Diversified versus Specialized Swine and Grain Operations

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Summary and Implications

Stochastic budget analysis compares diversified hog and grain operations to a specialized cash grain operation based on fixed labor resource. Benefits to diversified farms include decreased fertilizer costs due to manure application, shared machinery costs, and more stable grain price/cost assurances. As modeled manure application covers nearly all fertilizer requirements of the grain operation, greatly reducing fertilizer costs. The diversified operation is able to have dual-purpose tractors, enabling them to spread the tractor costs over more hours. Lastly, combining a grain and hog operation allows both enterprises to improve price assurance by treating the grain operation as a cost center. Grain is priced to the hogs at cost of production, thereby protecting the hog operation from volatility in the corn market. The risk reduction benefit of diversification is overshadowed when the 2002 Farm Bill is included in the analysis.

Introduction

There is a long-term trend in agriculture toward increased specialization and larger operations. The number of farms in Iowa decreased 22 percent between 1980 and 2001 while the average number of acres per farm increased 23 percent. Over 53% of Iowa farms produced hogs in 1980 while only 11% did so in 2002. Changes in farmer age, government farm programs, and tightening margins in pork production have contributed to this change. This paper summarizes a study examining the potential economic advantages to a diversified hog – grain operation compared to separate specialized farms. Areas of potential benefits include: nutrient utilization, greater use of fixed assets, diversified risk reduction, and other cost savings. The objectives of the study include:

1. Compare cost and return difference between a diversified hog and grain operation and a specialized cash grain operation for family sized businesses.
2. Evaluate the impact of the 2002 Farm Bill on the level and variability of returns by enterprise mix.

Methods & Materials

A spreadsheet model of the farming operations considered was developed using Iowa State University Extension Budgets for production coefficients, investment levels, and input prices. The grain production estimates came from Estimated Costs of Crop Production in Iowa for 2002 (FM 1712), the swine budgets came from Livestock Enterprise Budgets for Iowa 2002 (FM 1815) for confinement production, and the manure nutrient management came from Managing Manure Nutrients for Crop Production (PM 1811). The model compares four different operations:

- Cash grain, corn – soybean production
- Farrow-to-finish and grain
- Producing SEW pigs and grain
- Finishing SEW pigs and grain

The model has two primary assumptions. First, the amount of operator and family labor was set at 6000 hours per hear and no additional labor was hired. Thus, the size of the farm operation was determined by a yearly labor hour limit and the labor needs of each enterprise. There is no seasonal labor constraint and assumes the work can be done in a timely fashion. Second, the diversified operations must be "in balance". That is:

- Corn production equals feed demand for corn from the hogs
- Corn and soybean acres are equal and are in a rotation
- Manure from the hogs is applied to meet the crop nutrient needs.

Thus, increasing the farm by one sow has to account for the labor to produce the corn to feed the production from the sow and an equal acreage of soybeans to maintain the rotation. Also, the nutrients from hog production were applied to the land to produce the grain.

The program is based on 2.2 litters per sow per year. The farrow to finish operation market 7.8 hogs per litter; breed to wean markets 9.0 pigs per litter. Replacement gilts were raised within the operation. The model also assumes that the hog facilities and farm fields were perfectly adjustable to solve the model rather than restricting the results to fixed sizes (i.e., 80 acre tracts or 20 sow increments). The model also assumes sufficient on farm capacity to store the corn required, and the manure produced. Estimates are made regarding the amount of tractor sharing between enterprises on the diversified farms. All prices other than corn, soybeans, hogs, and nitrogen fertilizer originated from the ISU budgets. Fourteen year average (1988-2001) prices for corn, soybean, soybean meal, hogs and nitrogen fertilizer were used. Estimated manure nutrient production is figured into estimated nutrient requirements for the grain enterprise and removed from the fertilizer recommendations for each operation.

The analysis compared the specialized cash grain and diversified farms based on the 6,000-hour per year labor constraint. Table 1 compares the size of the operations

under this labor and management constraint. The cash grain operation naturally includes more acreage than the diversified farm alternatives. The diversified farms had fewer acres but also hog production. By design, half of the acres are corn and half soybeans. Manure is applied to land that will be planted to corn each year.

Table 1 also shows the amount of capital invested into each enterprise. The capital investment estimates assume 50:50 Rent:Own land tenure arrangement and a $2,500 per acre land value. Under these assumptions the specialized cash grain enterprise requires a substantially higher capital investment than the remaining three alternatives.

