Returns to Custom Cattle Feeding

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Cattle feeding is a significant economic activity on the Texas-Oklahoma-New Mexico High Plains. In 1991, 122 feedlots located in this area fed 5.6 million head of cattle (Southwestern Public Service Company). This generates approximately $15 billion for the area economy.[1] A large portion of the cattle fed in this area are owned by custom feeders who are outside investors utilized by feedyard managers as a method of reducing the price risk associated with holding large numbers of cattle. Custom feeders retain ownership of cattle which are placed in the feedyard and, therefore, accept the price and production risk associated with feeding those cattle. For a fee, the feedyard will feed and manage the cattle for the investor. In return, the custom feeder receives any residual returns. For an industry as large as cattle feeding, very little is known of the actual returns. Greater knowledge of historical returns would enable investors to make more informed decisions concerning custom cattle feeding investments. The research documented in this study provides estimates of custom cattle feeding returns over the 1980 - 1990 period for the Texas-Oklahoma Panhandle. Returns are derived based on actual feedlot performance data as reported in *Feedstuffs* and market prices as reported by USDA.

The remainder of this paper is organized into the following sections—Previous Studies; Data and Procedures; Cattle Feeding Returns per Head; Financial Analysis of Feeding Returns; Impact of Leverage; Summary and Implications.

Previous Studies

Previous studies have indicated that custom cattle feeding returns vary by season of the year, with highest returns in April-June and lowest returns in September-January (Trapp; Cattle-Fax, February 23, 1990). A recent study by Miller analyzed the investment potential of cattle feeding and compared returns from cattle feeding with common stocks (shares) over the 1985 - 1990 period.

Using private accounting data from selected Texas-Oklahoma feedyards, Miller estimates a compound annual rate of return from cattle feeding of 14.2%, which compares with a 16.2% compound return received from the Standard and Poor's 500 Index over the same time period. Miller concludes that the high returns received from cattle feeding relative to common stocks justify its consideration as an alternative investment.

The studies by Trapp and by Miller both utilized proprietary information. Both sets of returns were calculated using accounting data obtained from privately owned feedlots located on the High Plains. The research documented in this study, however, utilizes publicly available data obtained from published reports to calculate custom cattle feeding returns. Miller's analysis only considered the returns for the 1985 - 1990 period. Inclusion of the early 1980's may change both the level and risk of expected returns because of the volatility of fed cattle prices during this period.

In addition to level of returns and risk, investors are interested in the diversification potential of alternative investments. Correlation coefficients are useful in measuring the impact of including cattle feeding on the variance of portfolio returns. Financial portfolio managers seek alternate investments which can be used to diversify a financial portfolio (i.e., reduce portfolio return variance).

Data and Procedure for Deriving Feeding Returns

Estimation of custom cattle feeding returns requires data on feedyard performance and market prices. Feedyard performance data are collected and reported monthly in *Feedstuffs* by consulting nutritionist Marcus Hoelscher of Hereford, Texas. These data are collected from 22 or more feedyards which have a one-time total capacity of 300,000 head and are located primarily in the Texas-Oklahoma Panhandle (Table 1).

Feedyard performance data from *Feedstuffs* are based on individual pens of cattle. Hoelscher aggregates the data for all cattle that finish during a given month. Average performance measures for steers and heifers were calculated from the aggregate data (see Table 1). For example, the average in-weight was 710 lbs. for steers finished during March 1990, while the average out-weight was 1,114 lbs. These steers were on feed an average of 145 days, which means they were placed in a feedyard during October-November 1989. The average death loss was 1.20%, and the average cost of gain was $0.53/lb.[2]

Total feeding cost (TFC) on a per head basis is determined from the Hoelscher feedyard performance data by multiplying total pounds of gain by the total cost of gain (TCG):

Table 1.
Feedyard Performance Data, March 1990

	Steers			Heifers		
	March 90	Feb. 90	March 89	March 90	Feb. 90	March 89
Wt. In, lb.	710	742	691	616	655	635
Wt. Out, lb.	1,114	1,146	1,096	974	1,001	1,028
Days Fed	145	138	147	148	136	146
Daily Gain, lb.	2.79	2.93	2.77	2.42	2.54	2.69
Dry Conv., lb.	7.01	6.76	6.79	7.25	6.95	6.93
Death Loss, %	1.20	0.73	0.70	1.50	1.17	1.11
Cost Gain, $/cwt.	53.01	52.16	57.05	54.94	54.30	59.19

Source: *Feedstuffs, April 23, 1990, p. 5.*

$$TFC/head\text{-}out = [out\text{-}weight - in\text{-}weight/(1\text{-}d)] * TCG, \quad (1)$$

where d = death loss proportion. The exact procedure is explained in greater detail in the Appendix. The calculation of TFC/head-out is illustrated below using feedyard performance data for steers for March 1990 from Table 1:

TFC = [1,114 - 710/(1-.012)] * 0.5301 = $209.59 per head-out.

