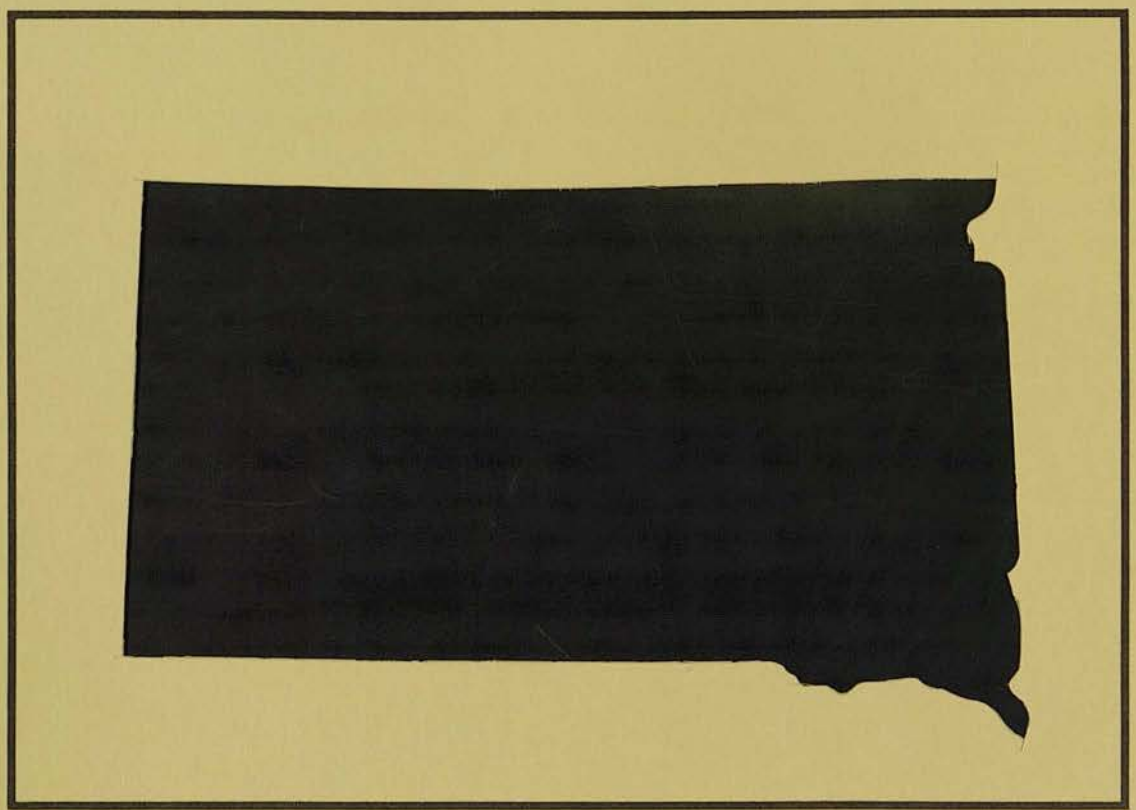

ECONOMICS DEPARTMENT

South Dakota State University
Brookings, South Dakota

THE EFFECTS OF UNCERTAINTY ON MARKET STRUCTURE

THE SOUTH DAKOTA SLAUGHTER CATTLE MARKET

by

Scott W. Fausti*
and
Dillon M. Feuz*

Economics Staff Paper 93-9**

October 1993

*Assistant Professors in the Economics Department at South Dakota State University.

"Thirty-two copies of this document were printed by the Economics Department at a cost of $.78 per document."

THE EFFECT OF UNCERTAINTY ON MARKET STRUCTURE: THE SOUTH DAKOTA SLAUGHTER CATTLE MARKET

BY

Scott Fausti and Dillon Feuz[1]

INTRODUCTION

In terms of population and income, South Dakota is a small, rural state relative to the rest of the nation. South Dakota's 1992 Gross State Product (GSP) was roughly 12 billion dollars, which implies South Dakota contributes .2% toward U.S. Gross Domestic Product (GDP).

