

Corn and Poultry: A Great Partnership

World Perspectives, Inc.

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America's corn growers and poultry producers form one of American agriculture's great partnerships, as each sector adds value to the other's production. This report considers how broilers, eggs, turkeys, and ducks benefit America's corn growers. More specifically, analysis from World Perspectives, Inc. will focus on the unique and important impact that exports of U.S. poultry and products have in regard to bringing value to the domestic market for corn. Over the next 10 years, this export value is projected to generate approximately **\$1 billion per year** (on avg.) to U.S. corn growers. With the opening of new markets and re-opening of closed markets, that value would only increase.

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Poultry and Feed Demand

Domestic and global demand will drive protein consumption into the coming decade. Over the next 10 years, according to the early release version of USDA's 2018-2027 Baseline Projections, feed demand for corn is projected to grow by more than 12 percent. That projected growth compares to an increase of only 0.3 percent for food and industrial use *and* a 1.4 percent drop in ethanol use of corn over the same period.

Fundamental to any growth in the feed demand for corn is poultry production. The U.S. is the largest poultry producer in the world. ***During 2016/2017, U.S. poultry utilized more than 30 percent of all feed use of corn.*** WPI estimates that the 2016/2017 corn utilization for broiler, egg and turkey production was 1.663 billion bushels. Additionally, 3.58 million tons of DDGS were used. At 17 pounds per bushel, this volume of DDGS is the equivalent of another 421.6 million bushels of corn. Combined, that is 2.084 billion bushels of feed use, representing the harvest from 11.953 million acres. That acreage equivalent represents 14.3 percent of the total corn area harvested for grain, according to data from the USDA's National Agricultural Statistical Service (NASS). Projected for 2027: total corn and DDGS use by poultry will increase by another 336 million bushels of corn and DDGS, to 2.42 billion bushels.

Many of the top corn producing states are also home to significant poultry production as well. Among the top 10 corn states are the top three egg-producing states and five of the top 10 turkey producing states. This production utilized more than 340 million bushels of home-grown corn and another 733,576 tons of DDGS in 2016.

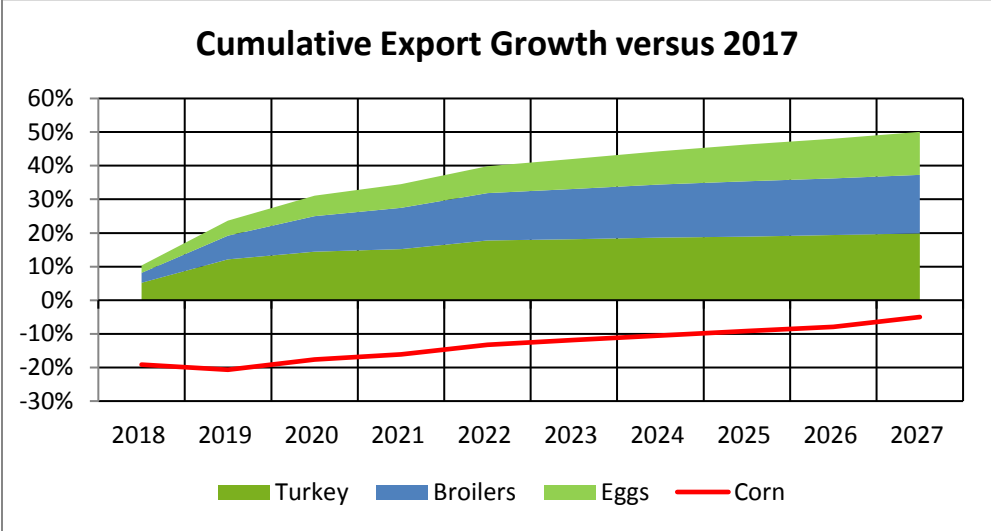
Top Corn States' Rank in Poultry and Egg Production					
State	Eggs	Broilers	Turkeys	<i>in-State Corn use mln bu</i>	<i>in-State DDGS use tons</i>
Iowa	1	-	7	62.02	133,612
Illinois	19	-	-	5.05	10,871
Nebraska	13	-	-	8.45	18,210
Minnesota	12	19	2	58.74	126,522
Indiana	3	-	3	58.75	127,545
South Dakota	29	-	12	8.7	18,760
Wisconsin	18	20	-	11.57	24,916
Missouri	11	12	4	73.49	158,270
Ohio	2	16	9	53.32	114,870

