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Economies of Size in Production Agriculture

MICHAEL DUFFY

Iowa State University, Ames, Iowa, USA

Economies of size refer to the ability of a farm to lower costs of production by increasing production. Agriculture production displays an L-shaped average cost curve where costs are lower initially but reach a point where no further gains are achieved. Spreading fixed costs, bulk purchases, and marketing power are cited as reasons for economies of size. Labor-reducing technologies may be the primary reason. Most studies do not include the external costs from prophylactic antibiotic use, impact on rural communities, and environmental damage associated with large-scale production. These can contribute to the economies of size.

KEYWORDS   economies of size in production agriculture, labor use, farm definition

INTRODUCTION

This article discusses economies of size, especially as they relate to production agriculture. It focuses mainly on Midwestern agriculture, but to the extent possible other regions will be discussed.

The discussion on economies of size presented here is from an overall perspective. The theoretical underpinnings and economic discussions can be found in other sources.[1]

Before beginning any discussion on economies of size it is first necessary to define the term. The concept of economies of size means that the average cost per unit of production decreases as the size of the farm increases. The economies can occur because the farmer is able to spread more production over the same level of fixed expenses. Or, economies of size can occur when a farm is able to obtain volume discounts for inputs such

Address correspondence to Michael Duffy, Graduate Program in Sustainable Agriculture, Iowa State University, 478 Heady Hall, Iowa State University, Ames, IA 50011. E-mail: mduffy@iastate.edu

as seed or fertilizer. An example would be the cost for pollution monitoring around a swine production facility. If the farm is required to monitor the groundwater around the facility for contamination, they must put in a well and monitoring equipment, which represent fixed costs and can serve a large number of pigs. As the number of pigs sold increases, the costs for this aspect of production would decrease. And, as a result, monitoring in this fashion would actually provide a cost advantage to a larger operation.

Two related concepts will be mentioned here only for the sake of avoiding confusion. One is economies of scale, which measure what happens if all inputs are increased by the same proportion. If costs per unit go up, then there are diseconomies of scale. If costs per unit go down, there are increasing economies of scale, and if the costs per unit remain the same, there are constant returns to scale.

The other concept is economies of scope, which refer to reducing costs for using resources by spreading the resources over more than one enterprise.

Hofstrand summarized the concepts of size and scope by noting that size spreads fixed resources over more units of output whereas scope spreads the cost of a given set of resources or skills over more than one product or enterprise.[2]

Discussion of economies of size in production agriculture and the desirability of small farms has ebbed and flowed over time. One of this country's earliest political debates centered on the conflicting views held by Thomas Jefferson and Alexander Hamilton regarding land ownership. Jefferson argued for family ownership of farms as a means of ensuring interest in the democratic process. Hamilton argued for selling the land to the highest bidder as a means of paying off the Revolutionary War debt. Jefferson won the debate and the United States followed the principal objective of promoting family farms.

In the early part of the 20th century problems emerged for this ideal, problems related to economies of size. In 1909 President Roosevelt formed the Country Life Commission to address the issues of poverty in rural America.

The Commission found that in spite of the advances and money spent up until that time ". . . agriculture is not commercially as profitable as it is entitled to be for the labor and energy that the farmer expends and the risks that he assumes . . ." and "The farmer is almost necessarily handicapped in the development of his business because his capital small and the volume of his transactions limited; and he usually stands particularly alone against organized interests" (Report of Commission on Country Life, 1909, in Wunderlich, p. 146[3]).

This Commission report renewed the efforts to improve the lives of the farmers by increasing their productivity. The increases in productivity were directed toward technologies that substituted capital for labor.

The period following the report was very good for US agriculture. In fact, "parity" prices were established in the period from 1915 to 1919. The

United States followed policies geared toward maintaining those prices for decades.

The US economy moved through two World Wars and the Great Depression after the parity price period. Agricultural productivity continued to increase as new labor-saving technologies were developed.

Farm incomes fell after World War II and again there was unrest in the countryside. In 1954 President Eisenhower ordered the US Dept of Agriculture to prepare a report on the state of the agricultural economy. The report concluded that expanding agricultural productivity was the key and "One of the recommendations to increase agricultural productivity was to allow farms to expand in order to take advantage of new labor-reducing technologies. It was argued that the expansion of small farms could be facilitated using programs designed to retrain and move agricultural workers to non-farm industries."[4] Others have noted that "While some of the implemented government policies were successful, most of the reductions in farm labor and the corresponding increases in farm size were the result of changing technology."[5]

At the beginning of the 20th century there were concerns over the need to add more technology to production agriculture. These were followed in the middle of the century by a feeling that the new technology had already removed the need for much of the labor and what we needed to do was "move agricultural workers to non-farm industries."

Towards the end of the 20th century, new fears were raised that family farms were losing ground and the move to increase productivity by decreasing labor may have yielded undesirable consequences. A Small Farms Commission, created by the Secretary of Agriculture in 1998, urged the government to recognize small farms and their contributions to society and actively support them.[6] The Commission emphasized that research must be ". . . dedicated to optimizing the labor and ingenuity of small farm operators and the biological assets of their farms using less capital-intensive investments." (p. 31)[6]

Over time in the United States economies of size with respect to substituting capital for labor have been encouraged and discouraged. Research and technology have been the primary drivers in changing the situation with respect to economies of size. In spite of the Small Farms Commission report, we continue to move toward a dual agriculture with many small farms and relatively few large farms. Economies of size remain an often-debated topic.

CENSUS DATA

The Census of Agriculture is the best source for a consistently gathered set of agricultural data for the entire country. The census provides an opportunity to examine several aspects of the issues related to economies of size.

