IOWA STATE UNIVERSITY
Extension and Outreach

Economic Importance of the Iowa Egg Industry

DECEMBER 2019

AUTHORS

Maro Ibarburu
Department of Animal Science, Iowa State University

Lee Schulz
Department of Economics, Iowa State University

Mark Imerman
Regional Strategic, Ltd.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Iowa leads the nation in egg production. Several factors account for the phenomenal growth of the egg industry in Iowa over the last several decades. Growing population and higher per capita egg consumption have supported a 1.5% annual expansion rate in egg production nationally over the last 30 years. During this same period, Iowa egg production increased eightfold. Iowa has a competitive advantage due to low feed costs, which represent approximately 50% of total production costs (feed for growing young chicks to an egg-laying age adds an additional 7% to the production cost of a flock). The Iowa egg industry utilizes 57.8 million bushels of corn and 531,317 tons of soybean meal for feed, including the feed used for growing young chicks (pullets).

Iowa has been able to capitalize on this tremendous competitive feed advantage due, in part, to the rapidly growing market for processed eggs. These eggs generally require a lower transportation cost to major population centers on the coasts, depending on the availability of a return freight. Another Iowa advantage is that food manufacturers that use egg products are less likely to locate in highly populated areas, which further reduces shipping distances. These advantages available to Iowa egg producers are relatively stable in regard to conventional egg production.

From 2007-14, Iowa produced more eggs than the second and third largest states combined. The United States Department of Agriculture (USDA) estimated there were approximately 57.7 million egg laying hens in Iowa during 2018 that produced 16.4 billion eggs. However, in recent years, two unprecedented phenomena have impacted egg production trends. The highly pathogenic avian influenza (HPAI) outbreak of 2015, considered the nation's largest animal disease disaster, affected Iowa's laying hen flock more than any other state. While hen numbers rebounded, in 2018, Iowa had 3% (or 1.6 million) fewer hens than in 2014. Additionally, the entire country's egg industry has experienced a rapid shift to cage-free production. This trend is expected to accelerate and has major implications for nationwide egg production. Cage-free production often means less hens in the same building footprint. Therefore, the value of the land and the building costs become a higher part of the total costs, decreasing the relative importance of feed costs. Despite these industry events, in 2018, Iowa still produced about 6.7 billion more eggs than the second-largest egg-producing state.

In addition to the shear value of the state's egg laying industry, marketing over $1.333 billion in 2018, its overall economic impact is important to the state. Its value-added activity in Iowa generated 7,084 total jobs in 2018, with 2,398 direct jobs. The industry supports 1.9 additional jobs for every job directly created in egg production and it generates over $450 million in total payroll. The average annual salary of workers within the Iowa egg industry is $45,967 per employee, a growth of 23% since 2014 ($37,259 per employee).

However, certain factors may challenge Iowa's future competitive advantage. The balance between the cost of transporting feed to production areas and the cost of transporting eggs and egg products will continue to impact regional competitiveness. Factors that increase truck, but not rail, transportation costs will be disadvantageous to Iowa. Another potential threat to Iowa's production advantage may be the transition to alternative production systems, especially if building these types of facilities would require higher investment per hen capacity, more labor, or require moving to production systems that mandate year-round access to the outdoors. While these challenges would also be experienced by other egg producing states in colder climates, it is a trend worth watching.

Currently, Iowa's feed cost advantage is effectively offsetting egg transportation costs. Additional advantages also remain such as the large scale farms, allowing farmers to dilute their fixed costs over more eggs, and hire experts such as veterinarians or nutritionists to improve their production efficiency and solve challenges. The Iowa egg industry proximity to crop land also allows Iowa producers to utilize manure generated by the laying hens as a highly sought after crop fertilizer. Additional work will be done in future reports to try and analyze the value of this production stream for Iowa's agriculture economy.

CHAPTER 1:
EGG INDUSTRY SITUATION AND OUTLOOK

This chapter examines national trends in egg supply and demand compared to Iowa's egg production industry. It starts by examining the national trend of increased consumption and the use of processed egg products. This has resulted in opportunities for growth in the egg industry. This increased consumer need, coupled with improved transportation systems, modernized facilities, and Iowa's significant feed cost advantage encouraged an investment in Iowa's egg production industry.

Per capita annual egg consumption reached its 30-year minimum in 1996 at 231.4 eggs per person per year. Since then, we have experienced an upward trend, with some fluctuations, to 284 eggs per person per year in 2018 (Figure 1.1). The drop in egg consumption per person in 2015 was a direct consequence of the HPAI outbreak. This drop occurred because of the reduced number of eggs available. Except for 2015, most years the industry has experienced growth due to increasing population, rising per capita egg consumption, and supportive prices. All of these factors suggest a strong demand. This has enabled the US table egg industry to expand production 56% from 1988 to 2018.

The growth in egg consumption over the past three decades occurred primarily in egg products rather than shell eggs (Figure 1.1). In 1980, approximately 13% of egg production was consumed as egg products. By 2000, this amount had grown to 29%, and continued to increase (albeit at a lower rate), stabilizing at 31%.

