Market Power in the United States Potato Industry

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Invited Case Study Paper prepared for presentation at the 2021 Agricultural & Applied Economics Association Annual Meeting, Austin, TX, August 1 – August 3

Abstract

The motivations for this case study are the U.S. potato industry developments involving the implementation of a potato supply management program by a nation-wide group of cooperatives of potato growers during the period of 2005-2010. This program aimed to mitigate potato over-supply adversely affecting profitability of potato growers and provide fair returns for potato growers. The potato supply management program raised legal issues leading to antitrust lawsuits filed by potato buyers against potato growers and their cooperatives, which resulted in a large settlement. The case study introduces economic, business, and legal issues surrounding the implementation of this potato supply management program. The case study also provides simple contemporary applications of economic models of the profit-maximizing behavior of firms with seller market power in the U.S. potato industry. The case study presents a theoretical framework, which explains conduct and performance of the U.S. potato industry in alternative market scenarios, and a basic market and price analysis. The intended audiences are undergraduate and graduate students, as well as extension and outreach audiences. A teaching note includes a set of discussion questions and suggested answers.[1] The teaching note also discusses teaching objectives, teaching strategies, and student background knowledge.

Key words: Antitrust, Capper-Volstead Act, cooperatives, potato industry, price-fixing, seller market power, supply management, Sherman Act.

JEL: L1, L2, L4, Q13.

[1] The teaching note is available from the author upon request.

1 Introduction

The motivations for this case study are the U.S. potato industry developments involving the implementation of a potato supply management program by a nation-wide group of cooperatives of potato growers during the period of 2005-2010.[2] This program aimed to (a) mitigate potato over-supply leading to disorderly marketing conditions adversely affecting profitability of potato growers, (b) help gain control over potato supply and price volatility, and (c) provide fair returns for potato growers. The potato supply management program combined a potato acreage management (control) program and a set of marketing programs. The potato acreage management program was used to control the number of potato acres planted each year during the period of 2005-2010.

In 2010 a group of buyers of potatoes filed class action antitrust lawsuits alleging that the potato supply management program, and in particular the potato acreage management program, was a form of illegal price-fixing leading to higher potato prices that potato buyers had to pay. The potato buyers argued that the potato acreage management program was not immune by the Capper-Volstead Act (1922) and thus violated Section 1 of the Sherman Act (1890). The cooperatives of potato growers settled these lawsuits for $25 million in 2015 (O'Connell 2018). In addition, according to the settlement agreement, cooperatives of potato growers agreed that they would not make any attempt to manage potato acreage prior to the potato planting season for seven years.

The case study introduces economic, business, and legal issues surrounding the implementation of this potato supply management program. The case study also provides simple contemporary applications of economic models of the profit-maximizing behavior of firms with

[2] Students are encouraged to read an article published in the Wall Street Journal (Martin 2006) and to listen to an NPR episode discussing the program and cooperatives (Godoy 2013).

seller market power in the U.S. potato industry. In particular, the case study presents a theoretical framework, which explains conduct and performance of the U.S. potato industry in alternative market scenarios, and a basic market and price analysis based on publicly available data reported by the U.S. Department of Agriculture. This case study is suitable for a variety of undergraduate and graduate courses taught in agricultural economics and agribusiness programs, including agricultural (agribusiness) marketing, agricultural markets and prices (or agricultural prices), agribusiness management, supply chain management, and applied industrial organization. The case study is also suitable for extension and outreach audiences.

The case study has the following student learning objectives (SLOs).

- SLO#1: Students should be able to explain economic forces leading to the idea of a potato supply management program in the U.S. potato industry, the role of cooperatives of potato growers in developing and implementing this program, and the program design and implementation procedure.
- SLO#2: Students should learn a theoretical framework incorporating seller market power of the potato industry and be able to apply this framework to analyze potato price-quantity relationship and industry profitability in alternative market scenarios differing due to the potato quantity produced, potato price, and industry profit.
- SLO#3: Students should be able to conduct a basic market and price analysis during the period of the program implementation and the periods before and after the program implementation in order to evaluate market and price effects of the potato supply management program.
- SLO#4: Students should be able to explain legal (antitrust) issues surrounding the implementation of the potato supply management program and discuss the role of the Capper-

Volstead Act in regulating collective agricultural marketing activities of agricultural producers, as applied to the analyzed industry setting.

2 U.S. Potato Industry

Depending on the harvesting season, potatoes are classified as fall, winter, spring, and summer potatoes. The majority of the potatoes produced in the U.S. are fall potatoes.[3] Fall potatoes are planted in the spring (April/May) and are harvested in the fall (September/October). The most common potato types grown include Russets, Reds, Whites, and Yellows.

The U.S. potato industry has two major segments: a fresh potato segment and a processing potato segment. Figure A1 presented in the Appendix depicts the potato supply chain. Potatoes produced for fresh market are washed, graded, and packaged in different types of packs before being shipped to wholesalers and retailers. Fresh potato prices are determined in a spot market setting. Fresh potato prices are based on a potato grade, variety, pack size and type (USDA AMS 2021). Potato shipping points are located in the major potato growing regions.

Potatoes produced for processing market go through processing before they reach consumers. The most popular processed potato products include French Fries, potato chips, and dehydrated potatoes. Processing potato prices are determined in contracts signed by potato growers and potato processors before the potato planting (production) season begins. These contracts specify a base price and a set of adjustments to this price (bonuses and penalties) for the presence and/or absence of certain potato quality characteristics, which are important for the quality of processed potato products (Bolotova and Patterson 2009).

[3] The share of fall potato production in total potato production in recent years was approximately 90 percent (USDA NASS 2021).

Figure 1 depicts the U.S. potato consumption per capita for various potato categories for the period of 1990-2019. The figure indicates a declining trend in total potato consumption beginning in the 2000s. A decline in fresh potato consumption was stronger than a decline in processing potato consumption.

