Price-Fixing in the United States Broiler and Pork Industries

Yuliya V. Bolotova

Assistant Professor of Agribusiness
Department of Agricultural Sciences
College of Agriculture, Forestry and Life Sciences
Clemson University
237 McAdams Hall
Clemson, SC 29634
E-mail: yuliyab@clemson.edu

Selected Paper prepared for presentation at the Southern Agricultural Economics Association (SAEA) Annual Meeting, Birmingham, Alabama, February 2-5, 2019

Abstract

During the recent decade a group of large meat processors in the U.S. broiler and pork industries implemented a series of production control practices at various stages of the broiler and pork supply chains. The meat processors used these practices to mitigate agricultural supply volatility and increases in agricultural input prices (i.e. feed prices), which led to the over-supply problem adversely affecting their profitability. Direct and indirect buyers of broilers and pork filed antitrust lawsuits alleging that by implementing these production control practices (i.e. production cuts), the meat processors engaged in unlawful conspiracies with the purpose of fixing, increasing and stabilizing prices of broilers and pork paid by various participants in the broiler and pork supply chains. The research presented in the paper applies a traditional theoretical framework explaining the seller market power to understand the economics of the conduct and performance of the U.S. broiler and pork industries in light of the alleged price-fixing conspiracies. It also provides a basic empirical evidence on the market and price behavior during the period of alleged price-fixing conspiracies (i.e. the implementation of production cuts) and the period preceding the implementation of production cuts.

Key words: Antitrust, cartels, price-fixing, Sherman Antitrust Act, agricultural supply control, seller market power.

1. Introduction

During the recent decade a group of large meat processors in the U.S. broiler and pork industries used various production control practices, which affected the quantity of broilers and pork produced and marketed in the country. The processors implemented a series of production cuts at various stages of the broiler and pork supply chains. The meat processors used these practices to mitigate agricultural supply volatility and increases in agricultural input prices (i.e. feed prices), which led to the over-supply problem adversely affecting their profitability. These meat processors are vertically integrated companies, who make decisions affecting the quantity of broilers and pork produced at the farm (production) level through either a direct farm ownership or via production contracts.

Direct and indirect buyers of broilers and pork filed antitrust lawsuits alleging that the meat processors engaged in unlawful conspiracies with the purpose of fixing, increasing and stabilizing prices of broilers and pork paid by various participants in the broiler and pork supply chains (wholesalers, retailers and final consumers) (NBC News 2017, Chicago Tribune 2018, CNN business 2018, Feedstuffs 2018, The Washington Post 2018, USA TODAY 2018, National Hog Farmer 2018[1]). The production control practices were alleged to be the primary method of implementing the price-fixing conspiracies in these two industries, the type of conduct violating Section 1 of the Sherman Antitrust Act (1890).

The research objective is to apply a traditional theoretical framework explaining the seller market power to understand the economics of the conduct and performance of the U.S. broiler and pork industries in light of the alleged price-fixing conspiracies and to provide a basic empirical evidence on the market and price behavior in the analyzed industries.

The paper is organized as follows. Section 2 presents the overview of the structure of the U.S. broiler and pork industries, the economic forces leading to the implementation of production control practices and the types of these practices. Section 3 presents a theoretical framework of the seller market power, which explains the conduct and performance of the U.S. broiler and pork industries in light of the alleged price-fixing conspiracies. Section 4 presents a basic empirical evidence on the market and price behavior in the analyzed industries prior to and during the period of the implementation of production control practices. Section 5 is the conclusion.

2. U.S. Broiler and Pork Industries

2.1. The structure of the industries

The U.S. broiler and pork industries are highly concentrated industries. There is a small number of large firms controlling the majority of the production and marketing in these industries. In the U.S. broiler industry, the 2007 five-firm concentration ratio was 60.9%, and the ten-firm

[1] The web-links to the broiler chicken antitrust litigation and pork antitrust litigation web-pages are provided in the reference list. All relevant court documents are available on these web-pages.

concentration ratio was 75.8%[2] (Weaver 2014). In the U.S. pork industry, the 2007 five-firm concentration ratio was 74.3%[3] (CRS Report 2009). As of 2007, Smithfield Foods and Tyson were the two largest firms in the U.S. pork industry, with their respective market shares of 28.4% and 17.6%; JBS USA was the third largest firm with the market share of 11.1% (CRS Report 2009). As of 2007, Pilgrim's Pride and Tyson were the two largest firms in the U.S. broiler industry, with their respective market shares of 31.3% and 25.9%; Perdue Farms was the third largest firm with the market share of 10.0% (CRS Report 2009).

During the recent decade a few economically significant acquisitions took place in both industries (CRS Report 2009, Johnson 2009). JBS South America bought Swift and Pilgrim's Pride in 2007 and 2009, respectively. After purchasing Pilgrim's Pride, JBS became the second largest poultry processor in the U.S. JBS and Tyson are the companies operating in both the broiler and pork industries. Smithfield foods was purchased by a Chinese-based company in 2013 (Daily Livestock Report 2013).

The U.S. broiler and pork industries are vertically integrated industries (MacDonald 2008 and 2014, CRS Report 2009, Giamalva 2014, Weaver 2014). The firms control production process at the consecutive stages of the broiler and pork supply chains by using complex production contracts with broiler growers and hog farmers and/or by operating their own farms. For example, broiler processors control breeding stage, feed production stage, production stage and processing stage of the broiler supply chain. Broiler processors own birds at the production stage and maintain the product ownership throughout the supply chain. The broiler and pork processors make decisions, which affect the quantity of broilers and hogs produced at the agricultural production stage. In particular, in the case of production contracts, integrators (i.e. broiler and pork processors) are responsible for making key production decisions, including the product quantity to be produced, as they maintain the ownership of the product (broilers and hogs). Broiler and hog growers (farmers) provide services of growing broilers and hogs under these contracts.

2.2. Agricultural production and price cycle and production control

As many agricultural industries, broiler and pork industries are subject to a high level of agricultural supply and price volatility, which is mostly due to a biological nature of agricultural production and other factors that the firms cannot control (weather conditions affecting animal growth, high level and volatility of feed prices, etc.). A natural agricultural production and price cycle is that producers expend their production in response to higher output prices, and they shrink their production in response to lower output prices. This natural agricultural supply and price cycle leads to the situations where there is over-production (over-supply) and output prices are below production costs, resulting in financial losses for the producers and industries. In light of a dramatic increase in feed prices (in particular, corn and soybean meal prices increased dramatically in 2008

[2] These CRs were calculated using ready-to-cook weight using survey data (Weaver 2014). The referenced CRs are for the year preceding the implementation of production control practices.
[3] The CR was calculated using the total commercial hog slaughter volume (CRS Report 2009). The referenced CR is for the year preceding the implementation of production control practices.

