Economic Impacts of Converting US Egg Production to Enriched Cage Systems

A Report for
United Egg Producers

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1. EXECUTIVE SUMMARY

Legislation now pending before Congress (H.R. 3798 and S. 3239) would amend federal regulation of the egg industry to require that existing cage systems for egg layers be gradually replaced with what are called enriched or furnished cages. These larger cages provide more space per hen and permit them to more freely engage in normal chicken behaviors like wing-stretching, perching and scratching. Most of the transition would be complete within 15 years, with 100% conversion by December 31, 2029.

Our assignment in this study has been to estimate the economic impact on capital investment, production costs, and consumer prices if the legislation is passed by the Congress and signed into law. We compare the situation with the legislation to a baseline scenario that reflects recent developments at the state level. In brief, the impacts would be the following, in 2012 dollars:

- Capital investment by the industry over the next 18 years would increase by an average of $143 million per year, from $3.1 billion under current law and practice, to $5.7 billion with the legislation.
- Average production costs at the farm level over the 18-year transition would increase by an average of 4% or one-quarter of a cent per egg, but would be up only 1.5 cents per dozen relative to the baseline scenario. By 2030, production costs will have increased by 12.7% or about three-quarters of a cent per egg, and be about 6 cents per dozen above the baseline scenario.
- The average impact on consumer prices during the 2013-2030 period would be an increase of about 1% based on the same 1.5 cents per dozen increase due to higher farm level costs. By 2030, retail prices would be up by 5% due to the three-quarter cent increase per egg in farm level production costs, but up only a half-cent per egg relative to the baseline scenario.

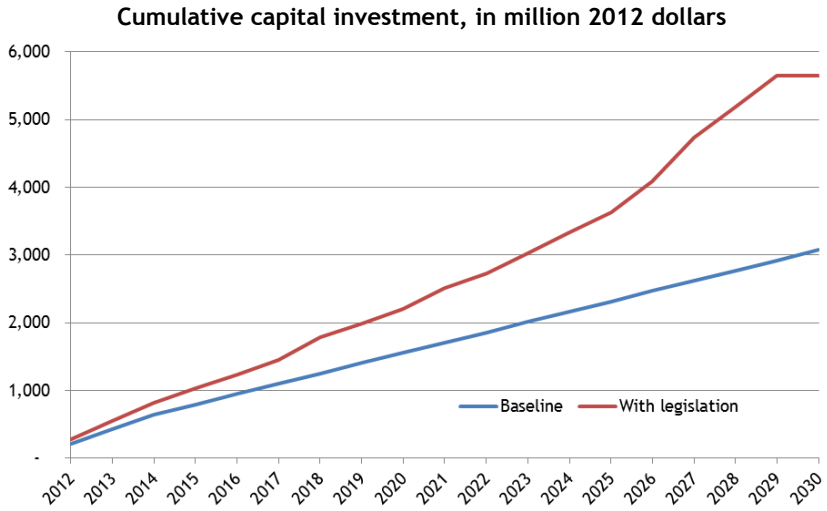
It should be underlined that the pattern of "normal" reinvestment would be seriously disrupted if the regulatory framework in states becomes a patchwork of many different standards. Also, some producers may decide to phase in their investments more quickly than the draft legislation requires.

The rather low average impacts on production costs and consumer prices for the 18-year period are due to the fact that there is a very gradual transition, with an average of 65-70% of hens being housed at traditional densities over that timeframe.

Capital investment

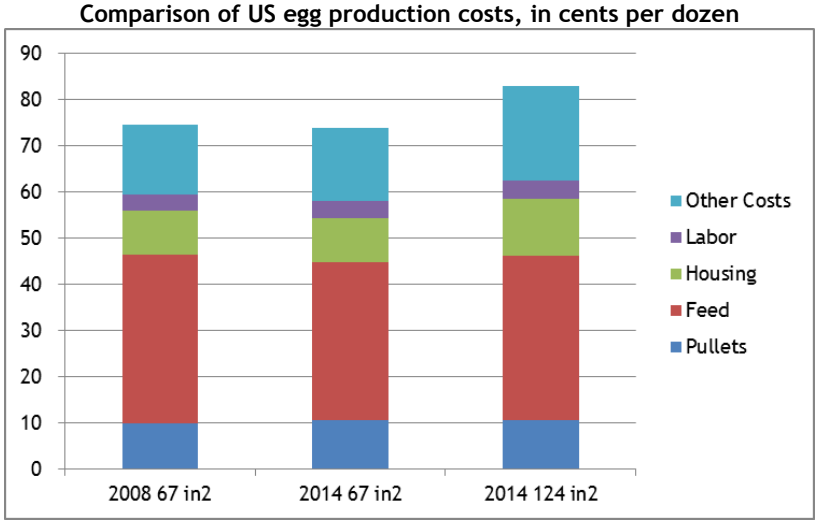
Since each hen will be given more space, the existing stock of layer facilities will not be sufficient to house the required number of hens. A significant portion of these will be suitable for renovation but there will also be a great deal of new construction. Some existing facilities are simply too small, too old, or of the wrong shape to warrant renovation.

Based on discussions with equipment suppliers and egg companies, we estimate the investment cost for enriched cages at $24 per hen for new construction and $20 per hen for renovations. If the enrichments (perches, scratch pads, etc.) are added later, the total cost is one dollar higher. We developed a baseline of normal reinvestment in conventional cages as buildings and equipment wear out, and compared it to what the legislation would require. Cumulative investment for the two scenarios is illustrated below, in 2012 dollars.



Production costs

Evidence from Europe, where the evolution of cage systems is more advanced, and from California where there is already some investment in enriched cages, provides a basis for cost comparison. The European research shows that total production costs in enriched systems like those required by the legislation are about 12.5% higher. We develop estimates for the United States for conventional and enriched cages, using USDA's projected costs for corn and soybean meal in 2014, that are similarly constructed and that are illustrated below. Labor costs are about 9% higher for enriched cage systems because a worker is able to manage fewer hens. Experience in California indicates that feed consumption is about 4% higher, due mostly to feed being put down on scratch pads. We estimate that housing and "other" costs would both be 30% higher as they are spread over fewer hens. Total costs for eggs produced in enriched cages are estimated at 81.9 cents per dozen in 2012 dollars, up about three quarters of a cent per egg or 12.7% compared to the 72.7 cent estimate for eggs from conventional cage systems.



Source: Agralytica

Consumer prices

If there were a sudden 9.2 cent increase for cage eggs at the farm level in 2013 that was fully passed through to the final consumer, the consumer price increase would average 5 percent. However, the transition is a gradual one and an average of 65-70% of hens remain at the conventional spacing during the transition. The legislation requires that eggs be labeled as to type of production and we expect that prices for the various categories of eggs would reflect their relative production costs. Eggs from enriched cages would sell at a slight premium, reflecting the increased costs related to providing greater space in furnished cages. And cage-free and free-range eggs would sell at their traditional premium.

Our conclusion is that most of the impact on consumer prices will not occur until well into the 2020s, and will probably average a 1% increase relative to the baseline (1.5 cents per dozen) over the 18 years due to the change in production costs at the farm level. If margins at wholesale and retail expand, the increase could average more than that, but should still be a fraction of a cent per egg.

Because customer expectations and consumer demands are changing, it is not certain that the proposed legislation would actually increase consumer prices beyond what might occur in its absence. This is because egg prices may well end up higher than we assume in our baseline case if the demand for higher cost cage-free eggs grows more than we have assumed, and/or customers increasingly demand a transition to enriched cages, especially once California's Proposition 2 and other state laws are in place. If either or both of these things happen, consumer prices might increase as much as or more than would be the case under the legislation. And in any case, it is worth noting that year-to-year fluctuations in feed costs, packaging and distribution costs, and other factors could well exert an upward or downward impact on prices that would exceed any change attributable to the proposed legislation.

2. INTRODUCTION

2.1. Background on egg layer housing

In the United States and worldwide, most eggs are produced in facilities where the hens are confined in cages in buildings in order to maintain sanitary conditions and minimize aggressive behavior. Until recently, 96% of US eggs have been produced in cage systems, with the remainder being produced either in barns or aviaries, or in free-range conditions. However, over the last couple of years, new investment in aviaries has been increasing the production of cage-free eggs.