The first agricultural census was taken in 1840 and it was conducted every 10 years until 1920. Since then the Census of Agriculture generally has been conducted on a 5-year basis.[7]

The Bureau of the Census conducted the Census of Agriculture until 1996 when the responsibility was transferred to the USDA primarily because the Census Bureau was going to increase the size needed for an operation to be considered a farm.

One of the major difficulties with examining national farm-level data is how to determine what is considered a farm. For the purposes of the Census, a farm is defined as ". . . any place from which $1000 or more of agricultural products were produced and sold, or normally would have been sold, during the census year." (p. ix)[7] This definition has been used since 1974 and has created many problems and inconsistencies when people use or try to interpret the Census data. A major problem currently is the age of the definition. Inflation alone would suggest that the cutoff point should be raised to at least $5000.

Another problem is the change in census coverage initiated by the USDA in 2002 in an effort to survey more very small farms. They did not change the definition; they simply chose to count more people. The change in coverage has led to a change in the composition of the farms considered in the census.

Figure 1 shows the distribution of farms and sales in the United States based on sales categories. Notice in this figure the very smallest category, sales of less than $1000, makes up over 30% of the farms. It is important to remember that the definition of a farm is any place that "could have sold"
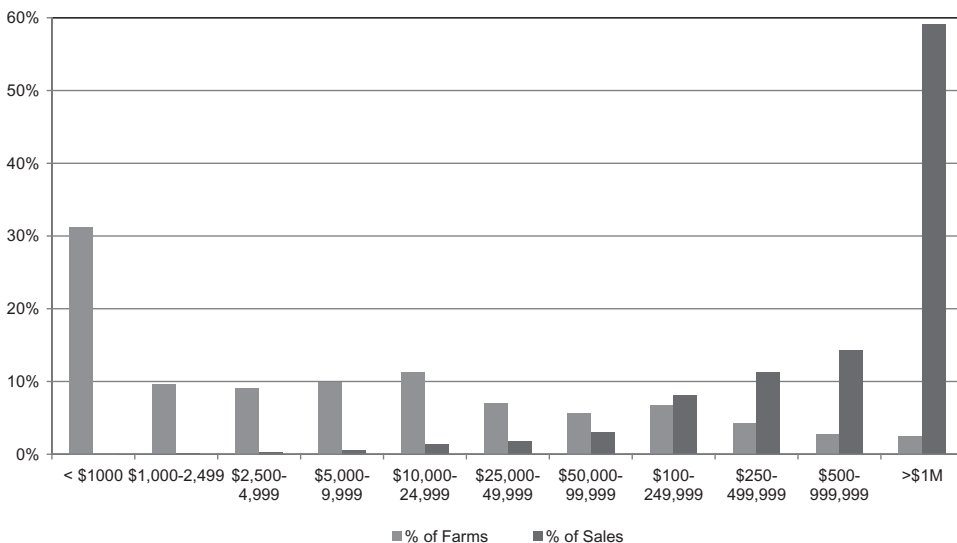
**FIGURE 1** Distribution of farms and sales in the United States, 2007.

$1000 worth of agricultural products. These farms with sales less than $1000 are referred to as *point farms*. The farms are assigned points based on the agricultural enterprises and if the points total 1000, they are included as farms in the count. One pig has a point value of 150, so raising 7 pigs would classify a place as being a farm. A horse has a point value of 200 whether or not it is sold, which means that 5 horses classify a place as a farm.

Figure 1 shows that the majority of farms are small and they account for very little of the agricultural sales in the United States. The largest two categories, those with sales over $500,000, represented 5% of US farms and had 74% of the sales in 2007. At the other end of the spectrum, farms with sales less than $5000 accounted for 50% of the farms and generated less than 1% of the sales.

It is interesting to note that government payments are greater than sales for the smallest group. For farms in the smallest size group over 90% of the combined sales and government payments come from the government.

It is important to keep the size issue in mind when working with the census data. In many contexts, discussions about average farms are almost meaningless without making some distinction regarding the size of farm.

