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THE FUTURE OF THE MISSOURI LIVESTOCK INDUSTRY

**Report of Seminar
College of Agriculture
and Extension Division
University of Missouri-Columbia
November 13-14, 1986**

**Special Report 349
Agricultural Experiment Station
University of Missouri-Columbia**

THE FUTURE OF THE MISSOURI LIVESTOCK INDUSTRY

For the first time in its 14 years the Harold F. Breimyer Agricultural Policy Seminar for 1986 dealt with issues in the economics of Missouri's livestock and poultry industry. Livestock and poultry remain highly important nationally and in Missouri, contributing half or more of all agricultural cash receipts from sales, yet have been in the comparative shadows the last decade or so. Crops, and especially their exports, have received most attention.

Various livestock enterprises have experienced difficulties in recent years. In Missouri some enterprises, particularly cattle feeding, have retrenched and moved to other states.

One negative factor that was explored at the seminar is the decline in demand for red meat. Speakers also reviewed the location of livestock and poultry production, and the organizational structure of the sector. An animal scientist gave insights into explorations into biotechnology.

The 1987 seminar is scheduled for November 12-13. A topic has not been chosen. The annual seminar is funded from the Breimyer Seminar Fund, a part of the UMC Development Fund.

-- Robert Bevins

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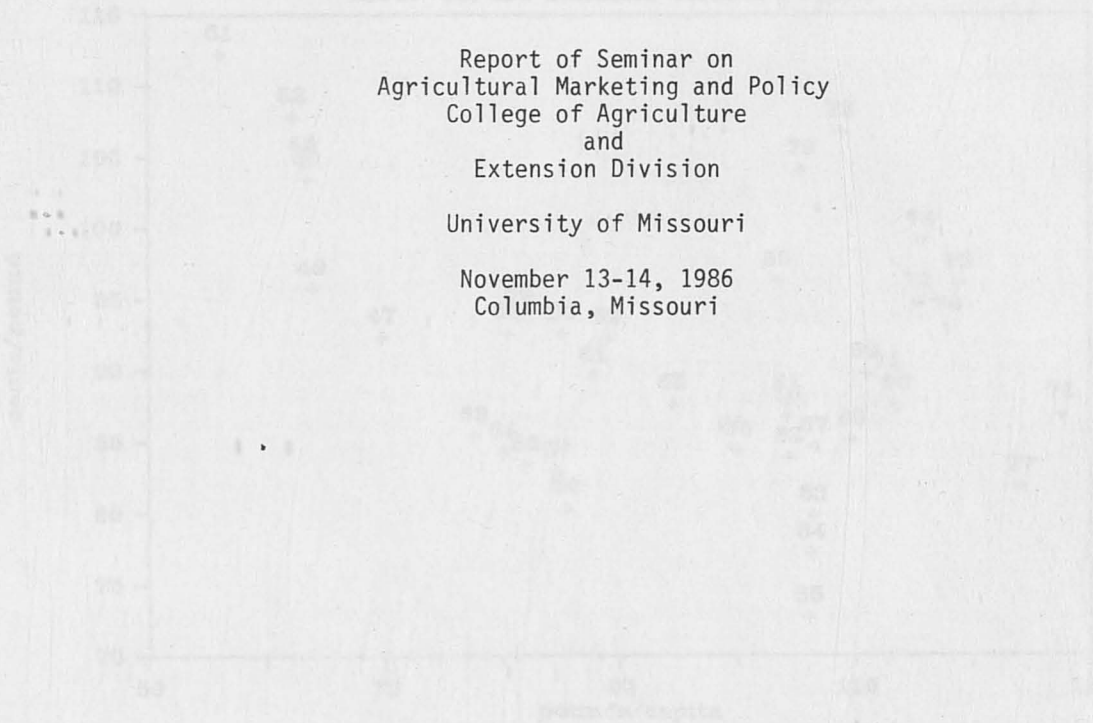
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THE FUTURE OF THE MISSOURI LIVESTOCK INDUSTRY

Beef Price/Quantity Combinations

Report of Seminar on
Agricultural Marketing and Policy
College of Agriculture
and
Extension Division
University of Missouri
November 13-14, 1986
Columbia, Missouri