Source: WPI calculations based on USDA data

Poultry Exports and Indirect Corn Exports

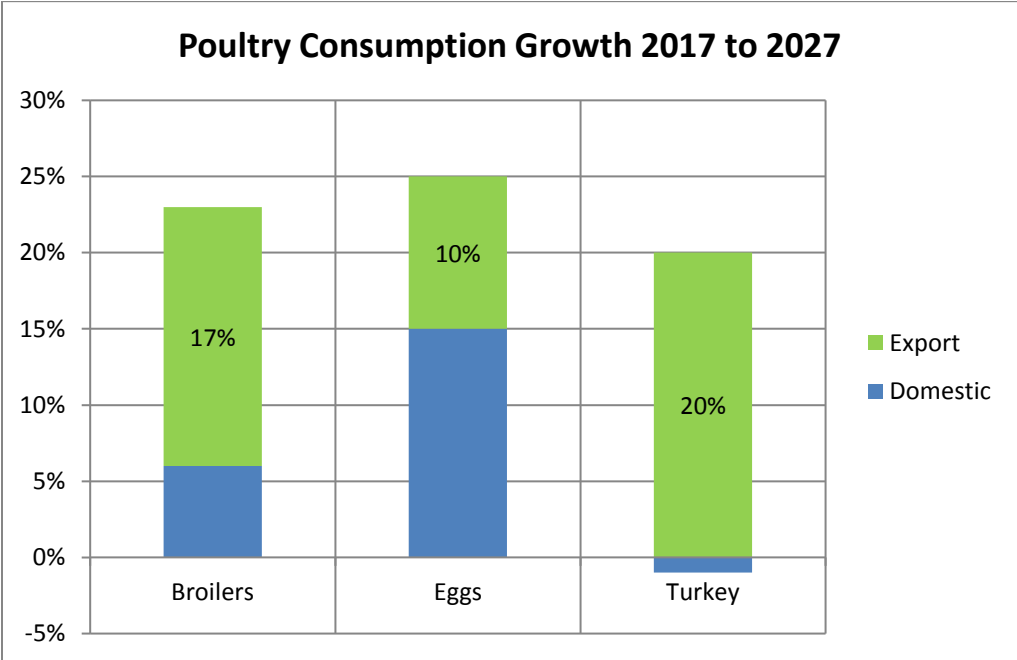
The U.S. is also the world's second largest poultry exporter. Therefore, poultry's demand for feed reflects both the domestic and international markets for U.S. broiler meat, turkey meat, shell

eggs and egg products. While poultry exports are projected to grow over the next decade, over that same period corn exports are not expected again to reach the total booked in 2016/2017. Consider: over the next 10 years, *direct corn exports will decrease 93 million bushels while indirect corn exports through poultry will grow by 40 million bushels.*



Source: USDA, WPI

According to USDA’s projections, the net growth for corn use derived from the global market will be generated from poultry exports, which generally are projected to expand at a faster rate than domestic consumption.

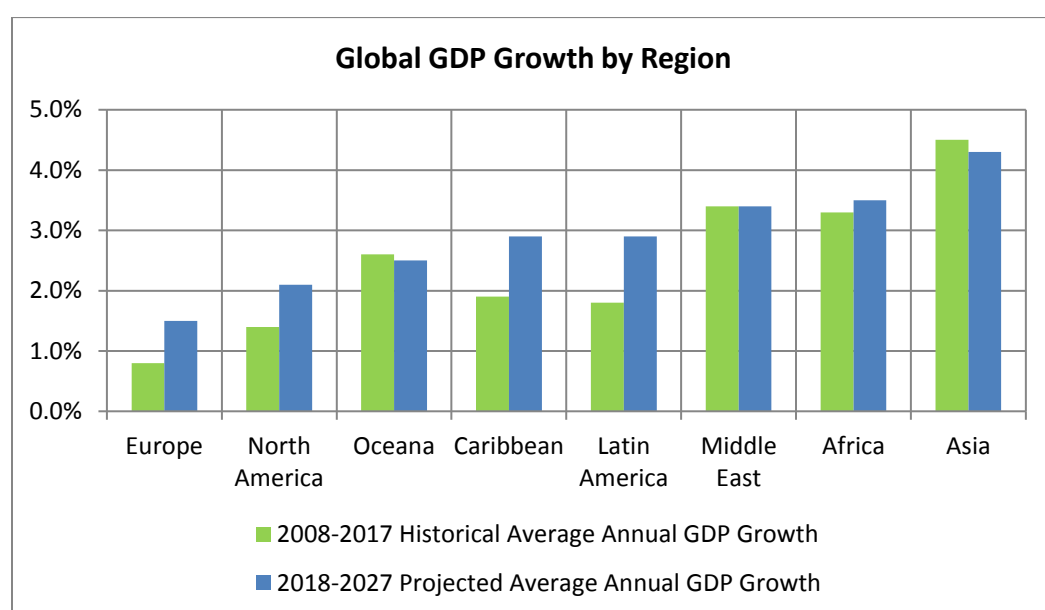


Source: USDA, WPI

The amount of corn and DDGS utilized by U.S. poultry exports are referred to as *indirect exports*. Each pound of poultry or product that is exported represents the domestic feed used in producing it. Thus, the domestic corn which has been fed is indirectly exported through poultry shipped to foreign markets.

