Effects of Competition and Space on Country Elevator Grading Practices and Prices

by

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Kenkel and Anderson (1997) found that grade information recorded on scale tickets by Oklahoma elevators tended to overestimate test weight and underestimate dockage and other undesirable grade factors for hard red winter wheat in the 1995 and 1996 harvest. The authors estimated that Oklahoma elevators were losing up to 9 cents per bushel in 1995 and 2.3 cents per bushel in 1996, on average, by not grading correctly. Measuring quality characteristics more precisely will cost more. Passing quality premiums and discounts on to producers will reward those producers who respond to those signals and deliver higher quality grain. However, an elevator that imposes discounts for lower quality wheat, even while paying a higher price for high quality wheat, risks losing business if farmers believe that a competing elevator is more likely to pay them a higher price net of discounts.

A simulation analysis is conducted tdetermine the amount of premiums and discounts that a profit-maximizing country elevator will pay producers for wheat of different quality characteristics. The results indicate that profit-maximizing elevators generally will not pass on the full difference in price between different qualities of wheat to producers that it receives from next-in-line buyers. Furthermore, in a scenario in which a competing elevator pays the same price for all qualities, the elevator may pass on very little of the difference. These results may have important implications for ability of the current marketing system to adequately respond to demands for particular quality characteristics.

Introduction

Kenkel and Anderson (1997) found that that grade information recorded on scale tickets by Oklahoma elevators tended to overestimate test weight and underestimate dockage and other undesirable grade factors such as damaged kernels, shrunken and broken kernels, and foreign material. for hard red winter wheat in the 1995 and 1996 harvests. The authors estimated that Oklahoma elevators were losing up to 9 cents per bushel in 1995 and 2 cents per bushel in 1996, on average, by not grading correctly (Kenkel and Anderson 1997). The study also found that elevator grading practices were providing imperfect incentives for producers to deliver high quality grain, since current practices tended to disproportionally benefit producers with the lowest quality grain.

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In the last two or three years, though, next-in-line (NIL) buyers have begun to charge larger discounts and pay larger premiums for specific quality characteristics (Kenkel and Anderson 1996). To some extent, better grain testing technology has facilitated this. In effect, the marketing system has developed its own system of contract specifications to supplement the official grades and standards. As foreign and domestic grain buyers increase standards for grain quality, elevator managers now must decide to what extent they will measure quality characteristics more precisely and impose the more rigorous standards on producers. Measuring quality characteristics more precisely will cost elevators more. Passing quality premiums and discounts on to producers will reward producers who respond to those signals and deliver higher quality grain, and will facilitate supplying products that meet consumers' needs.. However, an elevator that imposes discounts for lower quality wheat, even while paying a higher price for high quality wheat, risks losing business if farmers believe that a competing elevator is more likely to pay them a higher price net of discounts.

To the extent that maintaining volume is important to an elevator's profits, elevators may lose money by grading correctly and passing on premiums and discounts. They may use lenient grading as a form of nonprice competition. On the other hand, firms with more market power may have greater ability to impose discounts (Hall and Rosenfeld).

Grain elevators are interested both in maintaining adequate margins on the volume of grain they receive and in maximizing the use of their fixed assets. Strict and accurate grading will maximize an elevator's margin on each bushel handled, since all of the quality discounts imposed by the NIL buyer are passed on to the producer. However, more lenient grading may help an elevator maintain an economically efficient volume of grain. The research here attempts to describe how the presence and nature of competition between elevators in sourcing grain may influence the elevator's behavior in passing on or absorbing quality discounts.

Several factors may help explain current practices, including the additional cost of grading (time, labor, and equipment), the effect of space and distance on the difference between an elevator's bid price and the price at the farm net of transportation cost, competitive pressures faced by elevators, and elevators' use of grading practices as a form of nonprice competition – elevators may be consciously over-estimating grain quality in an attempt to gain market share. Other explanations include a "prospect theory" hypothesis that producers dislike discounts more than they like premiums of the same magnitude (Benartzi and Thaler), and risk averse behavior by producers who are uncertain about the quality of their grain and in the grade their grain will receive. Under either of these two explanations, elevators believe that discounting may cause them to lose profitable business from producers concerned about receiving discounted prices for grain.