In July 2011, United Egg Producers (UEP) and the Humane Society of the United States (HSUS) jointly announced a plan to ask the Congress for legislation requiring that most existing cage systems for egg layers be gradually replaced with what are called enriched or furnished cages. These larger cages provide more space per hen and enable them to more freely engage in normal chicken behaviors like wing stretching, perching and scratching.

The two organizations had been at loggerheads over what constitutes proper welfare for egg layers. The UEP had developed voluntary standards, endorsed by veterinary associations, which most of its member companies adhered to. These standards provide for specific minimum space requirements and various production practices. The HSUS had argued that those standards were inadequate and had been launching campaigns at the state level, either through ballot initiatives or legislation, to require more generous space requirements for chickens and other species.

Both organizations spent a lot of money fighting these battles and state legislatures were beginning to create a patchwork of different requirements around the country. Animal welfare legislation, not all affecting eggs, had passed in Arizona, California, Colorado, Florida, Michigan and Ohio, and HSUS was targeting another half dozen states. In California, the 2008 passage of Proposition 2 and subsequent legislation requiring that all eggs marketed in the state be produced using the same standards applicable in California had major implications for egg producers in other states that supply about half the eggs used in California. The prospect of needing to have different production systems for shipping to different states was undermining the whole concept of a national egg market and held out the prospect of a major market disruption and substantial additional associated costs.

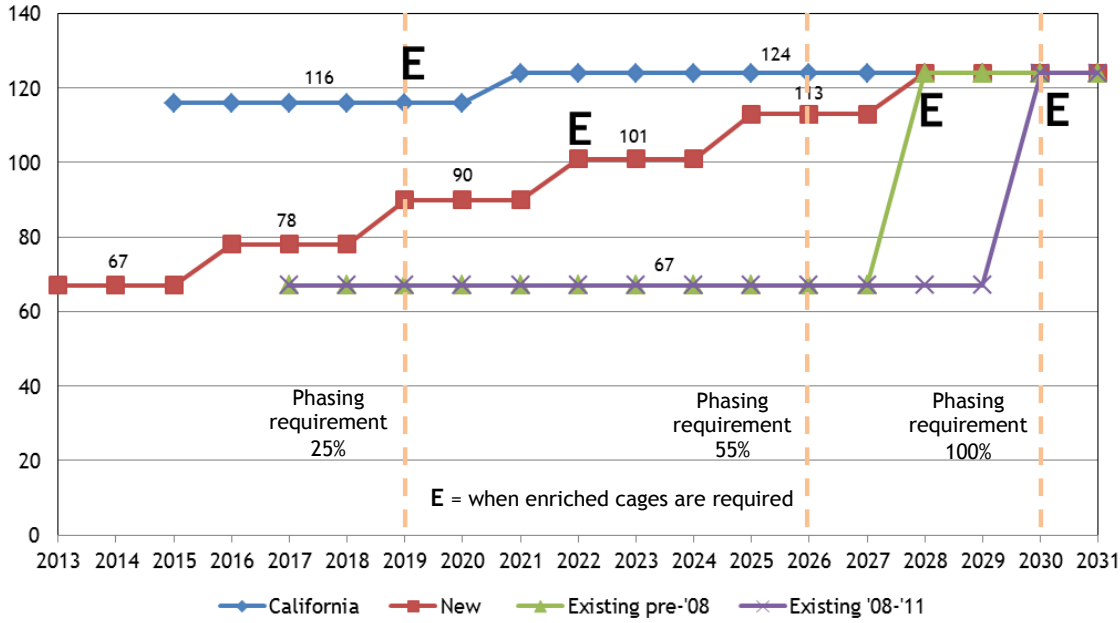
The result of this dialogue was an agreement between the two organizations to jointly work to convince the Congress to amend the Egg Products Inspection Act to require various steps. Legislation introduced in the Congress (H.R. 3798 and S. 3239) would require the following:

- For existing cage systems, implement the following minimum space requirement, in square inches:
  - 4 years from enactment, 67 for white hens and 76 for brown hens
  - 15 years from enactment, 124 for white and 144 for brown, fully enriched, except that cage systems installed between 2008 and 2011 would have until 12/31/29 to meet the requirement
  - California would be subject to a faster timetable of 116 for white and 134 for brown by 1/1/15, and 124 and 144 by 1/1/21
- For new cages, implement the following minimum space required in square inches:
  - Three years from enactment, 78 for white and 90 for brown, all enrichable
  - 6 years from enactment, 90 for white, 102 for brown, enrichable, and at least 25% of the total industry must be at that spacing
  - If not at 25% by 12/31/18, all equipment older than 1995 must be converted or closed
  - 9 years from enactment, 101 for white and 116 for brown, fully enriched

- 12 years from enactment, 113 for white and 130 for brown, fully enriched, with at least 55% of entire industry at that spacing
- 15 years from enactment, 124 for white, 144 for brown, fully enriched.
- By 12/31/29 all layers would have to be in enriched cages with 124 or 144 square inches per hen.
- All eggs would be labeled as to production method
- Finally the legislation stipulates humane treatment standards with respect to euthanasia, forced molting, air quality, and other production practices.

Figure 1 below, using white hens as an example, shows when the various space and enrichment requirements must be met if the law takes effect on January 1 of 2013. Most layers are white hens. White hens lay white eggs and brown hens lay brown eggs. Retail scanner data for 2010 from IRI indicated that virtually all free range eggs are brown, about 85 percent of cage-free eggs are brown, and about 5 percent of cage eggs are brown. At that point in time an estimated 9 percent of all eggs were brown. Currently we estimate that about 11 percent are brown.

Figure 1: Minimum requirements for white hens, in square inches, assuming January 1, 2013 implementation



Our assignment in this study has been to estimate the various economic impacts if the proposed legislation is passed by the Congress and signed into law. In particular, we focus on the following three key elements:

- The additional capital investment that the egg industry will have to make over the transition period.
- The effect on egg production costs over time of changing from conventional to enriched cage system.
- The impact on consumer prices for eggs.

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Before getting to those calculations, in Section 3 we provide some necessary description of the US egg industry. This assumes continuation of recent trends in consumption and relies in part on USDA's annual baseline projections of what is in store over the coming decade.

In Section 4 we first discuss the available information on capital investment in egg production. We then estimate the normal volume of capital investment each year as companies replace worn-out buildings and equipment and expand to meet growing demand.

This is followed by a forecast of how the industry would adapt to the requirements in H.R. 3798 and S. 3239. We base the forecast and calculations on a combination of published information and conversations with egg industry participants, suppliers, and observers. The key judgments and estimates that have to be made include the proportion of existing layer houses that can be converted, the relative costs of conversion and new construction, and the difference in operating costs for enriched cages. The difference between capital investment under this scenario and in the baseline scenario represents the effect of the proposed legislation, if passed.

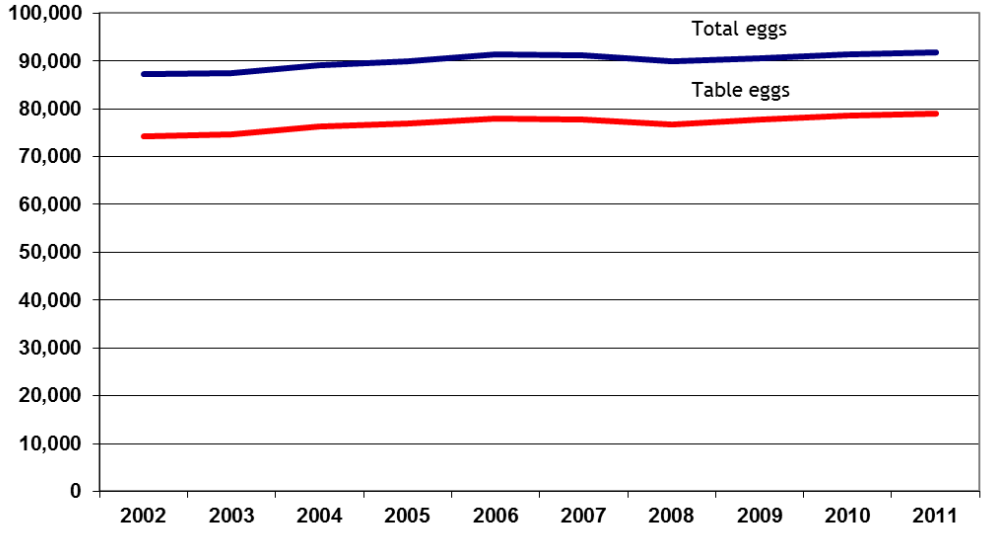
Finally, in Section 5 we discuss the differences in production costs with enriched cage systems and the likely impact on consumer prices.