Table 1. Description of the four enterprises included in the analysis.

Enterprise	Acres	Sows	Hogs Marketed	Capital Investment (1,000 Dollars)
Specialized Cash Grain	2,378			$3,463
Diversified Farrow-Finish with Grain	550	191	3,270	$1,281
Diversified Breed to Wean	229	616	12,200	$1,002
Diversified Wean to Finish	723		5,963	$1,784

Budgeted returns to an enterprise using long run average prices ignore the importance of production and price risk. The profitability of each enterprise can vary from year to year depending on prevailing prices and weather. To address this issue, we tested the robustness of the static model results by simulating grain prices and yields, as well as hog production and prices. The simulation model was designed to mimic historic variability in hog production, market hog prices, weaner pig prices, grain prices, and grain yields; while maintaining the historic correlation in these variables.

Table 2 shows the variables in the model designated as stochastic and the corresponding probability distribution and summary statistics. The distribution parameters were derived from annual average prices from 1988-2002. The 2002 Farm Bill provisions were included in the analysis. For each iteration, the model randomly selected a value for each variable listed in Table 2 and calculated net return to labor and management and return on investment for each enterprise. This process was repeated 1,000 times. The summary statistics for the 1,000 iterations are presented in Table 3.

Table 2. Input variables designated as stochastic along with the corresponding probability distribution and summary statistics.

Input Name	Distribution Type	Min	Max	Mean	Std Dev	90 Percent Interval	
Corn Price ($/bu)	Lognormal	1.21	5.35	2.27	0.42	1.67	2.99
Soybean Price ($/bu)	Lognormal	3.12	12.19	5.81	0.96	4.39	7.46
Soybean Meal Price ($/Ton)	Lognormal	101	431	185	35	135	246
Market Hog Price (Live, $/cwt)	Lognormal	22.77	89.39	43.79	7.28	33.00	56.46
Weaner Pig Price ($/Head)[1]	Lognormal	16.10	63.31	30.66	5.12	22.99	39.42
Sow Price ($/cwt)[1]	Lognormal	19.03	65.54	32.85	5.44	24.77	42.34
Corn Yield Dev. from Trend (bu/ac)	Logistic	(63.7)	119.3	(0.1)	16.9	(27.2)	26.7
Soybean Yield Dev. from Trend (bu/ac)	Logistic	(16.4)	30.7	(0.1)	4.2	(6.8)	6.5
Nitrogen Price ($/lb)	Uniform	0.12	0.23	0.17	0.03	0.13	0.22
Market Hogs per Litter	Normal	7.02	8.62	7.80	0.25	7.39	8.21
Weaned Pigs per Litter	Normal	7.40	10.58	9.00	0.50	8.17	9.82
Market Hog Weight	Normal	244	277	260	5	252	268

[1] Weaner pig and sow prices were not derived directly from a random draw, but were calculated as a percentage of the random variable *Market Hog Price*.

Table 3 compares net return to labor and management (NRLM) and return on investment (ROI) for each enterprise. Both NRLM and ROI are reported excluding and including federal farm program payments[1] triggered by each price scenario. When federal farm program payments are excluded from the results, the specialized grain operation offered the

[1] Based on the Farm Security and Rural Investment Act of 2002.

lowest return and the greatest risk. The diversified operations achieved higher returns and less risk, with the farrow to finish and breed to wean farms being close in average returns and risk. The wean to finish operation had lower returns with greater risk.

When government payments are included in the NRLM and ROI estimates, the results change dramatically. On average, the specialized cash grain enterprise produced the highest average NRLM and ROI and the least amount of risk. The farrow to finish enterprise ranked second, followed closely by the breed to wean farm. The wean to finish had the lowest average return and the greatest risk of return.

The last two columns of Table 3 present the 90 percent confidence interval (90 percent of the observations lie between these values) for each enterprise. These results suggest that at least 90 percent of the time, the combined income from the market and government program will offer an income level sufficient to generate a positive NRLM for the specialized grain, farrow to finish and breed to finish enterprises.

The federal loan deficiency and countercyclical payment programs appear to be successful in reducing the price risk inherent in grain farming. Consequently, integrating into livestock production offers very little income stabilization benefits typically attributed to asset diversification. The coefficient of variation in both NRLM and ROI is very similar across enterprises after government payments are taken into account.

