Case Study

Market Power in the United States Potato Industry

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Abstract
This case study is motivated by developments in the U.S. potato industry involving implementation of a potato supply management program by a nationwide group of cooperatives of potato growers from 2005 to 2010. This program aimed to mitigate potato oversupply, which adversely affected potato growers' profitability. 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 related to the program's implementation. It presents a theoretical economic framework, which explains the conduct and performance of the U.S. potato industry under alternative market scenarios, along with a basic market and price analysis. The intended audiences are undergraduate and graduate students as well as extension and outreach communities. A teaching note discusses teaching objectives, teaching strategies, and student background knowledge. In addition, it includes multiple-choice questions and suggested answers to discussion and multiple-choice questions.

1 Introduction

The motivations for this case study relate to developments in the U.S. potato industry involving implementation of a potato supply management program by a nationwide group of cooperatives of potato growers from 2005 to 2010.[1] This program aimed to (1) mitigate an oversupply of potatoes, which adversely affected profitability of potato growers; (2) control potato supply and price volatility; and (3) 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 between 2005 and 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 increased potato prices for buyers. The potato buyers argued that the potato acreage management program was not immune to the Capper-Volstead Act (1922) and that it 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 make no attempt to manage potato acreage prior to the potato planting season for seven years.

This case study introduces economic, business, and legal issues related to implementation of the 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

[1] 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).

industry. In particular, the case study presents a theoretical framework, which explains conduct and performance of the U.S. potato industry (which includes all potato growers) under alternative market scenarios, as well as basic market and price analyses based on publicly available data reported by the U.S. Department of Agriculture. The case study is suitable for a variety of undergraduate and graduate courses taught in agricultural economics and agribusiness programs, including microeconomics, agricultural economics, managerial economics, 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 program design and implementation procedures.

SLO #2: Students should learn a theoretical economic framework of seller market power in the potato industry and be able to apply this framework to evaluate potato price-quantity relationships and industry profitability under alternative market scenarios that differ due to the potato quantity produced, potato price, and industry profit (i.e., a potato oversupply scenario; a perfectly competitive industry scenario; a potato-supply management scenario, in which sellers have a small degree of market power; and a hypothetical monopoly scenario).

SLO #3: Students should be able to apply the theoretical economic framework to perform an analytical analysis of potato price-quantity relationships and industry profitability in alternative market scenarios by using the potato inverse demand and constant marginal cost functions.

SLO #4: Students should be able to conduct an analytical analysis of welfare transfer due to seller market power in the U.S. potato industry.

SLO #5: Students should be able to conduct a basic market and price analysis using U.S. Department of Agriculture (USDA) data before, during, and after the program was active to evaluate market and price effects of the potato supply management program.

SLO #6: Students should be able to explain legal (antitrust) issues related to 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, or summer potatoes. Most of the potatoes produced in the United States are fall potatoes.[2] Fall potatoes are planted in the spring (April/May) and are harvested in the fall (September/October). The most common potato types 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 the fresh market are washed, graded, and packaged in different types of packs before being shipped to

[2] In recent years, fall potato production has made up 90 percent of total potato production (USDA NASS 2021).

wholesalers and retailers. Fresh potato prices are determined in a spot market setting. Fresh potato prices are based on potato grade, variety, and pack size and type (USDA AMS 2021). Potato shipping points are located in the major potato-growing regions.

Potatoes produced for the processing market go through processing before they reach consumers. The most popular processed potato products are French fries, potato chips, and dehydrated potatoes. Processing potato prices are determined by 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 presence, absence, or both of certain potato quality characteristics, which are important for the quality of processed potato products (Bolotova and Patterson 2009).

Figure 1 depicts the U.S. potato consumption per capita for various potato product categories in the period 1990–2019. The figure indicates a decrease in all potato consumption beginning in the 2000s. The decrease in fresh potato consumption was greater than that in processing potato consumption.

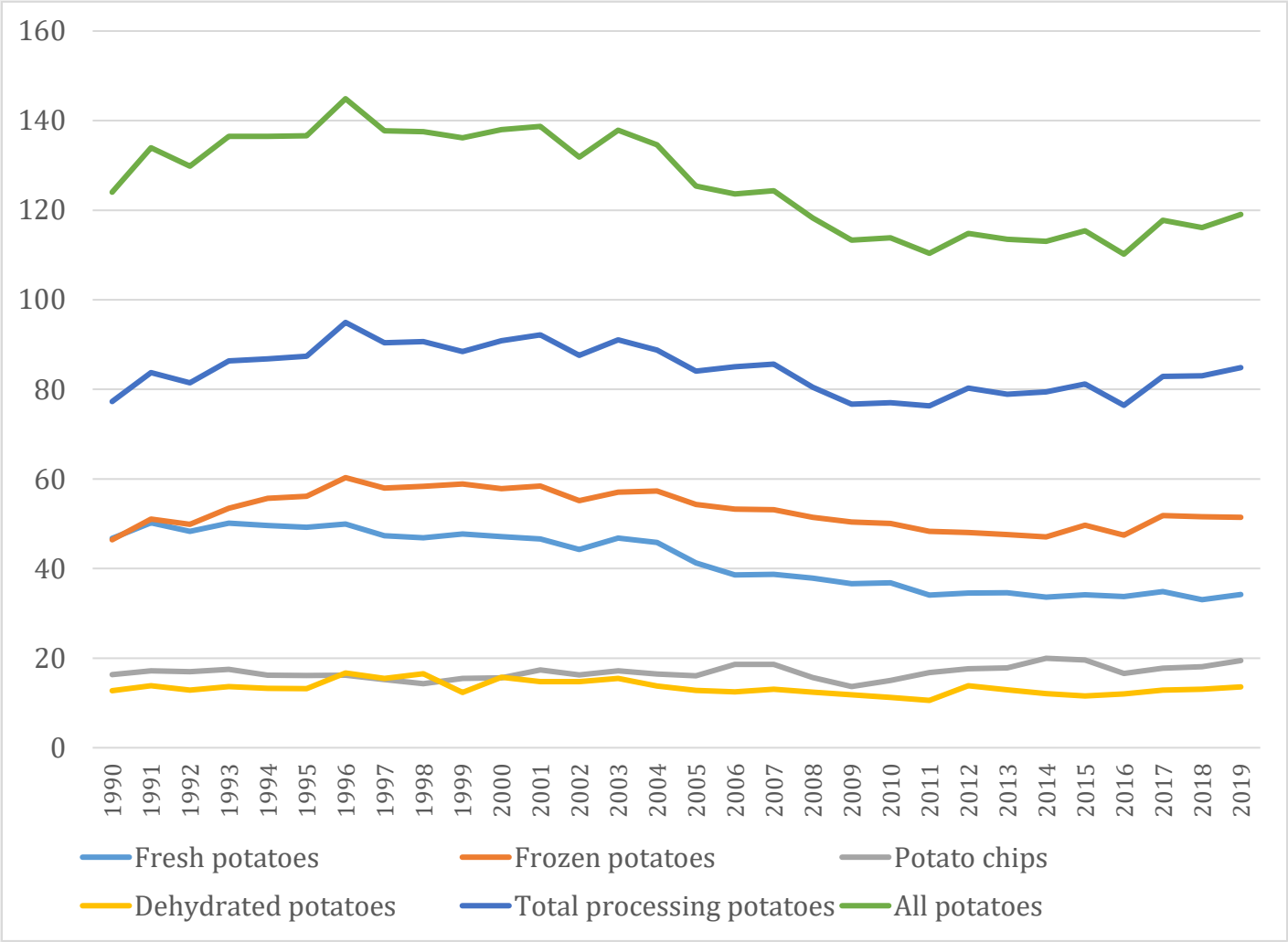

Figure 1. U.S. Potato Consumption in Pounds Per Capita, 1990-2019.

