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Introduction

Slaughter cattle prices are highly variable. Price changes of $10-15 per hundredweight are possible within a 12-month time period. Variability of that magnitude imposes costs on producers, processors, and consumers in the form of adjustments to price risk exposure.

Over time, cattle prices are determined by long-term supply and demand forces. If there are cyclical and long-run imbalances between supply and demand, the market will eventually correct the imbalances. However, short-run price variations are not caused by the cyclical developments on the supply side or by shifts in demand. Short-run fluctuations in placements of cattle into feedlots change supply expectations and prompt short-run variability in fed cattle prices (Koontz and Purcell).

Variability in placements of cattle into feedlots leads to highly predictable variability in the marketings of fed cattle. Volatile prices of feeder and slaughter cattle, coming from the short-run supply variations, lead to price uncertainty and to variable placements of cattle on feed, and a potential vicious cycle of price volatility repeats itself.

Both the volatility of prices and the related variability of supply increase the uncertainty of profitability of investment in cattle feeding activities over time. The price instability means producers face the risk of variable revenues in the short run, creating cash flow problems and raising the costs of borrowed funds. Most analyses indicate a highly inelastic demand for fed cattle at the feedlot level (Chang, 1977; Huang and Haidacher, 1983). This highly inelastic demand means that significant changes in supply will prompt often extreme price movements.

For consumers, supply fluctuations lead to volatile prices of beef at higher average buying prices over time. Exposure to price risk by cattle feeders and processors carries with it a cost and, eventually and predictably, that cost will be transferred to consumers in the form of higher prices. Research by Brorsen, *et al.* (1985) indicates exposure to price risk tends to prompt extraction of larger margins by agricultural processors, pushing consumer level prices up over time. If the initial response to price risk exposure by any middleman is to attempt to offset the costs of risk exposure by buying raw materials (cattle) cheaper, the long run result is still the same: Lower prices for cattle tend to push resources out of production at the margin, reducing supply, and eventually raising the price of beef at the consumer level.

Taken together, the two types of losses, to producer and consumers, constitute social losses. It can be argued that the social losses could be reduced and the economic viability of the entire beef sector enhanced by stabilizing the prices of feeder cattle and slaughter cattle. Since the quantity of fed cattle produced and offered is a function of prices, the importance of efficient and effective price discovery processes becomes immediately apparent. The need for effective price discovery, in turn, raises the need to look at futures trade in cattle, how futures markets enter the feedlot manager's decision process, and the contribution of cattle feeders' involvement in the futures markets to the effectiveness of price discovery processes.

Cattle Feeders' Economic Environment and Decision Processes

Cattle feeders turn feeder cattle of varying weights and grades into fed steers and heifers using their feedlot facilities and management skills. Part of the feedlot capacity can be utilized for custom feeding. In return for providing facilities and management services, the operator of the (custom feeding) feedlot is paid a per-head fee and/or a margin on feed by the owners of the cattle.

The decision to place cattle into the feedlots by any potential cattle feeder depends on feeder cattle costs, potential selling prices for fed cattle, and the related profit expectations. Figure 1 demonstrates the realized net margins on Great Plains feeding activities from 1983 through 1987.[1]

In the calculation of these margins, cattle feeders are treated as cash market speculators, implying no forward pricing is being employed. The net margins are calculated by subtracting the total costs of feeder cattle, corn, soybean meal, hay, and interest on those inputs from actual cash prices for fed cattle four months later when

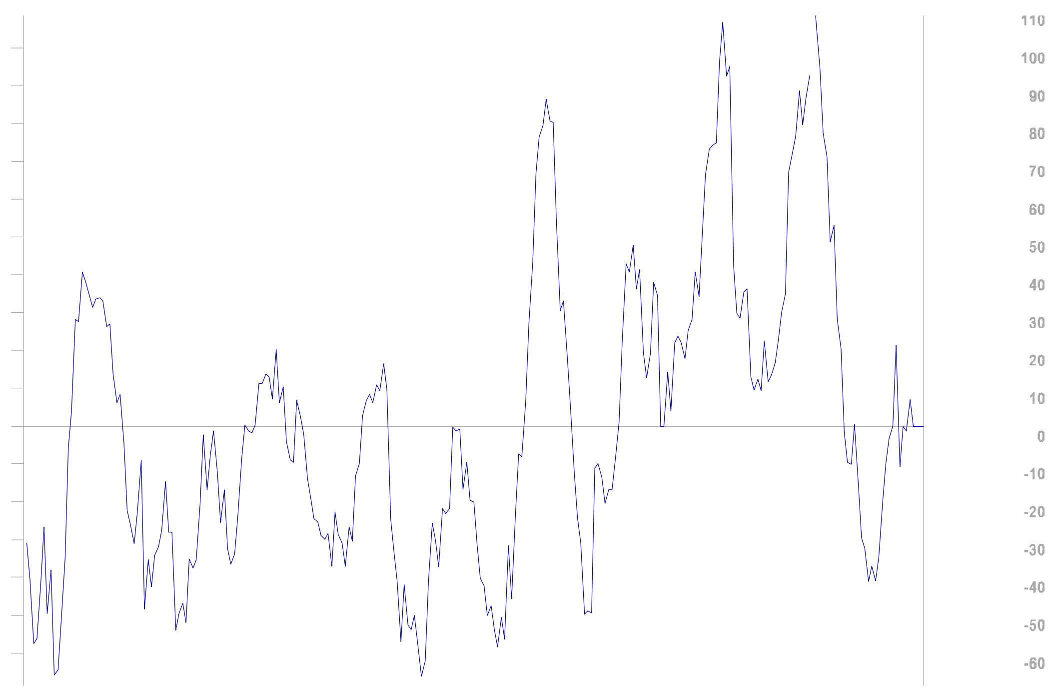
[1] The 1983-87 time period is used in calculating the margins because it coincides with a unique database of futures prices employed in this study.

the finished slaughter cattle are sold. The margins are on a per-head basis. The cash prices of feeder cattle, corn, soybean meal, hay, and the interest rates are assumed to be fixed at the beginning of the feeding program. The typical four-month feeding program involves turning feeder cattle weighing 750 pounds into fed cattle weighing around 1,150 pounds.

As shown in Figure 1, the net profit series exhibits pronounced variability. Losses may exceed $65 per head, and profits of $100 per head were experienced during the period. If an assessment for fixed costs were included in the margin calculation, the periodic losses would look even worse. The decision to place cattle into feedlots is obviously accompanied by high levels of risk and uncertainty.

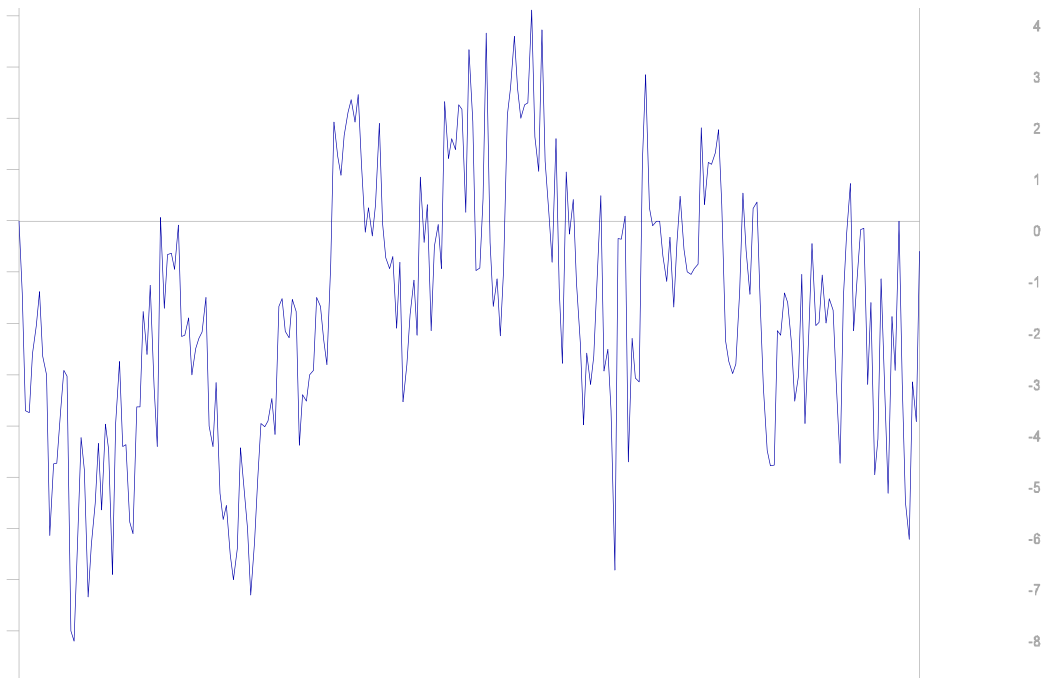
Even capable market analysts and astute managers of price risk management programs are faced with complex and uncertain market situations. Cattle feeders, as potential traders in futures markets, can seldom negotiate prices above the prevailing daily price for fed cattle of a particular grade and weight in a market area. They are price takers in the cash market for fed cattle, operating in what economists call a "competitive market." Also, individual cattle feeders have little or no ability to influence feed prices and feeder cattle prices, their primary costs, on a day-to-day basis.

Figures 2 and 3 document the economic and price-related difficulties facing cattle feeders. Feeding margins being offered by the appropriate distant live cattle futures are computed by subtracting the projected feeding costs from the weekly closing quotes for the live cattle futures contracts. The distant (four months) live cattle futures prices are not adjusted for a basis allowance, so cash-futures basis is implicitly assumed to be zero. The feeding costs used in Figure 2 are the same as in the calculation of the realized net margins defined in Figure 1. Figure 3 illustrates the case where fixed costs to reflect the feedlot investments are also included. In Figures 2 and 3, the margins are on a per-hundredweight basis, but multiplying by 11.5 hundredweight would show per-head variability paralleling that shown in the realized margins in Figure 1. The situation is charged with risk and uncertainty.



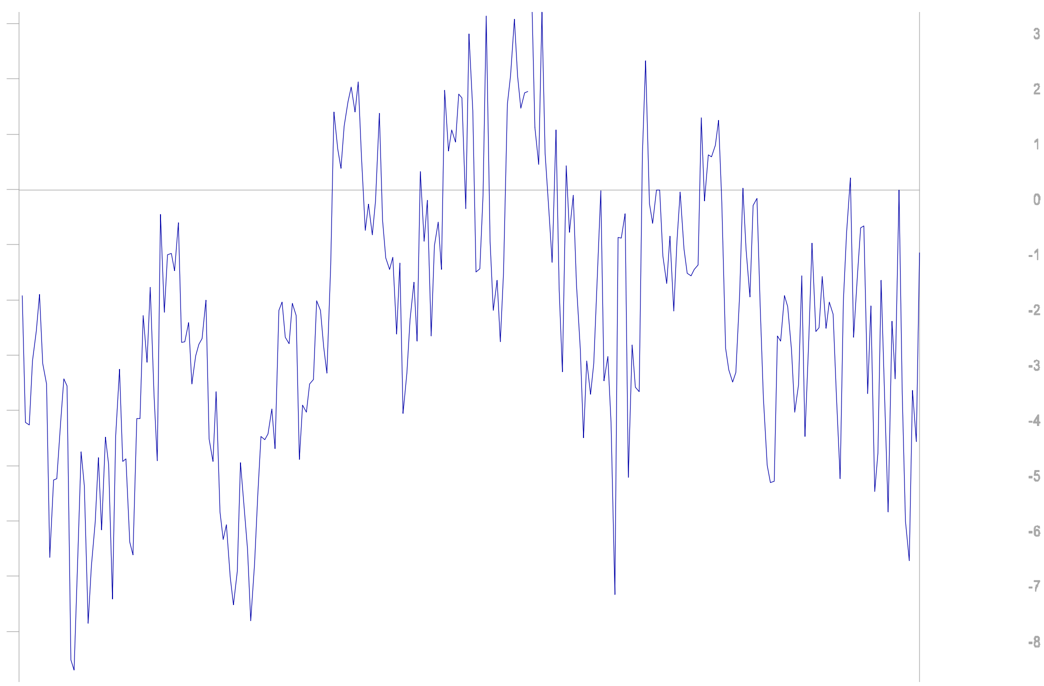
Margin ($ Per Head)

Figure 1. Estimates of Net Profits Per Head in the Great Plains Feeding Area by Weeks, January 1983-December 1987



Margin ($/cwt.)