(Schnepf 2008)), the natural agricultural supply and price cycle adversely affected the profitability of broiler and pork processors during the period of 2006-2012[4] (Giamalva 2014, Weaver 2014).

The over-supply problem was especially severe in the broiler industry. There was a consistent increase in the quantity of broilers produced. At the same time, the broiler demand declined. This led to the over-supply of broilers: there was the product quantity, which market could not absorb at a price profitable for the broiler processors.

The production cuts were necessary to maintain a viable profitability level during the period of increasing feed prices, declining demand and to avoid financial losses[5]. The broiler and pork processors implemented a series of production cuts at various stages of the broiler and pork supply chains beginning in 2008 (Table 1). In addition, the broiler and pork industries increased their export volume during the last decade.

3. Theoretical Framework

Based on the number of firms operating in the U.S. broiler and pork industries, these industries can be characterized as classic oligopolies. The economic model explaining the conduct and performance of a classic oligopoly is presented on Figure 1. The key assumptions are that the firms comprising the industry are profit-maximizers, the industry faces inverse demand (i.e. a price-dependent demand function) and has a constant marginal cost. The firms make a decision on the product (output) quantity to produce. Product (output) price is a function of product quantity (due to inverse demand).

The seller market power of the oligopolistic industry is evaluated relative to a perfectly competitive industry. To maximize its profit, the oligopolistic industry produces the output quantity (Qo), which is smaller than the output quantity produced by a perfectly competitive industry (Qpc). The output price in the oligopolistic industry (Po) is higher than the output price in a perfectly competitive industry (Pc), and the profit ($ per unit) is positive (Po-MC>0). If firms operating in the oligopolistic industry form a price-fixing cartel, they aim to decrease the output quantity (Qo) possibly to the output quantity produced by the monopoly (Qm). As a result, the oligopoly price (Po) may approach the monopoly price (Pm), and the industry profit increases by Pm-Po ($ per unit). The latter price increase is referred to as cartel overcharge.

A description of the nature of the production and profitability issues in the U.S. broiler and pork industries presented in the previous section may suggest that Figure 1 cannot be used to understand the conduct and performance of these industries. A high degree of the supply (output) volatility and a dramatic increase in feed prices (corn and soybean meal prices) led to the over-production

[4] The adverse effects of the natural agricultural supply and price cycle on the profitability of broiler and pork processors were also mentioned in the court documents (see citations included in the reference list).

[5] Declining demand for broilers was due to a recession (Weaver 2014). An evidence on the profitability issues in the broiler industry was the bankruptcy of Pilgrim's Pride; the firm could not maintain a viable profitability level due to increasing feed prices and filed for bankruptcy; it was purchased by JBS SA (The Wall Street Journal 2009).

(over-supply), output prices being below production costs and a negative profit (i.e. a financial loss).

Figure 2 presents an economic model which may explain the conduct and performance of the analyzed industries by placing the focus on the nature of agricultural production and price cycle, rather than on the number of firms to determine a market structure for further analysis (Bolotova 2016 and 2018). There are three market scenarios presented on this figure: a perfectly competitive industry scenario (the industry earns zero profit), a scenario with a relatively small degree of the seller market power (the industry earns a positive profit) and a product over-supply (over-production) scenario (the industry earns a negative profit: a financial loss for the industry).

In the product over-supply scenario, the industry produces the product quantity (Qos), which is larger than the product quantity in a perfectly competitive industry scenario (Qpc). As a result, product price (Pos) is below marginal cost, and the profit ($ per unit) is negative (Pos-MC<0: a financial loss). In the scenario with a small degree of the seller market power, the industry produces the product quantity (Qsmp), which is smaller than the product quantity in a perfectly competitive industry scenario (Qpc). As a result, product price (Psmp) is above marginal cost, and the industry's profit ($ per unit) is positive (Psmp-MC>0). In order to eliminate losses in the over-supply scenario and to earn profit, the industry has to decrease the product quantity produced, which will increase product price and will increase the industry profit. Figure 2 may be used to explain the reason for firms' conduct involving production cuts and the pattern of profitability in the U.S. broiler and pork industries caused by the natural agricultural production and price cycle.

The implementation of production cuts followed a dramatic increase in feed prices (corn and soybean meal prices). An increase in the feed price would represent an upward parallel shift in the marginal cost curve. Assuming the output price-quantity relationship does not change, an increase in marginal cost would require decreasing the output quantity to be produced to maintain a viable profitability level. Figure 3 illustrates changes in the product quantities and prices following the cost increase in three market scenarios originally depicted in Figure 2.

An upward shift in marginal cost curve leads to all three original price-quantity combinations to be within the over-supply range with prices being below marginal cost. $Qpc^{|}$ and $Ppc^{|}$ represent the new perfectly competitive price-quantity combination. $Qsmp^{|}$ and $Psmp^{|}$ represent the new seller market power price-quantity combination. Following the increase in cost, to remain in a perfectly competitive industry scenario ($PC^{|}$), the industry has to decrease the product quantity produced from Qpc to $Qpc^{|}$. This reduction in product quantity would cause the product price to increase from Ppc to $Ppc^{|}$. If the product quantity produced is not decreased, the former perfectly competitive industry scenario would become the over-supply scenario for the industry, leading to a negative profit (i.e. a financial loss).

4. Empirical Analysis

This section presents a descriptive statistical analysis of the behavior of key variables characterizing the conduct and performance of the U.S. broiler and pork industries during two periods: the pre-production control period (PPC-period) and the production control period (PC-period: alleged price-fixing cartels). The year of 2008 (January 2008 in the case of monthly data) is the point which distinguishes PPC-period and PC-period in the U.S. broiler industry[6]. The year of 2009 (January 2009 in the case of monthly data) is the point which distinguishes PPC-period and PC-period in the U.S. pork industry[7].

The analyzed variables include product quantities (production, domestic consumption and export), wholesale prices (or price index) and wholesale margins (or margin index). The variables and data sources used to collect these variables are summarized in Table 2. All variables were collected from the USDA Economic Research Service databases. The averages and the coefficients of variation for the analyzed variables are calculated for the two periods of interest. The changes in the averages and coefficients of variation between the two periods are also calculated.

