POTENTIAL FOR HIDE QUALITY IMPROVEMENTS

by

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ABSTRACT

The initial producer (cow-calf) is generally motivated to be more concerned about carcass quality than hide quality, and therefore brand to prevent theft. However, with the need for better quality hides in the leather industry, branding is a major issue in dealing with preventable damage. It is believed that branding does help in deterring theft but there should be a better way to identify livestock while also preserving hide quality. This study tries to determine the potential for using alternative identification methods in place of branding. This is estimated by analyzing what factors are present to induce producers to brand. These factors will include the value and benefits that cattle producers receive when they use branding to identify their cattle, both monetary and aesthetic.

Three surveys were constructed and submitted to 1608 cattle producers, 33 cattle inspectors, and 3 cattle rustlers. Personal interviews were conducted with cattle inspectors and cattle rustlers. Responses on returned producer surveys were encoded in spreadsheet format and analyzed via frequency analyses and logit modeling. Responses on inspector surveys and interviews were quantified and discussed in detail. Responses of cattle rustlers were used throughout the paper To provide anecdotal evidence to producer and inspector statements.

By considering these analyses, it was shown that a producer who owns a large number of cattle and who is aware of monetary loss due to branding , but does not consider the brand damage a problem, will brand his/her cattle more than other cattle

producers. The models in this study indicate that theft does not influence branding. The study has shown that cattle producers are willing to substitute the use of microchips in cattle identification for a monetary incentive, with an estimated average incentive at $13.54 per head.

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CHAPTER I

INTRODUCTION

The cattle industry is one of the oldest agricultural enterprises in the United States. Cattle ranching in the U.S., in some form, has been around since the 1500's, when cattle were introduced in North America, and has continued to grow over the years. During calender years 1993 to 1997, the average number of cattle operations throughout the United States has been around 1 million with an average of 102 million cattle per year estimated at a value of $59.9 billion. In Texas alone, there were 149 thousand cattle operations during this period. Also during this period, Texas cattle producers owned an annual average of 14.5 million cattle estimated at $6 billion. As this industry continues to grow, so do its technologies of production and management (USDA Agricultural Statistics (A), 1997).

In today's market environment, consumers continue to search for high quality products to fulfill their needs. Because consumers seek high quality products, producers wishing to remain competitive must respond appropriately. This can be accomplished through the adoption of new technologies or methods of production that may not have been previously used. However, historically, increasing the quality of a product generally results in an increase in the costs in the short run and a higher consumer price for the good. No industry is immune from such economic demand.

The leather industry in the United States is a sector of the economy seeking an increase in product quality. The leather industry is heavily dependant on the U.S. cattle

industry, and is a large supplier to the clothing and home furnishing sector of the U.S. economy. In 1996, there were 272 tanneries and blueing facilities located across the United States (Leather Manufacturer Directory, 1996). In 1994, the value of hides in the United States was estimated to be $1.9 million representing 1.6 percent of the agricultural Gross Domestic Product (USDA Agricultural Statistics (B), 1997). These tanneries increased U.S. bovine hide production by 3 percent in 1996 to 1.2 million metric tons. The United States continued to dominate the world hide market in 1996, and remains in a position to increase its hide exports to Asia and Europe. Every year these tanneries convert millions of raw hides and skins into leather.

However, it is difficult for the tanneries to consistently receive the best quality raw hides. Although the nation's tanned hides are generally taken from cattle slaughtered within the United States, these hides are often delivered with damage due to diseases, pests, manure burns, cuts and scratches, medication applications, and branding (i.e., fire and freeze branding). The value of loss due to branding damage is high. A single brand does result in an estimated average reduction in value of $7.41 per head (Eberspacher, 1997). To produce more quality leather, tanners must receive hides from cattle producers with less damage or find a way to remediate branding damage. Branding probably represents the husbandry practice that if altered could increase the quality of the hide at the lowest cost (Nelson et al., 1994).

Permanent identification of animals is essential to the beef producer for the purpose of record keeping and establishing ownership (Nelson et al., 1994). To prevent theft in some areas, producers need a method to permanently identify cattle to reduce the

risk of losing millions of dollars worth of cattle (Elam, 1977). Although there are many methods available to identify cattle, branding is generally adopted because it offers a low cost permanent form of identification. Other forms of identification are either too expensive to be implemented when compared to branding or are only temporary (Ingram, 1980). If cattle producers were to discontinue the practice of branding, they would need another way to permanently mark their animals to prove ownership or identification (Elam, 1977).

New methods of identification might be adopted by producers if the methods were lower in cost than those methods currently being used or if producers were to receive a premium for a higher quality hide. A premium for hides could offset the cost of more expensive forms of permanent identification. The value of the premium that could be offered to producers would be less than or equal to the difference in the value of a branded and an unbranded hide. However, until the premium is received by the cow-calf producer who first applies the brand, it is considered that there remains no incentive to discontinue this branding practice.

Identification Methods

Cattle producers have many types of identification methods available to be used. No one identification method fits the needs of all producers. For a proper identification system, a producer should select two different methods to insure permanent identification (Nelson et al., 1994). Identification methods used by producers include: temporary methods (stickers, chalk, paint, and metal tags); semi-permanent methods (ear tags, neck

chains, brisket tags, and ear notches); and permanent methods (brands, tattoos, photographs, electronic identification devices, and nose prints) (Hirschinger et al., 1978). The most common of these methods used by Texas cattle producers are the branding (both freeze and fire), ear tagging, and tattooing (Whittenburg, 1987). If the producer truly wishes to maximize profits, he/she should analyze his or her operation and determine which identification method should be used. A description of the use of ear tags, tattoos, branding and microchips is presented:

Ear tags: Ear tags are the most common form of semi-permanent identification used in the Midwest. Ear tags vary in shape, color, and method of attachment to the ear (Whittenburg, 1987). Ear tags, if large enough, can provide a way to identify cattle easily and quickly from a distance. Ear tags are classified into three groups: one-piece plastic, two-piece plastic, and metal (Whittenburg, 1987). The one-piece plastic tags are easily installed, and remain pliable in cold weather. The two-piece plastic tags are less preferred because the rigid, piercing plugs may catch on fences, brush, bunks, and etc. Metal tags, which are smaller and temporary, can be easily torn from the ear and are difficult to read from a distance (Nelson and Singleton, 1974). The primary advantages of plastic ear tags are low cost, ease of application, and being capable of identification at a distance.

Tattoos: Tattooing involves placing a series of numbers and/or letters inside an animal's ear or lips with indelible ink. Tattooing results in a marking that is permanent as long as the ear or lips remain attached and is required for some registered cattle (Nelson and Singleton, 1974). Tattooing requires the use of a special set of pliers to place the symbols (Whittenburg, 1987). The area above the upper ear rib is often used for tattooing.

The area between the cartilage ribs may be used if the one-piece, plastic tag is used. It may be best to tattoo in both ears, especially if the tattoo is four or five digits long. This allows the number to be readable if part of a number fades on one tattoo (Nelson and Singleton, 1974). Tattooing is the most effective form of permanent identification to be used with the flexible ear tag system. Tattoos are not visible from a distance and therefore are not recommended as the sole means of identification (Nelson et al., 1994).

Hot Iron Brands: Fire branding has been used for centuries and continues to be one of the most popular permanent identification methods used in identifying cattle and proving ownership. Branding is done usually in one of six positions. These are right and left hip, right and left shoulder, and right and left rib cage. Branding has also been done on the jaw, nose, hoof, and horn (Saskatchewan Agricultural and Food, 1996). Fire branding burns the hide and forms a scar, leaving a hair-free outline of the brand (Nelson and Singleton, 1974). If done correctly, a brand can be read easily from a distance and is difficult to alter (Whittenburg, 1987). However, disadvantages of a fire brand are initial cost of a set of irons ($60, $70, and $80 for a one letter, two letter, three letter brand, respectively (Husky Branding Irons, 1997)), labor required for branding, illegible brands in the winter due to long hair coats, and damage to the skin and hide (Nelson and Singleton, 1974; Alford, 1985).

Freeze Brand: Freeze branding was developed by Dr. Keith Farrell in 1954 as an alternative to hot iron branding (Wolfenstine, 1970). Freeze branding destroys the natural pigment in the hair resulting in white hair growth where the branding irons are placed. Freeze branding works well on cattle except for those with white coats (Whittenburg,

1987). If done correctly, freeze branding leaves a legible brand that will remain. This includes periods when the winter coat is shed in the spring or in the fall when the winter coats are grown (Alford, 1985). Disadvantages of this method include cost of the "irons" ($154 for a complete set of numbers 0-8 and $34 additional for each single character, $61 for a double character, or $89 for a triple character) (Gebo's, 1997), limited availability of ethyl alcohol and dry ice, and some hide damage (Nelson and Singleton, 1974); (Alford, 1985).

Microchips: Electronic microchip identification systems may be used in place of branding. The microchip portion of the system consists of two parts: the microchip and the microchip reader. The chip is small and is attached to a copper antenna coil. The chip itself is approximately the size of a grain of rice and can be injected into the base of the tail or in the ear. The reader is a wand that activates the chip by a radio-wave signal. Information from the chip is then transferred to a screen located on the reader. This readout may contain individual animal identification and records, such as weight gain. A readout distance of the microchip varies from 10 cm to 1 m, depending on the type of microchip. Microchips allow for animal identification records to be easily kept and they are also difficult to duplicate, alter, or remove. However, producers are wary to use microchips. This is because it is not currently economically feasible to replace branding with microchips because of the high cost (microchip reader is $3141, the microchip is $12.75 per chip, and microchip gun is $252). Also, there is no visible permanent identification to identify whose cattle are whose.

Branding Reasons

Generally, cattle producers raise cattle for the value of their meat rather than for their hide. Because of this, the hide is referred to as a by-product in cattle production. By labeling hides as a by-product, producers may feel that there is little value in the hides because it is perceived that they receive no premium or discount for the quality of a hide when an animal is sold. To the producer, the hide is considered part of the animal package and is a minor factor in the price of the total animal package. However, cattle feedlots do consider hide quality when purchasing an animal. Feedlots receive a premium for an animal if it has an unbranded (native) hide (John Foley, 1998).

Branding is a permanent way to show a registered mark of ownership and identification of the animal. Positive identification of an animal is desirable for all cattle and necessary in purebred herds. Identification makes it easy for producers to keep good records and to verify ownership of a stray or stolen animal (Nelson and Singleton, 1974). Ear tags and other temporary methods can be removed. According to Ingram (1980) other permanent identification methods are too expensive.

By marking animals, a cattle producer has proof of ownership and a hope for a theft deterrent. As stated in The Cattleman, rustling is becoming more sophisticated, but branding is still a deterrent to theft (Ingram, 1980). Rustling is as common today as it was 100 years ago. In Texas, it is a problem because the state borders four other states and Mexico. It is estimated that 60 percent of all stolen cattle recovered are recovered because they are branded (Cattleman Magazine).

Problem

For the leather industry to increase the quality of leather for their consumers, tanneries must receive higher quality hides. To do this, cattle producers should concentrate not only on the quality of the carcass but the hide as well. The value of the hide is largely determined by the area of hide with no damage. This damage includes, among others, scars left from branding and identification markings used by cattle producers.

The initial producer (cow-calf) is generally motivated to be more concerned about carcass quality than hide quality. Many producers will place an identification on them to mark ownership and personal identification of the animal. This is to prevent losses due to theft. Identification of the animal allows the producer to keep good records of the animals and allows for identification of stolen cattle (Elam, 1977). However, with the need for better quality hides in the leather industry, branding is a major issue in dealing with preventable damage. Does branding cattle deter theft well enough to warrant the damage? What value does the producer place on having a brand on his or her cattle? Are producers willing to change from branding cattle to another identification method if offered a premium for a native hide? It is believed that branding does help in deterring theft but there should be a better way to identify livestock while also preserving hide quality.

The researchable problem is determining the potential for using alternative identification methods in place of branding. This is estimated by analyzing what factors are present to induce producers to brand. These factors will include the value and benefits that cattle producers receive when they use branding to identify their cattle. These benefits

will be monetary as well as aesthetic, such as the ability of cattle inspectors to locate cattle because of brands.

Objectives

The general objective for this study is to elicit information from cattle producers with respect to potential hide quality improvements. The quality of hides is determined as a function of the extent of damage found on the hide. The specific objectives are to: (1) determine if branding is a theft deterrent; (2) estimate the true value the producer places on the brand; and (3) estimate the value of branding cattle to the industry from the perspective of brand inspectors.

CHAPTER II

LITERATURE REVIEW

Previous studies related to branding have focused on the economic costs of branding and the feasibility of alternative methods. Authors of the studies have not reported the reason that cattle producers prefer to use branding over alternative methods or the value of the brand on the animal. However, these studies provide a base for developing an estimate of the value of branding in the Southwest. The review of literature is organized into two sections: studies of the economic loss of branding and the feasibility of alternative identification methods, and studies of economic models that will be used in the methods of this study.

Economic Loss of Branding and Feasibility of Alternative Identification Methods

Frye (1995) studied the branding practices in the United States' beef industry and their economic costs. The economic loss to the leather industry resulting from the practice of fire branding has been high. Because of this, the leather industry has encouraged cattle producers to discontinue or reduce the amount of branding applied to cattle hides. However, these recommendations have yet to affect the practices of cattle producers. This may be because that there is not a feasible alternative identification method that will deter theft and prove ownership. In Frye's thesis, he has three chapters that deal with three different studies. Each study has a problem statement and objectives,

methods, and results. Two of these, which are pertinent to the current study, will be discussed.

The data collected from interviews over identification practices was used in conducting a cost- benefit analysis. The branding data for the feedlot industry was taken from the National Animal Health Monitoring Systems Cattle on Feed Evaluation (COFE). The analysis was used to show that the cost of branding resulted in the loss of $263 million per year. In 1991, branding cost producers $8.68 per calf born (Frye, 1995).

Many producers claim that if branding was eliminated, the supply of leather would increase resulting in a reduction in the price of hides. To estimate the change in hide prices due to an increase in hide supply, Frye (1995) estimated a demand model specifying price as the dependent variable. He used a linear price dependent multiple variable regression demand model with deflated native steer hide prices as the dependent variable. The independent variables were cattle slaughter (representing supply), US Trade dollars (representing exchange rates), hide exports and consumption expenditures (representing consumer demand), and price of other hide classes (representing substitutes). Based on the results of his study, it was found that if the quantity of leather was increased (i.e. by the discontinuation of branding) that the price of hides would drop enough that total revenue would decline.

Buguk (1996) studied the feasibility of replacing fire branding with the use of electronic microchips. In 1991, it was estimated that losses due to branding practices was $263 million (NBQA, 1992). Because of the amount of loss, the hide and leather industry has encouraged producers to discontinue or alter branding practices. Also, producers feel

that changing their methods of animal identification would not return a financial benefit. However, electronic microchip identification systems with the use of eartags might serve as a feasible alternative to fire branding with both tangible and intangible benefits.

Buguk, Ervin, and Eberspacher (1998) conducted an analysis of the cost efficiency of using a combination of plastic eartags and electronic microchips rather than fire branding to permanently identify cattle. They compared the costs of this identification system to those of fire branding. Tangible benefits of the eartag/microchip form of identification were considered to be the increased value of the hide. Additional intangible benefits to the cattle producer are: the ability to monitor each animal electronically and to be able to keep track of an animal's health, weight gain, and computerized maintenance of production records. However, at the time of the study, this system was not found to be economically feasible when compared to fire branding.

The studies that are discussed above address the economic costs of branding and the feasibility of introducing alternative methods of identification. It is evident from these studies that there are economic costs because of branding. Also, there seem to be no feasible alternatives to branding. However, these studies indicate that something must be done to eliminate this economic loss. This provides the foundation for this study's problem in determining why cattle producers brand and what value they place on their brands.

Studies of Economic Models

The following studies were researched to gain knowledge over economic models that may be used in the methods of this study. Such knowledge includes the different types of regression models that may be used. Also, these studies will provide information on which regression type should be used and why it should be used.

Berkson (1944) studied the application of the logistic function to bio-assay. Berkson believed that under certain circumstances, if the dosage of a drug is expressed in proportion to its logarithm, the effect, percentage of individuals killed in relation to dosage, assumes the form of a symmetric sigmoidal curve. The normal curve had been used for the estimation of the potency of a drug. However, the logistic function is close to the integrated normal curve. The logistic function applies to a wide range of physiochemical phenomena and may have a better theoretic basis than the integrated normal curve.

Berkson collected examples over dosage mortality in which the observations were numerous and had already used the integrated normal curve. The logistic function was applied to the same data and the results were compared. For the normal curve, evaluations were made by using the method of maximum likelihood formulated by Bliss and Fisher. For the application of the logistic function, each observation was evaluated. A least square solution for the function in linear form for logits was obtained weighting each observation. In the comparison of the normal curve and the logistic function, the results of the sum of weighted squared deviation was either similar or favored the logistic function. Because both curves are similar, the difference may not be great. However,

fitting the logistic was easier than fitting the normal curve by probits and maximum likelihood. Also, the more observations there were, the more favored the logistic function. Based on this finding, it is possible that with a large number of observations, the logistic function would appear to give a better fit.

Stanaland (1994) studied an analysis of producer participation in the Texas Agriculture Water Conservation Loan Program. A preliminary assessment of the Agricultural Water Conservation Loan Program suggests that only a few water districts and farmers have used this program. The problem was to identify why more farmers have not taken advantage of this program since only a high level of participation would lead to an efficient use of the water resources of Texas. The main objective was to identify program characteristics and the socioeconomic characteristics that influence potential producer participation in the loan program.

Survey questionnaires were randomly mailed to farmer/landowners in different areas of Texas. The data were then collected and placed in a database. Because the functions were assumed to be non-linear, the data were fitted to a binary-choice logit model. Through this analysis, is was possible to identify program characteristics and socioeconomic characteristics that influence potential producer participation in the low interest program. By looking at the results of the analysis, there are many conclusions that can be made. The main point, though, is that the author of the study found that the probability of producer participation in the low interest loan program can be increased significantly by organizing programs to emphasis benefits of water conservation.

This study was relevant to the current study because the methods and procedures used in this study are very similar to the methods and procedures that will be used in the current study. As Stanaland found the probability of producer participation in the low interest loan program, this study will find the probability of producer willingness to branding cattle or use other identification methods.

Johnson, Misra, and Ervin (1997) studied a qualitative choice analysis of factors influencing post-CRP land use decisions. The purpose of this study was to examine the effects of factors that influenced landowners' post-contract use of CRP lands in the Texas High Plains Region (THPR). Knowing the effects of significant characteristics and attitudes of CRP contracts and contract holders should help in a development of understanding the post-CRP land use decisions.

A qualitative choice model based on the premises of random utility maximization provided the appropriate theoretical foundation for the model formulation. An ordered probit model was used for empirical estimation. A mail survey was conducted among 740 CRP contract holders in the Texas High Plains Region. Respondents were asked to indicate the probable use of their CRP lands if current contracts were not extended. They had choices of returning all of their lands back to crop, some back to crop, or leave it for grazing, haying, and wildlife. Of CRP acres, 69 percent would be returned to crop production. The dependant variable in the ordered probit model was whether the producer should recrop the acres or not. The independent variables were soil type, conservation compliance requirements, if livestock was present in the operation, financial value of the commodity base, whether the land use would include being planted to cotton

or sorghum, if there were fencing and water on the CRP land, the number of acres in CRP, and the education level of the producer.

The results indicate that many factors have an influence on whether a producer will recrop or not. Significant factors include the financial value of the commodity base, the presence of a livestock enterprise in the contract holder's operation, contract size, and education level of the producer. The presence of a livestock enterprise increases the probability that the acres remained in the established cover. The probability of acres returning to crop production increased with contract size. Finally, as education increased, the probability that the acres would return to crop production increased.

This study was relevent to the current study because the methods and procedures used in this study are very similar to the methods and producedures that will be used in the current study. As Johnson, Misra, and Ervin found factors that influence producers to recrop or not, this study will find factors that influence producers to brand cattle or use other identification methods.

Haung (1993) conducted a study to formulate a model for analysis of consumers' food safety concerns relative to the use of pesticides in fresh produce production. The model connected consumer food safety concerns and pesticide use to consumers' willingness-to-pay for pesticide-residue free produce. Attitudes and willingness to pay were also linked to attitudinal behavior. Two consumer purchasing patterns were hypothesized in an empirical model, attitude-before-behavior and behavior-before-attitude. Attitude-before-behavior depicted situations that exhibited high consumer involvement. Behavior-before-attitude depicted situations that exhibited low consumer involvement.

Haung specified an empirical model that was represented by a system of three equations that had mixed quantitative and qualitative endogenous variables. Ordinary least squares was used to regress the willingness-to-purchase equation, while a joint maximum likelihood function was used to estimate the equations for risk perception and attitude. This study follows a two-stage estimation method developed by Nelson and Olson (1978) for a simultaneous-equation limited dependant variable model. The first stage estimates the reduced form equations and the second stage uses these estimates to obtain the fitted values of each dependant variable.

