Regional competitive position of pork industry

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Abstract

In the recent past U.S. pork industry experienced geographical shifts in its production and processing. Some geographical areas have competitive advantage over the other areas in raising pigs. Costs of raising pigs vary by type and size of operations, and other location specific factors. We used enterprise budgeting approach to estimate the profitability of representative feeder to finishing operations in different geographical regions in U.S. We obtained data from the United States Department of Agriculture databases, costs and returns survey and various university sources. The cost differences were not due to the unit prices of inputs but were largely driven by the differences in their efficiencies. Overhead cost varies by locations and size of operation. Pork feeding operations of all sizes operate at a loss if we account for all the cash expenses and opportunity costs given the prices of all inputs and output. However, producers got positive profits over the variable costs. The Eastern Corn Belt regions' pork producers reap the highest operating profit ($1,861 per 100 hogs) followed by the Western Corn Belt region and the West region ($1,661). The results of production systems analyses as outlined here suggest that smaller firms have limited ability to compete with larger firms on the basis of cost of production. The key to keeping hog business competitive is higher production efficiency. Feed, labor, and building and equipment efficiencies were potential means of cutting production costs. Smaller producers who do not attain strong efficiencies in production are at a disadvantage relative to larger producers.

Introduction:

Regional differences in pork production costs are influenced by variation in prices of inputs and their efficiencies. Expansion of an industry in different geographical areas arises because of cost advantages associated with production and marketing. In the pork industry, industrialization has contributed to productivity gains. Economic incentives, through lower production costs exist in many areas for improving the efficiency of the hog operations. Coordination between the production and packing stages assure stable flow of uniform pigs to the packing plant and reduce pork production costs and satisfy consumer demand for high quality pork products (Martinez, 1999). Economies of scale obtained by technological innovations have further contributed to lower per-unit production cost. The dramatic increase in hog production in the Southeast is contributed by the increase in contracting in hog production and the decline in tobacco industry (Hurt, 1994).

Historically, pork production and processing operations have been concentrated in the Corn Belt states, an area with surplus feed. Corn farms with pigs have been profitable relative to other types of farms (Hayenga et al, 1998). In the Corn Belt states, pig production has been a value-adding enterprise on available grain supplies and utilizing available labor. Recently, growth in production has occurred in areas outside the Corn Belt, especially in North Carolina, Kansas and Oklahoma. The possible reasons behind the pork production location shift out of the Corn Belt to the corn deficit states may be due to the bulk grain-purchasing capacity of larger firms that decreases per unit grain transportation cost, technological changes in production system for higher production

efficiency, lower environmental constraints and costs of compliance, and favorable climatic condition to lower the cost of temperature control in the production facilities.

Pork production systems are commonly divided into three stages: Breeding sows operations (Breeding), Early-weaned pigs operations (Nursery) and Feeding-to-finish operations (Finishing). All these three stages of production can be in a single site (different facilities) or in different sites. The feeder-to-finish production system is the most important since it incurs the major share of production costs and adds most of the gain. These operations produce 200-265 pound market hogs. These types of operations are easier to compare for their relative profitability in different locations.

Pig feeding operations budgets (grow to finish)

Cost of raising hogs varies by type of operation, size, and other location specific factors. A direct survey of production units could be very expensive and is beyond the scope of this study. This research mostly uses the secondary data from USDA databases, costs and returns survey (FCRS), and various university sources. Some data are based on expert opinion and some are derived based on existing information, and assumptions.

Assumptions made in enterprise budgeting

The source of revenues for feeding to finishing operations is from the sale of market hogs. The weight of market hogs is assumed to be 250 pounds per pig. Not all the feeder pigs started in feeding operations survive until the marketing stage. A four-percent death loss (expert opinion) is used in adjusting operating costs and revenue. The average market weight per pig is assumed to be constant throughout the regions. The differences in revenue in different locations come from market prices in different regions. Price of

market hogs doesn't vary within a region and size of operations since the producers are price takers. The product sold and the inputs used are homogeneous.

About 60 percent of the total variable cost of pork production is appropriated to feed. Corn is the single most important input in pork rations. Soybean meal is the second important feed component. Iowa, Minnesota, and South Dakota are the states where the corn prices are lowest among the major pork producing states. Higher feed costs in southern and western states are partially compensated by lower prices of feeder pigs and lower cost of hired labor.