Global Market Outlook

Looking out over the next decade, the projected growth in U.S. poultry and egg exports is driven by economic and demographic trends in key markets. Overall, global GDP is projected to grow at an average of 2.9 percent per year over the next 10 years; that's faster than the 2.3 average annual rate experienced over the past 10 years.



Source: USDA, WPI

The exceptions to increased growth rates are Oceania, where future growth is still pegged at a healthy 2.5 percent, and in Asia, which remains the highest growth region in USDA's forecast. Asia's growth is down slightly compared to the past 10 years, in part because of China slowing down from its growth rate of more than 8 percent to a still robust 5.5 percent.

Another key indicator for the future found in the USDA's preliminary numbers is the growth trend in global population. The four fastest growing regions – Asia, Africa, the Middle East and Latin America – are also the regions which will see the greatest population growth, ranging from an annual average of 0.8 percent in Latin America to 2.2 in Africa.

Population and economic growth are the drivers of global agricultural trade and protein demand. More people, with greater economic means, demand additional protein in the form of poultry and egg products. In its baseline outlook for 2017 to 2027, USDA projected that poultry exports

by the major poultry exporting countries will increase by almost 24 percent, reaching more than 14.0 million metric tons by 2026/27 and adding nearly 3 million metric tons over the projection period. U.S. corn growers benefit from this increased global trade when U.S. poultry captures part of that market expansion.

Export Recovery

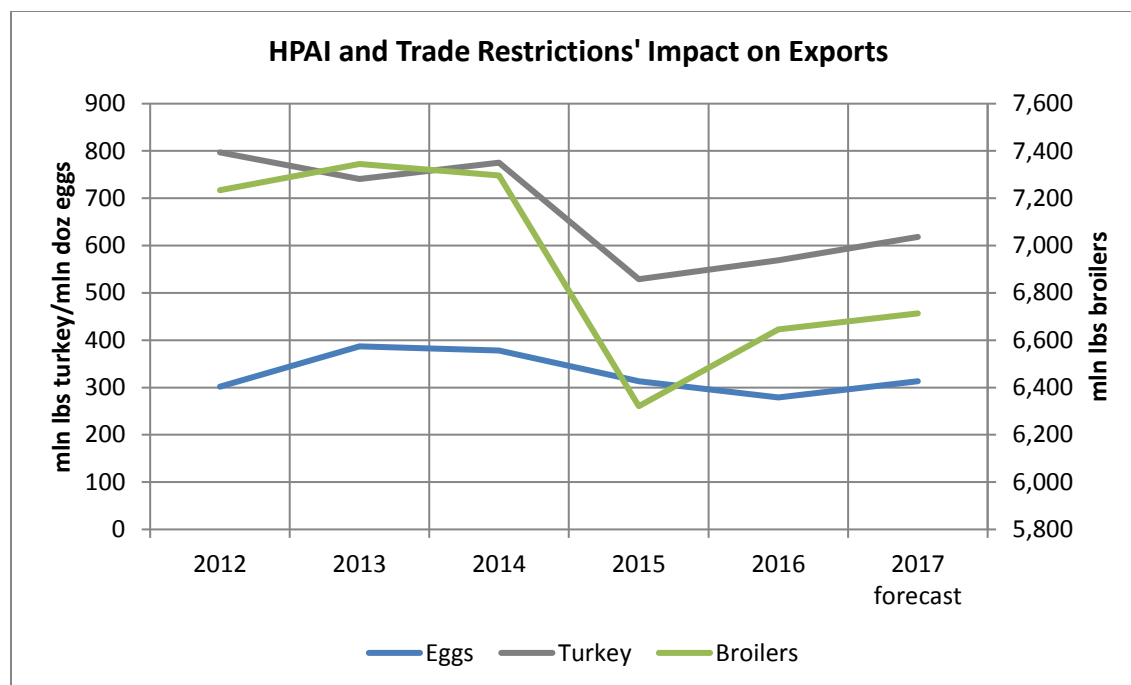
Expansion in poultry and egg exports is of critical importance, not only to the poultry sector, but to corn growers as well. Between December 2014 and June 2015, more than 50 million chickens and turkeys in the United States were lost due to the outbreak of highly pathogenic avian influenza (HPAI). According to the USDA, the lost birds comprised about 12 percent of the U.S. table-egg laying population and 8 percent of the estimated inventory of turkeys grown for meat.

As USDA's Economic Research Service (ERS) stated:

HPAI resulted in substantially lower exports of U.S. poultry products as the supply of egg and turkey products declined and over 50 countries restricted the import of U.S. poultry products to varying degrees. Lower supplies of turkey and egg products led to higher prices, which further reduced export volume.

