An Economic Analysis of Cow-calf Retained Ownership Strategies

by J. Carlberg and William J. Brown

Abstract

The article explores the risk efficiency of six strategies for beef producers using data from Saskatchewan, Canada for 1978 to 1997. The results indicate that the risk efficient strategies for the Saskatchewan beef industry are the cattle finishing enterprise and the cow-calf producer retaining ownership through both custom backgrounding and finishing.

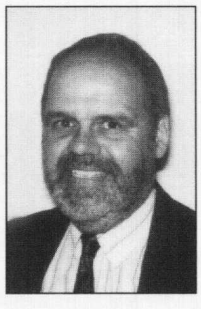
Background

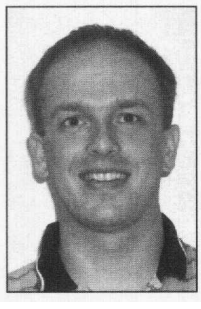
Retained ownership takes place when a producer keeps title of a group of calves beyond the traditional weaning period. The potential benefits and risks to retaining ownership are well-documented (Murra et. al., Joerger, Pierce, Guyer, Mc Kissick & Ikerd, Little et. al., Marshall & Wagner, Lawrence). For purposes of this article, ownership is assumed to be retained via contractual arrangements with custom feeders. Custom feeding means maintaining ownership of calves and the right to make major management decisions, even though the animals are not kept on the cow-calf producer's farm.

Retained ownership as a management strategy is not widely practiced by Saskatchewan beef producers. The sale of most calves after weaning in September and October still dominates the industry. Some ownership is retained by backgrounding animals, but it will be shown below that this puts the cow-calf producer in a worse position with respect to both return and risk.

Objective

The objective of this article is to explore the risk efficiency of various retained ownership strategies for cow-calf producers. Six alternatives are examined in this paper. The first is a cow-calf (CC) operation only, wherein ownership of a calf crop is relinquished after weaning. The second is cow-calf production and custom





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backgrounding (CC-B). At weaning, the calves are backgrounded at a location removed from the producer's farm, but the producer retains ownership of the calves. The third form is cow-calf, custom backgrounding and custom finishing (CC-B-F). The producer keeps title from weaning and backgrounding right through to finishing of the calves in a feedlot, but neither of the two latter stages of production are carried out on the producer's farm.

Three alternatives that do not involve the cow-calf producer are also examined. The first is backgrounding (B) only. This focuses on the risk and return encountered by parties who take title of the calves for only the first stage of post-weaning production. The second is finishing (F) only. Again, the focus is on the risk and return of the finishing operation, exclusive of the other stages of production. The final alternative is backgrounding and finishing (B-F). In this scenario, an entity takes title of the calves from the cow-calf producer at weaning, then holds the animals until they are ready for slaughter.

Transaction Cost Economics (TCE)

There are several types of transaction costs that apply directly to the retained ownership problem faced by beef industry participants. McNinch (1995) outlines the most common. The first type is selling and/or marketing costs, including commissions and transportation costs. Next is the cost of the negotiations involved between members of adjoining industry stages. The time taken by the involved parties, either personally or via an agent on the party's behalf, is a transaction cost. A third class of transaction cost is the management cost of the contract once it has been signed. A fourth type of transaction cost is the cost to the backgrounder and/or finisher of procuring animals. This can take the form of an order buyer's commission or the time spent by the party on his own behalf to find the necessary calves. The final type of transaction cost faced by all parties involved is risk.

Considering all these types of transaction costs, clearly TCE holds a prominent place in retained ownership decisions made by participants in the beef feeding industry. The five examples outlined above, coupled with the use of a model of industry restructuring (Barkema, Drabenstott and Cook, 1993), show that transaction costs are of concern to the beef industry and moreover that transaction costs have in part provided the impetus for the ongoing restructuring of the industry. As such, both production and transaction costs hold important places in any analysis of retained ownership opportunities for the various links in the beef supply chain.

