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THE CHANGING STRUCTURE OF AGRICULTURAL PRODUCTION

*D. I. Padberg and H. L. Goodwin
Texas A & M University*

The structure of American farms is changing. We see evidence of fundamental change. We who relate to and serve farmers need to understand the why, how much, and how soon questions about this change. We must change also. We may need lead time to redesign our products and services to fit the agriculture of the future.

The intent of this paper is to define emerging segments in the farm structure. We will attempt to identify what we are trending from and to as well as the driving internal and external forces. We will use the geological forces that shape land masses as an analog. Any tentative answers will be applied to the task of defining and describing market segments in the future agricultural services market.

The Farm Credit Study

In a strategic planning activity the Farm Credit System commissioned a number of farm structure studies. The specialists doing various parts of this study were asked to depict changes likely to occur by 1995 and the probable structure of farms at that time. Table 1 summarizes results of the Farm Credit analysis.

It is not at all easy to interpret these findings. We have difficulty defining a farm at a point in time and definitions blur considerably over a 15-year period. Where size is measured in dollars, uncertainty about inflation across 15 years increases the hazard. Data availability requires size categories one might not otherwise prefer. Formal (or informal) forecasting techniques apply parameters from experience to expected future conditions. When future conditions are much different from the experience base, forecasting is inevitably precarious, etc.

Chase Econometrics developed the central forecasts. Regional and financial breakouts were obtained through use of a forecasting model developed by the United States Department of Agriculture (USDA). Following are some conclusions and observations. It is quite possible that very different conclusions could be defended equally well.

1. These data do not relate well to the "bimodal agriculture" concept. The size categories do not fit it. The \$100,000 sales limit converts

TABLE 1
FARM SIZE AND ASSET STRUCTURE, U.S., 1980-1995

	All Farms		Sales Size				Less than \$100,000
	1980	1995	1980	1995	1980	1995	
Farm Numbers	2.4m	2.1m	24,035	127,114	262,654	628,499	2,141,141
Percent	100	100	1	6	11	30	88
Farm assets (000,000)	1,005,513	2,260,960	100,268	291,689	336,364	953,572	568,881
Percent	100	100	10.0	12.9	33.5	42.2	56.5
Average Asset Size (000)	414.2	1080.1	4171.7	2294.7	1280.6	1517.2	265.7
Real estate as % of assets	75.2	72.9	70.4	66.6	75.9	74.1	75.6

Source: [2]

to about a 300- to 400-acre grain farm. We know from other data that the growth part of the small farm distribution is about 50 acres or less.¹ If this small end is growing in numbers, then there must be massive attrition in the top part of this range to get the reduction observed across the whole category. This small category is expected to lose 803,000 farms. If we gain 200,000 in hobby farms (50 acres or less), that would mean the loss of a million of those “middle sized” (50 to 400 acres) farms. From the 1980 count of about 2.4 million farms, that is a big loss.

2. While these categories are poorly chosen for illuminating change in the small end (where 88 percent of present farms are located), they give interesting detail concerning the large end of the structure. The \$500,000 annual sales would relate to a grain farm of 1,500 to 2,000 acres. While several farms grew across this line, the average asset size of these large farms declined by roughly one-half. Assets in these largest farms rose from 10 percent of all agricultural assets to about 12.9 percent. Clearly, all of this increase was happening on the small end of the size range. This doesn't suggest any runaway influence of scale economies, pecuniary advantages, or anything else.

3. The middle range — from \$100,000 to \$500,000 in sales — had substantial growth, going from 11 percent of all farms in 1980 to 30 percent in 1995. They increased from 33.5 percent of agricultural assets to 42.2 percent. Since those farms in the category below were dying like flies and farms in the larger category were growing, it is fair to assume growth was skewed toward the large end of this range.

4. Real estate as a percent of total assets declined — most among the largest farms.

We have all seen these trends in farm numbers by general size brackets. Some observers see a new pattern of change (increasing numbers and different types of small farms). Others believe it is a continuation of trends observed over the past century. However you may characterize these trends, some fundamental questions remain: 1) To what are we trending? 2) What internal and external influences drive these changes? 3) How far and how fast will these forces take us in the future?