Though the outbreak did not impact the broiler sector, HPAI-related trade restrictions and other factors caused broiler exports during the July-to-December 2015 period to drop by 18 percent below the same period in 2014. Again, according to USDA figures, in 2015:

- Broiler exports were \$1.1 billion lower than year prior exports, a 26-percent decrease;
- Egg export income declined \$41 million, a loss of 13 percent;
- Turkey export income was \$177 million lower, a 23-percent decline.



Source: USDA, WPI

Though 2016 exports were still not at pre-HPAI levels, the impact of poultry and egg exports nonetheless was significant as detailed later in this report. Further, the impact of poultry and egg exports will grow as exports expand over the 2017 to 2027 period.

Economics of Poultry and Egg Exports

U.S. poultry exports help corn growers in two ways – by increasing volume and by adding value.

- **Volume:** First, exports expand the domestic demand for feedstuffs by driving flock expansion. The most illustrative example of exports leading to increased domestic production is the forecast growth in turkey. From 2018 to 2027, 64 percent of the projected increase in turkey production will be destined for export markets. Without those markets, production would be unlikely to expand as projected.
- **Value:** Secondly, and perhaps more importantly, exports also add value by selling certain cuts or certain products in markets where there exists a greater demand and a higher value. Consider products that are undervalued in the United States, vis-a-vis export markets: two key examples are dark meat broiler leg quarters which are preferred in many export markets, and chicken paws, which are not consumed in the U.S.

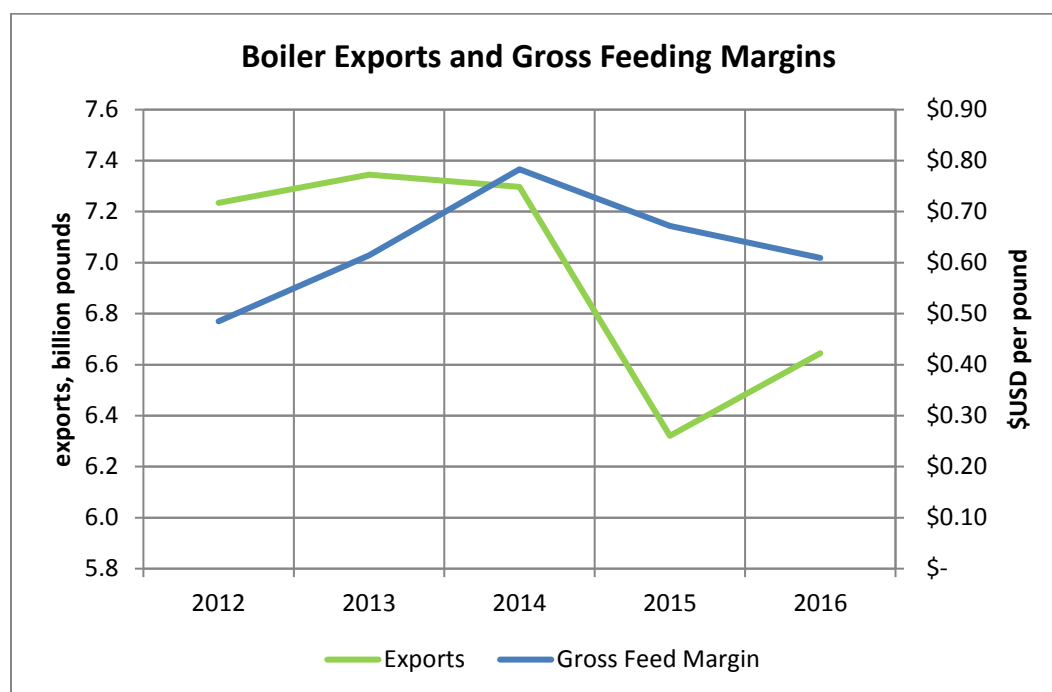
The portion of the overall price to poultry meat derived from export demand can be estimated by considering the total dollar value of all exports against the total production. The table below

shows the export premium brought to broilers over the past five years, as well as the estimated gross feeding margin for broilers.

Value of Exports to Broilers					
	2012	2013	2014	2015	2016
Export Premium	\$0.12	\$0.14	\$0.15	\$0.11	\$0.10
Domestic Value	\$0.74	\$0.86	\$0.90	\$0.80	\$0.74
Feed Costs	\$0.292	\$0.287	\$0.2026	\$0.181	\$0.175
Gross Feeding Margin	\$0.485	\$0.614	\$0.783	\$0.672	\$0.609

Source: WPI calculations on USDA data

Shown in a chart format below, exports clearly impact the profitability of broiler production. Of course, when poultry production is profitable expansion occurs – and corn demand increases.