With this caveat in mind there are two ways to use the Census data to examine economies of size in US agriculture. The first item of interest is presented in Figure 2, which shows the dollar value of sales for every dollar of expenses reported. This is a measure of efficiency. The more sales a farm can generate for each dollar of expense, the more profitable it will be. Such efficiency gains can be thought of as economies of size at the aggregate level.
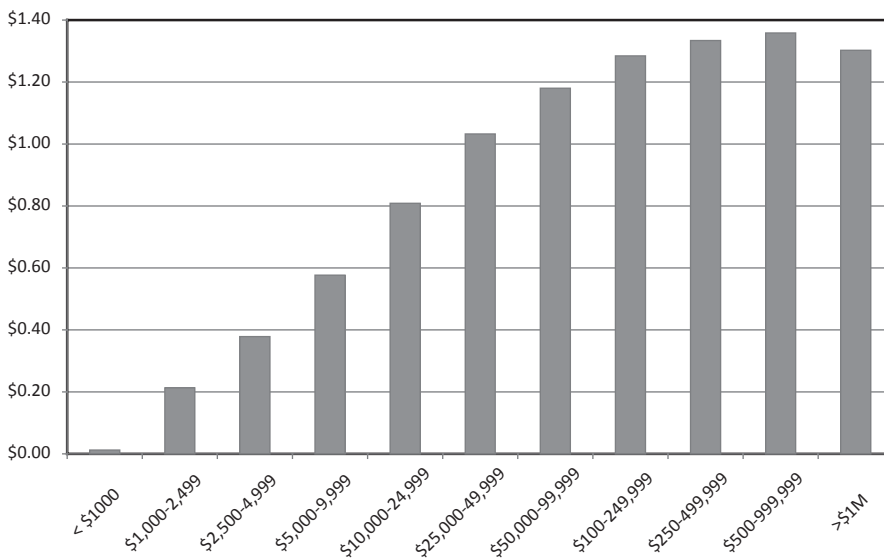
FIGURE 2 Dollars of farm sales per dollar of farm expenses, United States, 2007.
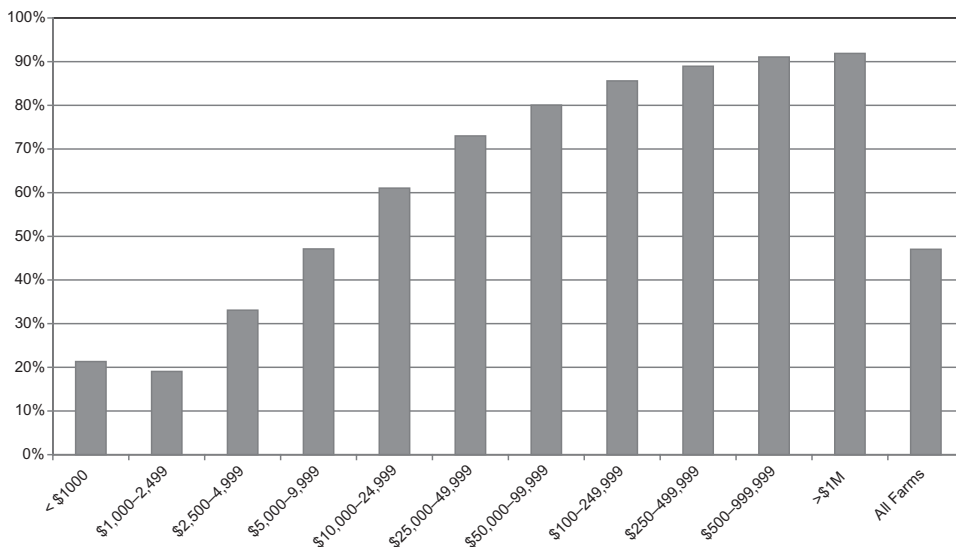
**FIGURE 3** Percentage of US farms with positive net farm cash income, 2007.

Notice in Figure 2 that the amount of sales per dollar of expenditure increases rapidly until reaching approximately $100,000 in sales. Once this level of sales is reached the ratio flattens out, indicating no further gains in efficiency with respect to expenses relative to sales. It is interesting to note in Figure 2 that the ratio tends to grow smaller with the largest size group. Figure 2 shows that there are very definite gains in efficiency as a farm increases in size but the rate of gain slows and actually decreases as size increases.

Figure 3 also illustrates the extent of economies of size present in the US farm sector. This figure shows the percentage of farms with a positive net cash farm income in 2007. It looks very similar to Figure 2 in that there are rapid increases in the percentage of farms showing positive net cash farm income, but this increase flattens out starting at around $100,000 in sales.

ECONOMIES OF SIZE IN IOWA

Economies of size for agricultural production in Iowa can best be illustrated using data from the Iowa Farm Business Association (IFBA), a record-keeping service for Iowa farmers. These farm operations would be more representative of the larger farms as shown in the census data.

Figure 4 shows the total economic costs of production per bushel of corn for farms in the IFBA based on the number of row crop acres farmed. In Figure 4 the cost per bushel decreases over the smaller acre categories
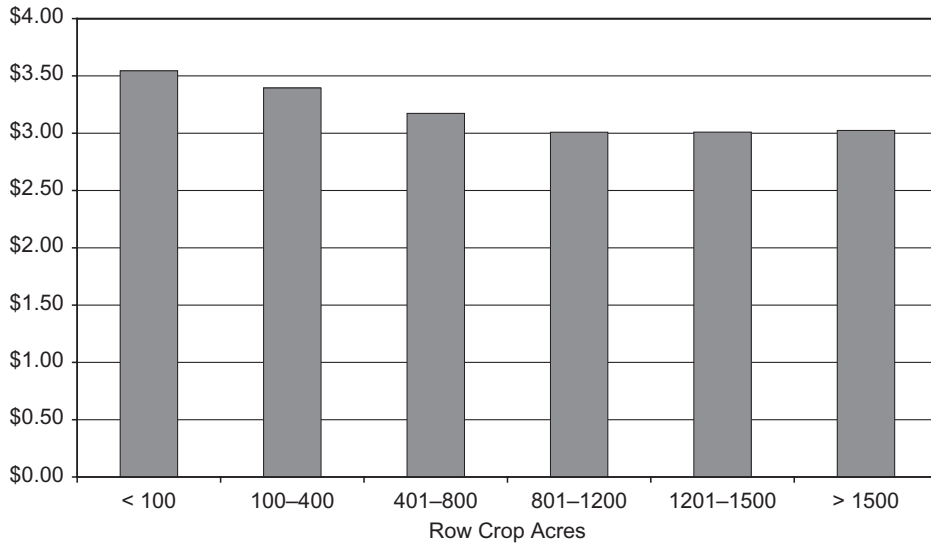
FIGURE 4 Total economic cost per bushel for corn based on number of row crop acres.[12]

but flattens out by 800 row crop acres. There is even some indication that the costs may start increasing at that point.