Figure 2. Margin over Variable Costs Offered by the Closing Price of Distant Futures, Weekly, 1983-87

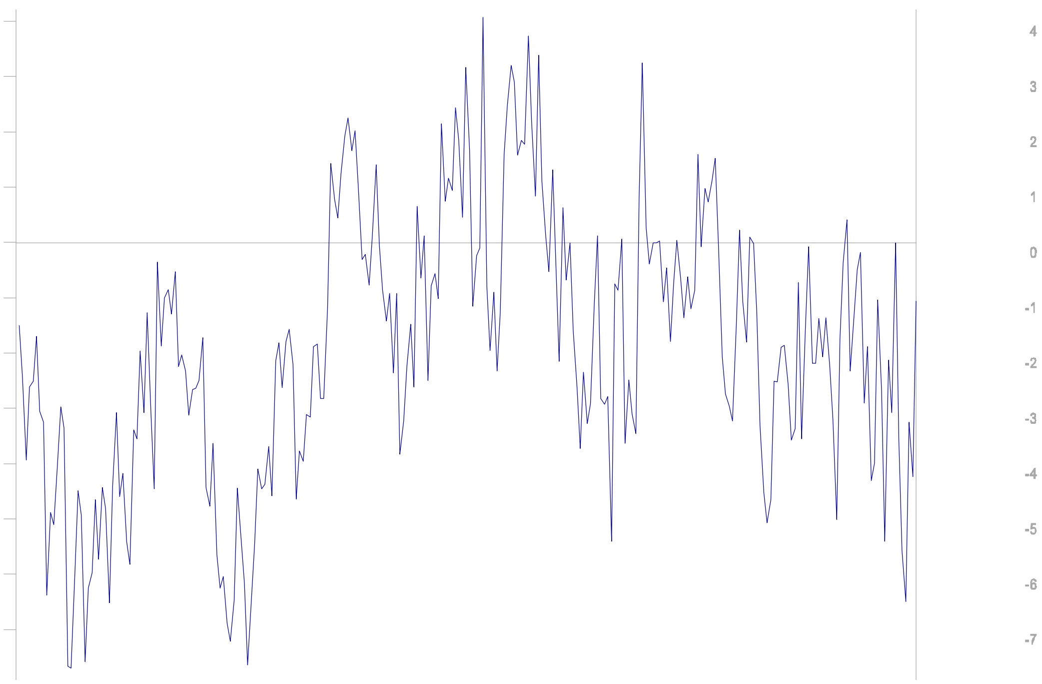


Margin ($/cwt.)

Figure 3. Margin Over All Costs Offered by the Closing Price of Distant Futures, Weekly, 1983-87

Some cattle feeders might be able to achieve costs below those estimated in the calculations of the realized net margins (Figure 1) and the expected margins offered by the distant futures prices (Figures 2 and 3). Also, they might be able to sell futures at more favorable prices than the monthly average of the futures price. Figure 4 demonstrates the case using the highest price offered by the relevant distant futures contract during the month the cattle are placed. From January 1983 to December 1987 (261 weeks in total), the *highest possible futures prices* covered all costs only about 20 percent of the time.

Cattle feeders are, then, faced with a situation in which cattle can seldom be placed and immediately hedged at a profit. Often, even the variable costs (feeder cattle, feed, and interest on those and other variable costs) cannot be covered. In such a case, the cattle feeders must leave the feedlots empty or partially empty or place the cattle and hope the situation will improve. As a result, placements of cattle on feed are indeed highly volatile. The volatility in the placements leads to highly variable prices for fed cattle, and the "vicious cycle" of variability that eventually reaches the consumer is perpetuated.[2]



Margin ($/cwt.)

Figure 4. Margin over All Costs Offered by the High Price of Distant Futures, Weekly, 1983-87

There are economic reasons that the futures market will not always offer profitable hedging opportunities to the cattle feeder. The market is competitive, with no significant barriers to entry. Thus, only the most efficient producers would be expected to cover average total production costs in the long run. In the short run, market imbalances between projected costs and available pricing opportunities can persist, resulting in variable supplies of fed cattle and variable prices in the cash market. The fluctuations at the feedlot level will, in turn, generate

[2]The variability is not reflected in the retail prices immediately, and may never be fully reflected. Retail price changes traditionally lag changes in the system at the live animal level, but much of the variability eventually reaches the consumer (Jones and Purcell).

variability in prices and in product availability at the consumer level over time. It could therefore be argued that the shorter the duration of any market imbalances or disequilibriums, the more efficient is the entire pricing system in an economic sense.

Since cattle feeders are essentially price takers in the fed cattle market, they have only limited ability to influence day-to-day prices as they manage the cattle being offered for sale on a "showlist" for the feedlot. Thus, any market imbalances or moves away from a price equilibrium cannot be corrected in the short run by changing the costs of feed or feeder cattle or by changes in the selling prices for fed cattle. These imbalances from an unknown but underlying equilibrium may be seen as evidence of inefficient markets. An efficient market in the Fama (1970) context is defined as a market that discovers a price that reflects all the available supply and demand information. The efficiency of the feeder cattle and live cattle futures markets is based on the availability and quality of the information base and the effectiveness of futures traders in transmitting that information into a discovered price.

Publicly available series of price-related information are often weekly or monthly. Information series are available from the USDA, electronic market services, and some private advisory services and university extension personnel. Price and projected revenue series typically reflect some average conversion rate for average cattle under average feedlot conditions. The margins plotted in Figure 1 are an example. Obviously, the cattle feeders themselves have access to better (more timely, more accurate, more specific) information on costs of cattle feeding, costs which will start to impact the related opportunities offered by the futures market as the price discovery process goes forward. Cattle feeders are directly involved in the feeding activities and thus have immediate access to proprietary information. They are, therefore, in an excellent position to be involved in any needed arbitrage between cash and futures markets.

The length of time lags in the price discovery process to changes in information is closely related to timely access to that information and to information quality. Factors that may influence the length of time needed for a market to incorporate new information and move toward the underlying but implicit equilibrium price include: 1) the time interval between public release of the information, and 2) the perceived accuracy and integrity of the information. Purcell and Hudson (1985) report that the futures market is capable of reflecting available information intra-day or with a time lag of one day or less. It is a tautology that the market must have access to all relevant information if it is to register its impact quickly and efficiently in the discovered prices.

What appears on the surface to be an inefficient market may result from any policy position that blocks well-informed (potential) participants from being directly involved in the futures markets and thereby directly involved in the price discovery process. Any policy that constrains the effectiveness of the price discovery process in the markets, generating pricing patterns and market behavior that could be viewed as market inefficiency, should be analyzed in terms of net benefits and costs to society. One policy that has the potential to influence price discovery is the Treasury/Internal Revenue Service (IRS) policy on how hedging versus speculative trades in futures or options contracts are defined and taxed.

IRS Policy Position on Futures Trading

In general, commodity futures contracts that are not part of hedges are treated as capital assets. The gain or loss from the sale or exchange of such contracts receives capital gain or loss treatment, which severely restricts the deductibility of losses. In *Arkansas Best Corp* (1988), the U.S. Supreme Court held that: (1) a tax-payers motivation for purchasing an asset is irrelevant to the question of whether the asset is a "capital asset," (2) the sole exceptions to the "capital asset" definition are those listed in the *Internal Revenue Code*, and (3) stock purchased by a company is subject to capital loss (rather than ordinary loss) treatment at sale regardless of whether it was held for a business purpose.

The *Arkansas Best* court thus rejected the broad interpretations of the earlier 1955 *Corn Products* case. The *Corn Products* doctrine had stood for the proposition that hedging transactions that are an integral part of a business inventory purchase system fall within the exclusion from the capital asset definition and are treated and taxed as hedges (Moran, 1988). The IRS does not provide detailed guidance on its interpretation of what is and is not hedging. The uncertainty engendered by Arkansas Best raised questions about taxpayers' use of futures markets in controlling the risk of commodity price fluctuations. The IRS, in a July 1994 release, moved to partially clarify the situation via an administrative ruling. The traditional inventory-type short hedge was restored as a legitimate hedge, but there still remains a great deal of uncertainty as to what is and is not a hedge and how cash connected firms such as cattle feeders should be involved in futures markets.

The distinction between hedging and speculation is very important to a business firm involved in agricultural commodities. Hedging is a legitimate business practice and futures losses in a hedged program are essentially fully deductible as an ordinary business expense. On the other hand, speculation is not a legitimate business expense and futures loss deductions are limited to $3,000 (per year or per tax period) for individuals and zero for most corporate entities.

A lingering concern, then, among users of the futures markets is the lack of a clear, appropriate hedge definition. Although three sections of the *Internal Revenue Code* explicitly exempt hedging transactions from general tax rules, only one section describes the tax rules that apply to a hedging transaction. Even that provision fails to define a hedging transaction beyond a transaction that reduces risk (Harris and Slavin, 1991). The July 1994 Treasury Department administrative ruling also failed to define hedging. It identified the traditional short hedge to protect inventory value and an option "fence" (buying a put option, selling a higher call option) as appropriate risk reducing (and therefore hedging) strategies, but it offered no general definition of a hedge and provided no general guidelines to cattle feeders who might be interested in participating more fully in the price discovery process.

Farmers and ranchers using risk management tools will be concerned that IRS auditors may disallow futures losses resulting from hedging strategies if the strategy involves positions other than the most simple and basic "hedge and hold." The IRS has historically applied a very rigid definition of what is seen as hedging and what is seen as speculative activity in futures markets.[3] A primary criterion of hedging ruled by the IRS is the "equal and opposite" requirement. In other words, the futures position must never exceed the actual or expected position in the cash market (the "equal" requirement) and must be the reverse of the cash position (the "opposite" requirement). For cattle feeders, this criterion restricts them to being long in feeder cattle futures (a "long" hedge) and being short in live cattle futures (a "short" hedge) in order to benefit from the tax treatment of a hedge. An option fence was added in the July 1994 ruling, and the possibility that a short hedge (or put option) can be placed, lifted, and then replaced one or more times during the production period has also been reviewed and approved (so long as other requirements are met) by IRS.