Industry size and location

During the time of industry growth related to processed egg production, the Iowa egg industry experienced rapid expansion growing 6.8 fold from 1988 to 2007. This expansion caused Iowa's production share to increase from slightly less than 3% in 1988 to 19% by 2007. More recently, the number of laying hens in Iowa stabilized between 17% and 19% of the US egg industry, which in part might be explained by the stable proportion (31%) of eggs broken for further processing.

This growth is best explained in that Iowa's primary competitive disadvantage was the cost of shell egg distribution because of the distance from Iowa to major population centers. As a result, the national trend toward processed egg use benefited Iowa because processing reduced transportation costs relative to shipping whole shell eggs for retail sales. Additionally, food manufacturers that use egg products are less likely to locate in highly populated areas, which further reduces shipping distances. At the same time, Iowa's egg producers are still able to sell into the higher value shell egg market if economics are favorable. Figure 1.2 shows the 30-year trend in Iowa egg production and its share of US egg production. According to the USDA, in 2018, there were approximately 57.7 million layers in Iowa, which consumed an estimated 57.8 million bushels of corn and 531,317 tons of soybean meal. While the HPAI outbreak in 2015 hit Iowa hard, the state recovered all but 1.6 million hens and retained its status as the top egg producer in the US. In 2018, Iowa represented 17% of the US flock. Other states like Indiana,

Figure 1.1 United States per capita egg consumption by processing type. *Source: USDA Economic Research Service*

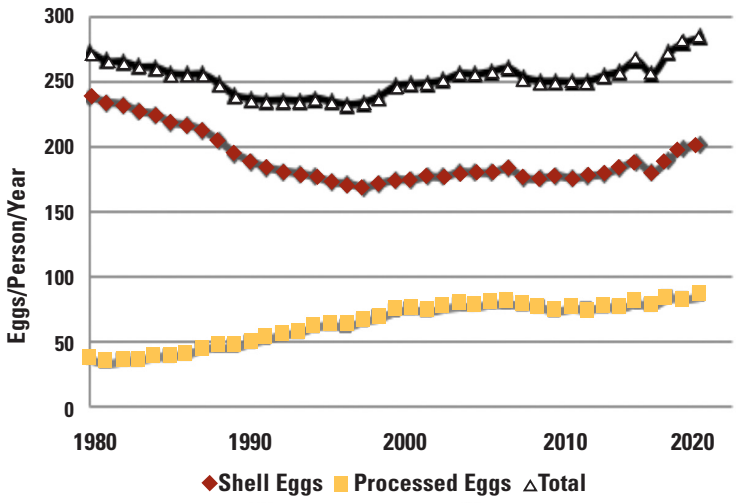
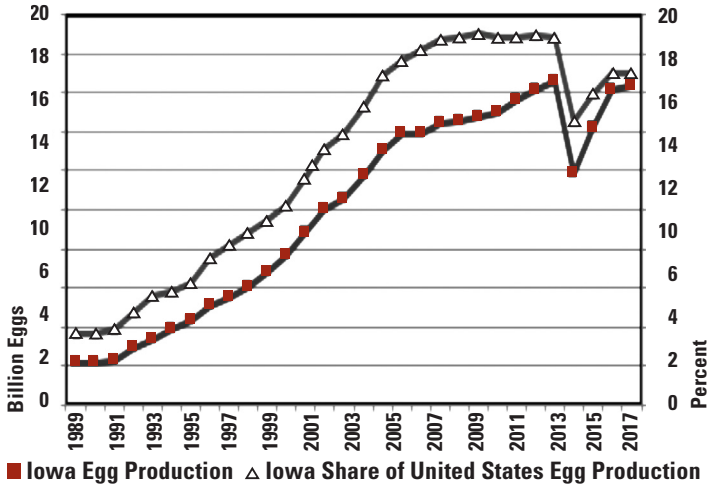


Figure 1.2 Iowa egg production and share of US production. *Source: USDA National Agricultural Statistics Service*



Texas, Michigan, Pennsylvania, and Wisconsin grew their flock during the 2014-18 period.

In contrast, states with higher costs of production as a result of higher feed costs, real estate values, or stringent industry regulations have lost significant status in flock size. California was the leading egg producer in 1988, with 32 million layers, which represented 13.5% of the US flock. It gradually lost laying hens and market share, and by 2012 it had 19 million layers (representing 6.5% of the US flock). California lost almost eight million laying hens (approximately 40% of its flock) during the three years prior to the inception of Proposition 2 in 2015, but has recuperated 2.5 million laying hens since. California is now situated as the seventh largest producing state with 14 million layers, which represents 4.2% of the US flock, after Iowa, Ohio, Indiana, Pennsylvania, Texas, and Michigan. The top five producing states account for 51% of US egg production. The clear contrasting tendency between California and Iowa is shown in Figure 1.3, where Iowa's flock grew rapidly and California's flock decreased rapidly over the last 30 years.