The results of this study suggested that risk perceptions have a positive and significant effect on consumers' attitudes toward pesticide use. This in turn influences their risk perceptions and willingness-to-pay for residue-free fresh produce. It was also suggested that perception itself had no significant direct impact on willingness-to-pay apart from its influence on attitudes. Haung also estimated that if consumers believe fresh produce should be tested for residue, they are willing to pay three percent more for the produce. It was found that socioeconomic and demographic characteristics as well as psychological factors influence consumer concern, attitude, and willingness-to-pay.

This study was relevent to the current study because the methods and procedures used in this study are very similar to the methods and producedures that will be used in the current study. The simultaneous equation model in Haung's study will serve as a example for a simultaneous equation in the current study.

Kyle Clem (1996) studied the impact of bovine somatotropin on consumer concern and purchase behavior of fluid milk in Texas. The purpose of this study was to determine

the consumers' attitudes and perceptions toward the use of bST in milk production, determine consumers' willingness-to-purchase milk produced using bST, and analyze the possibility of market segmentation by estimating price sensitivity of consumers' demand for conventionally produced milk and bST-treated milk.

A simultaneous qualitative choice model was developed with the aid of information processing theory to estimate consumer behavioral intention. Consumers willing-to-purchase and those not willing-to-purchase bST milk were divided into two groups. The demand relationships were estimated for each group, using OLS. The study found that the elasticity of demand for those willing-to-purchase bST milk was estimated to be -0.9 and the price elasticity of demand for conventional milk purchases was estimated to be -0.5. This lends support that there is a possible market segmentation and coexistence of both bST and conventionally produced milk. It was also found that the least likely purchaser of bST produced milk were older non-white, female consumers, with lower income and education levels. Human health and lack of information regarding the technology were cited as major reasons for higher level of concern.

The studies above present different types of methods that may be used to analyze the data. The producer data will use logit modeling, binary or multinomial. The double-bounded dichotomous choice contingent valuation is more efficient in determining contingent valuations. It gives the researcher tighter confidence intervals in predicting. This helps determine part of the methods and procedures for the rustler part of the current study. In running a contingent valuation model, it will help to know which method might prove to be more efficient in predicting.

This study was relevent to the current study because the methods and procedures used in this study are very similar to the methods and producedures that will be used in the current study. The simultaneous equation model in this study, as in Haung's study, will help develop a simultaneous equation in the current study.

The preceding set of literature has laid a foundation for the analysis for the current research. This foundation deals with the discovery of economic losses due to the branding of hides and the discovery of a feasible alternative method of identification. This provides a need for research in why producers brand and what value they place on their brands.

The foundation also helps in determining how the value of branding will be found. This information in these studies will no doubt prove to be useful in the proposed research.

CHAPTER III

CONCEPTUAL FRAMEWORK

Cattle producers yield two products for every animal that they sell. These products are the carcass and the by-products. The by-products referred to as the "drop", include the blood, all soft tissues, such as the heart and liver, the gut, and the hide. The drop has value which for the purpose of this presentation is assumed to be $110. The following four assumptions are made: (1) The producer wishes to maximize profits; (2) The producer markets the animals through a cooperative in which the producer retains possession of the carcass and drop after slaughter; (3) Cattle pose as equal proportions of the various separable products they represent, where there is no substitutability between outputs; and (4) The demand for hides (leather) is elastic.

Once cattle are sold to be processed, producers generally relinquish ownership. These cattle then move through middle-men, such as stockyards. Each person who deals with the cattle takes part of the profit from the cattle, and the producer does not make as much profit as he/she could. However, producers working collectively, could retain possession of the carcass and by-products after slaughter. Doing this, they could sell the carcass as meat cuts under their own local label, the hides to hide buyers, and the remainder of the drop to other various buyers. By keeping control and selling the animal in parts, the producer can realize more profit. The producer's total revenue can be presented as:

$$TR = P_H H + P_C C + P_D D \quad (1)$$

Where: TR = Total Revenue

P_H = Price of hides ($/Sq. Ft.)

H = Amount of usable hide (Sq. Ft.)

P_C = Price of the cattle carcass ($/lb.* total average weight)

C = Number of cattle carcasses

P_D = Price of balance of Drop ($/lb.* total average weight)

D = Number of units of Drop.

Hides change from being categorized a by-product to a joint-product when a producer protects the quality of both the carcass and the hide for the purpose of retaining the value of these products. The value of the carcass and hide can be increased by increasing the quality with proper management. The values of the carcass and hide will only be considered in this presentation. Therefore, the change of the value of the balance of drop will not be considered. Feeding high grade feed is one way a producer may increase the carcass muscling of the animal and thereby increase its value. However, to increase the value of the hide, the producer must prevent damage from birth to slaughter. Damage to the hide is caused by branding, insects, barb wire, urine burns while confined, chemical burns from pour-on insecticidal treatments, etc. Once producers accept the hide as a part of production, he or she can start to look at the joint product production possibilities frontier.

The production possibilities frontier for these joint products (carcass and hide) is presented in Figure 1. A typical producer who produces C^1 number of carcass will

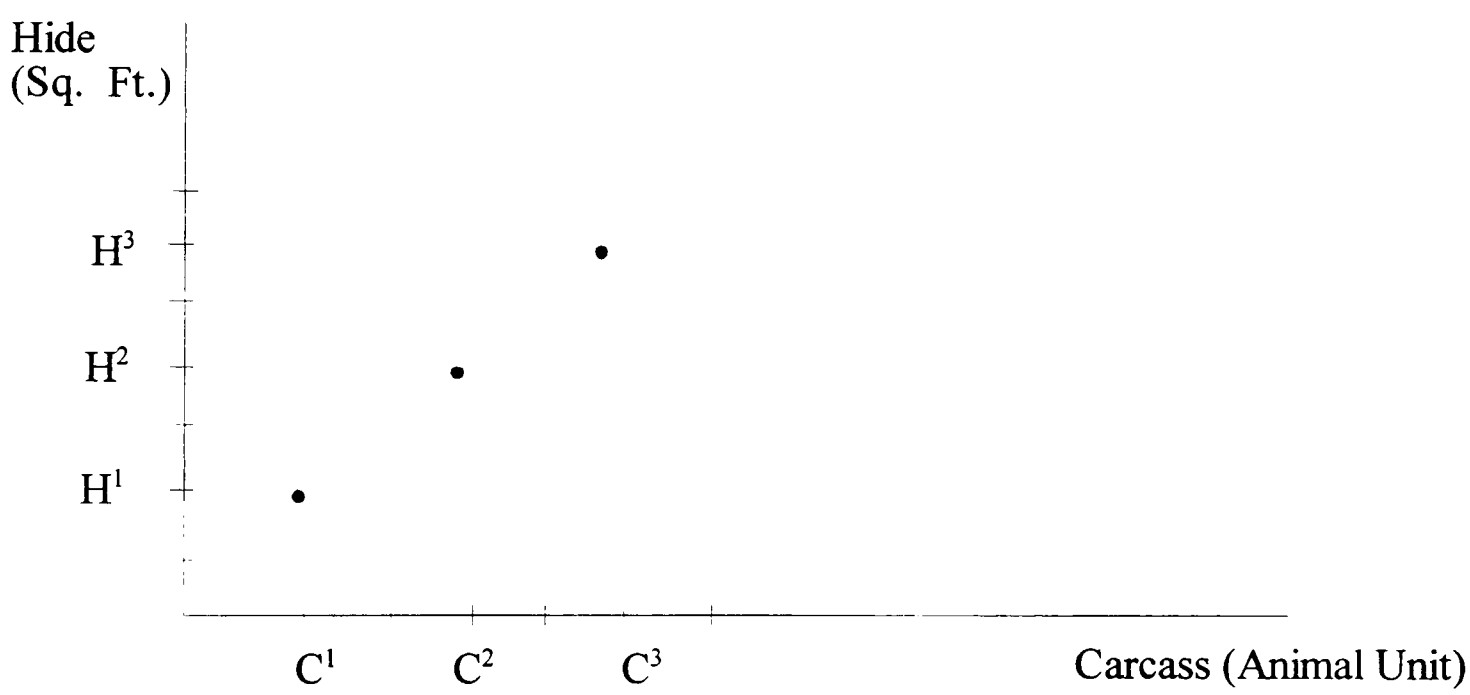

Figure 1: Joint production possibility frontier, where H^i represents levels of hide produced and C^i represents the level of carcass produced.

produce a proportionately fixed amount of hide in square feet (i.e. H^1). This fixed relationship between carcass and hides continues as production increases from C^1 to C^2 to C^3. There is no substitutability between the amount of hide in square feet and the number of carcass (i.e. you can not produce more hide without producing more carcass, unless your typical management practices change). When a producer finds the joint production possibilities frontier, he/she can maximize his/her profits by identifying the Isorevenue line. An Isorevenue line identifies all combinations of outputs of hides and carcass that result in the same Total Revenue (see Figure 2). There is a different Isorevenue line for every value of Total Revenue, but the slope of all Isorevenue lines are the same (Mansfield, 1988). As Total Revenue increases, the producer will shift outward to a different Isorevenue line. An example would be that the producer is producing enough carcass and hide to be on the IS_1. If, for some reason, he/she increases carcass and hide production, TR will also increase. When this happens, the producer will shift to a higher Isorevenue line, IS_2. This continues as the producer continues to increase his/her outputs. The point of joint production that falls on its respective IS line is the point of profit maximization for the producer. At this point of joint production, the producer maximizes total revenue. The producer would not want to operate anywhere else on the IS line because he or she would not be maximizing profits. The equation for the Isorevenue line is derived from the Total Revenue equation (1) when considering only two products (i.e., carcass and hide). Therefore, the equation for the Isorevenue line is :

$$H = TR/P_H - (P_C/P_H)*C \qquad (2)$$

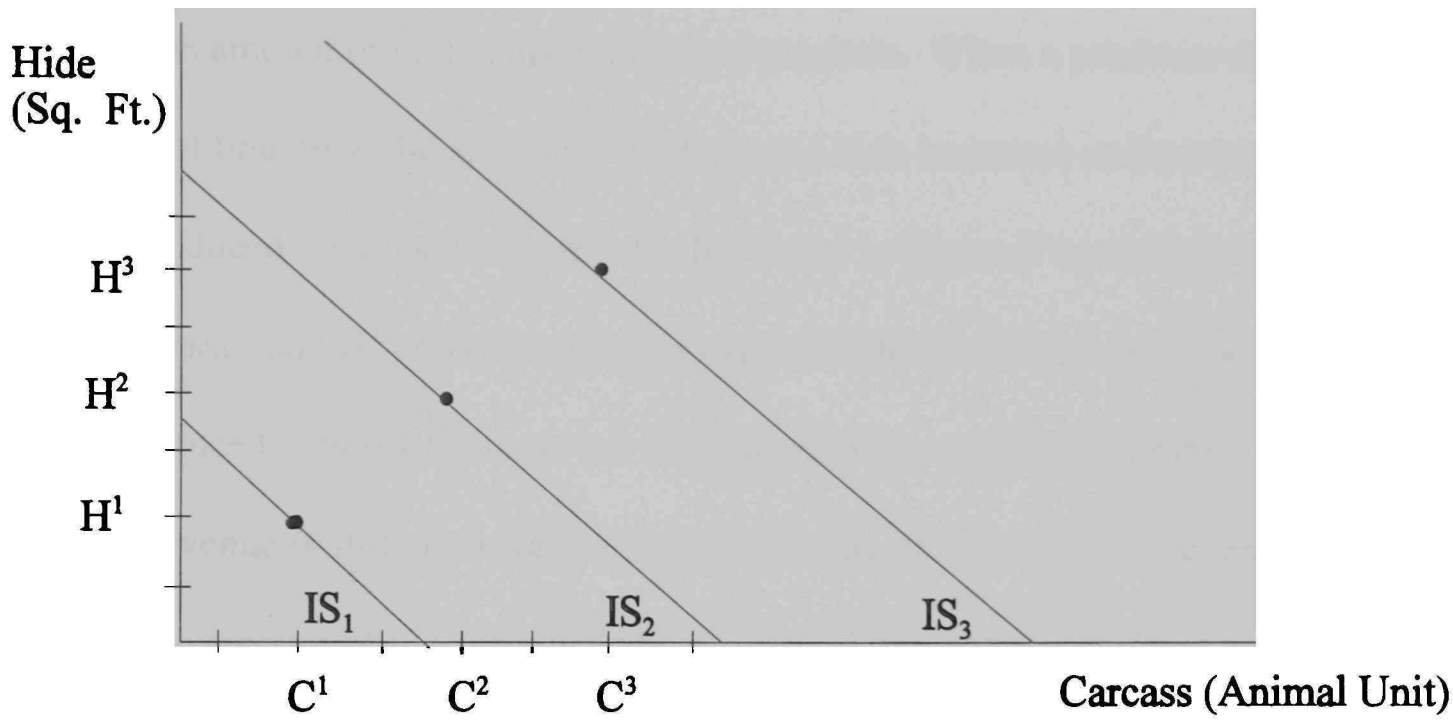

Figure 2: Joint production possibility frontier, where H^i represents levels of hide produced and C^i represents the level of carcass produced and Isorevenue Lines, where IS_i represents isorevenue line for a producer.

Where: TR/P_H represents the intercept of the isorevenue function on the axis representing hide units produced.

(P_C/P_H) represents the slope for Isorevenue line.

C represents the number of cattle produced.

Brands damage the collagen structure of leather and therefore reduces the amount of quality hide and value. Profit maximizing producers will reduce this damage by increasing the amount of undamaged hide they produce. When a producer discontinues the practice of branding, the amount of undamaged hide increases as the number of cattle carcasses produced remains the same. As illustrated in Figure 3 a producer producing C^1 units of carcasses and H^1 units of square footage of hides discontinues branding, he/she will still produce C^1 units of carcass but will increase the quantity of usable hides to $H^{1.5}$. Maximum revenue is shifted upward and increases the producer's total revenue by increasing the amount of hide produced by Z units. The producer shifts to a higher Isorevenue line (IS_1 to $IS_{1.5}$). The producer's Isorevenue line will shift in a parallel fashion to the right of the original isorevenue line because the slope of TR does not change (refer to eq. 2). As the amount of quality hide increases, the revenue for hide production increases. The intercept of the IR line (TR/P_H) increases because only the numerator increases. The line will have the same slope, however, because the ratio (P_C/P_H) is not affected by the change in total revenue.

Given that in a perfectly competitive industry one producer can not influence the market price, the price of hides does not change. However, as more producers adopt the practice of not branding, the price of hides may fall. Given that it was assumed that

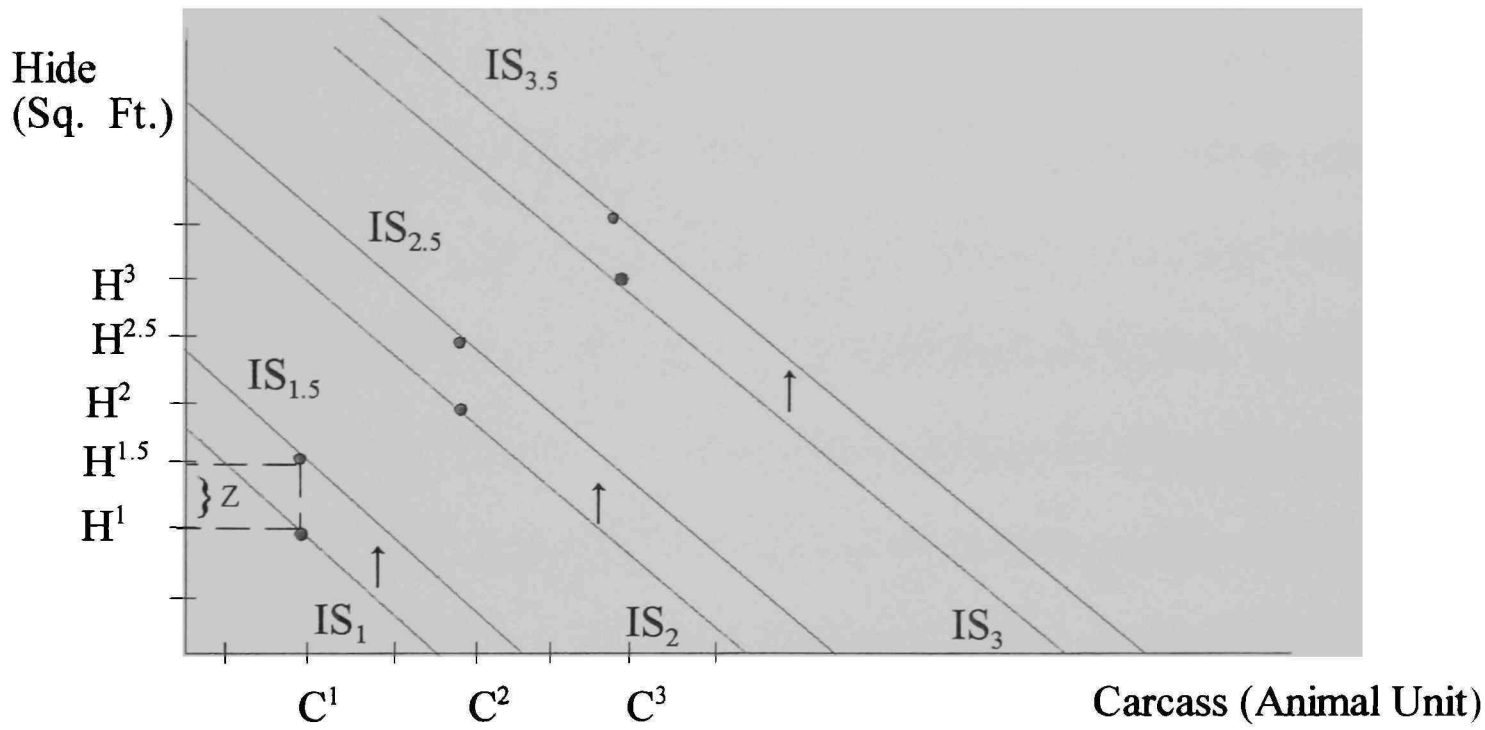

Figure 3: Shifts in the Isorevenue Lines due to an increase in usable hide when branding is reduced, where H^i represents levels of hide produced, Z represents the change usable hide, and C^i represents the level of carcass produced.

leather is an elastic good, total revenue will increase. Figure 4 illustrates the average revenue (AR), marginal revenue (MR), and total revenue (TR) curves representative of most imperfectly competitive firms. The center point of the average revenue curve corresponds with the maximum point on the TR curve and is where demand for unitary elastic goods begins to decline (Mansfield, 1988). To the right of the midpoint of the AR line, the demand for goods is inelastic, and to the left are elastic goods. Unitary elastic goods are those goods that do not affect Total Revenue when price changes. With an inelastic good, the good generally does not have many substitutes, such as college tuition. As price goes up, people will still pay tuition to go to school. So as price varies, Total Revenue changes as illustrated in Figure 4. With an elastic good, there are generally many substitutes. As price increases for an elastic good, the quantity demanded decreases, and Total Revenue decreases. However, when price decreases, the quantity demanded increases, and Total Revenue is increased (Mansfield, 1988). As shown on Figure 4, when price of an elastic good falls (from P1 to P2), output increases (from H1 to H2), increasing total revenue (from TR1 to TR2).

Hides are used to produce leather which has been defined to be an elastic good because of the numerous alternatives that may be used in its place. Such substitutes include rubber, vinyl, cotton, canvas, and other natural or synthetic fibers. A decrease in P_H will affect the Isorevenue line (see Figure 5). The intercept term, TR/P_H, will increase as a result of the decrease in the price of hides. The slope of the Isorevenue line (P_C/P_H) will also increase as illustrated by the shifts of IS*, IS**, and IS***.