According to these requirements, being short the nearby feeder cattle futures and/or long the distant live cattle futures, *positions reflecting what would appear to be logical and business-related cattle feeders' reactions when only large negative feeding margins are being offered*, would be speculative trades. The cattle feeder would not be allowed to be short in the cash market and long in the futures because it would not meet the strict "risk-reducing" criterion. But being "short" in cash and "long" in futures is precisely the actions that would be needed to move the markets back toward a price equilibrium.

[3] The *Internal Revenue Code* defines hedging as a transaction entered into by the taxpayer in the normal course of the taxpayer's trade or business, primarily:

(1) To reduce risk of price change or currency fluctuations with respect to property which is held, or to be held, by the taxpayer; and

(2) To reduce risk of interest rate or price changes or currency fluctuations with respect to borrowing made, or to be made, or obligations incurred, or to be incurred, by the taxpayer.

Since losses on speculative trade in futures are not deductible for tax purposes, cattle feeders will be reluctant to take positions that might be ruled as speculative by the IRS.[4] When the nearby feeder cattle futures and cash feeder cattle prices are high relative to the distant live cattle futures prices and no profitable hedge is being offered or appears likely, cattle feeders cannot be involved in any economically rational actions that would be defined as hedges (or as appropriate activity) given current IRS policy in the live cattle futures markets. They must act as speculators in the cash market and wait for other forces, and other traders, to discover price, restore a market balance, and offer (possibly) more attractive hedging opportunities in the futures market. Their only alternative, one they do eventually pursue, is to adjust their activities in the cash market by changing placements of cattle on feed. This will eventually change the supply/demand situation in the marketplace and influence the price being discovered in the futures, but only with significant time lag.

Such a situation accentuates variability in fed cattle supplies. Cattle feeders are discouraged from taking actions to influence discovered prices in futures directly by establishing positions designed to correct market imbalances when only negative margins are being offered. Any prolonging of market imbalances relative to market performance that could occur with full participation by cattle feeders in the price discovery process results in unstable and unprofitable margins offered to producers, volatile placements of cattle on feed, more volatile prices of beef to consumers, and higher average prices paid by consumers over time. Someone must pay for the risk exposure and the variability. As a result, the economic viability of investments in cattle feeding and the beef sector as a whole is threatened. Purcell (1991) states: "The market relationships between nearby feeder cattle and distant live cattle futures are critically important to the economic viability of feedlot owners' business on a day-to-day basis, but the only legitimate course of action (for cattle feeders) is to wait for the (negative margin) imbalances to be corrected by other participants in the futures markets" (p.7).

Problem Statement

Cattle prices are highly variable and this variability imposes costs on producers, processors, and consumers. The short-term variability is not caused by cyclical developments in supply or shifts in demand, but primarily by short-run fluctuations in placements of cattle into the feedlots. Prices and price expectations are related to fluctuations in placements as investors seek to take economically sound courses of action and, in the process, discount for risk and uncertainty.

Live cattle futures markets do eventually react to emerging information on changed placements (Koontz and Purcell, 1988). The market *is* performing a forward pricing role given the periodic releases of supply-side information. Cattle feeders do adjust their *cash activity* in response to significant changes in distant live cattle futures, and the impact of those adjustments will eventually change the price expectation in the futures market.

Cattle feeders, as potential traders in the futures market, have access to high-quality (more accurate and more timely) information on the costs of cattle feeding and the related opportunity being presented by the live

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[4] A special survey conducted by the Commodity Futures Trading Commission (CFTC) on March 13, 1987 indicates feedlots held only 4.5 percent of the short open interest in feeder cattle futures and 4.0 percent of the long open interest in live cattle futures. Since the average open interest for *all* holders of live cattle futures represented only about 30 percent of the on-feed count, it is clear the feedlots were not heavily involved in the markets. Involvement would be much less in the feeder cattle futures where open interest averaged only 17,923 contracts (Kuserk, 1988). In a survey of Kansas and Texas cattle feeders in September of 1991, there was clear implication that many cattle feeders do not enter the cattle futures markets in any but a very basic hedge because of concerns over the IRS treatment of any futures losses that might occur. Purcell concludes that cattle feeders are therefore discouraged from participating fully in the price discovery process (Purcell, February 1992).

cattle futures market. If IRS policies deny cattle feeders the opportunity to deal with *all* of the market imbalances, both negative and positive, *then corrections of the imbalances will be delayed until changes in placements are recognized by other traders*. These corrections in the futures are then made primarily by traders (speculators) in futures from outside the cattle feeding complex, traders who by definition have no cash-business connections and who may need a larger incentive (a larger market imbalance) to enter the market and participate in the price discovery process. Cattle feeders are not encouraged to be directly involved in the price discovery process in the futures markets. The IRS policy position thereby constrains the effectiveness of the price discovery process in the live cattle futures market by denying access to the market and to the price discovery process the highly relevant, timely, and proprietary information in the hands of cattle feeders.

Market imbalances involving large negative margins could be corrected by selling the nearby feeder cattle futures and buying the distant live cattle futures. Cattle feeders would be interested in taking such actions when no reasonable prospect for profits are being offered via the traditional short hedging strategies that involve buying in cash feeder cattle and/or selling in distant live cattle futures. In spite of their advantageous and well-informed positions, however, cattle feeders are facing strong obstacles to direct participation in this price discovery process. Too little is known about how these policy-based obstacles influence the price discovery process, how they influence the economic well-being of producers and consumers, and how they influence revenue flows at the IRS.

Hypothesis

The IRS position that discourages cattle feeders' more complete involvement in the cattle futures markets interferes with the effective and efficient workings of the cattle futures markets and their price discovery functions, perpetuates and accentuates short-run disequilibria in the cash and futures markets for cattle, and imposes unnecessary economic costs on producers and consumers.

Objectives

The primary objective of this research was to analyze the impact of changes in tax policy on cattle feeders' behavior, the price discovery process, and the effectiveness of the cattle cash and futures markets in correcting market imbalances or disequilibrium situations. More specific sub-objectives were:

1. To develop a conceptual framework to analyze the impact of changes in tax rates and probability of deduction of futures losses on cattle feeders' profit maximizing behavior;

2. To demonstrate the possible impact of denying cattle feeders' participation in correcting the imbalances between feeder cattle costs and the pricing opportunities in the live cattle futures markets; and

3. To suggest possible implications to the price discovery process, to market effectiveness and efficiency, to producer/consumer well-being, and to revenue flows to IRS, of the IRS policies on hedging versus speculation.

Expected Relationships in Cattle Markets

Conceptually, the live cattle futures markets would be expected to offer margins that cover variable costs over time (Purcell, 1991). In its simplest form, the markets are in a state of balance when:

$$FCC + FC = LCP,$$

where

FCC	=	cost of feeder cattle that could be placed using cash prices or the nearby futures ($ per head);
FC	=	cost of inputs other than feeder cattle during the period, reflecting variable and fixed costs where fixed costs include a return on the capital investment ($ per head); and

LCP = per head value of the finished steer using projected weights and available live cattle futures prices ($ per head).

The above equality implies that prices would be expected to approach the average total cost of production for the most efficient producer in the long run. This is, then, an equilibrium position toward which the markets would be expected to move. This perspective is important in moving toward discussion of the performance of the futures markets. What, precisely, is the futures market expected to do? What price should it discover? The notion that the market will, over time, approach the cost of production of the more efficient producers provides a context within which to think about market performance.

The markets are in a state of relative imbalance, then, when:

$$FCC + FC > LCP, \text{ or } FCC + FC < LCP$$

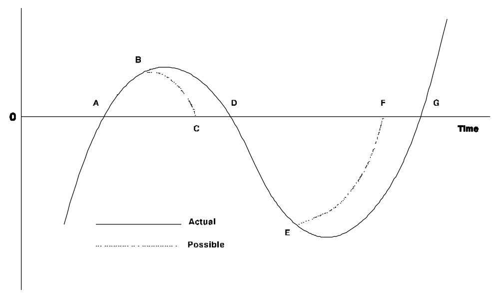
where the variables are defined above. Empirical evidence shown earlier suggests that the inequality (FCC + FC > LCP) is present in a majority of the cases and often persists over several months. The market seems to be relatively inefficient or ineffective in that it takes a great deal of time for the market to restore an equilibrium when the margins being offered are negative. In Figure 2, there is a string of 23 consecutive months during which the margins *over variable costs only* were negative in 1983 and 1984.[5] An imbalance which persists across several months suggests that there may be little or no influence from cattle feeders in discovering cattle futures prices. Cattle feeders are essentially "price takers" in both their output and input markets. They cannot change cash selling prices for fed cattle or buying costs for feeder cattle, corn, or interest rates. When forward pricing opportunities cannot provide cattle feeders with margins covering variable costs, they must therefore either (1) leave the feeding pens empty and absorb the fixed costs, or (2) place the cattle in the hope that profitable prices will be offered during or at the end of the feeding period. The net result is a sporadic pattern of placements and the highly variable prices that comes from volatile placements. From the viewpoint of society, any disequilibrium situation should be short lived and quickly corrected, but such is clearly not the case.

Figure 5 portrays the policy issue. Efficient producers are assumed to cover variable costs over time. That is, the net margins offered above variable costs for the efficient producers tend to be positive or zero over time. As previously implied, the moves through positive levels (A to D) may be less sustained than the moves through negative levels (D to G). Any policy position which blocks participation of well-informed participants tends to prolong the moves to negative margins and/or accentuate the price moves away from equilibrium over time.

If the market is effective in correcting the imbalances associated with both negative margins (losses) and positive margins (excessive profits), any social loss can be avoided or reduced. The area EFG in Figure 5 can be used to represent the loss which may be due to inefficient and ineffective price discovery processes when negative margins persist. Excess profits or economic rent, associated with the positive imbalances, is characterized by the area BCD. In an efficiency or economic effectiveness context, both areas EFG and BCD are measures of social loss.

Purcell (1992) suggests that it takes more time to correct the market imbalances by changing placement patterns in the cash markets than might be the case by influencing the price discovery process directly in the futures markets. When excessive positive margins appear, cattle feeders *can* be involved in correcting the situation by selling distant live cattle futures and placing short hedges. This action tends to decrease distant live cattle futures, reducing the positive margins. But when negative margins appear, the cattle feeder may not take short positions in the nearby feeder cattle and/or long positions in the distant live cattle futures prices for fear such trades will be ruled as speculative and any losses in futures will not be deductible. The cattle feeders cannot, therefore, be a full and direct participant in the price discovery process and must wait for the situation to correct itself. If theoretical and/or empirical evidence generally supports the hypothesis that cattle feeders would be effective market participants, then the markets are less effective than they could be if cattle feeders were more involved.

[5]As noted earlier, the analysis reported here was based on the 1983-87 period because of the availability of a unique data set on futures traders' positions. Even the casual observer will know, however, that these long "strings" of negative margins have been present in the 1990s. This was especially apparent in 1994 when break-even costs were consistently above the distant live cattle futures quotes.



Net Margin Over
Variable Cost ($/cwt.)