One can reduce the total cost either by paying a lower price of an input or using less of it. Therefore, production areas with higher feed cost can still be competitive if they can increase the efficiency of feed. Feed efficiency is measured in terms of pounds of feed used for per pounds of gain in hog's body weight. Similarly, production costs are expected to rise with increased labor use. Labor efficiency, hour worked per hundredweight gain for hogs is generally improved by capital-intensive production technologies. Regional differences in pigs weaned per litter, litters per sow, and operation size are also important in production efficiency. These elements reduce the cost of feeder pig production.

Table 1 Average prices of inputs in different regions (1994-1998)

Regions	Mkt.hog $/cwt	Corn price $/bushels	Soybean meal price $/bushels	Wage rate $/hr	Feeder pigs $/cwt
E. Corn Belt	45.22	2.54	13.89	6.49	84.17
W. Corn Belt	44.90	2.45	13.89	6.45	88.02
South	43.27	2.79	16.43	5.85	73.25
Northeast	42.11	2.84	15.20	6.10	88.08
West	49.66	2.99	22.20	6.47	83.38

Market hogs are most expensive on weight basis in the West followed by the Corn Belt. The Corn Belt has access to cheaper corn and soybean meal, which are the important inputs for raising hogs. Lower labor cost in pork production in the Southern region is due to lower wage rates. In addition to the direct production costs, firms incur regulatory costs, which is an important consideration in modern pork business.

Formulation of pig diets

Composition of corn-based feed as presented in Table 3 is based on nutrient and energy requirements of pigs. For example, to constitute 2000 pounds of feed for growing pigs, we need to mix 1631 pounds of corn, 321 pounds of soybean meal and minerals and vitamins. Rations are formulated to meet the nutritional requirements of pigs. Instead of corn grain, some pork producers may use barley and sorghum as a substitute. However, barley constitutes about two percent of total feed grain and use of sorghum is also limited in the U.S. Therefore, corn is taken as a standard feed grain in this study. Composite feed is fed according to the age of pigs until they are marketed.

Pigs undergo several physiological changes between weaning and finishing (market weight). Daily feed intake increases steadily during this period. Physiological

changes of pigs during the growth are important considerations for feeding requirements. In order to achieve maximum feed efficiency, it is necessary to feed well-balanced diets. Growing-finishing diets (45 to 250 pounds body weight) play an important role in the quality of meat and weight gain. Consumers demand for lean meat has resulted in greater efforts by breeders and finishers to improve the quality of meat. High lean gain pigs gain a minimum of 0.75 pound of lean pork per day from approximately 45 to 240 lb of body weights. In order to obtain high lean gain, specially formulated diets with higher amino acids levels should be fed.

Several biophysical factors: temperatures (weather), genetic background and health status of pigs, quality of feed, feed additives and growth promoters influence amount of feed and nutrient concentration[1]. Temperature and housing conditions play important roles in determining the nutrient needs for pigs. Pigs housed in open areas are exposed to greater fluctuation of temperatures than those housed in confinement facilities. Maintenance energy costs are higher in uncontrolled housing environments. Pigs of different genotypes and sex have different production efficiencies and thus the different nutrient requirements. Higher feed efficiency of feeding operations lowers the total feed requirement per pig.

Most of the pork production operations in the U.S. have more than 5,000 hogs and fall into the category of large operations based on the number of hogs in inventory. Southern states such as North Carolina, Arkansas, Georgia, and Oklahoma have a higher percentage of hog inventories in larger operations. Midwestern states such as Iowa, Indiana, Wisconsin, Nebraska, and Michigan have more hogs in small to medium sized

1 http://www.asci.ncsu.edu:80/Nutrition/NutritionGuide/introd~1/intro.htm

operations (Adhikari, 2002). Costs of raising hogs in these three different categories are calculated separately by the enterprise budgeting approach.

Table 2 Growing-finishing: feed usage by pig growth rate

Group (body weight in pounds)	Average daily gain (lb/day) from 45 to 250 lb		
	1.6	1.8	2.0
	Lb of feed per pig		
Grower 1 (45-80)	90	80	75
Grower 2 (80-130)	160	140	125
Finisher 1 (130-190)	205	180	165
Finisher 2 (190-250)	240	210	190
Total	695	610	555

Source: Swine nutrition guide Nebraska Cooperative Extension Service/USDA.

