$ 15,461,977
Eggs, dry	$ 7,002,644
Eggs, hard cooked	$ 1,337,263
Egg whites	$ 447,935
Egg patties, cooked	$ 2,074,645
Egg patties w/cheese	$ 2,039,549
Egg entree, crust/cheese/meat	$ 6,704,066
Egg entree, crust/cheese	$ 2,398,094
Egg salad	$ 1,533
Total (egg)	$ 47,348,612

In the case of the WIC program, eggs have been a major component of authorized food packages. USDA's Economic Research Service estimates that approximately $100 million was spent on eggs under the program in FY2008. With higher egg prices, costs would either rise proportionately or some states might

cut back on the amount of eggs included in approved packages for WIC recipients due to budget constraints. If the latter course is chosen, it would reduce the availability of this high quality protein source to this vulnerable population.

For the $42.4 billion spent on the Food Stamp, Child & Adult Care, and all other programs, we can only assume that eggs make up the same proportion of total consumption as in food consumption generally. For the Consumer Price Index, the Bureau of Labor Statistics assigns eggs a weight that is 1.25% of the total weight for food at home. That represents $530 million of expenditure on eggs under these programs.

Thus total estimated expenditures on eggs under all of the food assistance programs were the sum of $47, $100, and $530 milllion, or $677 million, and a 25% increase would be $169 million. (Purchases for the school lunch and breakfast programs are at prices less than retail prices, so the percentage increase due to a cage-free requirement would actually be greater than 25% but would not change the general order of magnitude.)

2.6 Impact on land use, the environment, and carbon footprint

2.6.1 Additional land requirement

A conversion of US egg production from conventional housing systems to cage-free systems nationwide will not only result in changes in consumption, trade flows, and production but also require significantly more feed use for table egg production, and accordingly greater cultivated acreage to supply increased feed demand.

To calculate the estimated change in feed use and the corresponding increase in acreage to supply that feed, we first established the following set of baseline assumptions to compare the impact of cage-free production in the egg layer industry:

- We estimate current table egg consumption to be 77 billion eggs, of which 95 percent are raised using conventional flock management systems and 5 percent are raised using alternative flock management systems.
- Overall egg consumption will decline approximately 1.4 percent, due to higher prices. Based on the price elasticity of demand, each percentage change in price causes a corresponding opposite but smaller percentage change in consumption. In this case, since cage-free egg production increases retail prices approximately 25 percent, there is a 1.4% consumption decline.
- Table egg imports would rise to account for an estimated 10 percent of total egg consumption. These would continue to be cage eggs. Since most imports would likely be from Mexico, the incremental Mexican eggs would be produced using US corn and soybean meal.
- Therefore, the mix of eggs consumed would shift from 95 percent conventional cage production and 5 percent alternative egg production in the current case, to 10 percent imported conventional production and 90 percent domestic alternative egg production in the case of a cage-free mandate.
- Feed conversion rates (FCR) for alternative management systems are higher than FCR values for conventional flock management systems. The FCR is critical in determining potential changes in

feed requirements due to conversion of flock management. Conversion rates from the literature are presented in the table below.

- The FCR is used to determine the metric tons of feed needed to produce the corresponding volume of eggs defined for US consumption needs above.
- US layer rations are composed of 80 percent corn and 20 percent soybean meal.
- Soybean meal makes up 80 percent of whole soybeans by weight. Therefore, each metric ton of soybean meal requires 1.25 MT (46.9 bushels) of soybeans for its production.
- Conversion factors for metric tons to US units:

Corn (56 pound bushel)	39.369 bushels
Soybeans (60 pound bushel)	36.743 bushels
1 metric ton	1.10231 short tons

- Long-term trend yields per acre are used to determine cultivated area needed to meet demand:

Corn	159 bushels per acre
Soybeans	43 bushels per acre

Feed conversion rates for specific layer management systems

Country	Management system	Spatial Allowance		FCR	Source
		in^2	cm^2	kg/kg	
US	Conventional cage	67	432	2.04-2.15	Bell, UCR 2009
Germany	Enriched cages	124	800	2.08	Flock et al, 2008
Netherlands	Enriched cages	85	550	2.11	Tacker et al, LEI, 2003
France, Denmark	Enriched cages	85	550	2.13	EU/AgraCEAS, 2005
Austria	Cage-free			2.41	EU/AgraCEAS, 2005
Germany	Barn, trimmed			2.24	Flock et al, 2008
Germany	Barn, untrimmed			2.36	Flock et al, 2008
EU	Barn, floor			2.33	LayWel, 2004
EU	Aviary (Barn, tiered)			2.52	LayWel, 2004
Denmark	Free-range	6,200	40,000	2.48	Hegelund et al, NJAS 54-2, 2006
Denmark	Organic	6,200	40,000	2.79	Hegelund et al, NJAS 54-2, 2006

For current US cage egg production, the average amount of feed required to produce a dozen eggs is slightly less than 3.4 pounds. This reflects a mix of single cycle flocks and flocks that molt and go through a second period of egg production. On a weighted basis, this represents a feed conversion ratio of 2.12, i.e. 2.12 pounds of feed to produce one pound of eggs. We analyzed three cage-free systems to measure the potential additional acreage needed to produce the required feed:

Case	Source	Description
A	LayWel	multi-tier non-cage systems such as aviaries
B	Hegelund	free-range with minimum area per hen of 4 square meters (43 square feet)
C	Hegelund	organically raised free-range brown layers housed as in Case C

One billion eggs weigh over 59,000 metric tons, so total US consumption amounts to more than 4.5 million metric tons and requires 9.7 million tons of feed. We compare this to three post-conversion scenarios in which 90% of the eggs come from alternative cage-free domestic sources and 10% are imported cage eggs. Industry sources indicate that most conversions and new construction will be aviaries rather than barn floor systems for labor cost and other efficiency reasons. In the case of free range production, there is no official US standard, but the European Union requires a minimum of four square meters per hen, or about 43 square feet. This is the equivalent of about 1,000 birds per acre.