Figure 5. Presentation of Actual vs. Possible Market Performance Patterns

Performance of the Cattle Futures Markets

In general, the competitive market model serves as a norm for evaluating market performance. Using the conditions of a (perfectly) competitive market, futures markets can be viewed as a close approximation to the concept of perfectly competitive markets due to the following reasons (Leuthold, Junkus and Cordier, 1989):

(1) Atomicity of participants. This condition is, in general, satisfied in futures markets, especially for the liquid, active contracts. There are a large number of relatively small participants;

(2) Homogeneity of product. This condition is well satisfied on the futures markets as each contract is standardized except for maturity month and price;

(3) Free mobility of resources. This condition is nearly fulfilled since futures markets come closer to free exit and entry than most markets and still maintain the integrity of their contracts; and

(4) Perfect information. This condition is essentially achieved as the public nature of futures markets, along with large volumes of publicly supported market information, may allow the futures markets to approach the theoretical state of perfect knowledge more closely, arguably, than other markets.

These characteristics would be consistent with the suggestion in the previous section that, over time, the discovered price will approach average total costs of production by the most efficient producers--since the markets *are* competitive.

The analysis of price relationships between current cash, current futures, expected cash, and expected futures prices are the domain of research on pricing efficiency. More specifically, forward-pricing efficiency refers to the ability of the futures markets to forecast the expected cash price at the maturity date of the futures contract.

It is popular when assessing forward-pricing efficiency to refer to futures prices as forecasts, broadly interpreted. A common and traditional model used to test forward-pricing ability is:

$$S_t = \alpha + ß \cdot F_{t-i} + \varepsilon_t,$$

where

S_t = the cash price at delivery,
F_{t-i} = the futures price i months before maturity, and
ε_t = a random error term.

For an efficient, forward-pricing market, it is hypothesized that $\alpha = 0$ and $ß = 1$ in an empirical test. Note that if $ß \neq 1$, then the test for $\alpha = 0$ is no longer appropriate (Martin and Garcia, 1981). Acceptance of this hypothesis implies that the futures price is (statistically) an unbiased predictor of the expected cash price.

The support for the validity of this model is mixed in empirical research on agricultural commodities. Continuous inventory commodities usually fail to reject the hypotheses that $\alpha = 0$ and $ß = 1$. Futures markets for these commodities are thus generally found to be unbiased predictors. Discontinuous inventory (e.g., potatoes) and noninventory (e.g., livestock) commodities often fail the hypothesis tests. Goss (1981) suggested that the absence of inventories may bring gaps in the flow of information or increase errors in expectations because of the lack of close ties between cash and futures prices.

When related to the live cattle futures markets, the biased futures price debate is covered by several articles concerning the forecasting performance of the futures price (Leuthold 1974; Just and Rausser 1981; and Martin and Garcia 1981). The agreement among these studies is the existence of significant errors (in the forecasts) in the live cattle futures prices beyond four months prior to maturity. They also find there is some seasonality in the predictive accuracy of the market.

Koppenhaver (1983) reviews several studies by Leuthold (1972), Cox (1976), and Helmuth (1981). According to Koppenhaver, the articles reviewed essentially argue that if the live cattle futures market operates efficiently in the context of the random walk model, the futures price must be an unbiased predictor of later cash prices.

Koppenhaver suggests, however, that there is a confusion between the theory of an efficient market and the hypothesis of forward prices as unbiased estimates of future cash prices. The author argues that although there is sometimes a bias in live cattle futures prices, it is not inconsistent with certain types of market efficiency. Unbiasedness, he argues, is not a necessary condition for market efficiency.

An efficient market is defined as one in which prices fully reflect available information (Fama, 1970). Fama classified empirical tests of market efficiency as weak, semi-strong, and strong. Fama's developments provide a base for the analysis of the informational efficiency of market prices. More recently, Blank (1989) has defined the criteria for evaluating price efficiency in futures markets. The forms of pricing efficiency are as follows:

(1) *weak form efficiency,* in which current futures prices reflect all information contained in past price series;

(2) *semi-strong form efficiency,* in which current futures prices reflect all currently available public information; and

(3) *strong form efficiency,* in which current futures prices reflect all currently available public and private information.

A statistically unbiased predictor is not the same as an accurate predictor. Accurate predictions require a relatively small variance of the ε_t, a characteristic that will not be present when the prices are volatile.

Related to the efficient market hypothesis is the random walk hypothesis which implies that the difference between the futures price in *t* and the subsequent futures price in *t* + 1 is a random number reflecting the random receipt of new information. This hypothesis might be tested by:

$$F_{t+1,T} - F_{t,T} = \varepsilon_{t+1},$$

where ε_{t+1} = a random variable with zero mean in independent drawings.

In his literature review, Rowsell (1991) concludes that there is a strong connection between efficient markets and the price discovery process. According to Rowsell, "Market efficiency is not a requirement for the price discovery process, but efficient markets can be a performance measure of price discovery" (p. 36). This statement implies that the market which is most "informationally efficient" will lead (in a time sense) the other markets in discovering the market clearing price.

In sum, the efficient market literature gives mixed results on the efficiency of the cattle futures markets. All the research, it should be noted, examines the prices being discovered and largely ignores the question of whether, and how, the price patterns would change if the mix of traders were different. It should also be noted that in the formal "efficient market" context, the cattle futures market cannot, by definition, be strong-form efficient. The private information in the hands of cattle feeders is *not* being reflected in the price discovery process unless one assumes that all other traders have access to the same information, a largely untenable assumption.

Some Needed Theory and the Resulting Analysis

In investigating further the possible implications of cattle feeders' involvement in the price discovery process, a theoretical base is needed. The theory is reported here and is then extended and applied to show how changes in the tax rate and/or percentage deductibility (of losses in futures) would influence cattle feeders' participation and what that participation could mean.

Cattle producers are assumed to maximize what are called "certainty-equivalent profits" adjusted by tax considerations. From the profit maximization position, the cattle feeders' demands for cash and futures positions can be derived as functions of a set of tax parameters (marginal tax rate and deductibility for futures losses) and known prices, and for the statistical expectations and variances of random output (slaughter cattle) prices.

The study makes two major assumptions to deal with the hedging decisions by cattle feeders. First, cattle feeders are assumed to face only price uncertainty. The model was not designed to accommodate producers with production uncertainty. Once feeder cattle are purchased, the final output is essentially fixed. This assumption is not unreasonable because death loss is minimal in the feedlot, and gains are only occasionally influenced significantly by outside forces such as weather.

Second, producers are assumed to be price-takers in a probabilistic context since the producers are unable to influence the distribution of selling prices. This assumption is commonly adopted in the systematic study of the theory of the competitive firm under price uncertainty and in the presence of risk. It is also assumed that producers' beliefs about the final sales price can be summarized in the form of a probability distribution.

Assume that a cattle feeder is considering selective hedging. In a strict sense, selective hedging refers to an approach to hedging where there are time periods when the hedger will assume a hedged position and times when he will be a cash-market speculator. However, unless discouraged by tax policy, he might also periodically enter the futures markets seeking profits but in a way that would contribute to the price discovery process, rather than assuming either an unhedged cash speculative position and trying to make all needed adjustments and

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The certainty-equivalent profit maximizing position is shown in the literature on decisions in risky settings to be the level of operation that would maximize a decision maker's utility, given a risk aversion measure for that particular decision maker. The certainty-equivalent framework is then useful in explaining how different decision makers with different attitudes toward risk might behave in futures trades.

corrections in the size of the cash position. This possibility is especially important when negative feeding margins are being offered.

Table I shows a sample situation faced by cattle producers. The producer is faced with a tax scheme comprised of profits that are adjusted by a constant marginal tax rate, (t) with a range from 0 to 1 (or 0 to 100 percent) and deductions for futures losses, (d), also ranging from 0 to 1. At time t = 0, suppose that the expected cash price, $E(S_1)$, exceeds the current cash price, S_0. The producer is expected to take long positions in the cash market--i.e., place cattle. When the expected futures price, $E(F_1)$, is greater than the current futures price, F_0, he might also like to take long positions in the futures market. A capacity constraint (cash cattle plus long futures ≤ feedlot capacity) could allow being long in either cash cattle and/or futures if such were not discouraged by tax policy.

Table I. A Possible Scenario Faced by Cattle Producers

	Cash Market	Futures Market
Price Expectation:	$E(S_1)-S_0 > 0$	$E(F_1)-F_0 > 0$
Action Taken at t=0:	Long Cash	Long Futures
Price Realization:	$S_1 - S_0 > 0$	$F_1 - F_0 < 0$
Realized Profit at t=1:	$\pi_s > 0$	$\pi_f < 0$
Current Tax Treatment:	Ordinary Gain	Capital Loss
Total Profits Adjusted by Current Taxation:	$\pi_s + \pi_f - t\pi_s$	
Total Profits Adjusted by Alternative Approach:	$\pi_s + \pi_f - t(\pi_s + d\pi_f)$	

At time t = 1, the cash expectation turns out to be correct, but the futures expectation is not correct. The realized cash profits are positive and the realized futures profits (from long futures positions) are negative. According to the current tax policy, the futures losses are capital losses (speculative trading) and are not deductible for tax purposes. In this example, the total profit function adjusted by taxation will be $\pi_s + \pi_f - t \cdot \pi_s$ where the symbols are as defined below. However, if any deductions for futures losses (measured by d) are allowed, then the total profit function becomes $\pi_s + \pi_f - t(\pi_s + d \cdot \pi_f)$, the expression shown at the bottom of the table under an "alternative approach" to tax policy.

The general analysis proceeds using an alternative or "corrected" definition of after-tax total profits from cash and futures positions defined by:

If the negative margins are due to low distant futures prices due to a developing or pending surge in placements and therefore in fed cattle supplies, the economically correct role of futures is to discourage placements in the cash sector. The issue pursued in this study is one of how quickly and how effectively the market equilibrates and moves back toward the expected zero margin. If the adjustment in the distant futures price (and therefore in the margins offered) is slow, then the possibility of an over-reaction is present. In the second quarter of 1994, cash (and futures) prices were in the low to mid-$60s for fed cattle, down from an $80+ market in the second quarter of 1993. Placements in May and June of 1994 were down 20.4 and 15.7 percent respectively, evidence of both a highly volatile marketplace and a discovered price that moved nearly $20 per cwt.

$$\Pi = \pi_s + \pi_f - t(\pi_s + d \cdot \pi_f),$$

where

Π = total profits;
π_s = cash profits;
π_f = futures profits;
t = marginal tax rate, t ranging from 0 to 1.0; and
d = deduction level, d ranging from 0 to 1.0.

Both cash and futures losses are deductible subject to, perhaps, a combined cash and futures feedlot capacity constraint and profits from both cash and futures activities are taxed at the marginal tax rate, t. Cash losses will be totally deductible and futures losses are deductible at the level set by d. There is no assumption needed in this general case as to whether cash and/or futures profits are positive or negative.

