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**PRICE DISCOVERY FOR THE NORTH AMERICAN BEEF SECTOR:**

**A REVIEW OF THE ECONOMIC LITERATURE**

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## **ABSTRACT**

Price discovery in the beef sector has been the topic of many economic papers and studies. The studies vary from what issues are important in the price discovery literature to studies that focus on how well market mechanisms function for price discovery in the livestock sector. This literature review mainly discusses studies written by U.S. based authors as the literature in Canada, Australia and New Zealand was not available at the time this review was done. The literature review found that there have been many studies done into the best marketing mechanism for fed/ slaughter cattle. The literature has not come to a final conclusion, as one market mechanism does not provide the best price discovery in every situation. This may be because of the cattle industry structure.

The issues related to price discovery include price transmission and identity preservation. These topics are important as they provide feedback to the producer about the preferences of the consumer. The literature suggests that the producer is setting the price level and the consumer desires are not being signaled through the supply chain to the producer. Therefore the producer may not be meeting the consumer preferences. The topic of identity preservation in the beef sector is not well defined in the literature at this point in time. This may have future implications for the producer if the proper feedback on animal quality is unavailable.

The topic of price discovery in the North American beef sector is a large area of the literature. This study attempted to find the significant papers on the related topics but cannot claim to give a complete and full understanding of all the literature and topics related to price discovery.

## TABLE OF CONTENTS

ABSTRACT .....	ii
TABLE OF CONTENTS .....	iii
INTRODUCTION.....	1
1.1 Purpose.....	1
1.2 Objective .....	1
1.3 Organization .....	1
PRICE DISCOVERY BACKGROUND .....	2
2.1 History of Beef Marketing.....	2
2.2 What is Price Discovery? .....	3
2.3 Traditional Market Mechanisms and Price Discovery .....	3
2.4 Recent Market Mechanisms and Price Discovery .....	4
2.5 Why is Price Discovery Important? .....	4
2.6 Summary.....	5
PRICE DISCOVERY LITERATURE REVIEW .....	6
3.1 The Issues .....	6
3.2 Market Mechanism Studies .....	7
3.3 Industry Structure and Location .....	9
3.4 Factors Affecting Price Discovery.....	10
3.5 Summary.....	11
PRICE TRANSMISSION LITERTURE REVIEW .....	12
4.1 Price Transmission.....	12
4.2 Identity Preservation.....	13
4.3 Summary.....	13
SUMMARY AND CONCLUSIONS .....	14
5.1 Summary and Discussion .....	14
5.2 Limitations and Areas for Further Study .....	14
REFERENCES .....	16
ADDITIONAL RELATED PAPERS.....	19

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 Purpose**

The purpose of this literature review was to find and discuss the research done on the issue of economic price discovery in the beef sector. The literature review focused on research done on the Canadian and the United States beef sectors.

#### **1.2 Objective**

The objectives of the literature review was to determine what price discovery research had been done in the beef sector related to fed cattle.

#### **1.3 Organization**

This report is organized into five chapters. The second Chapter gives an industry background and describes the economic theory of price discovery. Chapter Three gives a description of the literature that is focused on price discovery. Chapter Four is a discussion of literature focused on the issue of price transmission and identity preservation. Finally, Chapter Five is the summary and conclusions of the literature review. The end of the report contains the References and an Appendix with a bibliography of the related papers.

## CHAPTER TWO

### PRICE DISCOVERY BACKGROUND

This chapter describes the history of beef marketing in North America, how it has evolved and how price discovery is important in beef marketing.

#### 2.1 History of Beef Marketing

There are three different types of cattle that may be marketed. These types are: 1) bulls and cows for breeding, 2) feeder cattle that are going to backgrounding or finishing operations, and 3) fed cattle that are slaughter weight being sold directly to packers. This literature review pertains to the fed and slaughter cattle markets.

The market structure for fed cattle has evolved overtime. In the past most cattle marketing occurred at livestock assembly yards to which ranchers drove their cattle. At the yards the packers would have a captured market in that the rancher would not want to take their cattle elsewhere even if they did not feel the price was reasonable. The packers would also hope for market gluts and then hold cattle later until markets were short to increase their profits at the expense of the producers (Williams and Stout, 1964). The result was a market with poor price discovery.