3. THE US EGG INDUSTRY

The United States egg industry is the world's second largest producer of chicken eggs after China. Combined, US producers collectively care for approximately 338 million layers, which produced 92 billion eggs in 2011.

The US egg industry produces table eggs for human consumption and for 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 – 79 billion in 2011 (Figure 2). The table egg industry will be our principal focus in the balance of this study.

Figure 2: US egg production, in million eggs



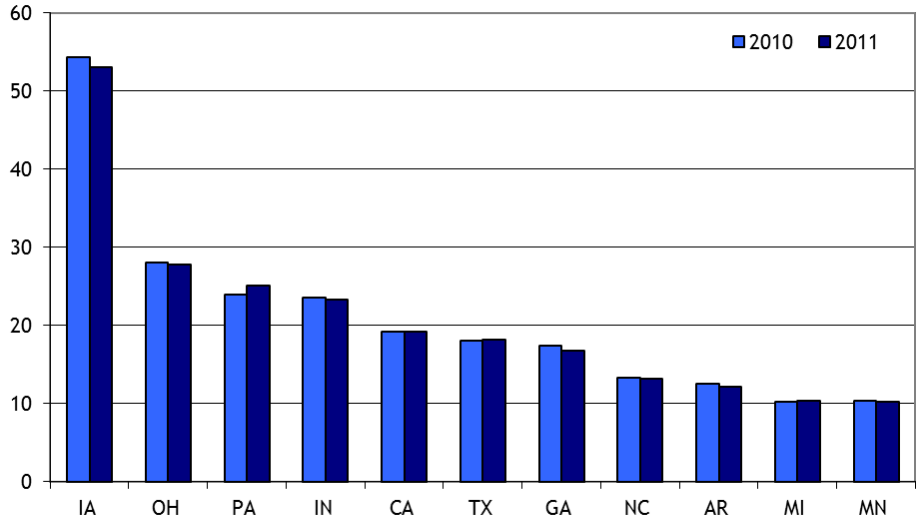
Source: USDA Chicken & Egg Summary, various editions

3.1. Size and distribution of the national flock

In 2011, the commercial egg farm sector averaged 277 million layers for table egg production. Table egg layer inventory and egg production at the national level are concentrated in a handful of states (Figure 3). The top five producing states account for 52 percent of the national flock. In 2011, Iowa alone accounted for almost 19 percent of national table egg layer inventory. Ohio and Pennsylvania take second and third place with 9.8% and 8.6% respectively.

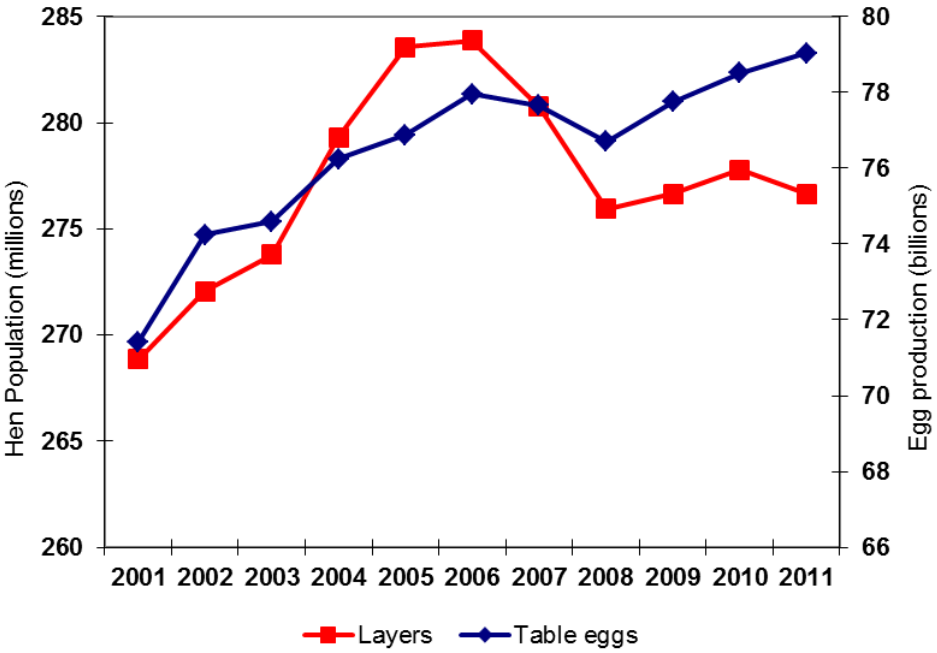
According to the 2007 US Census of Agriculture, there were 146,000 US farms with layers in 2007. However the vast majority are small-scale egg producers with no commercial significance at the national or regional level. There were 1,987 commercial farms with inventories greater than 20,000 layers. However, larger producers provide the bulk of commercially produced table eggs. According to United Egg Producers, approximately 180 egg-producing companies with flocks of more than 75,000 layers produce more than 95 percent of national egg production. These large integrated egg producers operate and manage virtually the entire production and marketing chain for fresh table eggs and egg products.

Figure 3: Layer inventory in top 10 production states, in million layers



Sources: USDA, NASS Chicken & Eggs Summary 2010, 2011

Figure 4: US layer numbers for table egg production



Source: USDA Annual Chicken & Egg Summary, 2001-2011

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 290 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.

3.1.1. Production systems

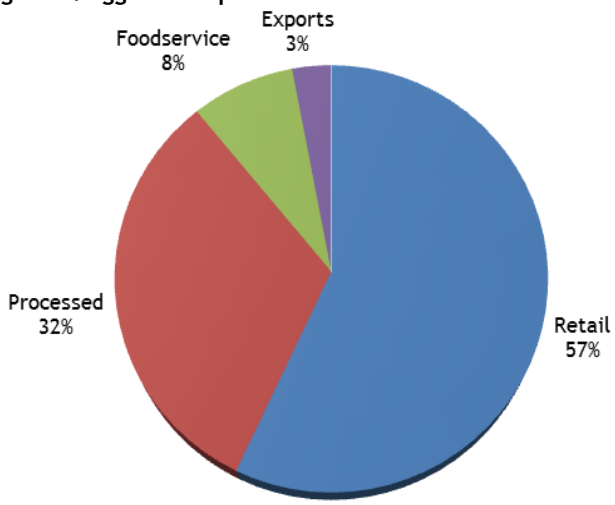
About 96% of commercial egg production in the United States in 2010 was from modern cage housing, with the other 4% coming from cage-free systems including barn or aviary raised and free range hens. The majority of US egg producers typically house laying flocks in modern, climate controlled facilities with arrangements of caged housing that distribute necessary inputs of food, water, and nutritional supplements to encourage egg 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, seating area, perches, and in some cases a dust bathing area with litter material.

3.1.2. Egg consumption

Almost two-thirds of US table egg consumption is in the form of shell eggs marketed through either retail or food service channels. Almost one third is in the form of processed egg products used in food service or food manufacturing. Exports account for about 3.5 percent of the total supply. Figure 5 shows the breakdown of end use in 2010.

