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Idaho–Eastern Oregon Onion Industry Analysis

Yuliya Bolotova and Brian Jemmett

The Idaho–Eastern Oregon onion industry operates in a market environment characterized by a high level of onion price and supply volatility. Years of relatively high onion prices are often followed by years of very low prices which do not allow onion growers to recover their onion production costs. This feature of the industry adversely affects the profitability of onion growers and the economic performance of their industry. This study conducts an analysis of alternative market scenarios for the Idaho–Eastern Oregon onion industry in the light of possible implementation of the onion supply management strategy. The results presented in this paper can be used to make a decision on the onion area planted and to predict how changes in the onion supply level would affect the level of onion price in the analyzed industry.

The Idaho–Eastern Oregon onion industry operates in a market environment characterized by a high level of onion supply and price volatility. Years of high onion prices are often followed by years of very low prices that do not allow onion growers to recover their onion production costs. This type of market environment adversely affects the profitability of onion producers and the economic performance and competitiveness of their industry. It is challenging for onion growers to make effective production and marketing decisions under these circumstances.

The supply and price volatility represents challenges for agricultural producers operating in various agricultural industries. Different mechanisms have been used to address this problem in order to reduce the price and income risks for agricultural producers. The government price-support programs and federal marketing orders are two examples. The government price-support programs traditionally have been used in grain industries and federal marketing orders have been used in fruit and vegetable markets.

The third example is organizations of agricultural producers—cooperatives in many cases—which are

formed by agricultural producers to coordinate their production and marketing activities (i.e., different strategies of supply management). The programs implemented by these organizations affect the industry conduct and performance. The market environment influenced by uncoordinated individual production and marketing decisions that may lead to over-supply and prices below the production cost can change to a more organized market environment that benefits the industry participants.

A recent example of this type of strategy is the Idaho potato industry's supply management program implemented by the United Potato Growers of Idaho. This cooperative was organized to change the adverse market situation characterized by a consistent over-supply of fresh potatoes, fresh potato prices below the potato production cost, and a high level of fresh potato price volatility (Bolotova 2008, Bolotova et al. 2008). A key component of potato supply management is the acreage-reduction program. According to the cooperative's rules, Idaho potato growers targeted a 15 percent reduction in fresh potato acreage each year starting in 2005, when the program was enforced for the first time. The effective implementation of the potato supply management program led to higher and less volatile fresh potato prices received by Idaho potato growers (Bolotova et al. 2008).

The onion industry market environment is similar to the potato industry market environment. Like potato growers, onion growers have to deal with a high level of supply and price volatility. Both industries have federal marketing orders and have never been subject to any government price-support program. In the current market environment, the Idaho–Eastern Oregon onion industry might

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consider developing and implementing a supply management strategy similar to the one used by the Idaho potato industry.

An economic analysis of the current industry situation and of the alternative market scenarios would provide invaluable information for the Idaho–Eastern Oregon onion industry decision-making process and can be helpful in developing effective production and marketing strategies. This paper performs this type of analysis for the Idaho–Eastern Oregon onion industry by examining how onion prices respond to changes in the onion supply level and by determining a set of market scenarios that the industry should follow to achieve a level of onion price that would allow onion growers to recover their onion production costs. Use of this type of information by the industry participants in their decision-making may help improve the economic performance of their industry and to increase the profitability of onion growers.

The paper is organized as follows. First, the theoretical background of the analyzed problem is presented. The economic concept used in this study is that the industry faces inverse demand, and market price is a function of the output quantity supplied to the market. The data on onion prices and quantities collected from the USDA National Agricultural Statistics Service are discussed in the following section; these data are used to analyze the current market situation and to estimate onion inverse demand. The next section presents a discussion of alternative market scenarios for the Idaho–Eastern Oregon onion industry, and is followed by the conclusion.

Theoretical Background

The following economic concept is used as a theoretical background for the empirical analysis presented in this paper. The onion industry is characterized by inverse demand. The onion price is a function of the quantity of onions supplied to the market each year. Therefore the quantity level determines the price level each year. Following a supply management strategy, the onion industry would control the onion supply each year to achieve a certain level of onion price that would allow onion growers to recover their onion production costs. By coordinating onion supply, onion growers can gain control over onion price volatility. This section pres-

ents an overview of previous studies that developed this concept and used it in empirical analyses.

In his revision of demand theory, Hicks (1965, p. 83–84) emphasizes two approaches to analyze the demand curve depending on whether an individual or a market demand is analyzed. First, when an individual consumer's behavior is considered, the demand curve shows the demand of this consumer (i.e., the quantity he would buy) at different price levels. Hicks refers to this approach to demand analysis as a "price into quantity" approach. Second, when the market demand consisting of individual consumers' demands is considered, the demand curve shows the price level at which a given total quantity of the product supplied to the market is sold. Hicks refers to this approach as a "quantity into price" approach, and in the modern demand literature this specification of demand is known as inverse demand. Furthermore, Hicks (1965) points out that the assumption of perfect competition is difficult to maintain under the "quantity into price" approach. When supply is pre-determined, each consumer is allotted a fixed quantity and decides on the price that he would pay for this quantity.

Agricultural markets are a good example of markets that should be analyzed using a "quantity into price" approach and where "perfect competition" assumption is difficult to maintain. In addition to the explanation provided by Hicks, several features of agricultural markets suggest that the quantity of an agricultural product supplied to the market determines its price level. There are many factors that impact the level of supply and therefore the level of price each year. Some of these are forces of nature that are not possible to control—for example, weather conditions and disease outbreaks. Some of the factors are market forces that are always beyond the control of a particular group of agricultural producers—for example, the level and volatility of agricultural input prices, import competition, changes in consumption patterns, and changes in international trade rules. Third, the individual growers' decisions are also important determinants of the level of supply in each given year; these are the decisions that can be controlled by growers representing a single industry.