Source: USDA ERS (2021).

Table 1 provides data characterizing the U.S. potato industry structure in 2004, the year prior to implementation of the potato supply management program. The data for the largest fall potato states are presented in Table 1. In that year, the United States had 9,408 potato growing farms. Among states, Idaho and Washington had the largest potato production, in terms of potato area planted, total potato quantity produced, and value of potato production. In 2004, of 1,040,700 fall potato acres planted nationally, 355,000 acres and 160,000 acres were planted in Idaho and Washington, respectively.

Table 1. U.S. Fall Potato Industry Structure: Nine 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: USD 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 were 26.8 percent and 22.0 percent, respectively. North Dakota and Wisconsin were the next two largest potato-producing states with 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 received by growers in these states were below the U.S. average potato price. Although the U.S average potato price was $5.12 per cwt (one hundredweight or 100 pounds) in 2004, the average potato prices received by growers in Idaho and Washington were $4.25 per cwt and $4.90 per cwt, respectively.

As Table 1 shows, Idaho had the lowest potato prices of potato-producing states. Potato prices received by growers in Idaho, the country's leading potato-producing state, were below potato production costs in a few years prior to the potato supply management program. Potato growers in Idaho received on average $3.89 per cwt when they sold their potatoes, but 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 the yearly average potato price in the period 1993–2016. Total potato quantity was much larger and potato prices received by growers were much lower before the potato supply management program than during it (2005–2010). The large potato quantity (supply) and low potato prices, as well as a high volatility of potato supply and price prior to 2005, reflect a potato oversupply problem, which adversely affected potato growers' profitability.

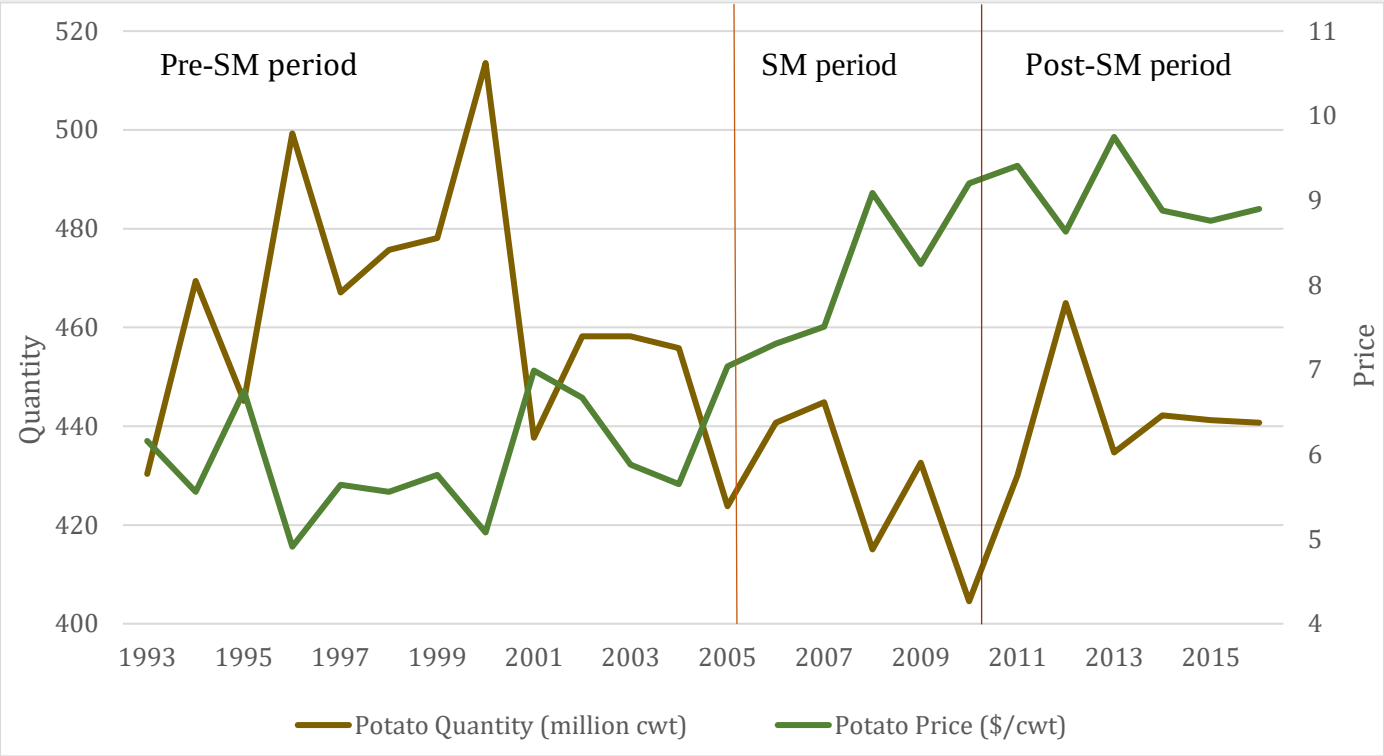

Figure 2. U.S. Yearly Potato Production and Yearly Average Potato Prices Before, During, and After the Potato Supply Management (SM) Program, 1993—2016.

Data source: USDA NASS (2021).
Note: Pre-SM period, SM period, and post-SM period are the pre-supply management program, supply management program, and post-supply management program periods, respectively.

3 Cooperatives of Potato Growers and Potato Supply Management Program

This section discusses cooperatives of potato growers, as well as the objectives, design, and implementation procedure of the potato supply management program.[3]

The economic forces that led to the development of a potato supply management program were a potato oversupply, increasing potato supply and price volatility, declining demand for fresh potatoes, and increasing competition from the Canadian potato industry due to international trade liberalization as a result of the North America Free Trade Agreement (NAFTA). These economic forces adversely affected the profitability of both individual potato growers and their industry.