THE CHANGING CONSUMER AND IMPLICATIONS
FOR THE LIVESTOCK SECTOR

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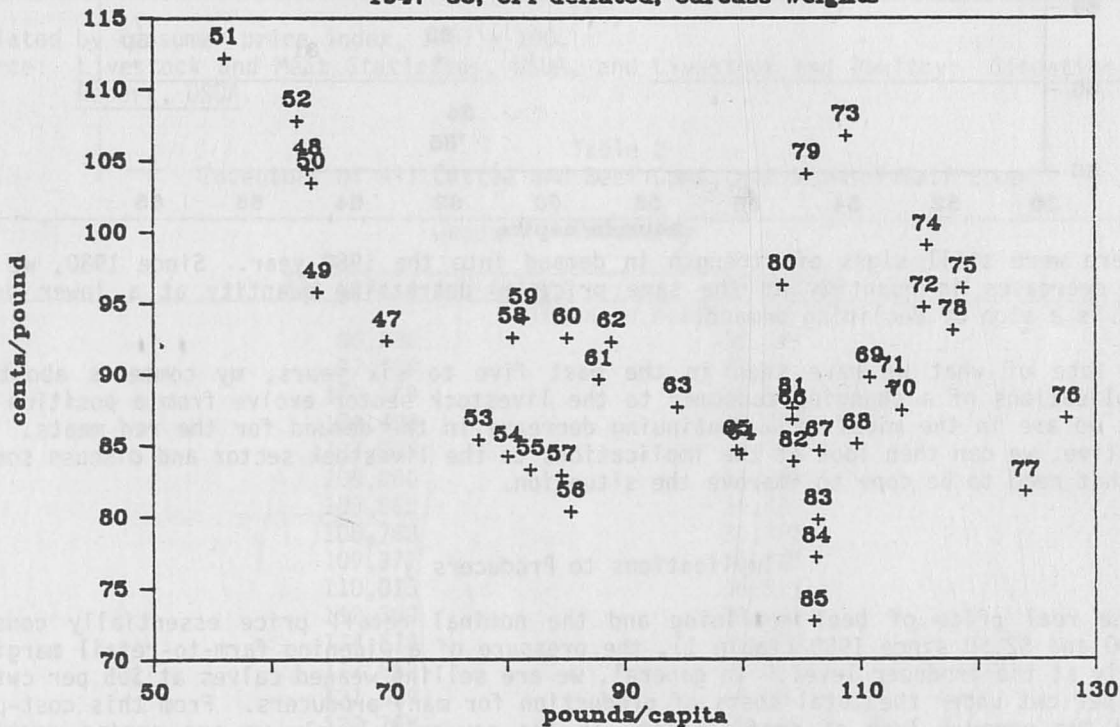
Introduction

The livestock industry is going through a transition. A major part of the forced adjustment is in response to significant decreases in the demand for beef and pork. The decreases in demand are rooted in a change in the basic preference pattern of consumers. Surveys reveal that a significant percentage of consumers have concerns about fat and cholesterol in their diet and there have been countless "official" guidelines that encourage the consumption of high-fiber and low-fat foods such as fruits and vegetables.

While there is some difference of opinion as to when the shift in the demand function occurred, study of the beef price/quantity chart suggests that there can be little doubt that something significant has developed (see chart). Since 1979, almost a 30 percent decrease in the inflation-adjusted price of Choice beef at retail has been required to move an essentially constant per capita supply of beef into consumption.

Beef Price/Quantity Combinations

1947-85, CPI deflated, Carcass weights



Note the tendency to move up and to the right that prevailed in the 1960s and into the 1970s, a sure sign of increasing demand. Since 1979 prices have fallen dramatically with essentially constant per capita supplies, a sign of decreasing demand.

