Financial Impacts of Regional Differences in Beef Cattle Operations

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Abstract: The sensitivity of net cash farm income to changes in selected production variables, output prices, and input costs varies significantly across representative U.S. beef cattle operations. Larger changes in profitability result from changes in productivity and output prices than from changes in input costs.

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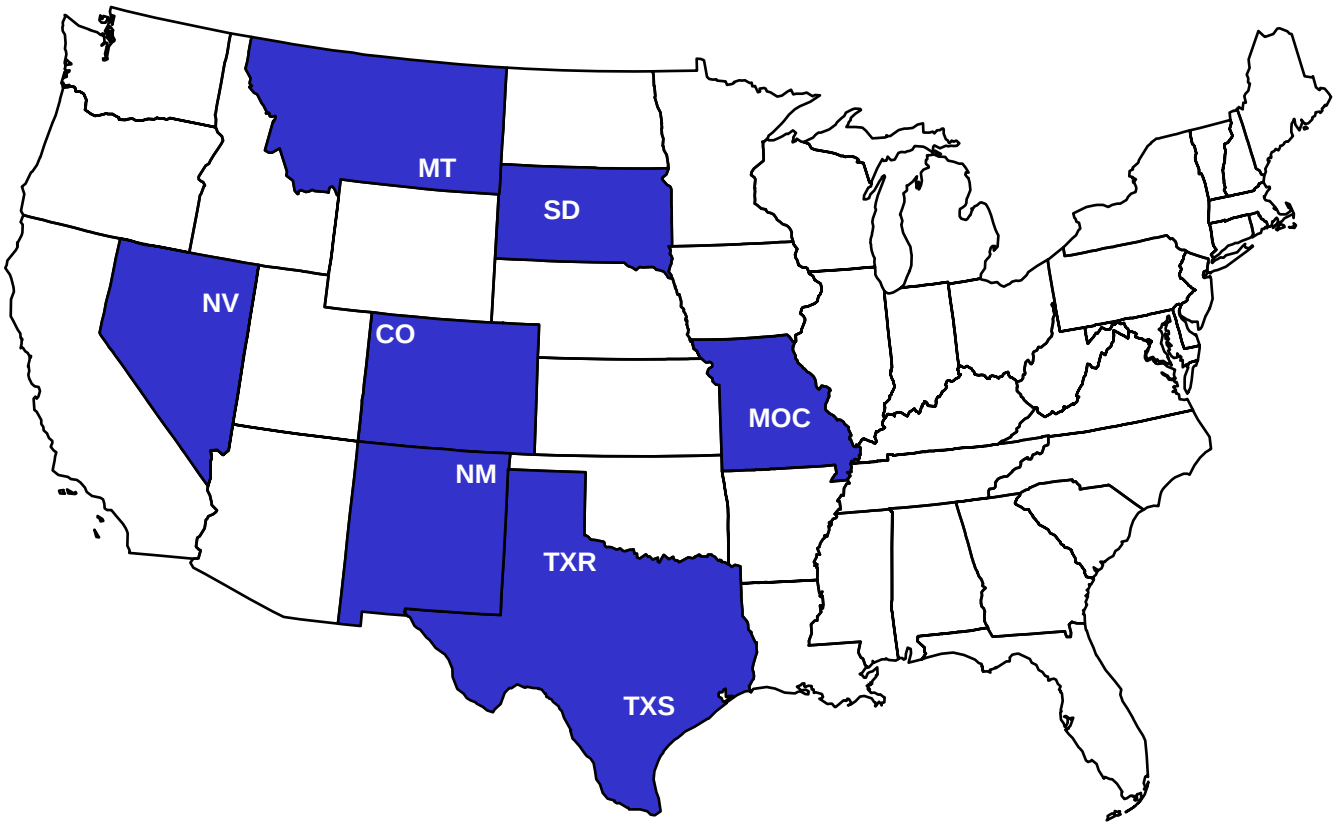
Introduction and Objectives

Beef cattle production across the United States is far from a homogeneous enterprise. On the contrary, differences in climate, geography, terrain, and cultural practices yield myriad types of operations. Feed costs, animal health expenses, calving season, weaning weights, reproductive efficiency, and access to financing are all influenced by regional differences. Two questions emerge: do the factors that drive profitability vary by region, and which factors influence profitability the most, under risk?