4.1. U.S. Broiler Industry (Figures 4-6; Tables 3,5 and 6)

Table 3 presents descriptive statistics on broiler production, export and availability for domestic consumption for two periods: pre-production control period (PPC-period) and production control period (PC-period). The yearly average broiler production is 33,127 million pounds in PPC-period, and it increases to 37,100 million pounds in PC-period (or by 12%). The yearly average broiler export is 5,162 million pounds in PPC-period, and it increases to 6,970 million pounds in PC period (or by 35%). The yearly average quantity of broiler meat available for domestic consumption is 27,833 million pounds in PPC-period, and it increases to 30,016 million pounds in PC-period (or by 7.8%). The yearly average quantity of broilers available per capita is 95 pounds in PPC-period, and it increases slightly to 96 pounds in PC-period (or by 0.7%). As indicated by changes in the coefficients of variation between two analyzed periods, the volatility of all quantity-related variables decreases in PC-period, as compared to PPC-period.

Table 5 presents descriptive statistics on wholesale broiler price for two periods of interest. The monthly average wholesale broiler price is $0.64 per pound in PPC-period, and it increases to $0.79 per pound in PC period (or by 23%). As indicated by the change in the coefficient of variation, the volatility of this price decreases by 32% in PC-period, as compared to PPC-period.

Table 6 presents descriptive statistics on three indexes characterizing changes in broilers feed costs, broilers wholesale composite price and margin (wholesale price minus feed costs) for two periods of interest. The monthly average feed costs index is 110 in PPC-period, and it increases to 176.5 in PC-period (or by 61%). The monthly average wholesale price index is 115 in PPC-period, and it increases to 138 in PC-period (or by 20%). The monthly average margin index is 117 in

[6] The beginning date of the alleged price-fixing conspiracy in the U.S. broiler industry is mentioned in *In Re Broiler Chicken Antitrust Litigation.*

[7] The beginning date of the alleged price-fixing conspiracy in the U.S. pork industry is mentioned in *Maplevale Farms, Inc. et al v. Agri Stats, Inc. et al.*

PPC-period, and it increases to 125 in PC-period (or by 6%). As indicated by changes in the coefficients of variation between two periods, the volatility of feed cost index increases and the volatility of wholesale price index and margin index decreases in PC-period, as compared to PPC-period.

4.2. U.S. Pork Industry (Figures 4 and 5; Tables 4 and 5)

Table 4 presents descriptive statistics on pork production, export and availability for domestic consumption for two periods: pre-production control period (PPC-period) and production control period (PC-period). The yearly average pork production is 20,600 million pounds in PPC-period, and it increases to 23,157 million pounds in PC-period (or by 12.4%). The yearly average pork export is 2,424 million pounds in PPC-period, and it increases to 4,854 million pounds in PC period (or by 100%). The yearly average quantity of pork available for domestic consumption is 19,013 million pounds in PPC-period, and it decreases to 18,975 million pounds in PC-period (or by 0.2%). The yearly average quantity of pork available per capita is 65 pounds in PPC-period, and it decreases to 60 pounds in PC-period (or by almost 7%). As indicated by changes in the coefficients of variation between two analyzed periods, the volatility of pork production and export decreases, and the volatility of the pork quantity available for domestic consumption increases in PC period, as compared to PPC-period.

Table 5 presents descriptive statistics on wholesale pork price and farm-wholesale margin for two periods of interest. The monthly average wholesale pork price is $0.66 per pound in PPC-period, and it increases to $0.85 per pound in PC period (or by 29%). As indicated by the change in the coefficient of variation, the volatility of this price increases by 40% in PC-period, as compared to PPC-period. The monthly average pork farm-wholesale margin is 32.5% of the wholesale value of pork in PPC-period, and it increases to 35.1% in PC-period (or by 8%). As indicated by the change in the coefficient of variation, the volatility of this margin increases by 40% in PC-period, as compared to PPC-period.

5. Conclusion

During the recent decade a group of large meat processors in the U.S. broiler and pork industries implemented a series of production cuts to mitigate the adverse effects of over-production on their profitability. The latter was mostly due to a dramatic increase in feed costs (i.e. increases in prices of corn and soybean meal). The firms had difficulties in passing on cost increases onto buyers of their products. The over-supply problem was especially severe in the broiler industry. There was a quantity of broilers which the firms could not sell at prices profitable for them.

The theoretical model presented in the paper illustrates that in the presence of increasing costs the industry has to decrease the output quantity produced to maintain the same profitability level. Otherwise, the industry is in the over-supply scenario earning a negative profit (i.e. a financial loss). This theoretical model explains the rationale for the implementation of production cuts by the firms in the U.S. broiler and pork industries. The empirical evidence tends to be consistent with the theoretical predictions.

The basic empirical evidence indicates that during the period of implementation of production cuts the total quantity of broilers and pork produced in the country increased by approximately 12%. The product quantity available for domestic consumption per capita increased by 0.7% in the case of the broiler industry, and it decreased by almost 7% in the case of the pork industry. This is because the export of both types of meat increased, and there was an increase in population. Wholesale prices of broilers and pork increased by 23% and 29%, respectively. These price increases are likely to reflect increases in feed costs. For example, in the case of the broiler industry, while feed costs index increased by 61%, wholesale price index increased by only 20%.

Buyers of broilers and pork filed antitrust lawsuits, in which they alleged that the production cuts were the primary method of the implementation of price-fixing conspiracies, the type of conduct violating Section 1 of the Sherman Antitrust Act (1890). Section 1 makes illegal agreements among competitors that have a potential to affect product quantities and/or prices. Price-fixing agreements are one of the examples. Buyers of broilers and pork (i.e. plaintiffs in the lawsuits) argue that the following conduct violated Section 1 of the Sherman Act: communicating the intentions to implement production cuts during industry meetings and sharing (exchanging) private, competitor-sensitive information (information on quantities, prices, costs and profit, etc.) for the purpose of benchmarking the performance of individual firms.

References

Bolotova, Y. 2018. Teaching Competition Topics in Undergraduate Courses in Agribusiness Programs: Applications of Seller Market Power. Selected paper, presented at Annual Meeting of Agricultural and Applied Economics Association, Washington D.C.; August 5-7, 2018. https://ageconsearch.umn.edu/record/274503?ln=en

Bolotova, Y.V. 2016. Agricultural Supply Management and Market Power: Evidence from the U.S. Dairy and Potato Industries. *Agribusiness* 32(4): 563-568.

Chicago Tribune. 2018 (January 15). Second Lawsuit Against Poultry Giants Alleges Chicken Price-Fixing Conspiracy. http://www.chicagotribune.com/business/ct-biz-winn-dixie-tyson-chicken-prices-20180115-story.html *accessed on December 10, 2018.*

Congressional Research Service Report. 2009. Livestock Marketing and Competition Issues.