The agent's expected profits for cash and futures positions in period t = 1, the date at which the positions are liquidated, are therefore denoted by:

$$E(\pi_s) = E(S_1{}^{3}I_0) \cdot x_s - c(x_s) - f$$

$$E(\pi_f) = [E(F_1{}^{3}I_0) - F_0]x_f - c(x_f)$$

where

$E(\pi_s)$	=	expected cash profit at t = 1;
$E(S_1{}^{3}I_0)$	=	expected cash price at t = 1 conditional on information available at t = 0, I_0;
x_s	=	cash position chosen at t = 0 (short if negative, long if positive);
$c(x_s)$	=	an increasing and convex positive cost function;
f	=	fixed costs;
$E(\pi_f)$	=	expected futures profit at t = 1;
$E(F_1{}^{3}I_0)$	=	expected futures price at t = 1 conditional on information available at t = 0, I_0;
F_0	=	futures price at t = 0;
x_f	=	futures position chosen at t = 0 (short if negative, long if positive); and
$c(x_f)$	=	an increasing and convex positive cost function.

In this framework, a decision maker plans to sell (go "short") or to buy (go "long") cash output (in the form of feeder cattle) in period 0, depending upon price expectations for period 1. The decision maker commits himself in period 0 to an amount x_s, to be sold in period 1 at the prevailing price expectation for period 1. Assume that he may also deal in futures. For the futures market, let x_f be the amount of the live cattle futures sold at time 0. This position is closed out by an offsetting trade at time 1. The decision maker would be a cattle producer so that $c(x_s)$ represents production costs. These production costs consist of purchased feeder cattle, feed, and overhead costs with fixed costs of f. Then, $c(x_s)$ is interpreted as the cost, valued at t = 0, incurred by producing the cash positions x_s. In addition to dealing in cash positions, the cattle feeder could enter live cattle futures markets with trading costs of $c(x_f)$ which includes commissions and interests on margins. The futures positions will be closed out by an offsetting trade at t = 1, assuming negative (positive) x_f means being short (long) in the distant live cattle futures.

An after-tax certainty equivalent problem involving expected revenue levels and variances, adjusted by tax parameters, can then be developed (Yun, 1995). A profit function can be developed (to maximize) that incorporates a decision maker's risk preference, the variance of cash and futures prices, and the correlation (as a covariance measure) between cash and futures prices.

By taking the derivatives of the objective function with respect to x_s and x_f, respectively, and setting the derivatives to zero, first-order conditions for profit maximization can be obtained. By solving those first-order conditions for x_s and x_f, demand functions for x_s and x_f can be obtained. This analytical procedure is developed in detail in Yun (1995), Chapter 3.

The demand for the cash position, x_s, is found to be a function of the expected cash price, costs, expected futures price, costs of futures trades, the current futures price, the marginal tax rate, the risk aversion coefficient, expressions for the variance of x_s and x_f respectively, and the covariance between the cash and futures markets. The demand for x_f is a similar expression, with the roles of the cash and futures prices being reversed. *The big difference is that d, the level of deductibility of futures losses, appears in the derived demand for positions in the futures market.*

Implications of Tax Policy to Optimal Cash and Futures Positions

Changes in deduction levels for futures losses, for a given marginal tax rate, would thus alter the optimal levels of both cash and futures positions since cash and futures positions will be jointly determined. A change in deduction level (d) for a given tax rate (t) is shown (Yun 1995, Chapter 3) to affect price volatility (in terms of variances) because the change in d influences positions taken in the cash and futures markets, thus changing supply-demand dynamics, and profitability in terms of price-marginal costs relationships. *A change in d therefore changes the perceived risk premiums or the risk/return tradeoffs in the mind of the decision maker.*

The derived optimal cash and futures positions, influenced by tax parameters, allow inferences to be made. Table II shows the expected changes in the optimal cash and futures positions in response to an increase in marginal tax rates for a given deduction level. These results are comparable to a case where price variances decrease or the profitability (in terms of expected gains) increases.

In Table II, Case 1 demonstrates the situation where both cash and futures profits are taxed at the same marginal tax rate, t. Losses in futures are assumed to be fully deductible (d is assumed to equal 1.0). Case 2 shows profits in futures being taxed at some larger rate than in Case 1 (so long as d is < 1.0) since the expression (1-td) increases as d approaches zero. In Case 3, for demonstration purposes, profits in cash are taxed at a rate of (1-td), and in Case 4, the notion of partial deductibility (d < 1.0) is applied to both markets. The DARA (decreasing absolute risk aversion) is a scenario the research literature generally supports as a relevant case. Such a decision maker shows less aversion to taking on risk as income potentials go up. The CARA case is also widely seen in the literature, suggesting some decision makers have a constant aversion to risk across income levels.

Table II. Expected Changes in Positions For Increases in Tax Rates

	DARA[1]	CARA[2]	IARA[3]
Case 1: $(1\text{-}t)E(\pi_s) + (1\text{-}t)E(\pi_f)$			
Δx_s:	(+)	(+)	(?)
Δx_f:	(+)	(+)	(?)
Case 2: $(1\text{-}t)E(\pi_s) + (1\text{-}td)E(\pi_f)$			
Δx_s:	(+)	(+)	(?)
Δx_f:	(+)	(+)	(?)
Case 3: $(1\text{-}td)E(\pi_s) + (1\text{-}t)E(\pi_f)$			
Δx_s:	(+)	(+)	(?)
Δx_f:	(+)	(+)	(?)
Case 4: $(1\text{-}td)E(\pi_s) + (1\text{-}td)E(\pi_f)$			
Δx_s:	(+)	(+)	(?)

Δx_f:	(+)	(+)	(?)

1 DARA stands for Decreasing Absolute Risk Aversion,

2 CARA stands for Constant Absolute Risk Aversion, and

3 IARA stands for Increasing Absolute Risk Aversion.

Suppose, to illustrate further, that there is an increase in marginal tax rates for a given deduction level. This increase in tax rates would decrease expectations of the risk in cash and in futures. For constant risk aversion (CARA in Table II), the decreased perception of risk, or decreases in the "risk premium" needed to take a position, will increase both the optimal cash and futures positions. For the decreasing risk aversion scenario (DARA), the changes in cash and futures positions will also be positive. In the DARA case, both substitution (direct) and income (indirect) impacts need to be considered since risk aversion is not constant. Both substitution and income impact prompt increases in demand for cash and futures positions as t increases. For increasing risk aversion (IARA), the responses of the optimal positions to a decrease in risk premiums induced by an increase in tax rates are ambiguous. Because this class of producers is less willing to assume risk as price variances decrease, their positive income effect combines with a negative substitution effect to leave the total effect ambiguous. It should be noted this IARA case is a much less important scenario. Decision makers *will* usually tend to be willing to increase their positions and thereby take on added risk exposure when the price (and therefore revenue) variances decrease. Often, in developments such as these, only the CARA case is considered, and the IARA case is seldom mentioned.

Table III shows the expected changes in the optimal cash and futures positions in response to an increase in deduction level for a given tax rate. For this study, of course, this is by far the more important development. Marginal tax rates are not likely to change, and there will be little consideration to a policy of changing marginal tax rates to change the situation facing the cattle feeder. But a policy to change the deductibility level for losses, d, *could* be considered for trade in commodity futures.

Suppose that the tax authority announces an increase in deduction level given a tax rate. This would decrease the perceived risk premiums in cash and in futures. For constant risk aversion (CARA), the decreased risk premiums will increase either the optimal cash or futures positions. This holds as well for the case of decreasing risk aversion (DARA). Note that although the cases of CARA and DARA have the same *qualitative* results in terms of the expected direction of change, this is not necessarily true for the *quantitative* results in terms of the adjusted amounts of the optimal positions. There is no income effect in the case of CARA, but there exists an income effect as well as a substitution effect in the case of DARA. Thus, the DARA case would show larger position responses to changes in deduction level than would the CARA case. For the less important use, increasing risk aversion (IARA), the responses of the optimal positions to a decrease in risk premiums induced by an increase in deduction level are again ambiguous. The positive income effect of decreased risk premiums combines with a negative substitution effect to make the total effect ambiguous.

The results shown in Table III are important. For the vast majority of decision makers (the CARA or DARA cases), *allowing deductions for futures losses with cash profits taxed as has always been the case (Case 2) would prompt cattle feeders to increase activity in both cash and futures markets.* These results raise added

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The idea that positions in the cash market and/or futures would increase in response to higher tax rates seems initially to be illogical. But this relationship is well established in the literature on financing and portfolio management. In the most basic of terms, the increases in the tax rate eliminate or reduce the frequency of occurrence in the "tails" of the profit distributions. This reduces the variance of the profits or income streams, and it is logical to expect the positions taken to increase when the variability of the income stream declines. What we have, then, is a reduction in the payment needed to take on risk, a reduction in the needed "risk premiums," when the variance(s) decline, and the cash and futures positions demanded increase in size.

and immediate questions. What will this mean to the well-being of consumers? What impact will it have, or could it have, on revenue flows to IRS? And, very importantly, what could this mean to the effectiveness and efficiency of the price discovery process in the futures markets? All these and related issues can be raised when the possibility of a revision in tax policy is considered.

The consumer maximizes the utility of consumption subject to a budget constraint and finds his demand for the commodity at time t = 0, C_0, as a declining function of price:

$$C_0 = a - bS_0 + u_0.$$

The simple demand function shown here is linear, a and b are fixed constants, S_0 is the cash price at t = 0, and u_0 is a disturbance term representing the consumers' unique utility characteristics. In this expression, the income effect of the price received by the producers upon market demand is ignored, suggesting (logically) that consumers do not change aggregate quantities consumed significantly in response to the impact on their own incomes of changing cattle prices.

Table III. Expected Changes in Positions For Increases in Deductibility of Futures Losses

		DARA[1]	CARA[2]	IARA[3]
Case 1:	$(1-t)E(\pi_s) + (1-t)E(\pi_f)$			
	Δx_s:	(0)	(0)	(0)
	Δx_f:	(0)	(0)	(0)
Case 2:	$(1-t)E(\pi_s) + (1-td)E(\pi_f)$			
	Δx_s:	(0)	(0)	(0)
	Δx_f:	(+)	(+)	(?)
Case 3:	$(1-td)E(\pi_s) + (1-t)E(\pi_f)$			
	Δx_s:	(+)	(+)	(?)
	Δx_f:	(0)	(0)	(0)
Case 4:	$(1-td)E(\pi_s) + (1-td)E(\pi_f)$			
	Δx_s:	(+)	(+)	(?)
	Δx_f:	(+)	(+)	(?)

1 DARA stands for Decreasing Absolute Risk Aversion,

2 CARA stands for Constant Absolute Risk Aversion, and

3 IARA stands for Increasing Absolute Risk Aversion.

Across the various market participants, (including futures market speculators) the supply and demand functions of cash positions and futures contracts can be aggregated in order to obtain market supply and demand schedules, and these aggregate schedules determine equilibrium or market-clearing cash and futures prices. Decision makers are assumed to be homogeneous within the group: (1) producers possess identical cost functions and identical risk aversion coefficients; (2) speculators are alike in their aversion to risk; and (3) consumers are similar in their demand coefficients and disturbances. These assumptions do not detract significantly from the relevancy of the results and they simplify the analysis. In addition, cattle feeders and pure speculators are assumed to share comparable price expectations since they pull from what is, in important respects, a similar (but not identical) information set.

Building on the conceptual developments, functions can be developed for demand by consumers, supply by producers (cash), futures demand by producers, futures supply by speculators, speculative supply by producers (the futures part of activity, which, when added to cash positions, would meet feedlot capacity restraints), a futures market clearing identity (futures supplied = futures demanded), and for what is called an "insurance price." This insurance price is the difference between the expected futures price in period 1 given information in period 0 (or $E(F_1{}^3I_0)$ less the current futures price (or F_0) and the costs of trading futures.