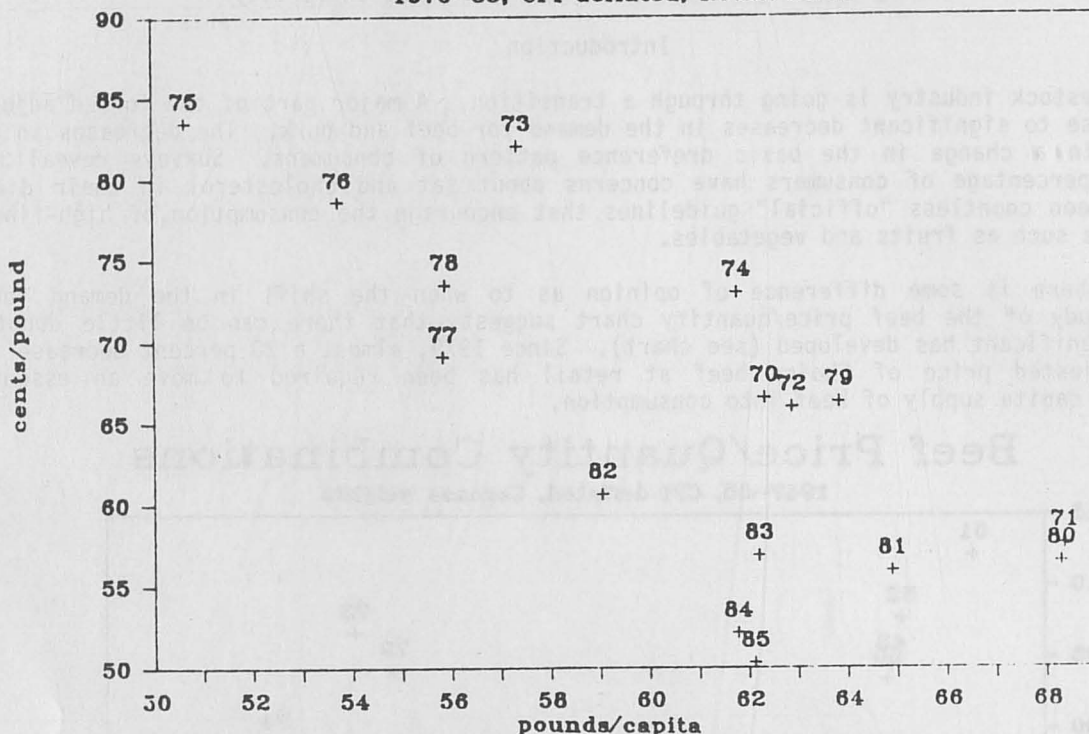
In a conceptual context, we are seeing a shifting demand curve trace out an inelastic (vertical) per capita supply function. Without quibbling over the measurement problems associated with the move to fast food consumption and with the retail beef price series, I adopt the posture that the shifts are so dramatic that we have seen a decrease in the demand for beef.

In recent years, the real price of beef has been declining while the real price of poultry has been relatively stable. Consequently, the decrease in demand for beef cannot be attributed solely to changing price relationships. If we add recognition that real incomes at the consumer level have increased in recent years, it is impossible to escape the conclusion that the fabric of demand for the red meats has been weakened by changing consumer preferences.

The second chart indicates that, in recent years, even a generally declining per capita supply of pork has been moved into consumption only at lower real prices. It appears that both the primary red meats have been hit with the same type of problem on the demand side.

Pork Price/Quantity Combinations

1970-85, CPI deflated, Retail Basis



In pork, there were still signs of strength in demand into the 1980 year. Since 1980, we have seen either decreases in quantity at the same price or decreasing quantity at a lower price. Either event is a sign of declining demand.

In the face of what we have seen in the past five to six years, my comments about the economic implications of a changing consumer to the livestock sector evolve from a position that accepts that we are in the midst of a continuing decrease in the demand for the red meats. From that perspective, we can then look at the implications to the livestock sector and discuss some of the things that need to be done to improve the situation.

Implications to Producers

With the real price of beef declining and the nominal retail price essentially constant between \$2.30 and \$2.50 since 1980 (table 1), the pressure of a widening farm-to-retail margin is felt primarily at the producer level. In general, we are selling weaned calves at \$65 per cwt and that is \$20 per cwt under the total costs of production for many producers. From this cost-price pressure and the general lack of profitability at the cow-calf level, we are seeing continued liquidation of the cattle herd. Table 2 reveals that we are more than 25 million head below the peak of 132 million in 1975, and most analysts expect a number only slightly above 100 million on January 1, 1987.