From Earth's Crust to Farmland

The interplay of forces within the earth results in the earth's crust being thrust up in various places. These forces persist for very long periods. The rising material (like the Rocky Mountains or the Ozark Plateau) is mostly rocks and doesn't support much commercial agri-

¹U.S. *Census of Agriculture* data indicate that the number of farms 10 to 49 acres in size increased 58,000 from 1978 to 1982, while farms of 50 to 499 acres decreased by 103,000 over the same period.

culture. After being eroded, sorted, moved, and rearranged into plains and deltas, it may support intensive cropping systems.

This system has a starting state in the rising earth. The transition is a process of erosion by water and wind. This process decomposes the initial material, sorts it into groupings, transports it, and builds new structures such as plains and deltas. These new structures are the final state. The process is affected by some environmental influences. Temperature regulates the speed of some of its processes. The level of precipitation also regulates the nature and speed of the transition. For the most part, the transition in this system proceeds slowly and steadily over the millennia. Surges in the movement of wind and water produce special effects. A 100-year flood may choose a whole new pattern of flood plains and deltas.

There are many variations on this basic process. Vegetation intervenes to slow erosion. Soft aggregates thrust up by glaciers erode quickly. Large particles stay close to the upthrust while smaller particles are carried further away. With all these variations, results can and usually do show a great variation. But we don't let that stand in the way of understanding the basic system and the processes within it.

From Subsistence Farms to Commercial Production

What is the basic system in the changing farm structure? What is the starting state, the ending state, and the transition mechanics? We define the starting state as the subsistence farm. The family farm the Homestead Act meant to create is a good identification of this concept. Perhaps the supporters of the Homestead Act didn't expect any transition at all. But we have had a transition to commercial production. The unit of commercial production is an operating unit. Its nature and size relate more to technology than land ownership evidenced by the fact that one farm operator can now produce food for 78 people. The transition is brought about by market and managerial forces. These processes are conditioned by technology and the rate and level of non-agricultural economic activity. Periods of agricultural prosperity and depression cause surges that temper or accelerate the transition processes.

It will be useful to establish a much better definition of the beginning and ending states, barriers that inhibit transition, transition processes, and environmental influences. Consider the starting state — the subsistence farm. This unit produces family consumer values but little money. It is most important that it be owned because it has difficulty with debt service. The many small enterprises are selected for the resulting consumption values much more than any concept of production efficiency. Selling some surplus output from these consumption-selected enterprises should not be confused with commercial production.

Commercial production describes the case in which an enterprise is selected because the market price is expected to more than cover fixed and variable costs in most years. Many land parcels have supported subsistence families for several generations while never meeting the test of “commercial production.” The occasional surplus of consumer goods sold to provide the small cash needs (taxes, tools, etc.) were subsidized from other enterprises. It should be remembered that market price to the farmer is usually much lower than the value of the same goods in family consumption. This may be especially true where primitive markets and poor transportation opportunities prevail.

The emergence of commercial production would be expected to first occur on the most fertile land. Nonagricultural economic growth that bids up market price would also be an important stimulus as would improvements in transportation. Early arrangements would probably have involved one or more commercial production enterprises among the many other activities in a subsistence farm. In times of brisk non-agricultural growth (and good farm prices), farms — especially those in the best soil types — would make the transition to commercial production in many enterprises. Soon the primary managerial strategy may revolve around considerations within commercial production.

But there may also be cultural and risk preferences that slow this transition. We have had generations of Midwest family farms, with one or two commercial cash grain enterprises and some market hogs, alongside a host of subsistence activities from bees and chickens to garden and orchard. Market hogs have been described as the “mortgage lifter” on otherwise subsistence farms. The more commercial unit can finance expansion, but it takes on a greater risk of failure than many farmers have preferred. Much of the farm management education has related to understanding and exploiting the growth potential of commercial production — and it has invited some farms into the current financial danger.

While this discussion accommodates a lot of what we have seen, it stops well short of defining what we are ultimately trending toward. What are the imperatives of the purely “commercial production” unit or farm? How much land, if any, must it have? What will determine its size in an operations sense? Are there special tendencies for multi-product conglomeration? While events to date don’t give final answers to these questions, we surely can find strong hints.

Some production activities formerly clearly classified as farm enterprises will become completely separated from the land or the “farm” business. Poultry and beef feedlots have completed this transition. They are more industrial operations than traditional farm operations. Confinement hogs and the Southwest dairy operations show some tendency to follow a similar path. There is a well established pattern in the grain belt for cash grain farmers to own machinery but little land. We see more orchards and citrus groves owned by absentee land-

lords and operated by local “grove care” specialists. For example, absentee ownership of groves in the Texas citrus industry increased from 38 percent in 1970 to more than 45 percent in 1983 [10]. While this separation of ownership and management doesn’t cover all regions or all enterprises, it is clearly an important trend.