Prices and profits

Egg companies, like any other business, try to locate in places where they can receive the greatest return on investment. However, the other component of profit (other than a low cost of production) is the price obtained for the product. The US egg industry was relatively unprofitable in 2005 and 2006; however, it experienced good margins until 2015, in spite of higher feed costs. Egg prices and profits have experienced much greater volatility since 2014, for different reasons.

The HPAI outbreak in spring 2015 dramatically reduced laying hen inventories and the production of eggs. As a result, egg prices skyrocketed to record highs. US egg imports reached record high values as well, increasing the value of eggs in the international market. These higher prices helped Mexican producers restock their flock, which was greatly affected by an HPAI outbreak in 2012. Most of the US flock lost in 2015 was recuperated by mid 2016; however, the US faced much lower export demand. This was due in part because Mexico recuperated its own flock and because Canadian producers were able to increase their quota for egg production. The loss in exports for the US resulted in an increase in egg inventory (the dried egg inventory increase was the main driver), and prices of eggs fell to a 10-year low in 2016 and 2017. Prices rebounded from late 2017 to early 2018, as many retailers decided to use eggs as loss leaders among other items in the supermarkets. This created a huge demand for eggs, but by late spring 2018 most supermarkets decided to abandon the price war and prices fell again.

Iowa's egg market mimicked the ups and downs of the national egg market. Prices paid to Iowa's egg producers are consistently below the national average. The spread between the Iowa producer's price and the national average producer's price ranged from one cent to eight cents per dozen and has averaged 5.3 cents per dozen during the last 10 years (Figure 1.4).

Figure 1.3 Market share of the top five egg producing states and California, 1988–2018. *Source: USDA National Agricultural Statistics Service*

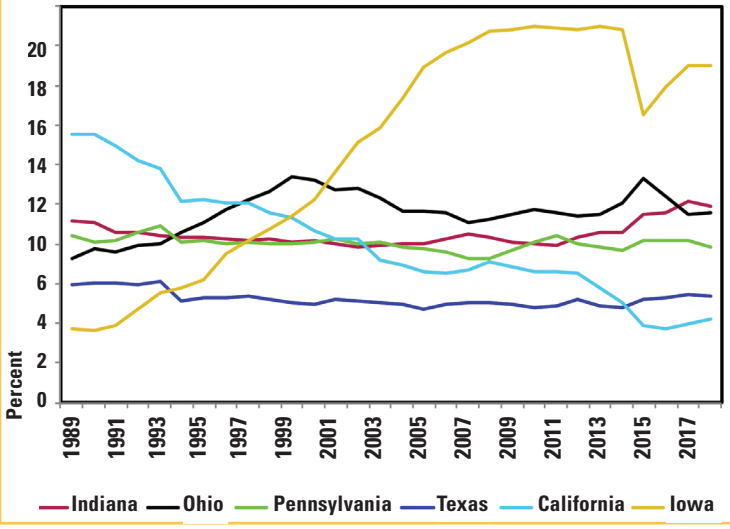
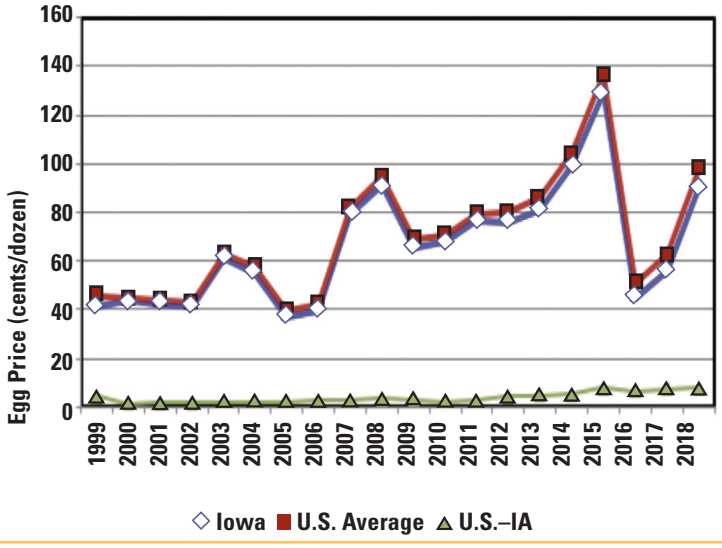


Figure 1.4 Egg producers price in Iowa and US average (excluding California).



CHAPTER 2:
COMPETITIVENESS OF THE IOWA EGG INDUSTRY

Iowa has a competitive advantage based on its low cost of production. This is balanced by the higher costs of transporting eggs to the highly populated areas on the East and West Coasts. The lower costs of transporting liquid or dried eggs to food manufacturers and other customers create opportunities for Iowa's egg producers.

Cost of egg production

Determining accurate and objective production costs is difficult because costs vary with operational efficiencies, production systems, age and condition of facilities, and input prices. This is compounded by a natural reluctance by producers to provide access to actual data. Moreover, operations can allocate costs differently, creating considerable variability around the average cost per item.