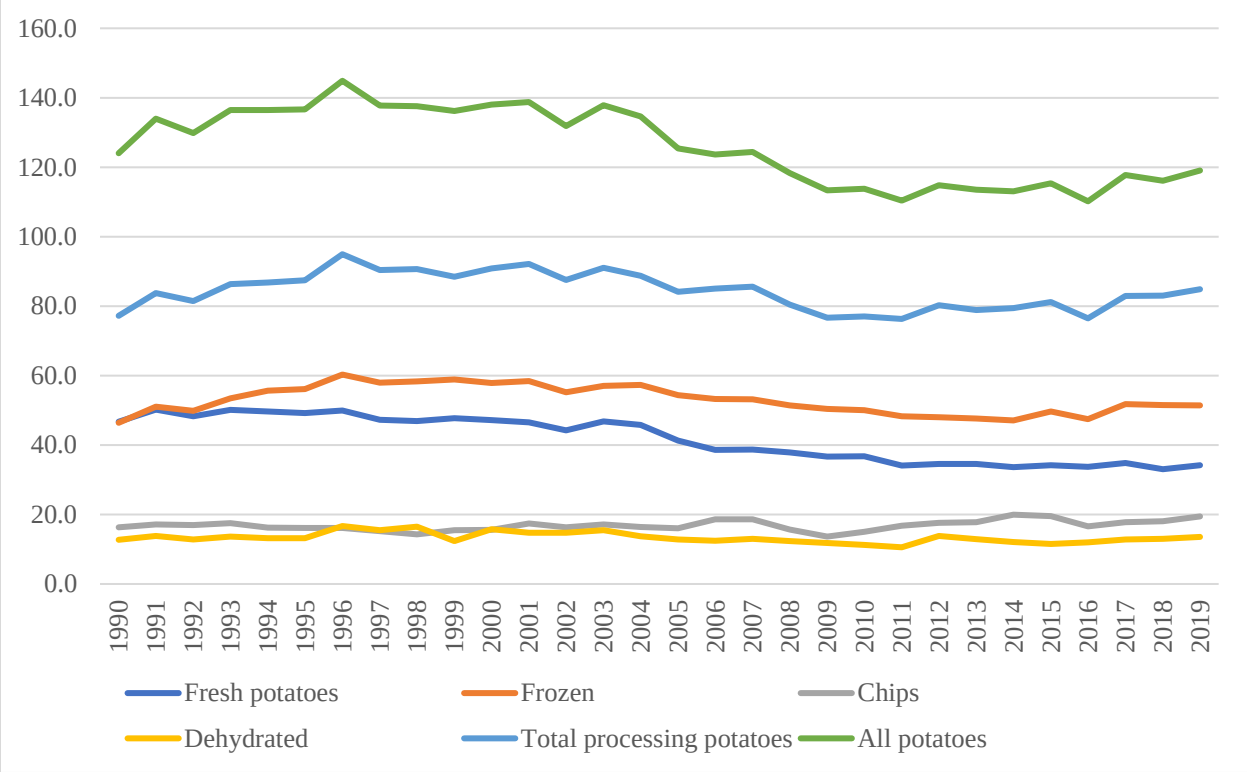

Figure 1. U.S. Potato Consumption in Pounds Per Capita (1990-2019).
Data Source: USDA ERS (2021).

Table 1 provides data characterizing the U.S. potato industry structure in 2004, the year prior to the potato supply management program implementation. The data for the largest fall potato states are presented in this table. There were 9,408 potato growing farms in the U.S. Idaho and Washington were the two states with the largest potato production, in terms of the potato area planted, total potato quantity produced, and value of potato production. While in 2004 there were

1,040,700 fall potato acres planted nationally, 355,000 of these acres were planted in Idaho, and 160,000 of these acres were planted in Washington.

Table 1. U.S. Fall Potato Industry Structure: 9 Leading States (2004)

State	Acres planted	Production	Price	Value of production	Number of potato farms[a]
	Acres	million cwt	$ per cwt	million $ (percent in total)	farms (percent in total)
US Total	*1,040,700*	*410.7*	*5.12*	*2,092.5 (100.0)*	*9,408 (100.0)*
Idaho	355,000	132.0	4.25	560.9 (26.8)	818 (8.7)
Washington	160,000	93.8	4.90	459.7 (22.0)	408 (4.3)
North Dakota	105,000	26.8	5.80	155.2 (7.4)	216 (2.3)
Wisconsin	71,000	30.5	5.80	176.6 (8.4)	399 (4.2)
Colorado	65,000	23.8	4.50	107.1 (5.1)	229 (2.4)
Maine	63,500	19.1	6.50	123.9 (5.9)	444 4.7
Minnesota	48,000	19.4	5.50	106.4 (5.1)	284 (3.0)
Michigan	43,000	13.7	6.95	94.9 (4.5)	395 (4.2)
Oregon	37,000	19.8	5.05	99.9 (4.8)	278 (3.0)

[a] The number of potato farms is for 2002.

Data Sources: USDA NASS (2021) and USDA Census of Agriculture (2002).

The 2004 U.S. value of potato production was $2,092.5 million. The market shares of Idaho and Washington in the U.S. value of potato production were 26.8 percent and 22.0 percent, respectively. North Dakota and Wisconsin were the next two largest potato producing states with the market shares of 7.4 percent and 8.4 percent, respectively, followed by Colorado, Maine, and Minnesota. Though Idaho and Washington were the largest potato producers in the nation in 2004, potato prices growers received in these states were below the U.S. average potato price. While the U.S average potato price was $5.12 per cwt[4] in 2004, the average potato prices received by growers in Idaho and Washington were $4.25 per cwt and $4.90 per cwt, respectively. Potato prices in Idaho were the lowest prices among the potato producing states presented in Table 1.

[4] "cwt" is one hundredweight (100 pounds).

Furthermore, potato prices received by growers in Idaho, the leading potato producing state in the country, were below potato production costs during a few years prior to the potato supply management program implementation. For example, while potato growers in Idaho received on average $3.89 per cwt when they sold their potatoes, potato production costs were in the range of $4.63 per cwt to $5.23 per cwt (Bolotova et al 2008: Table 5).

Figure 2 depicts the U.S yearly total potato quantity produced and potato price for the period of 1993-2016. During the period prior to the potato supply management program (prior to 2005), total potato quantity produced was very large, and potato prices received by growers were very low, as compared to the following period (2005 and later). The large potato quantity (supply) and low potato prices, as well as a high level of volatility of both potato supply and price prior to 2005, reflect potato over-supply problem, which led to a disorderly potato marketing adversely affecting profitability of potato growers.

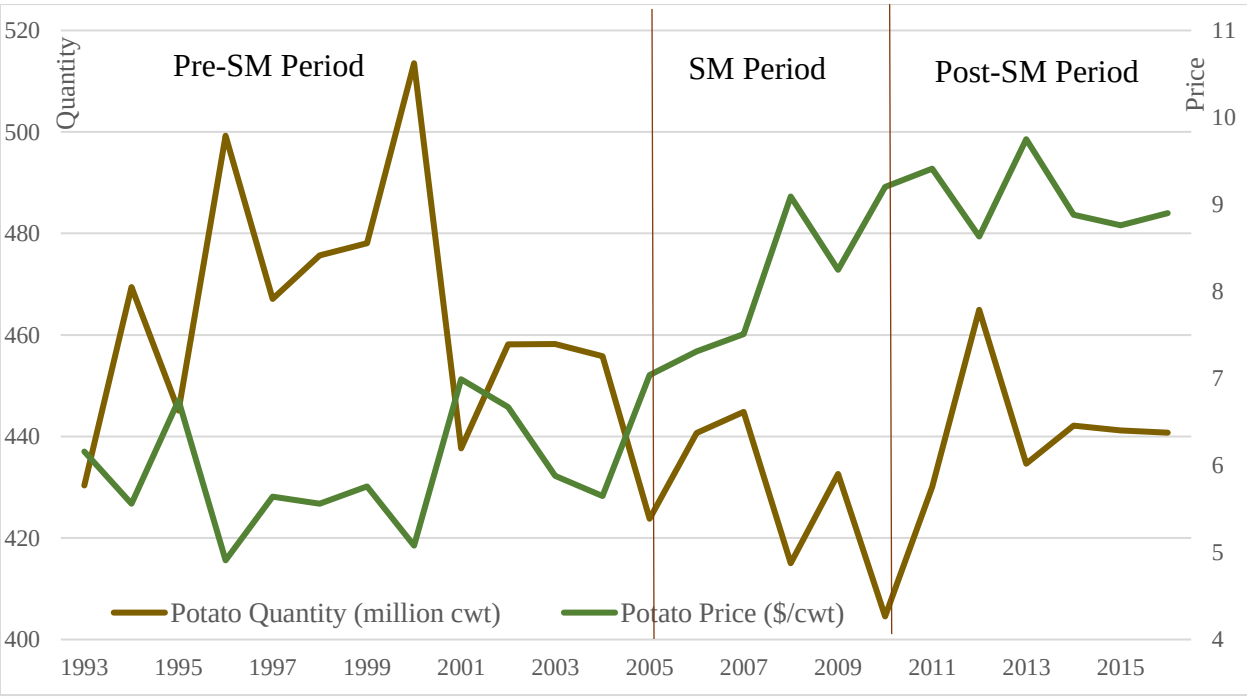

Figure 2. U.S. Yearly Potato Production and Price (1993-2016).
Data source: USDA NASS (2021).