The $209.59 figure represents the average per head feeding cost (not including interest) for steers finished during March 1990 in the 22+ feedlots surveyed by Hoelscher.

The total feeding cost along with data on feeder and fed cattle prices, interest rates, and transportation cost was used to derive custom cattle feeding returns for both steers and heifers. An example of the procedure used to derive per head returns for cattle finished in March 1990 is shown in Table 2. The fed price is

Table 2.
Derived Custom Cattle Feeding Returns for Steers and Heifers with 30% Equity, March 1990

	Steers	Heifers
Fed Price * Out-Weight (Pay-Weight)[a]	$883.51	$770.92
Total Feeding Cost, eq. (1) in text	-209.59	-191.53
Cost of Feeder (incl. transportation)[b]	-609.97	-507.37
Interest Cost[c]	-36.20	-31.18
Total Return per Head	$27.75	$40.84

a. Fed steer price is for Choice 11-1300 lb. steers, Texas Panhandle (USDA, AMS, Market News Service). Out-weight is after 4% pencil shrink. Fed heifer price is for 9-1100 lb. Choice heifers.

b. Cost of feeder animal = ((feeder price+transportation cost) * in-wgt.)/(1-d), where transportation cost is the per lb. cost to transport a feeder animal an assumed distance of 100 miles from auction to feedyard (Texas Railroad Commission), and d=death proportion (*Feedstuffs*). Feeder steer price is the Dodge City price for 7-800 lb., medium-large frame, no. 1 steers. Feeder heifer price is the Dodge City price for 6-700 lb., medium frame, no. 1 heifers.

c. Interest cost = r*(days on feed/365)*(cost of feeder*(1-% equity))/(1-d) + 0.5*total feeding cost), where r is the interest rate on Texas cattle taken from the Dallas Federal Reserve Bank.

for the Texas-Oklahoma Panhandle for the middle week of March.[3] Texas-Oklahoma fed prices are reported for 9-1100 and 11-1300 lb. steers, and 9-1100 lb. heifers (USDA). The price used is for the weight category which includes the finish (out-) weight (e.g., 11-1300 lbs. for March 1990 steers, Table 1).

A "deads in" approach is used to estimate the feeder animal cost to be consistent with the Hoelscher data. Feeder animal cost is determined by multiplying the actual cost (feeder animal price*in-weight) by the factor, 1/(1-d) where d is the death loss proportion. For example, if d=0.01 (meaning 1% death loss), then 1/(1-0.01)=1.0101. This factor represents the number of head of feeder cattle required on average to produce one finished animal. The feeder price used is for the weight category which includes the placement (in-) weight (e.g., 7-800 lbs. for March 1990 steers, Table 1). The feeder price used is the Dodge City auction price plus a 100 mile transportation charge (based on trucking rates obtained from the Texas Railroad Commission). Dodge City prices are reported for steers and heifers for weight categories 5-600, 6-700, and 7-800 lbs. (USDA).

The derived feeding returns shown in Table 2 assume that all feeding cost (ration cost, medicine, working cost, yardage) is financed, and the investor puts up 30% of the cost of the feeder animal. The steer return of $27.75 per head is an estimate of the average return for custom steers finished during March 1990 in the 22+ feedlots surveyed by Hoelscher. The derived heifer return of $40.84 per head is interpreted likewise.

Cattle Feeding Returns Per Head

Average feeding returns for steers and heifers were calculated by month and equity level for the period 1980 - 1990. For example, the average per head return for steers finishing during January with 100% equity in the feeder animal was $13.05 (Table 3). The percent of the equity in the feeder animal is varied over the levels 0%, 30%, 50%, 70%, and 100%. The additional interest cost resulted in a decline in return per head for steers from $29.76 for 100% equity to -$4.82 for 0% equity.