The objective of this study is to examine whether the chief factors influencing cow-calf profitability vary by region. This study will identify several of the chief factors influencing financial differences and quantify their impacts at the whole-ranch level under risk. Economic activity of eight representative beef cattle ranches in Montana, Colorado, Missouri, New Mexico, Nevada, South Dakota, and Texas (figure 1) was evaluated over a seven year horizon (2005-2011) and the influences of key production and input cost variables compared among ranches.

Sensitivity elasticities (SEs) were used to compare the impacts of selected change variables on the profitability of representative beef cattle operations. Use of SEs improves upon previous work of this type that used regression analysis and coefficients of separate

Figure 1. Representative Ranches Producing Beef Cattle



determination because actual ranch-level production risk is modeled stochastically up to 100 iterations per year. This added to the robustness of the analysis. SEs are similar to elasticities, but they quantify the average percentage change in a selected key output variable to a one percent change in an exogenous variable X (Richardson).

Methods and Data

Monte Carlo simulation was used to estimate the effects of changes in key production and input expense variables on profitability at the whole-ranch level. FLIPSIM, a farm-level simulation model, has been used for more than two decades to evaluate the likely impacts of policy alternatives (Richardson and Nixon). Using actual ranch-level data for weaning weights and calving percentage along with known historical variation in cattle and feed prices, FLIPSIM internally estimates parameters for multivariate empirical (MVE) probability distributions, then uses those parameters to simulate the MVE distributions. The program uses a set of standard assumptions and analyzes each representative agricultural operation using macro level projections of prices, inflation rates, and crop yield growth developed in the December 2005 FAPRI Baseline.

Economic and production data were available for eight representative beef cattle operations that have been developed and maintained by faculty of the Agricultural and Food Policy Center (AFPC) at Texas A&M University utilizing consensus-building interview processes. The representative ranches range in size from 240 to 700 head of beef cows. All information about the operations was fact-checked with panels of three to six producers before being included in any AFPC analysis. Table 1 presents characteristics of the ranches included in this study.

FLIPSIM was used to calculate the impacts of one percent changes in cattle prices, weaning weights, calving percentages, fuel expenses, labor expenses, cattle input expenses, and interest rates on net cash farm income (NCFI). NCFI was selected as a proxy for annual profitability.

Starting values for the change variables are reported in Table 2, along with the 2005 deterministic NCFI totals for each of the eight ranch firms. Along with cattle prices (steer, heifer, cull cow, cull bull, and replacement cattle), these 2005 numbers were each increased by one percent and formed the basis of the seven scenarios that were compared with the base (no change) scenario for each ranch. Economic activity for each scenario was simulated over the 2005 through 2011 analysis period. For each iteration of the model, the average NCFI for 2005-2011 was recorded. The 6,400 individual NCFI calculations (eight ranches times eight scenarios times 100 iterations) were copied from FLIPSIM into Excel to calculate sensitivity elasticities.

Results

Sensitivity elasticities (SE) are reported in Table 3. All SEs are reported with the lower and upper bounds of a 95 percent confidence interval. A one-percent change in cattle prices resulted in a range of increases in average NCFI from a low of 1.69 percent (TXSB250) to a high of 8.27 percent (NVB700). While all operations benefit from higher steer, heifer, and cull breeding cattle prices, those operations also suffer more from higher prices for replacement cattle. Some of the ranches with the lower SEs are operations which purchase higher percentages of their needed replacement females. Still, the results reveal greater than a one-for-one return to incrementally higher cattle prices.

The profitability response to a one-percent change in weaning weights ranged from a low of 1.45 percent (MTB500) to a high of 7.01 percent (NVB700). It should be mentioned that

weaning weights for all eight ranches were increased by one percent with no accompanying changes in input costs. Accordingly, one would expect no worse than a one-for-one response to higher sale weights for calves since all costs were held constant.

SEs for calving percentage ranged from 2.22 percent (TXSB250) to 10.73 percent (NVB700). Similar to weaning weights, calving percentages were changed with no corresponding increases in any expenses. Experience dictates that is a most unlikely occurrence. For each of the representative ranches studied, the SE for calving percentage was the highest of the seven SEs calculated.

The SEs associated with cost changes were all negative, as expected, and were all significantly smaller in magnitude than the SEs associated with revenue increases. Fuel expense SEs ranged from -1.07 percent (NMB240) to -0.13 percent (TXSB250). Labor expense SEs ranged from -1.26 percent (NVB700) to -0.04 percent (TXSB250). Cattle input expense SEs ranged from -6.29 percent (NMB240) to -0.13 percent (MTB500). Finally, the percent responses in NCFI resulting from a one-percent change in interest rates ranged from -0.89 percent (NMB240) to -0.05 percent (TXSB250).