Although the above factors may all be important in explaining prevailing elevator grading practices, the research reported here considers two of them: (1) the effect of transportation costs and space, and (2) competitive pressures faced by elevators. Transportation costs affect the price an elevator must pay to attract grain of various quality characteristics from various distances across its trade area. To the extent that space and transportation costs separate an elevator from competitors, it possesses monopsony power. Conversely, increased competition among country elevators cost may limit an elevators' ability to pay different prices for wheat of different quality characteristics.

Conceptual Framework

A country elevator that performs only merchandising activities is assumed to maximize profits. Grain is purchased from farmers and sold directly to next-in-line (NIL) buyers. Quantity of grain purchased by the elevator depends on price offered to producers and transportation cost.

The elevator's objective function can be expressed as:

$$\underset{P_{fi}}{\text{Max}}\ Profit = \sum_{b=1}^{m}\sum_{i=1}^{n}[P_{NILb}Q_{ib} - P_i Q_{ib}(k_i, P_i, t_i)] - C^{v}_{ib}Q_{ib} - C_{fx} \qquad (1)$$

where:

$$\sum_{i=1}^{m} Q_{ib} = \sum_{i=1}^{n} k_i \left[\pi \left(\frac{P_i - x_i}{t_i}\right)^2\right]$$

$$P_i - x_i \geq 0$$

P_{NILb} = price received by the elevator from NIL buyers for blend b (\$/bu)
P_i = price paid to farmers by the elevator for wheat of quality i (\$/bu)
C^{v}_{ib} = variable merchandising costs for elevating, blending, and/or segregating wheat of quality i into blend b
C_{fx} = fixed costs
Q_{ib} = quantity of wheat of i^{th} quality that becomes part of blend b
k_i = density of production of wheat of quality i in elevator's trade area (bu/mi^2)
x_i = alternative outlet price to producer for wheat of quality i
t_i = transportation rate for wheat of quality i from farm to elevator (\$/bu/mi)
π = pi (circumference of a circle divided by the diameter)

The expression for Q_{ib} above -- $k_i [\pi (\frac{P_i - x_i}{t_i})^2]$ -- provides a measure of the quantity of wheat available in the elevator's trade area. With this formulation, the elevator's trade area is the area of a circle surrounding the elevator (Bressler and King). The radius of the circle depends on the difference between the price paid to the producer by the elevator (P_{ib}) and the best alternative price at the farm (x_i), adjusted for transportation cost (t_i). The area of the circle, the elevator's trade area, is π times the square of the radius. The quantity of the i^{th} quality of wheat produced in the elevator's trade area is its production density times the trade area.

Thus, the quantity of wheat purchased by the elevator is positively related to the price paid by the elevator – with associated monopsony pricing characteristics – and to the density of production, but negatively related to the alternative market price and transportation cost. For a given price paid to farmers at the elevator, a higher transportation cost reduces the net price paid to producers. Since transportation costs typically increase with distance from the elevator, the farther a producer is from the elevator, the lower will be the net price to the producer. At some distance from the elevator, the elevator price minus transportation cost equals the producer's alternative price (which could be a competitor's price net of transportation cost or the value of an alternative use for the grain), marking the edge of the elevator's trade area (Bressler and King). The lower the price at the elevator, the higher the transportation rate, or the higher the value of an alternative use for grain, the smaller the elevator's trade area. From the producer's perspective, the lower the producer's alternative market value for grain the more monopsony power that can be exerted by the elevator.

Procedures

A simulation analysis is used to determine the extent to which a country elevator will pass on to producers premiums and discounts it receives from next-in-line buyers. It is assumed that an elevator grades correctly and pays premiums and charges discounts to producers based on that grading and on the premiums and discounts received from NIL buyers. Based on two years of harvesttime grain quality data collected by Kenkel and Anderson (1997) from Oklahoma country elevators, it is assumed that in the elevator's trade area the production density of 1st quality wheat (Quality 1) is 2,000 bushels/mi^2, production density of 2nd quality wheat (Quality 2) is 8,000 bushels/mi^2, and production density of 3rd quality wheat (Quality 3) is 5,000 bushels/mi^2.

Two different competitive environments are considered. In the first, the elevator is assumed to have no competitors in its trade area. In other words, the best alternative price to producers after paying transportation costs is the feed value of wheat, assumed here to be $3.00/bu. Figure 1 illustrates the effect of the elevator's choice on profit. If the elevator pays too high a price for either quality of wheat, its merchandising margin, and profit, rapidly declines. If it pays too little, quantity purchased, and profit, decline at a gradual rate.