3 Cooperatives of Potato Growers and Potato Supply Management Program

This section discusses cooperatives of potato growers, and the objectives, design, and implementation procedure of the potato supply management program.[5]

The economic forces that led to the idea of a potato supply management program included potato over-supply causing a disorderly potato marketing, increasing potato supply and price volatility, declining demand for fresh potatoes, and increasing competition from the Canadian potato industry. The latter was due to the international trade liberalization because of the North America Free Trade Agreement (NAFTA). These economic forces adversely affected profitability of individual potato growers and of their industry.

3.1 Cooperatives of Potato Growers

The idea of implementing the potato supply management program originated in Idaho, a leading potato producing state in the country. The United Fresh Potato Growers of Idaho (UFPGI), a cooperative of fresh potato growers, was formally organized in November 2004. At that time UFPGI represented approximately 85 percent of fresh potato growers in Idaho. A key to successful implementation of the potato supply management program was participation of other potato producing regions. The cooperatives with similar objectives were organized in other leading potato growing regions and in Canada. The United Potato Growers of America (UPGA), the national level cooperative performing a coordinating function, was organized in March 2005. At that time, UPGA represented approximately 70 percent of fresh Russet[6] potato growers in the country.

[5] A discussion presented in this section was developed using the information collected from newsletters and guidelines, which were available in public access on the webpages of cooperatives of potato growers during the period of the potato supply management program implementation.

[6] Russet is the most popular potato type. Russet potatoes have large tubers, which are suitable for baking, mashing, and manufacturing Frozen French Fries. Russet Burbank is the most popular Russet variety. For example, in 2006 the share of Russet Burbank in the total area of fall potatoes

While the potato supply management program originally targeted fresh potato market, growers producing potatoes used in processing and seed potatoes also joined the cooperatives. Fresh potato market is strongly affected by processing potato and seed potato markets. For example, a surplus of potatoes originally grown for processing market and eventually sold in fresh potato market would decrease prices for fresh potatoes and increase fresh potato price volatility. Therefore, the cooperation of fresh, processing, and seed potato growers was crucial for the program success. The cooperatives of potato growers and individual potato growers presumed that their potato supply management program, as a form of collective agricultural marketing, was within the scope of the Capper-Volstead Act (1922) immunity.

3.2 Potato Supply Management Program

The potato supply management program was developed and implemented for the first time in the spring of 2005. The program objectives were (a) to mitigate potato over-supply adversely affecting profitability of potato growers, (b) to gain control over potato supply and price volatility, and (c) to provide fair returns for potato growers. The originally developed potato supply management program combined a potato acreage management (control) program and a set of marketing programs.

3.2.1 Potato Acreage Management Program

The potato acreage management program (2005–2010) was used to control the number of potato acres planted each year. The acreage management was implemented using a bid buy down program.[7] Potato growers were submitting bids on how much money they needed to be

planted was 46 percent nationally, followed by Russet Norkotah (13.1 percent) and Ranger Russet (9.5 percent) (Bolotova et al 2008).

[7] The acreage bid buy down program was developed using a model of the "Cooperatives Working Together" (CWT) herd retirement program implemented in the U.S. dairy industry (Bolotova 2015).

compensated in order not to plant, and the cooperatives accepted the best bids. The acreage bid buy down program was financially supported by the cooperatives.

The guidelines developed by the cooperatives established a potato acreage reduction target on a yearly basis. During the first years of the program implementation, the potato planting area was to be reduced by 15 percent, relative to the 2004 year base. Each base acre was assessed at $50. Potato growers in the cooperatives, who reduced their potato planting area by 15 percent, did not owe any assessment. Potato growers in the cooperatives, who reduced their potato planting area by less than 15 percent, were assessed a pro-rated percentage of $50.

If a potato grower's acreage reduction was between 10 percent and 14.99 percent, then the grower payed $20 per base acre. If the acreage reduction was between 5 percent and 9.99 percent, then the grower payed $30 per base acre. If the acreage reduction was between 0 percent and 4.99 percent, then the grower payed $50 per base acre. Base acres were the acres, which had potatoes planted on them since the 2003-2004 crop year, regardless of whether these acres were registered with the cooperatives. Acres without base were those, which did not have potatoes planted on them since the 2003-2004 crop season. Planting on the acres without base was a "mindless expansion", as this strategy took advantage of improved market conditions facilitated by the cooperatives and their program.

If a potato grower, a cooperative member, planned to expand his potato acreage, the following strategies were possible. First, the grower could buy or rent base acres. In this case, the grower had to participate in the program (i.e. to reduce potato planting by 15 percent or pay a pro-rated $50 per acre assessment). Secondly, the grower could plant his full 2004 year base acres by paying $50 per acre. Thirdly, the grower could buy or rent acres without base or accelerate a

normal rotation of crops resulting in planting acres without base. This type of conduct (expanding without base) was illegitimate and against the mission of the cooperatives, as it led to potato over-production and represented the threat to the program success. A disincentive for this type of conduct was that growers, who decided to expand without base, were assessed $100 per acre on all acres (expansion plus base acres). The assessments collected by the cooperatives were used to "buy out" acres elsewhere.

To ensure that the potato acreage management program was implemented effectively, the cooperatives conducted field audits. The goal of field audits was to verify the compliance of members of the cooperatives with rules of the acreage reduction and bid buy down programs. At the beginning of planting seasons, growers filled out the Planting Intension Form. In this form growers recorded the 2004 year base acreage for fresh, seed, and processing potatoes by potato variety. Also, growers declared their current year planting intentions by potato variety. The Planting Intension Form was the grower's commitment against which his actual performance was evaluated. The documents used to assess actual acreage were copies of the USDA Farm Service Agency (FSA) Form 578[8] and aerial photography. The growers authorized FSA to release this information to the authorized representatives of the cooperatives.[9]

Accurate prediction of potato yield per acre was important for the program success. The cooperatives encouraged each member to perform a series of field digs. The first and second digs were performed by growers in August. The third dig was performed by a field man at the harvest.

[8] USDA FSA Form 578 is a report of acreage.

[9] The cooperative's field man reviewed the grower's planting intentions submitted to the cooperative earlier, filed maps and FSA Form 578. Then, the field man conducted inspection of each parcel of land to verify actual plantings and reductions. Using special software, the field man compared actual acreage planted versus the FSA Form and Planting Intentions. The results of the audit were reported to the Future Crop Committee and the Board of the cooperatives.

All volunteer growers were sent the instructions on how to perform field digs along with the record keeping forms.[10]

3.2.2 Potato Marketing Programs

The marketing programs included a potato flow control program, exchanges of market information, and secondary marketing programs.