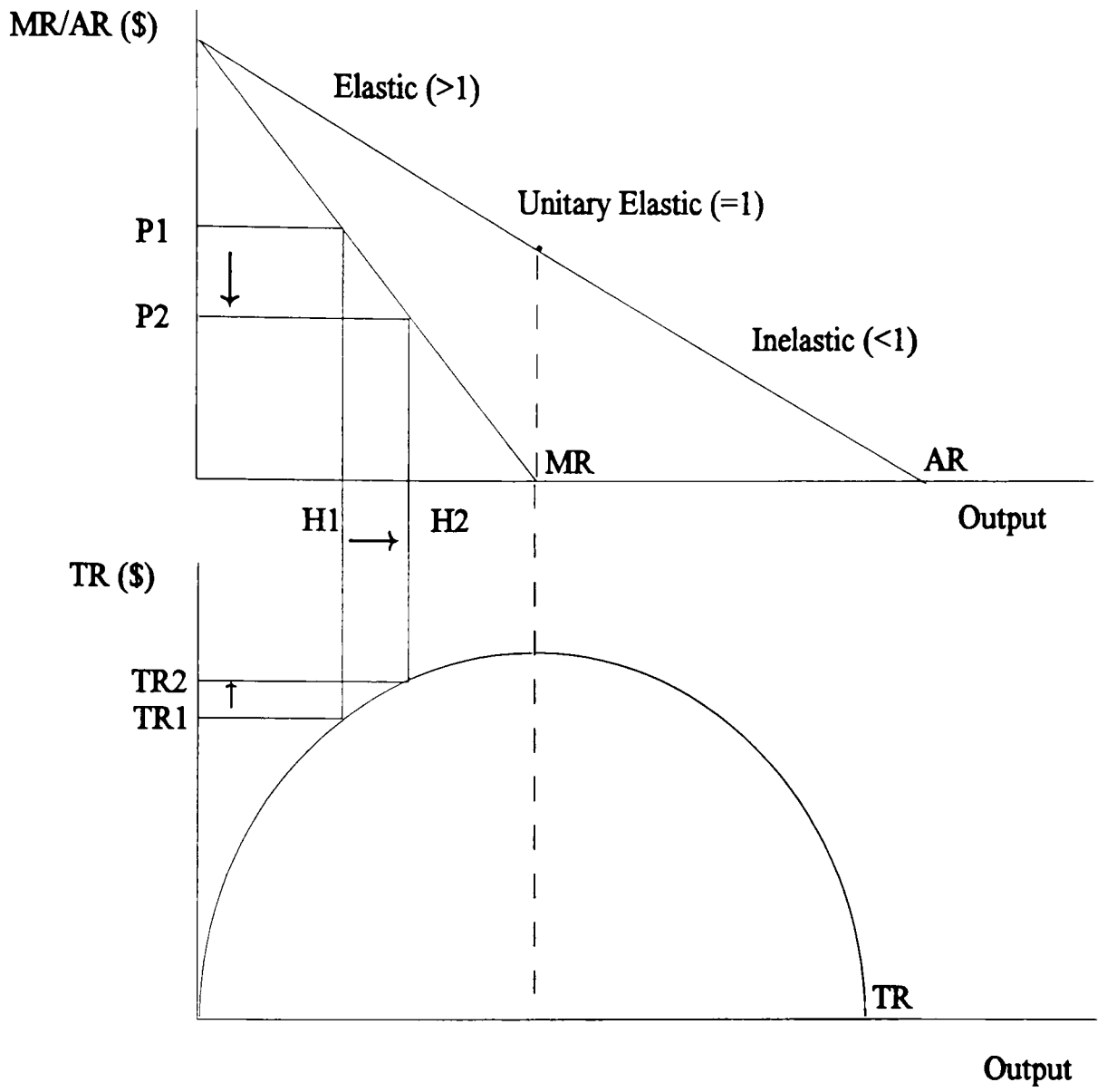

Figure 4: Revenue lines and elasticities for imperfect competition, where Total Revenue is Py * Y, Total Revenue is (Py * Y)/2, and Marginal Revenue is δ(Py * Y). If elasticity is greater than 1 or if Marginal Revenue is positive, it is said to be elastic. If elasticity is equal to 1 or Marginal Revenue is equal to 0, it is said to be unitary elastic. If elasticity is less than 1or Marginal Revenue is negative, it is said to be inelastic.

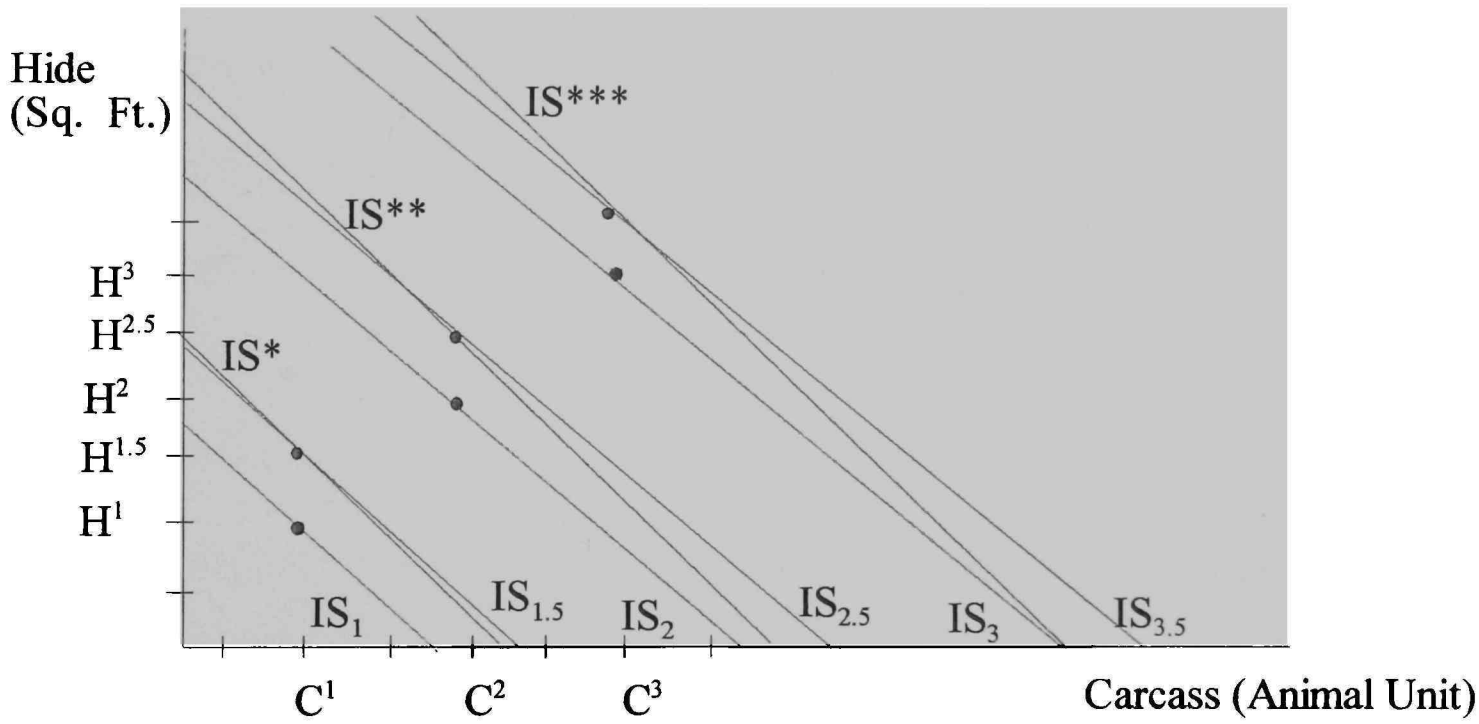

Figure 5: Shift in the intercepts and slopes of Isorevenue Lines due to a decrease in hide prices because of the increase amount of hide (elastic good) in the fiber market, where IS* represents the new isorevenue line.

When one producer changes his/her identification practices and replaces branding, total revenue received for cattle will be increased resulting in the producer operating on a new Isorevenue line. Even when an alternative practice is adopted by the industry as a whole, and the price of hides decreases, the total revenue will increase because hides (leather) are an elastic good. Therefore, if a producer wants to maximize profits, a feasible alternative would be to discontinue branding and increase the amount of usable hide that is proportioned to the production of cattle.

CHAPTER IV

METHODS AND PROCEDURES

The general objective for this study is to elicit information from cattle producers on the potential for producer initiated hide quality improvements. Quality of hides is determined in part as a function of the amount of damage on the hide. Thus, one way to increase hide quality is for producers to discontinue branding and use alternative methods of identification. Three surveys were constructed and submitted to cattle producers, cattle inspectors, and cattle rustlers. Personal interviews were conducted with cattle inspectors and cattle rustlers. The results of this study should provide the leather industry with the values producers place on branding, the factors which influence producers to brand, and the potential for a change in management practices that affect hide quality. Thus, the leather industry may be able to use compensation to affect a change in cattle producer identification methods. Survey development and methods of data analysis are presented within this chapter.

Survey Construction

Surveys were constructed to be sent to cattle producers, cattle inspectors, and cattle rustlers following the guidelines set forth by Dillman (1978). Each survey was specifically constructed to elicit attitudes on cattle identification methods from the different types of respondents. Personal information provided within the surveys were kept confidential.

Producer Survey

The producer survey was developed to elicit information from the cattle producer (see Appendix A). Questions focused on eliciting the producer's perspective toward adopting alternative methods of animal identification. Initially, the type of identification method used on each ranch was determined. If branding was used by a producer, the purpose and relative importance of the brand was indicated in the succeeding questions. Questions pertaining to theft of cattle were also posed. This series of questions will provide the basis for estimating the predominant identification methods used in the study area (Texas), and which identification method (if any) is most successful in deterring theft. The questions are also posed to allow the researcher to estimate the actual purpose and importance of a brand.

Producers were queried about their attitude with respect to acceptance or resistance of changing the identification methods currently being used. These questions were posed to determine if producers were aware of developing technologies and whether they would consider changing to the new methods if they were cost effective.

The cattle producers' survey was mailed to every fourth ranch listed in the *1997-1998 Texas Business Directory*, resulting in a total of 328 recipients. This was a systematic sample with a random start. To increase the sample size, Kyle Smith, Assistant Director of the Texas Agricultural Extension Service, was contacted. Five surveys were mailed to each Texas agricultural extension agent to pass along to cattle producers (ie. 1280 surveys). Thus, a total of 1608 surveys were distributed.

For the first group of 328 producers, the surveys were preceded by an announcement postcard to all 328 ranches (see Appendix A). The announcement postcard stated that a survey would follow within the week. Postage for being sent and also returned was personally applied to each survey. Four weeks after the surveys were mailed, a second postcard (see Appendix A) was sent to non-respondents requesting that they complete the second survey which they would receive in two to three days. A second mailing of the survey went to non-respondent ranches. For the second group of 1280 producers, five surveys were sent to each county extension agent in the state. The agent then personally passed on each survey to a producer. Return postage was personally applied to each survey.

Inspector Survey and Interview

Inspector surveys (see Appendix B) were sent to the thirty-three Texas Southwest Cattle Raisers Association Field Inspectors. Questions were developed so as to estimate the field inspectors' attitudes on theft and branding. Questions elicited information about the number of reports taken on stolen cattle and the method of identification used. The values inspectors place on various identification methods included the ability of a method to deter theft and aid in the recovery of stolen cattle.

The mailing list used to identify field inspectors came from the January 1998 issue of *The Cattleman* magazine. The geographical areas represented by the field inspectors include all of Texas and parts of Oklahoma. Inspectors' surveys were mailed in an envelope with a letter personally addressed to each field inspector. The letter stated the

purpose of the project and why their information would be helpful in this study. Each survey was self-addressed and stamped so that inspectors would find it easy to return them.

Interviews were also conducted with certain cattle inspectors. Questions asked specifically followed up on the inspector's survey. Other questions asked will aid in allowing the study to provide reliable information for the inspectors' views on branding and theft.

Cattle Rustler Survey and Interview

The third survey was created for persons convicted of cattle theft (see Appendix C). This survey was developed to obtain a convicted cattle thief's opinion on brands and was given during a personal interview with cattle rustlers. Survey results should aid in determining whether brands or any other form of identification have actually deter theft. Results also elicited the person's selection priorities used when stealing cattle. This would provide a new perspective on whether branding actually deters theft.

To obtain the ability to talk to cattle rustlers, a trip to Huntsville to visit cattle inspector Butch Davis was made. Mr. Davis offered a contact in the Texas Department of Criminal Justice system, Tom Fordyce, Assistant Director of Agriculture. Mr. Fordyce has agreed to allow visits with convicted cattle rustlers. The surveys were filled out during a personal interview with the convicted cattle rustlers.

Data Analysis

Data from the completed surveys were entered into spreadsheet software. The data was first analyzed via frequency analysis. An additional tool of analysis used was logit modeling.

Frequency Analysis

Frequency analyses will be conducted to categorize information from the data. Examples of this would be comparing the various sizes of respondent ranches, which form of permanent identification has the least amount of theft associated with it, and whether the various size of ranches differ in their form of permanent identification. This will be completed using graphs, pie charts, and other tools of frequency analyses. The first objective for this form of analysis is to determine what identification methods are being used and how theft rates affect them. This information will provide a preliminary understanding of whether cattle are stolen and methods the producer could use to prevent theft.

Logit Models

Cattle producers make an economic decision when they choose among potential methods of animal identification, specifically whether or not to brand. It is not necessarily true that these producers are seeking profit maximization, but utility maximization. This form of analysis assumes that the producer has a specific goal. Because of this, those factors dealing with potential outcomes must be assessed. Producers will make

assessments on income maximization and risk minimization to decide whether to brand or use some other identification method. If a producer increases his risk by not branding, he can increase the value of his hides and increase his total revenue. However, if he loses more cattle due to theft because of not branding, his losses may be greater than his increase in revenue from the hides. This causes the producer's income to decrease, and he loses money by not branding. Because of this, the producer will choose an identification method that increases his income with the smallest risk possible.

In the decision-making process, the producer is assumed to evaluate and compare the utility derived from each alternative specified. The alternatives in this study are whether or not to brand. Because we have only two alternatives, it is assumed that we have a binary-choice model.

The simple linear regression form of the model is

$$Y_i = a + BX_i + \varepsilon_i$$

Where X_i represents the value of the attribute (i.e. size of operation) for the ith individual

$Y_i = 1$ if the first option is chosen (to brand)

$= 0$ if the second option is chosen (not to brand)

ε_i represents an independently distributed random variable with mean of 0.

However, the use of a simple linear regression model in the case of an indicating dependant variable will result in problems. The first problem is that it may lead to inefficient estimates. The estimated coefficients will be inefficient in the case of binary dependant variables because the error terms are not normally distributed. Another problem with the error terms is that they do not have equal variances when the dependant

variable is an indicator variable. A third problem is that the estimated probabilities can be negative or exceed 1 for specific values of the independent variable, leading to meaningless results (Pindyck and Rubinfeld, 1981).

Because of these potential problems, an alternative model should be used. One such model that could be used is the logistic function. This function is expressed as

$$E(Y) = \exp(a + BX) / 1+\exp(a + BX).$$

When the dependant variable is an indicating variable, the shape of the response function will usually be curved with asymptotes at 0 and 1 (see Figure 6). The logistic function specified in the above equation has this property of a probability function. The logistic function may also be specified as a cumulative logistic probability function given that the property of 0 and 1 are also shared by cumulative distribution functions of any random variable. This equation is shown as:

$$Pr_i = F(Z_i) = \exp(Z_i)/(1+\exp(Z_i))$$

$$Z_i = \alpha + BX$$

where $F(Z_i)$ is the cumulative probability function (Pindyck and Rubinfeld, 1981).

The logit or logistic model with the dependant variable represented by branding or not branding will be estimated against independent variables. Some of these independent variables will include the number of cattle a producer runs, whether the producer has experienced theft, if the producer realizes the amount of damage a brand causes to a hide, if the producer realizes the monetary loss due to the brand, and if the producer considers the value of the damage important. This logit model will be run in Stata 5.0.

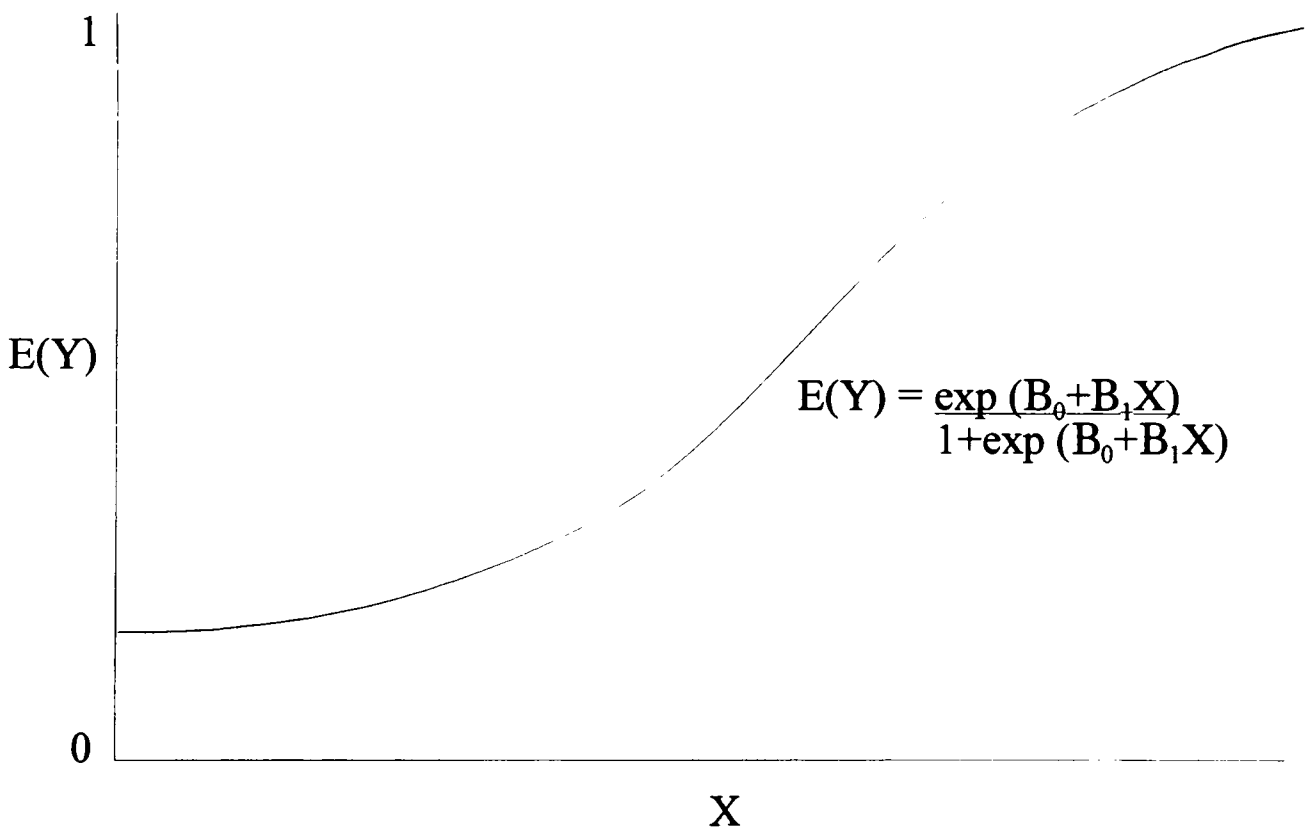

Figure 6: Logistic Response Function showing assymtopes at 0 and 1.

Summary

Data were collected by distributing surveys to cattle producers, cattle inspectors, and convicted cattle rustlers and conducting interviews with cattle inspectors and cattle rustlers. This data included ranching practices used, attitudes about cattle identification methods, and theft. This data allowed us to identify trends in the various areas of the information collected. The producer data was analyzed using a logit model to estimate the probability of theft occurring when certain variables are present. Also, the data was analyzed to determine which factors must be present for a producer to brand or not to brand. By completing this estimation, we can determine whether branding deters theft well enough to warrant the damage to the hide and whether producers can be convinced to discontinue branding practices.

CHAPTER V

PRODUCER RESULTS

Producer surveys (see Appendix A) were distributed to 1608 cattle producers in Texas. A total of 765 completed surveys were returned, representing a 48 percent response rate. Questions were developed to elicit the cattle producer's attitude toward branding and other cattle identification methods. Survey recipients were selected by two methods. One group of recipients was identified by Texas Agricultural Extension Service agents. The second group's addresses were taken from the mailing list 1997-98 *Texas Business Directory*. Responses on returned surveys were encoded in spreadsheet format and analyzed using software entitled Stata 5.0 developed by Stata Corporation of College Station, Texas.

Frequency Analyses

Frequency analyses for various questions presented were conducted on the responses of the 765 respondent cow-calf producers (see Appendix A). Producer surveys were separated into twenty-one groups according to the number of cattle produced (see Figure 7). Although group 10 (producers who own 501 to 750 head of cattle) had the highest percentage of respondents, 13 percent, the mean falls in group 8 (producers who own 301 to 400 head of cattle).