In the second competitive environment, the elevator is assumed to have a competitor in the same town. It is assumed that this competitor pays the same price to producers for all three qualities of wheat. Moreover, the price it pays for these three qualities is the price that the first elevator pays for Quality 2 wheat. Thus, the first elevator is permitted to choose the prices it pays for the three qualities of wheat, and the competitor matches the price for Quality 2 wheat. An additional assumption is made that if the price difference between the elevator and its competitor for a particular quality of wheat is less then 1¢/bu., each elevator purchases half of the wheat in the trade area. If the difference is 1¢/bu. or greater, the elevator with the higher price for that quality receives all of the wheat of that quality.

For each competitive environment, the model is optimized permitting the elevator to choose each of the three prices for wheat. This result is compared to an optimization in which the elevator is constrained to pay the same price for all three qualities of wheat. The difference between these two optimizations provides a measure of the incentive under each competitive environment the elevator has to pay different prices for different qualities of wheat.

For each of these optimizations, the elevator has variable costs for each of the three qualities of $0.10/bu., and fixed costs of $50,000 (see Kenkel and Anderson 1992). Transportation rate ($/bu/mi.) for each quality is $0.05/bu./mi. It is assumed for simplicity (arbitrarily) that prices received from NIL buyers are $5.00/bu. for Quality 1 wheat, $4.90/bu. for Quality 2 wheat, and $4.80/bu. for Quality 3 wheat. In this stylized simulation, the magnitude of these costs and prices is not assumed to reflect actual situations in the industry. However, they are sufficiently realistic to illustrate the effects of competition and space on elevator bids. (For example, it is unlikely that elevators would realize profits as high as those shown here; those profits could be easily reduced by increasing magnitude of fixed costs assumed, without affecting elevators' choices of prices paid for each quality of wheat.)

Results

As indicated in table 1, the elevator with no competition chooses prices of $4.27/bu. for Quality 1 wheat, $4.20/bu. for Quality 2, and $4.13/bu. for Quality 3, achieving a merchandising profit of $15.8 million. An elevator with no competition that pays the same price for each quality pays $4.19/bu. for all three qualities, and achieves a profit of $15.7 million, a decrease of $100,000, or about 0.6%. Thus, the gains from passing on premiums and discounts to producers appear to be small.

The elevator with a competitor in the same town (Table 3) chooses prices of $4.21/bu. for Quality 1 wheat, $4.20/bu. for Quality 2, and $4.19/bu. for Quality 3, achieving a profit of $9.1

million. (Although the prices reported in the table are rounded to the nearest cent, the price difference between the two elevators for Qualities 2 and 3 is less than one cent, so the quantity for each is split equally between the two elevators.) In this environment, the elevator receives a 10¢/bu. difference between qualities of wheat, but passes only 1¢/bu. of that difference to producers. As indicated in Table 4, however, if that same elevator chooses to pay the same price for each quality, its profit drops to $7.8 million, a decrease of 14 percent. Clearly, the assumption about the way in which the competitor responds to the elevator's prices affect these results.

Conclusions

Further work is needed to determine the expected effects of various competitive environments on an elevator's grading strategies and to what extent competition for market share explains elevators' observed grading inaccuracy. The results of these two extreme cases (no competitor vs. a competitor in the same town) illustrate the difficulty of making generalizations about how an elevator will respond to price incentives from NIL buyers for quality characteristics. In these two cases, the elevator does not pass on to producers all of the price difference received from NIL buyers. In the case with a nearby competitor, very little of the price difference will be passed on. These results suggest that even if elevators receive price incentives from NIL buyers for differentiated quality characteristics, producers may see little of those incentives.