The equilibrium "insurance price" becomes an important and convenient term in analyzing the demand for and the supply of futures contracts. While the cash demand and supply are determined by cash price level, the futures demand and supply are determined by the current futures price relative to the expectation of corresponding futures price, i.e., the deviation between the two prices. For the case in which $E(F_1{}^3I_0) > [F_0 + c'(x_f)]$, as the deviation between $E(F_1{}^3I_0)$ or the price expectation and $F_0 + c'(x_f)$ or the current price plus trading costs becomes larger, the supply of long speculation is expected to increase. For $E(F_1{}^3I_0) < [F_0 + c'(x_f)]$, the larger the deviation between $E(F_1{}^3I_0)$ and $F_0 + c'(x_f)$ becomes, the larger the supply of short speculation.

Using the notion of market efficiency introduced earlier, implications of these developments to pricing efficiency in cash and futures markets can be drawn. An announcement of increases in tax rate and/or deduction level will decrease the differences between prices and marginal production costs. That is, when an increase in tax rate or deduction level is expected, producers would respond by increasing their planned output of fed cattle (because profit variances will be expected to decline). Given downward-sloping demand schedules (logical) and predetermined feeding and hedging costs, the increase in planned output will decrease the expected cash prices and thereby reduce the difference between selling cash prices and marginal costs of production. Since the market "imbalances" referred to earlier are made up of departures (by price) from costs, these reduced deviations between selling prices and costs can be seen as improved pricing effectiveness and more effective price discovery in the cash markets.

In the futures market, an increase in the positions taken by hedgers and pure speculators would tend to reduce the deviation between expected futures prices and current futures prices plus hedging costs and reduce the "insurance price." Defining "unbiasedness" as current futures prices being equal to expected futures prices, this reduced difference is translated into a situation in which futures prices turn into an unbiased predictor of corresponding expected cash price or, alternatively, the probability of any bias in prediction in the futures is reduced.

In sum, increasing the tax rate and/or *allowing for deductions on losses from futures trade could have a positive impact on restoring market equilibrium in terms of the price-marginal costs relationships and thereby improve pricing efficiency and price discovery in both the cash and futures markets.* This benefit would be bolstered by increased participation of cattle feeders as fears of non-deductible losses decrease with increases in d, the deductibility of futures losses. Since a cattle feeder looking to protect investment in feedlot facilities would be expected to enter the market more quickly and at smaller magnitudes of market imbalances (especially for negative feeding margins) than the pure speculator (their objectives are somewhat different), the involvement of cattle feeders is especially important. This holds true even if one were willing to assume pure speculators will have equal access to all of the (often proprietary) information cattle feeders could bring to the price discovery process.

This does *not* mean their trading behavior will be the same. For cattle feeders, so long as $d > 0$, part of their futures losses will be deductible. For pure speculators, d is always zero and, in addition, their risk/reward relationship can and will be different from those of a cattle feeder who might, for example, be looking at a long position in distant live cattle futures as an alternative to being long in cash when the feeding margins being offered are negative. Too, the information sets may be at least slightly different in that information on costs, gains, and performance in the feedlot is potentially available to cattle feeders sooner.

A Framework for Welfare Measures and Directions of Impact

For risk averse economic agents including producers, pure speculators, and consumers, the most appropriate measure of welfare gains or losses due to a change in tax policy is the change in expected utilities generated by the change in tax rates or deduction levels. Under the procedure being discussed here, clear-cut conclusions cannot be made since it cannot be directly determined (cannot be observed) whether the utilities of each group increase or decrease. However, an alternative approach can be adopted which uses welfare measures based on means and variances of the profits accruing to the respective groups. If average profits increase and/or profit variances decrease, the economic agent being considered is better off. This would clearly be the case for producers as they seek to maximize their utility or satisfaction by maximizing profits.

The same measure can be adopted for pure speculators. It has to be recognized that expected profits do not absolutely and correctly capture welfare gains or losses for risk averse agents under uncertainty, so this procedure should be considered as only an approximation. For the consumers' side, without resorting to underlying utility maximization, the traditional consumers' surplus measure can be retained as an indicator of welfare gains or losses to consumers.

For producers, the level of expected profits adjusted by tax parameters is used as the measure of producers' welfare. The expected gains to producers from changes in tax policy are defined as:

$$\Delta E(\Pi_p) = E(\Pi_p^*) - E(\Pi_p).$$

where

$\Delta E(\Pi_p)$ = the change in welfare,

$E(\Pi_p^*)$ = the welfare of producers after a tax policy change, and

$E(\Pi_p)$ = the welfare of producers prior to tax policy change.

If this is positive, then producers would obviously be better off (for given variance of profits) due to the changed tax policy, at least in the aggregate sense.

For the pure speculator, the welfare changes, $E(\Pi_f)$, are given by

$$\Delta E(\Pi_f) = E(\Pi_f^*) - E(\Pi_f)$$

where

Π_f^* and Π_f are defined similarly to the measures for producers, with the * indicating welfare after a tax policy change. If this is positive (welfare gain), then pure speculators would be better off due to the changed tax policy, at least in the aggregate sense.

When considering the gains or losses received by consumers through a changed tax policy, a more traditional surplus measure is used. The expected gains to consumers from the changed tax policy are:

$$\Delta E(CS) = (1/2)E\{[S_1 - S_1^*][D(S_1) + D(S_1^*)]\}.$$

where

S_1 is the cash price to consumers before the tax policy change, and
S_1^* is the cash price to consumers after the tax policy change.

The $\Delta E(CS)$ expression assumes linear supply and demand schedules.

If this is positive (welfare gain), then consumers would be better off due to the changed tax policy, at least, in the aggregate sense. The measure will be positive, of course, if $S_1^* < S_1$. Cash prices after the policy change *will* decrease since the policy change prompts an increase in cash cattle production activities.

In this study, it is assumed that social welfare, W, can be obtained by summing individual economic agents' (approximate) measures of welfare. The expected value of aggregate welfare is then measured as:

$$E(W) = E(\Pi_p) + E(\Pi_f) + E(CS)$$

where

p, f, and CS refer to producers, speculators, and consumers.

In addition, social welfare gains are measured by the sum of the expected changes in the profits of producers and pure speculators, together with the expected change in consumers surplus, expressed as:

$$\Delta E(W) = \Delta E(\Pi_p) + \Delta E(\Pi_f) + \Delta E(CS).$$

Although this is positive, economic well-being is not necessarily raised to *everyone* by a change in tax policy. Some groups could be worse off as a result of changed tax policy, even though a positive $\Delta E(W)$ implies the gains to different groups are larger than any losses to other groups.

Government's Tax Revenue Function

Consider tax payments from cattle feeders who trade as traditional hedgers (when margins are positive), who get involved in correcting other imbalances (when margins are negative), and who would have been, historically, treated as speculators with zero deductibility of futures losses. The expected gains to the government from the changes in tax policy to allow cattle feeders to deduct futures losses are defined as:

$$\Delta E(G) = E(G^*) - E(G)$$

where

$E(G^*)$ refers to tax revenues after the tax policy change, and

$E(G)$ is tax revenue before the policy change.

If this is positive, then the government's tax revenues are raised due to the changed tax policy.

Some Analytical Measures of Impact

The impacts on the welfare of the various groups are analyzed under two cases: (1) a short-run case in which only optimal cash and futures positions (quantities) are allowed to vary, and (2) a "segregation" case under which prices as well as positions are allowed to vary, but there is assumed to be no recursive impact of futures price on cash price. To obtain the most complete picture of the overall welfare effects in terms of expected profits, each case considers the effects of tax policy on: (1) the before-tax and after-tax expected mean level of profit, and (2) the before-tax and after-tax variance of profits.

Table IV shows the anticipated changes in mean and variance of producers' before-tax and after-tax profits in response to an increase in tax rates, depending upon the assumptions of producers' attitudes toward risk. The expectations are comparable to those of changes in positions in response to changes in tax rates that were presented earlier. Suppose, to illustrate, that there is an increase in the tax rate. For constant risk aversion (CARA), the means of cash and futures *before-tax profits* are expected to increase. This occurs because the increased tax rate reduces the variance of the profit stream and, as a result, prompts increases in the optimal cash and futures positions with other things remaining constant.

This result also holds for the case of decreasing risk aversion (DARA). The increase in total *before-tax profits* is expected to be larger under the DARA case than under the CARA case since the DARA case involves an income effect as well as substitution effect. For the less important case of increasing risk aversion (IARA), the effects of increased tax rates on the mean of before-tax profit are ambiguous since the corresponding effects on the optimal positions, as noted earlier, are indeterminate.

For the CARA case, the means of cash and futures *after-tax profits* are expected to remain unchanged. The increased portion of the optimal positions are exactly offset by the increased tax rates and there is thereby no change in the total after-tax profits. For the DARA case, the mean of cash and futures after-tax profits (and thus total after-tax profits) will increase since the optimal positions increase more proportionally than the tax-adjusted profits decrease as tax rates increase. This result reflects the more aggressive reaction of the producer whose risk aversion decreases as income levels increase. For IARA, the changes in the mean of after-tax profits are again indeterminate.

Now, consider the impacts of an increased tax rate on the variances of before-tax and after-tax profits. For constant risk aversion (CARA), the variances of before-tax cash and futures profits will increase. For decreasing risk aversion (DARA), the magnitude of increases in the profit variances are bigger than under the CARA case since the DARA case involves the income effect as well as the substitution effect. For increasing risk aversion (IARA), the changes in the variances are indeterminate since the changes in the optimal positions cannot be determined.

Table IV. Expected Changes in Mean and Variance of Producer's Profits For Increases in Tax Rates[1]

		DARA[2]	CARA[3]	IARA[4]
Case 1:	$(1-t)E(\pi_s) + (1-t)E(\pi_f)$			
	$\Delta E(\pi_s)$:	(+)[4][+][5]	(+)[0]	(?)[?]
	$\Delta var(\pi_s)$:	(+)[+]	(+)[0]	(?)[-]
	$\Delta E(\pi_f)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\pi_f)$:	(+)[+]	(+)[0]	(?)[-]
Total	$\Delta E(\Pi)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\Pi)$:	(+)[+]	(+)[0]	(?)[-]
Case 2:	$(1-t)E(\pi_s) + (1-td)E(\pi_f)$			
	$\Delta E(\pi_s)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\pi_s)$:	(+)[+]	(+)[0]	(?)[-]
	$\Delta E(\pi_f)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\pi_f)$:	(+)[+]	(+)[0]	(?)[-]
Total	$\Delta E(\Pi)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\Pi)$:	(+)[+]	(+)[0]	(?)[-]
Case 3:	$(1-td)E(\pi_s) + (1-t)E(\pi_f)$			
	$\Delta E(\pi_s)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\pi_s)$:	(+)[+]	(+)[0]	(?)[-]
	$\Delta E(\pi_f)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\pi_f)$:	(+)[+]	(+)[0]	(?)[-]
Total	$\Delta E(\Pi)$:	(+)[+]	(+)[0]	(?)[?]