Of the 765 respondents, 487 (64 percent) use a combination of fire brand and other form of identification, 196 respondents (25 percent) use only fire branding, and 82 respondents (11 percent) use only some other forms of identification other than fire brands

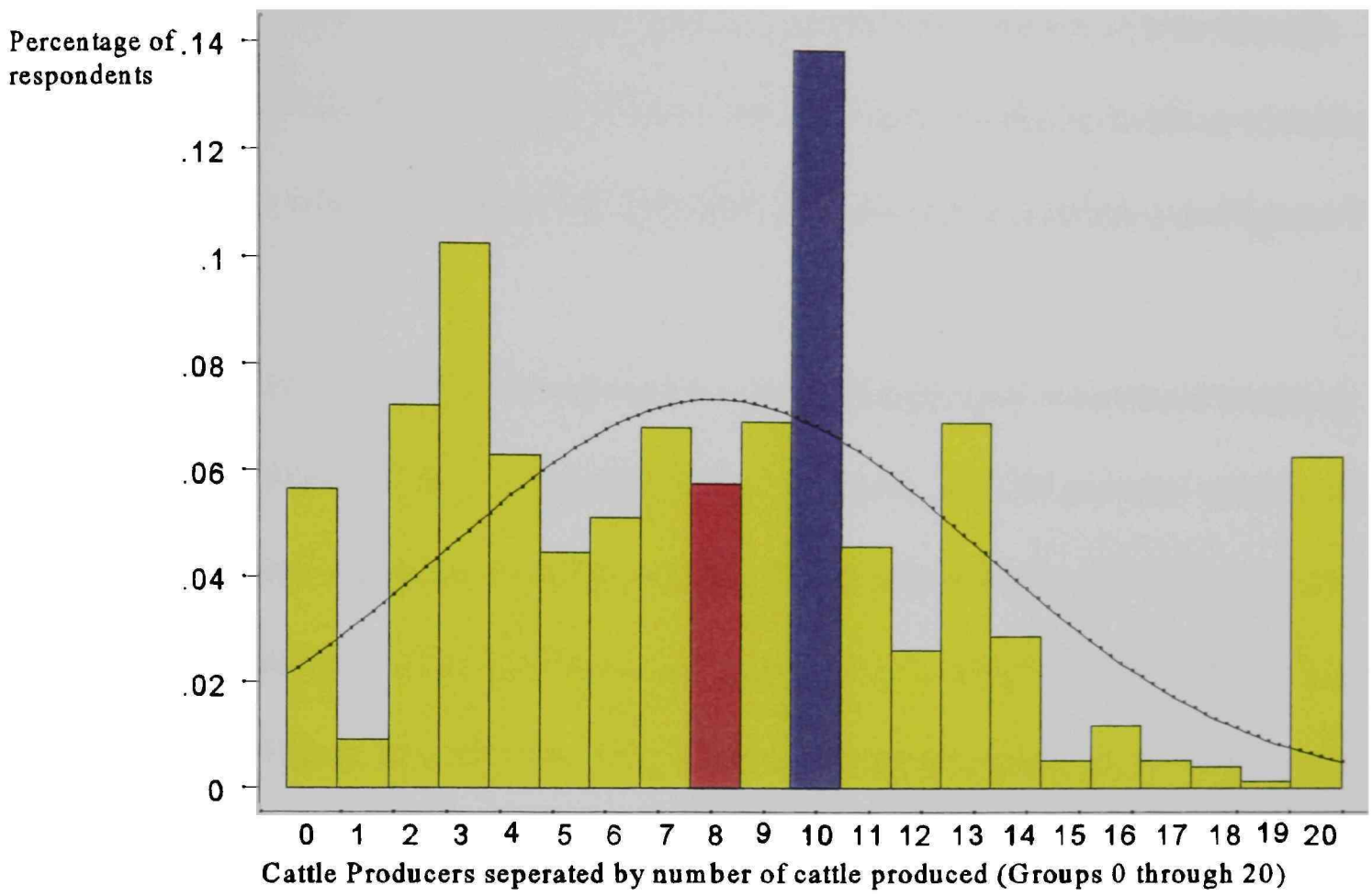

Figure 7: Percentage of producer survey respondents separated into groups (0 through 20) by the number of cattle produced. The highest response rate was group 10, representing 501 to 750 head of cattle (shown in blue). The mean was group 8, representing 300 to 401 head of cattle (shown in red). Where:

0 = 1-25 head of cattle	1 = 26-50 head	2 = 51-75 head
3 = 76-100 head	4 = 101-150 head	5 = 151-200 head
6 = 201-250 head	7 = 251-300 head	8 = 301-400 head
9 = 401-500 head	10 = 501-750 head	11 = 751-1000 head
12 = 1001-1500 head	13 = 1501-2000 head	14 = 2001-2500 head
15 = 2501-3000 head	16 = 3001-3500 head	17 = 3501-4000 head
18 = 4001-4500 head	19 = 4501-5000 head	20 = 5000 or more head

(see Figure 8). Therefore, 89 percent of the survey respondents use fire brands to identify their cattle. Of the 765 respondents, 696 (91 percent) were aware of hide damage caused by branding, 643 (84 percent) were aware of loss in value to hides as a result of brand damage, and 286 (37 percent) considered the damage a problem (see Figures 9 through 11).

Of those respondents who do not brand, 34 (42 percent) considered branding damage a problem. Of those respondents who do brand, 255 (37 percent) considered branding damage a problem (see Figure 12). Of 765 respondents, 439 (57 percent) were aware of microchips and 114 (15 percent) were willing to adopt the microchip in place of branding (see Figure 13). Of those respondents who do not brand, 11 (13.4 percent) are willing to adopt microchips. Of those respondents who do brand, 103 (15.1 percent) are willing to substitute microchips for the brands (see Figure 14).

Survey recipients were asked to indicate the monetary premium per head they would require to persuade them to quit branding and to produce native hides. The premiums that respondents asked for most are $5 per hide (5.4 percent), $10 per hide (16.6 percent), $15 per hide (7.6 percent), $20 per hide (11.4 percent). The average premium required to persuade producers to quit branding was $13.54 per head (see Figure 15).

Of the 765 respondents, 219(29 percent) producers have experienced theft of cattle (see Figure 16). Theft occurred more often for cattle producers owning 751 or more head of cattle than those owning fewer cattle. Of those respondents who brand, 196 (28.7 percent) have experienced theft (see Figure 17). Of those respondents who do not brand,

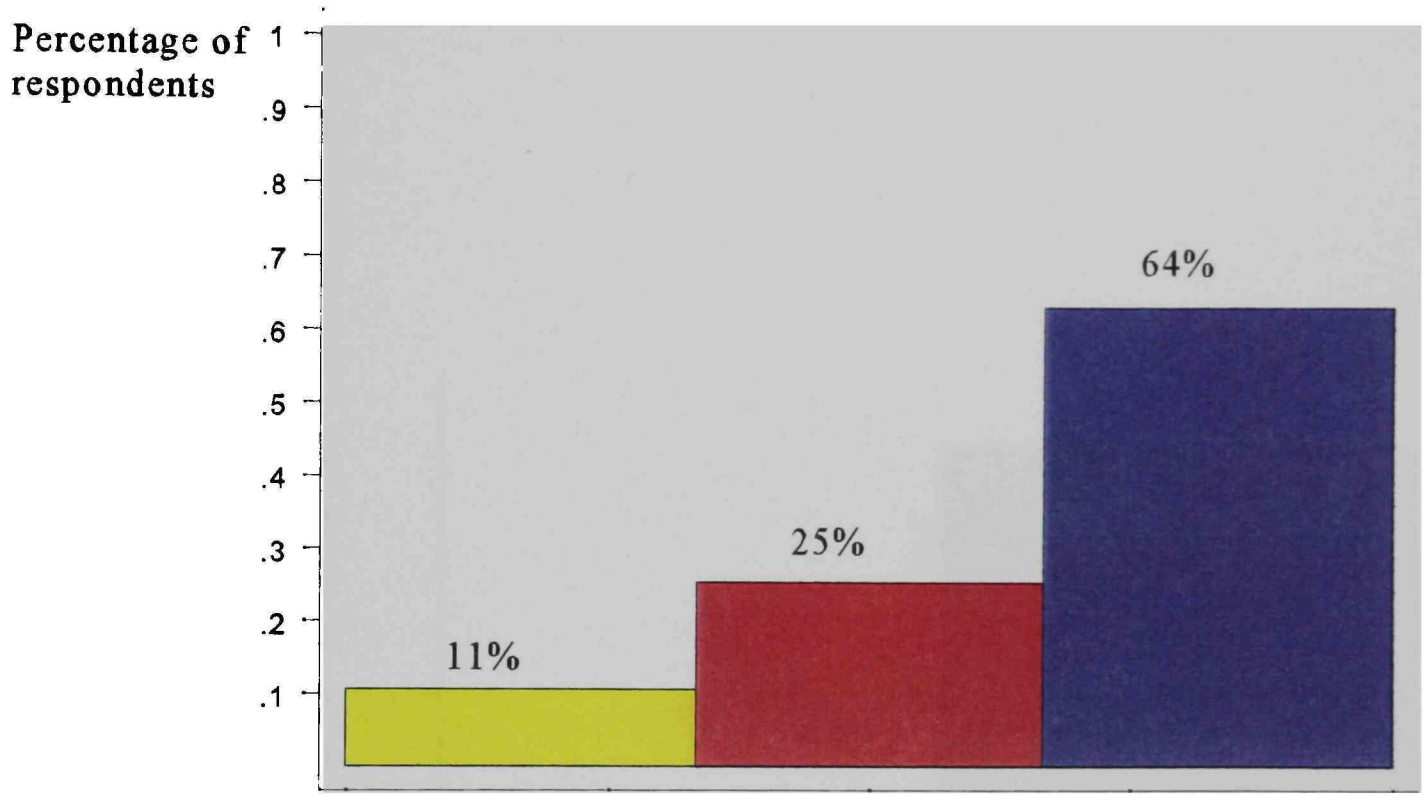

Figure 8: Types of identification methods used by producers, no fire brand , just fire brand and fire brand and others. Where:

Yellow = No Fire Brand
Red = Just Fire Brand
Blue = Fire Brand and some Other Form of Identification

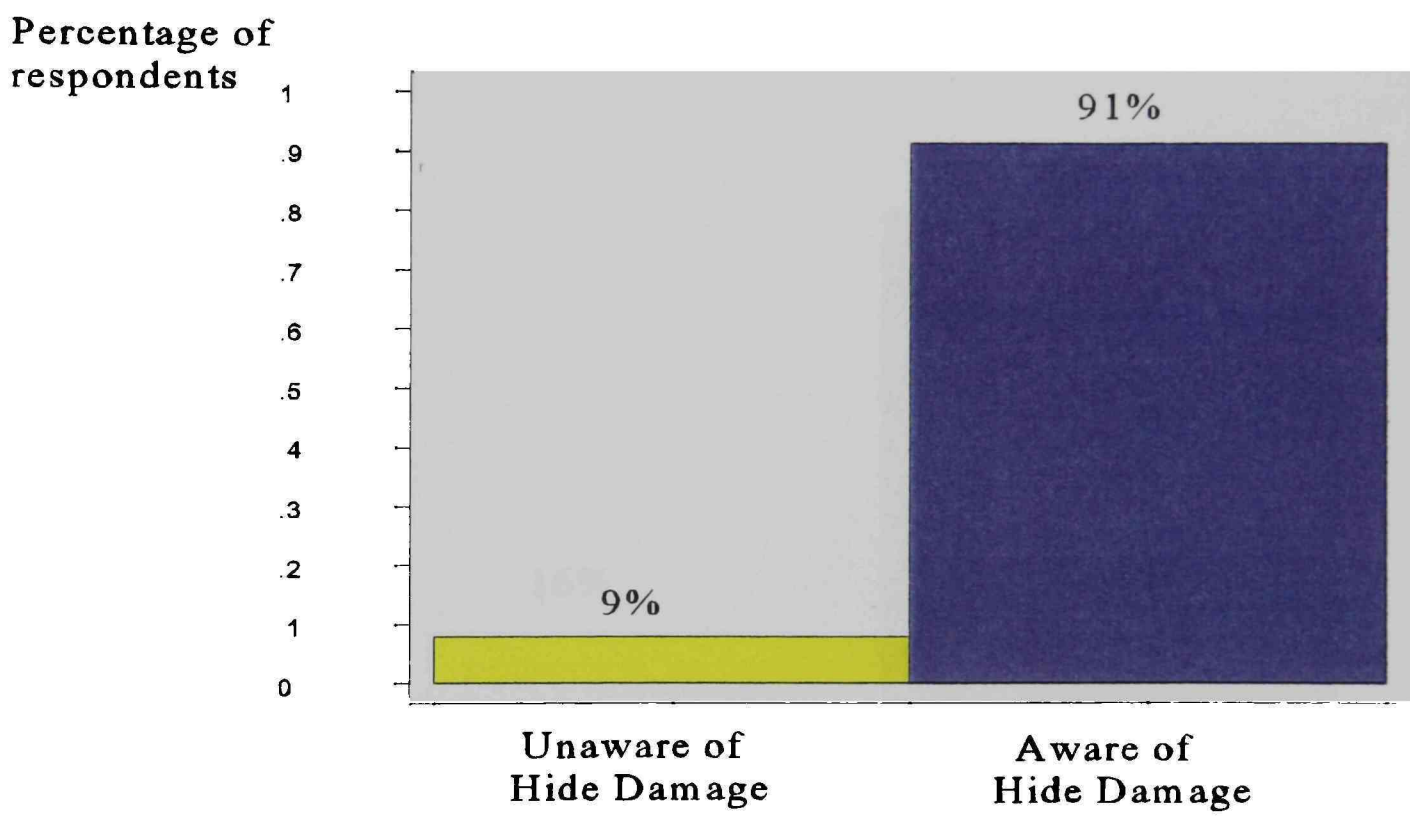

Figure 9: Response of Producers that are aware of hide damage as a result of branding.

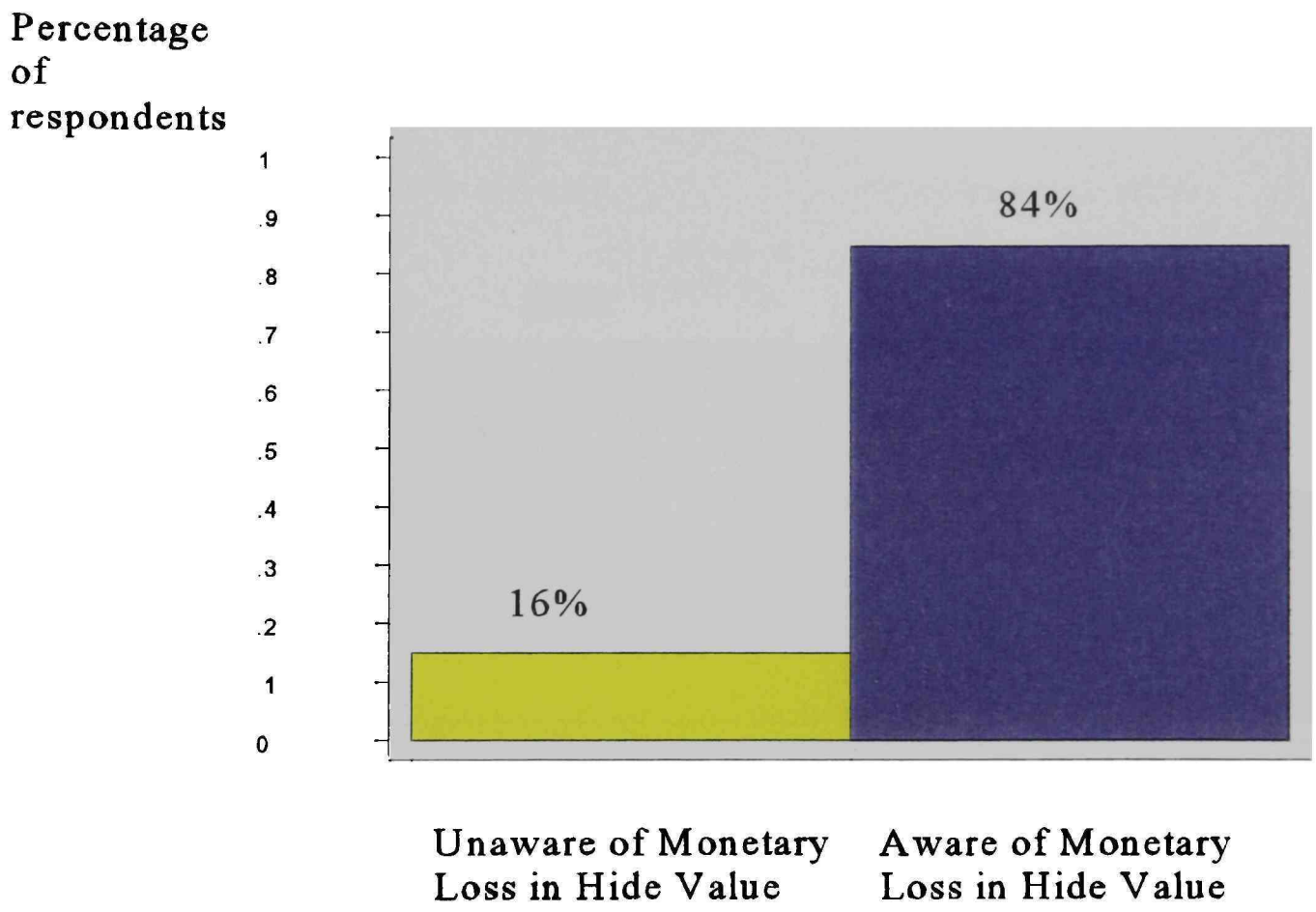

Figure 10: Response of Producers who are aware of monetary loss in hide value as a result of branding.

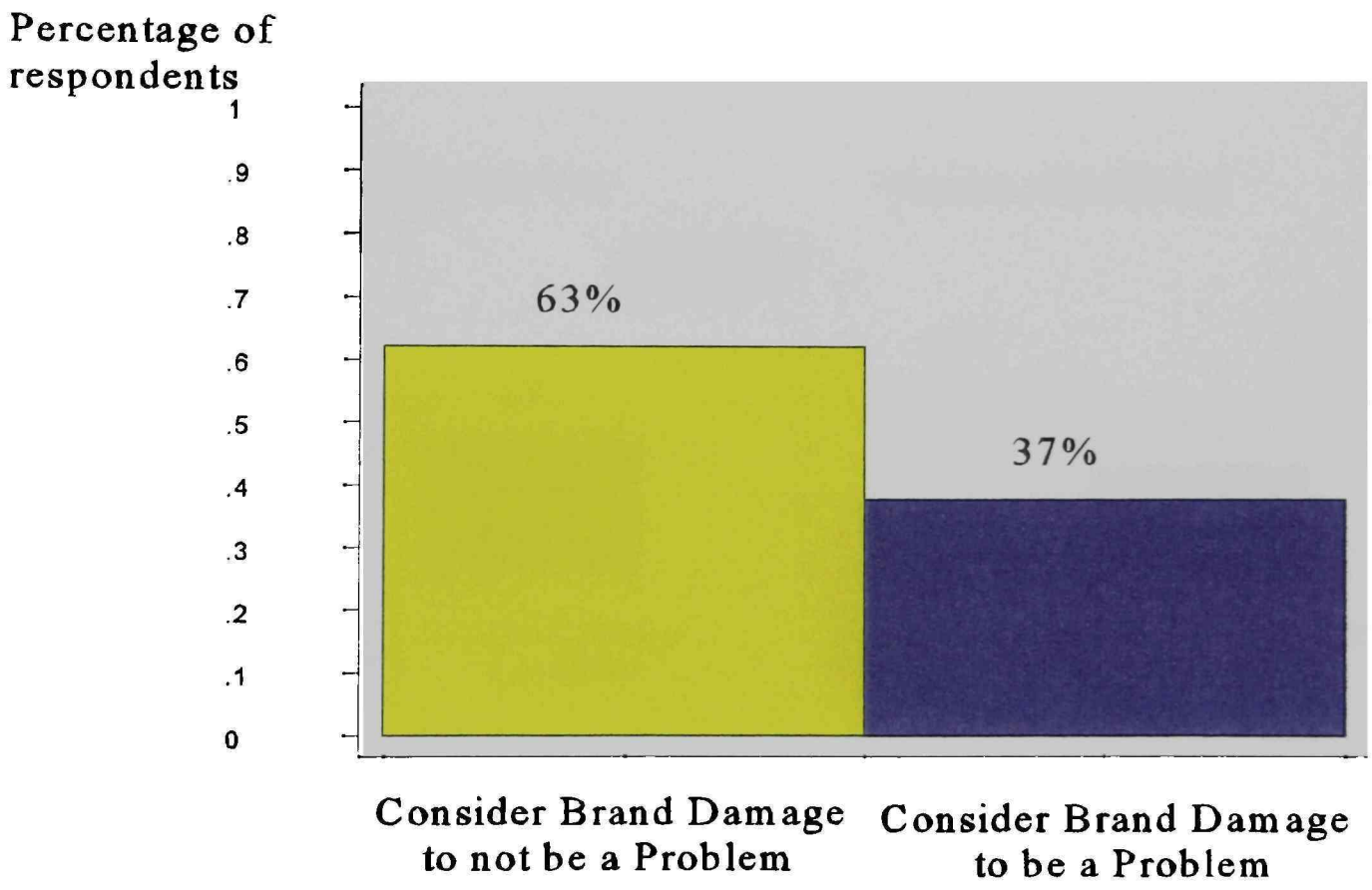

Figure 11: Response of Producers who consider brand damage a problem.