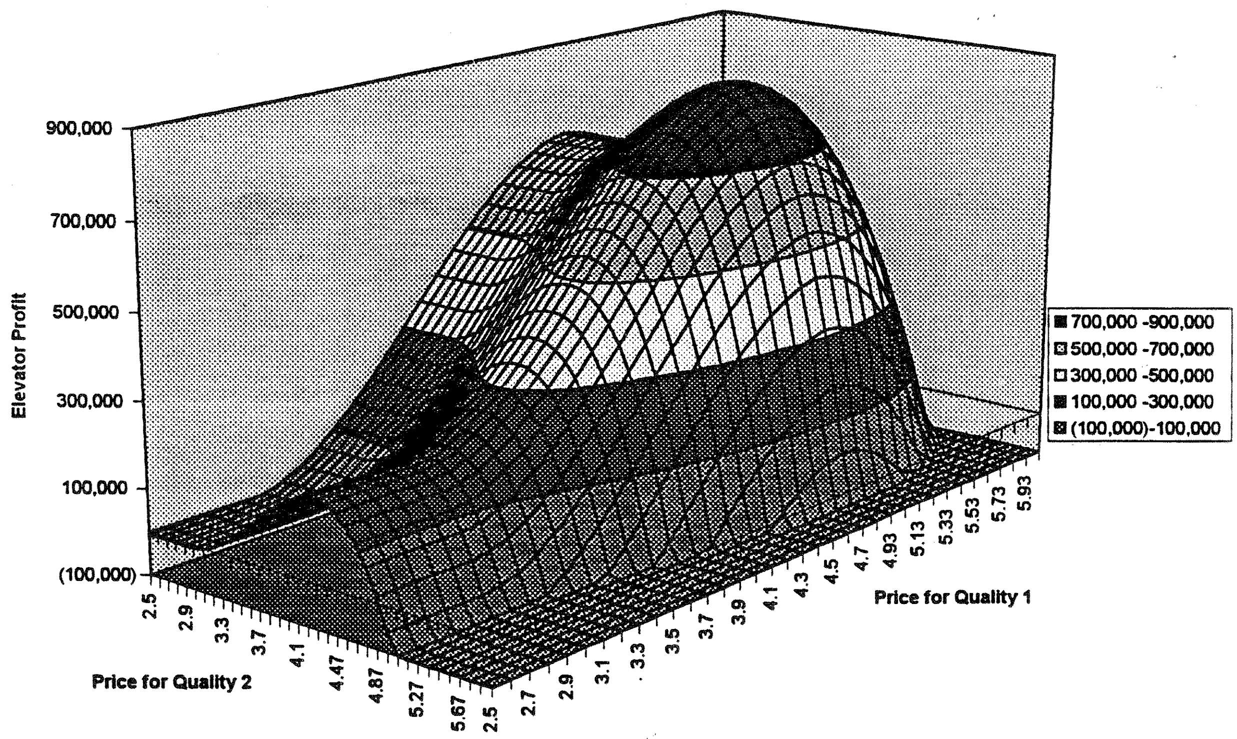

Figure 1. Elevator Profit vs. Prices Paid to Producers for Two Different Wheat Qualities

Table 1. Results of Elevator Maximizing Profits: No Competition (alternative wheat price of $3/bu.)

	Prices Paid to Producers	Quantity Purchased from Producers	Elevator Profit
Quality 1	$4.27/bu.	4.03M bu.	$15.8M
Quality 2	$4.20/bu.	14.48M bu.	
Quality 3	$4.13/bu.	8.07M bu.	

P_{NIL1} = $5.00/bu.; P_{NIL2} = $4.90/bu.; P_{NIL3} = $4.80/bu.

Table 2. Results of Elevator Maximizing Profit; No Competition (alternative wheat price of $3/bu.). Constraining Elevator to Pay Same Price for All Qualities

	Prices Paid to Producers	Quantity Purchased from Producers	Elevator Profit
Quality 1	$4.19/bu.	3.54M bu.	$15.7M
Quality 2	$4.19/bu.	14.16M bu.	
Quality 3	$4.19/bu.	8.85M bu.	

P_{NIL1} = $5.00/bu.; P_{NIL2} = $4.90/bu.; P_{NIL3} = $4.80/bu.

Table 3. Results of Elevator Maximizing Profit; Competing Elevator in Same Town Pays Quality 2 Price for All Wheat

	Prices Paid to Producers	Quantity Purchased from Producers	Elevator Profit
Quality 1	$4.21/bu.	3.71M bu.	$9.1M
Quality 2	$4.20/bu.	7.20M bu.	
Quality 3	$4.19/bu.	4.50M bu.	

P_{NIL1} = $5.00/bu.; P_{NIL2} = $4.90/bu.; P_{NIL3} = $4.80/bu.

Table 4. Results of Elevator Maximizing Profit; Competing Elevator in Same Town; Both Elevators Paying Same Price for All Wheat

	Prices Paid to Producers	Quantity Purchased from Producers	Elevator Profit
Quality 1	$4.20/bu.	1.80M bu.	$7.8M
Quality 2	$4.20/bu.	7.20M bu.	
Quality 3	$4.20/bu.	4.50M bu.	

P_{NIL1} = $5.00/bu.; P_{NIL2} = $4.90/bu.; P_{NIL3} = $4.80/bu.

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