The average per head returns for steers and heifers with 30% equity are plotted over time in Figure 1. Annual average returns range from -$49.80 to +$57.18 per head for steers, and from -$27.33 to +$56.18 per head for heifers. Per head returns for heifers are consistently greater than the average return received from steers.

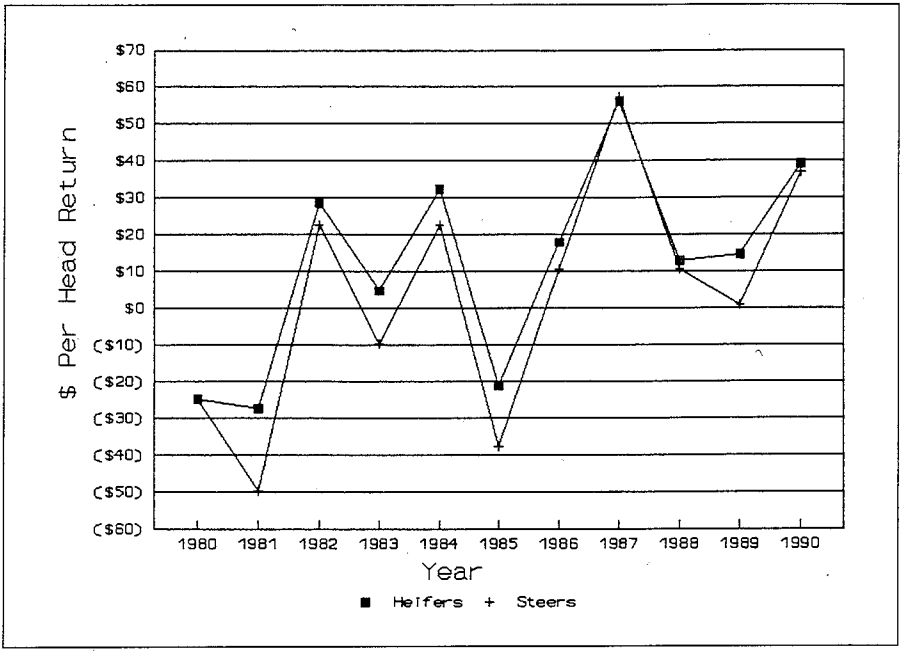
Table 3.
Average Per Head Custom Cattle Feeding Returns for Steers and Heifers, by Leverage Level and Season, 1980-90

Sex and Season	Equity level 0%	30%	50%	70%	100%
			(dollars per head)		
Steers:					
Jan.	-20.57	-12.25	-6.70	-1.15	13.05
Feb.	-16.88	-8.60	-3.08	2.44	16.70
Mar.	-11.73	-3.23	2.44	8.10	22.95
Apr.	4.58	13.35	19.19	25.04	40.73
May	8.63	17.34	23.14	28.95	44.65
June	-5.06	3.57	9.33	15.08	30.50
July	-26.81	-18.21	-12.47	-6.73	8.17
Aug.	-10.81	-2.29	3.38	9.06	24.07
Sept.	-6.00	2.18	7.62	13.07	27.43
Oct.	6.28	14.60	20.15	25.70	40.62
Nov.	11.26	19.63	25.22	30.80	45.61
Dec.	9.21	17.43	22.90	28.38	42.68
Average	-4.82	3.63	9.26	14.89	29.76
Heifers:					
Jan.	-0.39	6.03	10.31	14.60	26.22
Feb.	4.59	11.06	15.37	19.68	31.06
Mar.	7.66	14.39	18.87	23.35	35.56
Apr.	14.02	20.96	25.59	30.21	42.71
May	19.83	26.70	31.28	35.86	48.22
June	-1.25	5.85	10.58	15.31	27.98
July	-18.85	-11.95	-7.35	-2.76	9.22
Aug.	-6.54	0.30	4.85	9.41	21.65
Sept.	0.04	6.60	10.97	15.35	27.27
Oct.	13.57	20.17	24.57	28.97	40.83
Nov.	18.03	24.69	29.14	33.58	45.69
Dec.	14.23	20.75	25.10	29.45	41.16
Average	5.41	12.13	16.61	21.09	33.13

Financial Analysis of Feeding Returns

Returns on investment for cattle feeding were compared with various alternative investments. Total monthly returns for common and small stocks, long and short term U.S. government bonds, and corporate bonds were obtained from Ibbotson and Associates. The data necessary to estimate returns for world stocks, commercial paper, Moody's Baa rate, FHA yields, financial paper, federal funds, copper, gold, and the CRB index were obtained from the Delafield, Harvey, and Tabell Bank Index. Since cattle feeding requires an approximate 150-day period, returns for alternative investments were calculated assuming a

Figure 1:
Average Annual Custom Cattle Feeding Returns for Steers and Heifers with 30% Equity in the Feeder Animal, 1980-1990.



comparable holding period. Cattle feeding returns were compared with returns from alternative investments over the same time period. For example, returns from cattle finishing in May were compared with investments which were purchased in January and held through May.