Empirical Model and Methodology

Overview

There are five main steps that comprise the methodology used in this paper. The first step is to form budgets for each of the six enterprises of interest: CC, CC-B, CC-B-F, B, F, and B-F over the period of 1978-97 for Saskatchewan. The budgets and the prices used for barley and forages can be seen in Carlberg (1999). The second step is to deflate and inflate the costs of production from the base year to past and future years, respectively. Step number three is to specify the price ranges for output products, so that @RISK (Palisade Corporation, 1996) can stochastically determine the price received for the product of each enterprise: weaned calves, backgrounded feeders, or finished slaughter cattle. Step four involves a calculation of net returns once the costs and revenues of each operation are known. The fifth and final step is to provide these returns to RISKROOT so that it can use first degree stochastic dominance (FSD) and generalized stochastic dominance (GSD) to select among the risk alternatives (McCarl, 1988). A corollary to this fifth step is to plot the mean standard deviation (MSD) tradeoffs of the alternatives. This allows for a comparison of the respective strategies by inspection of graphical results.

CC Costs of Production

CC costs of production are based on Saskatchewan Agriculture and Food (SAF) benchmarks for the 1995 production year, the latest year available at the time the analysis was done (SAF, 1995). These costs are deflated backward and inflated forward to get costs of production for years other than 1995. Feed costs are based on actual yearly data from Saskatchewan for barley and roughage for all years. Labor costs are not considered in the cow-calf production costs; the cow-calf producer claims residual profits from the operation.

Total cost per head of production for the CC producer consist of operating costs plus fixed costs, as depicted in equation (1).

$$TC_{CC} = Oper + Fixed \quad (1)$$

Further, operating costs consist of all costs itemized in equation (2).

$$Oper = Feed + Vet + Breed + Herd + Death + Mkt + Past + Fuel + Manure + Fac + Misc + Int \quad (2)$$

where;

Feed = feed costs, consisting of roughage, straw, salt, and mineral for the CC operation. For the B and F operations, barley is also included

Vet = veterinary and medicine costs

Breed = breeding costs, consisting of the Prairie Farm Rehabilitation Administration (PFRA) breeding charges and all costs of owned bulls
Herd = herd replacement costs, accounting for value of cull cows and cost of replacement cows or heifers
Death = death loss costs, at a rate of 1 % for CC, 1.5% for B, and 0.5% for F
Mkt = marketing costs for each operation
Past = pasture costs, including cows pastured on community pasture (PFRA) and cows pastured on owned land
Fuel = fuel, lube, and repair costs
Manure = manure removal costs
Fac = facilities and fence costs, including maintenance and repair
Misc = miscellaneous costs, to account for costs not otherwise counted
Int = interest costs on operating costs

Fixed costs per head are shown in equation (3).
Fixed = Facdep + Eqpdep + Facint + Eqpint + Breedint + Graze (3)
where,
Facdep = depreciation costs on facilities
Eqpdep = depreciation costs on equipment
Facint = interest costs on facilities
Eqpint = interest costs on equipment
Breedint = interest costs on the breeding herd
Graze = grazing costs

The SAF CC budgets are based on costs for a one hundred cow herd, which is a representative size for Saskatchewan. It is also assumed that the average cow weight is 1200 lbs., that two bulls are required on owned pasture, and that the cow replacement rate is 15%. Further, it is assumed that forty cows are sent to PFRA pasture, while sixty cows are pastured on owned land. The average weight of the calves at the end of this stage of production is 550 lbs.

B Costs of Production

B costs of production per head are based on SAF benchmarks for the 1995 production year, the latest year available at the time the analysis was conducted (SAF, 1995b). As described below, these costs are deflated backward and inflated forward to get costs of production for years other than 1995. Feed costs are based on actual yearly data from Saskatchewan for barley and roughage for all years.

Total costs of production for Saskatchewan B operations consist of operating costs and fixed costs, as denoted in equation (4).
TCB = Oper + Fixed (4)
All operating costs can be summarized as in equation (5):
Oper = Feed + Feeder + Straw + Vet + Fuel + Mkt + Ins + Manure + Death + Misc + Int + Lab (5)
where;
Feeder = costs of purchasing weaned calf
Straw = cost of bedding
Ins = insurance on capital investment costs per head
Lab = labor costs
All other costs as described above
Fixed costs for the backgrounding operation are given in equation (6).
Fixed = Facdep + Eqpdep + Facinv + Eqpinv (6)

The SAF B budgets are based on costs for a five hundred head backgrounding enterprise. It is also assumed that the average weaned calf purchase weight is 550 lbs., and that the calves gain 2.0 lbs./day for 135 days on feed, and are sold at 820 lbs.