Source: WPI calculations on USDA data

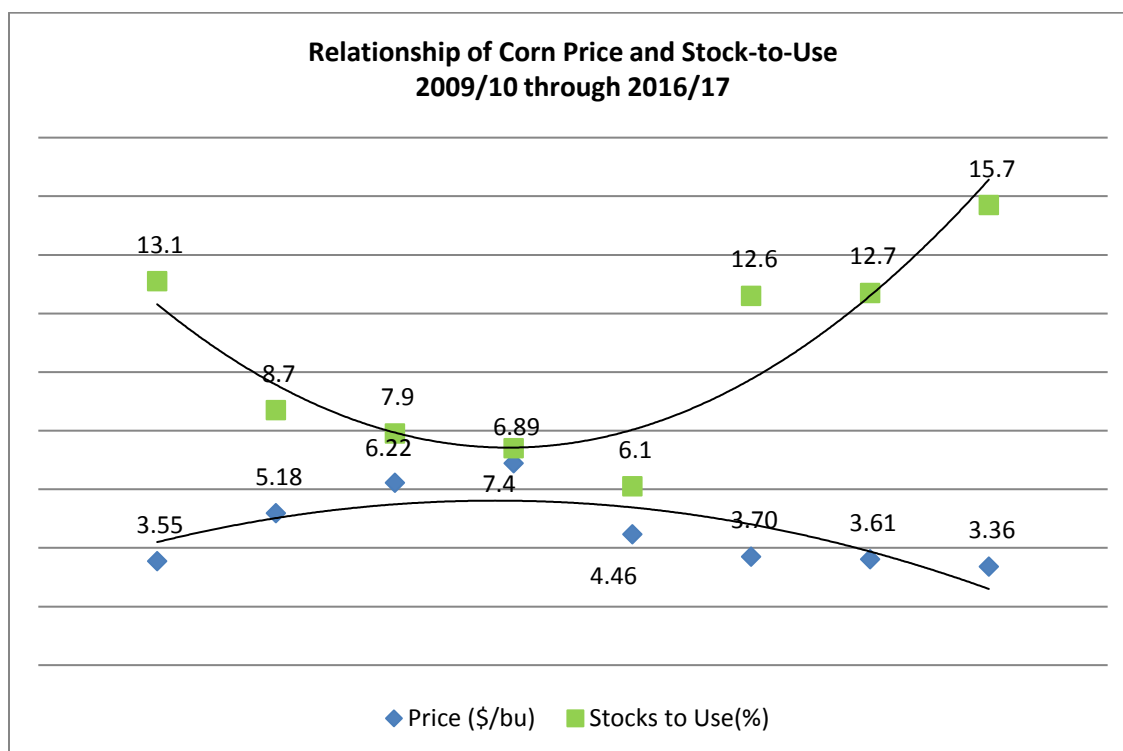
Poultry Exports' Impact on the Price of Corn

Exports do more than improve broiler margins, however. Overall, demand from poultry exports adds to the price of corn. While poultry exports comprise only about 4.1 percent of feed demand, and about 1.5 percent of total corn use, commodities are nonetheless priced on the marginal demand so the impact on corn prices is still significant.

Though the price relationship between supply and demand is complex and dynamic, the following calculation shows an example of the impact of indirect exports on corn prices:

1. Take a “snapshot” of the marketplace with end-of-the-year averages.
2. Hold other demands constant (i.e. food, seed, industrial, ethanol, non-pork and beef feed demand).
3. Hold supply constant.
4. Assume there were no beef or pork exports.
5. Add that amount to the ending stocks-to-use ratio.

The above steps lead to the estimate that – looking backwards at the year-end market totals – *in 2016/17 poultry exports added about \$0.28 to the per-bushel price of corn of \$3.36.*



Source: WPI based on USDA historical WASDE

The above chart shows the annual average price of corn and the market year ending stocks-to-use ratio. Based on the relationship of these curves, it can be estimated that poultry exports in 2016 contributed about \$0.28 to the season average 2016/17 price of \$3.36 per bushel. Based on this calculation, without poultry exports in 2016, U.S. corn growers would have lost about \$4.1 billion in revenues based on the same sized crop that was harvested that year. Among the top corn producing states, the would-be losses per state are shown below.

Lost Value to Corn without Poultry and Egg Exports in 2016		
State	Total Lost Value in millions \$USD	Per Acre Lost Value in \$USD
Iowa	\$741.750	\$54.94
Illinois	\$610.519	\$53.32
Nebraska	\$460.099	\$48.18
Minnesota	\$417.902	\$55.35
Indiana	\$256.130	\$47.70
South Dakota	\$223.548	\$43.58
Kansas	\$189.095	\$38.43
Wisconsin	\$155.133	\$48.18
Missouri	\$154.413	\$44.12
Ohio	\$142.016	\$43.04
North Dakota	\$139,840	\$42.76

Source: WPI, USDA

Poultry Exports and Indirect Exports of Corn

To calculate the amount of indirect exports of corn via poultry, WPI relied on the following assumptions based on feed conversion analysis and market data:

Estimated Feed Use by Poultry			
	Corn lbs.	DDGS lbs.	Soybean Meal lbs.
Broiler	8	1	3
Turkey	47	4	18
Eggs	2	0.2	1

Source: WPI

Based on the above, indirect corn exports through poultry and eggs were 230.4 million bushels in 2016 – which was 49 million bushels less than the three-year 2012-2013-2014 average.