CNN Business. 2018 (January 31). Tyson, Pilgrim's Pride Jacked Up Chicken Prices, Say Lawsuits. https://money.cnn.com/2018/01/31/news/companies/chicken-price-fixing/index.html *accessed on December 10, 2018.*

Daily Livestock Report (May 2013). Published by Steve Meyer & Len Steiner, Inc., Adel, IA and Merrimack, NH. http://www.dailylivestockreport.com/documents/DLR%2005-30-2013.pdf

Feedstuffs. 2018 (July 06). Chicken Industry Faces More Price-Fixing Lawsuits. https://www.feedstuffs.com/news/chicken-industry-faces-more-price-fixing-lawsuits *accessed on December 10, 2018.*

Johnson, R. 2009. Recent Acquisitions of U.S. Meat Companies. Congressional Research Service Report 7-5700.

Giamalva, J. 2014. Pork and Swine: Industry & Trade Summary. U.S. International Trade Commission, Office of Industries Publication ITS-11.

MacDonald, J.M. 2014. Technology, Organization, and Financial Performance in U.S. Broiler Production. U.S. Department of Agriculture, Economic Research Service, Economic Information Bulletin Number 126.

MacDonald, J.M. 2008. The Economic Organization of U.S. Broiler Production. U.S. Department of Agriculture, Economics Research Service, Economic Information Bulletin Number 38.

National Hog Farmer. 2018 (June 28). Pork Companies Face Price Fixing Lawsuit. https://www.nationalhogfarmer.com/business/pork-companies-face-price-fixing-lawsuit *accessed on December 22, 2018.*

NBC News. 2017 (February 17). You're Getting Skinned on Chicken Prices, Suit Says. https://www.nbcnews.com/business/consumer/you-re-getting-skinned-chicken-prices-suit-says-n721821 *accessed on December 10, 2018.*

Schnepf, R. 2008. High Agricultural Commodity Prices: What are the Issues? Congressional Research Service Report.

The Wall Street Journal. 2009 (September 17). Brazilian Giant JBS Agrees to Buy Pilgrim's Pride. https://www.wsj.com/articles/SB125310503697015705 *accessed on December 10, 2018.*

The Washington Post. 2018 (February 01). The Alleged Conspiracy To Fix The Price Of Chicken Meat, Explained. https://www.washingtonpost.com/news/wonk/wp/2018/02/01/the-alleged-conspiracy-to-fix-the-price-of-chicken-meat-explained/?utm_term=.a32ef99e77f5 *accessed on December 10, 2018.*

USA TODAY. 2018 (June 28). Hormel, Tyson, Smithfield and Other Major Pork Producers Accused of Price-Fixing. https://www.usatoday.com/story/money/2018/06/28/hormel-tyson-smithfield-other-pork-producers-price-fixed-lawsuit/742848002/ *accessed on December 22, 2018.*

U.S. Department of Agriculture Economic Research Service. Food Availability (Per Capita) Data System. https://www.ers.usda.gov/data-products/food-availability-per-capita-data-system/food-availability-per-capita-data-system/#Food Availability

U.S. Department of Agriculture Economic Research Service. Livestock & Meat Domestic Data. https://www.ers.usda.gov/data-products/livestock-meat-domestic-data/livestock-meat-domestic-data

Weaver, M. 2014. Poultry: Industry & Trade Summary. U.S. International Trade Commission, Office of Industries Publication ITS-010.

Sherman Act (1890) *15 U.S.C. §§ 1-2.*

Court documents and relevant web-pages

Broiler Chicken Antitrust Litigation web-page https://www.locklaw.com/broiler-chicken-antitrust-litigation/ *accessed on December 10, 2018.*

In Re Broiler Chicken Antitrust Litigation Case No. 1:16-cv-08637. Direct purchaser plaintiffs' third amended and consolidated class action complaint (dated January 31, 2018).

Pork Antitrust Litigation web-page https://www.locklaw.com/pork-antitrust-litigation/ *accessed on December 10, 2018.*

Maplevale Farms, Inc. et al v. Agri Stats, Inc. et al Case No 0: 18-cv-1803-PJS-SER. Direct purchaser plaintiffs' first amended and consolidated class action complaint (filed August 17, 2018).

Table 1: Supply (Production) Control Practices in the U.S. Broiler and Pork Industries.

Supply chain stage	Broiler Industry	Pork Industry
Breeding stage	Decreasing the size of broiler breeder flocks	Decreasing the size of swine breading stocks Decreasing the number of sows
Hatching stage	Decreasing the size of egg sets	
	Breaking eggs in hatcheries	
	Destroying newly hatched chicks	
Production stage	Decreasing the number of chicks delivered to contract growers	Decreasing the number of hogs (hog liquidations)
	Increasing the time period between picking up mature broilers and delivering new chicks	Increasing the use of production contracts
Processing stage	Decreasing the size of birds at slaughter by slaughtering them before they reach mature age	Controlling slaughter rates
	Closing (temporary or permanently) processing plants	Decreasing the slaughter capacity utilization
Export	Exporting eggs and chicks outside of the U.S.	Exporting pork outside of the U.S.

Sources: Giamalva (2014), Weaver (2014), In Re Broiler Chicken Antitrust Litigation and Maplevale Farms, Inc. et al v. Agri Stats, Inc. et al

Table 2. U.S. Broiler and Pork Industries: Variables and Data Sources.

Variable	Unit of measurement	Data source (years used in the analysis)
Quantity of broilers produced	Million pounds	USDA ERS Food availability data system: Broilers *yearly data* (2000-2015)
Quantity of broilers exported	Million pounds	USDA ERS Food availability data system: Broilers *yearly data* (2000-2015)
Quantity of broilers available for domestic consumption	Million pounds	USDA ERS Food availability data system: Broilers *yearly data* (2000-2015) (this quantity is a carcass-based quantity)
Quantity of broilers available for domestic consumption	Pounds per capita	USDA ERS Food availability data system: Broilers *yearly data* (2000-2015) (this quantity is a carcass-based quantity)
Quantity of pork produced	Million pounds	USDA ERS Food availability data system: Pork *yearly data* (2000-2015)
Quantity of pork exported	Million pounds	USDA ERS Food availability data system: Pork *yearly data* (2000-2015)
Quantity of pork available for domestic consumption	Million pounds	USDA ERS Food availability data system: Pork *yearly data* (2000-2015) (this quantity is a carcass-based quantity)
Quantity of pork available for domestic consumption	Pounds per capita	USDA ERS Food availability data system: Pork *yearly data* (2000-2015) (this quantity is a carcass-based quantity)
Wholesale broiler composite price US	Cents per retail pound	USDA ERS Livestock & Meat Domestic Data: Historical data for broiler composite *monthly data* (2000-2017)
Wholesale pork composite price US Central	Cents per pound	USDA ERS Livestock & Meat Domestic Data: Wholesale prices *monthly data* (2000-2017)
Pork farm-wholesale margin US	% of wholesale value	Calculated by the author using USDA data (farm-wholesale spread for pork in cents per retail pound and wholesale value of pork in cents per retail pound): *monthly data* (2000-2017)
Broilers feed costs *index*		USDA ERS Livestock & Meat Domestic Data: Poultry estimated returns *monthly data* (2001-2017)
Broilers composite wholesale price *index*		USDA ERS Livestock & Meat Domestic Data: Poultry estimated returns *monthly data* (2001-2017)
Broilers composite wholesale price minus feed costs *index*		USDA ERS Livestock & Meat Domestic Data: Poultry estimated returns *monthly data* (2001-2017)