3.1 Cooperatives of Potato Growers

The idea of the potato supply management program originated in Idaho. 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 the success of the program was the participation of other potato-producing regions. Cooperatives with similar objectives were organized in other leading potato-growing regions and in Canada. The United Potato Growers of America (UPGA), a national-level cooperative providing coordinating functions, was

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

formed in March 2005. At that time, UPGA represented approximately 70 percent of fresh Russet potato growers in the country.[4]

Although the potato supply management program originally targeted the fresh potato market, processing and seed potato growers also joined the cooperatives. The fresh potato market is strongly affected by the processing and seed potato markets: a surplus of potatoes originally grown for the processing market and eventually sold in the 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 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 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 to (1) mitigate a potato oversupply adversely affecting potato growers' profitability, (2) gain control of potato supply and price volatility, and (3) 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 program used a bid buy-down program.[5] Potato growers submitted bids reflecting the amount of money they would need to be 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. In the first years of program implementation, potato planting area was to be reduced by 15 percent, relative to 2004 acreage, which served as the base acreage. Base acres were acres on which potatoes had been planted since the 2003–2004 crop year, regardless of whether they were registered with the cooperatives. Each base acre was assessed at $50.

Potato growers in the cooperatives who reduced their potato planting area by 15 percent owed no 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, the grower paid $20 per base acre. If the acreage reduction was between 5 percent and 9.99 percent, the grower paid $30 per base acre. If the acreage reduction was between 0 percent and 4.99 percent, the grower paid $50 per base acre.

A potato grower (a cooperative member) who planned to expand potato acreage could pursue the following strategies. First, the grower could buy or rent base acres. In this case, the grower had to participate in the program (i.e., reduce potato planting by 15 percent or pay a pro-rated $50 per acre assessment). Second, the grower could plant base (year 2004) acres by paying $50 per acre. Third, the grower could buy or rent acres without base or accelerate a normal rotation of crops, resulting in the planting of acres without base.

[4] 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. In 2006, the share of Russet Burbank in the total area of fall potatoes planted was 46 percent nationally, followed by Russet Norkotah (13.1 percent) and Ranger Russet (9.5 percent) (Bolotova et al. 2008).

[5] The acreage bid buy-down program was based on a model of the Cooperatives Working Together (CWT) herd retirement program implemented in the U.S. dairy industry (Bolotova 2015).

Acres without base were acres on which no potatoes had been planted since the 2003–2004 crop season. Planting on acres without base was a "mindless expansion" because this strategy took advantage of improved market conditions facilitated by the cooperatives and their program. This type of conduct (expanding without base) was against the mission of the cooperatives because it led to potato overproduction and represented a threat to program success. Potato growers were penalized for planting on acres without base. These growers 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 potato planting seasons, growers filled out the Planting Intension Form. In this form, growers recorded the base acreage in 2004 for fresh, seed, and processing potatoes by potato variety. In addition, growers declared their current year planting intentions by potato variety. The Planting Intension Form was the grower's commitment against which actual performance was evaluated. The documents used to assess actual acreage were aerial photography and copies of USDA Farm Service Agency (FSA) Form 578.[6] The growers authorized FSA to release this information to the authorized representatives of the cooperatives.[7]

Accurate prediction of potato yield per acre was important for 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 the cooperatives' representatives at harvest. All volunteer growers were sent instructions on how to perform field digs, along with record-keeping forms.[8]

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 oversupply of fresh potatoes, leading to low fresh potato prices and high fresh potato price volatility. The potato flow control program was used to control fresh potato shipments throughout the marketing year. Warehouses participating in this program regularly entered information on capacity, stocks, and pack-outs on cooperatives' webpages. This information, along with other information (prices, demand and supply trends, weather), 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 cooperatives' webpages. 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. At the beginning of 2005, these programs removed approximately 8 percent of potato stock from the market. The potato surplus in 2004 was diverted to charities and food banks and as dehydrated potatoes for humanitarian services. One of the successfully implemented marketing

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

[7] The field audit proceeded as follows. The cooperatives' representative reviewed the grower's planting intentions submitted to the cooperative, filed maps, and FSA Form 578. Then, the representative inspected each parcel of land to verify actual plantings and reductions. Using special software, the representative compared actual acreage planted with information on FSA Form and submitted planting intentions. The results of the audit were reported to the Future Crop Committee and the board of the cooperatives.

[8] Potato growers who participated in the field digs 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-foot strip to check the quality and quantity of potato tubers. The tubers were segregated by sizes to determine the total weight for each size group. This information was recorded by the grower and was faxed to the cooperative's office.

strategies was obtaining 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 "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 "MC") is a graphical representation of the constant marginal cost function. The market scenarios depicted in Figure 3 differ due to total potato quantity produced, potato price, and industry profit.[9] The marginal cost is assumed to be the same in the four analyzed market scenarios.[10] Table 2 summarizes price, quantity, and profit information for these scenarios.