Table 2 presents the feed requirements during growing to finishing phase depending on the pigs' growth rate, as suggested by Nebraska Cooperative Extension service/USDA. If average daily gain is 1.6 pounds, then the total feed requirements will be 695 pounds per pig to reach the market weight of 250 pounds. Pigs need only 555 pounds of feed to reach the same weight if the daily average gain is two pounds but the ration will be more costly. Producers switch diets according to estimated pig weight.

Table 3: Suggested diets for finishing swine using corn as the major grain source

Ingredients	Weaning to 140 lbs body wt.		140 to 250 lbs body wt.	
	Pounds/ton	%	Pounds/ton	%
Corn yellow	1454	73	1631	82
Soybean meal 44 %	492	25	321	16
Calcium carbonate	15	0.75	16	0.80
Dicalcium phosphate	29	1.45	22	1.10
Salt	7	0.35	7	0.35
Trace mineral-vitamin mix	3	0.15	3	0.15
Totals	2000	100	2000	100

Compiled from Pork Industry Handbook, Michigan State University Extension, # E-1130

It is assumed that all the finishing operations buy feeder pigs. Costs involved prior to the growing phase are not included in the budgets. These costs are factored into the price of feeder pigs. Cost of feeder pigs is the second most important variable cost after feed costs. Labor cost is another important consideration. Labor availability and wage rates differ by geographical locations. Difference in hired labor costs comes from the amount of labor employed by the feeding operations and average annual hourly wages of field and livestock labor in different states. The proportion of hired labor and unpaid labor (family labor and management) per hundred hogs are assumed to be different by the size of operations. Small-sized operations rely more on family labor whereas large-sized operations employ a higher proportion of hired labor in total number of labor hours. Fringe benefits especially the health insurance to the employee in Eastern Corn Belt and

Northeast production regions are generally higher than the other production regions (Adhikari, 2002).

Opportunity costs of unpaid labor, capital recovery of machinery and equipment, opportunity cost of land, taxes and insurance, and general farm overhead come under overhead costs. Differences in overhead costs are greatly influenced by the economic opportunities of family labor, land values, government policies on income and property taxes.

Climatic conditions in the production locations contribute in regional differences in cost on facility construction and temperature control. Different sizes pigs (ages) require different air temperature ranges, for better performance. Smaller pigs up to 40 pounds require higher temperatures than the larger pigs. Larger pigs have an optimum feed efficiency when temperatures are between $50\text{-}70^0$ F (ASAE standards, 1997). The optimum temperature zone has narrower range for younger pigs. Older pigs can resist a wider range of temperatures. In addition to temperature control, proper ventilation, relative humidity, and sanitation are important for efficiency in pork production (Jones, 1996). Costs for fuel and electricity, and buildings and equipment are related to environmental control in pork feeding operations. However, the costs of heating and insulation in colder locations mostly offset the cost of cooling and ventilation in warmer locations (expert opinion). Regional differences in cost associated with the temperature, humidity, and ventilation are indirectly captured by the utility costs.

Enterprise budgets by regions and size of operations

The enterprise budgets are presented in 100 hog basis to compare costs and revenues across regions and size of operations. Three different scenarios by size of operations are considered for cost comparison. The medium size of operations is taken as the base scenario. An adjustment in variable costs and overhead costs are made to represent the budgets for small and large-sized finishing operations in all regions and budgets are modified to capture the economy of scale. The state level inventory data were obtained from a USDA database. Summaries enterprise budgets representing feeding operations in different regions and size (year 1998) of feeding operations are listed in table 4a to 4e (See Adhikari, 2002 for detail description of enterprise budgets).

Table 4a Feeder to finish system: cost and return per 100 hogs, E. Corn Belt*

Items	Small		Medium		Large	
	Quantity	$ Amt	Quantity	$ Amt	Quantity	$ Amt
Market hogs (cwt)	240	10,851	240	10,851	240	10,851
Corn (BU.)	938	2,252	885	2,252	885	2,252
Soybean meal (cwt)	134	1,856	126	1,751	126	1,751
Other feed cost		296		279		279
Feed cost		4,397		4,282		4,282
Hired labor (hr)	29	187	36	231	61	398
Unpaid labor (hr)	86	780	53	667	21	255
Total labor (hr)	115	967	89	898	82	653
Compliance cost		31		81		105
Veterinary med.		106		78		57
Total variable cost (VC)		10,487		8,988		8108
Overhead cost (OC)		3,067		2,378		1,966
Total cost (TC)		13,505		11,366		10,074
Rev. less TC		-2,653		-513		778
Rev. less VC		414		1,864		2,743