The agricultural sector of the South Dakota economy contributed approximately 10% to GSP in 1992. The beef industry is the largest agricultural subsector in the state. In 1992, it generated 1.3 billion dollars in marketing revenue and produced approximately 41% of agriculture's contribution to GSP. The importance of the beef industry to the South Dakota's economy merits an examination of the market structure which has evolved for the selling of slaughter cattle in South Dakota.

This essay examines the effect of relaxing the assumptions of the competitive model on firm behavior and market structure. The perfectly competitive market model is based on the following assumptions: 1) a large number of buyers and sellers who are price takers in the market; 2) freedom of firm entry and exit; 3) all participants in the market have complete information on all relevant market characteristics; 4) buyer preference and cost structures are identical and the same is true for sellers; and 5) firms (beef producers) produce a homogeneous product.

---

[1] Dr. Fausti and Dr. Feuz are assistant professors in the Dept. of Economics at South Dakota State University.

The slaughter cattle market in South Dakota does not comply with all of the assumptions stated above. The number of buyers in this market, for example, violates assumption one. However, the U.S. government, having conducted a number of through investigations, has found no evidence of restraint of free trade on the part of meatpacking industry. The assumption of perfect information must be modified and this introduces uncertainty into the market. Otherwise, the slaughter cattle market adheres to the assumptions of the competitive model. The introduction of uncertainty provides a plausible explanation for why the slaughter cattle market deviates from the predictions of competitive model with respect to firm pricing behavior and market structure.

THE SOUTH DAKOTA SLAUGHTER CATTLE MARKET

The market for slaughter cattle in South Dakota mirrors the national market except for minor regional differences. Producers of cattle for the slaughter market have three choices with respect to the marketing method for their cattle: 1) selling slaughter cattle on a live-weight basis, where the price is based upon the live weight of the animal; 2) selling slaughter cattle on a carcass or dressed-weight basis(hide and organs removed), where the price is based upon the hot carcass weight obtained in the slaughter house; and 3) selling slaughter cattle on a dressed-weight and grade basis (grade and yield), where the price is based upon the hot carcass weight and discounts are applied if the carcass does not grade USDA Choice or if the USDA yield grade is 4 or greater. A major buyer of South Dakota slaughter cattle reported that, for the period from 8-1-92 to 8-1-93, approximately 29% of the South Dakota cattle were marketed grade and yield, 56% were marketed dressed weight, and 15% were marketed live weight.

When the grade and yield marketing method is selected, the price paid to the seller is based on the actual carcass weight and the USDA Quality and Yield Grades of that carcass. If cattle are marketed via dressed weight, the carcass weight is known with certainty, but buyers must estimate the expected quality and yield grades. There is a risk of incorrectly estimating the quality and yield grades and offering a price not in line with the actual quality of the cattle. When cattle are marketed on a live weight basis, the buyer must estimate the dressing percent (dressing percent = carcass weight/live weight) and the quality and yield grades. There is not only the risk of incorrectly estimating the quality of the cattle, but also of paying for more or less carcass weight than actually exists.

Given the description of the slaughter cattle market above, the questions arise: Why do meat packing firms offer to purchase cattle through three different marketing methods and why do producers choose to sell their cattle in one of the three marketing methods? The answers have important economic implications for South Dakota beef producers and the state's economy.

EMPIRICAL EVIDENCE AND ITS IMPLICATIONS

The analysis begins with the assumption that the slaughter cattle market is competitive. As we mentioned earlier, this assumption is based on a series of U.S. government reports which have found no serious impediments to free trade in the meatpacking industry. The competitive assumption implies that meatpackers are paying producers the marginal value product of the cattle purchased and that producers are receiving an identical value for their cattle regardless of the marketing method chosen. If this last statement is correct, then the existence of the three marketing methods is due to other factors,

such as incomplete information (uncertainty), industry tradition or seller preference not accounted for in the simplest form of the competitive model.