The level and volatility of agricultural commodity prices historically have an adverse effect on the profitability of agricultural producers and coupled with the level and volatility of agricultural input

prices represent a serious challenge for many agricultural industries in the current complex market environment. There are examples showing how agricultural producers attempted to organize their industries to gain control over the output price level and volatility. By coordinating their production and marketing strategies, agricultural producers representing the same industry may attempt to act as a single monopolist who operates in the market with inverse demand and has market power over the price level. Given that the market price is a function of quantity of the product supplied to the market, by controlling the supply level agricultural producers can influence the level of market price. While this type of conduct in general is considered to be illegal according to antitrust laws, the Capper-Volstead Act establishes antitrust exemptions for agricultural producers. We discuss two examples of cooperative conduct in agricultural markets.

The first example is the U.S. cotton industry in the early decades of the last century. Moore (1919) used the “price as a function of quantity” approach to analyze the conduct and performance of the U.S. cotton industry in the light of possible implementation of a cotton supply management program. The cotton growers were considering a strategy of reducing the cotton supply level through cotton acreage control in order to increase cotton price level and to decrease cotton price volatility. The author examined changes in cotton price with respect to changes in cotton supply level. He determined that in order for the industry to maximize its profit, cotton output should be reduced by 35 percent.

The second example is the Idaho and the U.S. potato industry. The United Potato Growers of Idaho was organized to gain control over the fresh potato price level and volatility. The key program of this cooperative is a potato supply management program¹; it was implemented nationally in major potato growing regions through the United Potato Growers of America. Although the original focus of the program was on the fresh potato market, now fresh, processing, chip, and seed potatoes are affected by this program. A targeted reduction in the potato supply is expected to increase the potato price level and to decrease potato price volatility.

The acreage-reduction program targeting the

¹ Bolotova (2008) and Bolotova et al. (2008) discuss the potato supply management program implemented by the United Potato Growers of Idaho in greater detail.

potato area planted is used to control the level of fresh potato supply. Starting in 2005, the first year the program was implemented, fresh potato growers aimed at a 15 percent reduction in fresh potato acreage relative to the 2004 base. Using the estimated potato inverse demand, Bolotova (2008) evaluated the effectiveness of the implementation of this program by the Idaho potato industry. The author found that the supply of all potatoes² in Idaho was reduced by 10 percent which resulted in an increase in the potato price by 12.3 percent. Furthermore, it was determined that to maximize the industry profit, potato output should be reduced by 50 percent.

The inverse demand approach was used to analyze a variety of problems in the area of demand analysis in other research settings. For example, Houck (1964) used an inverse demand specification to study the U.S. demand for bananas. He assumed that the price of bananas was a dependent variable and other variables affected it but were not affected by it during the same year. More recent studies employed much more complex specifications of inverse demand and took a simple price-quantity relationship used in the earlier studies to the next level by developing inverse demand systems. For example, Huang (1988) used this approach to analyze a U.S. demand system consisting of thirteen foods and one non-food category. Eales, Durham, and Wessells (1997) studied Japanese demand for fish using both an inverse demand approach and ordinary demand approach. The models were estimated using a data set including 23 fish products aggregated in six categories.

Many studies conducting demand analyses use elasticities to determine percentage changes in quantities given percentage changes in prices. In the inverse demand framework, flexibilities measuring percentage changes in prices given percentage changes in quantities are appropriate measures. Houck (1965, 1966) emphasized the importance of using flexibilities in the analysis of agricultural markets, especially in the situations where the whole market is analyzed. Flexibilities are consistent with the inverse demand specification where price changes follow changes in quantity.

The most general form of the inverse demand model discussed in this section is represented by

² “All” potatoes includes fresh, processing, and seed potatoes.

$$(1) P = a + bQ, a > 0 \text{ and } b < 0.$$

A corresponding demand flexibility is

$$(2) f_{P,Q} = \frac{dP}{dQ} \times \frac{Q}{P}.$$

This demand model is used to develop an econometric model estimated in this study.

A decision on whether to use a more complex or a less complex version of the inverse demand in the analysis depends on whether intermediate or final demand is analyzed and the objective of the study. More complex demand systems are traditionally used to analyze final consumer demands, situations where more than one product along with income are included in the model consisting of a system of equations (Eales, Durha, and Wessells 1997; Huang 1988).

This study analyzes the conduct and performance of the Idaho–Eastern Oregon onion industry by estimating intermediate inverse demand specified using Equation 1. For the purpose of developing an onion supply management program, the key variable which influences onion price level and which is under control of onion producers is the level of onion supply.³ A similar specification of demand function was used in Moore (1919) and Bolotova (2008), who analyzed similar problems in the U.S. cotton industry and the Idaho potato industry, respectively.

Data

We used yearly data on the summer storage onion industry reported by the USDA National Agricultural Statistics Service. We collected data for Idaho and Eastern Oregon (Malheur County).⁴ The key

³ A more complex version of this model would include quantities of alternative crops grown in rotations with onions (sugar beets, alfalfa seeds, dry beans, grain, and corn). The crops included in rotations with onions vary across different geographic locations within the analyzed region. At the industry level the effect of each of several alternative crops on the onion price level is not likely to be significant. Alternative specifications of the econometric model were estimated using some of the alternative crops. They were not found to have a statistically significant effect on the onion price level.