	$\Delta var(\Pi)$:	(+)[+]	(+)[0]	(?)[-]
Case 4:	$(1\text{-}td)E(\pi_s) + (1\text{-}td)E(\pi_f)$			
	$\Delta E(\pi_s)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\pi_s)$:	(+)[+]	(+)[0]	(?)[-]
	$\Delta E(\pi_f)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\pi_f)$:	(+)[+]	(+)[0]	(?)[-]
Total	$\Delta E(\Pi)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\Pi)$:	(+)[+]	(+)[0]	(?)[-]

1 ( )s show before-tax impacts, and [ ] show after-tax impacts.

2 DARA stands for Decreasing Absolute Risk Aversion,

3 CARA stands for Constant Absolute Risk Aversion,

4 IARA stands for Increasing Absolute Risk Aversion.

Source: The table is adapted from Yun (1995). The mathematical derivations are presented there, and more detail is available on request from the Research Institute on Livestock Pricing.

For the CARA case, the variances of after-tax profits are expected to remain unchanged. This is because the increases in the optimal positions induced by an increased tax rate are exactly offset by the decreased constant, $(1 - t)^2$ or $(1 - td)^2$, embodied in the mathematical expressions calculating variances of profits (see Yun, 1995, p. 107). This result is not surprising since positions vary so that changes in tax parameters are exactly proportionally offset by changes in the optimal positions to accomplish constant risk exposure. For the DARA case, however, the profit variances increase in response to an increased tax rate. The very definition of DARA implies that risk aversion decreases as the expected profits increase. The optimal positions increase more proportionally and the decreased constant, $(1 - t)^2$ or $(1 - td)^2$, in the calculations fails to offset the increase in profits from the larger optimal positions. For the IARA case, the variances of profits are expected to be reduced. The substitution effect is positive and the income effect is negative, thereby decreasing after-tax variance.

With respect to pure speculators' welfare changes, the expectations are analogous to the case of producers' welfare changes. The difference is that the supply responses to the margin between current and expected futures prices have a different magnitude. For the CARA case, the mean of pure speculators' before-tax profit increases and its variance also increases. For the DARA case, the expected before-tax profit of pure speculators increases and its variance also increases. For the IARA case, the change in the expected before-tax profits is ambiguous and the corresponding change in the variances is also indeterminate. For CARA, the mean of after-tax profit and the corresponding variance are expected to be unchanged with the same reasoning as that presented for the producers' case. For DARA, both the mean and the variance of after-tax profits increase. For IARA, the change in the mean is indeterminate while its variance decreases when the tax rate increases.

The effects of an increase in deduction level given a tax rate, the more interesting case, are the same as those for tax rate increases, at least in a qualitative sense. The important differences between the case of a tax rate change and the case of a deductibility change are: (1) the relevant expectations can be made only when producers' tax-adjusted expected profit function involves the terms of $(1 - td)E(\pi_s)$ and/or $(1 - td)E(\pi_f)$, and (2) more importantly, the changes in mean and variance of expected profits in response to a change in deduction level will be smaller in absolute value compared to the case of an change in tax rate, unless the marginal tax rate is 100 percent. The deduction level, d, is always multiplied by tax rate, t, in the derivations. In addition, the mean and variance of pure speculators' before-tax and after-tax profits are not influenced by the changes in deduction level. This is because pure speculation itself is not to be involved in any level of futures loss deduction for tax purposes--i.e., for pure speculators, d=0. Table V summarizes the directional expectations of a change in deduction level in a short-run framework.

All four "cases" are shown in Table V for completeness, but Case 2 is the important case. It shows the deductibility term, "d," in the profit expression for futures positions, or $(1\text{-}td)E\pi_f$. *This corresponds to the scenario where a cattle feeder could be fully involved in the price discovery process (subject to some cash business position or capacity restraint) and any losses in futures trades would always be deductible at a level given by d.* For the CARA and DARA cases, the mean and variances of total before-tax profits would increase with increases in d. The cash side of the business would not be affected since losses are already deductible. The mean and variances of the total cash-futures positions would increase with increased futures market activity. For constant risk aversion (CARA), the "offsetting effects" discussed above would mean no change in after-tax means or variances. But for the very realistic decreasing risk aversion (DARA), the means and variances of both the futures and total profit streams would increase on an after-tax basis.

Table V. Expected Changes in Mean and Variance of Producer's Profits For Increases in Deductibility[1]

		DARA[2]	CARA[3]	IARA[4]
Case 1:	$(1-t)E(\pi_s) + (1-t)E(\pi_f)$			
	$\Delta E(\pi_s)$:	(0)[0]	(0)[0]	(0)[0]
	$\Delta var(\pi_s)$:	(0)[0]	(0)[0]	(0)[0]
	$\Delta E(\pi_f)$:	(0)[0]	(0)[0]	(0)[0]
	$\Delta var(\pi_f)$:	(0)[0]	(0)[0]	(0)[0]
Total	$\Delta E(\Pi)$:	(0)[0]	(0)[0]	(0)[0]
	$\Delta var(\Pi)$:	(0)[0]	(0)[0]	(0)[0]
Case 2:	$(1-t)E(\pi_s) + (1-td)E(\pi_f)$			
	$\Delta E(\pi_s)$:	(0)[0]	(0)[0]	(0)[0]
	$\Delta var(\pi_s)$:	(0)[0]	(0)[0]	(0)[0]
	$\Delta E(\pi_f)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\pi_f)$:	(+)[+]	(+)[0]	(?)[-]
Total	$\Delta E(\Pi)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\Pi)$:	(+)[+]	(+)[0]	(?)[-]
Case 3:	$(1-td)E(\pi_s) + (1-t)E(\pi_f)$			
	$\Delta E(\pi_s)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\pi_s)$:	(+)[+]	(+)[0]	(?)[-]
	$\Delta E(\pi_f)$:	(0)[0]	(0)[0]	(0)[0]
	$\Delta var(\pi_f)$:	(0)[0]	(0)[0]	(0)[0]
Total	$\Delta E(\Pi)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\Pi)$:	(+)[+]	(+)[0]	(?)[-]
Case 4:	$(1-td)E(\pi_s) + (1-td)E(\pi_f)$			
	$\Delta E(\pi_s)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\pi_s)$:	(+)[+]	(+)[0]	(?)[-]
	$\Delta E(\pi_f)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\pi_f)$:	(+)[+]	(+)[0]	(?)[-]
Total	$\Delta E(\Pi)$:	(+)[+]	(+)[0]	(?)[?]
	$\Delta var(\Pi)$:	(+)[+]	(+)[0]	(?)[-]

1 ( )s show before-tax impacts, and [ ] show after-tax impacts.

2 DARA stands for Decreasing Absolute Risk Aversion,

3 CARA stands for Constant Absolute Risk Aversion,

4 IARA stands for Increasing Absolute Risk Aversion,

For the IARA case, the before-tax measures involving futures and total profits are again indeterminate since the magnitudes of the substitution and income effects are not known. The variance of the futures profits (and therefore of total) would be expected to decrease consistent with at least partial deductibility of increased futures positions as d increases.

Concerning consumers' welfare changes, it would not be appropriate to offer expectations in a short-run analysis. Only positions expected to adjust in response to the changes in tax policy are being considered here. Thus, the relevant analyses for consumers' welfare changes are performed under the "segregation" result.

It is impossible, under the "segregation" result, to make any kind of general qualitative assessment of the welfare gains for producers and pure speculators without resorting to numerical methods. Contrary to the above case in which only the optimal positions are assumed to adjust in response to changes in tax policy, the segregation result is based on the proposition that the positions *and* prices are simultaneously determined but without recursive or time-lagged feedback from the futures market to cash. The amplitude of the changes in the equilibrium prices depends on the elasticities of the related demand functions (as supplies are allowed to change along those demand functions), thus dictating quantitative measures before any conclusion can be drawn. But it is important to keep in mind the scope of the marketplace in the cattle industry. Only when there is a widespread reaction to a changed deduction level, one large enough to change the quantities offered for sale in a significant way, would the price effects come into play and bring the issue of demand elasticity into consideration.

With respect to (aggregate) consumers' surplus, an expectation can be made with certainty since increases in the tax rate and/or deduction level *always* increase cash and speculative optimal positions. Assuming the demand schedules are downward-sloping, the increased optimal positions involve decreases in the prices, cash prices in absolute levels and futures' prices relative to cash and to current or known futures prices. *Thus, consumers' surplus unambiguously increases when there exists an announcement of increases in deduction level.* A quantitative measure will again depend upon the magnitudes of demand elasticities and, as noted above, the magnitude of any change in quantity offered at the consumer level.

Differential impacts that depend upon the risk aversion assumptions can be generated based on expectations about the changes in the optimal positions. The adjustments in the optimal positions in response to changes in tax policy are expected to be larger for the DARA case than those for the CARA case. Given down-sloping demand schedules, the gains in consumers' surplus are, therefore, expected to be bigger for the DARA case than for the CARA case when there is an increase in the deduction level.

When optimal quantity positions only are being considered, the government's tax revenue change induced by changes in tax policy can be inferred. The above results imply that *increases in either tax rate or deduction level have a positive effect on the optimal cash and futures positions and a negative effect on the equilibrium prices.* For the short-run case, the mean of before-tax profits will increase in response to an increased tax rate and/or increased deduction level while the variance of that profit stream increases. *This implies that the mean of expected government's tax revenue increases and its variance also increases.* The increases in tax revenues are greater when, in aggregate, producers are assumed to have a decreasing risk aversion (DARA) than when they are assumed to possess constant risk aversion (CARA). The changes in tax revenues are expected to be larger when tax rates are adjusted than when deduction levels are altered unless the tax rate is 100 percent, a trivial case.

Changes in tax revenues are, in general, indeterminate under the segregation analysis when prices are allowed to change with the changes in production levels. *Increased quantities at the cattle feeder level in response to an increase in, for example, the deductibility of futures losses will push cash prices down. Unless demand for fed cattle is elastic, this increase in output will reduce total revenue to cattle feeders.* Unless costs decrease with increased output levels, possible but not likely unless there is unused fixed capacity, profits to cattle feeders could decline and prompt a decrease in tax revenues from the cash side of the operation. Here again, the elasticities of the demand schedules play an important role in determining the magnitude and the direction of changes in tax revenues.

It should be noted, however, that the unknown (and hard to predict) increase in futures activities by cattle feeders can and will influence tax revenues. *The analysis shows futures positions will increase.* If cattle feeders are, in fact, effective traders who bring proprietary information to the price discovery process and thereby profit from helping to restore a market equilibrium, especially when negative margins are being offered, *then those increased profits are taxed.* Increases in cattle feeder participation and any profits from futures trading activities could offset any reductions in tax revenues due to deductibility of futures losses.

Summary to This Point

The analysis started by presenting basic assumptions adopted in the theoretical model: (1) cattle feeders are assumed to face only price uncertainty; (2) they are not diversified into nonagricultural assets; and (3) they are price-takers in the output market. Considering tax parameters, specific tax-adjusted objective functions were specified corresponding to possible scenarios. Based on these objective functions, input demand functions for feeder cattle and demand functions for futures position can be derived. The first-part of the analysis included: (1) changes in cash and futures positions as marginal tax rate varies, and (2) changes in cash and futures positions as the deduction level of futures losses varies.