The existence of the three marketing methods for the buying and selling of slaughter cattle was the impetus for a three year cattle revenue comparison study at South Dakota State University. The study was able to determine the per head price of each individual animal, marketed under each of the three methods. The study found that average revenue per head was $6.22 higher and $2.55 higher if the cattle in the study were marketed grade and yield as compared to marketing them through the live method or through the dressed weight method, respectively. The average difference for the live vs. dressed method was found to be $3.67. The revenue differential between methods reported above also represent the profit differential between methods since the cost of production is fixed at the time of sale.

These results contradict the predictions of the competitive market model. The competitive market model predicts that sellers will receive the same price (revenue) for their cattle regardless of the marketing methods selected. Furthermore, the competitive market model predicts that if revenue is not identical across marketing methods, then all producers will sell their cattle through the method which yields the highest revenue per head; the grade and yield method.

THE DEMAND SIDE OF THE MARKET

The explanation for the existence of revenue differentials between marketing methods can be found in the differences between the informational structures of the three marketing methods described in the introduction. That is, the known facts on the quality of cattle vary between methods.

The amount of information available in the grade and yield method allows the buyer to know with certainty the weight and quality of the cattle purchased. In the dressed weight system the information on quality is incomplete, so the quality of the cattle is not known with certainty until after the purchase. In the live weight system the information on quality and carcass weight is incomplete and the weight and quality of the cattle are not known with certainty until after the purchase. The implication is that the risk to the buyer of making a mistake in assessing the value of cattle increases as the buyer moves from purchasing cattle in the grade and yield to the dressed weight to live weight.

Economic theory describes the effect of uncertainty on economic agent behavior and provides a plausible explanation for the existence of the revenue differentials. For example: a firm faces two possible profit outcomes, one with certainty and the other is uncertain, but the uncertain outcome has an **average** outcome equal to the certainty outcome. If the firm is risk neutral, then the firm will be indifferent toward the two alternatives; however, if the firm is risk averse, then it will be willing to pay a risk premium to avoid the uncertain outcome even though the **average** values of the two outcomes are identical. The above discussion provides an explanation of why the revenue differentials exist without violating our competitive market assumption. Buyers of cattle know with certainty the quality of cattle purchased via the grade and yield method. There is uncertainty, however, over quality of cattle purchased through the other two methods, and the uncertainty (risk) increases as a buyer moves from the dressed weight to the live weight method. This implies that if firms are risk averse, they must be paid a risk premium to purchase cattle through another method other than the grade and yield method.

Furthermore, this risk premium will increase as the risk increases. The risk premium being charged in the slaughter cattle market comes in the form of a lower average price being paid for cattle purchased in the dressed weight and live markets. Thus, the cause of revenue differentials between marketing methods can be explained as the risk premiums being charged by the meatpacking industry to compensate for taking on the increased risk of incorrectly estimating the quality of cattle purchased in the dressed and live weight alternatives to grade and yield.

THE SUPPLY SIDE OF THE MARKET

We have covered only the meatpackers' response to uncertainty and its effect on the market structure for slaughter cattle. The next issue to be discussed is: Why do sellers of cattle sell their cattle via dressed or live weight when they could receive, on average, higher revenue per head by marketing their cattle via the grade and yield method?

From the sellers' perspective, they know the weight of their cattle and the average price for live cattle on market day. Therefore, the market value of their cattle if they sell via the live method is known with certainty. If they market their cattle via the dressed weight method, then they are uncertain about revenue per head because they do not know the dressing percentage of their cattle for certain. If sellers market their cattle via the grade and yield method, then they are uncertain over the revenue per head because they do not know with certainty the dressing percentage and the grade and yield scores of their cattle. Thus, sellers are exposed to the risk that as information increases, the actual quality and dressing percent of their cattle will be different than expected. Therefore, revenue will become more

uncertain as sellers move from the live to dressed weight to grade and yield method for marketing their cattle.