As the markets evolved the terminal livestock market was established. The terminals were along railways, which made transportation to different packers easier. Therefore there was more negotiation between buyers and sellers as the cattle could be sent to different packers from the terminal location (Williams and Stout, 1964). Williams and Stout go on to list the problems associated with a terminal market including reduced volumes, variations in volume, rising costs, and location.

Today most cattle producers have moved away from terminal and auction markets for their slaughter cattle and now usually sell directly to the packers. This creates the problem of very little open marketing and therefore a system of poor price discovery for slaughter cattle (Supply and Services Canada, 1976). This begs the question 'has cattle marketing come full circle and is price discovery any better today than it was in the distant past at the livestock assembly yards?'

In 1999, there were 43 federally inspected slaughtering plants in Canada<sup>1</sup> for cattle (Bateman, 1999). This is a far smaller number than the 400 plants available to producers in 1974 (Supply and Services Canada, 1976). This trend has also been documented in the United States with 743 plants and 667 firms in 1980 and a decrease to 204 plants and 166 firms in 1999 (USDA, 2001). Capps,

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<sup>1</sup> Of these 43 facilities there were three in Manitoba, two in Saskatchewan and seven in Alberta.

Jr. et. al., (1999) point out that in the United States the four-firm concentration ratio between 1980 and 1994 went from 36% to 81%. The packer concentration that has occurred gives rise to the question about the impact this may have on price discovery in the beef sector. This is discussed further in Section 3.1.

## **2.2 What is Price Discovery?**

According to Ward and Schroeder (undated ) “price discovery is the process of buyers and sellers arriving at a transaction price for a given quality and quantity of a product at a given time and place” (p. 1). There are many factors that influence price discovery. Some of these factors include market structure, market behavior, market information and price reporting, and futures markets and risk management alternatives. As stated by Ward and Schroeder (undated) price discovery starts at the market price level. Due to uncertain expectations by buyers and sellers the transaction prices will fluctuate around the market price level. The price fluctuation occurs because of changes in the quantity and quality of the commodity available, the time and place of the transaction and the quantity of buyers and sellers. In the case of the cattle market the amount and type of public information, captive supplies and packer concentration are also factors in price fluctuations and therefore price discovery.

One point to note is that price discovery is different from price determination. According to Ward and Schroeder (undated) “price determination is the interaction of the broad forces of supply and demand which determine the market price level” (p. 1) In the fed cattle market the supply is affected by input prices, technology and price of outputs produced from the inputs. The demand is affected by the price of products, price of substitute products, consumer income, and consumer tastes and preferences.

The interaction of price discovery and price determination comes from price determination finding the market price level and the fluctuations occurring due to price discovery. The problems with price discovery usually occur when there is either a strong demand for beef coupled with a large supply of beef or there is a weak demand and small supply of beef. At other times price discovery is generally efficient (Ward and Schroeder, undated)

## **2.3 Traditional Market Mechanisms and Price Discovery**

Cattle have traditionally been priced either based on live weight or dressed/carcass weight. (Ward, Schroeder and Feuz, undated) The live weight price is based on the packer’s price bid to meet their daily procurement needs. The price is based on expected dressing percentage of the animal, boxed beef price, byproduct price minus plant costs minus a profit target to get the bid price per hundredweight. This bid price does not consider quality variation in a sale lot.

The dressed/carcass weight price is similar to the live weight price except the dressed weight is based on the actual hanging carcass weight. This eliminates the dressing percentage estimate required for live weight bids. This method may result in a higher average price per animal than would live weight bids as the uncertainty about the dressed weight of the animal is removed. (Ward, Schroeder and Feuz, undated)

## **2.4 Recent Market Mechanisms and Price Discovery**

The more recently accepted market mechanisms used in the cattle industry include: 1) value-based pricing, 2) formula pricing, 3) price grids, 4) marketing agreements, and 5) alliances (Schroeder et. al., 2002).

Value based pricing is not a clearly defined term but in this study it refers to the carcass value-based on the total value of the different cuts. Value based pricing may also be defined as the price of the product in a specific niche market.

Formula pricing is where a transaction price is established using a formula that is based on another price. The other price is discovered external to the transaction price in the formula.