Returns were estimated assuming that at the beginning of the 5-month period an investor would make a $1 investment in a selected investment. The investor would subsequently receive dividend or interest income over the holding period before selling the investment at the end of the 5-month period.

The return for investment (i) was calculated as follows:

$$R_i = \frac{P_5 - P_1 + \sum_{t=1}^{5} I_t}{P_1}, \qquad (2)$$

where R_i is estimated return on investment i; P_5 is the face value of investment at the end of period; P_1 is the purchase price of investment at period 1; and I_t is the cash received from dividends and/or interest income during the 5-month investment period. It should be noted that the returns from equation (2) are not compounded because it is assumed that current income is not reinvested until the end of the 5-month period.

Previous studies have not clearly defined what comprises the cattle feeding investment. Miller defined investment for nonleveraged cattle feeding as the cost of the feeder plus the total feeding cost. Miller assumed that an investor would leverage by financing equal proportions of the feeding and the feeder cost. Investors in cattle feeding, however, typically use different degrees of leverage for feeding cost and feeder cost making it difficult to determine actual investment. Alternatively, we defined the average investment for unleveraged cattle feeding as the cost of the feeder animal, and thus assumed that 100% of the feeding cost was financed. Leverage was examined by financing differing levels of the feeder animal cost.

Average returns, standard deviation, and coefficient of variation by the month that cattle finish are shown in Table 4. While cattle feeding returns are comparable to stock returns over the entire period, analysis by month indicates the inherent riskiness of cattle feeding. Cattle feeding returns exceed common stock returns for periods ending in April, May, October, November, and December. However, for cattle finishing in 9 of the 12 months the coefficient of variation for cattle feeding returns was greater than 2.0, and in all months was greater than 0.8. The risk involved in cattle feeding is further reflected by the range of returns per head. Unleveraged per head steer returns ranged from -$123 to +$194, while unleveraged returns for heifers ranged from -$87.18 to +$144.

The results on monthly returns in Table 4 also indicate seasonality. The seasonal variation in returns for 1980-1990 for 100% equity feeding is shown in Figure 2. These results are consistent with previous research which has found a seasonal pattern in cattle feeding returns (Trapp). The pattern of seasonal variation is similar for steers and heifers. The seasonal high return occurs in May, with the seasonal low in July. Trapp found a similar seasonal pattern for the period 1978 - 1988 with some differences. He found that the seasonal low occurred in August (rather than July), and that the seasonal increase from August-December was less than shown in Figure 2.

While Trapp's results indicate seasonality, he does not test to determine if the seasonal variation is statistically significant. To statistically test for seasonal variation, we regressed feeding returns on a constant term plus 11 seasonal

Table 4.