This analysis attempts to address regional costs of production by modeling estimated costs for Iowa and competing states. First, costs for a typical Iowa egg production system are estimated based on producer-reported input costs, USDA's Agricultural Marketing Service (AMS) reported corn and soybean meal prices, and white layer production guidelines from genetic companies to approximate production efficiency. Second, this same production budget, with minor adjustments, is applied to two other states, using the feed ingredient costs and the cost difference for labor listed in Table 2.3. This approach examines the difference in cost of production due to input prices. Finally, a sensitivity analysis is used to determine the impact on cost of production to changes in key variables. The sensitivity analysis serves two functions: 1) It illustrates the magnitude of error in the cost of production if one of the underlying assumptions is not correct; and 2) It allows cost advantages to be compared across regions. For example, Iowa has lower feed costs than California. This raises the question of how much cheaper other production costs in California have to be in order to offset the Iowa corn and soybean meal price advantage.

Cost of production is based on Egg Industry Center producer surveys, and the white layer production guidelines provided by genetic companies. The diet used for calculations is corn (67%), soybean meal (22%), limestone (8%), and the remainder is vegetable oil, vitamins and minerals, and amino acids. Input prices for corn and soybean meal used in this analysis are based on weekly prices reported by USDA-AMS. Limestone is assumed to cost $60 per ton and the other feed ingredients cost $440 per ton. Transportation and milling cost is assumed to be $11.4 per ton.

Iowa's cost of production

In addition to feed, other expenses are listed in Table 2.1. Pullets were valued at $3.59 per bird at 19 weeks of age, after they were moved to the layer house and were productive over a 72-week laying cycle (up to 90 weeks of age, producing 34.5 dozen eggs per hen housed). The value of hens no longer in full production would help offset some of these costs, but this value was not considered for this analysis. Because there is a market for these birds, it will be added in future versions of this report. Another source of income not considered in this analsyis is the value of manure sales. While a viable income stream for many egg producers, a study is needed to quantify sales so it can be included in future calculations. All other costs are assumed to be 17.52 cents per dozen. Given these assumptions, the economic model estimates the cost of producing eggs in Iowa to be 56.39 cents per dozen for nest run eggs (Table 2.1).

Access to lower cost of feed is the primary advantage Iowa producers enjoy over other egg producing regions. Feed is the largest component, representing about 50% of production costs. Feed for growing pullets represents an additional 7% of the production costs. Consequently, feed prices can have a dramatic impact on egg production cost. The continued sustainability and growth of Iowa's egg sector will depend upon the state's competitiveness compared to other regions, especially those closer to major market centers. Iowa has a feed price advantage due to its extensive feed-grain production. Iowa's feed price advantage has been relatively stable over the last 12 years, with some natural fluctuations, and will likely be maintained for the foreseeable future. Producers operating in other states will have to focus on either improving feed efficiency or reducing non-feed costs to offset Iowa's advantage.

Table 2.1 Iowa egg cost of production budget, 2018.

Input	Cents per dozen
Pullets	10.40
Feed	28.47
Labor*	04.52
Other Costs*	13.00
Total Costs	**56.39**

* Note: The non-feed costs were obtained from producer surveys. *Source: Egg Industry Center*

Iowa's competitive position

The Iowa model is used as the starting point to estimate production costs in California and Pennsylvania. These two states are among the top ten US egg producers. While they are located away from the feed-producing region of the Midwest, they are located closer to large population centers on the coasts. While Iowa and Pennsylvania use similar systems for commercial egg production, California has a different set of rules under Proposition 2 that started in January 2015, and requires that all laying hens in California be provided at least 116 in.^{2} of space per hen. Starting in January 2015, all eggs imported into California were required to have the same space per hen, unless the eggs were pasteurized. Pasteurization is a general practice for egg products, but is rarely done for shell eggs. Therefore, this rule affected these two subsets of the industry very differently. The analysis accounts for different prices for production inputs in the region, but does not adjust for possible differences in the costs of land for the production site, construction materials, or utilities. The sensitivity analysis does address differences in the cost of production due to annualized facility and equipment costs.

Table 2.2 compares the relative price of inputs and total costs for egg production in Iowa, California, and Pennsylvania. The corn and soybean meal price is based on USDA-AMS prices. The labor cost differences are based on reported prices from USDA's National Agricultural Statistics Service (NASS). Iowa has the lowest feed and total cost of the states considered in the study.

Table 2.2 Input prices, indexes, and cost of production for Iowa, California, and Pennsylvania, 2018.