Figure 5 shows the average cost per bushel for soybeans based on the number of row crop acres. Soybeans exhibit an average cost curve similar to corn. The low point for soybeans appears to be approximately 400 row crop acres.
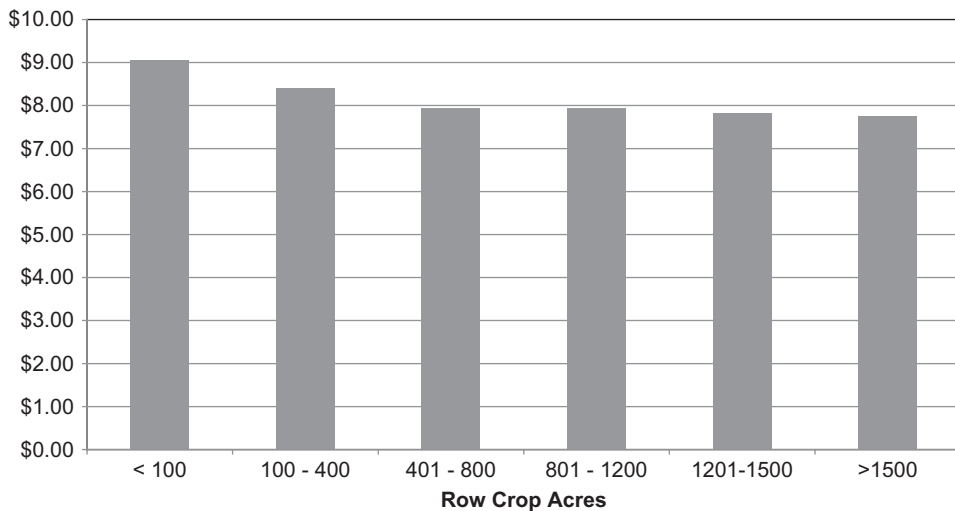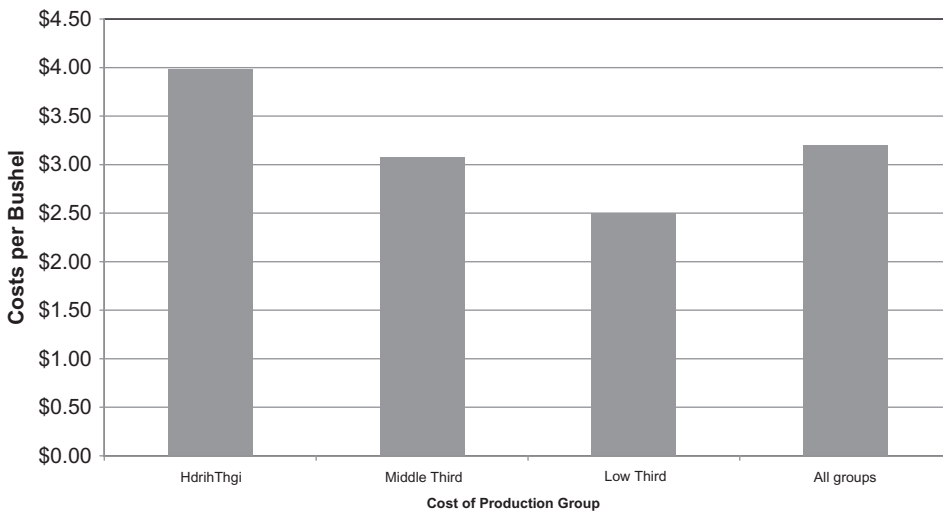

FIGURE 5 Total economic cost per bushel for soybeans based on number of row crop acres.[12]

Figures 4 and 5 display what is known as an L-shaped average cost curve. That means there are initial economies of size but these size advantages dissipate, and then costs remain relatively flat over a range of sizes. "Most normative studies of crop farms, both early and recent, while identifying economies of size, have given little evidence that the cost curve deviates significantly from a sagging "L" shape." (p. 206)[1]

Hallam further discussed the economies of size in agricultural production: "The general conclusion is that while some economies of size or scale may exist for livestock farms that significant economies, at least as conventionally defined, do not exist for most crop production activities. While differences in efficiency and growth paths differ among firms, few of these seem to be directly related to economies of size and scale."[1(p 224)]

One observation by Hallam[1] was the discrepancy between farmers with respect to costs of production. This is illustrated in Figure 6, which shows the costs per bushel for corn when the cost groups are divided into thirds. Figure 6 reports an almost $1.50 per bushel difference in costs of production between the high-cost producers and the low-cost producers.

Figure 7 presents the number of corn acres for the farms in each cost group. Figure 7 shows that the high-cost producers had the fewest corn acres, whereas the middle-cost producers had the greatest number of corn acres. This means that the lowest-cost producers had fewer acres. Figures 6 and 7 reveal a couple of distinguishing characteristics that are important to remember when considering production agriculture. First, there is considerable variation among farms, even farms producing the same crop. The second observation is that the number of acres is not a guarantee of lower cost

FIGURE 6 Corn total economic cost per bushel by cost group.[12]
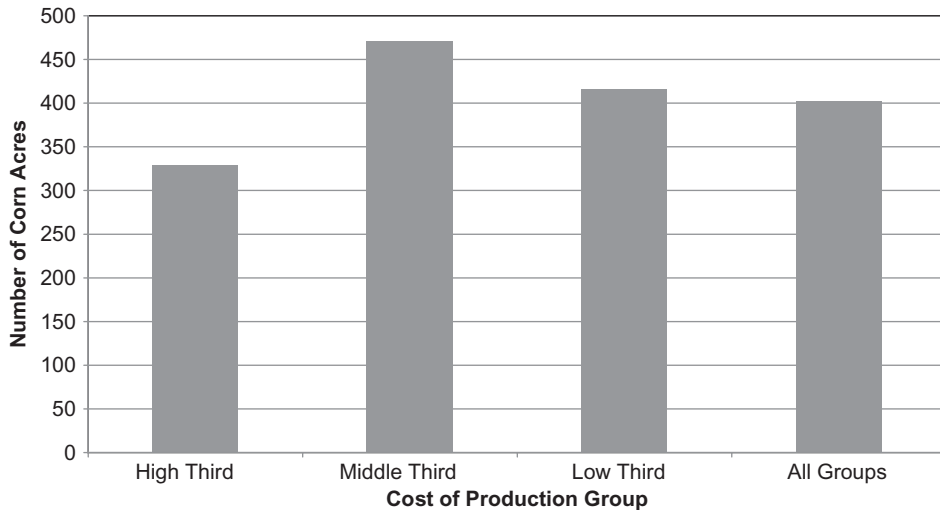
**FIGURE 7** Number of corn acres based on cost group for corn.[12]