Figure 5: Egg consumption and end-use estimates for 2010



Source: United Egg Producers website

3.2. Egg prices

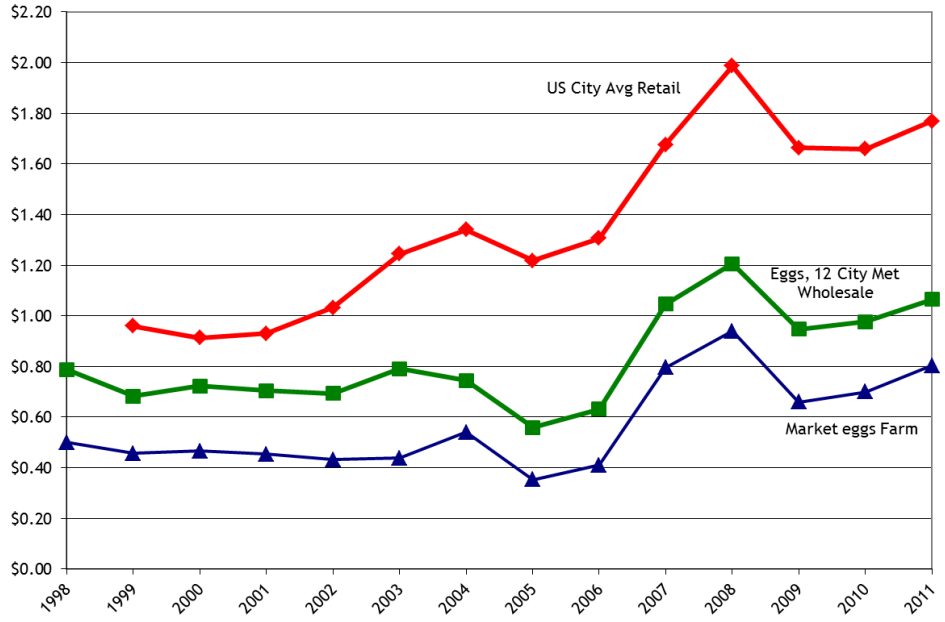
In the United States, a majority of table eggs are produced on a contract basis in which individual growers market eggs to retail vendors, distributors, and industrial consumers at a fixed or variable cost for periodic delivery.

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 and free-range eggs typically sell at retail price premiums of 100% or more above prices for standard fresh 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.

Figure 6 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 conventional 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 2011 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 2006 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. Prices edged closer to the $2 level in late 2011 and early 2012, ranging from $1.80-$1.95 for the first four months of 2012, due to firm retailer margins and the overall agricultural commodity markets as high feed costs pushed up prices at the farm level. However, farm prices fell sharply after Easter which might allow retail prices to fall back closer to the average level of the last three years. Interestingly, USDA's long term baseline projections show egg prices at the farm gate remaining at the 2011 level in constant dollars.

Figure 6: US Grade A eggs: prices by type, in dollars per dozen



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

Table 1: 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	47.6
2000	46.9	91.4	44.8	51.0
2001	42.9	92.9	47.6	48.8
2002	42.0	103.2	60.0	41.9
2003	59.4	124.4	80.6	35.2
2004	53.4	134.0	80.0	40.3
2005	35.3	121.8	86.5	29.0
2006	41.0	130.6	89.6	31.4
2007	79.6	167.6	88.1	47.5
2008	94.0	198.7	104.7	47.3
2009	65.9	166.4	100.5	39.6
2010	70.0	166.0	96.0	42.2
2011	80.3	177.0	96.6	45.4
2012				

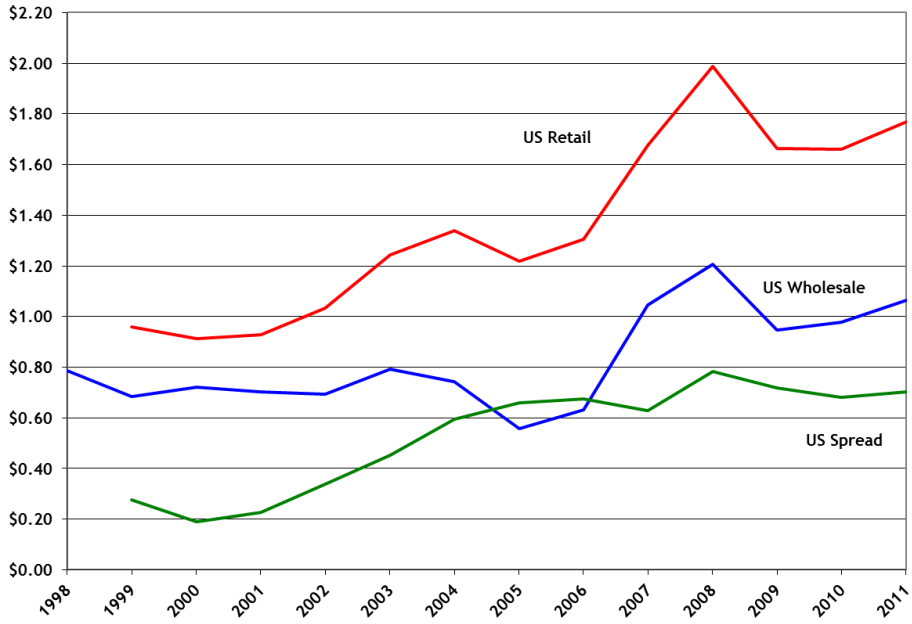
Source: USDA NASS Agricultural Prices and Department of Labor, Bureau of Labor Statistics, "Consumer Price Index Average Price Data"

The spread between farm and wholesale prices has ranged from $0.23-$0.45 per dozen over the past year. This figure is actually lower on average than during the previous decade. That reflects costs for cleaning, sorting, and packaging the eggs, and then shipping them to market in the major population centers. This trend is indicative of the evolution towards vertically integrated egg production to capture economies of scale in order to reduce production inefficiencies.

Over time, prices at the wholesale and retail levels tend to follow a similar pattern. Wholesale egg prices for volume buyers rose approximately 65 percent from 2002 to 2011. The US city average retail price basket of Grade A eggs also jumped, and exhibited a large percentage change from 2002 to 2011, increasing from $1.03 to $1.77 per dozen, or 71.5 percent.

The spread between retail and wholesale prices steadily increased from $0.20 to $0.68 per dozen from 1999 to 2005, as illustrated in Figure 7. The price spread narrowed slightly from 2005 to 2007, and then experienced a sharp increase from 2007 to 2008 at the height of the economic boom. The retail-wholesale price spread began declining in the first half of 2009 on the heels of the subsequent economic downturn. Recently, the spread has been increasing as the economy recovers. The current spread is about $1.00, slightly below the peak reached in 2008.

Figure 7: US eggs: retail-wholesale price spread, in dollars per dozen



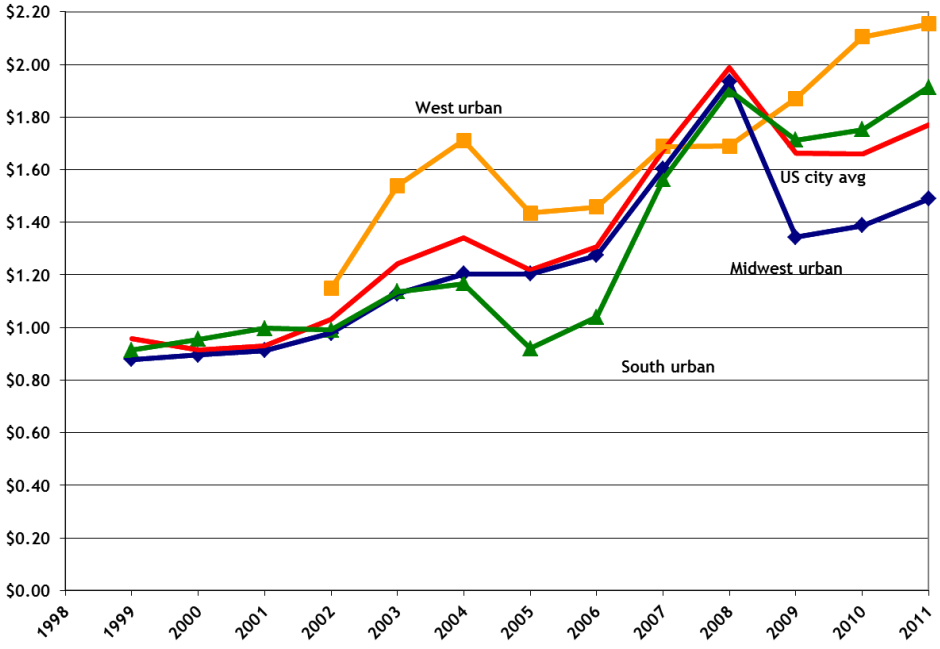
Sources: US Bureau of Labor Statistics, Consumer Price Index; USDA, Agricultural Marketing Service, 12-City Metropolitan Average

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, losses due to 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 (including the costs of segregation), 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 to conventional eggs, and the price determinants for organic eggs are distinct from conventional egg prices.