Price grids involve the determination of the value of each animal based on the carcass quality after slaughter. The price grid is made up of a base price with additional premiums and discounts for carcass quality and may vary by carcass weight. It is common to see a combination of both formula pricing and price grids in the pricing of the carcass.

Marketing agreements consist of an agreement between the grower and a contractor for a set price and market outlet for the commodity. There are many variations in marketing agreements such as forward sales, price setting based on a formula and pooling arrangement among a group of farmers.

An alliance is another term that has been given different definitions. One of the definitions is when the producer deals directly with the retailer. An alliance has also been used to refer to the actions defined under marketing agreements as defined above.

## **2.5 Why is Price Discovery Important?**

Price discovery is important for several reasons. As explained in Section 2.1 the historical price discovery in the beef sector has not been always acceptable to producers. First and foremost price discovery provides the means for achieving price determination and therefore the equilibrium supply and demand for the market. Without this producers will not know what the final consumer demand is for a product.

One question that may be asked is where does price discovery begin? Does it begin with the producer or the consumer? Purcell (1999) partially answers this by stating, "it is at the retail level that consumers are establishing the value" (p. 1).

Another question of importance in price discovery is who if anyone holds market power for prices in the beef sector. From the statement above we know that the consumer establishes the value but who has the power to set the price seen by the producer? Is it the producer, the packer or the consumer? Some of the literature described in this study will help answer these questions.

## **2.6 Summary**

This chapter has described a brief history of cattle marketing in North America and how the industry structure has changed. With price discovery defined, and what mechanisms are available today for price discovery described, the importance of price discovery may be understood. With this background complete, the studies that have been done into price discovery issues may now be described and discussed.

## CHAPTER THREE

### PRICE DISCOVERY LITERATURE REVIEW

Literature that focused on price discovery is reviewed in this chapter. The research for the literature concentrates on both Canada and the United States. The bulk of the literature reviewed in this chapter comes from the United States as very little work on the subject has been done in Canada and at the time this report was written, the literature requested from Australia and New Zealand had not yet been received.

#### 3.1 The Issues

The literature for price discovery in beef markets tends to discuss the problems being encountered by the buyers and sellers. The report by Purcell (1997) gives a thorough review of the issues in the beef and pork sectors. Purcell gives a quick history of why price discovery is an important issue and how it has changed. He describes how the marketing methods have changed for reasons ranging from reducing transaction costs to improving market access. Purcell then states that the problem of price discovery lies in the market failure in livestock pricing systems.<sup>2</sup> Purcell states that there are six issues important for price discovery in the beef sector. These issues are:

- 1) More accurate, less subjective measurements of beef quality,
- 2) Price premiums and discounts for fed cattle do not adequately reflect cattle value differences,
- 3) Inadequate market information inhibits efficient price discovery,
- 4) Live cattle futures basis risk is excessive,
- 5) Formula pricing arrangement adversely affect cash fed cattle markets, and
- 6) Group marketing of fed cattle may offer solutions to some price discovery problems.

Purcell (1997) reports that there is a desire for cattle prices to be more closely tied to red meat yield and the eating quality of the meat. This point comes back to how the yield and quality are assessed.

Peel (2002) also describes the issues faced by the U.S. beef cattle industry, both directly and indirectly important to price discovery. The issues given by Peel include supply chain development, structural change, global trade, and health issues. Supply chain development is important for developing targeted production rather than selling beef as a commodity. This follows the problems with value-based pricing. Supply chains may be used for sending signals from the market place to producers. Structural change in the beef industry is an issue

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<sup>2</sup> Market failure in this review is caused by a lack of information and therefore fully informed decisions may not be possible.

because of concentration, as explained in Chapter Two. Peel argues that these concentrated firms may benefit the whole industry because they have the ability to develop enhanced market coordination and to develop the supply chain. The issue of global trade is important as more countries are exporting all qualities of beef as consumers in many importing countries demand higher valued beef. The issue of health is important for the beef industry as diseases such as Food and Mouth Disease and BSE can spread more easily with the increase in movement of people and beef, among other goods, around the world.