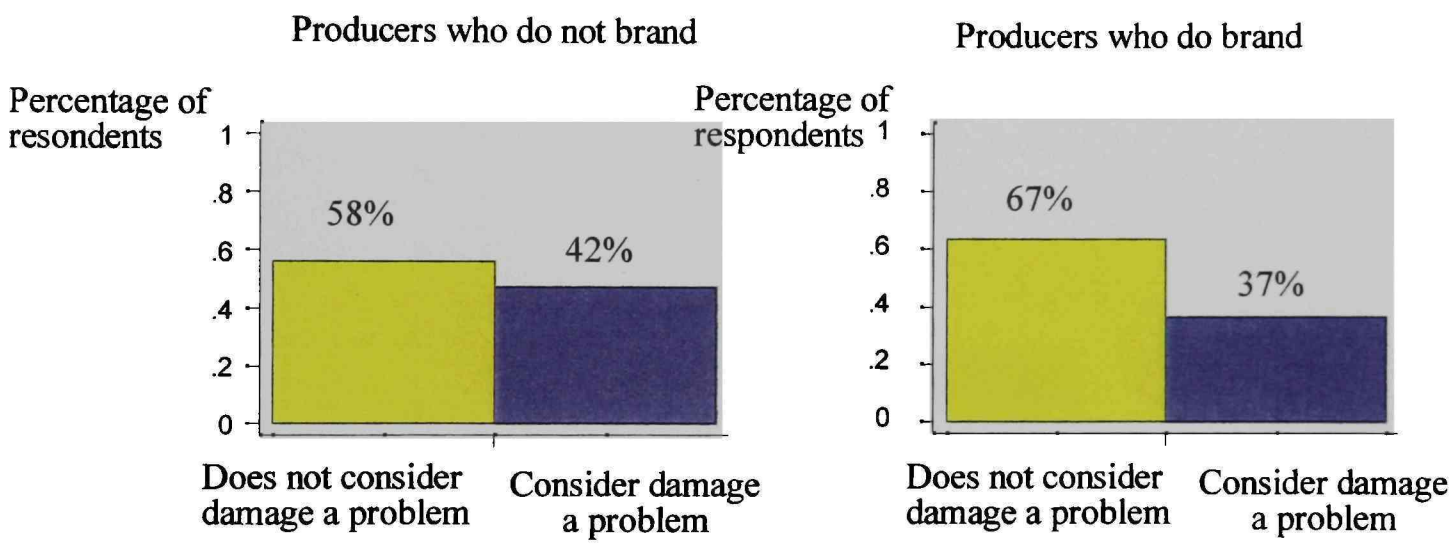

Figure 12: Percentage of producers who consider damage to be a problem.

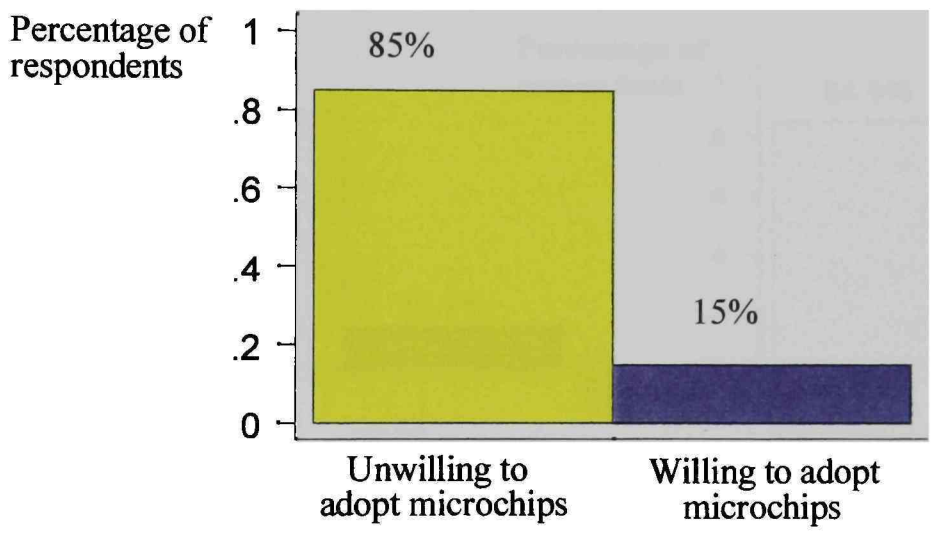

Figure 13: Percentage of producers who are willing to adopt microchips.

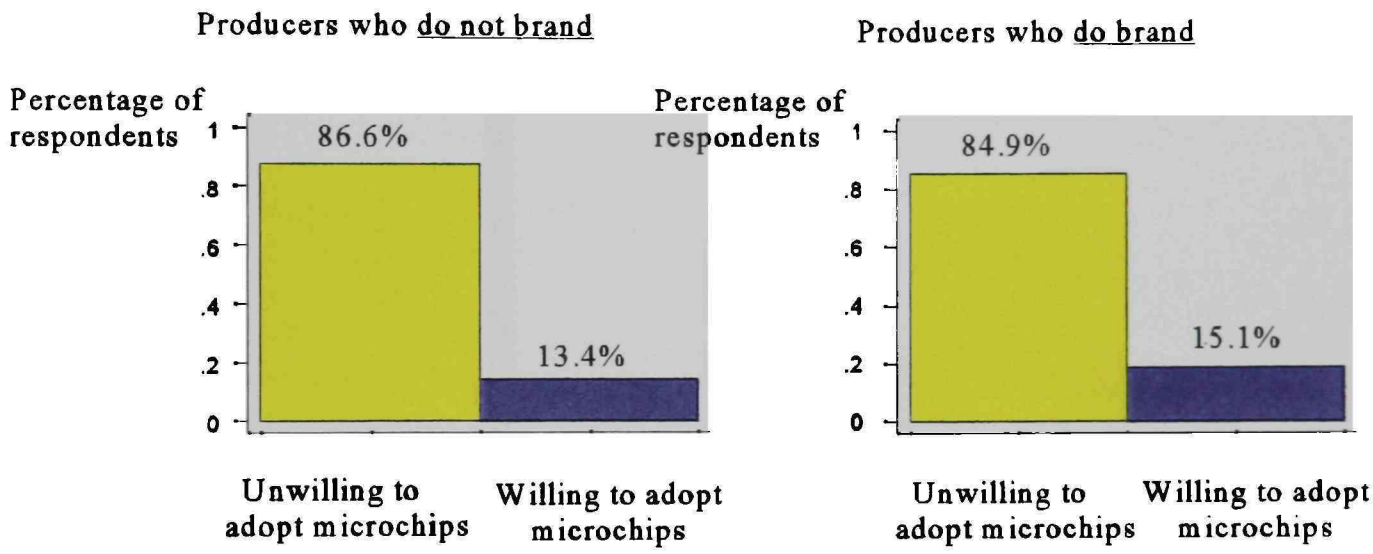

Figure 14: Percentage of producers who are willing to adopt microchips.

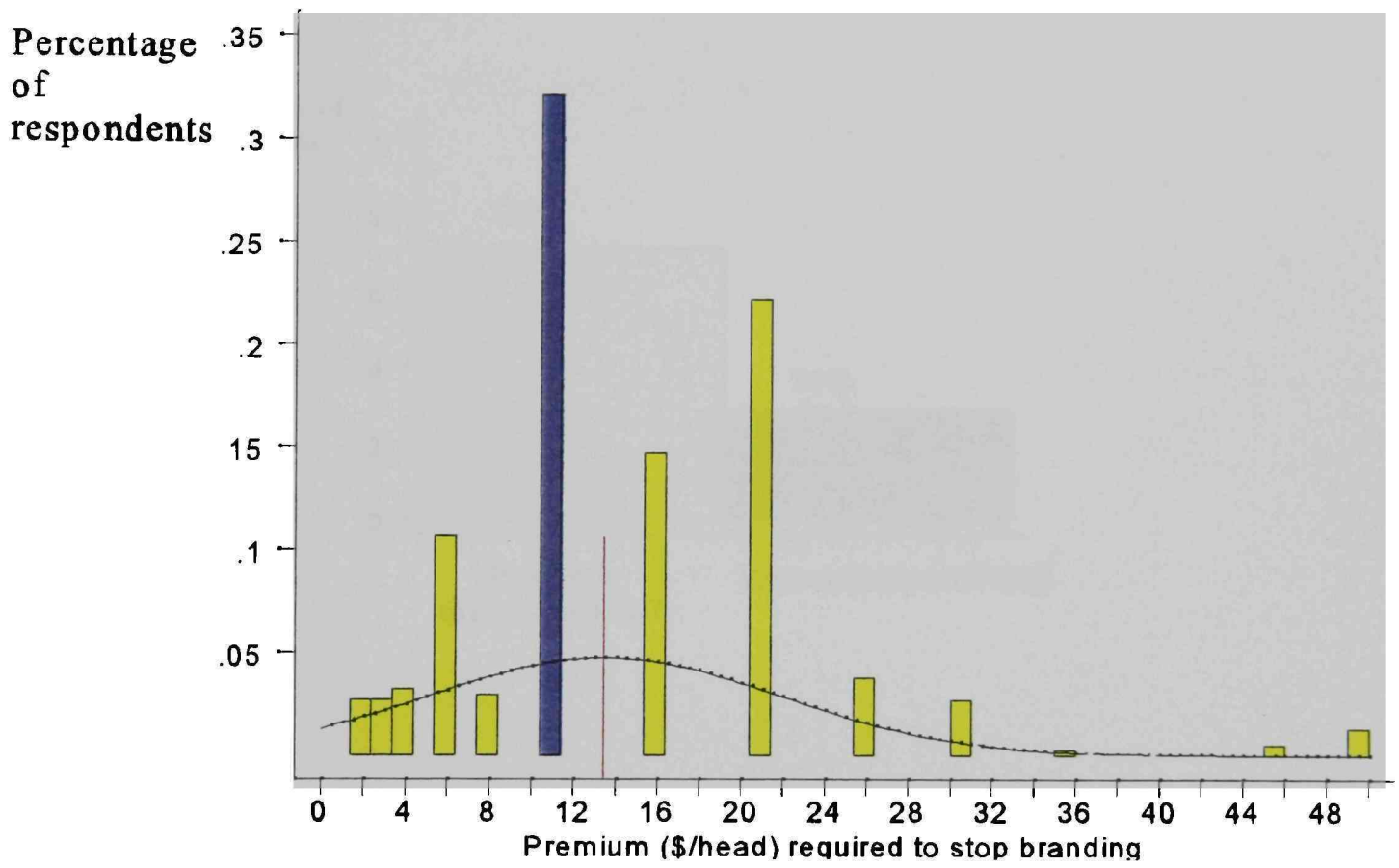

Figure 15: Value of monetary incentive required for producers to quit branding, as a percentage of producer survey respondents. Where:

Blue = Amount asked for most often ($10).
Red = Mean amount at $13.54.

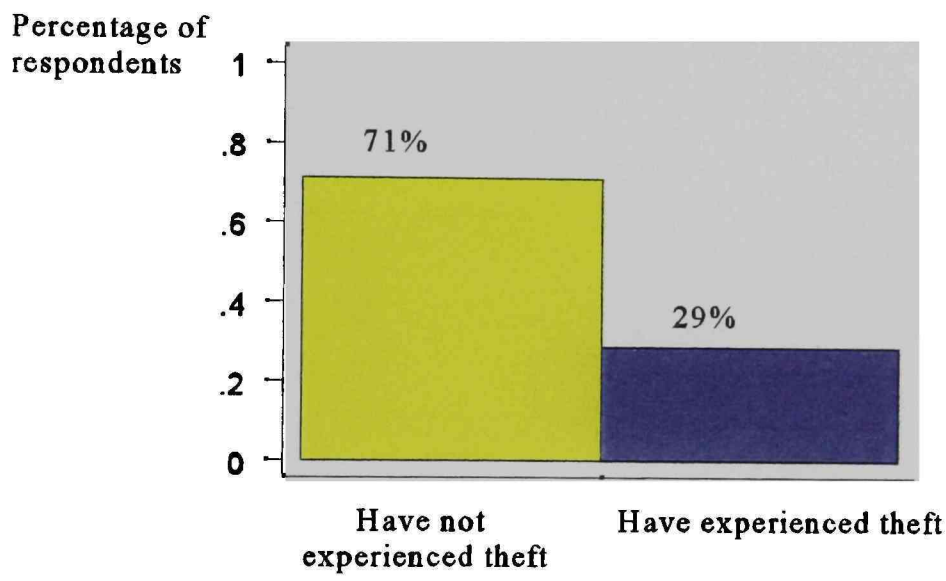

Figure 16: Percentage of producers who have experienced theft.

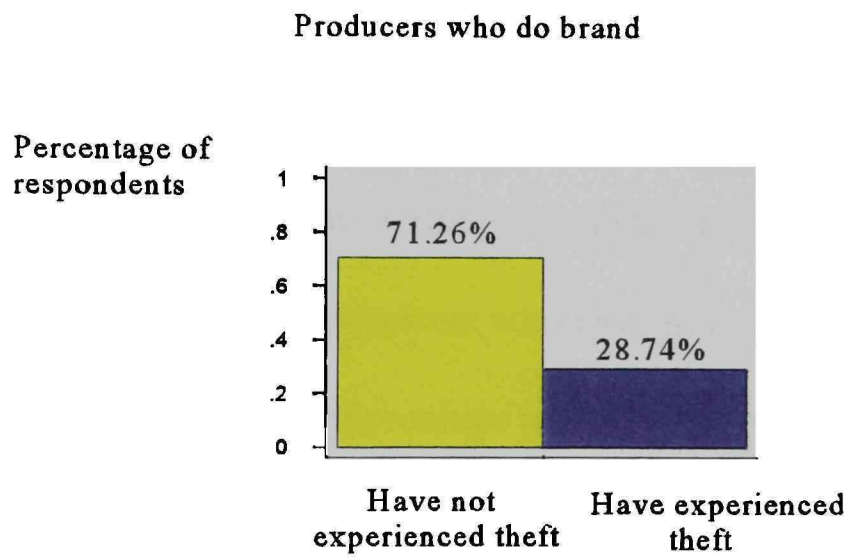

Figure 17: Percentage of producers who brand that have experienced theft.

24 (29.3 percent) have experienced theft (see Figure 18). Of those respondents who have experienced theft, 215 (97.7 percent) are aware of the damage caused by branding, 199 (90 percent) are aware of loss of value to hides as a result of branding, and 105 (48 percent) consider the branding damage a problem (see Figures 19 through 21). Of those respondents who have not experienced theft, 487 (90 percent) are aware of the damage caused by branding, 450 (83 percent) are aware of loss of value to hides as a result of branding, and 184 (34 percent) consider branding damage a problem (see Figures 22 through 24). Of those respondents who have experienced theft, 127 (58 percent) are aware of the use of microchips as a form of cattle identification (Figure 25), and 65 (30 percent) are willing to substitute microchip identification for branding (Figure 26). Of those respondents who have not experience theft, 315 (58 percent) were aware of the use of microchips to identify cattle (Figure 25), and 49 (9 percent) were willing to substitute microchip identification for branding (Figure 26).

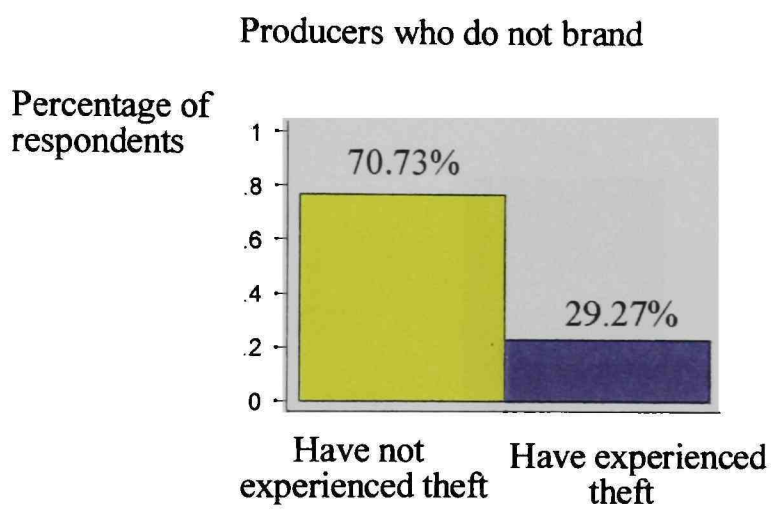

Figure 18: Percentage of producers who do not brand that have experienced theft.

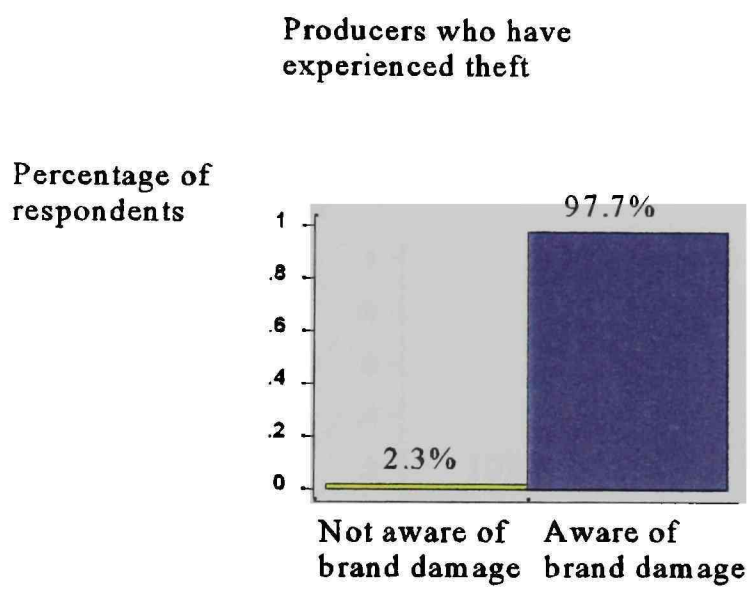

Figure 19: Percentage of producers that have experienced theft who are aware of hide damage as a result of branding.

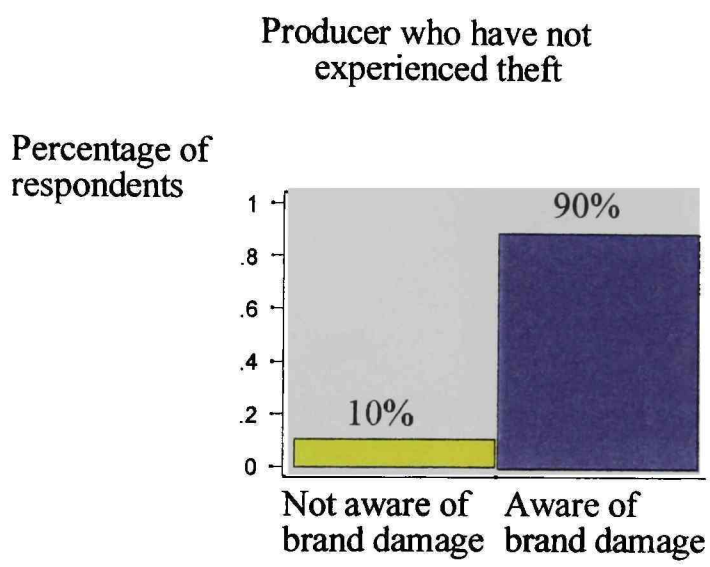

Figure 20: Percentage of producers that have not experienced theft who are aware of hide damage as a result of branding.

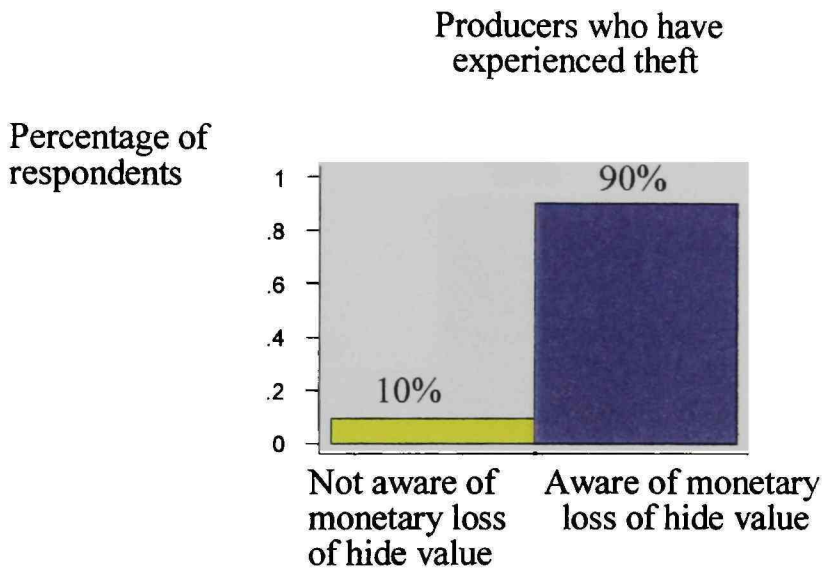

Figure 21: Producers who have experienced theft who are aware of the monetary loss of hide value due to brand damage.