Scenario Analysis

Expanding Turkey Exports to Oceania

USAPEEC has targeted the expansion of turkey meat exports to Australia and New Zealand. Australia is still closed to poultry imports; New Zealand has just opened its market. Chicken is the most consumed meat in Australia; it competes on price against beef, lamb, mutton and pork, and continues to expand. For the past 5 years, poultry consumption in Australia has grown about 2.8 percent, and it is expected to continue to grow. In New Zealand, the newly opened market

imported 304,000 pounds of turkey meat during the January to October 2017, compared to a mere 9,000 lbs. the year prior.

- **Projection:** If 3 percent of the growing poultry meat consumption in the combined Oceania market were imported U.S. turkey, the cumulative total of indirect corn exports would be 35 million bushels along with 76,000 tons of DDGS; that compared to 14,500 bushels of corn and 31 tons of DDGS in 2016.

Maintaining the North American Market for Eggs

Under NAFTA, egg exports to Canada grew 70 percent and exports to Mexico grew more than 400 percent; Mexico and Canada are the two largest markets for the export of U.S. eggs and products. In the last three years, egg exports to those two markets have used the equivalent of 21.5 million bushels of corn and 46,316 tons of DDGS. Likewise, egg exports to the Caribbean nearly quadrupled from 2010 to 2016, reaching more than 33 million dozen eggs. According to the AEB, targeting a goal of 150 eggs per capita in the region could triple exports to the region at the equivalent of 100 million dozen.

- **Projection:** Combined with moderate growth in Canada and Mexico, egg exports to North America and the Caribbean could utilize nearly 12 million bushels of corn and 25,500 tons of DDGS per year.

Restoring Broiler Exports to South Africa

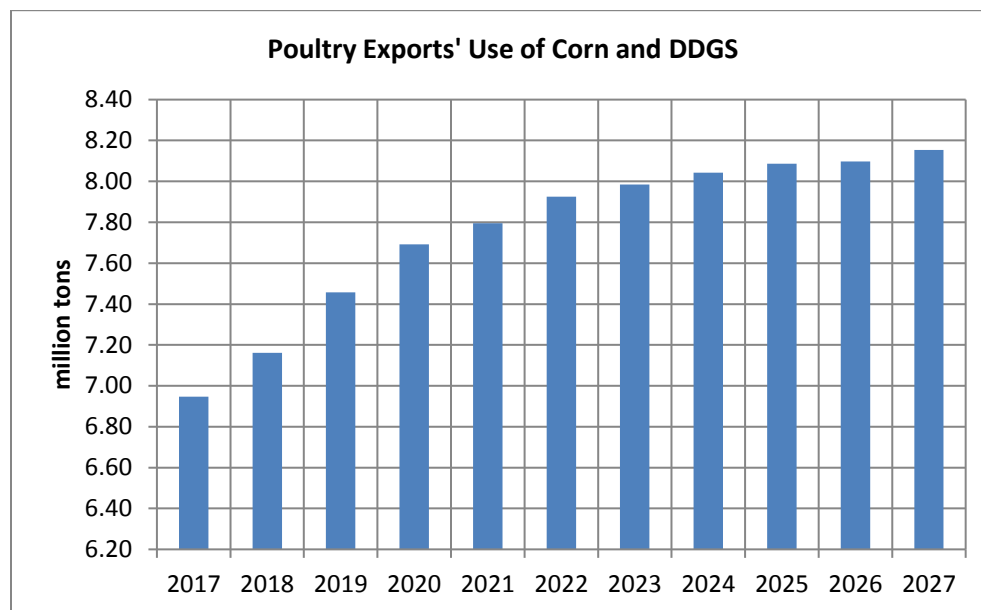
Access to South Africa for U.S. broiler meat was virtually cut off for 15 years due to the imposition of a duty on bone-in broiler meat of R2.35/kilogram (imposed in 2000). In 2012, the duty was extended for another 5 years, scheduled to expire in 2017, at the increased rate of R9.40/kilogram. In mid-2015, however, the U.S. negotiated a tariff rate quota (TRQ) of 65,000 tons of United States bone-in broiler meat to enter South Africa. This facilitated export shipments which arrived in the second quarter of 2016 and totaled 25,000 tons. Through the first 10 months of this year, shipments have increased more than 205 percent over the same period last year. This year's shipments of U.S. broiler meat alone could match the cumulative total of the last 5 years.