F Costs of Production

F costs of production are based on the model developed by Brown and McNinch (1996). In that work, they projected costs for 1997 for a 20,000 head capacity feedlot, which are used herein and then deflated for previous years as described below. Feed costs are based on actual prices for roughage and barley in Saskatchewan for all years.

Total costs of production for the F enterprise consist of operating costs and fixed costs, as denoted in equation (7).
TCF = Oper + Fixed (7)
All operating costs can be summarized as in equation (8).
Oper = Feed + Feeder + Straw + Vet + Fuel + Util + Mkt + Ins + Manure +Death + Int + Lab (8)

Fixed costs for the backgrounding operation are given in equation (9).
Fixed = Facdep + Eqpdep + Facinv + Eqpinv (9)

It is assumed that the average backgrounder purchase weight is 820 lbs., and that the finishers gain 3.25 lbs./day for 125 days on feed, and are sold at 1225 lbs.

CC-B Costs of Production

The costs of production budgets for the CC-B enterprise are based on a combination of the CC costs of production and the B costs of production detailed above. To arrive at the costs for the combined operation, the costs of production of the two independent enterprises are summed, and the appropriate transactions costs savings are subtracted. Note that the cost of purchasing the feeder is not incurred by the B operation and that the custom B lot charges a ten percent markup on all other costs.

The 1995 amounts for transactions costs saved by retaining ownership to backgrounding are: $15.75/head in sales commission, $6.00/head in buying commission; $1.00/head in check-off; $1.00/head in insurance; and $1.50/head in brand fee. The total is $25.25 per head saved by retaining ownership into backgrounding.

CC-B-F Costs of Production

The costs of production for the CC-B-F retained ownership option are calculated by adding the appropriate costs from each of the three independent operations. Besides the transaction costs savings outlined in the section above, there is an additional $6.00/head saving by avoiding the buying commission of the finisher. This puts total TC savings at $31.25/head. There is no cost to the enterprise at either the backgrounding stage or finishing stage of purchasing the feeder animal. However, the custom feedlot charges a ten percent markup on all other costs.

B-F Costs of Production

The B-F operation assumes that an independent party purchases weaned calves and then has them custom backgrounded and fed. The B-F operation saves transaction costs similar to the CC-B-F enterprise. Selling commissions for the backgrounded animal are avoided, as are purchasing commissions for the feeder entering the finishing lot. The only difference in transactions costs than those mentioned above is that the buying commission for weaned calves of $6.00/head is not realized in this case. That leaves transactions costs savings at $19.25/head for this strategy.

Deriving Historical Cost of Production Budgets

The cost of production budgets described above are based on 1995 costs for the CC and B operations and 1997 costs for the F operation. Without reliable data for previous years, it is important to find a method for deriving historical costs of production, which are calculated using consistent methodology.

1995 technology is assumed in all budgets. A number of production methods have changed over the years: weaning weights have increased, average daily gains have increased, veterinary and medicine innovations have been made, and others. Since the goal is not to examine the effects of technological change but rather to illustrate transaction cost savings and the effects of year-to-year fluctuations in market prices, it is assumed that all production methods and technology are constant over the period in question.

Statistics Canada calculates farm input price indices, which give the costs of inputs relative to their composite value in a certain base year (Carlberg, 1999). There are nine indices which are used in deflating costs: cattle, veterinary services, electricity, farm labor, supplies and services, prepared feed, value of land and buildings, building replacement cost, and machinery replacement cost. The indices are for Saskatchewan in most cases, and for Western Canada when specific Saskatchewan data are not available. The indices are used to adjust 1995 costs of production upward and downward to reflect the cost of production in other years.