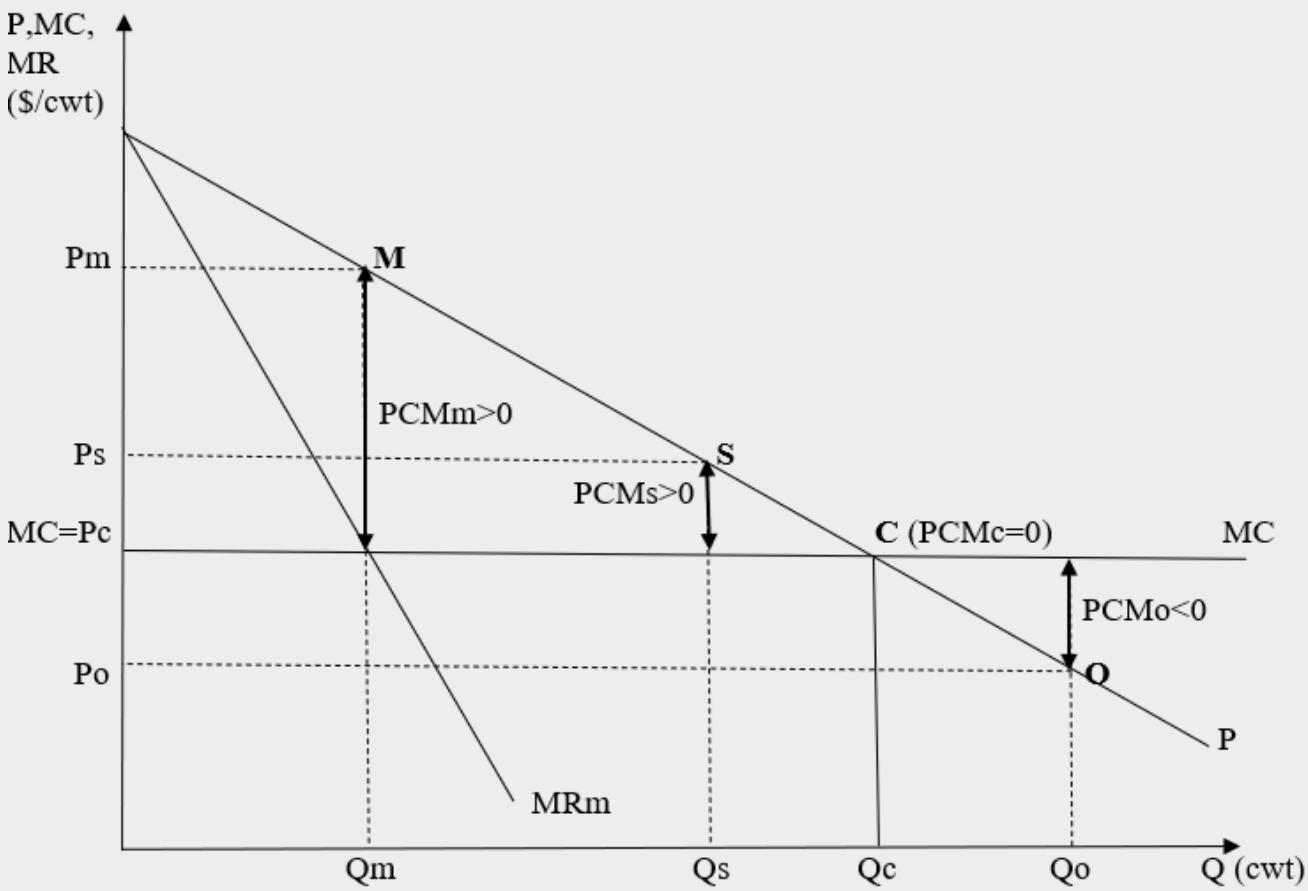

Figure 3. Alternative Market Scenarios for the U.S. Potato Industry.

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

[9] In this case study, "profit" refers to *economic* profit, which is different from *accounting* profit. Accounting profit is equal to revenue minus costs associated with generating that revenue. Economic profit is equal to revenue minus costs associated with generating that revenue and minus opportunity cost. Opportunity cost is the forgone benefit of using capital in an alternative business venue. A simple example is earning interest on the money deposited in a savings account in a bank.

[10] These market scenarios can be thought of as different years. Marginal cost can change from year to year, but for the purpose of identifying the effects of seller market power on industry profit, it is assumed to be the same in the analyzed scenarios.

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

Scenario	Price and quantity depicted in Figure 3[a]	Comparison of scenarios' prices and quantities	Profit
Perfect competition	Scenario C: Qc and Pc	Pc=MC	PCMc=Pc–MC=0 Zero profit for the industry and firms
Potato oversupply	Scenario O: Qo and Po	Qo>Qc Po<MC	PCMo=Po–MC< 0 PCMo<PCMc Loss for the industry and firms
Potato supply management (a small degree of seller market power)	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 oversupply* scenario, *a potato supply management* (a small degree of seller market power) scenario, and *a hypothetical monopoly* scenario, respectively.

The potato quantity (Q) used in the analysis is the total potato quantity produced by all growers in the potato production season ("potato production"). The potato price (P) is the yearly average potato price received by growers in the following marketing season. The total potato quantity produced affects potato prices received by growers: 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 (Qc) at the point at which the prices they receive are equal to the marginal costs of producing their outputs (Pc=MC). The economic profit is zero in perfectly competitive industries (PCMc=0). The first market scenario is a perfectly competitive industry scenario, which is used as a benchmark scenario to evaluate actual potato industry market situations before, during, and after the potato supply management program.[12]

The second market scenario is a potato oversupply scenario, which reflects a market situation prior to the potato supply management program. In this scenario, the potato industry produces a potato quantity (Qo) larger than that produced in a perfectly competitive industry scenario (Qc). As a result, potato prices received by growers are below marginal cost (Po<MC=Pc), and the price-cost margin (profit) is negative (PCMo<0). The industry and growers incur losses.

To correct the adverse potato oversupply 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 total quantity of potatoes produced. In the first years of

[11] A discussion of potato production and price cycle in light of a similar theoretical framework is presented in Bolotova (2019).
[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 P=MC is used to calculate quantity. This quantity and the inverse demand function are used to calculate price. Note that output price (P) is equal to marginal revenue (MRc) in perfectly competitive industries.

program implementation, the objective was to reduce potato acreage by 15 percent relative to potato acreage in 2004.

Effective implementation of the potato acreage management program was expected to increase seller market power in the potato industry. A decrease in the potato area planted and total potato quantity produced would increase potato prices and profit. The industry would move to a perfectly competitive industry scenario and possibly to a scenario in which potato growers (sellers) attained a small degree of market power.[13]

The third market scenario is a potato supply management scenario in which potato growers have a small degree of seller market power. This scenario reflects the market situation in the period of the potato supply management program. In the scenario, the potato industry produces a potato quantity (Qs) smaller than that produced in a perfectly competitive industry scenario (Qc). As a result, potato prices received by growers are above marginal cost (Ps>MC=Pc), and the price-cost margin (profit) is positive (PSMs>0). 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 the economic model of the profit-maximizing behavior of a monopoly operating in a market with linear demand and constant marginal cost, the profit-maximizing output quantity under monopoly (Qm) is 50 percent of the profit-maximizing output quantity under perfect competition (Qc). The potato industry never would have been able to reach monopoly market power because it was not cutting potato production by an amount close to 50 percent.

The market situation in the period following the potato supply management program theoretically could be described as a small degree of seller 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. Absent the potato acreage management program, potato growers have incentives to increase potato production in response to increased potato prices they received in the period of the potato supply management program.

Although potato growers are better off in market scenarios with decreased potato production and increased 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. Although potato buyers are better off in a market scenario with increased potato quantity and decreased potato prices (potato oversupply scenario), potato growers are worse off. Potato growers cannot sell their potatoes at profitable prices. Potato growers receive potato prices lower than potato production costs and incur losses.

A simple welfare analysis for the U.S. potato industry is presented in Figure 4. The two market scenarios depicted in this figure are a perfectly competitive industry scenario and a generic market power scenario. The latter encompasses any scenario in which a potato acreage management program decreases potato quantity and increases potato price relative to a perfectly competitive industry

[13] The total potato quantity produced each year is determined by potato area planted (and harvested) and potato yield per acre.

[14] In Figure 3, the profit-maximizing monopoly quantity (Qm) is at the intersection of the marginal revenue for monopoly curve (MRm) and the marginal cost curve (MC). In the case of a linear inverse demand curve, the marginal revenue for monopoly curve is twice as steep as the inverse demand curve; both curves have the same Y-axis intercept. Using a general version of a linear inverse demand function $P=a-bQ$, a marginal revenue function for monopoly is $MRm=a-2bQ$. Note that marginal revenue is the derivative of the total revenue (TR) with respect to quantity (Q): $MRm=dTR/dQ=d(PQ)/dQ=d((a-bQ)Q)/dQ=a-2bQ$. The profit-maximizing pricing rule $MRm=MC$ is used to calculate monopoly quantity. This quantity and the inverse demand function are used to calculate monopoly price.