As the table below indicates, converting to aviaries that use 19% more feed would increase total feed requirements by 15%, and harvested area by 588,000 acres after allowing for the consumption decline. If all domestic production were free-range, there would be a 13% increase in feed requirements and 523,000 additional acres of corn and soybeans would be needed. Thus some combination of aviary and free-range systems can be expected to require planting of about 580,000 more acres of cropland, with the attendant water use and environmental impacts. Completely organic production would require no less than 1,000,000 more acres, and probably much more due to lower yields for organic corn and soybeans.

Acreage Increase For Additional Feed For Cage-Free Production

Case	**A** Aviary	**B** Free-range	**C** Organic
Total feed change in MT	1,428,326	1,266,945	2,517,648
Total feed % increase	**15%**	**13%**	**26%**
Corn bushels	44,985,409	39,902,682	79,293,817
Corn acres	282,927	250,960	498,703
SBM short tons	314,892	279,313	555,046
Soybean bushels	13,120,244	11,637,839	23,126,482
Soybeans acres	305,122	270,647	537,825
Total additional acres	588,049	521,608	1,036,528

One other complication for free-range or organic production is the amount of land needed for the layers themselves. At the EU stocking density of 1,000 per acre, one would need as much as 400,000 acres of pasture for the layers and pullets. That is an area almost twice as large as the area inside Washington's Capital Beltway.

2.6.2 Environmental impacts

Recent studies on the sustainability of egg production conclude that modern laying-hen facilities have the lowest environmental impacts, followed by aviary or barn systems, and then free-range production methods, which have the greatest environmental impacts.[1]

[1] De Boer, I.J.M. and A.M.G. Cornelissen, A method using sustainability indicators to compare conventional and animal-friendly egg production systems, 2002, Poultry Science 81:173-181

In terms of resource utilization efficiency, aviary or barn systems require approximately four-times as much land use for production, 15-25 percent greater feed use, and significantly greater energy use. Free-range production systems require even greater land use for production, 19 to 33 percent greater feed use (including the feed from forage), and 15 percent greater energy use.

Higher feed use requires the transport of larger volumes of feed grains, which have been estimated in Carbon Lifecycle Analysis to account for the largest share of the overall atmospheric emissions for broiler production.[2] Although the final consumer products from layers and meat chickens are uniquely different, the primary inputs for table egg production and broiler meat are similar. Both consume corn and soybean based feed rations to convert to protein for human consumption.

Moreover, factors such as indoor air quality, ambient lighting, temperature, and ventilation, as well as atmospheric dust emissions, are managed more efficiently in modern environmentally controlled cage systems. Comparative studies indicate that indoor air-quality of non-cage (deep litter) production systems is significantly degraded in comparison to high rise or belt removal-equipped hen houses. Ammonia levels are 300 to 600 percent higher than those found in conventional cage layer houses due to higher pH in droppings, and lower temperatures in the non-cage house. European studies also indicate higher levels of particulate matter found in non-cage hen houses, causing higher dust emissions and lower environmental air quality.

Poultry manure in free-range management systems also becomes problematic as phosphorous concentrations accumulate over time, possibly leading to phosphorous run-off.

There have been no comprehensive studies of the carbon footprint of alternative flock management systems in the United States. However, the higher feed consumption, the transportation of that feed, the greater distances traveled by imported eggs, and the need for auxiliary heating in cage-free houses will dictate that the more resource intensive cage-free systems will have the greater carbon footprint.

2.7 Conclusions

The US egg industry's modern cage housing systems provide laying hens a safe and sanitary environment, and the industry makes an important contribution to national economic activity and employment. Any national requirement that would prohibit cage housing systems would have major negative impacts. Shifting all production to cage-free flock management systems would require billions of dollars of investment by the industry, increase production costs significantly, and raise costs to consumers by an estimated 25% or $2.66 billion annually. Federal outlays on food assistance programs would rise by an estimated $169 million.

Imports of eggs from Mexico and other countries would increase considerably because they will still be produced in conventional cage systems and will be cheaper. Most consumers prefer lower cost eggs.

[2] Pelletier, N., Environmental performance in the US broiler poultry sector: Life cycle energy use and greenhouse gas, ozone depleting, acidifying and eutrophying emissions, 2008, Agricultural Systems 98:67-73.

Hens in cage-free systems consume more feed and produce fewer, smaller eggs. The 3 billion pounds of additional corn and soybean meal needed for cage-free production would require US farmers to plant approximately 580,000 more acres to corn and soybeans, increasing the pressure on our agricultural resource base. Producing all our eggs in free-range systems would take an additional 400,000 acres for housing the hens.

Cage systems have smaller environmental and carbon footprints. They use less land, less feed, and less energy, and they have lower mortality. They permit better control of air quality and keep hens safe from predators, feather pecking, cannibalism and transmission of disease from wild birds. The additional miles of transportation associated with a rising level of imports would add significantly to the carbon footprint of cage-free production systems.