Figure 8 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. The Northeast Urban series was discontinued in 2007 and is not displayed here. There is clearly some regional variability but for the most part prices move in lockstep.

Figure 8: US Grade A eggs: retail prices by region, in dollars per dozen



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

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4. CAPITAL INVESTMENT IN THE EGG INDUSTRY

4.1. Available data on capital expenditures

All industries, whether agricultural, manufacturing or services, have to maintain an ongoing program of capital investment to replace and modernize aging structures and equipment, and provide additional capacity if demand and sales are expanding. Every five years the Department of Commerce's Census Bureau conducts a Census of Manufactures that collects, among other information, data on capital investment. The most recent census covers calendar 2007. The census for 2012 will be conducted in 2013 and is expected to be published in 2014 at the earliest.

Under the North American Industry Classification System (NAICS) used by Federal statistical agencies, the egg industry is included under the broader NAICS 311615 heading for poultry processing, which also covers production of chickens, turkeys and other fowl. If one looks at USDA data on the value of these products at the farm level, eggs consistently represent 21 percent of the total, and farm value is about 60 percent of the Census Bureau's shipments, which include handling and processing beyond the farm.

The industries are sufficiently similar that one can consider the aggregated financial structure and relationships in the Census report to be representative of those in the egg layer industry. Table 2 shows the value of shipments, book value of assets, capital expenditures, and depreciation for the industry during the last three census years. It also shows the ratio of capital outlays to shipments and to assets.

Table 2: Capital expenditures in poultry processing

	Total value of shipments	Book value of depreciable assets	Total capital expenditures	Depreciation	Relative to shipments	Relative to assets
	$1,000	$1,000	$1,000	$1,000	%	%
1997	31,656,144	6,479,809	620,310	483,636	2.0	9.6
2002	37,634,609	8,840,548	676,912	665,426	1.8	7.7
2007	49,827,709	11,323,147	1,257,632	766,615	2.5	11.1

Source: Census Bureau, Department of Commerce

The table indicates that about two percent of sales revenue is devoted to capital expenditures and that these represent about 8-11 percent of the book value of assets at the beginning of the year. The conventional wisdom in the egg industry is that facilities last about 25 years, so one is replacing about 4% of capacity each year. The ratio of capital expenditures to assets is higher than 4 percent because one can depreciate the investment over shorter periods, causing the book value to decline rapidly. For example, depreciation periods could be 7 years for equipment and 15 years for buildings.

We estimate the 2011 value of shipments in poultry processing at $60 billion based on the farm values reported by USDA and their relationship to total shipment value. Capital expenditures relative to shipments averaged 2.1 percent in the above table. Therefore a more recent estimate of capital expenditures in the industry would be 2.1% of $60 billion or $1.26 billion, about the same as in 2007. If we assign 21% of that to eggs, it is $265 million for both the farm level and further handling and processing. This ballpark number can be compared to the farm level estimates developed below.

To calculate the additional capital investment that the US egg industry will need to make with passage of H.R. 3798, one must first estimate the investment that would take place in its absence. In the next section we discuss investment costs for different types of facilities and whether they are new construction or renovation of existing houses. We then estimate baseline capital expenditures, the

investment that would need to take place as a result of the legislation, and the difference between the two.

4.2. Investment costs for egg layers

4.2.1. Types of layer cage housing

There are two basic types of layer cage housing. Historically most were so-called **high-rise** houses in which there is a platform below each level of cages to catch the manure. Periodically a plastic scraper runs along the platform, pushing the manure off the back, from where it drops down into a cellar below the building's superstructure. The levels of egg cages are slightly offset so that the manure does not fall on the cages below. The manure in the lower level gradually dehydrates and is removed once or twice a year for use as fertilizer on farm fields.

The newer type of house has a **manure belt** system. This has a belt below each level of cages that catches the manure and moves it to the end of the row where it is normally removed from the house for storage. The manure can be more rapidly dehydrated on the belt system by air that is moving through the house for ventilation purposes, and one result is better air quality for the layers and the workers moving around the building.

Estimating investment costs for renovation is challenging because the existing inventory of houses is very diverse – of different ages, sizes, styles, vintages of equipment, and geographic location. The decision that a current egg producer has to make is whether to renovate an existing house or start fresh and build a new one. An estimated 60-70 percent of layer houses are still high-rise types. In many of these the cage system is also part of the structural support for the building. If one removes the current cages, the building may need to have additional structural elements added. Renovation of roofing, insulation and other systems may also be required. Some companies are finding that it costs about the same to renovate as it would to knock down the old house and start over.

Size of the house is also a critical factor. A high rise house that has 100,000 hens can usually be redone to accommodate substantially more hens in enrichable cages with manure belts because one can make use of the lower level originally designed for manure accumulation. Also, one can often get an additional row of enriched cages in because there is no need to leave space for manure to drop to the basement. But even if you can get 150,000 birds in the renovated house, that number will be down to about 80,000 when the proposed legislative changes have to be fully implemented. That might be a non-economic size for a production facility 15 years in the future.

Another important factor is the length of the house. The reported maximum length for a manure belt is 550 feet. If a house is significantly longer, there will be wasted space unless it can be reconfigured for egg handling or manure storage.

4.2.2. Other considerations

In looking ahead at an environment when both the rules and consumer preferences are changing, there is the question of how to describe costs. If one invests in a new house in which enrichable cages are stocked at 67 square inches per bird, one might divide the total investment cost by the total number of birds at that spacing. If we assume that the investment is 100 percent financed by a loan, there is an annual payment of interest and principal that can be allocated per bird.

When the expenditure is made to enrich the cages 10 or 15 years later, that investment cost is spread over a smaller number of birds because spacing is then 101 or 124 square inches. Moreover, the annual payment on the original investment then has to be carried by the smaller number of birds. Therefore the contribution of capital costs to production costs will vary over time.

Based on conversations with egg companies, equipment manufacturers, and building firms we settled on the estimates of investment cost shown in Table 3. These estimates are for a 250,000 bird house at current stocking densities, which is probably the smallest that would be built if undertaking new construction.

To the best of our knowledge, there is little if any installation of traditional cages taking place currently because there is a general recognition that changes will be required either at the state or national level. California's requirement that all eggs sold in the state meet the requirements of Proposition 2, and the likelihood of similar measures in other states, mean that producers in the major egg producing states have to gear up to meet what the market demands. Nevertheless, we include estimates of the cost for traditional cage systems and use those in part of our baseline scenario.

What the industry is currently doing is putting in enrichable cages that can start out at 67 square inches per hen, gradually increase the space as required (i.e. reduce the number of birds), and install the furnishings as required. Therefore the $23 cost of new construction with enrichable cages does not include the actual enrichments. Those are added later at an additional cost of $2/bird for the labor and the perches, scratch pads, etc. If the enrichments are added at the outset, the total cost is a dollar more at $24.

Table 3: Investment necessary to implement proposed legislation*

	Space/ bird	Renovation	New construction	Add enrichments^	Land, roads, utilities^^
	inches	$/bird	$/bird	$/bird	$/house
Conventional cage	**67**	10	16	n.a.	90,000
Enrichable cage	**124**	19	23	2	90,000
Cage free**	**216**	15	30	n.a.	90,000
* Costs in constant 2012 dollars					
** Estimates from 2009 study					
^ 10 or 15 years later					
^^ For construction on new site					
These estimates are for a 250,000 layer house					
Investment cost per bird includes equipment and building, subsequent addition of furnishings, and if new construction, land, roads and utilities.					

The other issue here when discussing cost per bird is the density of birds in the cage. To facilitate a more even and orderly path of investment, the agreement between UEP and HSUS allows hens in new cages installed the first few years to remain at traditional densities that are then gradually reduced. Equipment suppliers quote investment costs variously as per initial or final number of birds in the cage. The investment cost for enrichable cages that initially hold hens at 67 in^2 is essentially no different than the investment cost for conventional cages. The main components of investment cost are shown in the table below, with full enrichment taking place immediately for that type.