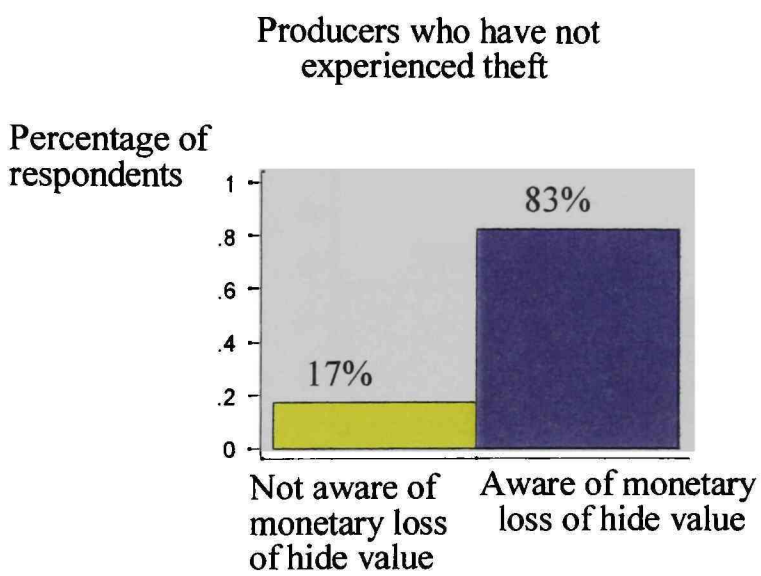

Figure 22: Producers who have not experienced theft who are aware of the monetary loss of hide value due to brand damage.

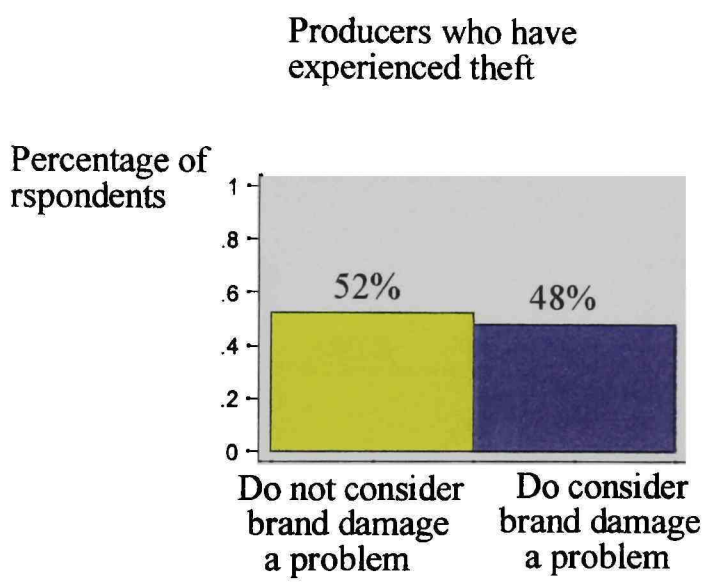

Figure 23: Producers who have experienced theft who consider brand damage to be a problem.

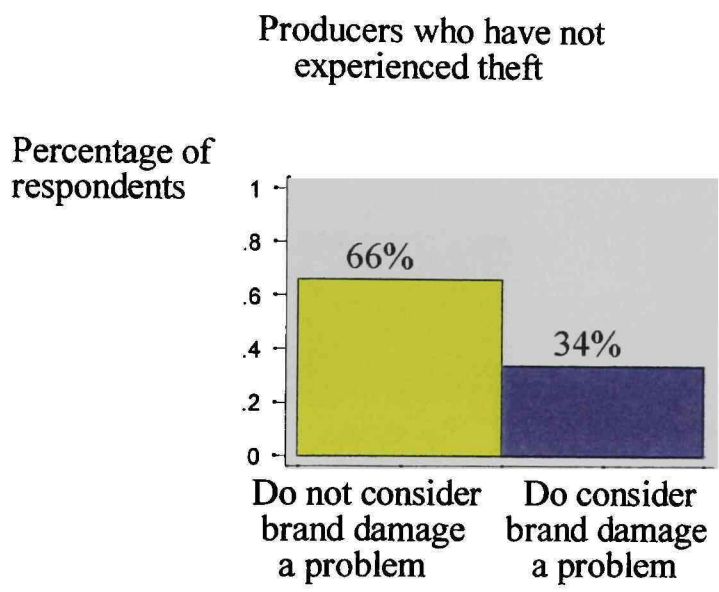

Figure 24: Producers who have not experienced theft who consider brand damage to be a problem.

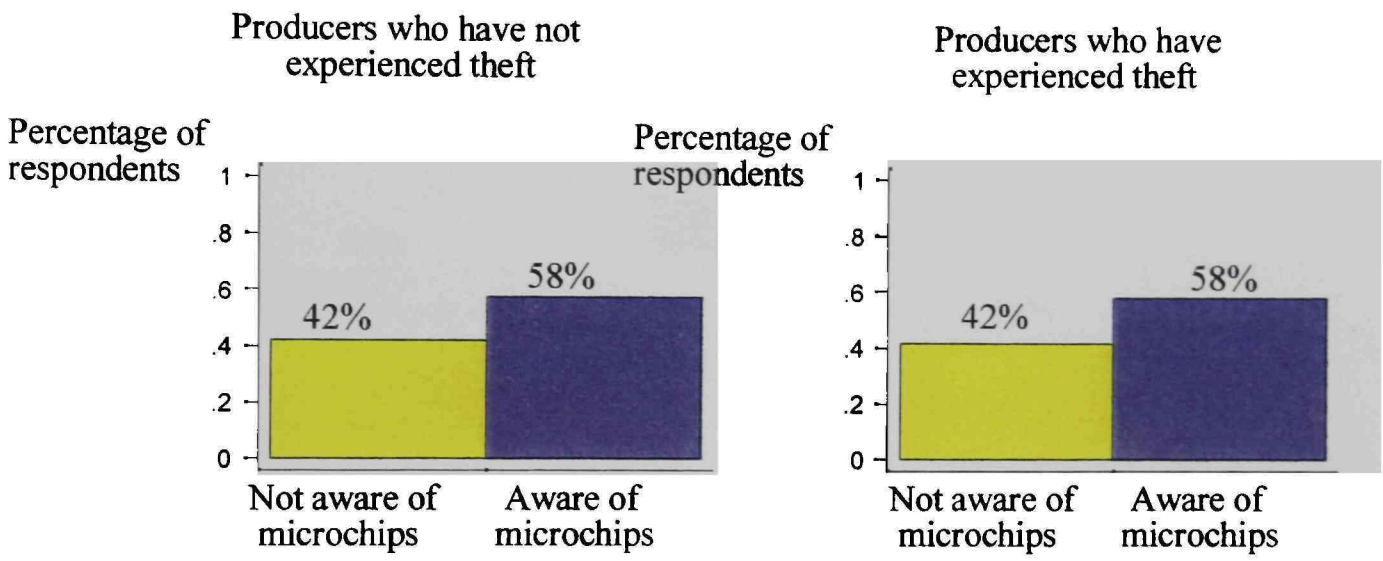

Figure 25: Producers who have and have not experienced theft that are aware of the use of microchips for cattle identification purposes.

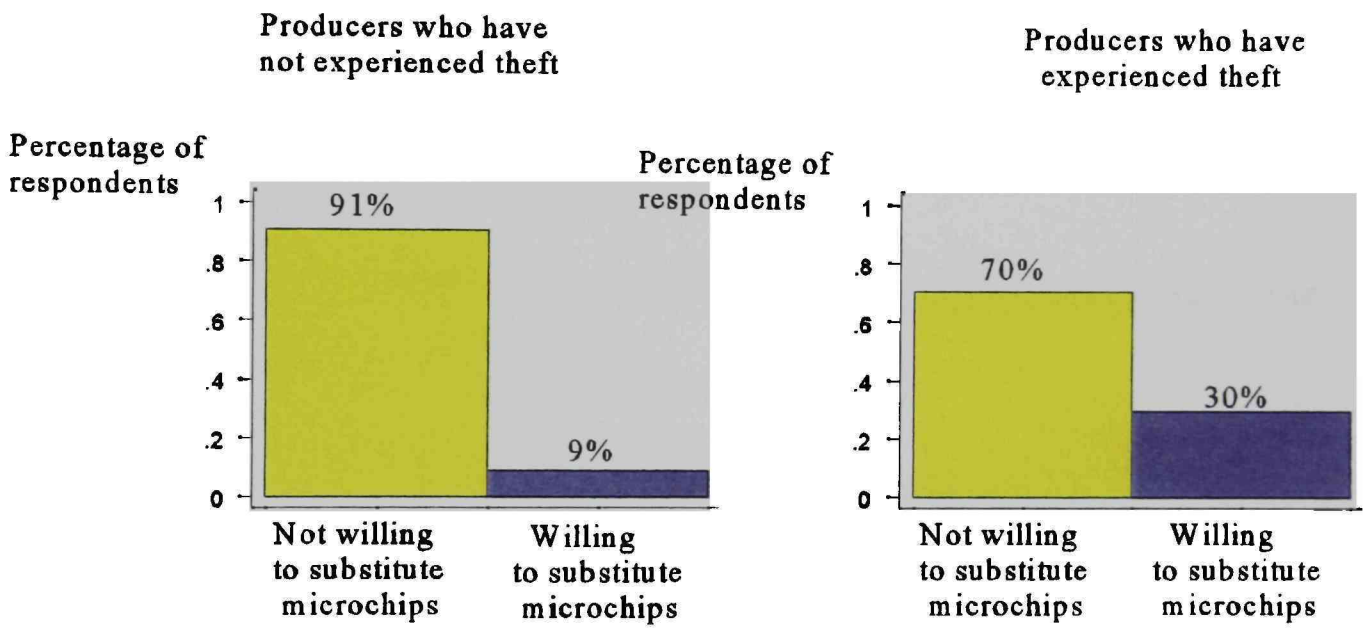

Figure 26: Producers who have and have not experienced theft that are willing to substitute microchips for their identification purposes.

Logit Models

To determine factors that influence producers' branding practices, the following model was developed.

Model 1- $B = f(\overset{+}{NC}, \overset{-}{AL}, \overset{-}{DP}, \overset{+}{T})$

Where: B = 1 if a producer Brands;

= 0 otherwise;

NC represents the Number of Cattle produced;

AL = 1 if a producer is Aware of Loss in value to hides as a result of branding;

= 0 otherwise;

DP = 1 if a producer considers branding Damage to be a Problem;

= 0 otherwise;

T = 1 if a producer has experienced Theft;

= 0 otherwise.

As a respondent's number of cattle (NC) produced increases, it is assumed that the producer is more likely to brand. This assumption is made for two reasons. First, producers with more to lose (i.e., having a greater number of cattle) should be more inclined to protect their investment, and therefore, brand their cattle. Second, a producer with a greater number of cattle is more capable of capturing the economies of size to invest in the equipment and labor required to brand. Therefore, the coefficient for the variable NC is expected to be positive. Assuming that as producers become increasingly aware of loss in hide value resulting from branding, the producer is less likely to brand.

Therefore, the coefficient for the variable AL is expected to be negative. The more a producer considers branding damage to be a problem, the less likely the producer should be to brand. Thus, the coefficient for the variable DP is expected to be negative. Additionally, the more a producer experiences theft of cattle, the more likely the producer will permanently identify his/her cattle (i.e., brand). Therefore, the coefficient for the variable T is expected to be positive.

The logit form for this model is:

$$E(B) = \frac{\exp(B_0 + B_1NC + B_2AL + B_3DP + B_4T)}{1 + \exp(B_0 + B_1NC + B_2AL + B_3DP + B_4T)}$$

Results of analysis for the above model are:

Model 1.1- B = .99 + .12NC + 1.37AL - 1.25DP + .13T chi-square (48.33) N=761

	[1.13]	[3.96]	[.23]	[1.13]
(3.52)	(3.84)	(4.16)	(-4.14)	(.4)

The numbers in brackets represent the odds ratio for the respective coefficients. The numbers in parenthesis represent the z-value for the respective coefficients. Theft was found to be not significantly different from zero at the .01 level and was dropped. The model was rerun with theft omitted.

Results of analysis for the new model are:

Model 1.2- B = 1.0 + .12NC + 1.38AL - 1.24DP chi-square (48.17) N= 761

	[1.13]	[3.96]	[.23]
(3.52)	(3.84)	(4.16)	(-4.14)

Cattle number (NC), being aware of monetary loss (AL), and considering damage a problem (DP) were all significantly different from zero at the .001 level. Although the

signs of the coefficients for NC and DP were as expected, the sign for AL was not. This may be because cow-calf producers are aware of the monetary loss resulting from branding, but not be willing to discontinue branding because they perceive that they do not receive monetary rewards to produce undamaged hides. The model resulted in a chi-square coefficient of 48.33 with 3 degrees of freedom. The value of the chi-square coefficient indicates that the relationships expressed in the model are significantly different from zero at the .001 level and there is a statistical relationship between the dependant variable B and the independent variables NC, AL, and DP.

Theft was not significant in the previous model. The following model was developed to determine whether branding and theft are related when considered in a simplified model:

Model 2- $B = f(T)$

Where the variables are as previously defined.

As previously stated, it is expected that branding will increase as the producer has experienced theft. Therefore, the coefficient for the variable T should be positive.

The logit form for this model is:

$$E(B) = \frac{\exp(B_0 + B_1 T)}{1 + \exp(B_0 + B_1 T)}$$

Results of analysis for the above model are:

Model 2.1- $B = 2.29 + .32T$ chi-square (1.18) N= 765

[1.38]

(15.43) (1.06)

Although the coefficient for Theft (T) is positive, it is not significantly different from zero.

The chi-square coefficient is 1.18 with 1 degree of freedom and is not significantly different from zero. This indicates that the null hypothesis (i.e., that there is no relationship between B and T) can not be rejected.

Whether a producer who owns more cattle is more likely to experience cattle theft than a producer who owns fewer cattle was also considered. The proposed model to address this question is:

Model 3- $T = f(NC)$

Where the variables are as previously defined.

It is assumed that as the number of cattle a producer has increases, theft will increase. This is because the more cattle a producer has, the less likely that producer might notice cattle missing, and that cattle thieves rely on this assumption. Therefore, it is expected that the coefficient for the variable NC will be positive.

The logit form for this model is:

$$E(T) = \frac{\exp(B_0 + B_1 NC)}{1 + \exp(B_0 + B_1 NC)}$$

Results of analysis for the above model are:

Model 3.1- $T = -1.56 + .07NC$ chi-square (18.17) N= 761

[1.07]

(-9.18) (4.23)

The coefficient for Number of Cattle (NC) was significantly different at the .001 level. This model resulted in a chi-square coefficient of 18.17 with 1 degree of freedom. This indicates that the relationships expressed in the model are significantly different from zero at the .001 level. Thus, there is a significant relationship between the dependant

variable T and the independent variable NC.

Another question that can be drawn from the producer survey data is "what factors influence producers to consider branding damage a problem?" The proposed model to address this question is:

Model 4- $$DP = f(\overset{+}{AL}, \overset{+}{NC}, \overset{-}{B}, \overset{+}{MC})$$

Where: MC = 1 if a producer is aware of MicroChip identification;

= 0 otherwise;

The other variables are as previously defined.

As a producer is more aware of loss in hide value resulting from branding, he/she will more likely consider branding damage a problem. Therefore, the coefficient for the variable AL is expected to be positive. As the number of cattle produced increases, producers are expected to consider branding damage a problem. This is because he/she has more investment in production, and stand to lose more money by damaging a hide. Therefore, the coefficient for the variable NC is expected to be positive. Producers using branding in their identification methods are not as likely to consider branding damage a problem as those who do not use branding. Otherwise, they would not be using branding. Therefore, the coefficient for the variable B is expected to be negative. Producers who are aware of the use of electronic microchips for cattle identification are more likely to consider brand damage a problem. It is assumed that if the producer is aware of electronic microchips, then he/she has looked into different forms of identification. One reason to look into different types of identification is to prevent the

damage done to the hide as a result of branding. Therefore, the coefficient for the variable MC is expected to be positive.

The logit form for this model is:

$$E(DP) = \frac{\exp(B_0 + B_1AL + B_2NC + B_3B + B_4MC)}{1 + \exp(B_0 + B_1AL + B_2NC + B_3B + B_4MC)}$$

Results of analysis for the above model are:

Model 4.1- $DP = -1.96 + 1.96AL + .06CN - 1.42B + .83MC$ Chi-square (109.8)

		[7.01]	[1.06]	[.24]	[2.28]	N=759
	(-5.21)	(5.59)	(3.70)	(-4.68)	(4.86)	

The coefficients for awareness of monetary loss due to brand damage (AL), number of cattle produced (NC), whether a producer brands (B), and whether a producer is aware of microchip identification (MC) were all significantly different from zero at the .001 level and all had signs as expected. The model resulted in a chi-square coefficient of 109.8 with 4 degrees of freedom. This indicates that the relationships expressed in the model are significantly different from zero at the .001 level.

Another question that can be drawn from the producer survey data is, "what factors influence producers to become aware of microchip identification?" The proposed model addressing the above issue is:

Model 5- $MC = f(\overset{+}{NC}, \overset{+}{AL}, \overset{+}{DP}, \overset{+}{T})$

Where the variables are as previously defined.

As the number of cattle produced increases, the producer is more likely to be aware of microchips. This is because he/she has more investment to protect, so he/she will keep more informed on new technology that will protect his/her investments. Therefore, the

coefficient for the variable NC is expected to be positive. As a producer is aware of monetary loss on hides due to brand damage, the more likely he/she will be aware of microchips because the use of the microchips cause a reduction in hide damage. Therefore, the coefficient for the variable AL is expected to be positive. If a producer considers brand damage a problem, the more aware he/she will be of the use of microchips for cattle identification. Therefore, the coefficient for the variable DP is expected to be positive. If a producer has experienced theft, the more likely he/she will be aware of microchips. This is because he/she will be searching for better identification methods to protect his/her investment. Therefore, the coefficient for the variable T is expected to be positive.

The logit form for this model is:

$$E(MC) = \frac{\exp(B_0 + B_1NC + B_2AL + B_3DP + B_4T)}{1 + \exp(B_0 + B_1NC + B_2AL + B_3DP + B_4T)}$$

Results of analysis for the above model are:

Model 5.1- MC = -.69 + .04CN + .55AL + .84DP - .20T Chi-square (53.36)
[1.04] [1.71] [2.29] [.82] N=761
(-3.32) (2.31) (2.5) (4.99) (-1.16)

The coefficient for theft (T) was not significantly different from zero and was dropped. The model was then re-run.

Results of analysis for the new model are:

Model 5.2- MC = -.71 + .04CN + .54AL + .83DP chi-square (52) N= 761
[1.04] [1.71] [2.29]
(-3.32) (2.31) (2.5) (4.99)

The signs of the coefficients for cattle number (NC), aware of monetary loss (AL), and

considering damage a problem (DP) were as expected. The coefficients associated with NC, AL, and DP were all significantly different from zero at the .01 level. The model had a chi-square of 52 with 3 degrees of freedom, indicating that the relationships expressed in the model are significantly different from zero at the .001 level.

The next question that can be drawn from the producer survey data is, "what factors influence producers to consider adopting microchips?" The proposed model to address this question is:

Model 6- $SC = f(\overset{+}{NC}, \overset{+}{AL}, \overset{+}{DP}, \overset{+}{T})$

Where SC = 1 if producers are willing to substitute microchips;

= 0 otherwise.

Other variables are as previously defined.

As the number of cattle produced increases, producers are expected to be more willing to substitute microchips in place of branding. As stated earlier, producers with more to lose (i.e. having a greater number of cattle) should be more inclined to protect their investment, and therefore, use the best perceived available identification method on their cattle. Also, a producer with a greater number of cattle is more capable of capturing the economies of size to invest in the equipment and labor required to use microchips. Therefore, the coefficient for the variable NC is expected to be positive. If a producer is aware of monetary loss due to brand damage, he/she is more likely to adopt microchips. Therefore, the coefficient for the variable AL is expected to be positive. If a producer considers the brand damage a problem, he/she is more likely to

adopt microchips. Therefore, the coefficient for the variable DP is expected to be positive. As a producer experiences theft, he/she will be more likely to adopt microchips. This is because the producer will look for the best identification method to protect his/her investment. If cattle are stolen when branding is used, the producer will look to other identification alternatives to protect his/her investment. Therefore, the coefficient for the variable T is expected to be positive.

The logit form for this model is:

$$E(SC) = \frac{\exp(B_0 + B_1NC + B_2AL + B_3DP + B_4T)}{1 + \exp(B_0 + B_1NC + B_2AL + B_3DP + B_4T)} .$$

Results of analysis for the above model are:

Model 6.1-	SC = -4.18 +	.05CN +	1.03AL +	1.16DP +	1.23T	Chi-square (97.76)
		[1.04]	[2.82]	[3.20]	[3.41]	N=761
	(-12.53)	(2.51)	(1.93)	(5.65)	(5.66)	

The coefficient for awareness of monetary loss (AL) was not significantly different from zero and was dropped. The model was then re-run. Results of analysis for the new model are:

Model 6.2-	SC = -3.33 +	.05CN +	1.28DP +	1.25T	chi-square (92.98)	N=761
		[1.05]	[3.58]	[3.48]		
	(-12.53)	(2.51)	(5.65)	(5.66)		

The coefficients of NC, DP, and T were also significantly different from zero at the .01 level and had signs as expected. The model had a chi-square of 92.98 with 3 degrees of freedom. This indicates that the relationships expressed in the model are significantly different from zero at the .001 level.