	Corn ($ per bushel)	Soybean Meal ($/ton)	Labor ($/hour)	Total Cost (cents/dozen)
Iowa	3.41	323.00	18.63	**56.39**
California	4.89	379.00	20.51	**77.73**
Pennsylvania	4.00	354.00	18.56	**60.13**

Note: Non-feed and non-pullet costs included in the total cost calculation are assumed to be equal across Iowa and Pennsylvania at 17.52 cents per dozen. It is assumed to be 73% higher in California as a consequence of the 73% higher space per hen required. *Source: USDA National Agricultural Statistics Service, Total Cost calculated by the Egg Industry Center*

The estimated cost of production in Pennsylvania was only 3.74 cents per dozen higher than in Iowa. On the other hand, the estimated cost of production in California was 21.34 cents per dozen higher than in Iowa, and 12.81 cents per dozen are explained by the higher space requirement. Therefore, Iowa egg producers supplying egg products to California can do so at a 21.34 cents per dozen equivalent lower cost of production, while Iowa egg producers supplying shell eggs to California can do so at only 8.53 cents per dozen lower cost of production. This difference is because the Iowa shell egg producers need to meet California's requirement of providing 116 in.^{2} space per hen.

Table 2.3 shows total production cost estimates at various combinations of corn and soybean meal prices and the impact of changes in key price and production variables. [The bolded red values are the initial values represented in Table 2.1.] Note that a 34 cents per bushel (10%) increase in corn price increases the cost of producing eggs approximately 1.45 cents per dozen. A $32 per ton (10%) increase in soybean meal price increases the cost of producing eggs approximately 1.27 cents per dozen. The largest non-feed expense factor is the cost of pullets – a 10% increase in this expense increases the cost of producing eggs 1.04 cents per dozen. Hen productivity and feed conversion are paramount. A 10% decrease in eggs per hen housed results in nearly a 3.10 cents per dozen higher cost of production, while a 10% increase in feed use per dozen eggs results in nearly a 2.84 cents per dozen higher cost of production.

Table 2.3 Iowa cost of egg production (cents per dozen) at different corn and soybean meal prices and due to a 10 and 20% change in selected variables.

Soybean Meal/Corn	$2.73	$3.07	$3.41	$3.75	$4.09
$258	50.94	52.40	53.86	55.31	56.77
$291	52.22	53.67	55.13	56.58	58.04
$323	53.48	54.94	**56.39**	57.85	59.31
$355	54.75	56.21	57.67	59.12	60.58
$388	56.02	57.47	58.93	60.39	61.85

	Eggs/hen/year	Feed/doz.	Pullet	Non-feed and non-pullet
Initial Value	290	3.36	10.40	17.52
-10%	59.49	53.55	55.35	54.64
Base	**56.39**	**56.39**	**56.39**	**56.39**
10%	53.85	59.24	57.43	58.14

It is remarkable to see that Iowa holds a lower cost of production than Pennsylvania and California, even if the feed costs in Iowa increase 10%, production drops 10% per hen, or non-feed costs increase by 10%. Production efficiency is primarily related to diet, environmental conditions, genetics, and other factors controlled by management. Efficiency improvements achieved in other states could threaten Iowa's cost advantage; however, feed conversion or production improvements achieved in other areas would also be available to Iowa producers, which suggests competitive gains would be short-lived.

Iowa's major challenge is its lack of proximity to population centers. Pennsylvania producers are closer to the urban areas on the East Coast. California producers are closer to the population centers on the West Coast. Table 2.4 estimates the cost (cents per dozen) of transporting shell eggs from central Iowa to markets near New York City and Los Angeles. It also compares the shipping cost associated with production areas closer to these population centers. The freight rate is based on current commercial rates for refrigerated trucks. The rate from Des Moines to a West Coast market would cost around $1.97 per loaded mile; the rate from Des Moines to the East Coast was found to be closer to $3.70 per loaded mile. The cost of transporting eggs between Pennsylvania and New York is the simple average of seven trucking companies replying to our survey. All seven responses were above $1,100 per trip, even though the distance was rather short. A response was not received for transporting eggs within California, but it was assumed that the cost per trip would be $1,100.

Iowa's transport cost is 11.3 cents per dozen higher than the cost from Pennsylvania to New York City and 8.8 cents per dozen more than a production site in California to Los Angeles. When competing against these regions for the table egg market, Iowa may be vulnerable to transportation costs, especially with respect to Pennsylvania. Iowa compensates for this freight disadvantage to major cities by sending a disproportionate number of eggs into the breaker market for further processing into processed egg products. In many cases, food manufacturers are also located in the Midwest, and what is shipped to the consumers are final products that contain eggs as one of the ingredients.

For the shell egg market, the difference in transportation cost between Iowa and California is similar to the difference in feed cost. Therefore, most of the competitive advantage of Iowa is egg products production (liquid or dried). For Iowa, it is more challenging to compete on the East Coast, especially considering that the second and third largest egg producing states (Ohio and Indiana) have lower transportation costs and only slightly higher feed ingredient prices.

Iowa's government and population, in general, understand the value that agriculture brings to the state's economy. The large

Table 2.4 Shell egg transportation to population centers (cents per dozen), 2019.