Prices Received for Output

Data used to generate the revenue per head for each of the three primary enterprises were taken from the Canada Livestock and Meat Trade Report published by Agriculture Canada from 1978 to 1995. Data used for 1996 and 1997 were obtained from Canfax Research Services. This resulted in 20 years of prices for each of the following weight ranges. For weaned calves, an average of September and October prices for 500 to 600 lb. steers and heifers was used. For backgrounded feeders, an average of January and February prices for 800 to 900 lb. steers and heifers was used. For finishers, averages of January/February, May/June, and September/October prices for A1, A2 slaughter steers and heifers was used. Note that the B operation only has one turn per year, producing backgrounded feeders in January/February, however, the F operation has three turns per year.

Using @RISK to Generate a Stochastic Price Variable

Palisade @RISK is an add-on to Microsoft Excel and works by generating stochastic values for variables according to a distribution specified by the user (Palisade Corporation, 1996). The program iteratively generates any number of values within the specified distribution, then gives various statistical information as a result. The TRIANG function of @RISK was used and requires the user to input the minimum, mean, and maximum values for a set of data. The high, low, and average values for prices from the 20 years (1978 to 1997) within the appropriate weight ranges listed in the previous section by month were provided to @RISK, which then generated the corresponding random value.

Determining the Risk-Efficient Retained Ownership Alternative

There are two methods used to determine the risk-efficient retained ownership strategy. The first is graphical and involves plotting the MSD tradeoff for all possible strategies. This method provides an appealing visual representation of the risk/return tradeoffs that exist among all alternatives. The second method involves stochastic dominance techniques and uses the

RISKROOT program, which is capable of performing FSD and GSD (McCarl, 1988). RISKROOT has the ability to use GSD to determine the risk aversion coefficients (RACs) that differentiate among prospects when constant risk aversion is assumed. RISKROOT informs the user which distribution dominates on either side of the RACs it discovers.

Results and Analysis

The results shown in Table 1 are indicative of the risk and return associated with each retained ownership alternative. Two outcomes stand out when considering the means and standard deviations of the alternatives: the CC-B-F enterprise and the F enterprise. These are the only two operations that average a profit over the twenty year period. The highest average return is earned by the CC-B-F operation, but the lowest standard deviation, indicative of the least risk, is found in the F enterprise.

Figure 1 plots the MSD tradeoff of each strategy. The risk-efficient frontier (REF) for the industry, if plotted, would pass through two points: the F enterprise and the CC-B-F enterprise. All other enterprises lie below the REF, illustrating their relative risk inefficiency.

Several observations can be made about the risk/return tradeoffs of the various strategies. The CC-B-F strategy earns higher returns than the F despite the ten percent markup on custom feeding. The reason for this is because the cost savings involved in CC-B-F are substantial. First, feeder animals are not purchased at market prices, they are carried forward at cost of production. Second, there are considerable transaction cost savings by retaining ownership through finishing. As outlined above, these transaction costs amount to $34.75/head.

The B-F strategy shows that the stability of the F operation lowers the risk of the combined enterprise relative to B alone, but the enterprise is still subject to more risk than F alone. With regard to net returns, the B-F strategy has lower returns than either of the independent alternatives. This is because the price markups involved in custom feeding outweigh the transactions cost savings realized by retaining ownership from the backgrounding to the finishing stage.

The CC-B strategy shows how the chronic poor performance of the B strategy lowers the return relative to the CC strategy. CC-B is also riskier than either CC or B, because the combined enterprise is subject to more price risk than either of the independent alternatives.

Table 2 gives the year-by-year summary of the best retained ownership alternative when considering the CC producer's retained ownership alternatives. There was only one year of the twenty simulated during which some form of retained ownership would not have benefited the CC producer. Further, the CC-B-F strategy provided the best return to the CC producer in 15 out of 20 years. In four of those five years for which

Table 1. Net Returns to Retained Ownership Enterprises, 1978-1997.