In looking at the models in this study, there is a simultaneous equation model (see Figure 27). The results of this analysis shows results that are similar to the independent

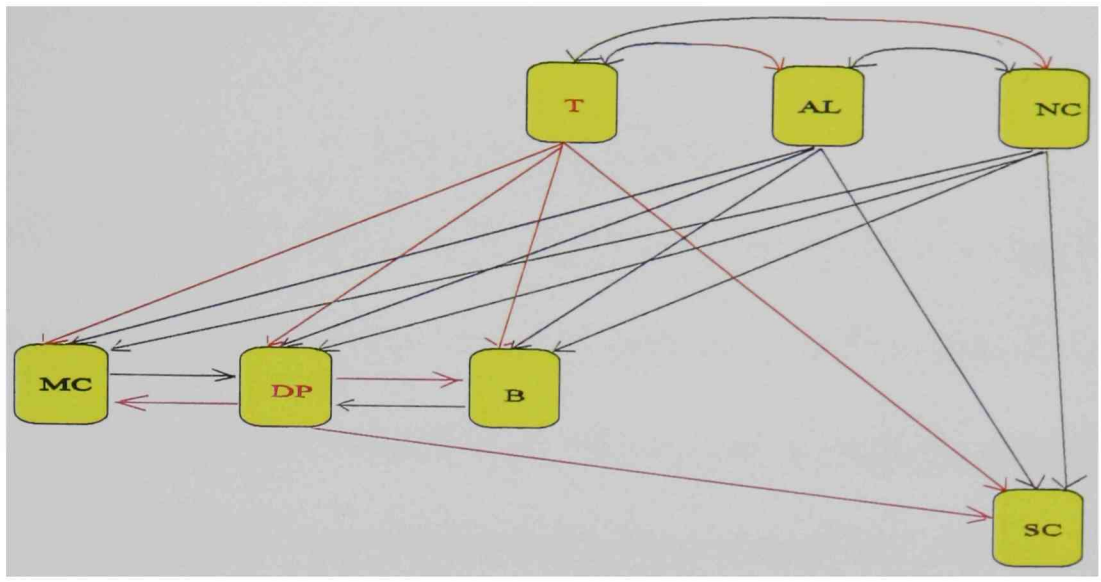

Figure 27: Simultaneous-structured model showing possible connecting paths. Model involves the variables T, AL, NC, DP, B, AM, SM.

logit models. This adds support to the first set of logit models. For further discussion on these results, refer to Appendix D.

Discussion of Results

By studying Models 1.2 and 2.1, it is suggested that theft is not significant in influencing producers to brand cattle. This may be because it is felt that thieves will steal what ever they wish. It may not make a difference if or how producers identify their cattle. However, it is felt by some persons that a brand may help in recovery. Alternatively, it may indicate that the occurrence of theft of branded cattle is so low that significance can not be identified. As shown in Model 3.1, the one factor that was associated with theft was the number of cattle a producer owns. As the number of cattle a producer owns increases, the likelihood of him/her experiencing theft increases 1.07 times. An example of this is that a producer who owns 101 to 150 head of cattle is 1.07 times as likely to experience theft of his/her cattle than a producer who owns 76 to 100 head of cattle. Likewise, a producer who owns 251 to 300 head of cattle is $(1.07)^3$ times as likely to experience theft as the producer that owns 101 to 150 head of cattle. This may be because the more cattle a producer has, the less likely that producer might notice cattle missing, and that cattle thieves rely on this assumption.

However, in determining what factors influence producers to brand, the NC, AL, and DP all have an impact on whether a producer will brand. Shown in model 1.2, as the number of cattle a producer owns increases, he/she will be 1.13 times more likely to brand. This may be because producers with more to lose (i.e., having a greater number of

cattle) should be more inclined to protect their investment, and therefore, brand their cattle. Additionally, a producer with a greater number of cattle is more capable of capturing the economies of size to invest in the equipment and labor required to brand then producers with fewer cattle. If a producer is aware of loss of hide value as a result of brand damage, he/she is 3.96 times likely to brand. If a producer considers brand damage a problem, he/she is .23 times likely to brand. This indicates that if a producer considers the brand damage to be a problem, he/she will not be as likely to brand as a producer who does not consider hide damage a problem. This is because the producer wants to preserve the hide quality, and knows that brands damage the hide. More issues other than theft should be addressed if the leather industry wants better quality hides. Such issues include awareness of branding damage, loss of value of hides as a result of brand damage, and the consideration of brand damage to be a problem.

Of the pool of respondents, the majority of producers stated that they knew that brands damaged the hides (92 percent) and that they knew of loss in value of hides as a result of branding damage (85 percent). However, only 38 percent considered the brand damage to be a problem. Producers realize that there is a damage that results in a loss in value when they brand. However, they themselves may feel that they do not realize this loss in value when they sell their cattle. Therefore, they consider the damage problem to be someone else's. This could explain the difference in the percentages of producers who acknowledge brand damage and loss of value but do not consider the brand damage a problem. If producers were to receive a perceptible premium or discount for their hides, the damage problem would become theirs, and the number of producers that consider

brand damage a problem might increase. This, in turn, should influence more producers to not brand. As indicated in model 1.2, if producers consider brand damage to be a problem, they are .23 times as likely to brand as those who do not consider brand damage to be a problem.

What factors influence producers to consider brand damage a problem? As shown in model 4.1, the results indicate that number of cattle owned, awareness of loss in hide value as a result of branding, whether a producer brands, and if the producer is aware of the use of electronic microchips for cattle identification are significant in determining whether a producer considers brand damage a problem. As the number of cattle a producer owns increases, he/she will be 1.06 times likely to consider brand damage a problem. This means that as a producer increases the number of cattle he/she owns, he/she will more likely consider brand damage a problem than a producer with fewer head of cattle. This is because he/she has more investment in production, and stands to lose more money by damaging a hide. If a producer is aware of the loss in hide value as a result of branding, he/she is 7.01 times likely to consider brand damage a problem. This means that if a producer realizes the loss of hide value as a result of branding, he/she will be more likely to consider the brand damage a problem than a producer who does not realize the hide value loss. This is because he/she is realizing profit loss, and will want to remidiate this loss. If a producer is aware of microchips, he/she is 2.28 times likely to consider brand damage a problem. This means that if a producer is aware of the use of microchips for cattle identification purposes, he/she will be more likely to consider brand damage a problem than a producer who is not aware of microchips. This may be because

he/she is aware of alternative methods of permanent identification that will not damage the hide. If a producer brands, he/she is .24 times likely to consider brand damage a problem, because if he/she did, the producer would not use branding in the first place. This means that if a producer already brands, he/she will be less likely to consider brand damage a problem than a producer who does not brand.

If producers were to discontinue branding, they would need a new permanent identification method. Currently, only 15 percent of producers are willing to adopt microchips in their identification methods. From Model 6.2, the willingness of a producer to adopt microchips has a significant relationship with three independent variables. As the more cattle the producer owns increases, he/she will be 1.05 times as likely to use microchips for identification purposes. This means that as a producer increases the number of cattle he/she owns, he/she will more likely consider using microchip for identification purposes than a producer with fewer head of cattle. This is assumed because, as stated earlier, producers with more to lose (i.e., having a greater number of cattle) should be more inclined to protect their investment, and therefore, use the best identification method available on their cattle. Also, a producer with a greater number of cattle is more capable of capturing the economies of size to invest in the equipment and labor required to use microchips for identification purposes. If a producer considers the brand damage a problem, he/she is 3.58 times as likely to substitute microchips for branding. This means that if a producer considers brand damage a problem, he/she will more likely substitute microchips in place of brands than a producer who does not consider brand damage a problem. This is assumed because they realize the

loss in hide value as a result of branding. The producer will look for the best alternative permanent identification method available. If a producer has experienced theft, he/she is 3.48 times as likely to substitute microchips for branding. This means that if a producer has experienced theft, he/she will be more likely to substitute microchips in place of branding than a producer who has not experienced theft. This is assumed because if the producer brands and has had theft, he/she may feel that branding does not deter theft well enough for him/her and will look for the best alternative permanent identification method available. This might indicate that producers perceive microchips to be better than brands.

CHAPTER VI

INSPECTOR RESULTS

Inspector surveys (see Appendix B) were sent to the thirty-three Texas Southwest Cattle Raisers Association Field Inspectors. Thirty inspectors responded representing a 90 percent response rate. Questions were developed so as to estimate the field inspectors' attitudes on theft and branding. The mailing list used to identify field inspectors were taken from the January 1998 issue of *The Cattleman* magazine.

Surveying and interviewing field inspectors of the Texas and Southwestern Cattle Raisers Association (TSCRA) provides a different perspective of cattle branding when compared to cattle producers. Field inspectors reported various advantages of branding.

When asked about the importance of the threat of cattle rustling in Texas, 24 of the inspectors responded that it was somewhat serious, while four reported that it was very serious and two reported that it was not too serious. A reason why 93 percent of the field inspectors might consider cattle rustling to be a somewhat serious to very serious problem in Texas is that it borders four other states and has an international boundary with Mexico (Ingram, 1980). Once cattle are transported over state and international boundaries, it is difficult to locate them.

Although field inspectors must work hard to recover stolen branded cattle, they must work even harder to recover those which are not branded. The majority of the cattle recovered by the TSCRA field inspectors are branded. Bruce Davis, TSCRA inspector of district 24, states that the majority of cattle in his district are not branded. Mr. Davis

reported that the probability of recovery of branded cattle is about 50 percent. The probability of recovery decreases greatly for unbranded cattle.

There are ways to identify missing cattle with no brands. Butch Davis has used numbered vaccination tags to identify cattle for the purpose of recovery. There is also a database used throughout Texas and Oklahoma to distribute brands. brands on stolen animals, pictures, and characteristics of all animals registered, not just those that are stolen. Butch Davis reports that animals may be recovered through these other means of identification, but that brands make the work easier.

Branding not only aids in the recovery of animals, but may be a deterrent to theft. Cattle inspectors unanimously agree that they feel that branding is a theft deterrent. Some inspectors claim that cattle rustlers are more likely to steal unbranded cattle and leave branded cattle alone (Davis, 1998). Interviewed cattle rustlers agreed with the cattle inspectors on this point. One inspector reported an instance of rustlers who stole cattle at night. The rustlers stole both branded and unbranded cattle. In the morning, the rustlers separated out branded cattle from the unbranded cattle, loaded up the branded cattle in the trailer, drove down the road, and turned the branded cattle loose. Another inspector reported an example about a cattle producer who did not brand his calves which would eventually be sold. The calves came up missing, a few at a time. The owner suspected theft and branded the remaining calves who were eventually sold as intended. These two instances provide anecdotal evidence that branding may be considered to be a theft deterrent.

However, branding is not alone in being a deterrent to theft. One inspector has reported that many producers feel that being a member of the TSCRA as well as branding cattle will deter theft. A respondent inspector reports that, "rustlers have stated that they have passed up opportunities to steal cattle on some ranches just because of the TSCRA sign that producers may hang on their fences." The rustlers felt that it was too big a risk to steal cattle and have the TSCRA inspectors trailing them to recover the cattle. Because of this, the inspector reported that many producers have joined the TSCRA to reduce the risk of losing cattle to theft.

Because of the strong belief that branding is a deterrent to theft, all responding field inspectors consider branding to be the best identification method used on cattle. Of the responding inspectors, 28 (93 percent) feel that it is almost impossible to recover cattle that are not branded, and other identification methods are almost useless without also branding. Temporary identification methods, such as eartags, can be removed or destroyed. These identification methods are used for temporary animal identification purposes. Other forms of permanent identification methods, such as microchips and tattoos, also have their disadvantages. Tattoos are difficult to read without confining the animal in a chute or with a rope. This is because the tattoo is generally placed in the lip or inside the ear. Although microchips are a permanent form of identification when surgically implanted, the technology is new to the industry. However, because this technology is new, cattle producers do not know too much about its use. It has also been estimated that microchips are not economically feasible to use (Buguk, Ervin, and Eberspacher, 1998). Butch Davis stated, "if microchips are used alone, there is no visible

identification of the cattle, as there is with a brand." If stolen cattle of numerous owners were mixed, an inspector would have trouble knowing who they belonged to unless he had a microchip reader available. An inspector voiced concerns over the microchip system being

electronic, making it difficult to maintain and care for the external equipment. Because of this, he would prefer not to use the electronic microchip.

No matter the identification method a producer uses, if a rustler wants the cattle bad enough, he will steal them (Davis 1998). Interviewed cattle rustlers have agreed. Rustlers state that cattle are sometimes taken because the convenience of taking the cattle is there. For instance, if cattle are in a pen with a trailer nearby, rustlers are more likely to take the cattle, brand or no brand, than cattle out in a pasture. Mr. Davis has stated that many inspectors feel that the producer should be educated on branding practices and herd maintenance. Herd maintenance includes everything from how to protect a herd from theft to how to protect it from diseases. Mr. Davis states that inspectors recognize that branding damages the hide, and are trying to educate the producers to brand on less valuable areas of the hide, such as the nose, jaw, high hip, or low leg. Also, producers need to watch cattle constantly, varying their feeding times, and keeping pens and gates locked. Producers need to inform the TSCRA inspectors as soon as cattle are missing, for it is better to have a false alarm than to lose the trail because of time lapse (Davis, 1998).

When analyzing the value of branding from the field inspectors' perspective, many issues come up. Rustling in Texas is a serious problem because of the number of borders the state shares (i.e., New Mexico, Louisiana, Oklahoma, Arkansas, and Mexico) and the

number of cattle produced. It is important to have a permanent form of identification on an animal to increase the chance of recovery if it is lost or stolen. The TSCRA inspectors prefer that producers brand because of the visible proof of ownership associated with branding. This allows the recovery of animals easier, and may actually deter theft. Damage to hides is a problem, but can be reduced by branding non-usable areas of the hide. Inspectors feel that even if a better identification method is needed for the future, today, branding is the best identification method used to stop theft. Mr. Davis states that the damage done to the hides is worth the monetary loss to stop theft of cattle.

CHAPTER VII

SUMMARY AND CONCLUSION

The United States Leather Industry needs better quality hides to compete in today's international market. For the Leather Industry to receive better quality hides for tanning, the cattle producer must be educated on the various forms of permanent identification methods available, and the improved product resulting from some.

By considering these analyses, it was shown that a producer who owns a large number of cattle and who is aware of monetary loss due to branding, but does not consider the brand damage a problem, will brand his/her cattle more than other cattle producers. This is saying that a producer who owns many cattle will brand to protect his/her investment, even though he/she realizes the monetary loss of the hide. Also, if the producer does not consider the damage a problem, he/she will be more likely to brand his/her cattle.

The models in this study are inconclusive in determining if branding is an actual theft deterrent. The models indicate that theft does not influence branding. This study does show that the average monetary incentive a producer would require to discontinue branding is $13.54 per head.

Cattle producers are reluctant to discontinue branding because it represents a low-cost form of permanent identification. Producers have voiced their opinions that they think that branding helps to deter theft. Cattle inspectors do not want producers to discontinue branding because brands aid in ownership identification. Interviewed cattle

rustlers have also voiced that brands probably deter theft. They have stated that they would rather steal unbranded cattle than branded cattle. This is because the rustlers feel that they are less likely to get caught. Although the cattle inspectors agree that the damage due to brands is a problem, they realize that brands might deter theft and make recovery of stolen cattle easier. Cattle inspectors have voiced their opinions that if producers were to stop branding, it is imperative that producers be able to switch to another permanent form of identification in order to prevent theft or make cattle recovery easy. If the leather industry wants better quality hides, a monetary incentive provided to cattle producers could provide the desired outcome.

One potential identification method would involve the use of microchips. A study has been conducted over the economic feasibility of using microchips and have concluded that microchips are not cost effective. But with a monetary incentive, (i.e., increased hide value returned to the producer) microchip identification may become possible. Terell Dharpin, a Louisiana Department of Agriculture employee, who works in the Brand Division, has stated that microchips are the identification of the future. Not only are some sectors of the livestock industry using microchips for identification already, but other industries are also. Some saddles and other livestock related equipment that do not have a serial or identification number are microchiped in Louisiana. This aids in the recovery of items that may not have been identified without the microchip. Also, the law enforcement in Louisiana has started to use microchips to identify non-livestock items that do not have any type of identification.

The horse industry in Louisiana is one sector of the livestock industry that uses microchip identification. Dr. Maxwell Lea, Jr., a Louisiana State Veterinarian, states that every horse that is tested for EIA (Equine Infectious Anemia) and found with negative results must be permanently identified by tattoo, brand, or microchip. If the results are positive, the animal is put down in some way.

Dr. Lea stated that even though the producer may use a brand or tattoo to identify his/her horse, most producers use the microchip to identify his/her horses. There are many reasons that the microchip is used more frequently than the other forms of identification. According to Dr. Lea, "Horses do not become as stressed when microchips are implanted as they do when they are branded." Also, many producers do not like the brand on their horses. With brands, the same brand may represent many different producers. With microchips, the animal is identified with a unique number. The horse is always identified with the same number, and the number is never repeated.

The type of microchip a producer can use may vary. The Department of Agriculture provide veterinarians with microchips at costs. These microchips are sterilized, suspended in saline, placed in a syringe, and individually packaged. This costs the owner of the horse $7.50 per animal. The producer may buy their own microchips if they wish. Dr. Lea estimated that if a producer bought microchips that were not ready to inject in bulk, the cost would most likely be around $4.00 per chip. This does not include the syringe for implanting or other equipment. The two largest companies in the United States that produce microchips for identification purposes are Destron in Fort Worth, Texas and Avid in Mandeville, Louisiana.

When microchips are used for identification, the microchip is injected into the neck of the horse. By placing the microchip in the neck, the microchip is hard to be tampered with by anyone. Once the microchip is implanted, it sends out a signal to a microchip reader. The majority of the readers used by producers are the hand held wand readers. The type of hand held reader that Dr. Lea uses and sells, costs about $300. There are some wand readers that cost between $700 and $800. The drawback to using microchips is that you have to be close to the animal to use a hand held wand reader. However, there are chute readers. These are readers that are like a livestock chute, where the animal passes beneath it and is identified.

This program of identifying horses in Louisiana with microchips was implemented in 1994. At first, the horse producers and owners were apprehensive in using microchips to identify their animals. However, it was soon accepted openly because the microchips seem to work fine and have no problems. The producers and owners realized that the microchip was easily placed with very little stress to the animal. Since the program's beginning, more than 75,000 horses have been microchiped in Louisiana.

As in Louisiana, microchips are becoming more popular as more producers are educated about them and their uses. The Texas cattle industry could easily implement a microchip program for identifying cattle. The Texas cattle producer may be apprehensive at first, like the Louisiana horse owners. However, if the leather industry would educate producers about microchips and their uses, producers might begin to see the advantages of using microchips. As stated by Dr. Lee, the many advantages might be worth the cost of implementing this program. Cattle rustlers that have heard of the microchip feel that they

would probably be less likely to steal cattle with microchip identification than cattle identified other ways. This is because other identification is easy to remove or alter if desired. However, they feel it would be hard to remove or alter microchips implanted in cattle. The microchip may not only deter theft, but may aid in recovering the animal as easily or easier than brands. For example, all sale barns in Texas could have a chute reader in place to read each microchip as the cattle pass beneath it. These chute readers could be paid for by taking a few cents from the sale of every cow, and placing it in a fund. This fund would not only pay for the chute, but would provide money for any software needed and the chute's maintenance over the years. The microchip would identify the animal, its owner, if it has been reported stolen, or any other information a producer wanted. This would make it difficult for cattle thieves to sale the cattle through a sale barn. Because of this, theft may decrease if cattle are identified with a microchip. Also, as more producers adopt this new technology, microchip identification would become more economically feasible to use in place of branding as a permanent identification method.

Currently, branding is the most popular permanent identification method being used. The TSCRA constantly sends brochures to producers about branding their cattle to permanently mark them. This is to educate the producer to help prevent theft and make recovery easy. The TSCRA educates the producers about brands because it is low in cost and easily seen. The TSCRA realizes that brands damage the cattle hide.

Given that the sample of cattle producers is representative of the population, the majority of the cattle producers also realize that branding results in unnecessary damage to

the hide, and, that as a result of this, the value of the hide decreases. However, a monetary incentive might have to be used to induce Texas cattle producers to switch to a more expensive identification method. The study has shown that cattle producers are willing to substitute the use of microchips in cattle identification for a price. As shown, the average price cattle producers ask for is $13.54 per head, with a range of prices from $2.00 to $50.00 per head.