*Values may vary by each state in the region

Table 4b Feeder to finish system: cost and return per 100 hogs, W. Corn belt

Items	Small		Medium		Large	
	Quantity	$ Amt	Quantity	$ Amt	Quantity	$ Amt
Market hogs (cwt)	240	11,003	240	11,003	240	11,003
Corn (BU.)	938	2,194	885	2,194	885	2,194
Soybean meal (cwt)	134	1856	126	1,751	126	1,751
Other feed cost		296		279		279
Feed cost		4,376		4,224		4,224
Hired labor (hr)	21	137	28	181	50	323
Unpaid labor (hr)	64	715	42	527	17	208
Total labor (hr)	85	852	70	708	67	531
Compliance cost		31		81		105
Veterinary cost		133		98		71
Total variable cost (VC)		10,652		9,127		8,168
Overhead cost (OC)		3,101		2,108		1,790
Total cost (TC)		13,752		11,235		9,958
Rev. less TC		-2,750		-232		1,095
Rev. less VC		351		1,876		2,835

Table 4c Feeder to finish system: cost and return per 100 hogs, South

Items	Small		Medium		Large	
	Quantity	$ Amt	Quantity	$ Amt	Quantity	$ Amt
Market hogs (cwt)	240	10,385	240	10,385	240	10,385
Corn (BU.)	938	2,653	885	2,503	885	2,503
Soybean meal (cwt)	134	2,195	126	2,071	126	2,071
Other feed cost		295		279		279
Feed cost		5,144		4,852		4,852
Hired labor (hr)	19	111	26	155	46	267
Unpaid labor (hr)	57	468	40	326	15	126
Total labor (hr)	76	579	66	481	61	393
Compliance cost		31		119		108
Veterinary cost		115		85		62
Total variable cost (VC)		10,592		9,136		8,266
Overhead cost (OC)		2,288		1,586		1,384
Total cost (TC)		12,880		10,722		9,651
Rev. less TC		-2,495		-337		734
Rev. less VC		-207		1,248		2,118

Table 4d Feeder to finish system: cost and return per 100 hogs, Northeast

Items	Small		Medium		Large	
	Quantity	$ Amt	Quantity	$ Amt	Quantity	$ Amt
Market hogs (cwt)	240	10,040	240	10,040	240	10,040
Corn (BU.)	938	2,665	885	2,514	885	2,514
Soybean meal (cwt)	134	2,031	126	1,916	126	1916
Other feed costs		296		279		279
Feed cost		4,992		4,709		4,709
Hired labor (hr)	34	207	46	283	78	478
Unpaid labor (hr)	102	1323	70	803	27	301
Total labor (hr)	136	1530	116	1086	105	779
Compliance cost		39		195		113
Veterinary cost		80		59		43
Total variable cost		11,218		9,685		8,686
Overhead cost (OC)		3,288		2,992		2,992
Total cost (TC)		14,506		12,677		11,678
Rev. less TC		-4,466		-2,637		-1,638
Rev.less OC		-1,178		354		1,354

Table 4e Feeder to finish production system: cost and return per 100 hogs, west

Items	Small		Medium		Large	
	Quantity	$ Amt	Quantity	$ Amt	Quantity	$ Amt
Market hogs (cwt)	240	11,208	240	11,208	240	11,208
Corn (BU.)	938	2,807	885	2,648	885	2,648
Soybean meal (cwt)	134	2,831	126	2671	126	2,671
Other feed costs		296		279		279
Feed cost		5,934		5,598		5,598
Hired labor (hr)	18	112	25	158	42	108
Unpaid labor (hr)	52	827	37	620	13	376
Total labor (hr)	70	939	62	741	55	484
Compliance cost		31		81		105
Veterinary med.		145		57		107
Total variable cost (VC)		12,509		10,784		9,802
Overhead cost (OC)		3,291		2,105		1,740
Total cost (TC)		15,801		12,889		11,542
Rev. less TC		-4,592		-1,681		-333
Rev.less VC		-1,301		741		1,406

Average feed cost varies among the sizes of feeding operations. Smaller operations (fewer than 1000 pigs) are less efficient in feed than the medium (1000-4,999 pigs) and large (more than 5,000 pigs) operations. Overall, six percent more feed cost is considered in smaller operations. Quantity and costs of corn and soybean meals are included in tables. Other feed costs include the cost of minerals and vitamins that are mixed in the pig's diets.