### **3.2 Market Mechanism Studies**

With the issues related to price discovery in the beef sector established the question is 'what price discovery mechanisms work or do not work?' There have been many studies done on how market mechanisms impact price discovery. One of the earlier studies on the topic was done by McPherson (1956). McPherson did a study of how well auctions performed price discovery in the cattle market. The study focused on three Florida auctions based on the number of animals traded, simple average of prices discovered for comparable animals, price trends, and stability of prices. Looking at the price discovery results it would be expected that the auctions should have reasonably equal prices paid for similar animals plus the cost of transfer. The result of the study did not show this. Rather the result was that the prices at all three Florida auctions were below the ideal price of Chicago plus transportation. McPherson concluded that the limited supplies and higher variability in the quality of the cattle caused the low price. Another conclusion of the study was that large auctions "provide a more accurate price discovery mechanism than the small auctions" (p. 43).

Bailey, Peterson, and Brorsen (1991) concluded a study comparing video cattle auctions and regional market prices. According to economic theory it would be expected that video auction prices should be higher than traditional auctions due to reduced costs for the buyers in travel and time. The paper compared the prices of cattle sold using video auctions to three large traditional regional auctions in the United States. The study adjusted for transactions costs and quality. The results showed that video auctions had higher net prices than regional auctions. This was most likely due to the reduced trucking and shrink costs. Another benefit from video auctions may be the increased information about the cattle than had been available in the past from regional auctions.

In the study by Capps, Jr. et. al., (1999) they looked at the choices of fed cattle procurement and pricing methods. The study used a multinomial logit model. The study used daily fed cattle purchase transaction records from April 1992 to April 1993 from the Grain Inspection Packers and Stockyards Administration (GIPSA) Packers and Stockyards Program (PSP). Using this data a polychotomous choice model using a multinomial logit model was developed. The model was specified based on procurement and price methods. The procurement methods included: 1) the open or spot market, 2) marketing

agreements, 3) forward contracts, and 4) packer fed and/or owned. The pricing methods included: 1) live weight, 2) carcass weight and 3) formula. Among other factors for the model specification nine regions were used. These regions were: 1) Nebraska, 2) Texas, 3) Kansas, 4) Colorado, 5) California and Arizona, 6) Idaho, Washington and Utah, 7) Iowa and Illinois, 8) Wisconsin and Minnesota, and 9) Pennsylvania. In the data, 81% of the cattle were bought using the spot market, 9% through marketing agreement, 8% from forward contracts, and 3% using packer fed agreements. The cattle were priced by live weight 44% of the time, 38% by carcass weight and 18% by a formula. These percentages varied by region. The results of the study determined that “the method chosen by packers to procure fed cattle was found to affect the probability that a given pricing method will be chosen” (p. 24). The results were that spot market procurement tended to use live weight pricing, while the other procurement methods used carcass weight and formula pricing.

In a paper by Zhang and Sexton (2000) they studied the exclusive contracts between processors and producers. The study used spatial modeling to determine if exclusive contracts impacted the cash market. The study was based in the idea that bulkiness and perishability create high transportation costs for agricultural raw products. The study used duopoly price competition without captive supplies, a two-stage game and a three-stage game. The result of the study found ‘that processors may be able to use captive supply contracts to influence the cash market price to producer’s detriment.’ Therefore it is important to evaluate captive supply contracts in a region as they can create a barrier between firms and create a monopsonist in the region on the spot market.

In the paper by Schmitz, Moss and Schmitz (forthcoming) the authors examined the transaction costs of using public auctions, private sales, video auctions, and internet auctions in the 15 top beef cow producing states. A survey was carried out to determine the percentage of cattle going through different marketing channels. The survey found that the most common marketing channel for stocker cattle was public auctions, then private sales, video sales, and internet sales. The study was based on supply and demand for different marketing services. Their study determined that economies of scale determine the benefits of using different marketing channels. The results show that areas with large, in this case states, cattle herds will tend toward non-public auctions and private sales. This is based on the impact of direct transaction costs.

The study by Ward et. al. (1999) looked at market agreements and their impacts for fed cattle. The study used the Fed Cattle Market Simulator<sup>3</sup> (FCMS) to analyze the market impacts. The results of the experiment showed that the transaction price for an agreement period were higher than a non-agreement period. This was caused by a reduction in supplies and commitment to one packer. In the experiment, packers without agreements would bid up prices for the reduced fed cattle supply. The study concluded “abrupt changes in

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<sup>3</sup> For more information about the Fed Cattle Market Simulator see Ward et al. (1999)

marketing arrangements can have a significant impact on price discovery, and, under some conditions, such an effect may be positive” (p. 357).