Projection: The new baseline of broiler exports to South Africa should utilize about 7.25 million bushels of corn and 15,625 tons of DDGS per year.

Long-Term Impact of Poultry Exports

Per USDA's projections for poultry exports, by 2027 indirect corn exports via poultry will grow to 270.4 million bushels, up from 239.4 million bushels in 2017, and indirect exports of DDGS will grow to 582,300 tons in 2027 from 496,100 tons in 2017. Combined, the total tonnage of corn-

based feedstuffs used by poultry exports will grow 1.2 million tons to 8.153 million tons in 2027, from 6.95 million tons in 2017.



Source: WPI calculations based on USDA data

That is a total bushel equivalent of corn and DDGS in 2027 of 338.9 million bushels, which represents 1.77 million acres of corn production at the projected per acre yield for 2027/28 of 191.5 bushels per acre.

Over the next 10 years, the cumulative growth of corn exports is projected to be 2.83 billion bushels of corn. Poultry and egg exports will also account for another 717.2 million bushels equivalent of DDGS, bringing the total impact of exports through 2027 to 3.547 billion bushels.

At the projected corn price in USDA's baseline, over the next 10 years, the value of broiler, turkey and egg exports to corn is projected to be \$9.678 billion and the total value to DDGS is projected to be \$634.37 million. ***That is a total combined value of \$10.312 billion.***

Those values are broken down by state in the table below.

2017-2017 Projection of Revenues per State from Poultry and Egg Exports		
State	Corn in millions \$USD	DDGS in millions \$USD
Iowa	\$1,750.800	\$163.9
Illinois	\$1,332.900	\$65.553
Nebraska	\$1,085.800	\$87.861
Minnesota	\$986.200	47.578
Indiana	\$559.498	\$43.995
South Dakota	\$527.460	\$43.327
Kansas	\$446.163	\$20.338
Wisconsin	\$365.835	\$22.139
Missouri	\$364.480	\$10.372
Ohio	\$334.864	\$22.203
North Dakota	\$330.025	\$19.444
OTHERS	\$1,594.150	\$87.664
TOTAL	\$9,678.176	\$634.374

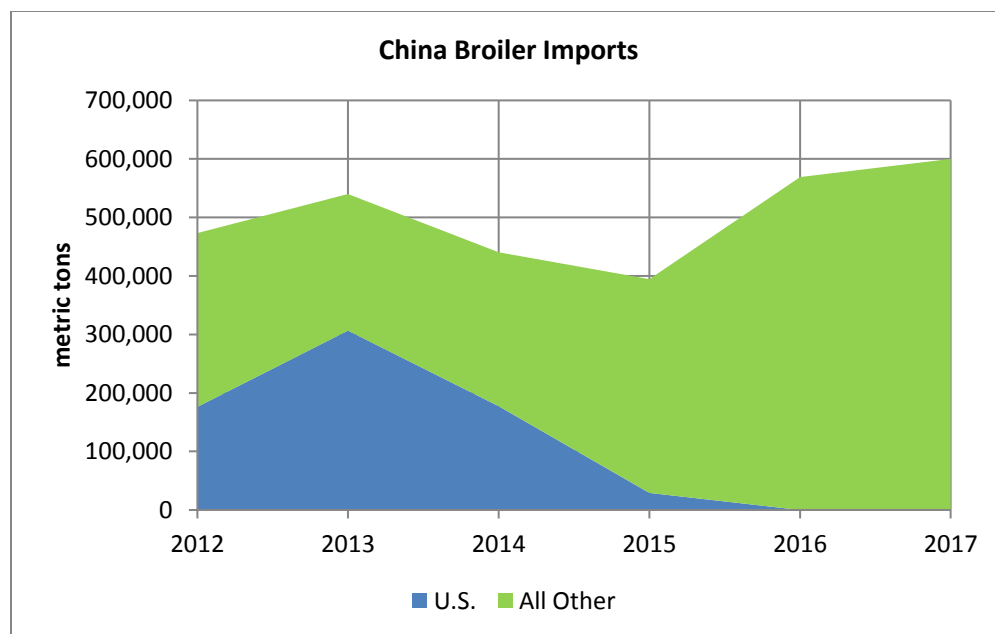
Source: WPI, USDA, RFA

Alternative Scenario: Access to China and India

The greatest opportunity for poultry and egg exports from the U.S. lies in access to the world's two largest markets: China and India. Both markets present "overwhelming potential for a quality, low-cost sources of protein like U.S. chicken, eggs and turkey," as was stated in joint testimony presented on behalf of the USA Poultry & Egg Export Council and the National Chicken Council to the House Agriculture Committee in the summer of 2017. However, U.S. exporters have virtually no access at present.