Before the potato supply management program, uncoordinated potato flow to the fresh potato market often resulted in the over-supply of potatoes leading to low potato prices and a high potato price volatility. The potato flow control program was used to control fresh potato shipments throughout the marketing year. Warehouses participating in this program entered information on the capacity, stocks, and pack-outs on the webpage of the cooperative on a regular basis. This information along with other information (prices, demand and supply trends, weather, etc.) was discussed during conference calls twice a week at the state level and once a week at the national level. The results of these discussions were summarized in a price advisory, which was posted on the cooperative webpage. The price advisory was used as a pricing strategy for the coming week.

To remove the surplus of already produced potatoes, the cooperatives implemented secondary marketing programs. The effectively executed secondary marketing strategy at the beginning of 2005 removed approximately 8 percent of potato stock from the market. The 2004 year potato surplus was diverted to charities, food banks, and as dehydrated potatoes used for

[10] Participating in the field digs growers were required to sample each field. The growers had to select a spot of the field representing the average soil and growing conditions for that field. The grower had to dig a 10-feet strip to check plant count, health, and quantity of potato tubers. The tubers were segregated by the sizes to determine the total weight for each group of different sizes of potatoes. This information was recorded by the grower and was faxed to the cooperative's office.

humanitarian services. One of the successfully implemented marketing strategies was winning the USDA procurement contracts.

4 Theoretical Framework: Seller Market Power in the U.S. Potato Industry

Figure 3 is a graphical representation of a theoretical framework incorporating the potato industry's seller market power and four alternative market scenarios. The potato inverse demand curve (labeled as "P") is a graphical representation of a potato inverse demand function at the farm stage of the potato supply chain. The marginal cost curve (labeled as "MC") is a graphical representation of the constant marginal cost function. The market scenarios depicted in Figure 3 differ due to the total potato quantity produced, potato price and industry profit. The marginal cost is the same in the four analyzed market scenarios. Table 2 summarizes price, quantity, and profit information for these market scenarios.

The potato quantity (Q) used in the analysis is the total potato quantity produced by all growers during the potato production season ("potato production"). The potato price (P) is the yearly average potato price received by growers during the following marketing season. The total potato quantity produced each year during the production season affects potato prices received by growers during the following marketing season: potato price is a function of potato quantity (inverse demand).[11]

Agricultural industries are often characterized as perfectly competitive industries. There are many agricultural producers in these industries, who act as price-takers. To maximize their profit, they produce output quantity, at which prices they receive are equal to marginal costs of producing their outputs. The profit is zero in perfectly competitive industries. The first market

[11] A discussion of potato production and price cycle in light of a similar theoretical framework is presented in Bolotova (2019).

scenario is a perfectly competitive industry scenario[12], which is used as a benchmark scenario to evaluate actual potato industry market situations during the period of the potato supply management program and the periods before and after the program implementation.

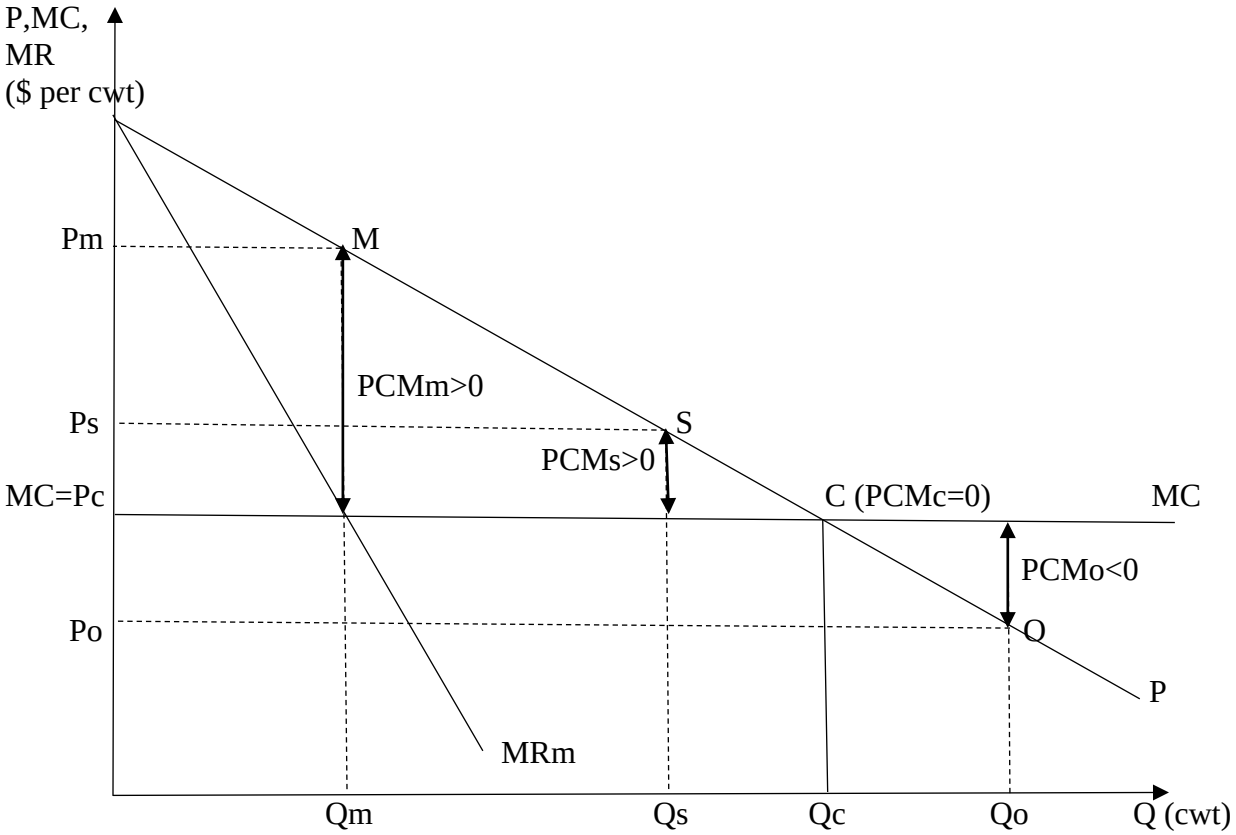

Figure 3. Alternative Market Scenarios for the U.S. Potato Industry

Note: Qo and Po (Point O) is a potato *over-supply* scenario. Qc and Pc (Point C) is a *perfectly competitive industry* scenario. Qs and Ps (Point S) is *a potato supply management* scenario (a small degree of seller market power). Qm and Pm (Point M) is a *hypothetical monopoly* scenario.

[12] In Figure 3, the profit-maximizing quantity in a perfectly competitive industry scenario is at the intersection of the inverse demand and marginal cost curves. The profit-maximizing pricing rule is P=MC. Note that output price (P) is equal to marginal revenue (MRc) in perfectly competitive industries.

The second market scenario is a potato over-supply scenario, which reflects a market situation prior to the potato supply management program. As compared to a perfectly competitive industry scenario, in the potato over-supply scenario the potato industry produces potato quantity, which is larger than the quantity in a perfectly competitive industry scenario. As a result, potato prices received by growers are below marginal cost, and price-cost margin (profit) is negative. The industry and growers incur losses.