⁴ There is no aggregate price reported for the Idaho–Eastern Oregon region.

variables used in our analysis are the yearly production of summer storage onions (in cwt⁵) and the yearly onion price (in \$/cwt).⁶ The data source reports the total level of production and the shrinkage (loss). In our analysis we use the level of production corrected for shrinkage (loss).⁷ We subtracted the shrinkage from the total production. The onion production corrected for shrinkage is used to calculate the value of production in the original data source, and this is the onion supply level that determines the level of onion price. The reported yearly prices are prices received by growers for onions sold in fresh and processing markets. The onion price and production data for Idaho are shown in Figure 1 and the onion price and production data for Eastern Oregon are shown in Figure 2.

The onion prices and production levels were collected for the period 1998–2006. The decision on the data period to be used in the analysis was influenced by the objective of the study. To provide information to be used in developing a supply management program, the onion industry conduct during the recent years is most relevant. Although the data are available for a few decades, the industry's most conduct and performance should be taken into account when the supply management program rules are developed.⁸ To collect information on onion production

⁵ “Cwt” stands for a hundredweight, or 100 pounds.

⁶ To accomplish our objective, we are restricted to analyzing yearly data. The key variable for evaluating alternative market scenarios in the light of implementation of the supply management is the level of supply. It is determined once a year and is affected by the planting decisions of onion growers.

⁷ In Idaho the shrinkage fell in the range of 12–22 percent of the total production during the analyzed period, with an average of 17 percent. In Eastern Oregon the shrinkage was in the range of ten to 24 percent of the total production, with an average of 18 percent.

⁸ For example, the industry's structure, conduct, and performance 40 years ago are not the same as those five years ago. For the purpose of developing the supply management program rules, the most recent industry characteristics (i.e., the level and volatility of supply and prices) are relevant. Therefore we decided to focus our analysis on the last several years. Our decision to use 1998 as the first observation in our data sets was influenced by the fact that in 1998 the approach used to report onion prices was changed. Before 1998, yearly onion prices were calculated based on the shipping-point prices associated with fresh onion market. Starting in 1998, the reported yearly onion prices are prices received by growers for onions sold in both fresh and processing markets. The data-reporting approach

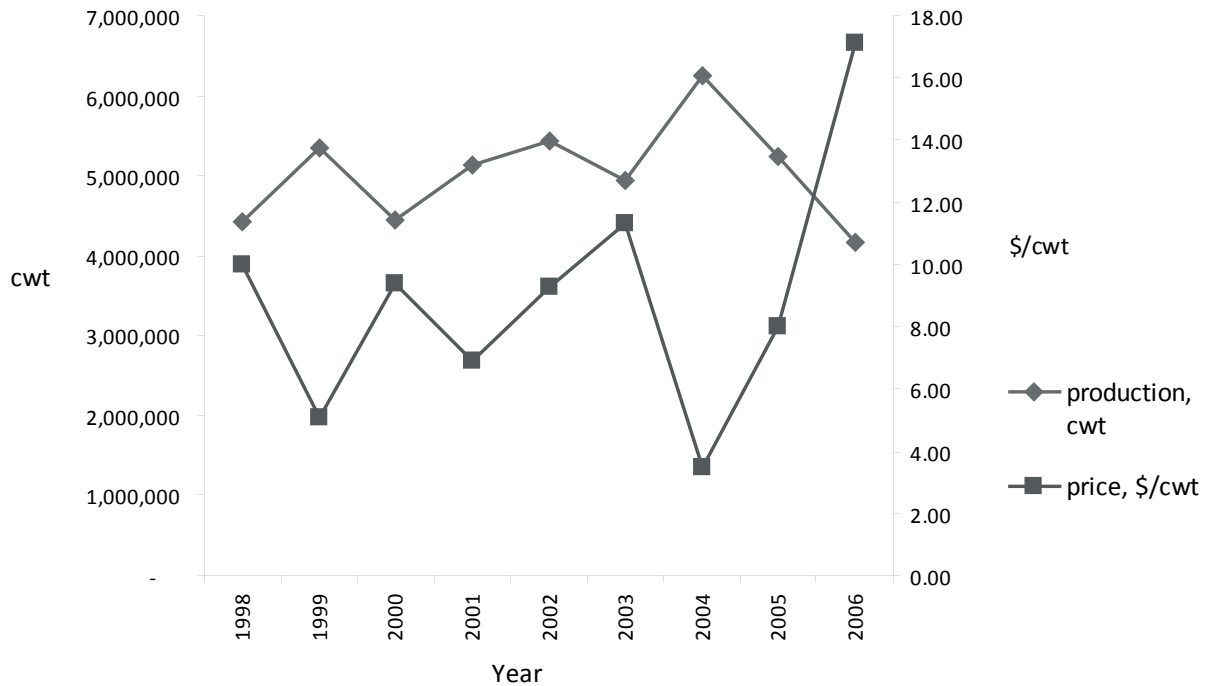


Figure 1. Idaho Onion Production and Prices, 1998–2006.

Data source: USDA National Agricultural Statistics Service (n.d.).

costs, we used data reported in the onion production budgets presented in the University of Idaho crop costs and returns estimate reports (Edmiston, Bolz, and Smathers 1997, Smathers 1999, Smathers, Geary, and Rimbey 2001; Smathes, Thornton, and Rimbey 2003, 2005; Thornton et al. 2007).

Overview of the Idaho–Eastern Oregon Onion Industry

The Idaho–Eastern Oregon onion industry is one of the largest producers of summer storage onions in the country, with approximately 23 percent market share in the national value of production as of 2006. In terms of the area planted, the Idaho–Eastern Oregon onion industry is the second largest, following California (Table 1). In Idaho, onions are grown in the southwestern part of the state. Although onions are grown in different parts of Oregon, is mentioned in Idaho Department of Agriculture Statistical Bulletin (2008).