Table 3. U.S. Broiler Industry: Broiler Production, Export and Availability (2000-2015).

	Broiler production	Broiler export	Broiler availability	Broiler availability per capita
	million pounds	million pounds	million pounds	pounds
Pre-Production control period (PPC-period): 2000-2007				
Average	33,127	5,162	27,833	95
CV	0.06	0.08	0.07	0.05
Production control period (PC-period): 2008-2015				
Average	37,100	6,970	30,016	96
CV	0.04	0.05	0.05	0.03
Change: PC-period relative to PPC- period				
Average (pounds)	3,973	1,808	2,183	1
Average (%)	12.0	35.0	7.8	0.7
CV	-0.03	-0.03	-0.02	-0.01
CV (%)	-43	-36	-32	-28

CV is the coefficient of variation.

Table 4. U.S. Pork Industry: Pork Production, Export and Availability (2000-2015).

	Pork production	Pork export	Pork availability	Pork availability per capita
	million pounds	million pounds	million pounds	pounds
Pre-Production control period (PPC-period): 2000-2008				
Average	20,600	2,424	19,013	65
CV	0.07	0.44	0.02	0.02
Production control period (PC-period): 2009-2015				
Average	23,157	4,854	18,975	60
CV	0.03	0.10	0.04	0.04
Change: PC-period relative to PPC- period				
Average (pounds)	2,557	2,430	-37	-4
Average (%)	12.4	100.3	-0.2	-6.8
CV	-0.04	-0.34	0.02	0.02
CV (%)	-58	-77	101	106

CV is the coefficient of variation.

Table 5. U.S. Broiler and Pork Industries: Wholesale Broiler Price, Wholesale Pork Price and Pork Farm-Wholesale Margin (2000-2017).

	Wholesale broiler composite price US	Wholesale pork composite price US Central	Pork farm-wholesale margin US
	cents per pound	cents per pound	% of wholesale value
Pre-Production control period (PPC-period)	*2000-2007*	*2000-2008*	*2000-2008*
Average	64.26	65.67	32.48
CV	0.16	0.13	0.16
Production control period (PC-period)	*2008-2017*	*2009-2017*	*2009-2017*
Average	78.94	84.53	35.13
CV	0.11	0.18	0.23
Change: *PC-period relative to PPC- period*			
Average (cents per pound)	14.68	18.86	2.65
Average (%)	23	29	8
CV	-0.05	0.05	0.07
CV (%)	-32	40	40

CV is the coefficient of variation.

Table 6. U.S. Broiler Industry: Feed Costs Index, Wholesale Price Index and Wholesale Price Minus Costs Index (2000-2017).

	Feed costs per lb *index*	Composite wholesale price *index*	Composite price minus feed costs *index*
Pre-Production control period (PPC-period): 2000-2007			
Average	109.75	115.40	117.40
CV	0.12	0.15	0.17
Production control period (PC-period): 2008-2017			
Average	176.50	138.25	124.72
CV	0.18	0.11	0.16
Change: *PC-period relative to PPC- period*			
Average	67	23	7
Average (%)	61	20	6
CV	0.06	-0.04	-0.01
CV (%)	46	-28	-7

CV is the coefficient of variation.