Year	CC	CC-B	CC-B-F	B	B-F	F
1997	(6.63)	(137.73)	(8.83)	(159.06)	(128.09)	47.06
1996	(80.55)	(190.81)	(28.02)	(143.65)	(61.83)	86.03
1995	(100.63)	44.76	13.43	125.52	1.26	6.17
1994	26.80	121.23	99.97	54.29	(72.25)	(32.55)
1993	121.48	84.15	221.66	(84.92)	(58.34)	44.29
1992	45.51	19.38	121.30	(65.92)	(61.93)	24.20
1991	30.64	89.64	124.73	13.15	(55.14)	(12.89)
1990	(8.01)	(25.13)	36.40	(70.12)	(119.11)	5.94
1989	(10.72)	15.73	(27.14)	(19.79)	(167.69)	(56.71)
1988	(38.73)	34.91	(11.45)	38.89	(109.74)	(57.31)
1987	50.55	13.52	94.26	(89.73)	(115.67)	(2.14)
1986	(12.72)	(69.32)	(7.63)	(95.55)	(126.56)	10.55
1985	(115.39)	(128.18)	(91.34)	(33.55)	(77.86)	18.17
1984	(117.21)	(100.18)	(99.13)	(50.36)	(85.65)	23.90
1983	(113.24)	(185.50)	(42.83)	(16.48)	(35.85)	39.09
1982	(129.53)	(126.66)	(56.04)	(89.72)	(38.03)	64.63
1981	(169.41)	(144.39)	(112.52)	18.95	(42.18)	19.56
1980	(20.17)	31.62	37.44	13.80	(61.91)	36.71
1979	58.18	89.68	192.20	(19.28)	(7.05)	52.84
1978	110.58	(79.72)	138.36	(244.71)	(98.25)	66.04
Mean	(23.96)	(32.15)	29.74	(45.91)	(76.09)	19.18
Std. Dev.	82.54	99.25	96.57	83.03	42.99	38.53

CC=cow-calf; CC-B=cow-calf/backgrounding; CC-BF=cow-calf/backgrounding/finishing; B=backgrounding, B-F =backgrounding/finishing; and F=finishing.

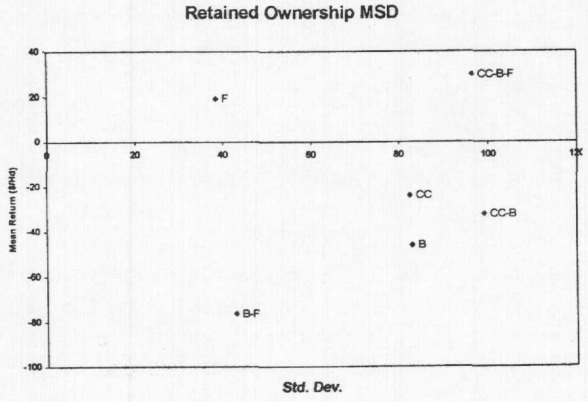
CC-B-F was not optimal, retaining ownership through only the backgrounding stage would have been the best strategy. Considering all ownership options in the industry, both F and CC-B-F would have yielded the highest return eight years out of twenty. There were only four years during which participating in the finishing process in some form would have caused returns to decrease.

Figure 2 shows the cumulative density functions (c.d.f.s) of the six retained ownership strategies discussed in this paper. As can be seen, the CC-B-F strategy dominates all the other strategies, except F, by FSD. Their c.d.f.s intersect and FSD is not present.

Table 2. Best Retained Ownership Strategy, Considering Return Only, 1978-1997.

Year	Benefit to R.O.?	Best R.O. For CC Producer	Best Overall
1997	No	CC Only	F
1996	Yes	CC-B-F	F
1995	Yes	CC-B	B
1994	Yes	CC-B	CC-B
1993	Yes	CC-B-F	CC-B-F
1992	Yes	CC-B-F	CC-B-F
1991	Yes	CC-B-F	CC-B-F
1990	Yes	CC-F-F	CC-B-F
1989	Yes	CC-B	CC-B
1988	Yes	CC-B	B
1987	Yes	CC-B-F	CC-B-F
1986	Yes	CC-B-F	F
1985	Yes	CC-B-F	F
1984	Yes	CC-B-F	F
1983	Yes	CC-B-F	F
1982	Yes	CC-B-F	F
1981	Yes	CC-B-F	F
1980	Yes	CC-B-F	CC-B-F
1979	Yes	CC-B-F	CC-B-F
1978	Yes	CC-B-F	CC-B-F
Overall	Yes	CC-B-F	CC-B-F *or* F

Figure 1. REF for Retained Ownership Options.