The quantity of hired labor also hours varies by regions and size of operations. The number and hours of labor employed are dependent on the type of technology used in pork feeding operations, wage rates, and labor availability. Total labor hours consist of hired labor and family labor. The labor costs and corresponding labor hours are based on the USDA's commodity costs and return survey, 1998[2.] Dollar amounts on hired labor were divided by average wage rate in the region to obtain labor hour per hog. Similarly, opportunity costs of labor were used to calculate hours of family (unpaid) labor used in the production process.

Hisham El-Osta (1996) estimated the average opportunity costs (Table 5) of farm labor for different regions using weighted least squares regression. Although these estimations are for the 1988 fiscal year, we may assume that these costs have increased or decreased proportionately in 1998 and can be used as information to compare the relative opportunity cost of labor in different regions.

2 Producers were surveyed about production practices and costs in 1998. Hog costs and return accounts were prepared using a guideline by the American Agricultural Economics Association (AAEA) task force on cost and return estimation.

Table 5 Estimated opportunity cost of unpaid family labor

Region	Opportunity Cost ($)
South	8.24
West	15.74
Northeast	11.53
Midwest	12.49

Source: USDA, Technical Bulletin Number 1848, pp.19

Traditional (old) technology requires more labor as compared to modern automated systems of feeding. Labor costs in larger and smaller sized operations are adjusted from medium (base) sized operations. It is assumed that larger operations require 73 percent of labor hours as compared to mid-sized operations. Similarly, smaller operations are less efficient and require 36 percent more labor than the mid-sized operations. These adjustments are based on a publication from the Purdue Cooperative Extension Service.

Table 6 Cost of production comparisons by pork production system ($/Cwt)*

Costs	1200 sow (Large size)	600 sow (Mid size)	300 sow (Small size)
Total Feed	18.56 (100)	18.56 (100)	19.80 (106.68)
Total Labor	2.06 (72.54)	2.84 (100)	3.86 (135.92)
Total Direct	22.07 (100)	22.07 (100)	23.37 (105.89)
Total	34.25 (95.88)	35.72 (100)	38.63 (108.15)

Source: Compiled from "Positioning Your Pork Operation for the 21st Century"

*Numbers in parentheses are relative costs in percentage by sizes

Cost structure in three different sizes of operations is for the farrow-to-finish operation systems. These relative costs are extrapolated to adjust the cost differential of different sizes of feeder-to-finish production systems. The cost differential lies mainly in feed costs due to differences in feed efficiencies, labor efficiencies, and in indirect costs such as building and equipment. The cost differences are not due to the unit prices of inputs but are due to the differences in their efficiencies.

The Eastern Corn Belt region's producers reap the highest operating profit ($1,861 per 100 hogs) followed by the Western Corn Belt region and the West region ($1,661). The results of production systems analyses as discussed above suggest that smaller producers have limited ability to compete with larger producers on a cost of production basis. The key to keeping hog business competitive is higher production efficiency. Feed, labor, and building and equipment efficiencies are potential means of cutting production costs. Smaller producers who do not attain strong efficiencies in production are at a disadvantage relative to larger producers. Prices of inputs and output in one location do not differ by size. All the firms are assumed as price takers and the individual firm does not have market power to control the price of inputs and outputs.

Pork processing industry in regional competition

The pork processing industry is one of the determinants of the regional competitiveness of the pork industry. Modern restructuring of pork processing facilities has given the pork processing industry the ability to process large quantities of high-quality pork products at competitive prices. The pork processing industry today is characterized by a decreasing number of firms, the most profitable of which operate very large, relatively new, capital-intensive processing and packing facilities (Martinez, 1999). Packing costs decrease by increasing firm size, but the procurement and transportation costs rise. Improvement of vertical coordination offsets high procurement costs (Cassell and West, 1967). Competitiveness of such facilities is critically dependent on high volumes of raw product, because unit costs are driven lower as more hogs are slaughtered (up to a certain range). In the current state-of-the-art packing facilities, economies of size begin to be realized when four million pigs are processed per year (ERS, 1996).