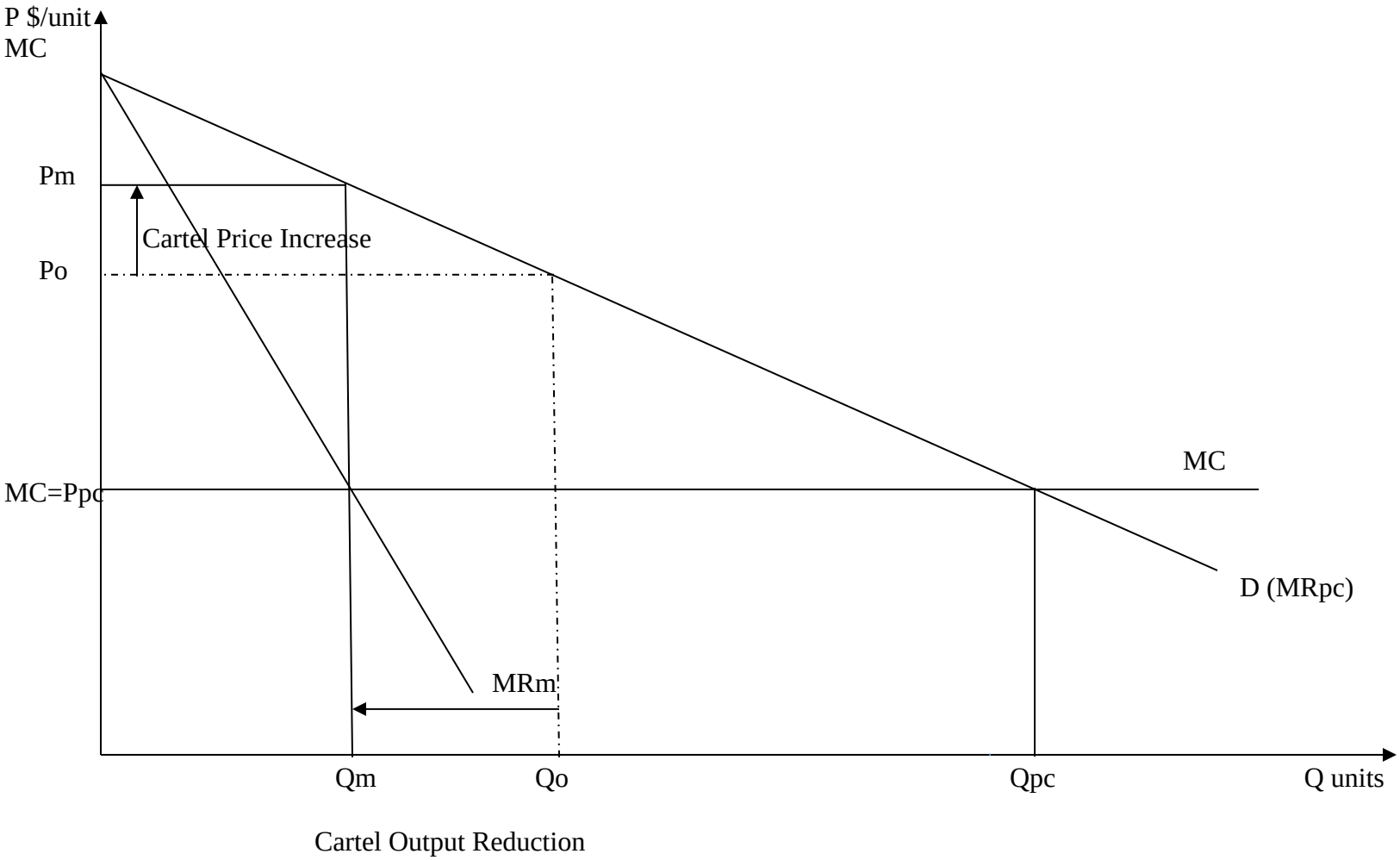

Figure 1. The Price Effect of Output Reduction: Classic Oligopoly as a Price-Fixing Cartel.

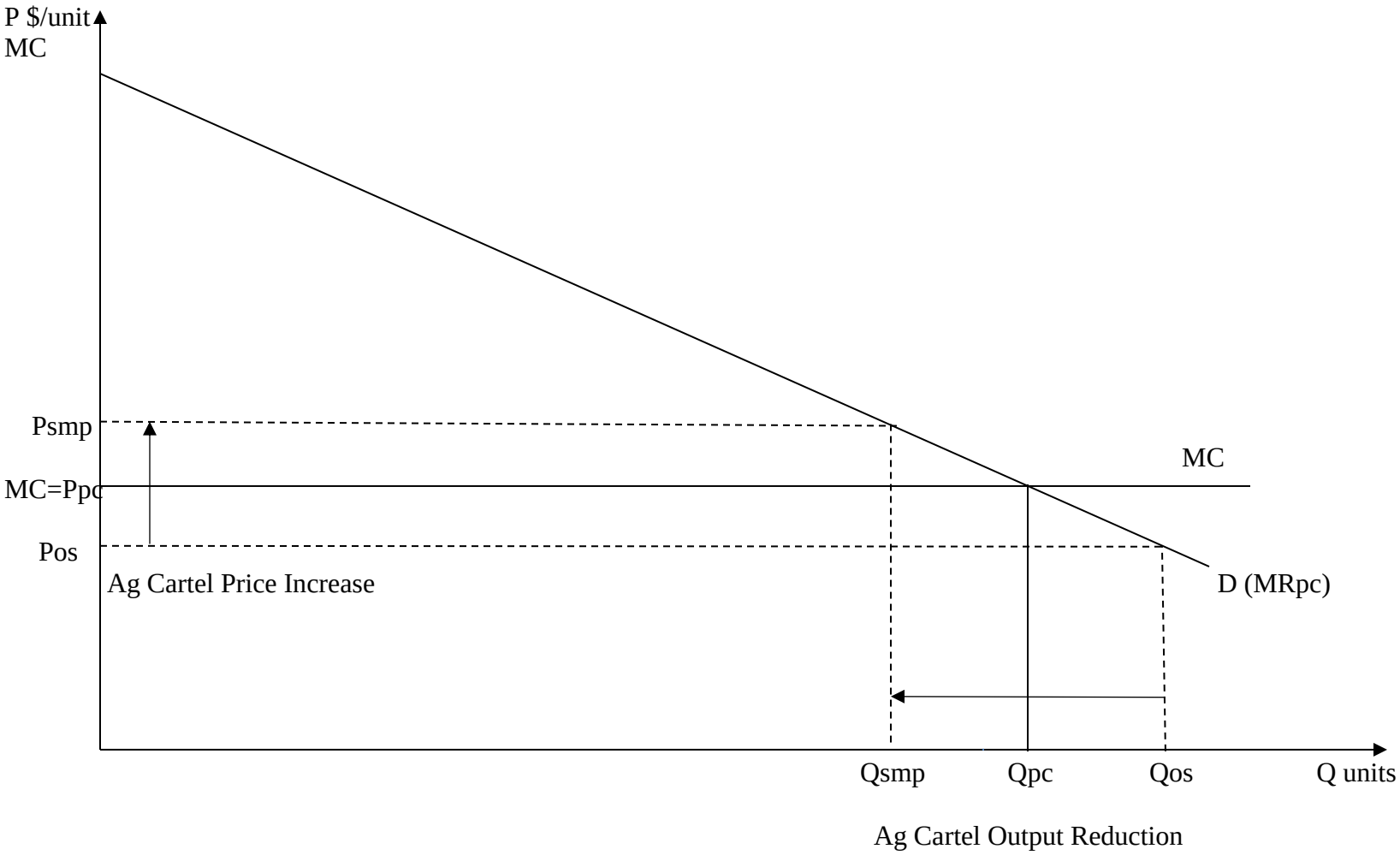

Figure 2. The Price Effects of Output Reduction: Agricultural Cartels.