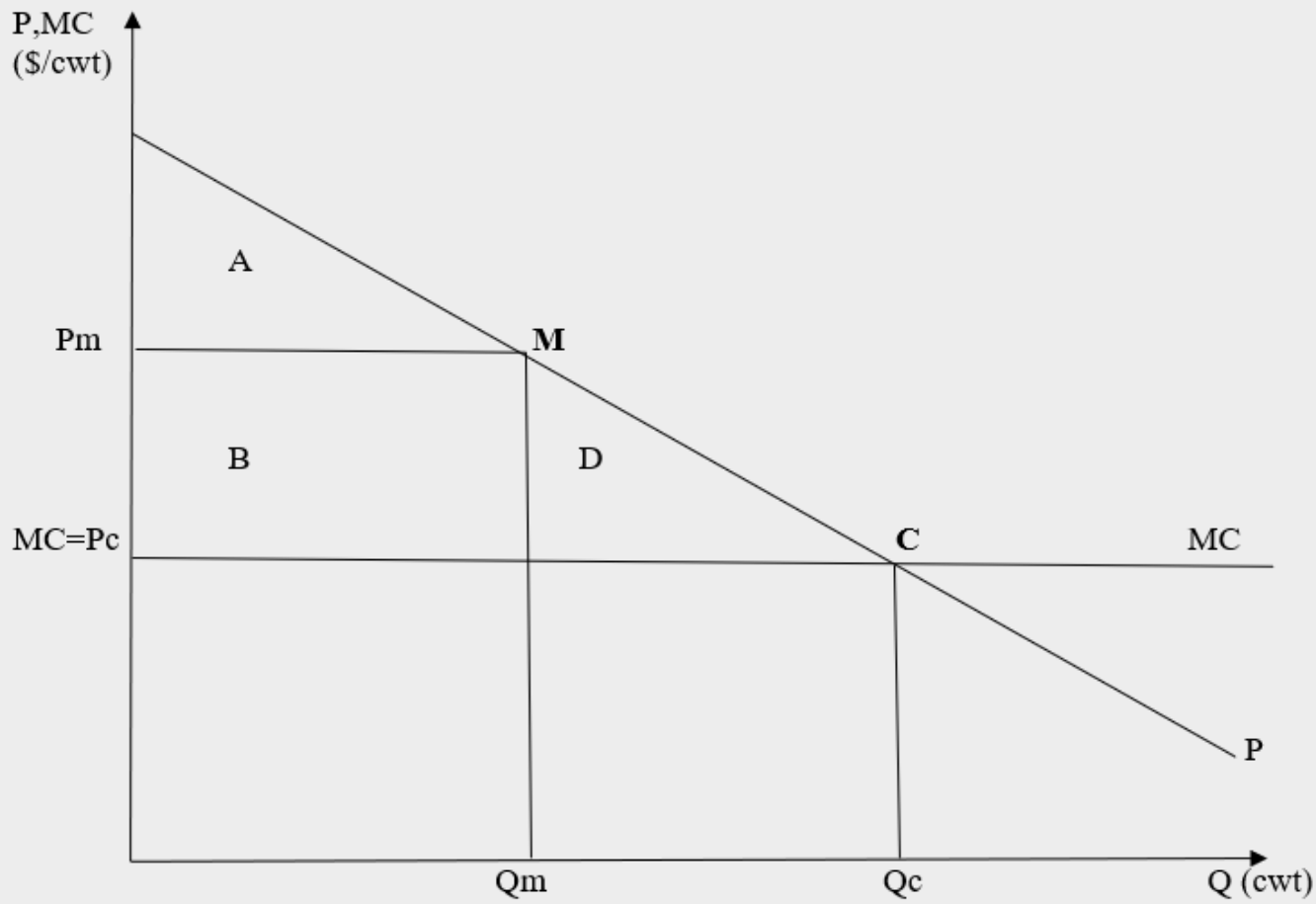

Figure 4. Welfare Analysis of the U.S. Potato Industry.

Note: Point C at Qc and Pc is *a perfectly competitive industry* scenario. Point M at Qm and Pm is *a generic market power* scenario.

scenario. Table 3 summarizes welfare elements for both scenarios and changes in these elements.[15]

The following changes in market welfare occur due to the potato supply (acreage) management program. Consumer surplus decreases from the triangle area (A+B+D) to the triangle area A, and producer surplus increases by the rectangle area B. Triangle area D is consumer deadweight loss due to the decrease in potato quantity and increase in potato price. Some consumers do not buy potatoes because of increased potato prices. Consumers who purchase potatoes pay higher potato prices. Rectangle area B is the producers' profit, also referred to as cartel overcharge. The overcharge is a welfare transfer from consumers to producers (potato growers) because of the producers' seller market power. The total $ overcharge (Pm-Pc)*Qm is the basis for damages that potato buyers aimed to recover during the potato antitrust litigation.[16]

[15] In standard microeconomics textbooks, the explanation of a market welfare analysis in seller market power cases relies on an upward sloping marginal cost (supply) curve. Using this cost assumption, producer surplus is positive under perfect competition, and producer deadweight loss occurs because of seller market power. In this case study, Figure 4 depicts a constant marginal cost curve for the welfare analysis to be consistent with the theoretical framework depicted in Figure 3 and with the analytical analysis included in the discussion questions. Given a constant marginal cost curve, producer surplus is equal to zero under perfect competition (the area below actual market price Pc and above marginal cost curve in Figure 4 is equal to zero because Pc=MC). There is no producer deadweight loss due to seller market power.

[16] Buyers purchasing potatoes directly from potato growers were entitled to recover treble damages under the Clayton Act (1914) (a federal law).

Table 3. Welfare Analysis for the U.S. Potato Industry

Welfare element	Perfectly competitive industry scenario	Generic market power scenario	Difference between the market power and perfectly competitive industry scenarios
Consumer surplus	A+B+D	A	- (B+D)
Producer surplus	0	B	B
Consumer deadweight loss	0	D	D
Producer deadweight loss	0	0	0
Total market deadweight loss	0	D	D
Welfare transfer from consumers to producers: overcharge (producer profit)	0	B	B

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 in the three periods of interest: the period prior to the potato supply management program (2000–2004), the period of the program (2005–2010), and the period following it (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 to provide evidence of program effectiveness. The analysis uses publicly available data from 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 potato production and price over the three periods of interest, the yearly averages and coefficients of variation are calculated for potato area harvested, potato yield per acre, potato production (quantity), and potato price.[17] Table 4 summarizes descriptive statistics and presents changes in the averages and coefficients of variation among the analyzed periods. Figure 2 depicts yearly potato production and price in the period 1993–2016.