production. Many other factors determine whether a farmer is a low-cost producer per unit of output.

Hallam[1] noted that livestock production appears to be different with respect to economies of size. Livestock production efficiencies and the changing structure of animal agriculture have been discussed in many places, most recently by MacDonald and McBride.[8]

Figure 8 shows the costs of production per hundredweight for farms in the Iowa Farm Business Association based on the number of pigs marketed. Figure 9 presents the cost per hundredweight of pork produced based on the number of sows. Figures 8 and 9 both illustrate economies of size found in most animal production. They show a more extreme drop in costs of production as size increases when compared to the crop costs shown in Figures 4 and 5.

Technological changes and changes in production have led to the dramatic decreases in costs of production. Differences in costs of production for swine have been noted for a long time. One study reported that ". . . farrow-to-finish swine producers can achieve essentially the same profitability per unit of production across a wide range of volumes of production." (p. 1)[9] MacDonald and McBride note, "There are substantial economies of scale up to certain threshold sizes, and farms can operate efficiently at sizes that are much larger than the thresholds." (p. 36)[8]

There appears to be two major differences between animal and crop production with respect to economies of size. One of the major differences is the vertical integration of the industry, which has led to a major consolidation in the processing industry.
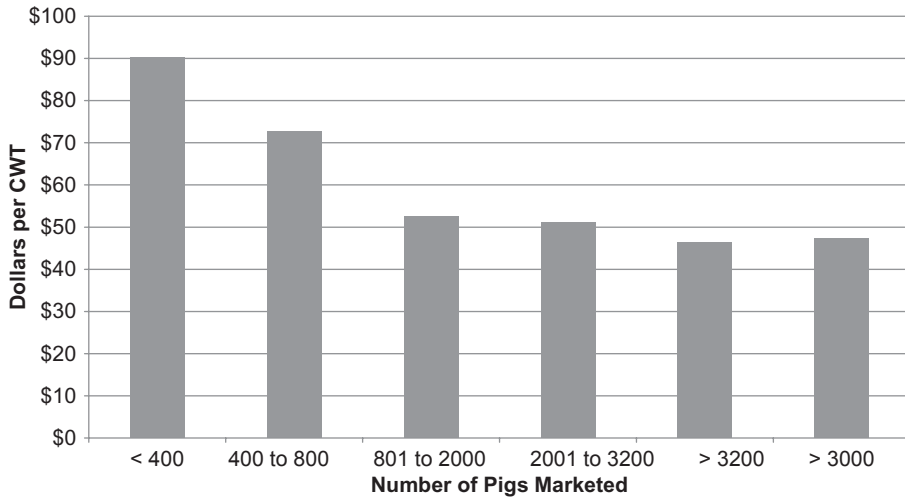
FIGURE 8 Cash flow costs per hundredweight for pork based on the number of pigs marketed.[12]
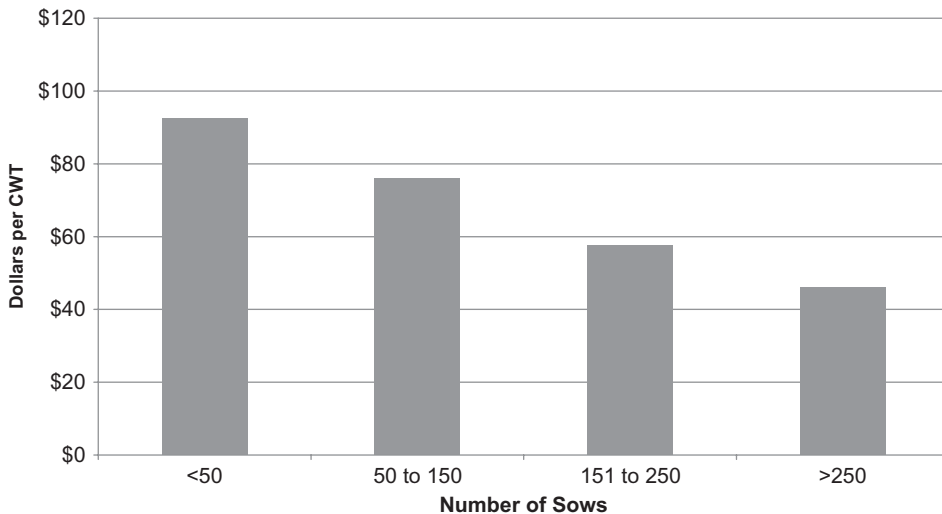
FIGURE 9 Cash flow cost per hundredweight of pork produced based on the number of sows.[12]

The declining number of packing plants illustrates the consolidation in the processing industries. In 1976 there were 858 cattle packing plants and 497 swine packing plants. In 1998 there were 221 and 182 cattle and swine processing plants, respectively, a decrease of 74% in the cattle plants and a 63% decrease in swine processing plants.