Table 4: Components of investment cost ($/bird)*

	Traditional		Enriched	
	Renovated	New	Renovated	New
Equipment, installed	6.00	6.00	12.00	12.00
Building	2.00	5.00	4.00	6.00
Other	2.00	5.00	4.00	6.00
Total	10.00	16.00	20.00	24.00

* Traditional at 67 in^2 and Enriched at 124 in^2

We did not reinvestigate the investment cost for cage free systems. We simply increased the estimates from our 2009 study by a factor of 8 percent to cover inflation.[1] (Industry sources report that costs for new construction are closer to $32 than the $30 shown in Table 3.) We assume for both scenarios that the share of egg production in cage free systems increases by 0.2 percent annually, from 8.0 percent in 2013 to 10.0 percent in 2023 and then remains constant at that level. The investment in cage free facilities is the same in both our scenarios.

4.3. Baseline scenario

For the baseline scenario we assume that the industry adapts to state legislation that has already been passed or that is likely to materialize in the absence of federal legislation. The population of the five states with layer housing laws already on the books or highly likely to be passed if pushed is 71 million or 23% of the national total. These are California, Michigan, Ohio, Oregon and Washington. Over half of the fifty states have statutes addressing animal confinement or proposed legislation that is variously active or inactive at the present time. Assuming that egg consumption is proportional to population, one can conservatively project that by 2030 more than a third of US eggs will be produced cage-free or in enhanced cage systems.

Our capital investment model is shown in Tables 5 and 6 below. The upper portion of those tables shows projected table egg production. From now through 2021 the numbers are from the USDA baseline projections published in February 2012.[2] For the subsequent nine years we extrapolated that trend. We subtract the share of total eggs produced in cage-free conditions to get cage egg production. Industry sources report that a surge in investment in cage-free facilities will increase their share from 4.0% in 2010 to 8.0% in 2013. We assume subsequent growth to a 10% share over the projection period.

There has recently been an upward trend in the number of eggs produced per layer. We project a continuing increase of one egg per year. Dividing total egg production by eggs per layer yields the necessary layer population in cage systems.

The middle portion of Tables 5 and 6 shows the number of layers in different categories of housing. The categories are related to the legislative requirements, which distinguish between new cages, old cages installed between 2008 and 2011, old cages in California, and old cages installed before 2008 or in 2012. The latter group is divided into unrenovated, renovated to enriched or enrichable cages (renovated-E), and renovated to conventional cages (renovated-C).

[1] Promar International, Impacts of Banning Cage Egg Production in the United States, August 2009
[2] USDA Agricultural Projections to 2021, Office of the Chief Economist, USDA, February 2012

The bottom section of each table shows anticipated capital investment in each category using the costs from Table 3.

California has to meet the minimum space target of 116 square inches by 2015 so we assume that all necessary investment in enriched cage systems and new buildings is completed by then. Assuming an average cost of $22 per bird on 14 million birds still in cages in 2015, spread evenly over 2010-2014, with half of them in new construction, the annual investment is $62 million. Some current capacity is abandoned and some portion of it is renovated.

During 2008-2011 we can assume that conventional cages for 8 million layers per year were installed, in addition to investment taking place in California.

From 2012 throughout the projection period, we estimate that new investment will cover about 10 million birds per year in a mix of renovation and new construction. We project that 30% will be new construction of enriched cages to meet current and anticipated mandates, 60% renovation with conventional systems, and 10% renovation with enriched systems.

After the initial surge in investment to meet requirements in California, annual capital requirements for new construction of houses with enriched cages and for replacing worn out conventional cages with either conventional or enriched cages are estimated at $152 million per year. Note that this is about 60% of our pro forma calculation in Section 4.1 of total industry investment, which also includes investment beyond the farm level. The cumulative investment in cage facilities between 2012 and 2030 is $3.07 billion. In addition there would be investment of about $10 million per year in cage-free facilities as their share of total production grows.

In 2030 there would be 64 million layers housed in new facilities and 197 million in existing houses that have been renovated. A total of 90 million layers, 34% of the total, would be in fully enriched cages to meet the requirements of existing and anticipated state mandates. If all the new houses are on new sites, it would require about 450 buildings at 140,000 hens each. At $90,000 per building for land, roads and utilities, that would be a cost of $41 million, bringing the total capital investment for cage housing to $3.1 billion.

These calculations are based on space requirements for white hens that are currently about 94% of the total hen population. Investment costs for brown hens would be slightly higher due to the 15% higher space requirement, but a separate calculation for that group would only increase total investment by about one percent. Since that is likely to be well within the margin of error on this type of forecast, we have chosen to ignore it for the sake of simplicity.

We note that we have not analyzed the additional costs should federal legislation fail to be enacted. A patchwork of state legislation would add significant extra costs. In particular, it is likely that current economies of scale would be reduced and unit product marketing and distribution costs would be increased.

4.4. Legislative scenario

This scenario assumes passage of H.R. 3798 or similar legislation in 2012 with implementation on January 1, 2013. The calculations in the upper portion of Table 6 are the same as in the baseline except that beginning in 2022 we increase production of eggs per layer by two eggs per year rather than one. In 2022 all new cages will be fully enriched with 101 square inches per bird, and California will be at a fully

enriched 124 square inches. Recent US industry experience with lower population densities indicates that there is higher production per layer.

The projections for California are the same as in the baseline. The conventional cages installed in the 2008-2011 period have to be brought up to fully enriched status by the end of 2029, so we spread this investment over the 2026-2029 period. Replacement of cages in existing houses and installations in new houses are all assumed to be enrichable. No company would be permitted to put in conventional cages after passage of the new requirements. From 2012 through 2022, the industry would re-cage 10 million layers annually, equally divided between new and renovated facilities. From 2023-2029 the rate would have to increase to 14 million annually in order to eliminate the last of the conventional cages.

We also show investments of $2 per bird to upgrade enrichable cages to fully enriched in the year prior to the deadlines illustrated in Figure 1. In practice these would likely be spread out over two or three years.

The total capital investment in buildings and equipment is estimated at $5.65 billion in 2012 dollars, which is 84% more than the investment in the baseline scenario. In 2030, 142 million layers are projected to be housed in current houses that have been renovated, and 111 million in new houses. Assuming all the new houses are on new sites, that would be about 800 buildings if the average population is 140,000 hens. At $90,000 each for land, roads and utilities, the investment for those purposes would be $72 million, bringing total capital requirements for improved cage housing to $5.7 billion compared to $3.1 billion in the baseline. The $2.6 billion difference between these two numbers, when averaged over the 18-year period, is $143 million per year in additional investment that will be required. Cumulative investment under the two scenarios is shown in Figure 9.

Figure 9: Cumulative capital investment, in million dollars

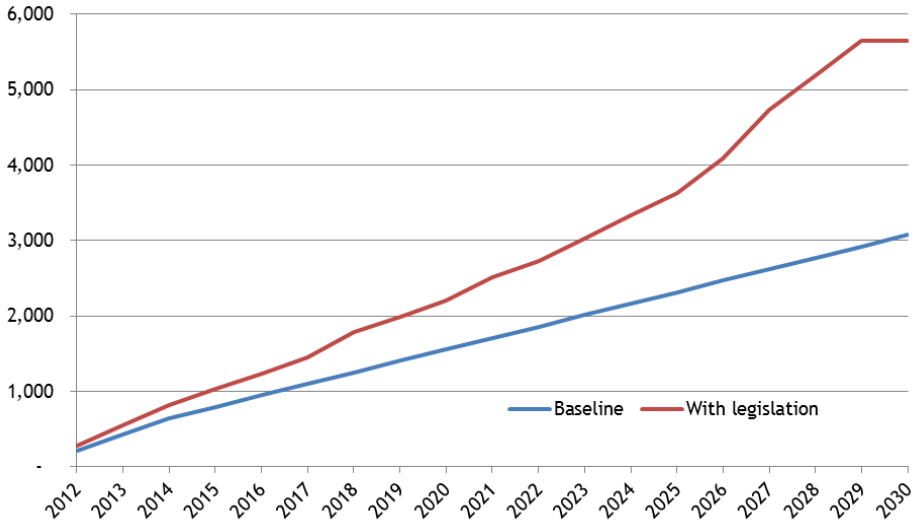

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Table 5: Baseline investment requirements