Eastern Oregon (Malheur County) is traditionally considered to be a separate onion production area in this state. The handling of onions grown in certain designated counties in Idaho and Malheur County, Oregon, is covered by Federal Marketing Order No. 958.⁹ Locally, this Order is administered by the Idaho–Eastern Oregon Onion Committee, the main functions of which are to provide best quality

⁹ Although marketing orders are federal regulations, they target a particular geographic area. Locally, marketing orders are administered by the appointed committees/organizations. Marketing orders affect handlers of agricultural commodities (i.e., the distribution segment of the food supply chain) and are typically used to establish minimum quality requirements by authorizing and enforcing grade, size, and pack regulations and to regulate the flow of a product to the market. Marketing orders are not used to control the supply (i.e., production) level at the production stage of the food supply chain. In some situations, marketing orders can have some indirect effect on the supply level. For example, authorization of a more stringent quality requirement or limiting the amount of product shipped outside the area may have some effect on the industry supply level and therefore on the level of market price received by growers.

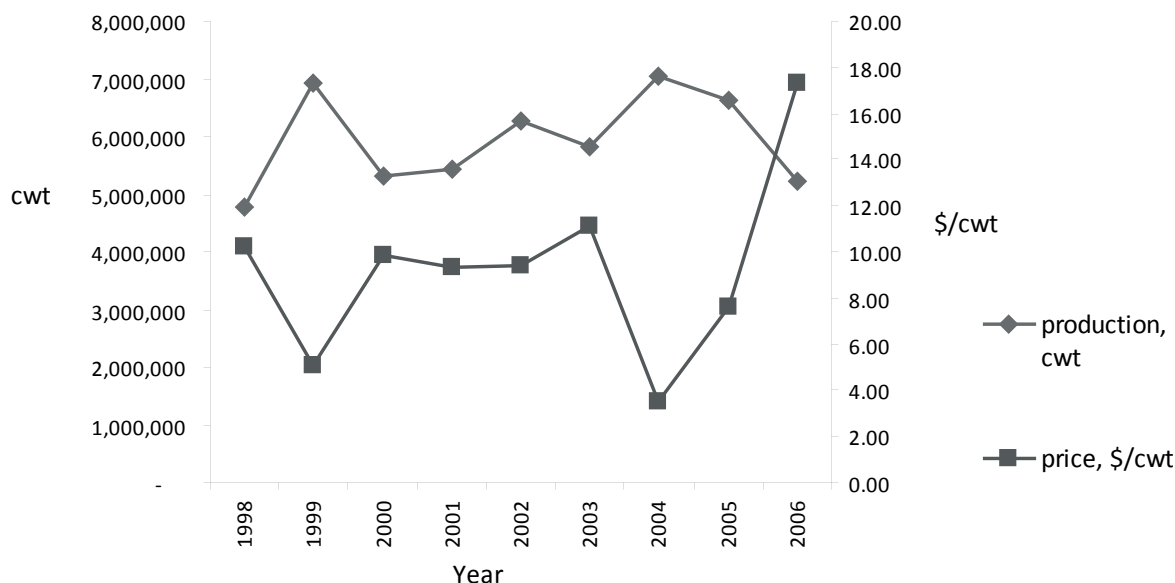


Figure 2. Eastern Oregon (Malheur County) Onion Production and Prices, 1998–2006.

Data source: USDA National Agricultural Statistics Service (n.d.).

onions and to increase onion consumption through the implementation of promotion, education, and advertising programs.

Table 1 presents the structure of the national summer storage onion industry in 2004 and 2006. The 2004 market situation is a typical example of a high-supply and a low-price year, and the 2006 market situation is a typical example of a low-supply and a high-price year. The data pattern characterizing the 2004 and 2006 market situations supports economic theory. When supply is high (low), then price is low (high). In 2006 the Idaho–Eastern Oregon region supplied to the market fewer onions than in 2004. Consequently, the onion price in 2006 was higher than in 2004, which resulted in a higher level of value of production in 2006 relative to 2004. By supplying 13,286 thousand cwt of onions in 2004, the Idaho–Eastern Oregon region generated \$46,501,000 in value of production. By supplying 9,400 thousand cwt in 2006, the region generated \$161,787,000.

Therefore, by supplying approximately 30 percent less onions in 2006 than in 2004 the region generated 3.5 times more value of production in 2006 relative to 2004. This led to an increase of the Idaho–Eastern Oregon region’s market share in the national value of onion production from 15.7 percent in 2004 to 23.4 percent in 2006. In 2004 the onion price in both Idaho and Eastern Oregon was \$3.5/cwt, which was below the national-level price of \$5.93/cwt. In contrast, in 2006 the onion price in both Idaho and Eastern Oregon was approximately \$17/cwt, which was higher than the national-level price, \$15.20/cwt.

The onion production costs for the Idaho–Eastern Oregon region for the period 1997–2007 are summarized in Table 2.¹⁰ These onion production

¹⁰ Differences in the farm size, crop rotation, age and type of equipment, and the quality and intensity of management across farms impact the level of onion production costs. The costs presented in Table 2 are for a 1,000-acre farm which grows 125 acres of onions in addition to growing potatoes or sugar beets, alfalfa seeds or dry beans, grain, and corn.

Table 1. National Summer Storage Onion Industry Structure, 2004 and 2006.