There have been many other studies carried out using the FCMS. Ward et. al. (2001) reviewed these studies. The FCMS has been used to study fed cattle price discovery, marketing agreement impacts, value of public market information, vertical coordination benefits, price reporting accuracy, meatpacking firm merger impacts, negotiating strength of buyers and sellers, extent of contracting, and mandatory price reporting impacts. From these studies the conclusions found were that higher prices exist during agreement periods and increased price variation during agreement periods. Another study found increased price variation and reduced marketing efficiency with reduced information. A study on vertical coordination found higher industry profits from non-price coordination strategies. The result found in the price reporting study was little loss in price reporting accuracy as transaction numbers were reduced. A paper on firm merger found that during merger periods, profits were higher for the merged firms. A paper about the negotiation strength showed that feeders were favored when supplies were light and packers when supplies were heavy. The results of the extent of a contracting study showed that higher contracting was associated with lower prices and also was associated with inconsistently higher or lower price variation. The last paper reviewed by Ward et. al., showed additional information on forward contracting was associated with lower, less variable cash prices and higher contract prices and increased marketing efficiency.

### **3.3 Industry Structure and Location**

Industry structure and location also have an impact on price discovery as shown by the studies described below. In the study by Walburger and Foster (1998) they show that price discovery may differ by region. Using data for twenty-one sale locations in the United States the study determined that the spot markets do not move independently but there may exist regions where prices move independently of other regions.

The study by Bailey and Brorsen (1985) also looked at the dynamics of regional fed cattle pricing. Their study used four regions and determined that regional prices were interdependent. This result was most likely caused by the concentration of packers in Texas and transportation cost between regions and therefore Texas would lead the other prices. The authors suggest that increased meat packer concentration in a region will not give the packers increased market power for pricing.

Boehleje and Doering (1999) described price discovery issues to include the structural changes occurring in agriculture. The structural changes range from changing product characteristics to technology to the size of farms and business. These changes have implications for market access and firm concentration.

In the study by Capps, Jr. et. al., (1999) the authors found that an increase in slaughter capacity increased the use of forward contracts and decreased the use of packer fed cattle unless there was a high packer concentration in the region. The authors also found that an increase in the wholesale beef demand caused an increase in the number of marketing agreements, packer fed cattle and a move toward formula and live weight pricing. The study found that grade yield one was sold through spot market and forward contracts.

A point to consider from the Purcell (1999) study was that “higher priced corn ...pushed the price of calves down” (p. 3). This suggests that slaughter cattle prices are more inelastic than the producer prices for calves. Therefore the producer could be considered to lack market power for their product. Purcell continued to state, “The primary source of the constant-price squeeze on the cow-calf operator is the long-standing and persistent inability to pass any of the increased costs of operating throughout the system up to the consumer in the form of higher prices at retail.” (pp. 3).

### **3.4 Factors Affecting Price Discovery**

There have been several other studies done that focus on factors affecting price discovery such as risk, transaction costs and public information.

A point to consider when choosing a market mechanism is price disparity between alternatives caused by risk. According to Fausti and Feuz (1995) the risk the packers perceive between dressed weight and live weight creates an uncertainty for the packer. If the packer is risk averse they will pay less for the product they have less information about. In the case of beef, a live animal will receive a lower price per animal than the dressed carcass equivalent. The implication is that the producer selling by live weight is receiving a lower price for the same animal than if it were sold based on the dressed carcass due to the packer taking a premium for the additional risk.

In the paper by Hobbs (1997) transaction costs in cattle marketing were studied in the UK. The study focused on the choices a producer may make based on the transaction cost of the various marketing mechanisms. The study laid out a method for measuring the transaction costs of different methods of selling fed cattle for slaughter. The transactions costs come from information costs such as price discovery costs, price uncertainty, number of buyers, and product information. Transaction costs also come from negotiation costs, which include organizing transportation, and the transportation cost, frequency of the auction, sale order, and packer concentration among others. Monitoring costs complete the total transaction costs. The results from the study suggest that live weight marketing does not have significant information costs but negotiation and monitoring costs were important as well.