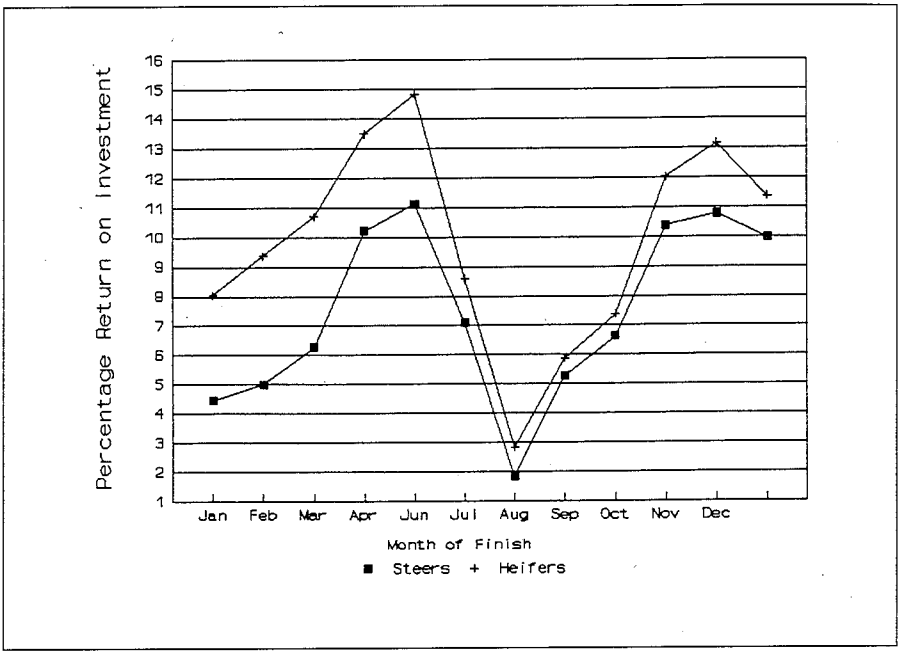
Mean Return on Investment, Standard Deviation, and Coefficient of Variation for Custom Fed Steers and Heifers, Domestic and World Stocks, Financial Instruments, and Commodities by Month of Finish, for 1980-1990.

	January			February			March			April		
	Mean Return	Standard Deviation	C.V.	Mean Return	Standard Deviation	C.V.	Mean Return	Standard Deviation	C.V.	Mean Return	Standard Deviation	C.V.
Steers	4.45	11.26	2.53	5.00	9.52	1.90	6.27	12.91	2.06	10.22	14.36	1.41
Heifers	8.05	12.35	1.53	9.37	9.38	1.00	10.70	12.59	1.18	13.49	15.98	1.19
Common stock	6.52	12.84	1.97	5.83	11.47	1.97	7.87	12.41	1.58	8.73	9.30	1.07
Small stock	2.25	14.92	6.63	3.43	14.44	4.21	6.64	15.33	2.31	10.29	11.35	1.10
World stock	6.23	10.44	1.68	6.94	11.90	1.74	9.01	13.44	1.49	8.38	14.66	1.75
T-Bill	3.60	1.03	0.29	3.53	1.03	0.29	3.50	1.04	0.30	3.49	1.12	0.32
Moody's BAA rate	4.66	0.79	0.17	4.65	0.79	0.17	4.64	0.79	0.17	4.64	0.80	0.17
Gov't long term bond	6.92	8.62	1.25	7.87	6.25	0.79	6.84	7.82	1.14	4.96	5.96	1.20
CRB return	1.96	5.36	2.74	1.13	4.05	3.59	-1.51	4.37	-2.90	-1.36	5.84	-4.29
Gold return	10.78	29.42	2.73	8.95	35.46	3.96	-0.71	21.38	-30.14	-1.76	14.33	-8.14

	May			June			July			August		
	Mean Return	Standard Deviation	C.V.	Mean Return	Standard Deviation	C.V.	Mean Return	Standard Deviation	C.V.	Mean Return	Standard Deviation	C.V.
Steers	11.13	17.02	1.53	7.10	14.47	2.04	1.84	10.73	5.84	5.27	11.48	2.18
Heifers	14.84	17.38	1.17	8.59	14.99	1.75	2.83	9.94	3.51	5.88	11.11	1.89
Common stock	7.59	9.87	1.30	8.36	9.72	1.16	7.35	7.82	1.06	6.82	6.84	1.00
Small stock	9.97	12.29	1.23	11.30	13.23	1.17	9.65	12.03	1.25	7.82	8.81	1.13
World stock	5.52	13.71	2.48	4.69	11.10	2.36	4.89	8.26	3.18	5.17	9.16	1.77
T-Bill	3.56	1.16	0.33	3.56	1.14	0.32	3.62	1.16	0.32	3.62	1.21	0.34
Moody's BAA rate	4.66	0.82	0.18	4.67	0.83	0.18	4.67	0.84	0.18	4.66	0.85	0.18
Gov't long term bond	3.20	6.98	2.18	3.53	7.82	2.22	3.98	7.27	1.83	4.24	8.50	2.01
CRB return	-1.75	6.05	-3.45	-1.38	6.65	-4.80	-1.54	8.24	-5.33	-0.16	8.18	-49.93
Gold return	-4.04	11.99	-2.97	-4.67	9.70	-2.08	-6.14	9.33	-1.52	-0.86	10.11	-11.78