State	2004				2006			
	Planted all purposes acres	Production* (% in the U.S. total production) 1,000 cwt	Price \$/cwt	Value of production (% in the U.S. total value of production) 1,000 cwt	Planted all purposes acres	Production* (% in the U.S. total production) 1,000 cwt	Price \$/cwt	Value of production (% in the U.S. total value of production) 1,000 cwt
United States	115,600	50,015 (100.0)	5.93	296,540 (100.0)	114,080	45,624 (100.0)	15.2	692,940 (100.0)
California	30,900	12,950 (25.9)	6.26	81,120 (27.4)	33,100	13,265 (29.1)	9.14	121,221 (17.5)
Colorado	12,500	4,100 (8.2)	12.2	50,020 (16.9)	10,000	3,420 (7.5)	18.4	62,928 (9.1)
Idaho	11,000	6,248 (12.5)	3.5	21,868 (7.4)	9,700	4,166 (9.1)	17.1	71,239 (10.3)
Michigan	3,500	789 (1.6)	10.8	8,521 (2.9)	2,700	520 (1.1)	14.6	7,592 (1.1)
New York	13,500	4,470 (8.9)	12.1	54,087 (18.2)	14,100	2,830 (6.2)	19.4	54,902 (7.9)
Oregon	19,900	10,626 (21.2)		42,932 (14.5)	20,100	9,254 (20.3)		133,160 (19.2)
Malheur county	12,500	7,038 (14.1)	3.5	24,633 (8.3)	11,700	5,234 (11.5)	17.3	90,548 (13.1)
Other counties	7,400	3,588 (7.2)	5.1	18,299 (6.2)	8,400	4,020 (8.8)	10.6	42,612 (6.2)
Utah	1,600	620 (1.2)	6.6	4,092 (1.4)				
Washington	20,000	9,510 (19.0)	2.9	27,579 (9.3)	20,000	10,800 (23.7)	21	226,800 (32.7)
Wisconsin	2,000	543 (1.1)	7.85	4,263 (1.4)	2,100	618 (1.4)	10.9	6,736 (1.0)
Other States	700	159 (0.3)	12.9	2,058 (0.7)	2,280	751 (1.6)	11.1	8,362 (1.2)
Idaho–Eastern Oregon region**	23,500	13,286 (26.6)		46,501 (15.7)	21,400	9,400 (20.6)		161,787 (23.4)

* Production is calculated as the total production minus shrinkage.

** The Idaho–Eastern Oregon onion growing region includes Idaho and Malheur County, Oregon.

Data source: USDA National Agricultural Statistics Service (n.d.).

Table 2. Idaho–Eastern Oregon Onion Industry: Onion Production Costs.

Year	Yield cwt/acre	Cost per acre			Cost per cwt		
		Operating costs \$/acre	Ownership costs \$/acre	Total costs \$/acre	Operating costs \$/cwt	Ownership costs \$/cwt	Total costs \$/cwt
1997	510	1,524.90	589.63	2,114.54	2.99	1.16	4.15
1999	485	1,442.95	587.86	2,030.82	2.98	1.21	4.19
2001	440	1,477.35	526.38	2,003.73	3.36	1.20	4.56
2003	445	1,432.59	507.22	1,939.81	3.22	1.14	4.36
2005	445	1,546.41	534.90	2,081.31	3.48	1.20	4.68
2007	550	2,327.53	770.94	3,098.47	4.23	1.40	5.63

Data source: University of Idaho Crop Costs and Returns Estimate Reports.

costs were taken from the onion production budgets for 1997, 1999, 2001, 2003, 2005, and 2007 (Edmiston, Bolz, and Smathers 1997; Smathers 1999; Smathers, Geary, and Rimbey 2001; Smathers, Thronton, and Rimbey 2003, 2005; Thornton et al. 2007). Table 2 presents the operating, ownership, and total costs per acre and per hundredweight.¹¹ The onion production total cost per acre was in the range of \$2,000 during 1997–2005. There was a significant increase in the total cost during the last years; the 2007 total cost was \$3,100, which was 49 percent higher than the 2005 cost. Total cost per hundredweight was in the range of \$4.15–4.68 during 1997–2005. This cost increased significantly during later years—it was \$5.63/cwt in 2007, a 20 percent increase over 2005 and a 36 percent increase over 1997). The level of the per hundredweight cost depends on the yield level, which tends to vary substantially from year to year.¹²

¹¹Operating costs represent approximately 70–75 percent of total onion production costs and ownership costs represent 25–30 percent. The major operating costs are associated with seeds, fertilizers, pesticides, custom application and consulting services, irrigation, fuel, labor, and storage. Ownership costs include depreciation, insurance, land, overhead and management fees.

¹²In Idaho the onion yield was in the range of 540–770 cwt per acre during the analyzed period, with an average of 651 cwt

per acre. In Eastern Oregon the onion yield was in the range of 510–780 cwt per acre, with an average of 636 cwt per acre.

Table 3 summarizes the yearly onion prices received by growers and the onion production costs for the most recent years.¹³ The price-cost comparison conducted using this information shows the adverse effect that a high level of price volatility had on the profitability of onion growers. Onion growers were not able to recover the onion production costs in two out of four recent years. In 2004 the reported onion price was \$3.5/cwt; this was below the level of onion production cost, which was \$4.52/cwt. During the two following years, the prices were higher than the onion production costs. For example, the 2005 onion price was in the range of \$7.6–8.0/cwt, while the production cost level was \$4.68/cwt. The market situation dramatically changed in 2007, when the onion production cost was twice as high as the reported onion price. While the reported price was in the range of \$2.50–\$2.70/cwt, the onion production cost was \$5.63/cwt.