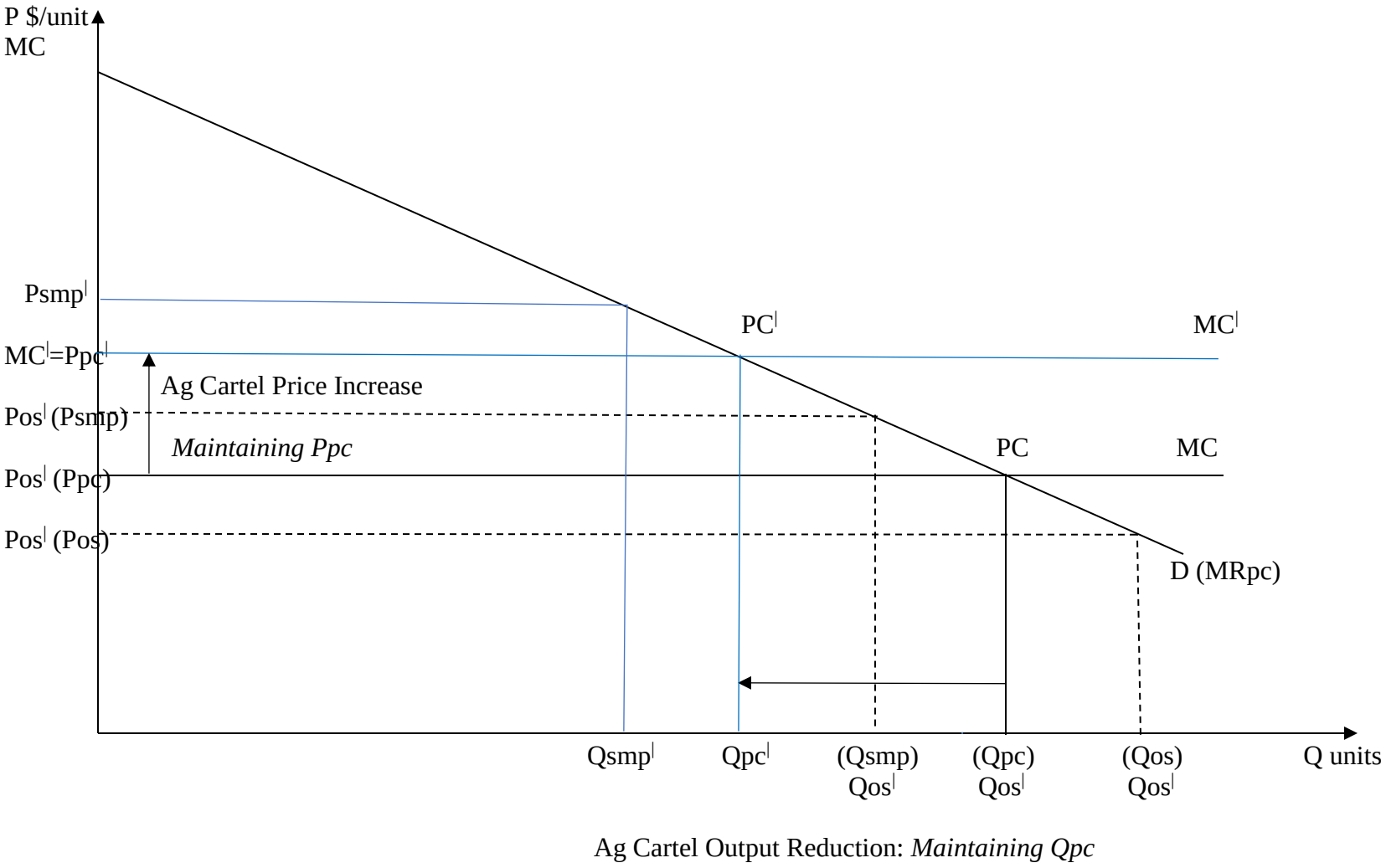

Figure 3. The Price Effects of Output Reduction: Agricultural Cartels *Facing Increasing Costs*.

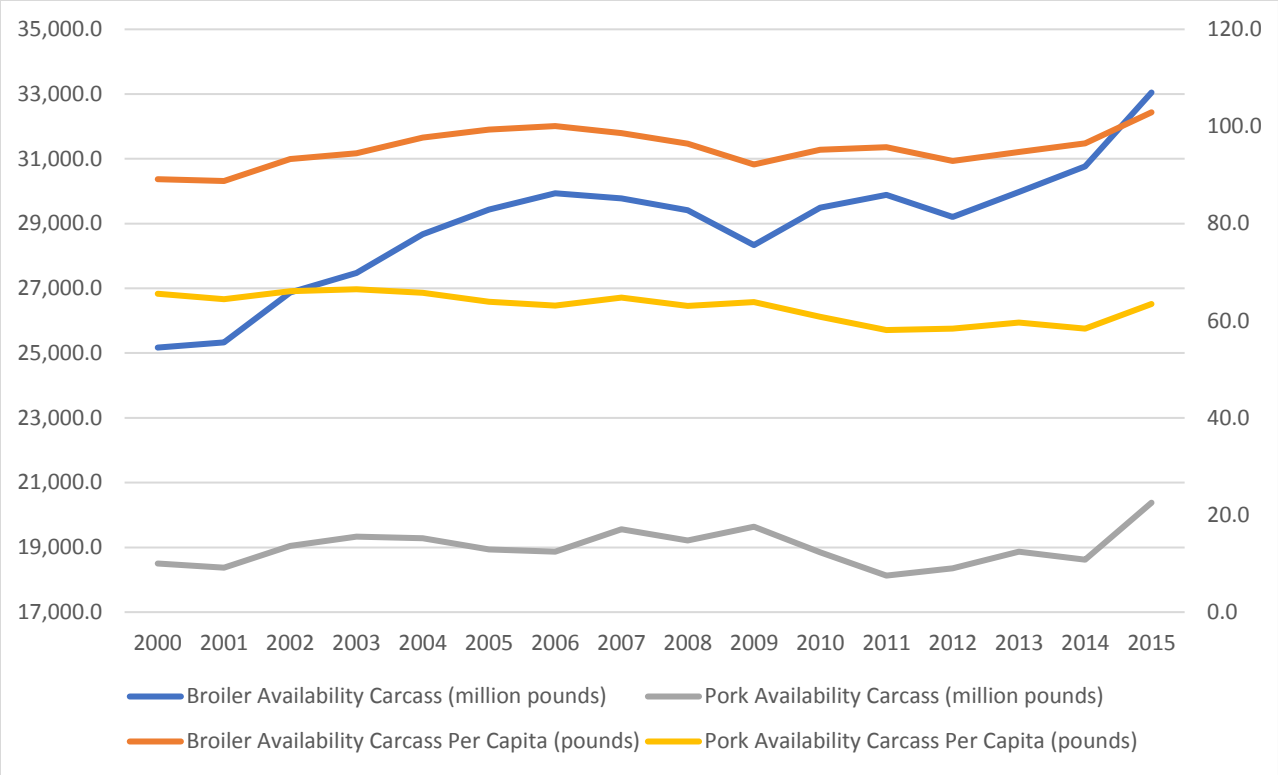

Figure 4. U.S. Broiler and Pork Industries: Broiler and Pork Availability (2000-2015).
U.S. broiler industry: Pre-production control period is 2000-2007
Production control period is 2008-2015
U.S. pork industry: Pre-production control period is 2000-2008
Production control period is 2009-2015