Per capita consumption has been constant in recent years because per capita production has been constant. In turn, per capita production has not expanded because it has not been profitable to expand the basic cow herd. The result has been the widely discussed loss of market share as poultry has replaced beef and pork in the diet. The red meats are losing market share because per capita production is constant or declining. Per capita production is down because the cow-calf business and, to a lesser extent, the brood sow business, are not profitable. All of these results flow from the fact that we cannot move the product we have into consumption at prices sufficient to cover all the costs of production. In the near term, I expect this pattern to continue. As we look out toward the 1990s, it will be this weakness in demand that will be the driving force behind changes we will see in the livestock sector.

Table 1
Per Capita Beef Consumption and Price of Choice Beef at Retail, Actual and Deflated

Year	Consumption per capita (retail weight) (lb.)	Retail price per pound	
		Actual	Deflated ¹ (cents)
1970	84.01	101.7	87.90
1971	83.38	108.1	89.04
1972	85.44	118.7	93.83
1973	80.54	142.1	106.28
1974	85.60	146.3	100.62
1975	87.89	154.8	97.48
1976	94.36	148.2	88.69
1977	91.76	148.4	83.89
1978	87.24	181.9	95.84
1979	78.05	226.3	109.91
1980	76.50	237.6	105.93
1981	77.13	238.7	96.72
1982	77.17	242.5	92.38
1983	78.72	238.1	87.35
1984	78.58	239.6	84.72
1985	79.10	233.8	80.03

¹Deflated by consumer price index, 1967 = 100.

Source: Livestock and Meat Statistics, USDA, and Livestock and Poultry: Situation and Outlook Report, USDA.

Table 2
Inventory of All Cattle and Beef Cows, and Size of Calf Crop

Year	January 1 inventory		Annual calf crop
	All cattle and calves	Beef cows	
	Thousand head		
1960	96,236	26,344	39,419
1961	97,700	27,327	40,180
1962	100,369	28,691	41,441
1963	104,488	30,589	42,268
1964	107,903	32,794	43,809
1965	109,000	34,238	43,922
1966	108,862	34,442	43,537
1967	108,783	34,708	43,803
1968	109,371	35,565	44,315
1969	110,015	36,511	45,177
1970	112,369	36,689	45,871
1971	114,578	37,878	46,738
1972	117,862	38,810	47,682
1973	121,539	40,932	49,194
1974	127,788	43,182	50,873
1975	132,028	45,712	50,183
1976	127,980	43,901	47,384
1977	122,810	41,443	45,931
1978	116,375	38,738	43,818
1979	110,864	37,062	42,603
1980	111,192	37,086	44,988
1981	114,321	38,726	44,776
1982	115,604	39,319	44,420
1983	115,199	37,940	43,925
1984	113,700	37,494	43,500
1985	109,749	35,370	41,045
1986	105,468	33,362	NA

Source: Livestock and Meat Statistics, USDA and Cattle, USDA.

The continuing liquidation will be turned back to herd building sometime in the next few years, possibly around the end of the decade. When the turn to herd building occurs, it will be from a herd size smaller than any we have seen since the 1950s (table 2). To turn the herd from a 3-5 percent annual rate of liquidation to a 2-4 percent annual rate of building will exert a significant influence on the quantity of beef available for consumption as heifers are held back from the feedlot and put into the breeding herd. In 1984 and 1985, when the liquidation was continuing, we slaughtered about 33 percent of our January 1 inventory. In the early to mid-1970s (excluding 1973, the year of the price ceilings), when the herd was being built at an annual rate of 2-4 percent, we were slaughtering 29 to 30 percent of the January 1 inventory. A return to herd building from a herd size of 90 million head will mean an annual slaughter of 26.5 million if we slaughter 29.5 percent of the January 1 inventory. A slaughter of 26.5 million stands in stark contrast to the 36.3 million head slaughtered in all commercial slaughter in 1985. With population still growing, this could mean a reduction in per capita supply in excess of 25 percent when 1985 is compared with the anticipated 1990 scenario. Such a reduction in per capita supply will mean a sharp increase in price at retail, and that would be a major problem for the red meat sector.