Without accounting for risk, one might expect the response in NCFI to changes in returns and costs components to be more or less one-for-one. Accounting for the risk actually faced on each ranch presents a different set of results. The relatively large SEs for cattle prices, weaning weights, and calving percentage are associated with ranches that have relatively low base NCFIs on an NCFI/cow basis. For those operations, relatively small increases in NCFI represent comparatively large increases in NCFI from the base.

Conclusions and Implications

This research indicates exogenous factors, while not insignificant, are not the primary drivers of profit and loss in ranching, industry analysts might be better served examining macroeconomic forces to determine economic viability of this sector than by delving into regionalized variations in cultural practices. This implies the relative profitability of beef cattle ranches across the United States is dictated less by macroeconomic factors (e.g., rising costs of inputs, interest rates) than by regionalized production variability and marketing. Industry practitioners and those who advise them would be better able to develop risk management strategies that effectively deal with the true sources of risk for that region.

References

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Table 1. Description of Representative Ranches Included in this Study.

Ranch Name	Location	Description
MTB500	Custer County, Montana	500-cow ranch located in eastern Montana. Ranch runs cows on a combination of owned land and land leased from federal, state, and private sources. Federal land satisfies one quarter of total grazing needs. The ranch owns 14,000 acres of pasture. 640 acres of hay are produced annually on the owned land. Sales of high-quality replacement females comprise a significant portion of receipts for this ranch. Also, all deeded acres are leased for hunting. Cattle sales represented 98 percent of this ranch's 2005 receipts.
COB250	Routt County, Colorado	250-cow ranch located in northwestern Colorado. Federal land provides seven percent of the ranch's grazing needs. The ranch owns 2,300 acres of rangeland. 450 acres of hay harvested annually. Ranch retains ownership of 75 percent of its steers through the backgrounding stage. Land development pressures have reduced grazing capacity. Cattle sales accounted for 76 percent of the ranch's 2005 total receipts.
MOCB350	Phelps County, Missouri	350-cow ranch located in central Missouri. This farm consists of 1,020 acres of owned ground and 500 acres of leased ground. 560 acres of hay are harvested. 2005 cattle sales represented 91 percent of cash receipts.
NMB240	Union County, New Mexico	240-cow ranch located in northeastern New Mexico. In 2002, this ranch liquidated 20 percent of its mature cowherd in response to oppressive drought, culling 60 of its 300 cows. Ranch has opted to fill the gap with 200 summer stockers. During 2005, 97 percent of gross receipts were derived from cattle sales.
NVB700	Elko County, Nevada	700-cow ranch located in northeastern Nevada. Ranch consists of 1,300 acres of owned hay meadow and 8,725 acres of owned range, supplemented by 4,450 AUMs of federal grazing. Each year, the ranch harvests 1,300 acres of hay. Annually, cattle sales represent all of the ranch's receipts.
SDB450	Meade County, South Dakota	450-cow West River beef cattle ranch. Hay and oats produced on 1,150 acres of owned cropland, and runs its cows on 6,700 acres of owned native range. Grazing needs are supplemented with 2,100 AUMs leased from federal and state sources. In 2005, calf and culled cow/bull sales accounted for 92 percent of gross receipts.
TXSB250	Gonzales County, Texas	250-head ranch located in south central Texas (Gonzales County). Cows derive most of their forage needs from improved coastal Bermuda pasture. Native pasture serves as fallback pasturage and is host to this operation's fledgling lease hunting program. Contract broiler production is an important source of agricultural revenue for this ranch. Cattle sales accounted for 86 percent of 2005 gross receipts.
TXRB500	King County, Texas	The western Rolling Plains of Texas (King County) is home to this 500-head cow-calf operation. This ranch operates on 20,000 acres (half owned, half leased) of native range. After weaning, calves are placed on wheat pasture and then either sold as feeder cattle or retained as replacement females. Eighty-six percent of 2005 receipts came from cattle sales.

Table 2. Selected 2005 Deterministic Net Cash Farm Income, Weights, and Expenses for Representative Ranches.