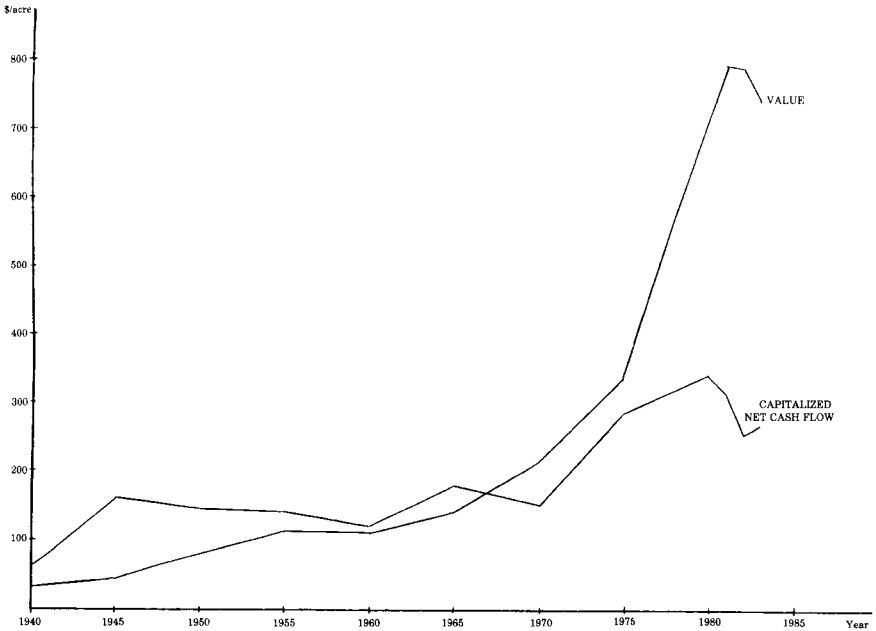
The nonagricultural economy has a conditioning effect on the transition from subsistence to commercial production. The value of farmland has always had several components, including a real estate or “space” value and an agricultural productivity value. In addition to the speculative and productive components, there is a consumptive demand component of rural land values [8]. It is widely acknowledged that land has associated with it elements of tradition, social values and beliefs, and intrinsic goodness. Those acclimated by education or environment to farming as a way of life are likely to be quite competitive in obtaining a farm title [5, 9, 3].

With the nonagricultural economy growing much faster than the agricultural economy throughout this century, the nonproductive components of land values have risen faster than the value of agricultural productivity. Between 1970 and 1980 the per acre value of farm real estate in the United States grew by 245 percent, while inflation, as measured by the GNP implicit price deflator, was 195 percent [11]. It is not surprising that rural land was perceived to be a sound investment and a good hedge for inflation. From 1981 to 1984, however, land values have declined by more than 7 percent, due largely to lower interest rates and to a lesser degree by relatively lower agricultural profitability [8]. Since that time, agricultural land values have continued in sharp decline.

Agricultural technology has also substituted for land, having a similar effect. In many regions, land suitable for subsistence farms was not competitive for commercial production. For all of these reasons the agricultural productivity component of land value has gotten small relative to other components. Much debate has occurred over the appropriate fashion in which to measure this productive value or, more graphically, the value of land based on agricultural productivity and capital gains [7, 1, 6]. One can quite easily be “caught up” in the complexities of the varying approaches, seeking specific explanatory factors in land value, and fail to grasp the broader, more pertinent issue as it relates to land value and productivity and their impact on farm structure.

Utilizing the admittedly basic but sound technique of capitalized net cash flow, information presented in Figure 1 lends fascinating support to the hypothesis that we are in a fundamental change in agriculture. Actual farm real estate values per acre are compared with per acre net cash flows for five-year intervals over the period 1940–1983, which were capitalized using the weighted Federal Land Bank new loan rate for loans of 25 years duration [12]. Expressed in current

FIGURE 1
 NOMINAL VALUE OF LAND AND BUILDINGS AND CAPITALIZED NET CASH FLOWS,
 PER ACRE, 1940-1983



dollars, from 1940 to sometime in the late 1960s, capitalized net cash flows exceed the value of farmland by as much as 250 percent. Farmland intended for productive purposes was a good buy prior to about 1970. From that time to 1983, per acre capitalized net cash flows have comprised an increasingly smaller percentage of land value. No longer, it appears, can one support the purchase of farmland based upon cash flow from productive enterprises. As Castle and Hoch appropriately state, "Recent increases in agricultural real estate prices cannot be explained on the basis of earnings in agricultural production alone" [1]. We feel these data support the observation that a fundamental change has occurred in the appropriateness of farmers owning farmland.