Locations of pork processing plants

The meat industry is one of the largest manufacturing industries in rural America. Meat processing plants provide a substantial impact in rural economy. It is a source of economic growth and many communities welcome meatpacking industries for their impact on the local economy. On the flip side, meatpacking industries can pose environmental threats and, hence, local, regional or state government limit their growth by imposing various regulations. These two factors along with other many factors contribute to shaping the industry structure. Pig slaughter and the pork processing industry in the U.S. are becoming more concentrated and the number of plants is declining. The number of pork processing firms reporting to the USDA in 1980 was 446 and this number in 1995 declined to 209 (Hayenga, 1997). The few large pork-processing companies are dominant in their market shares.

The largest five companies slaughtered 62 percent of total hogs in 1997. Smithfield and IBP only captured 36 percent of the market share. Average capacity of processing plants by geographic regions is summarized in Table 7.

Table 7 Regional distribution of pork processing capacity

Region	Capacity (head/day)	Capacity share (percent)
Northeast	7,800	2.04
Eastern Corn Belt	83,850	24.57
Western Corn Belt	174,470	45.67
South	97,475	25.52
West	8,400	2.2

About 46 percent of the pork processing capacity lies in the Western Corn Belt States (Iowa, Minnesota, Nebraska, South Dakota and North Dakota) only. Another 25 percent of hogs are processed in the Eastern Corn Belt and about 30 percent of hogs processing capacity are out of the Corn Belt (South, Northeast and West). From the above tables we may conclude that Corn Belt states are still the important states in pork production and processing. The state of North Carolina (Southern production region) is also one of the dominant players in the pork processing industry.

Pork processing cost

According to a survey of managers of the six largest firms and two firms with new plants conducted by Hayenga in 1997, average estimates of fixed plant and equipment costs were $6 per head for single-shift plants and $3 for double-shift plants. Average variable costs were $22 and $20 per head for single-shift and double-shift plants respectively. Labor cost is making up approximately 50 percent of total variable costs in slaughter and processing. Therefore, total-processing costs in different locations are greatly affected by wages paid to the slaughterers and butchers. Regional differences in processing costs are calculated based on the wage rates of the workers employed in

animal slaughtering and processing facilities, and information obtained from the survey by Hayenga (1997).

Table 8 Regional pork processing costs, 1997

Region	Processing cost $/Head	Processing cost $/cwt*
Northeast	25.88	10.49
Eastern Corn Belt	24.50	9.93
Western Corn Belt	25.50	9.83
South	25.26	10.34
West	26.50	10.74

*Compiled from ERS/USDA monthly hog slaughter data 1974 –1997.

Because of structural changes in animal production, manure nutrient loading is on the rise (McBride, 1997). Almost all state governments impose restrictions on manure applications to some extent. Nitrogen and phosphorus standards are the most common nutrient restrictions. According to the Animal Confinement Policy National Task Force Survey (1998), the states of Florida, Kansas, Michigan, Oklahoma, Pennsylvania, Texas, Vermont, Washington and Wisconsin are concerned with phosphorus standards. Similarly, nitrogen standards are imposed in Arkansas, Iowa, Illinois, Florida, Georgia, Kansas, Kentucky, North Carolina, New Mexico, Missouri, Oklahoma, Pennsylvania, Rhode Island, Texas, Utah, Vermont, and Wisconsin.

Table 9 Environmental stringency by states

Stringency	States
Highly Restrictive	Illinois, Kentucky, Maryland, Nebraska, North Carolina, Ohio, Oklahoma, South Carolina, and South Dakota.
Restrictive	Arkansas, California, Connecticut, Florida, Indiana, Iowa, Kansas Minnesota, Missouri, Mississippi, Montana, North Dakota, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Virginia, Vermont, Wisconsin, and Wyoming.
Moderately Restrictive	Arizona, Colorado, Idaho, Maine, Michigan, Nevada, New York, New Mexico, and Washington
Little or Nonrestrictive	Alabama and New Jersey

Source: Adhikari, 2002. Factors and trends of regional shifts of production: Analysis of the U.S. pork sector.