The paper by Anderson et. al., (1998) analyzed the impact of public market information on price discovery. The study used “the FCMS to assess the impact of limiting information on the efficiency of the fed cattle market” (p. 276). The analysis of the data determined “that the absence of current market information created inefficiencies” (p. 276). The study could not determine the impact on the sectors of the industries as price impacts were in either the producers’ favor or packers’ favors at different times. However the reduced public information did increase the price variance and therefore the price risk increased. The authors did find that the loss of public information did hurt production efficiency and therefore increased feeding costs and impacted producers more than packers.

### **3.5 Summary**

From the studies reviewed in this chapter it may be determined that much of the work in price discovery has focused on the effectiveness of the different market mechanisms. Of the market mechanisms, it has not been proven that any one mechanism is better in all situations. Depending on the fed cattle characteristics, such as quality or location, there may be different preferred mechanisms depending on the situation. The next chapter continues the price discovery literature by reviewing studies that looked at price transmission through the supply chain.

## CHAPTER FOUR

### PRICE TRANSMISSION LITERATURE REVIEW

The focus of this literature review thus far has been price discovery in the beef sector. There are also several additional issues related to price discovery that should be considered. Among these issues are price transmission and identity preservation.

#### 4.1 Price Transmission

Price transmission was an important issue when the report by Purcell (1997) was discussed. He gave market information as an important issue for price discovery. There have been many studies that considered price transmission up the supply chain from producer to consumer and in reverse down the supply chain.

A paper by MacArthur et. al., (1985) looked at price transmission both vertically and horizontally. The study used a univariate residual cross correlation analysis on price series at the farmgate, wholesale and retail levels for fresh meat from 1979 through 1982 at various points in Canada. In the beef sector, when moving from the retail price to the farmgate price the results showed “that farmgate prices changed first due to a shifting farmgate demand curve which shifted because of wholesalers’ expectations of a change in the wholesale price, retailers in turn reacted to the live price when negotiating with wholesalers” (p. 162). In other words the farmgate price led the retail price. The farmgate to wholesale results showed that farm prices led wholesale prices.

Another paper on price transmission by Goodwin and Holt (1999) determined that any change in price at the farm or wholesale level is seen in the retail market but any change in retail prices does not move back down to the producer. The result is that beef producers may not be receiving the proper signals to encourage them to adjust their product to consumer preferences. Although Goodwin and Holt suggest in their 1999 study that responsiveness to price shocks has increased in more recent years, price transmission therefore may have become more efficient from retail through to the producer.

Ward and Stevens (2000) discussed the price linkages in a structurally changing beef industry. Their study reported, among other things, that “all of the underlying activities with contracting, electronic trading and communication, etc. do not appear to have impacted the price transmission as we move closer to the producer end of the supply chain” (p.1121).

Papers by MacArthur et. al., (1985), Goodwin and Holt (1999) and Ward and Stevens (2000) all found the same conclusion that the producer leads the price of beef. If the producer is not seeing the signal from the consumer, the producer

will not be changing their product to meet consumer demand. This of course may not benefit the producer in the long run. This also appears to be contrary to Purcell (1999).

In a paper by Feuz (1999) the transmission of economic signals from consumers to producers using value-based marketing was analyzed. The paper looked at whether cattle were sold on a show list, pen-by-pen, or individual head and priced by live weight, dressed weight, grid or formula. The result of the paper for three different value-based pricing systems returned three different price premiums/discounts. The second part of the paper discussed the price signals. The paper determined that producers would most likely receive the appropriate price signal if cattle were priced individually. Feuz determined that no one grid pricing system was the most efficient but rather that different grids should be used based on the intended consumer type.

#### **4.2 Identity Preservation**

There are several other issues that have been studied in the beef sector. Not all of these issues focus on price discovery or price transmission but they were still important to price discovery and price transmission. One of these issues was identity preservation. Two studies found on the topic were by Trenkle (2000) and Bailey and Hayes (2002). These two studies were not exhaustive of the research on the topic but gave an idea of the importance of the topic. The identity preservation of individual animals may be used for better pricing and through the supply chain for determining value by the consumer.

Trenkle (2000) looked at electronic identification of thirty feedlot steers using transponders. This study was simply used to determine the possibility of tracing animals with a certain type of transponder. Bailey and Hayes (2002) looked at the traceability programs in the U.S. UK, Denmark, Canada, and Australia/ New Zealand.