5.1.1 Pre-Supply Management Period

In the pre-SM period, the yearly average potato area harvested is 1,250 thousand acres, potato yield is 372 cwt per acre, potato production is almost 465 million cwt, and potato price is $6.05 per cwt.[18] 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 with the SM and post-SM periods. This potato price-quantity relationship (large quantity and low price) in the pre-SM period, as compared with the SM and post-SM periods, reflects a potato oversupply problem. As indicated by the coefficients of variation, the volatility

[17] Coefficient of variation is chosen to measure the volatility of the analyzed variables in this case study. Although other measures of volatility are 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 percentage form.

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

Table 4. U.S. Potato Industry: Acres Harvested, Yield, Production, Price, 2000—2016

	Acres harvested (acres)	Yield (cwt per acre)	Production (cwt)	Price ($ 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] 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 6.1).

of potato acres harvested, potato production, and potato price is the highest in the pre-SM period, as compared with the SM and post-SM periods.

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

The following changes take place in the SM period, as compared with 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 the 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 U.S. potato industry production and price in the SM period, as compared with the pre-SM period, indicates that 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 a potato oversupply problem, which was one of the objectives of the potato supply management program. In addition, the volatility of potato production and price decreases. Control of potato supply and

price volatility was another objective of the potato supply management program. In summary, the empirical evidence is consistent with the program's effective implementation.

It should be emphasized that total annual potato production, which affects potato prices received by growers, is determined by both the potato area harvested and potato yield per acre. Although potato growers were able to affect potato area planted each year, they did not have complete control over potato yield per acre. Over time, increasing potato yield per acre (for example, due to improvements in potato varieties and agronomical practices) might have diminished the anticipated effects of potato acreage reduction on potato prices.

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

The following changes take place in the post-SM period, as compared with 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, 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 of changes in the level and volatility of U.S. potato industry production and price in the post-SM period, as compared with the SM period, indicates that industry conduct and performance might still reflect some of the effects of the potato supply management program. First, although the yearly average potato area harvested is slightly smaller in the post-SM period than in the SM period, area harvested is approximately 15 percent smaller in the post-SM period than in the pre-SM period. 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.

An analysis of changes in yearly potato production and price in the post-SM period provides additional details on industry dynamics in the absence of the potato acreage management program.[19] In 2010, the last year of the SM period, potato area planted and potato production were the smallest and yearly average potato price was one of the highest in the SM and post-SM periods. The potato area planted increased 6.9 percent, from 1,009 thousand acres in 2010 to 1,078.5 thousand acres in 2011, the first year of the post-SM period. Given a decrease in the potato yield per acre in 2011, potato production increased 6.3 percent, from 404.5 million cwt in 2010 to 430 million cwt in 2011, and the yearly average potato price increased 2.3 percent, from $9.20 per cwt in 2010 to $9.41 per cwt in 2011. In 2012, potato area planted further increased 5.6 percent to 1,138.5 thousand acres. Given an increase in the potato yield per acre, potato production increased 8.1 percent to 465 million cwt, and the yearly average potato price decreased 8.3 percent to $8.63 per cwt.

In response to high potato prices in 2010 and 2011—prices likely due to effective implementation of the potato acreage management program—potato growers increased potato area planted in 2011 and 2012, when the potato acreage management program was no longer in effect. This expansion led to increased potato production and a lower yearly average potato price in 2012. In response to this lower potato price, potato growers decreased potato area planted in 2013 by 7.7 percent to 1,051 thousand acres. Despite an increase in the potato yield per acre, potato production decreased by 6.5 percent to 434.7 million cwt, and the yearly average potato price increased by 13 percent to $9.75 per cwt. In the following years, 2014 and 2015, potato area planted remained virtually unchanged, but in 2016 it decreased to 1,008 thousand acres, the smallest potato area planted in both the SM and post-SM periods. Given a constantly increasing potato yield per acre, potato production reached 441 million cwt in 2016, and the yearly average potato price was $8.90 per cwt.

[19] The teaching note includes an Excel file with all data used in the analysis presented in this case study.

The patterns of changes in potato production and price in the post-SM period indicate that potato growers' experience with the potato acreage management program might have helped them stabilize the industry. Initially they expanded potato area planted in response to high potato prices. The consequence was lower potato prices in 2012. In the following years, the growers decreased and then maintained potato area planted to keep potato prices at a reasonable level.

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

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. The monthly averages and coefficients of variation are calculated for fresh, processing, and all potato prices for the three periods of interest. The all potato price combines the fresh and processing potato prices. Table 5 summarizes descriptive statistics and presents changes in the averages and coefficients of variation among the analyzed periods. Figure 5 depicts monthly prices for fresh, processing, and all potatoes.

Table 5. U.S. Potato Industry: Fresh, Processing, and All Potato Prices ($ per cwt), 2000—2016

	Fresh potato price	Processing potato price	All potato price
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] 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 6.2).

In the pre-SM period, the monthly average prices are $____ per cwt for fresh potatoes, $____ per cwt for processing potatoes, and $____ per cwt for all potatoes.[20] As indicated by the coefficients of variation, the volatility of fresh potato price is approximately ____ times the volatility of processing potato price.

[20] In the three paragraphs describing monthly average prices and changes in these prices and their volatility, students should fill in missing answers by using data presented in Table 5.

In the SM period, as compared with the pre-SM period, the monthly average fresh potato price, processing potato price, and all potato price increase by approximately ____ percent, ____ percent, and ____ percent, respectively. The volatility of fresh and all potato prices decreases by ____ percent and ____ percent, respectively. The volatility of processing potato price increases by almost ____ percent.

In the post-SM period, as compared with the SM period, the monthly average fresh potato price decreases by ____ percent, and the monthly average processing and all potato prices increase by ____ percent and ____ percent, respectively. The volatility of fresh, processing, and all potato prices decreases by almost ____ percent, ____ percent, and ____ percent, respectively.