The decrease in the number of plants has been coupled with an increase in the number of animals slaughtered by size of plants. For example,

in 1976, 9% of the cattle were slaughtered in plants slaughtering more than 500,000 head per year. By 1998, these same-sized plants were slaughtering 67% of the animals. In 1976, 2% of the swine were slaughtered in plants slaughtering more than 1 million head per year. By 1998 the plants slaughtering over 1 million head increased to 16% of the hogs slaughtered.

Large-scale processing plants possess economies of size. One of the biggest components of these economies of size is procurement of the animals. As the packing plants have gotten larger, they have demanded a larger volume from the individual producer. This favors the larger-scale producers and requires either an increase in the size of production or some form of joint marketing. Production contracts have become commonplace and today the majority of pork is raised under some form of contract. Smaller producers may have similar costs of production but access to the market has become a significant problem.

The second major factor that has led to the increased size of animal production operations is the ability to pass along costs to those not making the production decisions. These external costs are generally not calculated in the costs of production or measuring the efficiency of the large scale production. MacDonald and McBride discussed these external costs, which generally fall into two major categories.[8] The first category is the environmental costs. Confinement of large numbers of animals generates manure and odor and has the potential to cause water and air quality deterioration. These problems will increase as the number of animals per unit increase.

A second potential external cost concerns the threat to food safety from the use of prophylactic antibiotics. Large numbers of animals housed together have greater potential for disease. Routine antibiotic use can increase the chances for antibiotic resistance to develop and for contamination of the product. The severity of these problems depends on the individual operator, and the potential for problems increases as the concentration of the animals increase.

Animal agriculture demonstrates the changes inherent in an industrial approach to agriculture. The specialization of production often ignores the benefits and advantages of the synergy that exists in agriculture. Crops can feed the animals, animal manure can provide nutrients for the crops, and the farmers can add value to their production with a more holistic approach. Increased environmental costs, food safety concerns, undesirable odor, and concentration of the food supply are just a few of the concerns that have arisen with the change in philosophy of producing animals and animal products. One publication in the early 1990s stated that "animal agriculture is changing rapidly from Midwestern enterprises of diversified farming to those which manufacture muscle protein." (p. 1)[13] This industrialized approach has led us to many of the problems and issues we face today.

DISCUSSION

If farms display an L-shaped average cost curve and expansion does not lower the costs of production, why are we seeing such expansion in farm size? The basic answer is that farms are getting larger because they do not incur diseconomies of size. As the farm increases in size the cost per unit of output remains relatively flat. As the number of units of output increases and there is no significant difference in the cost of production, income will increase. For example, using the average acreage shown in Figure 4, a farm with 800 acres of corn would have an average total cost of production of approximately $3.00 per bushel. If the yield was 200 bushels per acre and the price of corn was $3.50 per bushel, the farm would make $80,000 [($3.50−$3.00) * 200 * 800]. But, if the same farm had 1,500 acres of corn they would make $150,000 [($3.50−$3.00) * 200 * 1500]. So, the larger farm will earn almost double the amount of income.

Such expansion is possible because of the labor-saving technologies that have been developed for production agriculture. Figures 10 and 11 show the hours of labor required for corn and soybeans per acre and per 100 bushels, respectively.

Figure 10 illustrates the tremendous decline in labor requirements per acre, especially since the end of WWII. This decrease is primarily due to adoption of mechanical technologies, in particular the tractor. Figure 11 shows the major decrease in labor requirements per unit of production that occurred between 1939 and 1949. This decrease was due to the changes in technologies available, especially seed and fertilizers.
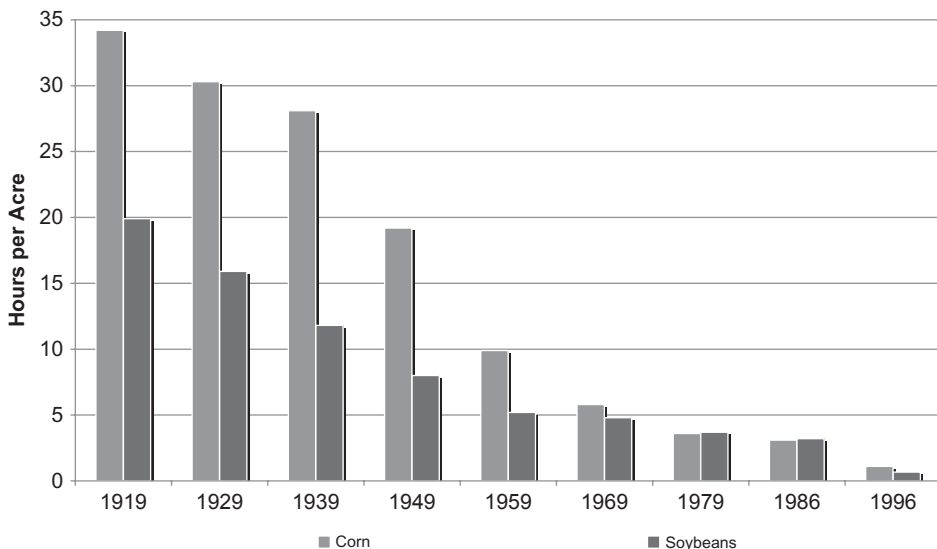
FIGURE 10 Number of hours per acre for corn and soybean production.
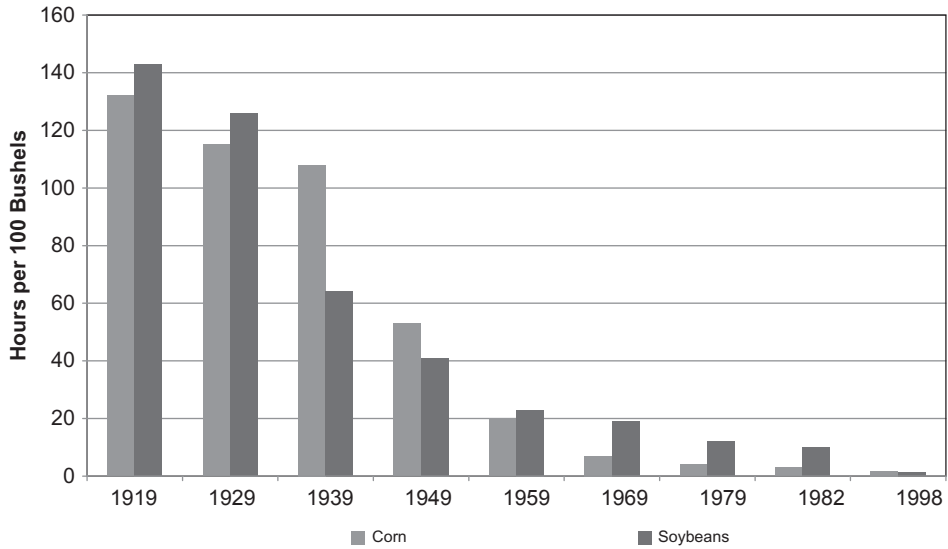
FIGURE 11 Number of hours to produce 100 bushels of corn and soybeans.