	September			October			November			December		
	Mean Return	Standard Deviation	C.V.	Mean Return	Standard Deviation	C.V.	Mean Return	Standard Deviation	C.V.	Mean Return	Standard Deviation	C.V.
Steers	6.63	12.24	1.85	10.38	10.35	1.00	10.78	7.63	0.71	9.96	7.66	0.77
Heifers	7.39	10.23	1.38	12.02	9.77	0.81	13.14	8.71	0.66	11.36	8.02	0.71
Common stock	7.97	8.61	1.08	5.21	8.56	1.64	3.51	11.00	3.13	4.57	13.89	3.04
Small stock	6.94	12.58	1.81	3.45	13.93	4.03	-0.75	17.18	-22.77	-0.59	19.39	-33.07
World stock	1.45	9.24	6.35	2.91	8.39	2.88	4.42	10.73	2.43	5.27	11.33	2.15
T-Bill	3.58	1.18	0.33	3.49	1.16	0.33	3.50	1.14	0.33	3.46	1,10	0.32
Moody's BAA rate	4.66	0.85	0.18	4.67	0.85	0.18	4.66	0.84	0.18	4.65	0.82	0.18
Gov't long term bond	3.83	8.65	2.26	3.42	7.77	2.27	5.79	9.78	1.69	6.70	10.20	1.52
CRB return	0.06	10.01	173.57	-0.34	9.79	-28.91	0.43	8.52	19.62	0.91	7.15	7.86
Gold return	3.56	14.33	4.03	4.24	16.11	3.80	3.50	14.73	4.21	5.40	14.41	2.67

Figure 2:
Average Custom Cattle Feeding Returns for Steers and Heifers with 100% Equity in the Feeder Animal, By Month of Finish, 1980-1990.



dummy (zero-one) variables. The regression model also included a time trend variable to capture long-term trends in feeding returns.

$$R_i = b_0 + \sum_{j=1}^{11} b_j D_j + b_{12}\text{Time} + e_i, \qquad (3)$$

where R_i = return for cattle finishing in month i;
D_i = 1 if month is January and 0 otherwise;
D_2 = 1 if month is February and 0 otherwise; and so on;
Time = time trend, January 1980 equals 1.0;
e_i = third-order autoregressive error term;
b_0 = intercept term;
b_j = seasonal intercept shifters for January (j=1) through November (j=11);
b_{12} = time trend coefficient.

A Cochrane-Orcutt procedure was used in estimation to correct for third-order autocorrelation in the ordinary least squares residuals. The estimated values of the intercept shifters (b_1, ..., b_{11}) in eq. (3) measure the seasonal effects.

The hypothesis of no seasonal effects was tested using an F-test. The null hypothesis is:

$$H_0: \beta_1 = \beta_2 = \ldots = \beta_{11} = 0,$$

and the alternative hypothesis is that not all β_j's are equal to zero. (Note that the betas (β_j's) are population parameters as compared to b_j's in eq. (3) which are statistics.) The calculated F-values are 1.53 for steers and 1.52 for heifers (for returns based on 100% equity in the feeder animal). Neither F-value is significant at the 5% level; the critical F-value is 1.87 with 12 and 119 degrees of freedom. The lack of significance indicates that the apparent seasonal variation in feeding returns in Figure 2 may not be due to fundamental factors but instead merely a product of the particular sample of data.

Since seasonal variation was not significant, we decided to evaluate returns to cattle feeding as if they occurred on a year-round basis. Over the 1980-1990 period, cattle feeding resulted in an unleveraged annual rate of return of 17.8% for steers and 23.5% return for heifers (Table 5). The feeding results reported in Table 5 were calculated using 100% equity in the feeder animal. Applying Miller's method of calculating return on investment to data used in this study resulted in a return of 13.87% over the 1985-1990 period. This compared with Miller's finding of 14.15% for steers and heifers over the 1985-1990 period.[4]

Of the assets analyzed, cattle feeding provided the highest returns. Custom feeding returns for heifers were highest followed in order by steer custom feeding, common stocks, small stocks, and world stocks. Returns for cattle feeding were substantially higher than returns obtained from investing in metals, commodities, or interest rate instruments.