¹³The onion production costs are those reported in Table 2. As the onion production budgets are developed on a bi-annual basis, the production budget data for 2004 and 2006 are not available. We calculated the costs for these years as the average between the preceding and following years.

Table 3. Idaho–Eastern Oregon Onion Industry: Price–Cost Comparison (\$/cwt).

Year	Price		Production cost
	Idaho	Eastern Oregon	
2004	3.50	3.50	4.52
2005	8.00	7.60	4.68
2006	17.10	17.30	5.16
2007	2.70	2.50	5.63

Data source: Prices are from the USDA National Agricultural Statistics Service (n.d.) and costs are from Table 2.

Inverse Demand Analysis

Using yearly data on onion production and price for 1998–2006, we estimated inverse demand for Idaho and Eastern Oregon.¹⁴ There is no aggregate onion price reported for the Idaho–Eastern Oregon region; therefore we estimated inverse demand for each of the analyzed sub-regions. A regression model to be estimated is represented by

$$(3) P_i = \alpha \times \beta \times Q_i + \varepsilon_i,$$

where P_i is onion price for year i measured in \$/cwt, Q_i is onion quantity for year i measured in cwt, ε_i

¹⁴ As pointed out by one of the anonymous reviewers, it is important to discuss the effect that the Federal Marketing Order has on the level of onion supply. The Federal Marketing Order does not directly affect the level of onion supply at the production stage. It targets the distributors of onions (some of them are onion growers) and through them it affects the decisions of onion growers and therefore the level of onion supply. The implementation of the quality control, promotion, and advertising programs by the Idaho–Eastern Oregon Onion Committee results in shifts in demand and supply. These shifts are reflected in the level of price and shipments at the distribution stage. Given that this stage is tightly connected with the production stage, these effects are further embedded in the level of onion supply and prices at the production stage that are subject to analysis in our study. So the federal marketing order effect is partially accounted for through the type of data used. Given that Federal Marketing Order No. 958 was established in 1957–1961, the period analyzed in our study is completely covered by the rules of this Marketing Order. A more comprehensive analysis of the effect of the Federal Marketing Order on the level of onion supply at the production stage could be the topic of a new study.

is the error term, and α and β are the intercept and slope to be estimated, respectively; β is expected to be negative. The OLS estimation procedure was used to estimate demand functions.

The estimated Idaho onion inverse demand is represented by Equation 4 and the estimated Eastern Oregon onion inverse demand is represented by Equation 5.

$$(4) P_{ID} = 34.35 - 0.000005Q_{ID}^{15}$$

$$(5) P_{EOR} = 30.63 - 0.0000036Q_{EOR}^{16}$$

In the following section these demand functions are used to evaluate alternative market scenarios for the Idaho–Eastern Oregon onion industry.¹⁷ Before

¹⁵ The model's explanatory power (R2) is 0.67. The t-statistics for intercept and slope are 5.03 and -3.74, suggesting that both estimates are statistically significant at a one percent significance (alpha) level. The cut-off value of T-statistic at a one percent alpha level is [2.58].

¹⁶ The model's explanatory power (R2) is 0.55. The t-statistics for intercept and slope are 4.19 and -2.95, suggesting that both estimates are statistically significant at a one percent significance (alpha) level. The cut-off value of T-statistic at a one percent alpha level is [2.58].

¹⁷ Despite a relatively small number of observations used in our analysis, the statistical performance of the regression models is reasonable. The estimated coefficients are statistically significant at a one percent alpha level and the degree of explanatory power for this type of data and model set up is acceptable. Therefore we feel confident that the estimation results can be used in developing a set of benchmark market scenarios to refer to during the process of designing the

doing this, we derive inverse demand flexibilities that provide useful information for the decision-making process as well. Flexibilities are calculated using Equation 2. The point-specific and average flexibilities are summarized in Table 4.¹⁸ Given that onion supply and price are extremely volatile, these flexibilities should be used with caution and only in situations where small changes in the level of onion supply are analyzed.

The Idaho onion industry average demand flexibility is -2.80 , indicating that a one percent increase (decrease) in the Idaho onion industry supply would result in 2.8 percent decrease (increase) in the Idaho onion price. The Eastern Oregon onion industry average demand flexibility is -2.31 , suggesting that a one percent increase (decrease) in the Eastern Oregon onion industry supply would lead to a 2.31 percent decrease (increase) in the Eastern Oregon onion price.

supply management program rules. If necessary, the estimated demand equations can be used to analyze a more specific set of alternative market scenarios.

¹⁸ The point-specific flexibilities are calculated for each year represented in the data set. The estimated slope of the demand function and the actual supply and predicted price for each year were used to calculate point-specific flexibilities. The average flexibilities are calculated using the slope of inverse demand, the average supply, and the average predicted price.

The point-specific flexibilities should be used to analyze alternative market scenarios for the upcoming year given small changes (typically less than five percent) in the supply level. The onion supply volatility was extremely high during the last several years. For example, in six of seven recent years the Idaho onion supply changed by more than 15 percent; in five of seven recent years the Eastern Oregon onion supply changed by more than 15 percent. Using flexibilities for the purpose of demand analysis in this market environment is problematic unless relatively small changes in the supply level are expected. If the industry decides to stabilize the onion supply level, then demand flexibilities can be useful in analyzing price changes in response to relatively small changes in the onion supply.

For example, in 2000 the Eastern Oregon onion supply was 5,320 thousand cwt and the next year supply was only two percent higher. In 2000 the onion price was \$9.88/cwt. The estimated demand flexibility for 2000 is -1.67 , suggesting that a one percent increase in the onion supply level would lead to a 1.67 percent decrease in the onion price level. Therefore a two percent-increase in the onion supply level would lead to a 3.34 percent decrease in the onion price level. Based on this flexibility, the predicted 2001 year price is \$9.55/cwt; the reported 2001 year onion price was \$9.32/cwt.