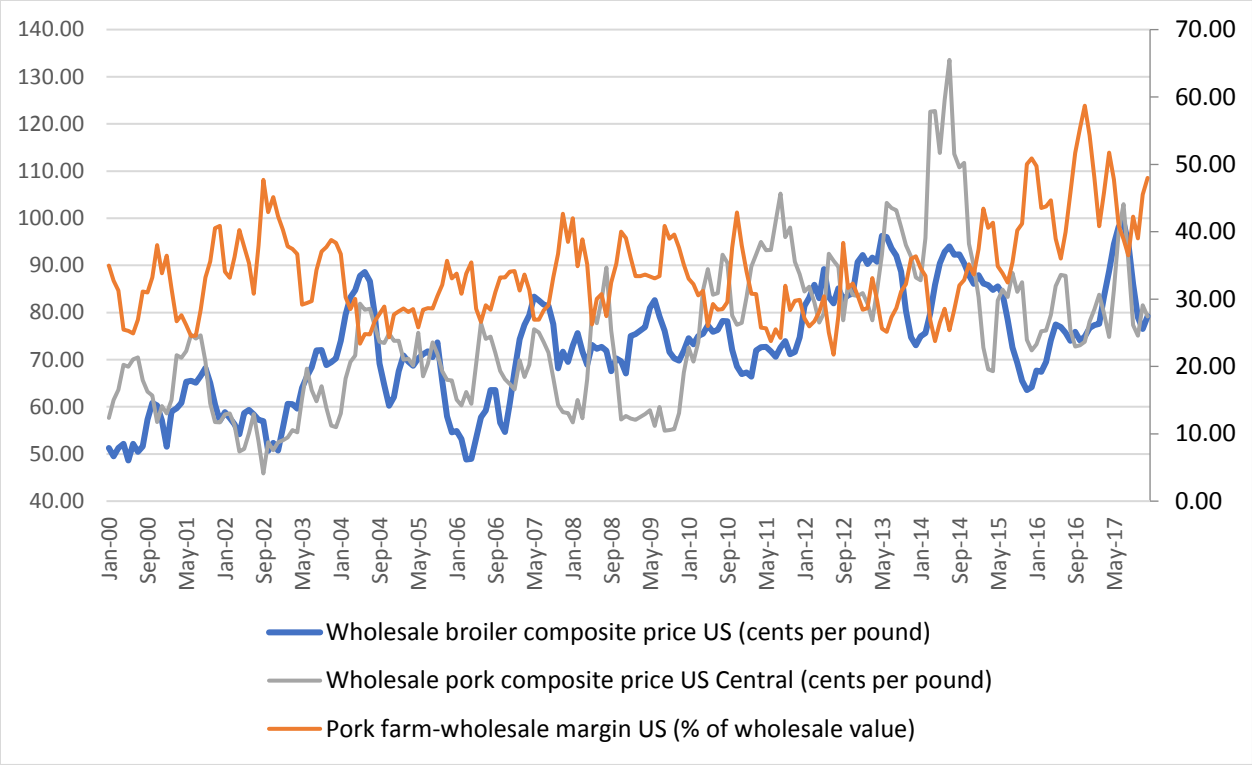

Figure 5. U.S. Broiler and Pork Industries: Wholesale Broiler Price, Wholesale Pork Price and Pork Farm-Wholesale Margin (2000-2017).
U.S. broiler industry: Pre-production control period is 2000-2007
Production control period is 2008-2015
U.S. pork industry: Pre-production control period is 2000-2008
Production control period is 2009-2015

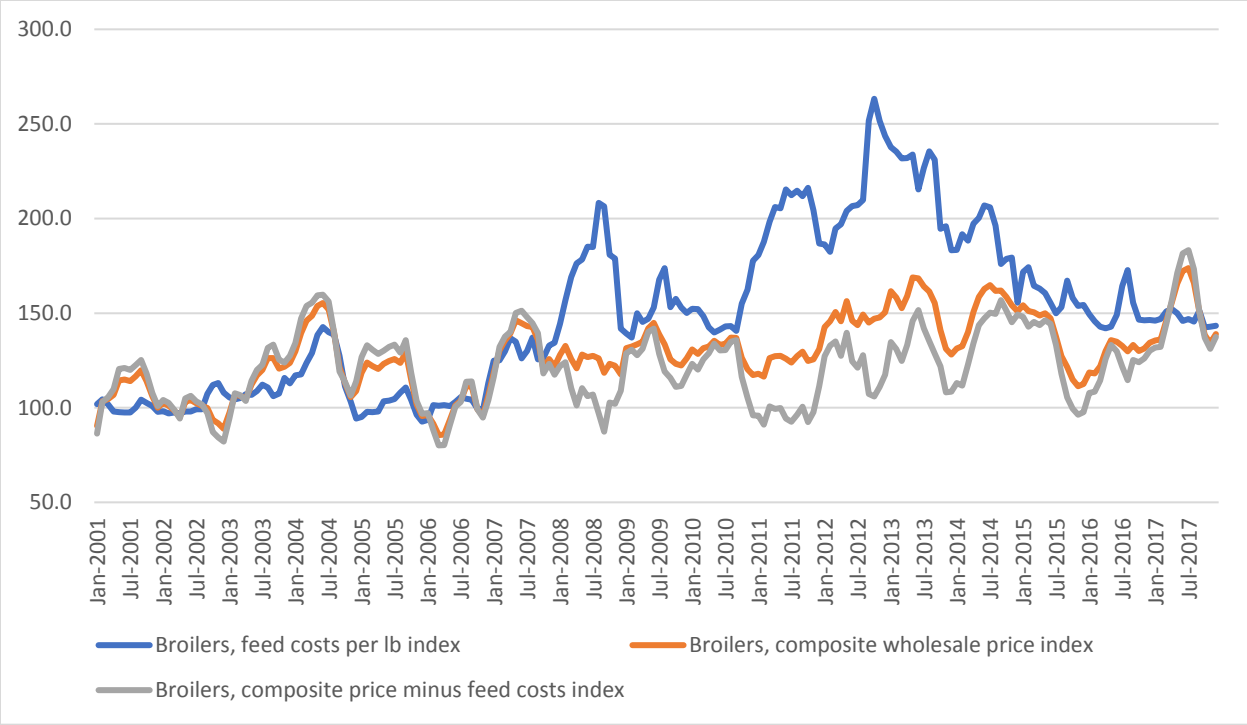

Figure 6. U.S. Broiler Industry: Feed Costs Index, Wholesale Price Index and Wholesale Price Minus Costs Index (2000-2017).
U.S. broiler industry: Pre-production control period is 2000-2007
Production control period is 2008-2015