Table 5.
Average Annual and 5-Month Returns for Cattle Feeding and Various Alternative Investments Over the 1980-1990 Period

	5-Month Return	Annual Return		5-Month Return	Annual Return
	Percent			Percent	
Common Stock U.S.	6.69	16.07	Federal Funds	4.12	9.89
Small Stock U.S.	5.87	14.08	Financial Paper	3.82	9.17
World Stock	5.40	12.96	Moody's BAA	5.26	12.62
Corporate Bonds	4.85	11.64	FHA Rate	5.14	12.33
Long Term Gov't Bond	5.10	12.25	T-Bill	3.54	8.50
Intermediate Term Gov't Bond	4.53	10.87	Commercial Paper	4.02	9.65
CRB Return	-0.30	-0.71	Heifers	9.80	23.52
Copper	2.32	5.58	Steers	7.42	17.80
Gold Return	1.52	3.65			

Correlation coefficients provide insight into the diversification potential for various investments. Diversification is enhanced by including assets which are negatively correlated. Financial portfolio managers are searching for alternate investments which can be used to reduce portfolio return variance. Theoretically, one could reduce all risk by holding two assets which have perfect negative correlation. It is indicated that cattle feeding is negatively correlated with bonds and interest rate instruments: Treasury Bill, Moody's AAA rate, commercial paper, FHA yield (Table 6). Therefore, cattle feeding may offer some diversification potential for individuals who invest in these instruments. A positive relationship with commodities is indicated by the significant positive correlation with the Commodity Research Bureau (CRB) index. There was no apparent relationship between cattle feeding returns and common, world, or small stock returns. Also, cattle feeding returns displayed no apparent relationship with indicators of economic activity such as unemployment and housing starts.

Impact of Leverage

Investment returns for leveraged cattle feeding are displayed in Table 7. Returns were estimated for equity levels of 30, 50, and 70 percent and compared with unleveraged cattle feeding. Principles of finance state that leverage should increase investment returns if the return on assets is greater than the cost of debt. In the case of custom cattle feeding, unleveraged returns are equivalent to return on assets. Higher leverage decreases investment returns for steers indicating that for the period analyzed returns did not consistently exceed the cost of debt. Heifer returns, on the other hand, increased as equity declined from 70% to 30%.

Summary and Implications

Published data series were used to estimate custom cattle feeding returns for the Texas-Oklahoma Panhandle over the 1980-1990 time period. Monthly feedyard performance data for High Plains fed cattle were taken from *Feedstuffs*. Fed cattle prices for the Texas-Oklahoma Panhandle were obtained from Agricultural Marketing Service (AMS) published reports. Feeder cattle prices were obtained from AMS published series for Dodge City, Kansas, auction market. The results indicated that unleveraged cattle feeding returned an average of $29.76 per head for steers over 132 feeding periods. Heifers provided somewhat higher returns with an estimated average return of $33.13 per head over all feeding periods. There were indications of seasonality of feeding returns with a seasonal high occurring in May and a seasonal low in July. A statistical test, however, indicated that the seasonal pattern was not significant.

Table 6.

Pearson Correlation Coefficients Between Selected Investments Over the 1980-1990 Period

	Steers	Heifers	Common stock	Small stock	World stocks	3-month T-bill	Com. paper	FHA yield	Moody's BAA	CRB return
Steers	1	0.963*	-0.101	-0.145	0.046	-0.237$	-0.260$	-0.193$	-0.197#	0.208#
Heifers		1	-0.121	-0.156	-0.019	-0.214$	-0.239$	-0.144$	-0.144#	0.172#
Common stock			1	0.817	0.725	-0.202	-0.222	-0.170	-0.155	0.087
Small stock				1	0.594	-0.016	-0.009	-0.012	-0.012	0.223
World stocks					1	-0.338	-0.366	-0.290	-0.259	0.098
T-Bill						1	0.971	0.811	0.757	-0.324
3 M commercial paper							1	0.812	0.754	-0.318
FHA yield								1	0.991	-0.358
Moody's AAA									1	-0.391
CRB return										1