As the amount of labor required per acre has declined, the number of acres that a farmer can farm has increased. Although there will be considerable variation, a conservative estimation of the hours of fieldwork for corn and soybeans is approximately one hour per acre. Using this estimate, farming 800 acres would take approximately 800 h of labor and farming 1500 acres would take 1500 h of labor. A 40-hour-a-week job for 50 weeks a year would be 2000 h. Of course, the hours of labor for crop production are not evenly distributed over the year. Crop production labor has two heavy periods: in the spring at planting time and in the fall during harvest. This makes direct comparisons difficult, but such a comparison does provide some order of magnitude regarding the hours of labor available.

In addition to labor-saving technologies, other technologies have been developed that have lead to economies of size and thus an increase in the size of farms. Herbicide-resistant soybeans are one such technology. A state-wide comparison of the returns to herbicide-resistant soybeans and conventional soybeans in Iowa found there was no significant difference in returns.[10] Given these findings, why was there such rapid adoption of herbicide-resistant soybeans? There were essentially no herbicide-resistant acres planted in 1996, and yet in just 4 or 5 years more than 90% of the soybean acres were using this technology. Farmers had a variety of reasons, including ease of harvest and ability to cover more acres. Perhaps most telling was the farmer who said that he planted them because "they offered weed management that any idiot could do."

Mechanical technology is another reason farms are getting bigger. New machines are capable of covering far more acres in less time and they are

able to perform different jobs. Strip-tillage is an example of a popular recent practice made possible by changes in equipment. Strip-tillage saves soil, but its primary appeal for many is the decrease in labor needed.

Technology comes with a price. If costs increase and the resulting changes in revenue do not offset the increases, the profit margins narrow and farmers need to cover more acres to maintain their incomes. Willard Cochrane described this phenomenon as the "technology treadmill."[14] Technology enables one person to farm more acres, but as more acres are farmed, the costs increase. So, they must adopt technology that allows them to farm even more acres and the cycle escalates further.

One of the advantages for larger farms is the ability to purchase in bulk. Bulk purchases allow the larger farm to acquire the same input but at a reduced cost. The cost reduction reflects the lower transaction costs for the input supplier: less paperwork, less handling, lower shipping costs, and so forth. In addition, the risk of default or non-payment increases as the number of purchasers increases. It could be argued that even though the probability of the risk of a default increases with more purchasers, the loss associated with any single default would go down and so the expected value would be the same. However, it would be easier and cheaper for the supplier to monitor fewer purchasers and so the probability of any single farm defaulting would be reduced.

Another advantage for larger farms is the ability to more fully utilize labor and employ labor-saving technology. Some technologies such as machinery might be cheaper for a smaller farm if they used smaller equipment. But, other technologies such as yield monitors, soil sampling, and weather stations have relatively fixed costs, and the more bushels or units of production, the cheaper the cost of technology per unit.

Information technologies, including marketing, would be relatively fixed in price; the more units of production, the lower the cost per unit. Some smaller farms will find it uneconomical to employ these technologies relative to their larger counterparts.

There are disadvantages to increasing farm size as well. One of the major drawbacks is the changing nature of farming as the farm size grows. As a farm gets larger, the composition and complexity of the farming operation are altered. The farmer changes from being someone actively involved with the agronomic/animal husbandry aspects of farming to being one who is a personnel and office manager. Whether or not this is a good move depends on the goals of the individual farmer.

The United States is no longer seeing an increase in farmland and instead is actually seeing a decrease as available land is converted to urban and other uses. This means that if farmers are going to expand the amount of land being farmed, they have to travel greater distances. In Iowa traveling 50 to 100 miles to farm a parcel of land is becoming more common. This transformation in farming styles has at least 3 ramifications.

The farther a farmer has to travel to reach land being farmed, the greater the cost. Equipment has to be hauled adding transportation costs, and extra time is needed to move the equipment from farm to farm.

A drawback to traveling greater distances and increasing the amount of acres farmed in general is the loss of time to pay attention to details. Studies examining the characteristics of high-profit farms relative to low-profit farms show that management is a key factor. Much of this management is in the intangible attention to details. A farmer who is farming many acres will have to be quick about it and cannot take the time to ensure that equipment is functioning at the optimum level.