Table 4. Idaho–Eastern Oregon Onion Industry: Inverse Demand Flexibilities.

Year	Demand flexibility	
	Idaho	Eastern Oregon
1998	-1.86	-1.28
1999	-3.65	-4.34
2000	-1.89	-1.67
2001	-3.02	-1.76
2002	-3.89	-2.78
2003	-2.61	-2.17
2004	-10.98	-4.79
2005	-3.30	-3.51
2006	-1.57	-1.60
Average	-2.80	-2.31

Alternative Market Scenarios

This section presents an analysis of alternative market scenarios for the Idaho–Eastern Oregon onion industry. For a market environment characterized by a high level of supply and price volatility, the analysis presented in this section is an alternative to using demand flexibilities to predict changes in the price level. Table 5 presents 12 scenarios differing due to the onion supply level.¹⁹ Using the estimated inverse demand equations, the onion price and value of production are predicted for each scenario. Furthermore, the total industry supply and value of production are calculated and reported in this table. By moving from the first to the last scenario, the onion supply level increases and the predicted onion price and value of production decrease. We select two representative scenarios to discuss the results in greater detail. These are a low supply level scenario (Scenario A) and a high supply level scenario (Scenario B). The total Idaho–Eastern Oregon onion industry supply is 10,000 thousand cwt in Scenario A and 13,000 thousand cwt in Scenario B.

In Scenario A, the Idaho onion industry supplies 4,500 thousand cwt²⁰ and the Eastern Oregon onion industry supplies 5,500 thousand cwt.²¹ These levels of onion supply lead to an onion price of \$11.85/cwt for Idaho and \$10.83/cwt for Eastern Oregon. The value of onion production is \$53,325,000 in Idaho and it is \$59,565,000 in Eastern Oregon, a total of \$112,890,000 for the Idaho–Eastern Oregon region.

In Scenario B, the Idaho onion industry supplies 6,000 thousand cwt²² and the Eastern Oregon onion industry supplies 7,000 thousand cwt.²³ These levels of supply lead to a price of \$4.35/cwt for Idaho and

¹⁹ The supply level changes between two subsequent scenarios are in the range of four to six percent. Based on historical information, Idaho's market share in the total region's supply is approximately 45 percent and Eastern Oregon's market share is approximately 55 percent.

²⁰ Approximately the same level of onion supply was reported in 1998 and 2000.

²¹ Approximately the same level of onion supply was reported in 2000, 2001, and 2006.

²² Approximately the same level of onion supply was reported in 2000.

²³ Approximately the same level of onion supply was reported in 1999 and 2004.

\$5.43/cwt for Eastern Oregon. The value of onion production in Idaho is \$26,100,000 and the value of onion production in Eastern Oregon is \$38,010,000, a total of \$64,110,000 for the Idaho–Eastern Oregon region.

These results suggest that a lower level of supply would lead to a higher price level and, consequently, to a higher value of production. A decrease in onion supply from 13,000 thousand cwt to 10,000 thousand cwt (a 23 percent decrease) leads to an onion price increase from approximately \$5/cwt to \$11.5/cwt (a 130 percent increase). In the case of Idaho, an onion supply decrease from 6,000 thousand cwt to 4,500 thousand cwt (a 25 percent decrease) would result in an onion price increase from \$4.35/cwt to \$11.85/cwt (a 172 percent increase). In the case of Eastern Oregon, an onion supply decrease from 7,000 thousand cwt to 5,500 thousand cwt (a 21.4 percent decrease) would lead to an onion price increase from \$5.43/cwt to \$10.83/cwt (almost a 100 percent increase). The total region value of onion production would increase from \$64,110,000 to \$112,890,000 or by 76 percent.

Assuming that the average onion production cost in the Idaho–Eastern Oregon region is in the range of \$5.5 to \$6.0/cwt and is likely to continue increasing, in order to cover this level of onion production cost the industry should implement one of the first seven scenarios presented in Table 5. To achieve the price level of approximately \$7/cwt, the total Idaho–Eastern Oregon onion industry supply should be approximately 12,000 thousand cwt. Following higher onion supply level scenarios is not likely to allow onion growers to recover their onion production costs.

If these results are used to decide on the onion area planted, two factors have to be taken into account: the level of shrinkage and the yield level. The average level of shrinkage during recent years was 17 percent in Idaho and 18 percent in Eastern Oregon. The average yield was 651 cwt per acre in Idaho and 636 cwt per acre in Eastern Oregon. Using a low supply level scenario (Scenario A), onion production with shrinkage would be 5,422 thousand cwt in Idaho and 6,707 thousand cwt in Eastern Oregon, a total of 12,129 thousand cwt.

The onion area planted and area harvested are calculated for a number of scenarios differing by the level of onion yield.²⁴ The results are presented

²⁴ These scenarios are developed for the low supply level Scenario A.

Table 5. Idaho–Eastern Oregon Onion Industry: Alternative Market Scenarios.