It has been estimated that the hog producers bear the extra burden of $0.40 to $3.20 per hog in compliance costs, and that is up to eight percent of total hog production costs (Sullivan et al., 2000). Pig operations can reduce the total production costs by controlling compliance costs. In order to achieve this goal, firms either need to change the existing production practices to the practices that are environmentally friendly or move their operations to the geographic locations that are less stringent and friendlier. There is a general belief that strict environmental regulations drive industries out of some states into others. Studies have shown that environmental regulations are relatively unimportant compared to the other factors in a firm's location decision (Metcalfe, 2001 and Adhikari 2002).

Conclusion:

The Eastern Corn Belt region has the highest operating profit ($1,861 per 100 pigs) followed by the Western Corn Belt region and the West region ($1,661 per 100 pigs). The results of production systems analyses suggest that smaller producers have limited ability to compete with larger producers on a cost of production basis. The key to keeping hog business competitive is to obtain higher production efficiency. Feed, labor, and building and equipment efficiencies are potential means of cutting production costs. Smaller producers who do not attain strong efficiencies in production are at a disadvantage relative to larger producers. Pork processing costs by different regions do not have big differences but the processing capacity constraints play important role in limiting the production.

Appendix 1 Average prices of inputs and market hogs in selected States, (1998)

State	Mkt. hogs $/cwt	Corn price $/bushel	Soybean meal $/bushel	Wage $/hr	Feeder pigs $/cwt	Region
Illinois	44.88	2.60	14.00	6.74	86.08	E. Corn Belt
Indiana	44.93	2.59	14.00	6.81	89.18	E. Corn Belt
Michigan	45.75	2.48	13.63	6.58	83.48	E. Corn Belt
Ohio	46.40	2.57	14.00	6.39	78.98	E. Corn Belt
Minnesota	47.63	2.36	13.63	7.03	91.17	E. Corn Belt
Wisconsin	44.13	2.48	13.63	5.92	83.13	E. Corn Belt
Maine	42.00	NA	15.53	NA	88.08*	North East
N. Jersey	39.93	2.82	15.53	6.86	88.08*	North East
Pennsylvania	44.03	2.96	15.53	5.93	88.08*	North East
N. York	40.55	2.88	15.53	6.37	88.08**	North East
Arkansas	44.00	2.57	15.60	5.76	73.25*	South
Florida	40.53	2.86	17.47	6.59	73.2*5	South
Georgia	44.15	2.92	17.47	6.11	68.08	South
Kentucky	45.65	2.68	14.03	5.68	72.43	South
Louisiana	40.50	2.75	15.60	5.64	73.25*	South
Maryland	42.15	2.88	15.53	6.27	73.25*	South
Missouri	44.75	2.61	14.00	5.92	74.48	South
Mississippi	45.88	2.66	15.60	5.39	73.25*	South
N. Carolina	47.08	2.87	16.20	5.85	79.63	South
Oklahoma	43.88	2.83	16.43	5.98	73.25*	South
S. Carolina	43.45	2.87	17.47	5.48	73.25*	South
Tennessee	43.78	2.66	16.20	5.88	71.67	South
Texas	40.98	2.78	16.43	5.56	73.25*	South
Virginia	46.50	2.76	16.20	6.02	73.25*	South
W. Virginia	40.03	2.90	16.20	5.62	73.23*	South
Iowa	47.63	2.47	14.00	6.54	89.58	W. Corn Belt
Kansas	44.78	2.60	16.20	6.84	83.23	W. Corn Belt
North Dakota	40.85	2.32	14.03	6.76	73.25*	W. Corn Belt
Nebraska	48.10	2.52	14.03	6.39	90.80	W. Corn Belt
S. Dakota	47.20	2.30	14.03	5.66	88.02	W. Corn Belt
Arizona	45.00	2.99*	20.17	6.00	83.38**	West
California	48.28	3.23	20.17	6.57	83.38**	West
Colorado	48.48	2.66	20.17	6.08	83.38**	West
Idaho	43.88	3.22	21.30	6.32	83.38**	West
Montana	45.43	2.68	20.17	5.61	83.38**	West
N. Mexico	43.93	2.76	20.17	5.90	83.38**	West
Oregon	50.15	3.15	22.20	6.50	83.38**	West
Utah	44.90	3.25	20.17	5.99	83.38**	West
Washington	45.48	2.99	22.20	7.08	83.38**	West
Wyoming	44.58	2.79	20.17	5.32	83.38**	West

* Calculated on the basis of regional average ** Based on national average

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