That is, if demand is still declining or weak when the retail prices are pushed higher, we could see another major series of problems in terms of market share for beef. The consumer will walk away from higher priced beef unless attitudes are changed or the product is altered to fit the emerging set of consumer preferences.

In pork, the breeding herd has shown little ability to sustain an increase in recent years, but there have been significant increases in the production of pork for a given herd size. Increased levels of carcass cutability and increases in litter sizes have pushed the production of pork up and offset some of the decreases in the breeding herd. Even so, the pattern of losing market share to poultry and to other competing foods is very evident in pork. The pork chart shows the tendency toward lower real prices for a smaller per capita supply, and that is the worst possible scenario. Table 3 records pertinent information on the pork sector. Since 1979, the real price of pork has suffered the same dramatic decrease we have seen in beef, and the price decline has come in spite of slightly lower per capita supplies. Like beef prices, pork prices in nominal terms have been constant to lower, and that means the pressure of any increase in the farm-to-retail price spreads is felt primarily at the producer level. The evidence in support of significant decreases in demand is very strong.

In the short run, then, the demand problems coming from a changing consumer preference means pressure on retail prices, and that type of pressure will inevitably be passed back down through the system to the producer. Historically, agricultural producers have relieved the pressure by adopting new technology and cutting the costs of production. Over time, that means the producer survives and the benefits of the technology get passed on to the consumer in the form of plentiful supplies of product at relatively low prices. But in the 1980s the pressure of changes is too intense, and the cattle and hog producer are being forced out of business. There is not enough technology and it cannot be adopted quickly enough to keep afloat financially the producer who is carrying significant debt.

Longer term, the implications of the current trends in the red meat sector are clear. Both beef and pork face the possibility of still further losses in market share to competing meats and to other food products. Table 4 indicates that broiler producers have been able to increase the per capita availability of broilers in the face of relatively flat real prices (i.e., deflated). A bit of reflection on this and study of the data in table 4 suggest that it is the increased efficiency on the supply side, along with some relatively favorable reaction by consumers (they have taken increased quantities at constant prices), that is helping the poultry sector.

We have to keep working on technology to keep costs of production low, but I do not believe technological advancement on the production side alone can keep the red meats competitive. There must be progress on the demand side, because it is problems on the demand side that are forcing the adjustments. We have to do something to arrest the continuing decrease in demand and try to turn the downward trend around.

Table 3

Per Capita Pork Consumption and Price at Retail, Actual and Deflated

Year	Consumption per capita (Retail weight)	Retail price per pound	
		Actual	Deflated ¹
	(lb.)	(cents)	
1970	62.3	77.4	66.6
1971	68.3	69.8	57.5
1972	62.9	82.7	66.0
1973	57.3	109.2	82.0
1974	61.8	107.8	73.0
1975	50.7	134.6	83.5
1976	53.7	134.0	78.6
1977	55.8	125.4	69.1
1978	55.9	143.6	73.5
1979	63.8	144.1	66.3
1980	68.3	139.4	56.5
1981	65.0	152.4	55.9
1982	59.0	175.4	60.7
1983	62.2	169.8	56.9
1984	62.1	162.0	52.2
1985	62.1	161.9	50.2

¹Deflated by consumer price index, 1967 = 100.

Source: Livestock and Meat Statistics, USDA and Livestock and Poultry: Situation and Outlook Report, USDA.

Table 4

Per Capita Consumption of Broiler Meat and Retail Price of Broilers, Actual and Deflated

Year	Consumption per capita (Retail weight)	Retail price per pound	
		Actual	Deflated
	(lb.)	(cents)	
1970	36.8	41	35
1975	36.7	63	39
1980	47.0	72	29
1981	48.6	74	27
1982	49.7	72	25
1983	50.8	73	24
1984	53.0	81	26
1985	55.5	76	24

Source: MeatFacts, American Meat Institute, 1986 edition; Livestock and Poultry: Outlook and Situation Report, ERS, USDA.

A Plan of Action: The Macro Level

As always, what one sees as a needed plan of action is different depending on whether micro or macro issues are being viewed. There are lots of things individual producers can do to help enhance the profitability of their business, but a broader plan is in order if we are to see the red meat sector recapture part of the lost markets and get some profitability back into the entire sector.