	Cost	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Base data																								
Table egg production (mil.)		76,702	77,754	79,668	80,364	80,460	80,172	80,016	80,280	80,844	81,444	82,152	82,884	83,652	84,300	84,995	85,410	85,825	86,240	86,655	87,071	87,486	87,901	88,316
Percent non-cage (%)		3.6	3.8	4.0	5.0	6.5	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4	9.6	9.8	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Cage egg production (mil.)		73,941	74,799	76,481	76,346	75,230	73,758	73,455	73,536	73,891	74,277	74,758	75,259	75,789	76,207	76,666	76,869	77,243	77,616	77,990	78,363	78,737	79,111	79,484
Eggs per layer		278	281	283	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305
Layers in cages (mil.)		266	266	271	267	262	256	254	254	254	255	255	256	257	258	258	258	259	259	259	260	260	260	261
Cage layer location		(million layers)																						
California		18	17	17	17	16	16	16	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Pre-2008 + 2012 unrenovated		240	233	230	218	204	188	176	168	158	149	139	130	121	112	102	92	83	73	63	54	44	34	25
Pre-2008 + 2012 renovated-E						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Pre-2008 + 2012 renovated-C						6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114
2008-2011		8	16	24	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
New enriched						3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57
Total		266	266	271	267	262	256	254	254	254	255	255	256	257	258	258	258	259	259	259	260	260	260	261
Capital investment		(million dollars)																						
California				62	62	62	62	62																
Pre-2008 + 2012 renovated-E	$20					20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Pre-2008 + 2012 renovated-C	$10					60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
2008-2011	$10	80	80	80	80																			
New enriched	$24					72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
Total		80	80	142	142	214	214	214	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152

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Table 6: Investment requirements with federal legislation

	Cost	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Base data																								
Table egg production (mil.)		76,702	77,754	79,668	80,364	80,460	80,172	80,016	80,280	80,844	81,444	82,152	82,884	83,652	84,300	84,995	85,410	85,825	86,240	86,655	87,071	87,486	87,901	88,316
Percent non-cage (%)		3.6	3.8	4.0	5.0	6.5	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4	9.6	9.8	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Cage egg production (mil.)		73,941	74,799	76,481	76,346	75,230	73,758	73,455	73,536	73,891	74,277	74,758	75,259	75,789	76,207	76,666	76,869	77,243	77,616	77,990	78,363	78,737	79,111	79,484
Eggs per layer		278	281	283	286	287	288	289	290	291	292	293	294	295	296	298	300	302	304	306	308	310	312	314
Layers in cages (mil.)		266	266	271	267	262	256	254	254	254	255	255	256	257	258	258	256	256	256	255	255	254	254	253
Cage layer location		(million layers)																						
California		18	17	17	17	16	16	16	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Pre-2008 + 2012 unrenovated		240	233	230	218	204	188	176	168	158	149	139	130	121	112	102	86	72	58	43	29	14	0	0
Pre-2008 + 2012 renovated-E						5	10	15	20	25	30	35	40	45	50	55	62	69	76	83	90	97	104	104
2008-2011		8	16	24	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
New enrichable						5	10	15	20	25	30	35	40	45	50	55	62	69	76	83	90	97	104	104
Total		266	266	271	267	262	256	254	254	254	255	255	256	257	258	258	256	256	256	255	255	254	254	253
Capital investment		(million dollars)																						
California				62	62	62	62	62																
Pre-2008 + 2012 renovated-E	$19					95	95	95	95	95	95	95	95	95	95	95	133	133	133	133	133	133	133	0
2008-2011	$10	80	80	80	80															160	160	160	160	
New enrichable	$23					115	115	115	115	115	115	115	115	115	115	120	168	168	168	168	168	168	168	0
Add enrichments	$2											124			100						180			
Total		80	80	142	142	272	272	272	210	210	210	334	210	210	310	215	301	301	301	461	641	461	461	0

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5. PRODUCTION COST AND CONSUMER PRICES

5.1. Production costs

Cost of production is a thorny concept. Businesses view it in a variety of ways, the tax code's "cost of goods sold" does not include many costs, and agricultural economists use a mix of fixed and variable cash expenses and opportunity cost for some inputs. In the case of eggs, of the individual firm records we have reviewed, no two are structured in the same way. Often the costs vary by flock.

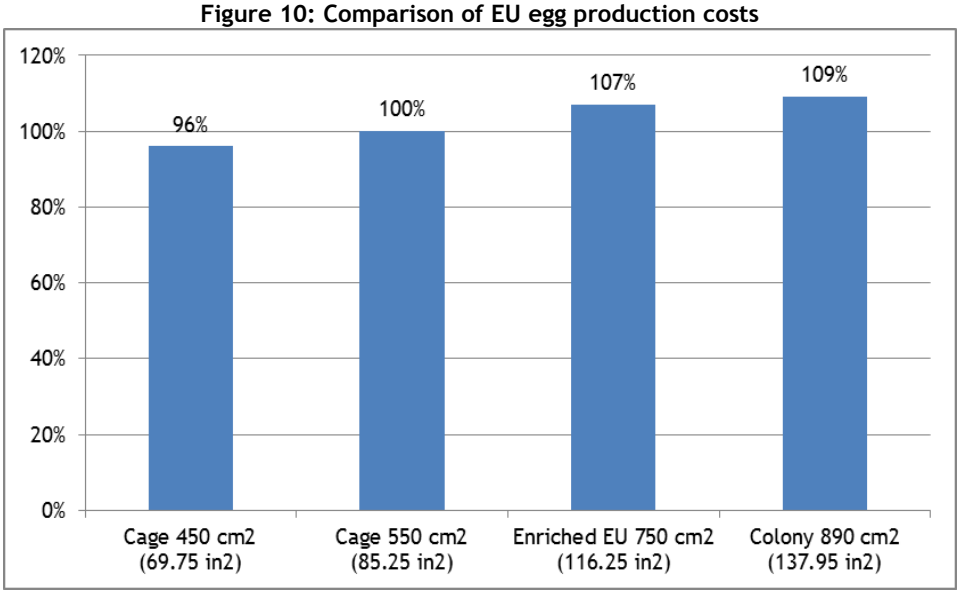
A layer house is populated with a flock that all goes in at the same age. The young birds that have just reached maturity are called pullets, and their cost represents a capital investment that must be recovered over their lifetime. A flock typically lays eggs for about 80 weeks. Over that period there is mortality that may reach 6-8% by the end of the period. Thus total egg production from that house declines over time. During the laying period, feed and labor costs per dozen are relatively constant.

Housing costs are a combination of an allocation for the original investment in the building and equipment, and the ongoing maintenance, supplies and utilities. They tend to be the same order of magnitude as the allocation for the initial cost of the pullet.

Feed costs are the largest component, and the most variable from year to year. In the United States they usually account for almost half of total costs. Finally there are a variety of other costs including taxes, interest on working capital, management, vehicles, fuel, office equipment, leases, etc.

The Europeans have had considerably more recent experience with alternatives to conventional cages and there is now quite a bit of published research on those alternatives. Peter Van Horne, a poultry economist at the Agricultural Economics Research Institute associated with Wageningen University in the Netherlands has presented on production costs at various International Egg Commission conferences. His most recent comparison is reproduced in Figure 10.

Figure 10: Comparison of EU egg production costs



Source: Peter Van Horne, Economics and Housing Systems for Laying Hens, IEC Venice 2012

The standard of 124 square inches in proposed US legislation is midway between the two columns for two new EU standards on the right. If we average those to an index of 108% and compare it to the index of

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96% for 450 square centimeters, which is about the same as the 67 square inch standard in the United States, it represents a 12.5% increase in production costs when one fully transitions to the enriched cages.

In the course of the debate in California over animal housing, University of California economists published a report on the issues that included the results of a survey of egg producers on their production costs.[3] That is the most recent published estimate of costs of which we are aware, so it is the basis for the estimates below in the first column of Table 7. We use the median numbers from the study cited. In 2008, pullet costs were 10 cents per dozen, feed 36.5 cents, housing 9.5 cents, labor 3.5 cents, and total costs were 74.5 cents. The two categories that would be most affected by the proposed legislation are housing, obviously, but also the "other" category which includes some overhead costs that would have to be spread over fewer birds and fewer eggs.