	Production Center		
Destination	**Iowa**	**California**	**Pennsylvania**
Los Angeles	13.2	4.4	
New York City	16.3		5.0

Source: Egg Industry Center

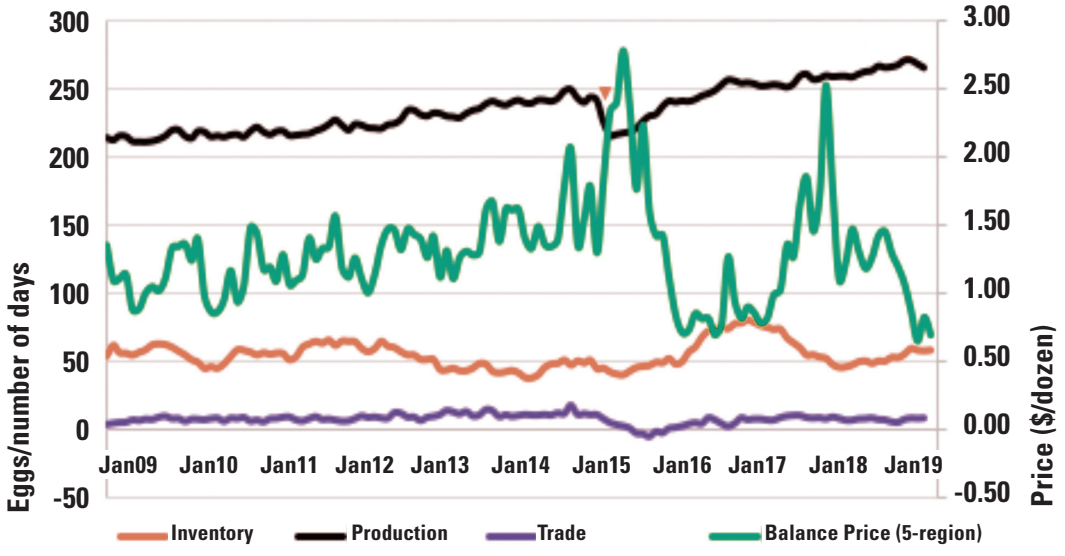
scale of production in the state reduces the fixed costs per unit of output, and also allows producers to hire experts to solve their production challenges resulting in better production efficiency. The proximity to cropland makes it easy for Iowa's producers to utilize the manure as fertilizer and the egg shells for field amendment.

While Iowa enjoys many advantages for its egg industry, some challenges should be monitored closely. The most important one is the transition to cage-free production. This requires a major investment in new facilities in order to comply with customer requirements and regulations in states where the eggs are sold. To meet these requirements, the investment needed per hen is much higher than for conventional production. This can reduce the relative importance of feed cost on the total egg production cost. The lower stocking density requires higher insulation of the layer barns, and in some cases requires additional heat. The cage-free transition will not only impact Iowa, but also other colder climate states with a sizable egg industry such as Indiana, Ohio, and Pennsylvania. Much of the new investment in cage-free production is in warmer weather locations that are closer to California, specifically targeting that market with its new regulations. Cage-free production requires more rural labor and more specialized labor. Recruiting and retaining adequate labor is already a challenge nationwide, and especially in Iowa, which has one of the US's lowest unemployment rates. Development of new technologies including automation and robotics could help offset this challenge for rural areas, and any opportunity to make rural living more appealing in Iowa should be seriously considered. It remains unclear if companies will use rural labor availability as a factor when deciding whether to build the newer cage-free facilities.

Beyond cage-free, further regulations or customer-driven requests that would require moving to production systems that mandate access to the outdoors year-round would pose a significant challenge for Iowa's egg industry. Cold winters represent a big challenge to egg production systems that require access to the outdoors such as free-range or organic.

Prices of eggs delivered to the store door have been very volatile since the end of 2014 for the many reasons explained in Chapter 1. This volatility creates uncertainty for the egg industry in general regardless of the region of the country the farms are located. Figure 2.1 below shows the trend of the prices of eggs delivered to the store door as an illustration. The figure is a five-region average of all other states in the US, excluding California, because the differences associated with Proposition 2 resulted in higher prices paid for eggs that are sold into the California market.

Figure 2.1 Production, inventory trade, and large white egg prices



CHAPTER 3:
ECONOMIC IMPACTS

Iowa is the largest egg-producing state in the US. The national Egg Industry Center, administered by Iowa State University, estimates that Iowa eggs produced and marketed in 2018 had a value of over $1.333 billion. This includes hatchery eggs produced in Iowa for export ($34.5 million), eggs for the shell market ($499.0 million), and liquid eggs ($799.3 million). Some $42.1 million worth of hatchery eggs were utilized to maintain Iowa's laying flock, but their value is subsumed into the final sale value of Iowa eggs as an intermediate input.[1]

The value of hens no longer in full production and manure were not considered for this analysis. Further research is needed to quantify these so they can be included in future reports.

The majority of Iowa egg production takes place in large integrated laying and breaking facilities. Iowa delivers approximately 70% of its eggs in liquid form. This allows Iowa producers to take advantage of plentiful and inexpensive local feed supplies and optimize transportation costs to more distant population centers. This also holds the first step of value-added processing in Iowa at the egg production facility.