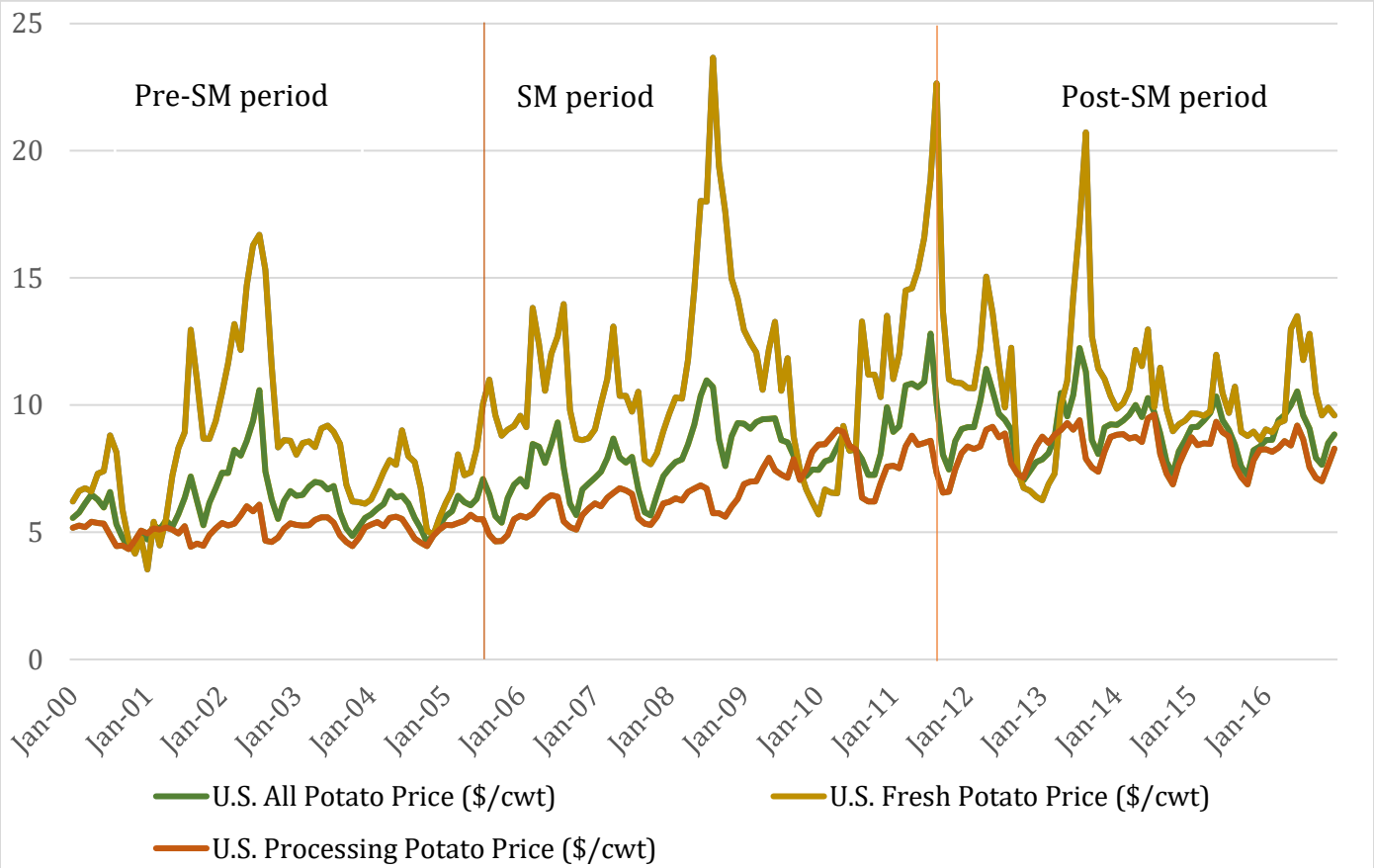

Figure 5. U.S. Monthly Fresh, Processing, and All Potato Prices: Before, During, and After the Potato Supply Management (SM) Program, 2000—2016.

Data source: USDA NASS (2021).
Note: Pre-SM period, SM period, and post-SM period are the pre-supply management program, supply management program, and post-supply management program periods, respectively.

The empirical evidence indicates some differences in the price behavior of fresh and processing potatoes over the three analyzed periods, but both fresh and processing potato prices increase in the SM period, as compared with the pre-SM period. This behavior is consistent with that of yearly potato prices described 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 with the pre-SM period, reflect the effective implementation of the potato supply management program.

The monthly average fresh potato price decrease in the post-SM period 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 increase in the post-SM period 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 and processing potato segments of the industry have distinct marketing and pricing institutions (spot market and pre-production season contracts, respectively) that 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 Capper-Volstead Act immunity. The Capper-Volstead Act (1922) provides limited antitrust immunity from Section 1 of the Sherman Act for collective agricultural marketing activities of agricultural producers implemented through their organizations.[19]

Section 1 of the Sherman Act (1890) makes illegal agreements among competitors (firms producing and selling the same or similar products) that aim to affect product quantities, prices, or both in interstate commerce.[22] These agreements are often referred to as cartels, price-fixing cartels, or price-fixing conspiracies. Agricultural producers are competitors, and collective agricultural marketing activities (programs) that affect agricultural product prices, quantities, or both are agreements among competitors. In the absence of the Capper-Volstead Act, collective agricultural marketing activities would have violated Section 1 of the Sherman Act.

Beginning in 2010, a group of buyers of fresh potatoes and processed potato products that purchased these products directly from potato growers (wholesalers and retailers) and indirectly (final consumers) filed class action antitrust lawsuits against the cooperatives of potato growers and individual potato growers.[23] These buyers (plaintiffs) alleged that the potato supply management program, 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 price-fixing cartel, setting potato prices above a 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, the cooperatives agreed that they would make no attempt to manage potato acreage prior to the potato planting season for seven years (O'Connell 2018).

The main legal issue raised in the potato antitrust litigation is whether the potato acreage management (control) program was within the scope of Capper-Volstead Act immunity. Apparently, no well-developed case law interpreted the legal status of agricultural supply management programs and, in particular, programs implemented at the agricultural production stage in light of the Capper-Volstead Act.

In December 2011, a U.S. district court for the first time in the 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. After conducting a comprehensive

[21] The organizations of agricultural producers must conform to the Capper-Volstead Act standard established in Section 1 of the act.
[22] Section 1 of the Sherman Act refers to these agreements as contracts, combinations, or conspiracies in restraint of trade.
[23] The Clayton Act (1914) allows private parties (individuals and firms) to recover treble damages and reasonable attorney fees for violations of the Sherman Act.

analysis, the court concluded, in its advisory opinion, that "acreage reductions, production restrictions, and collusive crop planning are not activities protected by the Capper-Volstead Act."[24]

One of the main arguments of the defendants (cooperatives) was that if the Capper-Volstead Act cooperatives were allowed to fix prices, they should be allowed to restrict production.[25] This argument did not persuade the court, which responded 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."[26]

Recent legal decisions and related legal discussions establish that the types of agricultural supply management programs—whether implemented at the pre-agricultural production stage, agricultural production stage, or post-agricultural production stage—affect their legal status in light of the Capper-Volstead Act (Frackman and O'Rourke 2011; Hibner 2011; Bolotova 2014 and 2015; Peck 2015). It is crucial whether the collective agricultural marketing activities (programs) in question can be interpreted as "marketing" under Section 1 of the Capper-Volstead Act.

Collective agricultural supply management activities implemented at the post-agricultural production stage are more likely to be interpreted as marketing and therefore are likely to be within the scope of Capper-Volstead Act immunity. An example is the potato flow control program, through which a cooperative withholds already-produced product from the market in the anticipation of higher prices. Collective agricultural supply management activities implemented at the pre-agricultural production and agricultural production stages are not likely to be interpreted as marketing and therefore are outside the scope of 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 for responding to selected discussion questions and suggested answers to all discussion questions. In addition, the note includes multiple choice questions, which can be used as in-class assignments, quizzes, and exam 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 the design of the potato acreage management program and the procedure of its implementation. Discuss a set of potato marketing programs.