This condition has a profound effect on the transition of farms from subsistence to commercial production. Consider the case of a recently sold, 300-acre farm in the corn belt. It has supported four to five generations of "family farmers." The current owner is 65 years old. He bought the land from the sibling heirs for \$150 per acre in 1945. The mortgage was paid off in 1960. By 1970 this farm unit was obsolete. It was worth more to others than to the owner. Any time after 1970, if it were offered in the market, it would bring more than a 300-acre

farmer could afford to pay for it. Its destiny included several alternatives, but continuing as a 300-acre farm was not among them. It could have gone into nonagricultural development or into another larger farming unit. The highest price was obtained by selling the best 120 to a nearby farmer and the remaining 180 with the farmstead to a professional family. They kept 60 acres and sold two 60-acre tracts to other professional people who wanted to live in the country. Most of the subdivided 180 acres stayed in production and was rented to local operators.

This farm might have continued as a middle sized farm if real estate values had not pushed up so high. Operating agriculture in the midst of a vigorous nonagricultural economy has severe consequences for agriculture. Where farmers compete with industrial buyers for land, water, or labor, they usually come off second best, residual claimants of resources. This is especially true where agricultural technology provides for food in abundance.

What Are We Trending To?

What kind of production unit will do the commercial production? As we put these pieces together, we feel there will be at least two major market segments. One will be the *commercial producer*. This would include the cash grain producer, the hog confinement operator, the beef feedlot or grove care operator. They will be large enough to use complementary machinery or animal confinement packages. They may have a half dozen workers in busy seasons.

The other major segment will be "*hobby*" farmers. Many of these will be small and involve land owned by a professional person or one who wishes to maintain or regain contact with a rural lifestyle. These farmers are concerned with the increasing availability of amenities and services in rural areas that provide the comforts of city living with the privacy and romance of rural living [4, 8]. Cow-calf farms fit this very well. With custom work, some cash grain or cotton can be produced on these units. They will also rent land to commercial operators.

In addition two other segments will be present, but likely less important. The *mega farm* may have some economic justification or explanation in some regions and some enterprises. These are large (thousands of crop acres, dozens of workers, etc). They usually involve land ownership and are an historical accident. They have more to do with inheritance, minerals, and real estate considerations than with farm operations. We will develop few new ones and some existent ones will be dispersed.

The last major segment is the *traditional family farm*. The 300-acre farm discussed above continued 15 years after it was obsolete. If that family could deal with the sibling division problem and "keep it in the family," it could continue many more years. While these are under

pressure from the forces we have described, they are strong and durable units especially if debt free. Since there are so many of them now, they will be around for many years.

It is interesting to compare and contrast the two smaller types and the two larger types of farms. Both the hobby farm and the traditional family farm are small. Owning the land is important to both. Farming operations are less important. They have vastly different cultural orientations. The hobby farmer is more highly educated and generally more liberal. The family farmer sees his life in a more restricted, narrower pattern relating to the land and local events. The family farmer is a better co-op member than the hobby farmer. The family farmer has quite a noneconomic motivation to "keep the land in the family" which is not at all shared by the hobby farmer. Both, however, seem to have the craving for ownership of land independent of its yield, as noted by Keynes [5].

The commercial farmer is operations oriented. He is a manager. The commercial farmer is less driven by or distracted by land ownership or financing. He is a farm operations specialist. The land is frequently priced far beyond its value in farm operations. Technology has provided many opportunities for separating ownership and management. He can leverage his managerial skill much further by managing land for others. His size is determined by such considerations as technical economies of scale, diversification for risk management, and pecuniary advantages. His income will have less variability than landowners. The commercial farm is a growing segment.

The mega farmer got large for whatever reasons (more likely inheritance than operations). Even though the mega farmer may have managerial and operations experience and interests, he is driven by the nonfarm dimensions of his portfolio — including farm real estate. Even if the mega farm chooses to focus on farm operations and management, the much larger nonfarm economic pressures soon reorient his attention to the more important opportunities and vulnerabilities. While the commercial farmer is large by choice, the mega farm is large by accident.