Table 2. Alternative Market Scenarios for the U.S. Potato Industry

Scenario	Price and Quantity Depicted in Figure 3[a]	Comparison of Prices and Quantities between Scenarios	Profit
Perfect competition	Scenario C: Qc and Pc	Pc=MC	PCMc=Pc–MC=0 Zero profit for the industry and firms
Potato over-supply	Scenario O: Qo and Po	Qo>Qc Po<MC	PCMo=Po–MC< 0 PCMo<PCMc Loss for the industry and firms
Small degree of seller market power (potato supply management)	Scenario S: Qs and Ps	Qs<Qc Ps>MC	PCMs=Ps–MC>0 PCMs>PCMc Profit for the industry and firms
Hypothetical monopoly	Scenario M: Qm and Pm	Qm<Qs<Qc Pm>Ps>MC	PCMm=Pm–MC>0 PCMm>PCMs>PCMc Profit for the industry and firms

[a] Q (cwt), P ($ per cwt), MC ($ per cwt), and PCM ($ per cwt) are quantity, price, marginal cost, and price-cost margin, respectively. Subscripts "c", "o", "s", and "m" denote a perfectly competitive industry scenario, a potato over-supply scenario, a small degree of seller market power scenario (potato supply management), and a hypothetical monopoly scenario, respectively.

To correct the adverse potato over-supply situation, cooperatives of potato growers developed and implemented the potato supply management program. The potato acreage management program directly affected potato area planted each year, and consequently it affected

total quantity of potatoes produced each year by the industry. During the first years of the program implementation, the objective was to reduce potato acreage by 15 percent, relative to the 2004 year base acreage.

Theoretically, the effective enforcement of the potato acreage management program had to increase seller market power of the potato industry. A decrease in the potato area planted and consequently a decrease in the total potato quantity produced[13] would increase potato prices and profit. The industry would move to a perfectly competitive industry scenario and possibly to a small degree of seller market power scenario.

The third market scenario is a small degree of seller market power scenario, which reflects market situation during the period of the potato supply management program. As compared to a perfectly competitive industry scenario, the potato industry produces potato quantity, which is smaller than the quantity in a perfectly competitive industry scenario. As a result, potato prices received by growers are above marginal cost, and price-cost margin (profit) is positive. The industry and growers earn profit.

The fourth market scenario is a hypothetical monopoly scenario, representing the extreme case of seller market power.[14] According to economic model of the profit-maximizing behavior of monopoly operating in a market with linear demand and constant marginal cost, the profit-maximizing output quantity under monopoly is 50 percent of the profit-maximizing output

[13] Note that total potato quantity produced each year is determined by potato area planted (and harvested) and potato yield per acre. While the potato acreage management program directly affected the area planted, potato yield per acre was beyond the control of potato growers. Increasing over time potato yield per acre would decrease the price effects of the potato acreage management program.

[14] In Figure 3, the profit-maximizing monopoly quantity is at the intersection of marginal revenue for monopoly curve (MRm) and marginal cost curve. The profit-maximizing pricing rule is MRm=MC. The marginal revenue for monopoly curve is twice as steep as the inverse demand curve; both curves have the same Y-axis intercept.

quantity under perfect competition. The potato industry would have never been able to reach a monopoly market power because it was not cutting potato production by any amount close to 50 percent.

The market situation during the period following the potato supply management program implementation theoretically may be described as a small degree of market power scenario, if the industry does not increase potato production, or as a perfectly competitive industry scenario, if the industry increases potato production to a relatively small extent. In the absence of the potato acreage management program, potato growers have incentives to increase potato production in response to higher potato prices they received during the period of the potato supply management program.

While potato growers are better off in market scenarios with a smaller potato production and higher potato prices (seller market power scenarios), potato buyers are worse off. Potato buyers have access to a smaller potato quantity and pay higher potato prices. While potato buyers are better off in market scenarios with a large potato quantity available in the market and lower potato prices (potato over-supply scenario), potato growers are worse off. Potato growers cannot sell their potatoes at profitable prices. Potato growers receive potato prices below potato production costs and incur losses.

5 Empirical Market and Price Analysis in the U.S. Potato Industry

This section presents a basic market and price analysis in the U.S. potato industry during the three periods of interest: the period prior to the potato supply management program (2010-2014), the period of the potato supply management program implementation (2005-2010), and the following period (2011-2016). These periods are referred to as pre-SM period, SM period, and post-SM period, respectively. The purpose of this analysis is to identify and evaluate changes in the potato

market and price behavior, which would provide evidence on the program effectiveness. The analysis uses publicly available data available in the U.S. Department of Agriculture National Agricultural Statistics Service Quick Stats database (USDA NASS 2021). The analysis is conducted at the farm stage of the potato supply chain.

5.1 An Analysis of Yearly Potato Production and Price

To analyze changes in the potato production and price over the three periods of interest, the yearly averages and coefficients of variation[15] are calculated for potato area harvested, potato yield per acre, potato production (quantity), and potato price for these periods. Table 3 summarizes descriptive statistics and presents changes in the averages and coefficients of variation between the analyzed periods. Figure 2 depicts yearly potato production and potato price for the period of 1993-2016.

5.1.1 Pre-Supply Management Period

During the pre-SM period, the yearly average potato area harvested[16] is 1,250 thousand acres, potato yield is 372 cwt per acre, potato production[17] is almost 465 million cwt, and potato price is $6.05 per cwt. The potato area harvested and potato production are the largest, and potato yield per acre and potato price are the lowest in the pre-SM period, as compared to the SM and post-SM periods. This pattern of potato price-quantity relationship (a large quantity and a low price) in the pre-SM period, as comparted to the SM and post-SM periods, reflects potato over-supply problem.

[15] Coefficient of variation is chosen to measure the volatility of the analyzed variables in this case study. While there are other measures of volatility available, for example standard deviation and variance, an advantage of the coefficient of variation is that it measures the standard deviation relative to the mean of the analyzed variable. The coefficient of variation can also be expressed in the percentage form.

[16] The area harvested may be smaller than the area planted due to crop failure (because of weather, insects, and diseases), lack of labor, low market prices, or other factors (USDA ERS 2019).

[17] The total potato quantity produced ("potato production") is approximately equal to the area harvested times potato yield per acre.

As indicated by the coefficients of variation, the volatility of potato acres harvested, potato production and potato price is the highest in the pre-SM period, as compared to the SM and post-SM periods.

Table 3. U.S. Potato Industry: Acres Harvested, Yield, Production and Price: Descriptive Statistics (2000-2016)

	Acres harvested	Yield	Production	Price
	acres	cwt per acre	cwt	$ per cwt
Pre-Supply Management period (2000-2004)				
Average[a]	1,249,980	372	464,678,600	6.05
CV[b]	0.053	0.037	0.062	0.128
Supply Management period (2005-2010)				
Average	1,071,400	398	426,927,667	8.07
CV	0.043	0.021	0.036	0.115
Supply Management period, relative to pre-Supply Management period				
Average percentage change	-14.29	7.14	_____	_____
CV percentage change	-19.78	-42.54	_____	_____
Post-Supply Management period (2011-2016)				
Average	1,063,517	416	442,293,167	9.06
CV	0.041	0.031	0.027	0.048
Post-Supply Management period, relative to Supply Management period				
Average percentage change	-0.74	4.48	_____	_____
CV percentage change	-4.61	44.79	_____	_____
Post-Supply Management period, relative to pre-Supply Management period				
Average percentage change	-14.92	11.93	_____	_____
CV percentage change	-23.48	-16.81	_____	_____

[a] The averages are yearly averages.
[b] CV is the coefficient of variation (the ratio of standard deviation to the average).
Data Source: USDA NASS (2021).
Note: Students should perform relevant calculations to record their answers in cells with missing answers (Discussion Question 5.1).