What we need is a concerted plan of action or an industrial strategy that all states "buy into" and push at the national level. As is always the case, the first need is money to support action programs and that means the referendum on the checkoff program has to pass. Without getting too involved in discussion of that program here, I would simply say that financial support is a necessary condition to the programs that will be needed to make some progress on the demand side.

If financing is available, there are several "needs" that must be met as the industry moves forward.

----We must come to grips with the magnitude and complexity of the task before us. The National Livestock and Meat Board, the Beef Industry Council, the National Pork Producers Council, and the state associations must understand what is occurring and recognize there are no quick fixes. There are no easy solutions and the research and analysis that lies ahead of us is complex and difficult. What we do not need are reports like that recently submitted to the American Meat Institute by consultant Paul Prentice. Prentice suggests that per capita consumption of red meats, especially beef, will be sharply higher in the mid-1990s but says nothing to explain how increased per capita production will occur in the face of a lingering herd liquidation and unprofitable operations at the producer level. We eat what we have (production plus imports) and the converse is also true: we cannot eat what we cannot afford to produce. If production continues to be unprofitable because of problems on the demand side, there is no basis on which to suggest increased per capita consumption in the years ahead. To repeat, there are no quick fixes, and it is critically important that all producers and producer groups recognize that. We must have more research on consumers and consumption patterns and why they are changing. All the other things that need to be done have to be built on a base of understanding of the changing consumer and how to get the consumer to buy the product.

-----If we get the improved understanding of the consumer, one additional need stands out. We must have significant progress in product development. In recent years, the consumer has changed in a major way but there have been few changes in the product offered in the supermarket. In an era in which over 50 percent of households have microwaves, we are just now seeing research on pre-cooked beef and pork products that are especially suited to the microwave. Over 50 percent of the households now have two wage earners, and those folks have neither the time nor the inclination to spend several hours planning and cooking the meat entree. For whatever the reasons, the packers have not been aggressive in this area and the retailers have not been overly concerned -- the meat department is only one department to them. A major failing of the producer and trade groups is their not recognizing that, if no other sector was going to work on product development, it was imperative that those groups make sure it gets done. After all, it is product of the producing segment that is not being accepted by the changing and discriminating consumer! We need products designed in recognition of concern over fat and cholesterol, products prepared and packaged with convenience in mind, products available in a variety of packages, and products tailored to the socio-economic profile of the consumer in a particular market area. Although we are trying now to make up for lost time, this area will require a major effort and extensive venture or risk capital. If the problems on the demand side are going to be solved, I believe improvement and progress in product development is a necessary condition to success -- and I believe that at least part of the consuming public will pay for these added services.

-----Related thereto, we need to see a move toward brand-name promotion by the packers and/or the retailers. I believe this will occur if there is something different about the product (product development again) to tie the message to. Lots of literature raises questions about the effectiveness of advertising a generic product, and it would be a mistake in my opinion to rely solely on a promotion campaign for "beef" or for "pork" as a generic product. In this area, I would like to see much more cooperation among the segments of the system. Producer groups need to try to work with the retailer, for example, to help launch a planned program of product development, promotion, and price featuring. It does not help the situation when the producer groups sue the retailers when retail prices are not adjusted quickly enough to suit the producers. If you owned all the stages of economic activity in the production-marketing system, would you not want the various stages to work together?

The list of needs at the macro or aggregative level is more illustrative than exhaustive. Overall, we need better information and better analysis. We need better understanding of the issues at all levels, and especially at the producer level. It is not the case anymore that every

consumer is going to knock down the door to get the steak or pork chop, and the time for a "back of the hand" attitude toward the consumer who "ought to know a good deal when he or she sees one" and just buy the product is long since past. These days, the consumer will give the red meat industry the back of the hand attitude if the product does not fit preference patterns and needs for the late 1980s.