Table 7: US egg production costs

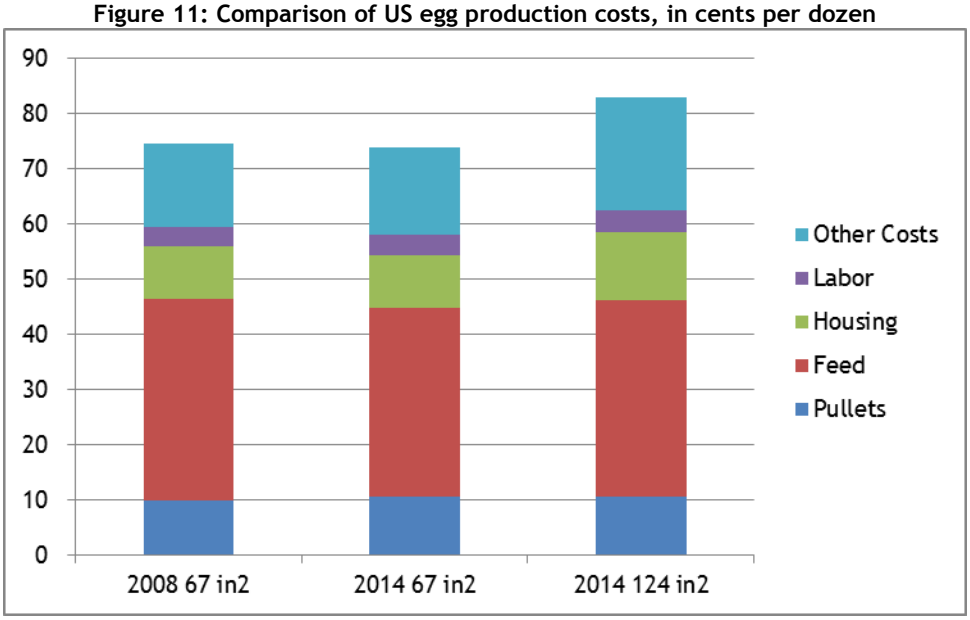
	2008 67 in2	2014 67 in2	2014 124 in2
		cents/dozen	
Pullets	10.0	10.5	10.5
Feed	36.5	33.2	34.5
Housing	9.5	9.5	12.4
Labor	3.5	3.7	4.0
Other	15.0	15.8	20.5
Total cost	74.5	72.7	81.9

Looking ahead to the period when the proposed legislation might be implemented, it seemed unreasonable to estimate feed costs based on the current unusually high agricultural commodity prices. We therefore looked ahead to 2014 and compared the projected corn and soybean meal prices in the USDA long-term baseline to those that prevailed in 2008 when the California study was completed. Based on those price relationships and the standard composition of layer feed, we estimated that feed costs for egg production in conventional cages would be 9 percent lower than in 2008, at 33.2 cents per dozen. We increased pullet, labor and other costs by 5 percent but did not change housing costs. The middle column of Table 7 shows that these estimates total 72.7 cents per dozen. For comparison, the average US farm price for market eggs for 2009-2011 was 72 cents, which tells us that this cost estimate is at least in the right ballpark.

What would costs be in enriched cages with 124 square inches per hen? These estimates are shown in the final column. European research shows that labor costs are about 9% higher because a worker is able to manage fewer hens. Experience in California indicates that feed consumption is about 4% higher due mostly to feed being put down on scratch pads. We estimate that housing and "other" costs would both be 30% higher. Total costs are estimated at 81.9 cents per dozen, up about 9 cents per dozen or 12.7% compared to the 72.7 cent estimate for eggs from conventional cage systems. The numbers from Table 7 are reproduced below in Figure 11

[3] Sumner, Daniel et al, "Economic Effects of Proposed Restrictions on Egg Laying Hen Housing in California", University of California Agricultural Issues Center, July 2008, page 99

Figure 11: Comparison of US egg production costs, in cents per dozen



Source: Agralytica

These would be the ***average*** production cost only at the end point in 2030 when 100% of cages are at the 124 inch standard. Note in Table 6 that as late as 2025 there are still 134 million hens, 52% of the total, in pre-2008 cage systems that can be stocked at the 67 inch spacing.

The phasing requirements in the proposed legislation are intended to insure that there is continual progress during the transition period, rather than a flurry of investment in the 2020s. Recall that by 2019, 25% of layers must be in enrichable cages at no less than 90 square inches. By 2026, at least 55% must be at 113 square inches, and this reaches 100% by 2030. If one plots a linear transition path, the average share of hens still at 67 inch spacing over the 18 years is about 60%. Since conversion to enrichable cages will inevitably be slightly back-loaded, the average share of hens at 67 inch spacing over the period will probably be in the 65-70% range.

The average increase in production costs over the 2013-2030 period is therefore projected at 30-35% of the 12.7% described above, i.e. about 4% or 3 cents per dozen. However, production costs increase in the baseline as well because we project that the percentage of hens in enriched cages rises to about 34% due to legislation at the state level. We estimate the average increase for the period at 1.5 cents per dozen, as shown below in Table 8. Thus the average cost difference at the farm between the two scenarios is only 1.5 cents, and the full difference in 2030 is only 6.1 cents per dozen. This has direct implications for the anticipated impact on consumer costs, discussed below.

5.2. Consumer prices

Based on recent price relationships discussed above in Section 3.2, and assuming constant wholesale and retail margins, and taking into account cage-free eggs being at 8-10% of the national total, average retail egg prices in 2012 dollars would be about $1.75 per dozen during the projection period in the absence of legislation. If there were a sudden 9.2 cent increase for cage eggs at the farm level in 2013 that was fully passed through to the final consumer, the consumer price increase would average 5 percent (keeping in mind that cage-free prices are unaffected).

However, as discussed above, the transition is a gradual one. We cannot actually be certain how egg pricing will evolve. Recall that the legislation also requires that one year after enactment all eggs must be labeled as one of the following:

- Eggs from free-range hens
- Eggs from cage-free hens
- Eggs from enriched cages
- Eggs from caged hens.

It seems likely that price differentiation will occur between the last two categories. If that is the case, eggs from hens in conventional cages will still be the cheapest through most of the transition period, reflecting their lower production costs. Eggs from enriched cages would sell at a slight premium, reflecting the increased costs related to providing greater space in furnished cages. And the other two categories would sell at their traditional premium.

Our conclusion is that most of the impact on consumer prices will not occur until well into the 2020s, and will probably average a 1% increase (1.5 cents per dozen or about one-quarter cent per egg) over the 18 years due to the change in production costs at the farm level. If margins at wholesale and retail expand, the increase could average more than that, but should still be a fraction of a cent per egg. By 2030, retail prices for cage eggs would be up by the full 9.2 cents or 5.3%. Taking into account constant prices for cage-free eggs, the average retail price for all eggs would be up about 5%.

Compared to the baseline scenario in which only 34% of cage eggs are from enriched cages, the legislative scenario results in consumer prices in 2030 that are higher by 6.1 cents per dozen, or about a half-cent per egg.

Table 8: Cage egg costs per dozen in 2012 dollars

	2012	Average 2013-30	2030
	cents/dozen		
Baseline - farm	72.7	74.2	75.8
Baseline - retail	175.0	176.5	178.1
With legislation - farm	72.7	75.7	81.9
With legislation - retail	175.0	178.0	184.2
Difference - farm	0.0	1.5	6.1
Difference - retail	0.0	1.5	6.1

Because customer expectations and consumer demands are changing, it is not certain that the proposed legislation would actually increase consumer prices beyond what might occur in its absence. This is because egg prices may well end up higher than we assume in our baseline case if the demand for higher cost cage-free eggs grows more than we have assumed, and/or customers increasingly demand a greater transition to enriched cages, especially once California's Proposition 2 and other state laws are in place. If either or both of these things happen, consumer prices might increase as much as or more than would be the case under the legislation. And in any case, it is worth noting that year-to-year fluctuations in feed costs, packaging and distribution costs, and other factors could well exert an upward or downward impact on prices that would exceed any change attributable to the proposed legislation.