5.1.2 Supply Management Period, as Compared to Pre-Supply Management Period

The following changes take place in the SM period, as compared to the pre-SM period. The yearly average potato area harvested decreases by 14.29 percent. This percentage decrease in the potato area harvested is very close to a 15 percent target potato acreage reduction established by the guidelines developed by the cooperatives. Because the yearly average potato yield per acre increases by approximately 7 percent, the yearly average potato production decreases only by

approximately 8 percent. According to the theoretical framework (inverse demand), total potato production affects potato prices. The yearly average potato price received by potato growers (this is the price paid by potato buyers) increases by approximately 33 percent. As indicated by the coefficients of variation, the volatility of potato area harvested, potato production and potato price decreases by approximately 20 percent, 41 percent, and 10 percent, respectively.

The empirical evidence on changes in the level and volatility of the U.S. potato industry production and price in the SM period, as compared to the pre-SM period, indicates that the industry conduct and performance reflect the effects of the potato supply management program. The potato area harvested decreases by a targeted percentage, which causes potato production to decrease and potato price to increase. These changes in potato production and price indicate that the potato industry effectively managed potato over-supply problem, which was one of the objectives of the potato supply management program. In addition, the volatility of potato production and price decreases. Gaining control over potato supply and price volatility was another objective of the potato supply management program. In summary, this empirical evidence is consistent with the effective implementation of the potato supply management program.

It should be emphasized that total potato quantity produced each year, which affects potato prices received by growers, is determined by both the potato area harvested and potato yield per acre. While potato growers were able to affect potato area planted each year, potato yield per acre was beyond the growers' control. An increasing potato yield per acre over time (for example, due to improvements in potato varieties and agronomical practices) might have diminished the anticipated effects of the potato acreage reduction on potato prices.

5.1.3 Post-Supply Management Period, as Compared to Supply Management Period

The following changes take place in the post-SM period, as compared to the SM period. The yearly average potato area harvested decreases by 0.74 percent, and the yearly average potato yield per acre increases by approximately 4.5 percent. As a result, the yearly average potato production increases by 3.6 percent, and the yearly average potato price increases by approximately 12 percent. As indicated by the coefficients of variation, the volatility of potato area harvested, potato production, and potato price decreases by approximately 4.6 percent, 25 percent, and 58.6 percent, respectively.

The empirical evidence on changes in the level and volatility of the U.S. potato industry production and price in the post-SM period, as compared to the SM period, indicates that the industry conduct and performance might still reflect some of the effects of the potato supply management program. First, while the yearly average potato area harvested practically does not change in the post-SM period, as compared to the SM period, the post-SM period area harvested is approximately 15 percent smaller than the pre-SM period area harvested. The yearly average potato area harvested did not increase in the post-SM period, although the potato acreage management program was not enforced. Second, the volatility of both potato production and price continues to decrease.

5.2 An Analysis of Monthly Fresh, Processing, and All Potato Prices

To analyze changes in fresh, processing, and all potato prices over the three periods of interest, the monthly averages and coefficients of variation are calculated for fresh, processing, and all potato prices for these periods. This section presents a disaggregated price analysis for the two major potato categories (fresh and processing), as compared to the yearly all potato price analysis presented in the previous section. Table 4 summarizes descriptive statistics and presents changes

in the averages and coefficients of variation between the analyzed periods. Figure 4 depicts monthly prices for fresh, processing, and all potatoes (the latter category combines fresh and processing potatoes).

Table 4. U.S. Potato Industry: Fresh, Processing, and All Potato Prices (2000-2016)

	Fresh Potato Price	Processing Potato Price	All Potato Price
		$ per cwt	
Pre-Supply Management period (January 2000 – July 2005)			
Average price[a]	8.21	5.14	6.18
CV[b]	0.34	0.08	0.18
Supply Management period (August 2005 – August 2011)			
Average price	11.48	6.71	8.19
CV	0.32	0.17	0.18
Supply Management period, relative to pre-Supply Management period			
Average price percentage change	39.80	_____	_____
CV percentage change	-5.49	_____	_____
Post-Supply Management period (September 2011 – December 2016)			
Average price	10.61	8.25	9.03
CV	0.23	0.09	0.12
Post-Supply Management period, relative to Supply Management period			
Average price percentage change	-7.62	_____	_____
CV percentage change	-27.57	_____	_____
Post-Supply Management period, relative to pre-Supply Management period			
Average price percentage change	29.15	_____	_____
CV percentage change	-31.55	_____	_____

[a] The average prices are monthly averages.
[b] CV is the coefficient of variation (the ratio of standard deviation to the average).
Data Source: USDA NASS (2021).
Note: Students should perform relevant calculations to record their answers in cells with missing answers (Discussion Question 5.2).

During the pre-SM period, the monthly average prices are $8.21 per cwt for fresh potatoes, $5.14 per cwt for processing potatoes, and $6.18 per cwt for all potatoes. As indicated by the coefficients of variation, the volatility of fresh potato price is approximately four times the volatility of processing potato price.

During the SM period, as compared to the pre-SM period, the monthly average fresh potato price, processing potato price, and all potato price increase by approximately 40 percent, 30

percent, and 33 percent, respectively. The volatility of fresh and all potato prices decreases by 5.5 percent and 0.12 percent, respectively. The volatility of processing potato price increases by almost 119 percent.

During the post-SM period, as compared to the SM period, the monthly average fresh potato price decreases by 7.6 percent, and the monthly average processing and all potato prices increase by 23 percent and 10 percent, respectively. The volatility of fresh, processing, and all potato prices decreases by almost 27.6 percent, 46.7 percent, and 33.4 percent, respectively.