	Gold	Long term US gov't bonds	PPI	Unemployment	CPI	Housing starts
Steers	-0.058	-0.067	-0.173	-0.017	0.224#	-0.061
Heifers	-0.064	-0.087	-0.193	0.033	0.216#	-0.023
Common stock	0.153	0.209	-0.063	0.204	-0.057	0.201
Small stock	0.102	0.025	-0.337	0.297	-0.369	0.159
World stocks	0.22	0.33	-0.14	0.156	-0.093	0.365
T-Bill	-0.132	0.034	-0.186	0.283	-0.412	-0.536
3 M commercial paper	-0.106	0.011	-0.203	0.258	-0.422	-0.576
FHA yield	-0.284	0.164	0.053	0.636	-0.234	-0.56
Moody's AAA	-0.327	0.222	0.108	0.677	-0.182	-0.528
CRB return	0.461	-0.451	-0.366	-0.085	-0.269	0.275
Gold return	1	-0.058	-0.448	-0.122	-0.362	0.209
Gov't long term bond		1	0.197	0.202	0.142	-0.249
Producer price index			1	0.029	0.953	-0.365
Unemployment				1	-0.196	-0.148
Consumer price index					1	-0.221
						1

* $P \leq .0001$ $ $.001 < P \leq .01$ # $.01 < P \leq .05$ Levels of probability only provided between cattle feeding and all other investments.

Table 7.
Average Returns and Standard Deviation of Returns for Custom Fed Steers and Heifers over 132 Feeding Periods Between January 1980 and December 1990, By Equity Investment in Feeder Animal

	Equity Level	5-Month Return	Standard Deviation	Annual Return
			percent	
Steers	30	7.10	40.31	17.04
Steers	50	6.53	24.04	15.67
Steers	70	6.28	17.08	15.07
Steers	100	7.42	11.78	17.80
Heifers	30	15.49	41.02	37.16
Heifers	50	11.48	24.47	27.55
Heifers	70	9.75	17.39	23.40
Heifers	100	9.80	12.01	23.52

Analysis of the investment in cattle feeding indicated that returns on investment were comparable with returns received from stock investment. Annual return to the feeder animal investment over the 1980 - 1990 period for steers was 17.8% and 23.5% for heifers. This compared with 16.1% return for common stock over the same period. Negative correlations with interest rate instruments (Treasury Bills, commercial paper, bonds, federal funds, Moody's BAA) indicated cattle feeding may present diversification potential for investors in these assets.

The results of this analysis indicated that cattle feeding is an investment alternative which may deserve serious attention by investors. The results and conclusions are similar to those obtained in previous studies by Miller and Trapp. However, this particular study examined a longer time period, utilized publicly available data, and examined differences between steer and heifer feeding returns.

The results further indicated that returns obtained by feeding heifers consistently exceeded returns from feeding steers. This suggests that feeder heifer prices may not accurately reflect the differences in feedyard performance between steers and heifers.

Notes

1. This information was provided by Burt Rutherford, Communications Director, Texas Cattle Feeders Association, Amarillo, Texas.
2. The finish weight published by Hoelscher incorporates a 4% pencil shrink on fed cattle, and the cost of gain is calculated using a "deads-in" formula

(eq. (1a) in Appendix). "Deads in" assumes that in order for a cattle feeder to finish a pen of 100 head of cattle, he would purchase and place on feed 100 feeders plus the expected death loss.

3. The performance data compiled by Hoelscher were for the average of all cattle finished during a given month. Fed cattle prices were quoted as weekly averages while feeder cattle prices were from daily auctions. This incompatibility among data series was handled by assuming that all cattle finished on the 15th of each month. The fed cattle price was, therefore, taken from the middle week of the month. The feeder cattle price was obtained by counting back the average days on feed. For example, for steers finished in March 1990, 145 days before March 15, 1990, is October 21, 1989. The feeder price was taken for the week which includes October 21, 1989.
4. Miller compounded all monthly returns from cattle feeding through a monthly reinvestment of all earnings.

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Appendix—Derived Total Feeding Cost per Head-Out

Total feeding cost on a per head-out basis was derived using two equations. Cost of Gain Equation with Deads In:

$$TCG = \frac{\text{total feeding cost (TFC)}}{(\text{head-out} * \text{out-weight}) - (\text{head-in} * \text{in-weight})} \qquad (1a)$$

where TCG = total cost of gain, deads in ($'s/lb. gained);
TFC = cost of feed, medicine, working cost, and yardage ($'s);
head-in = number of cattle placed on feed;
head-out = actual number of cattle sold.

Death Loss Equation:

$$\text{head-out} = (1-d) * \text{head-in}, \tag{2a}$$

where d = death loss proportion, with d=(head-in - head-out)/head-in.

The derivation of total feeding cost per head-out involves two steps. First, solve eq. (2a) for head-in and substitute the result into eq. (1a); second, solve the resulting equation for TFC/head-out. The result is equation (1) in the text for total feeding cost per head-out.