In order to examine the implication of varying risk aversion, conceptual arguments were presented. Direct and indirect effects were considered to show different changes in positions in response to changes in tax policy. Implications to the optimal cash and futures positions were drawn. For the cases of decreasing risk aversion (DARA) and constant risk aversion (CARA), both the optimal cash and futures positions were expected to increase in response to an increase in the tax rate and/or deduction level. For increasing risk aversion (IARA), a much less likely scenario, the responses of the optimal cash and futures positions to an increase in the tax rate and/or deduction level were considered to be ambiguous.

The second part of the analysis examined the determination of cash and futures prices as well as cash and futures positions. For this purpose, profit optimizing behavior of producers, pure speculators, and consumers was presented under a "segregation" approach which assume the cash and futures prices are determined jointly. Implications to equilibrium cash and futures prices were drawn. *When expected cash price exceeds costs, an increase in the tax rate and/or deduction level was expected to push down the equilibrium cash price to reduce the spread between price and costs. When the expected cash price is less than costs, the cash price was expected to increase in response to an increased tax rate and/or deduction level. This reduces the "gap" between prices and costs and moves the market toward a state of equilibrium.* When short (long) futures positions were increased in response to an increased tax rate and/or deduction level, the current futures prices were expected to decrease (increase) to reduce the spreads between the expected futures price and the sum of the current futures price for the same contract plus costs of trading. *This reduced gap or difference between expected futures prices and current futures prices plus costs would increase the effectiveness of the market as a price discovery mechanism.*

In order to examine welfare changes induced by tax policy, welfare measures were specified. For producers and pure speculators, the welfare measures are expected profits. For consumers, the measures are the traditional consumers' surplus. Also, changes in tax revenues were considered. For the short-run case when only positions are allowed to vary, producers' and consumers' welfare and expected tax revenue would increase in response to an increased tax rate and/or deduction level. The changes in individual agent's welfare and tax revenues are, in general, indeterminate under the segregation result where output price is also allowed to change with changes in the level of production. Prices would decline in the face of increased output levels, and this could decrease profits and tax revenue from the cash side of the operation. Whether profits (and tax revenues) from cattle feeders' increased involvement in futures trade in response to a change in deductibility of futures losses would increase or decrease will depend on cattle feeders' effectiveness in recognizing market imbalances and taking positions to correct them, positions that generate futures profits.

Implications to pricing efficiency were drawn by considering whether the changes in prices induced by changes in tax policy reduces the difference between the selling price and marginal costs. An increase in the deduction level could have a positive impact on restoring market equilibrium and thereby improve pricing efficiency in both the cash and futures markets. The importance of this finding is accentuated by the recognition that increased positions or activity by cattle feeders will mean bringing their private and proprietary information into the price discovery process for cattle futures.

To extend the analysis and broaden the inferential base, a simulation was conducted to generate optimal sizes of cash and futures positions and equilibrium cash and futures prices for a typical cattle feeding program of the 1980s. The results can be considered as what the optimal positions and equilibrium prices "should have been" in the context of profit maximization given tax parameters (marginal tax rate, t, and deduction level, d) and the 1983-87 distributions of actual cash and futures prices. The results were examined in terms of direction only. Large numbers are sometimes generated at extreme levels of the tax parameters. The *direction of change* in response to changes in the tax parameters, to determine whether the directions of influence already presented are confirmed empirically, was the intent of the simulation.

Details of the simulation are presented in Yun (1995). The mathematical formulations involved are often complex, and will not be presented in detail here. Overall, the simulations confirmed the direction of influence from changes in the level of deductibility of futures losses, the focus of attention in the analysis. Still somewhat unresolved, even after the simulations, are issues such as the net impact on IRS revenues of an increase in deductibility. The tendency for cattle feeders to increase cash *and* futures positions if the level of deductibility were to be increased is confirmed by the simulation. But direction of change is not enough to allow definitive conclusions on changes in IRS revenue flows. Working with an inelastic demand for fed cattle (consistent with the research literature), an increase in cash cattle positions will decrease total revenue to cattle feeders. This helps consumers via a lower price, but decreases profits to cattle feeders from cash positions. But the impact on tax revenues is still not determined because cattle feeders seeking to maximize profits will also increase futures positions when the deductibility of any futures losses is increased. What this will do to total feedlot-level profitability will depend on how effective cattle feeders are in their futures trades. If they take futures positions that reflect an accurate assessment and recognition of market disequilibria (futures prices too high or too low) then they would, at least periodically, earn profits on futures positions when the markets eventually move back to equilibrium. Those profits, which do not exist under current tax policy (or exist at nominal levels) would then be taxed.

Thus, the size of increases in futures positions taken by cattle feeders if they no longer had to worry about zero deductibility of futures losses *and* their effectiveness in the futures price discovery process will ultimately determine the level of IRS revenue flows. A thesis throughout this analysis is that cattle feeders are discouraged from participating in the cattle futures by existing IRS policy and, very importantly, that increased participation in futures would improve the price discovery process. But their impact on price discovery is not a clear cut issue. The extensive work by Murphy (1995) as reported in a companion Research Institute on Livestock Pricing bulletin by Murphy and Purcell does not provide a simple answer. In general, cattle feeders would become members of trading groups found to improve price discovery, but the evidence is not overwhelming and there are exceptions.

There is no evidence to date that the only possible impact cattle feeders would have on price discovery is to improve it. There are only limited empirically generated measures of cattle feeders' trading effectiveness and the related probability that their expanded trading activities and a more complete participation in the price discovery would generate profits. The simulation confirms consumers will be helped and confirms that cattle feeders would be more actively involved in cattle futures, but evidence is not yet complete on the net change in cattle feeders' profitability across cash and futures activities in response to (at least partial) deductibility of futures losses. Until those measures are generated, the net impact on revenue flows to IRS is somewhat indeterminate and would be positive only if at least part of the expanded futures activity by cattle feeders would be profitable, and then only if that expanded activity is indeed significant in volume.

Summary and Conclusions

This research focused on an examination of the impact of changes in tax policy on cattle feeders' behavior, the price discovery process, and the effectiveness of the cash cattle and futures markets in correcting market imbalances or disequilibrium situations. Emphasis was on the deductibility of futures losses, an issue that is subject to change by IRS policy adjustments. A summary of the results follows.

- An increase in the deduction level of futures losses increases the optimal cash positions taken by cattle feeders. For pricing efficiency in the cash market, this adjustment of the optimal cash position reduces the spreads or differences between expected cash prices and marginal costs, thus helping to correct market imbalances. When expected prices exceed projected costs, cattle feeders will increase cash positions. The increased supply of fed cattle, along with the resulting reduced prices, implies a welfare gain for consumers.

- An increase in the deduction level of futures losses increases the optimal futures positions taken by producers/hedgers. For informational efficiency, these increased futures positions provide more liquidity in the live cattle futures market. For pricing effectiveness in the futures market, this increase in futures positions also reduces the spreads between expected distant futures and current futures levels, correcting imbalances or disequilibria in the futures market.

- An increase in the marginal tax rate and/or deduction level of futures losses decreases the means of expected equilibrium cash prices over the sample period. The decrease in the expected cash price has an important implication for improvement in consumers' welfare since consumer buying prices are reduced. Combined with the result of the increased optimal cash positions, this finding also has an important implication for pricing efficiency in the cash market. An increase in the tax rate and/or deduction level pushes down the equilibrium cash price to reduce premiums of cash price to marginal costs of production, and boosts cash price back up toward costs when price is below costs. The market moves toward a state of relative balance or equilibrium more quickly and more effectively over time.

- An increase in the marginal tax rate decreases the means of expected equilibrium current futures prices over the sample period, while an increase in the deduction level for futures losses slightly increases futures prices. These findings have important implications for pricing effectiveness in the futures market. When short (long) futures positions are increased, the current futures price decreases (increases) to reduce or constrain futures price moves that are drifting above (below) equilibrium levels. Futures prices turn into more accurate predictors of the corresponding expected cash prices. This increases the effectiveness of the futures market as a price discovery mechanism.

- An increase in the marginal tax rate and/or deduction level decreases the means of producers' welfare over the sample period, given an inelastic fed cattle demand. As price responses become more flexible (demand less inelastic or elastic), the impacts of changes in tax policy become smaller, and producers' welfare would be increased by deductibility of futures losses when demand is elastic.

- An increase in the marginal tax rate and/or deduction level increases consumers' welfare over the sample period no matter the elasticity of demand for fed cattle or for beef at retail.

- An increase in the deduction level decreases the expected tax revenues from cash operations over the sample period, given an inelastic demand for fed cattle. *Depending on the magnitude and profitability of producers' increased participation in futures, this result could be positive when cattle feeders go short cash cattle and long live cattle futures (in the face of negative feeding margins) up to a feedlot capacity constraint.* Cash prices would increase if long cash cattle positions are partially replaced by long futures positions. This could increase cattle feeders' profits since total revenue increases as quantity offered declines in the face of an inelastic demand. The long positions in futures would also yield positive profits if the market, showing large negative feeding margins, is indeed out of balance. *Thus, impacts on tax revenue will vary with cattle feeders' increased participation in the futures markets and, unless a majority of their trades lose money (and that should not be the case if they are reacting correctly to significant market imbalances), tax revenues to IRS could increase.*

Overall, the current policies of Treasury/IRS discourage cattle feeders' participation in the price discovery process in cattle futures. The *Arkansas Best* controversy prompted widespread concern over IRS policies. The administrative adjustments by the Treasury Department during 1994 to resolve the *Arkansas Best* controversy did little to resolve the basic underlying issue. Traditional short hedges were restored, option fences were approved as "hedges," and the rules on lifting and replacing hedges (or options) were relaxed. But IRS policies still impose an asymmetry on the futures market participation by cattle feeders. When positive margins are occasionally offered by the distant futures prices, cattle feeders can go short in live cattle futures to push futures prices back down toward an underlying equilibrium price. Any sustained departure from the equilibrium or market-clearing price in the form of excessively high futures prices tends to prompt excessive supply responses, so cattle feeders can help the price discovery process when futures prices are moving too high. *But sustained periods of excessively low futures prices is arguably the more important type of disequilibrium, and the evidence clearly shows that this is the type of disequilibrium or market imbalance that is more likely to be present. IRS policies discourage cattle feeders from being involved in correcting this type of market imbalance, and the effectiveness of the price discovery process in cattle futures is decreased because of the IRS policy positions.*

When negative margins are being offered, cattle feeders are discouraged from decreasing, or constraining increases in, placements of cattle (the cash-market correction possibility) and going long in the distant futures. Any futures losses would be seen as speculative and non-deductible. But that means cattle feeders' often proprietary information may not be quickly and directly reflected in discovered futures prices. Cattle feeders can and do react by slowing placements, but this process of correction is, based on the data, often slow and costly in terms of the duration of significant market imbalances. Yun, *et al.*, confirm that when futures prices are dropping too low, it is the speculator that has to come in and start the correction. But speculators' objectives are different than cattle feeders', and market imbalances that are damaging to cash-connected operations like cattle feeders may still not be large enough to attract the speculator into the markets. *If effective and efficient price discovery processes are the objective of futures trade--and they should be--then the IRS policies that discourage cattle feeders from being fully involved in that price discovery process need to be critically examined.*

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