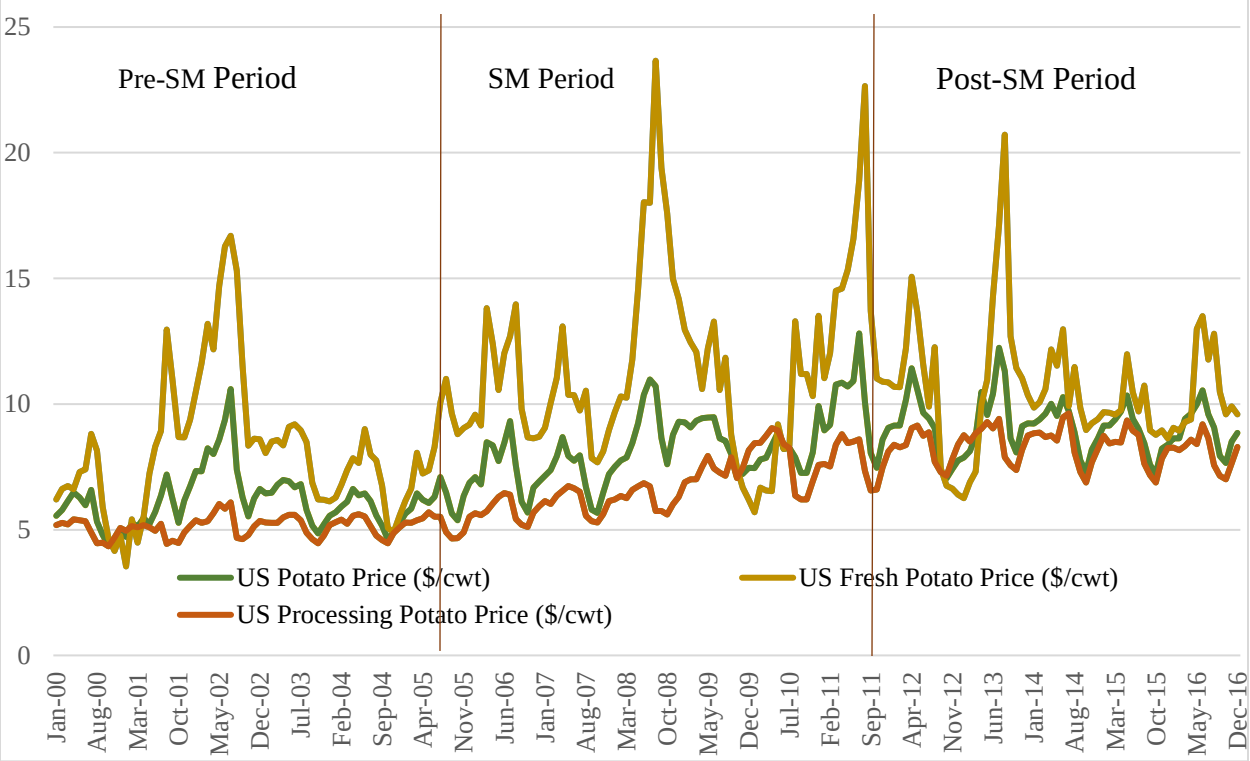

Figure 4. U.S. Monthly Fresh, Processing, and All Potato Prices (2000-2016).
Data source: USDA NASS (2021).

While the empirical evidence indicates some differences in the price behavior of fresh and processing potatoes over the three analyzed periods, both fresh and processing potato prices increase during the SM period, as compared to the pre-SM period, which is consistent with the

analysis of yearly potato prices presented in the previous section. The potato supply management program originally targeted the fresh potato segment, but later it started affecting the processing potato segment as well. Increasing fresh and processing potato prices and decreasing volatility of fresh potato prices in the SM period, as compared to the pre-SM period, reflect the effective implementation of the potato supply management program.

The monthly average fresh potato price decreases in the post-SM period, which reflects the fact that the potato supply management program (in particular, the potato acreage management program) is no longer in effect. The monthly average processing potato price increases in the post-SM period, which might reflect the fact that processing potato prices are negotiated by potato growers and potato processors in contracts signed prior to the potato production season. In addition, potato growers in the major potato producing regions are represented by bargaining organizations ("cooperatives") in contract negotiations with potato processors, when they negotiate contract prices and other terms of trade. In summary, the fresh potato segment and processing potato segment have distinct marketing and pricing institutions (spot market and pre-production season contracts, respectively), which affect potato price behavior in each of these segments and in the entire potato industry.

6 Potato Supply Management Program and Antitrust

The cooperatives of potato growers presumed that their potato supply management program was within the scope of the Capper-Volstead Act immunity. The Capper-Volstead Act (1922) provides a limited antitrust immunity from Section 1 of the Sherman Act for collective agricultural marketing activities of agricultural producers implemented through their organizations.[18]

[18] The organizations of agricultural producers must conform to the Capper-Volstead Act standard established in its Section 1.

Section 1 of the Sherman Act (1890) makes illegal agreements among competitors, which aim to affect product quantities and/or prices.[19] These agreements are often referred to as cartels or price-fixing cartels or price-fixing conspiracies. Agricultural producers are competitors, and collective agricultural marketing activities ("programs"), which affect agricultural product prices and/or quantities, are agreements among competitors. In the absence of the Capper-Volstead Act, collective agricultural marketing activities would violate Section 1 of the Sherman Act.

A number of buyers of fresh potatoes and processed potato products, who purchased these products directly from potato growers (wholesalers and retailers) and indirectly (final consumers), filed class action antitrust lawsuits against cooperatives of potato growers and individual potato growers beginning in 2010.[20] These buyers (plaintiffs) alleged that the potato supply management programs, and in particular the potato acreage management program, was a form of illegal price-fixing violating Section 1 of the Sherman Act.

The plaintiffs argued that the cooperatives of potato growers (defendants) acted as a classic pricing-fixing cartel causing potato prices to be above competitive level. Potato buyers had to pay higher potato prices and were overcharged. The cooperatives of potato growers settled these lawsuits for $25 million in 2015 (O'Connell 2018). In addition, according to the settlement agreement, cooperatives of potato growers agreed that they would not make any attempt to manage potato acreage prior to the potato planting season for seven years.

The main legal issue raised during the potato antitrust litigation is whether the potato acreage management (control) program was within the scope of the Capper-Volstead Act

[19] Section 1 of the Sherman Act refers to these agreements as contracts, combinations, or conspiracies in restraint of trade.

[20] The Clayton Act (1914) allows private parties (individuals and firms) to recover treble damages and reasonable attorney fees for violations of the Sherman Act.

immunity. Apparently, there was no well-developed case law interpreting the legal status of agricultural supply management programs in light of the Capper-Volstead Act, and in particular those implemented at the agricultural production stage.

In December 2011, a U.S. district court for the first time in history of the Capper-Volstead Act evaluated the legal status of agricultural production restrictions in a lawsuit against a group of cooperatives of potato growers and individual potato growers (*in Re: Fresh and Process Potatoes Antitrust Litigation*). After conducting a comprehensive analysis, in its advisory opinion the court concluded that *"*acreage reductions, production restrictions, and collusive crop planning are not activities protected by the Capper-Volstead Act.*"*

One of the main arguments of the defendants (the cooperatives) was that if the Capper-Volstead Act cooperatives were allowed to fix prices[21], they should be allowed to restrict production. This argument did not persuade the court, which response was to advise that *"*Individual freedom to produce more in times of high prices is a quintessential safeguard against Capper-Volstead Act abuse, which Congress recognized in enacting the statute.*"*

In summary, the most recent legal decisions and related legal discussions inform that the type of agricultural supply management programs - whether they are implemented at the pre-production stage, production stage, or post-production stage - affects their legal status in light of the Capper-Volstead Act.[22] It is crucial whether the collective agricultural marketing activities in question can be interpreted as "marketing" included in Section 1 of the Capper-Volstead Act.

[21] There is a well-established case law informing that price-fixing activities of agricultural cooperatives are generally within the scope of the Capper-Volstead Act immunity. This is because "price-fixing" is a form of pricing activities, which are essential elements of "marketing" mentioned in Section 1 of the Capper-Volstead Act. Frederick (1989 and 2002) provides a detailed analysis of the Capper-Volstead Act.

[22] Bolotova (2014 and 2015) provides an overview of relevant legal decisions and discussions.

Agricultural supply management activities implemented at the post-production stage are more likely to be interpreted as “marketing” and therefore are likely to be within the scope of the Capper-Volstead Act immunity. An example is an agricultural cooperative withholding already produced product from the market in the anticipation of higher prices. Agricultural supply management activities implemented at the pre-production and production stages are not likely to be interpreted as “marketing” and therefore are outside the scope of the Capper-Volstead Act immunity. The potato acreage management program is an example. The courts interpret the legal status of collective agricultural marketing activities on a case by case basis.

7 Discussion Questions

The teaching note provides additional guidance to selected discussion questions and suggested answers to all discussion questions.

1. Discuss the U.S. potato industry structure and economic forces leading to the idea of a potato supply management program.

2. Explain objectives of the potato supply management program and the role of cooperatives of potato growers in developing and implementing this program. Discuss a design of the potato acreage management program and a procedure of its implementation. Discuss a set of programs affecting potato marketing.