Because nearly all egg breaking facilities in Iowa are either in-line (integrated with production facilities) or locally housed as dedicated extensions of specific laying facilities, Iowa egg-breaking employment is included in statistics for egg production. Chicken egg production employment and wage statistics[2] for Iowa from 2014 through 2018 are presented in Table 3.1. The first section of Table 3.1 presents the number of establishments and employees and the value of employee compensation in the Iowa egg production industry. The lower two sections show statistics for Iowa egg production as a percent of all Iowa poultry production and as a percent of all Iowa animal production and aquaculture.

Table 3.1 also shows that chicken egg production accounts for over 75% of all poultry product production employment in the state. Additionally, it shows chicken egg production accounts for over 20% of all reported livestock production employment in Iowa. Employment in the chicken egg production sector pays more than employment in the production of poultry or livestock in general.

The most recent Census of Agriculture (2017) reports 4,425 egg-producing farms housing 56.5 million layers in Iowa. The majority of these farms, however, are relatively small producers serving local markets (range, organic, farm-fresh) without USDA inspection. Some 92% of these farms have fewer than 100 layers per farm. Only 29 farms that responded to the census report having 100,000 layers or more. The majority of Iowa egg production is concentrated in the large laying facilities inspected by the USDA and covered by employment security legislation. This means these operations are included in the report's production valuation and employment statistics above. This report focuses on the economic impact of these large-scale commercial egg production facilities.

Egg production depends on inputs, and the purchase of these inputs generates significant economic activity throughout the state. As Table 3.1 shows, one of those inputs is labor. When labor spends the money earned from egg production activities to purchase housing, cars, food, entertainment, and more, that further expands the economic contribution of egg production to the Iowa economy.

Table 3.1 Chicken egg production enployment statistics.

Year	Industry	Establishments	Employment	Total Wages	Average Annual Pay
2014	Chicken egg production	55.00	1,691	62,994,185	37,258
2015	Chicken egg production	59.00	2,153	96,515,696	44,820
2016	Chicken egg production	60.00	2,238	96,683,023	43,201
2017	Chicken egg production	60.00	2,307	102,756,331	44,536
2018	Chicken egg production	58.00	2,398	110,214,142	45,967
2014	As a % of poultry and egg production	58.51	59.96	57.74	96.32
2015	As a % of poultry and egg production	62.11	75.46	79.95	105.91
2016	As a % of poultry and egg production	60.00	75.10	77.76	103.53
2017	As a % of poultry and egg production	58.82	75.86	78.10	102.92
2018	As a % of poultry and egg production	57.43	75.34	77.40	102.76
2014	As a % of animal production and aquaculture	5.46	16.02	16.55	103.35
2015	As a % of animal production and aquaculture	5.80	19.64	23.67	120.46
2016	As a % of animal production and aquaculture	5.85	19.88	22.65	113.94
2017	As a % of animal production and aquaculture	5.79	20.22	22.87	113.11
2018	As a % of animal production and aquaculture	5.48	20.31	22.80	112.31

Source: Private Industry Employment, Census of Employment and Wages, United States Bureau of Labor Statistics

The value of egg production itself is looked upon as the "Direct Effect" of the industry. The value of inputs purchased to support egg production generates the "Indirect Effect" of egg production. When workers and owners spend their incomes from the egg production and input production processes, that generates the "Induced Effect" of egg production.

Direct effects include the 2,398 employees, the $110.2 million payroll, and the $1.333 billion in output directly engaged in or resulting from egg production. Indirect effects include the purchase of 1.618 tons of corn (57.789 million bushels valued at $196.789 million) and 531,317 tons of soybean meal valued at nearly $171.817 million to feed the laying hens, produce 96 million fertilized eggs ($35.2 million), and raise pullets to replenish laying-hen inventories.[3] Figure 3.1 provides a simplified view of these processes, inputs, and expenditures. Induced effects result from the expenditure of the $110.21 million egg production payroll and all of the input-producing business payrolls initiated by egg production.

The discussion above and in Figure 3.1 provide a simple overview of the most obvious effects of egg production in Iowa upon the surrounding economy, but it does not begin to capture all of the transactions surrounding input production or payroll expenditures that egg production initiates. To get a picture of how far and wide Iowa egg production affects the Iowa economy, the IMPLAN economic modelling software was configured to reflect the initial state of the egg industry. The software was then run to estimate all the transactions within the state that result from input purchases and payroll expenditures initiated by Iowa egg production.

The modeling process starts with direct activity from the Iowa egg production industry. The US Bureau of Labor Statistics reports that 2018 Iowa egg production employed 2,398 workers who received $110.21 million in compensation. The Egg Industry Center estimates the value of Iowa egg production output in 2018 as $1.298 billion and that Iowa hatcheries produced $34.5 billion worth of fertile eggs for export to other states (fertile hatchery eggs produced to renew Iowa flocks will show up as an egg production input – an indirect effect). So model inputs were a direct effect of 2,398 jobs and $1.333 billion in egg industry output (sales). Table 3.2 summarizes the results generated by the IMPLAN model for these initial direct inputs.