If we assume the checkoff program will survive the referendum, I am not at all sure that the producer group that directs the use of the monies will be willing to focus the attention that is needed on the consumer and on the needed product development. We need something like a "matching fund" program where the industry is willing to match every dollar a private firm or a coalition of private firms (retailers, breakers, etc.) is willing to put into research on product development and analyses and/or surveys dealing with consumer demand. With the advent of retailer scanning, we have a unique opportunity to match product and promotion to the socio-economic profile of the consumer in the particular market area. The program that will work in Colorado Springs will not necessarily work in downtown Pittsburgh. It is late and a lot of time has been lost, but there is much that can be done.

A Plan of Action: The Micro Level

The individual, to put it bluntly, is going to have to act like a manager. The need for effective price risk management strategies has been widely documented, and I will not detail the analyses here. A program of forward pricing at reasonable per head profit levels would have saved the cattle feeder, and the stocker operator, during the major price breaks of 1985 and 1986. The opportunities were there.

A program of forward pricing would have saved the hog producer during the volatile period from late 1979 into 1981. Forward pricing the hogs and pegging corn costs would have saved the tremendous losses during the period of relatively low hog prices and high-priced corn from the summer of 1983 until harvest of 1984. The basis patterns were calling for long hedges to be set in late 1982, long before we knew there would be a PIK program and an accompanying drought. A program of forward pricing is going to be important again this year and into 1987 as we anticipate a cyclical expansion in the face of a \$50 hog market in early November and corn as cheap as \$1.00 per bushel in some areas.

In addition to the use of more effective price risk management strategies, it is going to be important that the producer maintain some flexibility in production and in financing. There are farmers and outside firms taking advantage of the profit opportunities in hogs during 10 weeks of early fall just because they recognized the opportunity and were able to arrange the financing. When corn is \$1.25 per bushel and it can be "walked to market" in the form of cattle and/or hogs at the equivalent of \$3.00 per bushel, it is worth some time and energy to keep an eye on the profit opportunities. This fall, a farmer could have bought feeder pigs, contracted with producers with idle feeding floor capacity, pegged the corn costs, and forward priced the hogs at profits ranging up to \$20 per head. If the farmer and his or her bank is not aware of these opportunities, they are increasingly going to go to the business entity that is accustomed to watching for an opportunity and is willing to take a nice profit margin per head and tie it down.

In more specific terms, then, I see these needs at the micro or individual level.

-----The producer must become familiar with the available price risk management tools and use them when appropriate. The key need is a willingness to forward price when the good profit margin is offered. With options on the futures contracts, there is now a choice of cash forward contracts where the buyer deals in the futures, the futures markets, or the options which set a floor and leave the upside potential open. Increasingly, the producer who insists on being just a cash market speculator is going to go broke.

-----There is a need to move toward a position of being more diversified in what the producer can do and what is being considered. This fall, no investment in facilities has been required to take advantage of the opportunities in hogs. Idle facilities are available. In cattle, it does not require investment in feeding facilities (there is already excess capacity) to maintain ownership of yearling steers or heifers when the cattle can be forward priced out of the feedlot at a nice additional profit. The managers of feedlots around the country will be glad to handle the cattle to help cover their fixed costs and, in some areas, guarantee a market for their feed grains.

-----As at the macro level, we are going to have to see some "teams" developed in the farm community to allow the capable producer to have a chance. There are still situations where the bank does not understand the basic principles of forward pricing and price risk management and is therefore not willing to stay with the producer when margin calls come in. Conversely, we can find situations in which the producer turns into a speculator in futures with the bank's money, and that is equally bad. A little common understanding and a 3-party agreement that involves the commodity broker can help make sure the marketing plan that has been set up is followed. We have to do a better job here, especially since we now have the opportunity to put floor prices in place and leave the upside price potential open using options -- and eliminate the need to manage margin calls.

Concluding Observations

The livestock sector is going to change. Continued weakness in demand for red meats is the moving force, and a changing consumer is behind that weakness. Much of the economic pain of the forced adjustment is going to be passed down to the producer level. If the current liquidation runs too far, as it likely will, we will see another period of volatility around the end of the decade. I am concerned that we are headed for another period that parallels to an extent the 1973 period during which we saw limited availability of beef and high prices -- and consumer unrest. We need to do what can to improve understanding and to keep the liquidation from running to extreme levels.