Another serious drawback to farming more acres or handling more livestock is the inability to fully understand the unique characteristics of each unit of the operation. Different fields have areas that respond differently to inputs. Technology in global positioning and guidance systems can help overcome, this but there are still nuances that can be captured only by personal observation over time. Too often with large acreages, farmers do not have the time to observe the land they are farming.

CONCLUSIONS

Economies of size exist in production agriculture. But, these economies are dissipated much sooner than is realized. Almost every study has found that the average cost curve of most agricultural production is L-shaped. That is, costs decrease over a certain size range, but then they become flat. Increases in size beyond where the curve becomes flat lead to increased income but not increased efficiency. Studies also have shown that the curve may start to increase after certain sizes are reached. These studies suggest a U-shaped average cost curve.

There are many reasons why farms continue to get larger. One is that agriculture has such tight margins and farmers must increase the volume of production if they are to produce an adequate income. In many cases the farmer has stepped onto the technology treadmill. They get bigger equipment so they can farm more acres. As they farm more acres they have to adopt techniques that increase their costs but also lower their profit margins. As the farmers' profit margins tighten they need to have more acres to generate an adequate income. With more acres they need bigger equipment so they can farm more acres. And so it goes.

Farming, like most other industries, has substituted capital for labor. The capital can buy technology that makes life and the job easier but the technology comes with a price. The substitution of capital for labor has led to many changes in agricultural production. Unfortunately, today we are seeing situations where the capital is substituting for management. The farmer's comment that herbicide-resistant soybeans

offered him weed management that "any idiot could do" is a perfect example.

This does not imply that farmers do not use management. They must continually evaluate and manage, but what they manage now are chemicals and methods to overcome natural systems. They do not use management that helps them ". . . work with the biological assets of their farms using less capital-intensive assets." (p. 31)[6]

The technology being developed today is technology that favors larger farms. It either has a high fixed cost and/or technology that enables one person to cover more acres. Such technology is furthering the goals of the Eisenhower Commission discussed earlier.

The technology we have developed has led to the cheapest out-of-pocket food supply in the world. In the United States today we spend less of our disposable income on food (9.8% in 2007) than anywhere else in the world. The farmers' share of the food dollar has actually been declining, and in 2006 of the farmer received just 19 cents of every $1 spent on food in the United States.[11]

Technological advances have led to the lower portion of disposable income being spent on food and to the farmer receiving a lower share of the food dollar. But, it is important to recognize that increases in disposable income also have contributed to these trends. Food has a low-income elasticity; in other words, after basic food needs are met, increases in income will lead to lower amounts of income being spent on food. This concept is known as Engle's law, which states that with constant tastes and preferences as the level of income rises, the proportion of income spent on food decreases. This concept, named after the statistician Ernst Engle, does not imply that expenditure on food will not change but that the proportion of income spent on food will decrease.

In spite of the increases in income, technology and the move toward greater economies of size have led to many unintended consequences. These consequences have not been factored into the estimate of costs of our food.

Outcomes of larger farms capturing current economies of size include questions about the stability of the food supply and potential monopolization of food production. Based on the 2007 Census, farms with sales over $500,000 accounted for 5% of the farms and 74% of all agricultural sales. This means that just 116,286 farms accounted for almost three fourths of all the value of sales of agricultural products in the country. The changing structure of agriculture can lead to a breakdown in competition and maybe even monopolization of food production. Hallam noted that "An industry with numerous producers may be more likely to supply food in both good and bad economic times." (p. 41)[1] He went on to note that this could be due to profits elsewhere, bad management, labor unrest, attempts to manipulate the market, weather problems in concentrated areas, etc.

Food safety is another concern that arises from large-scale production and distribution. The recent cases of salmonella in tomatoes, sprouts,

peppers, meat, and peanut butter are examples of what can occur. It can be argued that larger farms are better able to afford the technology necessary to prevent such food contamination. This harkens back to the ability to spread fixed costs over more output, thus lowering average costs of production. There are arguments that can be made about food contamination episodes, but one thing is clear: large-scale production can have large-scale impacts when problems do occur. Illnesses and the costs of massive recalls are not likely to be factored into most discussions of the advantages of larger farms and agricultural operations.

Environmental impacts are another factor not clearly accounted for in the discussion regarding economies of scale. It is interesting that some of the production technologies producing lower soil erosion also promote more chemical usage and produce labor savings which leads to economies of size. No-till and strip-till are examples of such conservation-friendly production technologies.

Most of the existing environmental regulations tend to favor large-scale operations. Monitoring requirements, fencing regulations, and other regulations generally have a large component of their costs as fixed costs. This means that the larger-scale operations will have more units of output over which to spread the costs, thus lowering the average costs of production.

Rural communities/life, intrinsic rural values, and socioeconomic welfare are all being affected by the changing structure of agriculture. Larger farm sizes spurred by economies of scale have had a significant impact on rural America as witnessed by the formation of the Small Farms Commission.

Economies of size exist in production agriculture for a variety of reasons and have far-reaching consequences for food production and rural America's future. Whether the economies of size would exist to the same extent if we accounted for all costs is debatable. Research that favors large-scale farming and reducing the amount of labor needed has led to many of the economies of size. Such research has produced cheap bulk commodities and cheap food for consumers. What would happen if we made better use of the biological nature of production agriculture, researched technologies that favored small-scale production, and accounted for all costs is unknown. One thing is certain: the current path with its emphasis on economies of size has produced many undesirable consequences.

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