Table 3. Net farm income, return on investment, and corn production cost statistics for specialized grain and diversified grain livestock enterprises considered in the analysis. (N=1,000)

	Min	Max	Mean	Std Dev	90% Interval	
Net Return to Labor and Management Excluding Government Payments ($)						
Specialized Grain	(278,825)	971,505	18,414	124,520	(164,984)	226,791
Farrow-Finish	(103,842)	557,788	78,807	73,283	(29,760)	207,421
Breed-Wean	(85,025)	542,497	91,555	68,697	(11,351)	208,914
Wean-Finish	(170,125)	587,902	55,492	90,643	(84,884)	212,825
Return on Investment Excluding Government Payments (%)						
Specialized Grain	-4.8%	31.3%	3.8%	3.6%	-1.5%	9.8%
Farrow-Finish	-10.0%	38.0%	4.5%	5.6%	-4.0%	14.3%
Breed-Wean	-12.9%	48.7%	4.8%	6.8%	-5.5%	16.5%
Wean-Finish	-10.4%	29.4%	2.6%	5.0%	-5.3%	11.2%
Net Return to Labor and Management Including Government Payments ($)						
Specialized Grain	25,786	1,030,171	127,564	81,819	56,591	285,458
Farrow-Finish	(66,448)	578,186	104,119	67,430	7,490	221,214
Breed-Wean	(70,191)	550,979	102,079	66,344	4,085	216,494
Wean-Finish	(123,237)	614,710	88,758	82,814	(30,681)	236,775
Return on Investment Including Government Payments (%)						
Specialized Grain	4.0%	33.0%	6.9%	2.4%	4.9%	11.5%
Farrow-Finish	-7.0%	39.5%	6.5%	5.1%	-1.0%	15.4%
Breed-Wean	-11.4%	49.5%	5.8%	6.6%	-3.9%	17.1%
Wean-Finish	-7.6%	30.8%	4.5%	4.5%	-2.2%	12.4%

Table 4 shows the frequency that all four enterprise alternatives fell into each respective rank category. The cash grain operation appears to dominate the rankings, achieving the greatest NRLM 55 percent of the time and the greatest and ROI 52 percent of the time. In all 1,000 iterations, the farrow to finish enterprise ranked either first or second 59 percent of the time and beat the cash grain farm in 39 percent of the observations. The breed to wean diversified farm was first or second 52 percent of the time and beat cash grain 38% of the time. Even the wean to finish enterprise, which was first or second only about a quarter of the time, beat the cash grain enterprise in nearly one third of the observations.

When comparing on ROI, the ranking distributions change slightly. The farrow to finish ranks first or second 84 percent of the time while the cash grain is first or second in only 63 percent of the observations and is last in 24 percent.

Table 4. Relative frequency that each enterprise fell into each ranking category based on net farm income and return on investment comparisons (All rankings include Government Payments).

	Profitability Rank				
Enterprise	1	2	3	4	>Specialized Grain
	----------Percent of Observations----------				
Net Farm Income Comparison					
Specialized Grain	55%	8%	9%	28%	
Farrow-Finish	15%	44%	37%	4%	39%
Breed-Wean	20%	32%	31%	17%	38%
Wean-Finish	10%	16%	23%	51%	32%
Return on Investment Comparison					
Specialized Grain	52%	11%	13%	24%	
Farrow-Finish	20%	64%	16%	0%	43%
Breed-Wean	28%	20%	19%	34%	40%
Wean-Finish	0%	5%	53%	42%	26%

Summary

The analysis shows an advantage to diversified hog and grain operations over specialized operations in the absence of government farm programs. The main benefits include: decreased fertilizer costs due to manure application, shared machinery costs, and stabilized grain price/cost assurances. The manure application almost completely covers the fertilizer requirements of the grain operation, greatly reducing fertilizer costs. The diversified operation is able to have dual-purpose tractors, enabling them to spread the tractor costs over more operations.

When the effect of the 2002 Farm Bill is incorporated into the analysis, the specialized cash grain operation changes from the low income high risk to the high income low risk enterprise. These results suggest Government programs have trumped the traditional advantage of diversification. Given a fixed labor constraint as was modeled in this analysis, these results suggest producers are faced with an incentive to reduce hog production and increase acreage enrolled in the farm program, thereby shifting to a larger specialized cash grain farm.

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