	Idaho			Eastern Oregon			Idaho–Eastern Oregon		
	Supply cwt	Price \$/cwt	Value of production \$	Supply cwt	Price \$/cwt	Value of production \$	Supply \$/cwt	Value of production \$	
	4,000,000	14.35	57,400,000	5,000,000	12.63	63,150,000	9,000,000	120,550,000	
	4,250,000	13.1	55,675,000	5,250,000	11.73	61,582,500	9,500,000	117,257,500	
(A)	4,500,000	11.85	53,325,000	5,500,000	10.83	59,565,000	10,000,000	112,890,000	
	4,750,000	10.6	50,350,000	5,750,000	9.93	57,097,500	10,500,000	107,447,500	
	5,000,000	9.35	46,750,000	6,000,000	9.03	54,180,000	11,000,000	100,930,000	
	5,250,000	8.1	42,525,000	6,250,000	8.13	50,812,500	11,500,000	93,337,500	
	5,500,000	6.85	37,675,000	6,500,000	7.23	46,995,000	12,000,000	84,670,000	
	5,750,000	5.6	32,200,000	6,750,000	6.33	42,727,500	12,500,000	74,927,500	
(B)	6,000,000	4.35	26,100,000	7,000,000	5.43	38,010,000	13,000,000	64,110,000	
	6,250,000	3.1	19,375,000	7,250,000	4.53	32,842,500	13,500,000	52,217,500	
	6,500,000	1.85	12,025,000	7,500,000	3.63	27,225,000	14,000,000	39,250,000	
	6,750,000	0.6	4,050,000	7,750,000	2.73	21,157,500	14,500,000	25,207,500	

in Table 6. The area harvested is calculated by dividing the onion supply level with shrinkage by the onion yield. The area harvested is typically 98–99 percent of the area planted.²⁵ The following results characterize a scenario with approximately average yield level. If the onion yield is 650 cwt per acre, the onion area harvested in Idaho is 8,341 acres and in Eastern Oregon it is 10,319 acres, a total of 18,660 acres. The onion area planted is 8,468 acres in Idaho and 10,476 acres in Eastern Oregon, a total of 18,944 acres.

The results presented in Table 6 indicate that the onion area planted is strongly affected by the assumption on the level of onion yield. If the level of yield is low—for example 550 cwt per acre—the total region’s onion area planted should be 22,389 acres. If the level of yield is high—for example, 750 cwt per acre—the total region’s onion area planted should be only 16,418 acres, which is approximately 27 percent lower than in the low yield level scenario.

Conclusion

The Idaho–Eastern Oregon onion industry operates in a market environment characterized by a high level of onion price and supply volatility. This adversely affects the profitability of onion growers and the competitiveness of their industry. One of the strategies to change this adverse market situation is to develop and implement an onion supply management program similar to the potato supply management program implemented by the United Potato Growers of Idaho.

This study conducts an analysis of alternative market scenarios for the Idaho–Eastern Oregon onion industry in the light of possible implementation of this program. By using information on onion production costs and benchmark results for the alternative market scenarios presented in the paper, the Idaho–Eastern Oregon onion industry can make a decision on the level of onion supply if it decides to develop the supply management program. For example, using the assumption on an average onion production cost of approximately \$6/cwt, to cover this level of production cost the industry should supply to the market approximately 12,000 thousand cwt of onions. A higher level of onion supply

²⁵ The onion area planted is calculated by dividing the onion area harvested by 0.985.

is likely to lead to onion prices that are below this level of onion production cost.

The results presented in the paper are based on historical levels of onion supply and prices received by onion growers in Idaho and Eastern Oregon. The assumption used to predict alternative market scenarios is that the future structure of the U.S. summer storage onion industry is the same as that during the analyzed period (i.e., onion growing regions maintain approximately the same historical market shares). However, in the light of implementation of an onion supply management program, the intensity of inter-regional competition gains a crucial importance.

The competition among onion growing regions might undermine the effectiveness of a supply management program implemented by the Idaho–Eastern Oregon onion industry. For example, if the industry were to decrease the area planted to gain an increase in price, other onion growing regions might react by increasing their onion supply. Their legitimate objective of increasing their market shares would undermine the success of the Idaho–Eastern Oregon onion growers.

Idaho potato growers realized this kind of problem, and shortly after founding the United Potato Growers of Idaho came up with the initiative to organize the United Potato Growers of America. This was done to bring other potato growing regions under the umbrella of a national cooperative to ensure the success of potato supply management program.

When we were performing the last revision of this paper, onion growers in Idaho and Eastern Oregon did in fact organize a cooperative with the objective of price and supply stabilization. Realizing the significance of the effect of inter-regional competition on the success of programs and strategies of the cooperative, the founding members named their organization United Onions USA, Inc. with the hope that other onion-growing regions would join the organization to contribute to its success.

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Table 6. Idaho–Eastern Oregon Onion Industry Low Onion Supply Level Scenario (Scenario A): Onion Yield, Area Planted, and Area Harvested.

Onion yield cwt/acre	Idaho		Eastern Oregon		Idaho–Eastern Oregon Region	
	Area harvested	Area planted	Area harvested	Area planted	Area harvested	Area planted
550	9,858	10,008	12,195	12,381	22,053	22,389
600	9,036	9,174	11,179	11,349	20,215	20,523
650	8,341	8,468	10,319	10,476	18,660	18,944
700	7,745	7,863	9,582	9,728	17,327	17,591
750	7,229	7,339	8,943	9,079	16,172	16,418
800	6,777	6,880	8,384	8,512	15,161	15,392

The Idaho onion supply is 4,500 thousand cwt and Eastern Oregon supply is 5,500 thousand cwt (Table 5, Scenario A). The supply accounting for shrinkage is 5,422 thousand cwt in Idaho and 6,707 thousand cwt in Eastern Oregon (assuming a shrinkage level of 17 percent in Idaho and 18 percent in Eastern Oregon). The area harvested is calculated by dividing the supply level with shrinkage by the onion yield level. The area harvested is 98.5 percent of the area planted.

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