There is a continuing ambiguity involving the mega farm and the traditional farm. Farm operation is secondary to both, but neither can it be ignored. The mega farm has trouble dividing attention between farm and nonfarm interests while the family farm is torn between economic and noneconomic motivations.

There is much more clarity of purpose in both the hobby farm and the commercial farm. The hobby farmer wants to be a modern country gentleman and he has the means to do it, either through accumulated wealth or sizeable nonfarm income. The commercial farmer by definition is driven by economic motivations. He is an industrial component in the production of agricultural commodities. He gets into and out of enterprises as he sees prospect of a profit. He is not very ro-

mantic. Family tradition is not an element in business decisions. *While the transition may stretch out a long time, some division between hobby farms and commercial farmers will be the eventual farm structure.*

Transition Mechanics

While it is useful to identify the four structural types of farms, the actual transition may frequently involve mixtures. A very large hobby farm is a mega farm. A traditional farmer may become highly skilled in operations and evolve into operations on much rented or leased land and hence be a commercial farmer. Or, as in the illustration, a traditional farm may become one or more hobby farms. Very successful commercial farmers have become mega farms.

While we think most of the very large number of traditional farms are obsolete, they will persist well into the future. If they can stay debt free, it doesn't matter what the real estate value is. Clearly the current agricultural depression is hard on these units. They are especially vulnerable if they have much debt. They need to leave the industry faster than there are hobby farm buyers. This depresses land values. In more normal times hobby farm buyers and mega farms will be prepared to buy land as fast as traditional farms are ready to leave. When traditional farms come to a generation transition, few will continue as traditional farms. They will go to hobby farms, many of which will be owned in absentia by heirs and rented to commercial farmers. Some will be bought by mega farms. While consolidation of land into larger holdings was the major event in the past, we expect less of this to happen in the future.

Regional Differences

The scenario presented here proceeds at quite a different pace in "coastal" regions as compared to the "heartland." Nonagricultural growth has been faster in several coastal areas than in much of the hinterland. Because of this, rates of transition are higher — pushed by more industrial competition for basic resources. What is the long-run prospect in the hinterland? Is it immune to nonagricultural economic growth? Will the discussed transition be inapplicable to these regions?

North America has been "opened" to participation in the world economy only a couple of centuries — a short time in terms of western civilization. Agriculture initially occurred in a vacuum of nonagricultural activity. Clearly, this is an accident of history. With population growth burgeoning around the world, that blissful undistracted agricultural scene cannot be maintained. The nonagricultural economy has steadily grown faster than the agricultural economy in most places, including the hinterland.

Technology substitutes for land in agricultural production and stim-

ulates nonagricultural growth. The inevitable result of these trends is a flow of resources from agriculture to other sectors. In this setting, the model of transition discussed above seems relevant to all regions, although at differing rates. In the analogy, erosion occurs slower in some regions than others but is no less a valid explanation of the transition.

Reconciliation

There are a few ways in which the hypothetical transition looks different from the Farm Credit extrapolation. Perhaps the most apparent one is the commercial farmer in the model who is less driven to own land than most live ones we have seen. The Farm Credit data show only a modest tendency for real estate to get smaller in the asset structure. The reasons we feel that the future may be different from the past are as follows:

1. Our experience base (especially the 1970s) is taken from times with low to negative real interest rates. This will not likely be a frequent aspect of the future.
2. Growth in the nonagricultural economy puts upward pressure on land prices and makes owning agricultural land by farm operators far less appealing or appropriate than in previous years.
3. Financing land will increase variability of commercial producers' income stream.
4. Other western economies have quite a separation of ownership and management in farming.

Conclusions

We come to the following observations and conclusions on the evolving farm structure:

1. We will lose perhaps a million small family farms which just can't make it without some income from asset appreciation or sizeable off-farm income.
2. The eventual farm structure will include a little bit of everything, but will have two dominant segments: the hobby farmer and the commercial farmer.
3. The commercial producer will be of a size that comfortably accommodates equipment and technology. There seem to be no great advantages in very large size.

Market segments include the traditional farmer (who is largest in present numbers and, even though declining, will be around for a long time) plus the two new segments, hobby farms and commercial producers. The new segments will have more education and more sophisticated tastes in the marketplace.

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