Because cattle producers have shown that they are willing to substitute microchips in place of branding for their identification purposes, the leather industry must take the next step. The leather industry needs to educate producers about microchips and their uses. The leather Industry should also show that microchips have worked in one sector of the livestock industry already. This will put to ease any apprehension cattle producers may have about using microchips and allow producers to become comfortable with microchip use. The leather industry should educate the producers on how they might be able to receive premiums for native cattle hides. One such way is to promote the formation of cattle alliances.

Several cattle alliances have already started to form in Texas. Some of these include the R. A. Brown Ranch alliance in Throckmorton, TX, Ranchers' Renaissance, Ervin's Natural Beef, found in Safford, AZ, and Minnie Lou Bradley's alliance in Childress, TX, B3R Branded Beef. These alliances work as cooperatives, with the members owning shares in the company. Alliances such as these are able to give cattle producers the most money for their cattle. The producer who markets his/her cattle through the alliance will be able to see the quality of every part (i.e., hide) of the animal,

and what price he/she received for that part. The alliances wish for the best quality animals, and promote ways that improve the quality of the animals that are processed. This includes promoting the discontinuation of branding to increase the quality of the hide of the animal. In these alliances, the producer will receive a premium for a native hide. These premiums can help cover the cost of microchips used as an identification method.

By promoting cattle alliances, the Leather Industry can receive higher quality hides while the cattle producer receives his/her premium for a native hide. The leather industry will not have to front the cost of the premium either. The premium comes naturally from the alliances being able to market the native hides for the producers, in order to get the best price.

Receiving better quality hides to produce leather is a reachable goal for the leather industry in the near future. However, it will take work and dedication from the Leather Industry in educating the producers about the different related topics associated with microchips and promoting cattle alliances. These alliances would be able to give the producers the premium the producers would need to use microchips for identification purposes and the high quality hides to the Leather Industry who demand them in order to stay competitive in today's world market.

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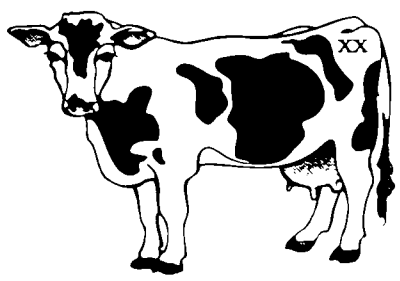
APPENDIX A

PRODUCER POST CARDS AND SURVEY

The Cattle Industry is losing money as a result of hide damage caused by current

branding practices. In an attempt to quantify the economic impact of such practices, I will be surveying a select group of producers to better understand this segment of the cattle industry. In the next ten days you will receive a questionnaire which addresses this issue. Please take the time (approximately 5 minutes) to complete the survey and return it in the self-addressed stamped envelope.

Thanks in advance,

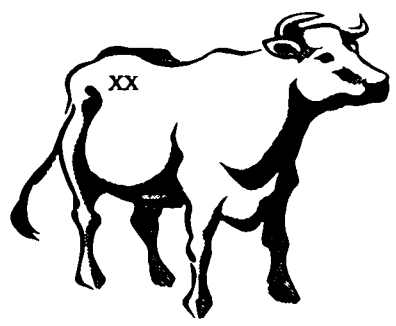


Chris E. Schraeder

Three weeks ago, I sent you a survey to determine your opinion about cattle identification methods. If you have already completed and returned the survey, please accept my thanks. Because the survey was sent to a small sample of Texas producers, it is extremely important that yours be included in the study.

If you did not receive the survey, or it was misplaced, I would like to give you the opportunity to be part of the study. In the next week, I will be sending you another survey. Please take the time to answer the questions and return the survey.

Sincerely,



Chris Schraeder
Research Assistant

Cattle Producer's Branding Survey*

The Leather Research Institute of Texas Tech University has funded a research project involving an in-depth study of branding practices in the Southwestern United States. In an effort of meeting this objective I have developed the attached survey.

Completing the enclosed survey should not take longer than 5 minutes. Please take the time to complete and return the survey in the self addressed stamped envelope.

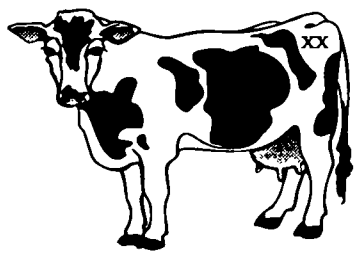
Please rest assured that all personal information generated from this endeavor will be held strictly confidential. The questionnaire has an identification number for mailing purposes only. This is so I can check your name off the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire.

You may receive a summary of the results by marking the appropriate space at the end of the survey.

I would be happy to answer any questions you might have. I can be reached at (806) 742-1936 during the day and at (806) 788-0869 during the evenings.

Thank you for your assistance.

Sincerely,



Chris Schraeder, Research Assistant
Texas Tech University
Agricultural and Applied Economics

* Please return "pre postage paid" blank survey if you do not produce cattle.

Producer Survey No._____

1. How many acres of land do you own or operate?

OWN==> : _____ACRE CROPLAND
_____ACRE PASTURE
RENT==>: _____ACRE CROPLAND
_____ACRE PASTURE

2. How many cattle animal units do you run?

_____NO LONGER RUN CATTLE
_____1-25 _____26-50 _____51-75
_____76-100 _____101-150 _____151-200
_____201-250 _____251-300 _____301-400
_____401-500 _____501-750 _____751-1000
_____1001-1500 _____1501-2000 _____2001-2500
_____2501-3000 _____3001-3500 _____3501-4000
_____4001-4500 _____4501-5000 _____5000or more

3. What type of identification technique(s) do you use on your cattle?

_____NONE
_____FIRE BRANDING
_____FREEZE BRANDING
_____EAR TAG
_____OTHER(Please Specify)_____

4. If you brand (freeze or fire),

a) do you apply a ranch identification brand?
_____ YES
_____ NO

If yes, what is the purpose of placing this brand? If you have more than one reason for placing a ranch brand, please prioritize by specifying the most important (1) to the least important (4).

_____PREVENTION OF THEFT
_____RANCH IDENTIFICATION
_____DISEASE
_____OTHER_____

b) do you apply an animal identification brand? _____ YES
_____ NO

If yes, please indicate the importance of applying this identification brand to your operation as:

_____VERY IMPORTANT
_____SOMEWHAT IMPORTANT
_____NOT REALLY IMPORTANT

c) Please provide a short statement specifying why the reason of the level of importance of branding was indicated above._____
_____

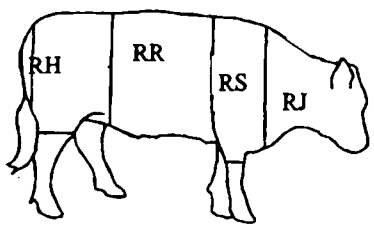
d) If you apply a brand for purposes other than ranch or animal identification, please specify: _____
_____

5. Specify the location(s) and purpose of the brand(s) that you use: RB- Ranch Brand; ID- Animal Identification Brand; D- Disease;
O- Other.
Please mark the Location or circle the location on the picture below.
Example:__RB__RIGHT HIP

LOCATION

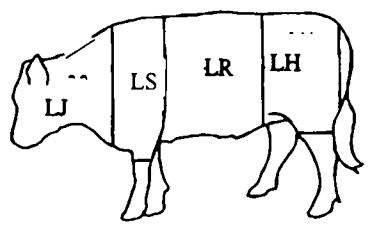
_____LEFT HIP _____RIGHT HIP
_____LEFT RIB _____RIGHT RIB
_____LEFT JAW _____RIGHT JAW
_____LEFT SHOULDER _____RIGHT SHOULDER
_____NOSE

_____OTHER (Please Specify) _____



Right Side

<N>



Left Side

6. Have you lost cattle due to theft since 1993?
   _____YES
   _____NO If no, Please proceed to question 8.

7. What is the approximate number of cattle that you have lost to theft?
   _____ In 1993 _____In 1996
   _____ In 1994 _____In 1997
   _____In 1995 _____NONE

8. Are you aware of the damage caused to the hide as a result of branding?
   _____YES
   _____NO

9. Are you aware of the loss of hide value as a result of branding?
   _____YES
   _____NO

10. Do you consider hide damage caused by branding to be a problem?
   _____YES
   _____NO
   If yes, do you have any recommendations that might be used to solve the problem of hide damage caused by branding?_____
   _____
   _____
   _____

11. Are you familiar with the use of microchips for permanent identification of cattle?
   _____YES
   _____NO, If no please go to question 14.

12. What advantages and disadvantages do you see in using microchips for permanent identification?
   ADVANTAGES_____
   _____
   DISADVANTAGES_____
   _____

13. Do you think that cattle producers will eventually substitute branding with the use of microchips to identify their cattle?
   _____YES
   _____NO

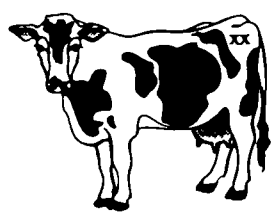
14. Producers may use many different types of identification methods on their cattle. However, a person might feel that certain types of identification practice will deter theft better than others. Please indicate which of <u>each pair</u> you consider prevents theft better.
   1._____NO BRAND Vs. _____BRAND
   2._____NO BRAND Vs. _____EARTAG
   3._____NO BRAND Vs. _____MICROCHIP

4.____BRAND Vs. ____EARTAG
5.____BRAND Vs. ____MICROCHIP
6.____EARTAG Vs. ____MICROCHIP

15. How much of a premium would you expect to receive from a buyer if you were to brand your cattle?
____$/Head

17. Do you wish to receive a copy of the results of this survey?
____YES
____NO

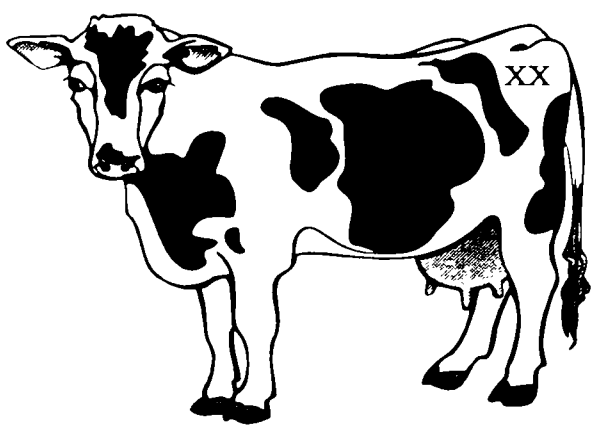
Please tape the right side of pg 6 to the left side of this pagge (5) so that my address & stamp are on the outside. Thank you for your response.



APPENDIX B

INSPECTOR SURVEY

Inspector's Branding Survey



Chris Schraeder
Department of Agricultural and Applied Economics
Texas Tech University

Inspector's Survey No._____

1. Do you consider cattle rustling a problem in your district?(please circle)
   _____SERIOUS
   _____SLIGHTLY SERIOUS
   _____SOMEWHAT SERIOUS
   _____NOT TOO SERIOUS
   _____NOT SERIOUS

2. Have you investigated reports of stolen cattle in your district since 1993?
   _____YES
   _____ NO--- If No, please go to question 6.

3. How many cattle were reported stolen in your district in:
   _____1993 _____1994 _____1995
   _____1996 _____1997

4. How many cattle were recovered in:
   _____1993 _____1994 _____1995
   _____1996 _____1997

   Are these numbers exact or approximate?

5. Were the recovered cattle wearing ranch identification brands or any other identification?
   _____YES (Please estimate how many cattle that were recovered were branded and not branded)
   _____BRANDED
   _____OTHER IDENTIFICATION
   _____NO
   _____DO NOT KNOW

6. Please respond to the following statements:

A) *It is just as easy to recover cattle wearing permanent identification as it is cattle wearing temporary identification.*
   _____STRONGLY AGREE
   _____AGREE
   _____SOMEWHAT
   _____DISAGREE
   _____STRONGLY DISAGREE

B) *Branding is an excellent theft deterrent.* 4
   _____STRONGLY AGREE
   _____AGREE
   _____SOMEWHAT
   _____DISAGREE
   _____STRONGLY DISAGREE

7. Do you feel that you could recover stolen animals just as well with or without permanent brands?
   _____YES
   _____MAYBE
   _____NO

Technology is increasing the number of identification methods for livestock. One such method uses electronic microchips implanted in the animal. This identification method allows positive identification of animals up to a quarter mile with the use of a computer while not requiring the producer to brand.

8. A) Have you heard of this electronic identification method before?
   _____YES
   _____NO

B) If a producer were to use the electronic identification system, what advantages and disadvantages do you see?

ADVANTAGES:_____

_____

DISADVANTAGES:_____

_____

9. Producers may use many different types of identification methods on their cattle. However, a person might feel that certain types of identification are more effective at preventing theft than others. Please mark which method of each pair you consider prevents theft better.

1._____NO BRAND or _____BRAND

2._____NO BRAND or _____EARTAG

3._____NO BRAND or _____MICROCHIP

4._____BRAND or _____EARTAG

5._____BRAND or _____MICROCHIP

6._____EARTAG or _____MICROCHIP

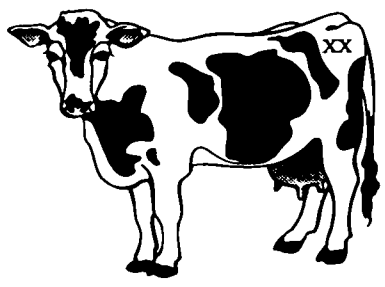
10. How long have you worked as a brand inspector in your district?_____

11. Copy of Results Requested?

_____YES

_____NO

Please tape the right side of pg 7 to the left side of page 6 so that my address & stamp are on the outside. Thank you for your response.



APPENDIX C

CATTLE RUSTLER SURVEY

Rustler Survey

1. Do you consider brands to be a theft deterrent?

2. Were the cattle branded?

3. Did it occur to you that branded cattle may be easier to recover than those without brands?

4. Would you have stolen branded cattle just as likely as unbranded cattle?

5. Have you heard of microchip identification in cattle?_____
   If yes, would you have stolen the cattle if they had been identified with microchips?

6. How did you steal them?
   Did you steal them in the pasture or were they in a pen?

7. Other factors that played a part in deciding what cattle to pick?
   E.g.) Large ranch
   Producer does not watch cattle closely

8. Anything else you would like to say?

APPENDIX D

Simultaneous Equation

By looking at the models in this study, a simultaneous equation model is formed. A four equation model can be developed and is given by:

Model 7)

$$B = f(NC, AL, T, DP) + \varepsilon_1$$
$$MC = f(NC, AL, T, DP) + \varepsilon_2$$
$$DP = f(NC, AL, T, B, MC) + \varepsilon_3$$
$$SC = f(NC, AL, T, DP) + \varepsilon_4$$

Where variables are as stated earlier.

These relationships can also be seen in Figure 27. Figure 27 shows the model diagramed, with its possible relationships drawn.

A simultaneous-structured model was used to analyze these qualitatively dependent variables. An alternative two-stage estimation was adopted to analyze this model. In the first stage, the reduced form equations for branding (B), awareness of microchip (MC), consideration of brand damage a problem (DP), and willingness to substitute microchips (SC) were estimated by regressing each dependent variable on all independent variables included in the system. All equations were estimated using logit analysis. Using the estimated reduced form parameters, the fitted values of each dependent variable (B_{hat}, MC_{hat}, DP_{hat}, and SC_{hat}) were calculated and computed as the inverse Mills' ratio.

In the second stage, the endogenous variables B, MC, DP, and SC appearing on the right hand side of the equations were replaced with the estimated variables B_{hat}, MC_{hat}, DP_{hat}, and SC_{hat}.

This was to estimate the structural parameters using logit analysis. This approach will yield consistent estimates of the structural parameters because the inverse Mills' ratios are highly correlated with corresponding dependent variables, but they are uncorrelated with

the error terms in the structural equations.

After running the model 7, the results are as follows:

Model 8- $B = .828 + .111NC + .960AL - .001DP_{hat}$ Chi-square = 30.68
(2.65) (3.63) (3.82) (-3.05)

Model 9- $MC = -.828 + .043NC + .770AL + .001DP_{hat}$ Chi-square = 25.62
(-2.72) (2.87) (3.76) (-6.84)

Model 10- $DP = -1.935 + .049NC - 1.366B_{hat} + 1.782AL + .730MC_{hat}$ Chi-square = 136.26
(-5.11) (2.95) (-4.38) (5.13) (4.25)

Model 11- $SC = -3.928 + .064NC + 1.307T + .004\ Dp_{hat}$ Chi-square = 70.90
(-6.81) (3.06) (6.08) (7.62)

The numbers in parenthesis are the z coefficients for the corresponding variable. It was found that theft was not significantly different from zero in model 8, model 9, and model 10. Theft was dropped from the models and the models were ran again. Aware of monetary loss of hide due to brand damage was not significantly different from zero in model 11. Aware of monetary loss of hide due to brand damage was dropped and the model was ran again. The results are as shown:

Model 12- $B = .816 + .112NC + .965AL - .001DP_{hat}$ Chi-square = 30.65
(2.67) (3.57) (3.27) (-3.10)

Model 13- $MC = -.830 + .041NC + .759AL + .001DP_{hat}$ Chi-square = 25.17
(-2.72) (2.78) (3.61) (-3.10)

Model 14- $DP = -1.955 + .047NC - 1.387B_{hat} + 1.791AL + .735MC_{hat}$ Chi-square = 115.45
(-4.87) (2.93) (-4.21) (5.02) (4.35)

Model 15- $SC = -3.858 + .071NC + 1.351T + .003\ Dp_{hat}$ Chi-square = 59.64

(-6.75) (3.49) (6.33) (12.19)

The new proposed diagramed model is shown in figure 28. The significant relationships are shown in green. The non-significant relationships are shown in red. All models had a significant chi-square coefficients. This indicates that the models all show significant relationships between the dependent variable in the model and the independent variables in the model.

Results were very similar to the previous independent logit models. As shown, the variables in these model are similar to the independent logit models in the results of this paper. The variables that are significant in the independent logit models were significant in the simultaneous equation. Those variables that were not significant in the independent logit models were not significant in the simultaneous equation. The signs of the coefficients of the variables were the same for both the independent logit models and the simultaneous equations. The over all goodness of fit (Chi-square coefficient) for both the independent logit models and the simultaneous equations were all significantly different from zero. This indicates that the relationships shown are significantly different from zero.

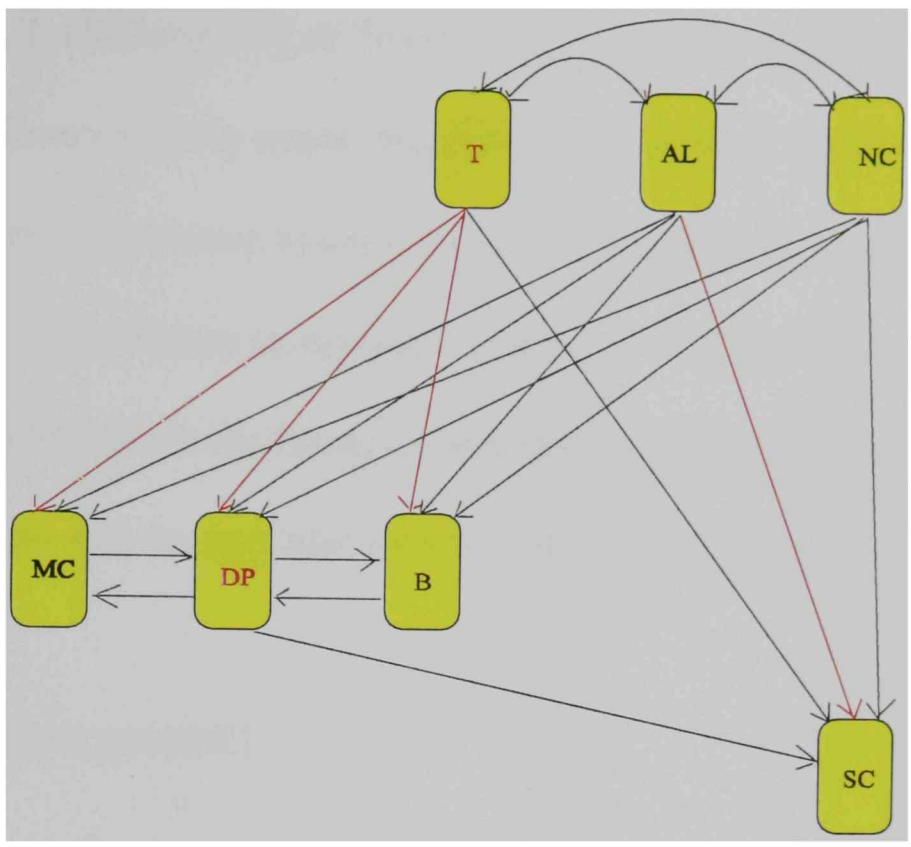


Figure 28: New proposed model, showing significant relationships (green) and non-significant relationships (red).

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