3. Using a graphical analysis, explain a theoretical framework, which incorporates seller market power of the U.S. potato industry and describes potato price-quantity relationship and industry profitability in four alternative market scenarios: a potato over-supply scenario, a perfectly competitive industry scenario, a potato supply management scenario (small degree of seller market power), and a hypothetical monopoly scenario.

4. Evaluate potato price-quantity relationship and industry profitability in four market scenarios mentioned in the previous question. To complete this analysis, use the following assumptions. The potato inverse demand function is $P = 20.45 – 0.026Q$ (P is in $ per cwt, and Q is in million cwt), and marginal cost of producing potatoes is $9.00 per cwt of potatoes; marginal cost is the same in these four scenarios.[23] Assume that the U.S. potato industry produces the following total potato quantity in four alternative market scenarios: 460 million cwt, 440.3846 million cwt, 420 million cwt, and 220.2 million cwt.

4.1. Using these assumptions, calculate the following economic measures to complete the profitability analysis of the potato industry. For each market scenario, calculate potato price in $ per cwt, total costs in $, total revenue in $, total profit in $, price-cost margin measured in $ per cwt and as a percentage of the potato price (Lerner Index of market power). Classify each scenario as a potato over-supply scenario, a perfectly competitive industry scenario, a potato supply management scenario, or a hypothetical monopoly.

4.2. Discuss the results of your analysis. First, draw a figure similar to Figure 3 of the case study and show the four analyzed market scenarios in this figure: show relevant curves, price-quantity combinations and price-cost margins. Second, explain the patterns of potato price-quantity relationship and industry profitability in the analyzed scenarios. In which scenario(s) potato growers are better off? In which scenario(s) potato growers are worse off? In which scenario(s) potato buyers are better off? In which scenario(s) potato buyers are worse off? Explain your reasoning.

5. Perform a basic market and price analysis in the U.S. potato industry.

[23] The potato inverse demand function is estimated using USDA NASS yearly potato production and price data (Bolotova 2017). The marginal cost assumption is developed using production costs reported in the potato production budgets (Patterson 2015).

5.1. Evaluate changes in the yearly potato area harvested, yield per acre, production, price and their volatility during the three periods of interest in this case study: prior, during, and after the potato supply management program implementation.

5.1.1. Reproduce calculations of changes in yearly averages and coefficients of variation among the analyzed periods for the economic variables for which answers are provided in Table 3.

5.1.2. Calculate changes in yearly averages and coefficients of variation among the analyzed periods for the economic variables for which answers are not provided in Table 3.

5.1.3. Describe the results of your analysis. Explain which patterns of changes in the potato area harvested, yield per acre, production, and price and in their volatility are consistent with the effective implementation of the potato supply management program.

5.2. Evaluate changes in the monthly fresh, processing, all potato prices and their volatility during the three periods of interest in this case study.

5.2.1. Reproduce calculations of changes in monthly averages and coefficients of variation among the analyzed periods for the economic variables for which answers are presented in Table 4.

5.2.2. Calculate changes in monthly averages and coefficients of variation among the analyzed periods for the economic variables for which answers are not presented in Table 4.

5.2.3. Compare fresh potato price behavior and processing potato price behavior. Explain which patterns of changes in potato prices and their volatility are consistent with the effective implementation of the potato supply management program.

6. Explain the reason why potato buyers filed antitrust lawsuits against cooperatives of potato growers and individual potato growers. Explain the outcome of the potato antitrust litigation. Discuss the role of the Capper-Volstead Act in regulating collective agricultural marketing activities in the industry setting discussed in this case study.

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Appendix

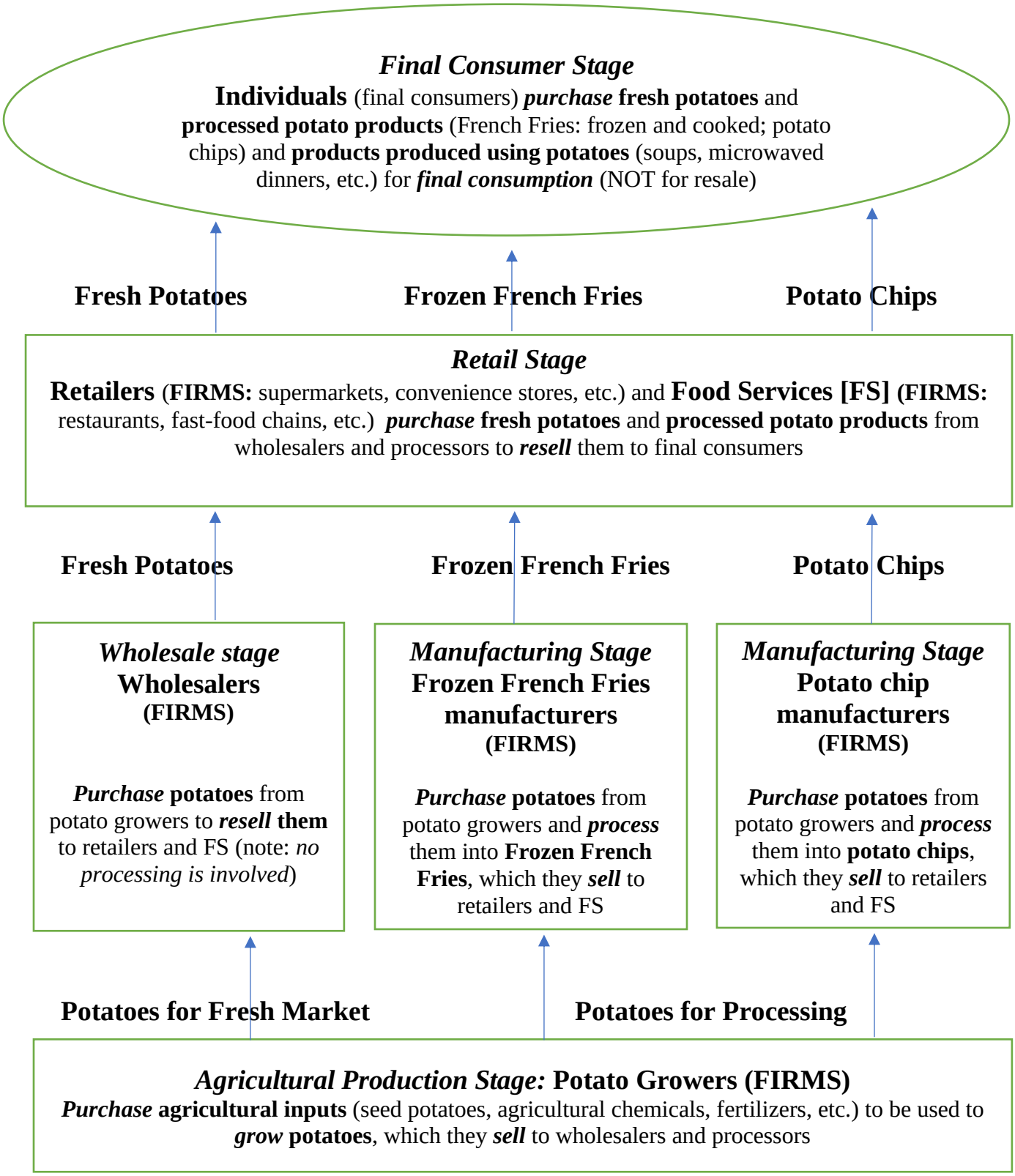

Figure A1. Potato Supply Chain