#### **4.3 Summary**

In addition to the studies that directly focused on price discovery there were many issues that related to price discovery. As shown in this chapter, these issues included price transmission and identity preservation.

## **CHAPTER FIVE**

### **SUMMARY AND CONCLUSIONS**

This chapter provides a summary of the literature reviewed in the study and some potential areas for study.

#### **5.1 Summary and Discussion**

As stated in Chapter Three this literature review is not exhaustive of all the studies done on price discovery and related issues due to time and access to the literature. However in this review the importance of providing quality price discovery is shown in Chapter Two. Chapter Two explains the possible problems with the industry structure that may be affecting price discovery. The pricing mechanisms available to the industry, which include live weight, dressed/carcass weight, value-based pricing, formula pricing, price grids, marketing agreements, and alliances, are described.

Literature on price discovery describes the issues that range from the measurement of beef quality to the global industry. The authors of the literature have considered the effectiveness of different market mechanisms, transaction costs, availability of information, and risk.

The literature related to price discovery, which include price transmission and identity preservation, are also briefly reviewed. From the review of the literature one conclusion that may be drawn is that all price mechanisms have good and bad reasons for their use. Price discovery has always been important and today with several mechanisms available to producers and processors there is a need to determine which methods are the most efficient. The efficiency is affected by several factors ranging from the volume of cattle using a certain mechanism to the availability of information about the transactions for a certain mechanism.

The author of this literature review would suggest that no matter what pricing mechanism is used, the volume used by any one pricing mechanism affects the other mechanisms and therefore the availability and cost of information becomes the important factor for price discovery across different pricing mechanisms. In addition, the importance of price transmission and preference of consumer to producer is important and one method to achieve this may be a carefully designed system of identity preservation.

#### **5.2 Limitations and Areas for Further Study**

The literature reviewed in this study covers many of the topics important to price discovery. However it should be noted that the literature covers many decades of work by many authors. Therefore this study has focused on the significant and broad based work found in the literature.

As previously stated, there are several areas of price discovery that were not found to be studied extensively or with consistent results. Areas that need further study include:

- 1) What methods of price discovery work best for the beef sector including both small and large producers of fed cattle,
- 2) The interaction between price discovery and other issues such as price transmission and identity preservation, and
- 3) Who sets the initial price seen in the supply chain; the consumer, wholesaler, packer, or producer.

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Ward, Clement E., Ted C. Schroeder and Dillon M. Feuz, undated. Fed Cattle Pricing Live and Dressed Weight. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources. Oklahoma State University

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## **APPENDIX A**

### **ADDITIONAL RELATED PAPERS**

Peel, Derrell S. and Clement E. Ward, undated. Feeder Cattle Production and Marketing. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources. Oklahoma State University

Schroeder, Ted C., 2002. Producing and Marketing Quality Beef in the 21<sup>st</sup> Century. Kansas State University, Manhattan, Kansas

Schroeder, Ted C., Sarah Grunewald and Clement E. Ward, 2002. Mandatory Price Reporting in Fed Cattle Markets: Motivations and Implications. Council on Food, Agricultural, and Resource Economics (C-FARE) Annual Symposium

Unterschultz, James and Darren Chase, 2002. Cattle Identification-The Canadian Experience. Managing for Today's Cattle Market and Beyond. Wyoming State University

Ward, Clement E., undated. Price Spreads for Beef and Pork. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources. Oklahoma State University

Ward, Clement E. and James N Trapp, undated. Meat Trends Consumption, Prices and Production Costs. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources. Oklahoma State University

Ward, Clement E. and Stephen R. Koontz, undated. Fed Cattle Pricing: Basis Contracts. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources. Oklahoma State University

Ward, Clement E., Ted C. Schroeder and Dillon M. Feuz, undated. Fed Cattle Pricing: Formulas and Grids. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources. Oklahoma State University

Ward, Clement E., Ted C Schroeder, James Mintert, and Derrell S. Peel, undated. Fed Cattle Price Discovery Issues and Projections. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources. Oklahoma State University

Ward, Clement E., Derrell S. Peel, Stephen R. Koontz, and James N. Trapp, undated. Fed Cattle Market Simulator Applications. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources. Oklahoma State University

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