China is the world's most populous country with an increasing demand for protein. Additionally, regarding broiler meat in China, new regulatory oversight of traditional wet markets is adding opportunity for processed birds and broiler meat cuts, which could be filled by imports. Currently, imports from Brazil dominate the market.

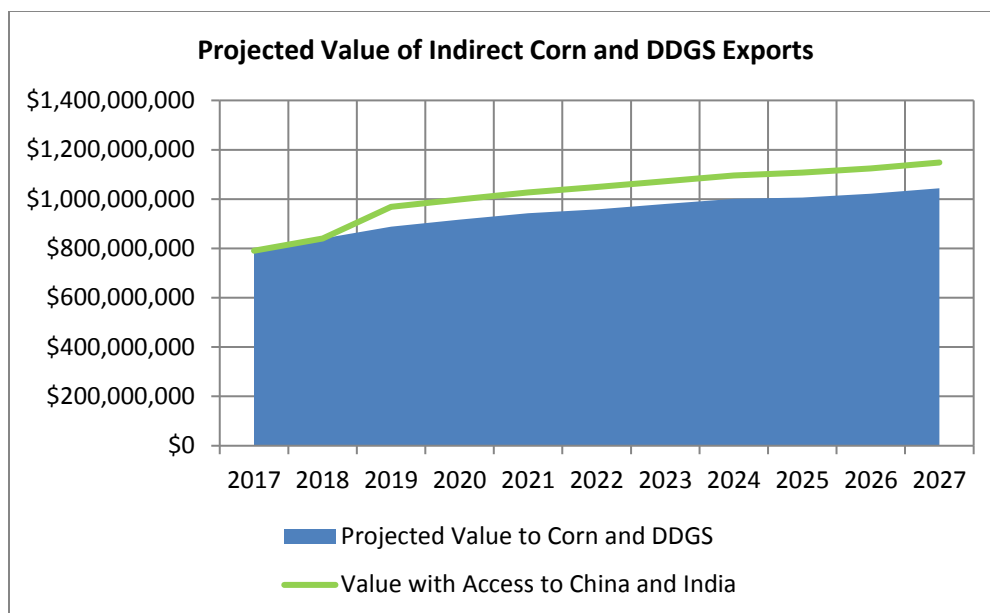
China maintains AI (both highly pathogenic and low pathogenic) related import restrictions and an import duty structure; these are inconsistent with the World Organization for Animal Health (OIE) and World Trade Organization (WTO) guidelines and rules. This has led to a dramatic reduction in broiler meat imports from the U.S. The U.S. went from supplying more than 50 percent of the import share in 2013 to no access the last two years.



Source: USDA, WPI

India currently has a population of 1.2 billion, and is on track to pass China and become the world's most populous country, with middle class households numbering about 80 million. Broiler meat consumption in India has increased more than 30 percent in the past five years. Imports from the U.S., however, have been shut out due to avian influenza-related restrictions. In 2015, the WTO ruled against India's ban, which could open the market to U.S. exports, particularly of leg quarters.

Projection: Based on gaining access to the Indian market for processed poultry, which is growing between 15 to 20 percent per year, and regaining a 35 percent share of the Chinese market (similar levels to 2012), broiler exports could grow to between 800 and 850 million pounds per year. That would result in the indirect export of 24 million bushels of corn, which is 10 percent of the 2019 projected total indirect corn exports through poultry. That level of exports to China and India would also represent another 51,560 tons of DDGS, or 6 million bushels equivalent.



Source: WPI calculations on USDA data

Reaching that goal of exports to China and India in 2019 would:

- Boost indirect corn exports through poultry by 24 million bushels per year, which is nearly 10 percent;
- And another 6 million bushels equivalent of DDGS per year in indirect exports;
- Bring a total cumulative value to corn growers of \$11.2 billion by 2027/28.

Spotlight on Ducks

In 2016, there were about 27.3 million head of commercial ducks in the U.S. Approximately 45 percent of the flock was in Indiana; the next two major duck producing states were California and Pennsylvania. Total commercial production was 186.72 million pounds (live weight) in 2016; corn usage totaled 4.67 million bushels plus another 9,336 tons of DDGS. About 2.1 million bushels were fed to ducks in Indiana.

While per-capita consumption of duck meat in the U.S. is only about one-third of a pound annually, it is a popular product globally. Exports bring extra value to producers and to the feed they use because, in addition to duck meat, there is a strong export demand for offal items which are undervalued in the U.S. market.

- Duck exports in 2016 totaled 15.82 million pounds;
- North America accounts for about 60 percent of all exports;
- Indirect exports of corn through ducks in 2016 represented about 560,000 bushels of corn and 1,100 tons of DDGS.

More Information

For further information, questions, or comments please contact [USAPEEC](#) or [World Perspectives, Inc.](#)