Ranch Name	Net Cash Farm Income	-----Base----- Heifer Weaning Weight	Steer Weaning Weight	Calving Percent	Fuel Expense[1]	Labor Expense[2]	Cattle Input Expense[3]	Interest Expense
MTB500	$ 155,119	480 lbs.	525 lbs.	91.0%	$ 31,252	$ 15,124	$ 12,803	$ 11,200
COB250	$ 80,268	500 lbs.	530 lbs.	92.0%	$ 15,000	$ 15,000	$ 12,253	$ 7,736
MOCB350	$ 74,452	540 lbs.	627 lbs.	92.0%	$ 17,404	$ 24,113	$ 30,593	$ 5,218
NMB240	$ 39,934	540 lbs.	560 lbs.	90.0%	$ 14,420	$ 944	$ 30,114	$ 12,542
NVB700	$ 106,980	437 lbs.	496 lbs.	89.2%	$ 24,203	$ 36,688	$ 55,730	$ 15,904
SDB450	$ 102,599	479 lbs.	517 lbs.	95.1%	$ 19,424	$ 32,682	$ 25,179	$ 8,030
TXSB250	$ 85,129	540 lbs.	600 lbs.	88.0%	$ 6,918	$ 2,038	$ 12,382	$ 4,456
TXRB500	$ 125,255	750 lbs.[4]	800 lbs.[4]	89.6%	$ 16,680	$ 5,096	$ 100,754	$ 11,451

[1] Sum of gasoline, diesel, utilities, and hauling expenses.
[2] Sum of full-time and part-time labor expenses.
[3] Sum of veterinary services, veterinary products/supplies, purchased feed, custom services, salt and mineral, and backgrounding expenses.
[4] Calves are backgrounded on the ranch post-weaning; therefore, these "weaning weights" reflect the sale weights for this ranch and not true off-the-cow weights.

Table 3. Sensitivity Elasticities with Upper and Lower Confidence Intervals.

		Cattle Prices	Weaning Weights	Calving Percentage	Fuel Expense	Labor Expense	Cattle Input Expense	Interest Rates
MTB500	SE	0.0220	0.0145	0.0294	-0.0035	-0.0016	-0.0013	-0.0007
	LCI	0.0188	0.0125	0.0243	-0.0051	-0.0025	-0.0019	-0.0011
	UCI	0.0270	0.0180	0.0416	-0.0026	-0.0012	-0.0010	-0.0005
COB250	SE	0.0204	0.0174	0.0282	-0.0031	-0.0029	-0.0024	-0.0019
	LCI	0.0174	0.0147	0.0235	-0.0042	-0.0040	-0.0032	-0.0025
	UCI	0.0246	0.0211	0.0364	-0.0023	-0.0022	-0.0017	-0.0014
MOCB350	SE	0.0546	0.0467	0.0711	-0.0067	-0.0086	-0.0108	-0.0018
	LCI	0.0299	0.0258	0.0390	-0.0127	-0.0164	-0.0206	-0.0041
	UCI	0.0963	0.0816	0.1273	-0.0030	-0.0039	-0.0048	-0.0005
NMB240	SE	0.0558	0.0656	0.0926	-0.0107	-0.0006	-0.0629	-0.0089
	LCI	0.0359	0.0428	0.0580	-0.0215	-0.0013	-0.6448	-0.0182
	UCI	0.1024	0.1164	0.1669	-0.0060	-0.0004	0.1487	-0.0045
NVB700	SE	0.0827	0.0701	0.1073	-0.0090	-0.0126	-0.0192	-0.0047
	LCI	0.0375	0.0313	0.0504	-0.0237	-0.0330	-0.0502	-0.0158
	UCI	0.1981	0.1687	0.2654	-0.0036	-0.0050	-0.0076	-0.0011
SDB450	SE	0.0447	0.0401	0.0617	-0.0059	-0.0091	-0.0070	-0.0018
	LCI	0.0214	0.0190	0.0278	-0.0237	-0.0365	-0.0280	-0.0102
	UCI	0.1611	0.1449	0.2232	-0.0021	-0.0033	-0.0025	-0.0004
TXSB250	SE	0.0169	0.0175	0.0222	-0.0013	-0.0004	-0.0022	-0.0005
	LCI	0.0153	0.0158	0.0197	-0.0018	-0.0005	-0.0030	-0.0007
	UCI	0.0198	0.0205	0.0281	-0.0010	-0.0003	-0.0017	-0.0004
TXRB500	SE	0.0258	0.0233	0.0271	-0.0023	-0.0007	-0.0057	-0.0008
	LCI	0.0220	0.0198	0.0227	-0.0032	-0.0009	-0.0077	-0.0014
	UCI	0.0322	0.0294	0.0318	-0.0017	-0.0005	-0.0042	-0.0005