The earlier discussion on risk again provides the framework in which to discuss the marketing behavior of cattle producers. If sellers of slaughter cattle are risk neutral, then because of the revenue differentials among the three marketing methods, all cattle would be marketed via the grade and yield method. However, if cattle producers are risk averse, then the producer would be willing to pay a risk premium to avoid the risk associated with this method, since the grade and yield method has the greatest uncertainty over revenue per head. The greater the level of producer risk aversion, the larger the risk premium the producer will be willing to pay.

Given the revenue differentials between marketing methods discussed above and the existence of the three marketing systems, it is a reasonable conclusion that producers are risk averse and that risk aversion levels vary among producers. Thus, because producers are risk averse, the grade and yield method is not the sole marketing method. The existence of three marketing methods is reasonably explained as the result of risk aversion varying among producers. The most risk averse producers market their cattle via the live method, less risk averse producers market via the dressed weight method, and the least risk averse producers market via the grade and yield marketing method.

THE EFFECT OF UNCERTAINTY ON THE MARKET: THE MICRO IMPLICATIONS

This is exactly the type of results we would expect when the assumptions of the competitive model are modified by relaxing the perfect information and identical firm preference assumptions. By allowing incomplete information on quality combined with varying firm attitudes toward risk, a market structure

evolves which is strikingly different from the predicted structure of the simple version of the perfectly competitive model. Yet, the economic outcome is efficient in a competitive sense (the U.S. government's conclusion).

The preceding section has shown that the present South Dakota slaughter cattle market structure is economically efficient. However, there is an important transfer of income taking place that may not be (politically) desirable. When producers choose to market either on a live or dressed weight basis, rather than grade and yield, they are paying a risk premium to the meat packing industry. Since there are no major meat packers in South Dakota, this represents a transfer of income out of the state.

To provide the reader with a rough approximation of the income transfer, in 1992 1,321,000 head of cattle were marketed in South Dakota. Approximately 29% of the cattle were marketed grade and yield, 56% were marketed dressed weight, and 15% were marketed live weight. This implies that for those producers who chose to market their cattle via the live method instead of the grade and yield method, an income transfer of $1,232,493 has been made to out of state meatpackers. For those producers who chose the dressed weight method instead of the grade and yield method, an income transfer of $1,886,388 has been made to out of state meatpackers. This represents a transfer of income of $3,118,881 out of South Dakota.

THE EFFECT OF UNCERTAINTY ON THE MARKET: THE MACRO IMPLICATIONS

The transfer of income from producers to the meat packing industry does not affect producers alone. All markets are interconnected, and changes in one market generates a ripple effect that is felt in all of the other markets. The transfer of 3 million dollars of income out of the state has economic implications for the rest of the state's economy.

The U.S. Department of Commerce has estimated the household earnings (income) multiplier for the agricultural sector of the South Dakota economy to be 3.4177. Taking the income transfer times the multiplier gives the total loss in household earnings (income) in the state from the transfer, $10,659,400.

The loss in income represents approximately .1% of state income. However, the decline in household earnings due to the transfer does reduce employment in the state. The U.S. Department of Commerce has estimated that for every one million dollars of output delivered by the agricultural sector of the South Dakota economy, 25.6 jobs will be created in the state. While it is our belief that the impact of an increase in income is greater than the impact of an increase in output on employment, the estimate of the Commerce Department gives us a conservative estimate of the jobs lost in the state due to the income transfer from producers to the meatpacking industry. Taking the value of the income transfer (3.118) times 25.6 gives us an estimate of the jobs lost to South Dakota, approximately 80. The results indicate that both income and employment in the state would increase if producers would market their cattle through the grade and yield method.