Further, because each distribution seems to dominate over approximately half of the plotted area, it is not possible to discern the results by inspection as it has been for other pairwise comparisons. RISKROOT found that a slightly risk averse decision maker would choose F over CC-B-F. Such a person would not be willing to trade the promise of higher returns for the increased risk involved in CC-B-F.

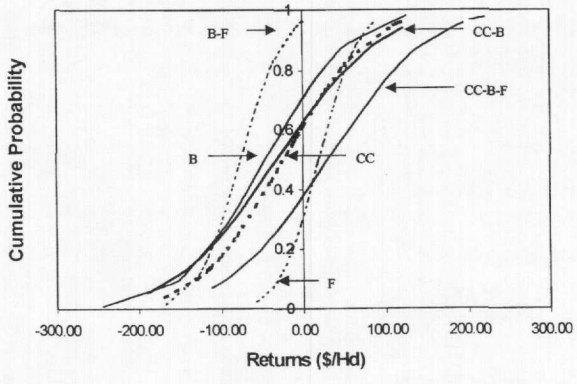
It is also important to consider those alternatives that are available to the CC producer separately from the others. The CC producer is unlikely to abandon his farm and way of life to invest in the feeding industry just because his risk attitude is more in line with the risk/return tradeoff associated with feeding. For the CC producer, the only important options are CC, CC-B, and CC-B-F. Even when all of these options are considered, the best strategy available to the CC producer is to retain ownership through to F. The empirical results support this argument strongly, since CC-B-F exhibits FSD over each of the other four strategies considered. This means that regardless of the risk attitude of the CC producer, he can do no better than the strategy of CC-B-F without completely removing himself from CC production.

Conclusions

The results clearly indicate that there are two dominant retained ownership strategies in the Saskatchewan beef industry: CC-B-F and F. They are the only strategies to yield positive average returns over the twenty year period from 1978 to 1997. They are the only strategies that could possibly lie on the risk efficient frontier. And they are proven to be the dominant strategies by the results of the RISKROOT program (Figure 2).

There are several noteworthy implications of the results. One of the most important is that the CC producer, traditionally somewhat on the less profitable

Figure 2. Cumulative Distribution Functions of Retained Ownership Alternatives.



end of the beef supply chain, has an opportunity to better his financial condition by retaining ownership through to finishing. As the results show, simply retaining ownership through backgrounding is not enough; this option places the producer in greater difficulty than engaging in CC alone. Additionally, the F strategy occupies an enviable position in the beef industry. Finishers make the second highest return of all the operations considered, and have the lowest level of risk. A decade or two ago, backgrounding and finishing were often performed by the same enterprise. Finishers recognized that they could increase profits in two ways if they removed the backgrounding component from their operations. First, they would lower the death loss, and second, they could switch facilities used in backgrounding to more profitable finishing, and as a result, increase the number of finished animals they produced each year. Both of these factors have lead to an increase in returns and decrease in risk for the finishing sector.

Limitations and Suggestions for Further Research

The paper has attempted to provide an in-depth analysis of six possible alternatives relating to retained ownership. On farm backgrounding and finishing has not been considered. Producers who may have inexpensive feed available, extra labor, and low capital investment may be able to retain ownership on their farms for less cost than having the animals custom fed at a feedlot. Appropriate opportunity costs for home grown feeds, unpaid labor, unpaid management, and equity capital would of course have to be factored into the costs. The extra costs and risks associated with marketing small lots of cattle would also have to be considered.

Other limitations of the paper include no consideration of production risk and no forecast of the effects of technological change on predicting risk efficient retained ownership strategies in the future. Little data are available on the variability of production factors, for example, death loss ranges. It is also unknown whether weaning weights, average daily gain, feed conversion ratios, and other important variables will change quickly, gradually, or not at all in the future. Further research into the limitations listed above is warranted.

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