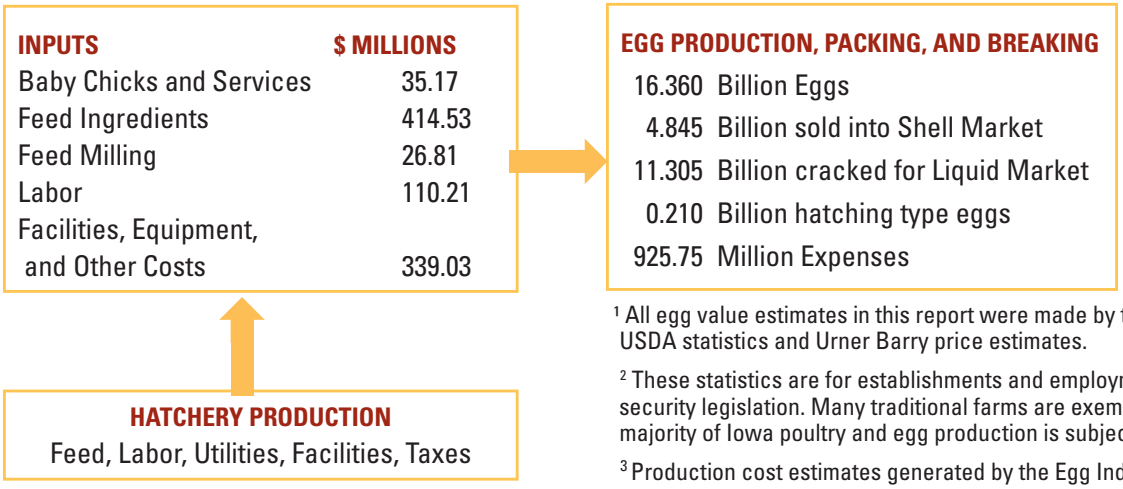
The egg industry's 2,398 direct employees and $1.333 billion in total direct output generated an additional 2,647 indirect jobs in industries that supplied inputs for egg production. When these 5,045 employees all spent their earnings, they induced another 2,039 jobs in the industries that provide goods and services to households (home construction and sales, auto sales, grocery stores, etc.).

Table 3.2 Summary of statewide economic impacts.

Impact Type	Jobs	Labor Income	Value Added	Output
Direct Effect	2,398	$194,943,827	$327,972,806	$1,332,799,953
Indirect Effect	2,647	$172,516,725	$308,940,482	$1,017,624,671
Induced Effect	2,039	$82,686,727	$151,301,673	$265,826,894
Total Effect	7,084	$450,147,278	$788,214,961	$2,616,251,518

Source: Regional Strategic, Ltd. utilizing IMPLAN modeling software

Figure 3.1 Egg production and integrated packing and breaking facilities.



[1] All egg value estimates in this report were made by the Egg Industry Center utilizing USDA statistics and Urner Barry price estimates.

[2] These statistics are for establishments and employment covered by employment security legislation. Many traditional farms are exempt from these regulations, but the majority of Iowa poultry and egg production is subject to employment security rules.

[3] Production cost estimates generated by the Egg Industry Center.

Table 3.3 Iowa Industry Sector Impacts Supported by Iowa Egg Production.

	Jobs	Labor Income	Value Added	Output
Total	**7,084**	**$450,147,278**	**$788,214,961**	**$2,616,251,518**
Agriculture	2,846	$219,551,437	$367,300,930	$1,534,522,432
Mining	8	$219,930	$430,495	$1,140,554
Construction	89	$5,314,095	$6,179,103	$13,581,724
Manufacturing	396	$34,804,105	$73,447,179	$490,582,372
Transportation & Public Utilities	505	$36,095,090	$60,558,945	$120,928,337
Trade	1,028	$59,153,324	$107,685,928	$168,586,538
Service	2,164	$91,347,398	$168,426,355	$278,559,941
Government	49	$3,661,899	$4,186,024	$8,349,620

Source: Regional Strategic, Ltd. utilizing IMPLAN modeling software

In the end, egg production activities support 7,084 jobs, $450.15 million in labor and proprietor income, and $2.62 billion in total industrial output in the state. Thirty percent of this output represents value-added, or the portion of production value that is added by Iowa economic activity rather than imported as inputs.

Table 3.3 breaks these contributions down by major industrial sectors in Iowa. The top row (Total) in Table 3.3 corresponds to the bottom row (Total Effect) in Table 3.2. While Table 3.2 breaks down effects by direct egg production activity, indirect input production activity, and induced payroll-generated activity, Table 3.3 shows only the total effect distributed across Iowa's major industrial sectors. It is no surprise that the majority of activity is supported in the agricultural sector, as that sector includes the direct effect and major input expenditures for feed and hatchery output. The next largest sector effects are in the trade and service sectors, which absorb a large proportion of the payroll-induced effects resulting from household expenditures.

Total additional economic output supported is almost equal to the initial direct egg production output, and additional labor income and value-added components supported by egg production are 1.3 and 1.4 times, respectively, the initial direct labor income and value-added components of the actual egg production activity. The egg production industry in Iowa supports 1.9 additional jobs for every job directly created in egg production.