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

[24] In Re: Fresh and Process Potatoes Antitrust Litigation No. 4:10-MD-2186-BLW (D.Id.). 2011. https://scholar.google.com/scholar_case?case=3083777526870283711&q=Re:+Fresh+and+Process+Potatoes+Antitrust+Litigation+&hl=en&as_sdt=3,33.

[25] Case law has established that price-fixing activities of agricultural cooperatives are generally within the scope of Capper-Volstead Act immunity 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; 2002) provides a detailed analysis of the act.

[26] In Re: Fresh and Process Potatoes Antitrust Litigation No. 4:10-MD-2186-BLW (D.Id.). 2011.

4. Perform an analytical analysis of the potato price-quantity relationships and industry profitability for the 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 the marginal cost of producing potatoes is $9.00 per cwt. Marginal cost is the same in these four scenarios.[27] Assume that the U.S. potato industry produces the following total potato quantity under the four alternative market scenarios: 460 million cwt, 440.3846 million cwt, 420 million cwt, and 220.2 million cwt.

4.1. Using the assumptions on potato inverse demand, marginal cost, and quantities, calculate the following economic measures to complete a 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 $, and price-cost margin (profit) measured in $ per cwt and as a percentage of the potato price (Lerner Index of market power). Classify each scenario as potato oversupply, perfectly competitive industry, potato supply management, or hypothetical monopoly.

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

5. Perform a welfare analysis for the U.S. potato industry.

5.1. Show on a graph relevant curves and potato price-quantity combinations for a perfectly competitive industry scenario and a generic market power scenario reflecting the potato supply management program. On the same graph, show market welfare elements for both scenarios. Explain the market welfare elements and discuss changes in these elements caused by implementation of a potato supply management program.

5.2. On the graph you developed in Question 5.1, show potato price-quantity combinations for a perfectly competitive industry scenario (Qc=440.4 million cwt and Pc=$9.00 per cwt) and a generic market power scenario reflecting the potato supply management program (Qm=420 million cwt and Pm=$9.53 per cwt). The Y-axis intercept is 20.45. Perform a welfare analysis for the U.S. potato industry by calculating market welfare elements and their changes from one to the other scenario. In the case of each scenario, calculate consumer surplus, producer surplus, consumer deadweight loss, producer deadweight loss, total market deadweight loss, and producer profit (cartel overcharge). Discuss the results of your analysis from the perspectives of potato growers (producers) and potato buyers (consumers).

6. Perform a basic market and price analysis of the U.S. potato industry.

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

[27] 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).

6.1.1. 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 4.

6.1.2. 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 4.

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

6.2. Evaluate changes in monthly fresh, processing, and all potato prices as well as in their volatility in the three periods of interest.

6.2.1. 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 5.

6.2.2. 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 5.

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

7. Explain why potato buyers filed antitrust lawsuits against the 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.

Appendix

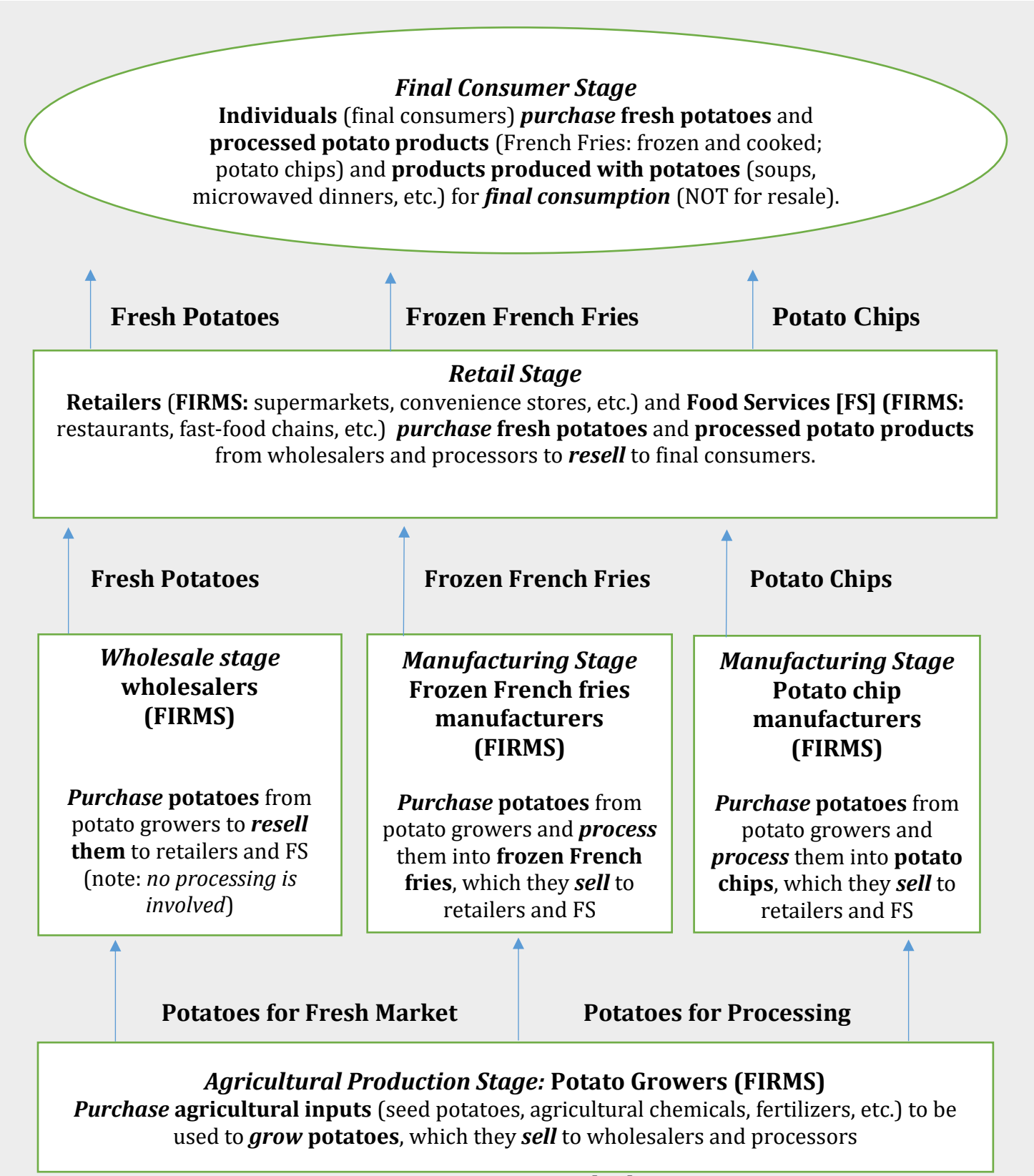

Figure A1. Potato supply chain.

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