In the midst of change, there is always opportunity. At the aggregative level, the changing consumer would buy a different product today -- if the "different" beef and pork product were available. If we can develop new products that are consistent with the needs and preferences of a changing consumer, and develop them in a hurry, we can head off some of the displacement at the producer level. All of us need to help make sure the administrators of the checkoff funds understand the importance of finally getting to product development and doing it right.

At the individual level, where nothing can be done to stop the national trends, the producer has to do a better job of production and marketing management. There is no alternative except to go quietly out of business. Diversification by the cow-calf producer into the stocker and/or feeding business can help if it is done with understanding of the markets and in the presence of an ability to manage the increased exposure to price risk. All of us engaged in education should ask ourselves why there is still little understanding of basic business and risk management principles and even less use of that technology by producers in late 1986.

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TECHNOLOGY, BREEDING, AND PRODUCTIVITY

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Genetic selection has been practiced for centuries by humankind, often inadvertently, to produce better agricultural products. More recently geneticists have established defined protocols to allow desired traits to be selected, and this approach has allowed dramatic changes to be made in the performance and even physical appearance of livestock. Genetic engineering in its broadest sense has been with us as long as agriculture has been practiced.

On the other hand, the changes that are realizable by classical breeding and backcrossing techniques can be achieved only slowly and are able to exploit only the variability present within the rather narrow germ lines available. The question arises as to how much more can be achieved by these classical genetic approaches.

Within the last decade or so a number of new approaches have been developed which could potentially have a major impact on the livestock industry. These have included in vitro fertilization (or IVF), a number of techniques involving embryo manipulation, the production of hormones and other pharmacological reagents by recombinant DNA procedures, and the selective introduction of novel or additional genes from the genome of one germline to another by direct transfer of cloned DNA molecules. In this paper I propose to discuss the first three of these topics only briefly. I shall concentrate on the last.

In Vitro Fertilization

In vitro fertilization, as its name implies, involves the fertilization of oocytes (or eggs) by sperm outside the animal, e.g., in a test tube. It has achieved most fame for treating certain forms of human infertility. In general, immature oocytes are collected surgically from preovulatory follicles (the egg sacs) of the ovary from a donor female, allowed to mature, and then exposed to activated sperm. Following successful fertilization, the egg (or eggs) is returned to the reproductive tract (usually the uterus) of a suitable recipient female which may or may not be the oocyte donor.

The longterm advantages of this technique in animal husbandry are likely to be few. Nonetheless, it does allow several offspring derived from the eggs of a single female to be transferred to different surrogate mothers. It can provide almost unlimited extension of semen (since only very small amounts are required for each fertilization event). It is clearly a means for overcoming certain sorts of infertility in what may be an otherwise valuable animal. Finally, it provides a way in which sperm fertilizing ability might be assessed. In vitro fertilization is also potentially useful in relation to embryo manipulation and gene transfer work, because it can provide a large number of synchronously developing embryos for experimentation.

Embryo Manipulation

Embryo manipulation is a catch-all title that includes a variety of relatively novel procedures which fall within the domain of what is now popularly known as biotechnology. Embryos, for example, can now be stored frozen at liquid nitrogen temperatures or temporarily maintained in a metabolically inactive state within the female reproductive tract of another species prior to their transfer to a suitable recipient mother. The sex of embryos can now be determined under the microscope by a nondestructive, highly specific, immunological staining procedure involving the detection of a gene product of the male Y-chromosome.

Perhaps the most useful procedure involving embryo manipulation is our ability to produce sets of identical offspring. One way in which this can be achieved is simply by cutting embryos into halves or quarters. This technique is limited by the amount of cytoplasm present in each segment, and no more than four fetuses have been successfully derived from a single starter embryo. A more sophisticated approach has been to inject single blastomeres (nuclei from 4, 8, or 16 cell embryos) into eggs which have been enucleated following fertilization but whose cytoplasm has been retained. Single blastomeres for 16-cell embryos have given successful pregnancies in sheep. This ability to raise identical multiplets should allow the cloning of valuable crosses or exotic species. The procedure may provide significant numbers of genetically identical animals which can be used for experimentation, e.g., in nutrition experiments, to reduce the amount of variability. The success of this technique raises the possibility that nuclei of somatic cells

derived from tissues of adult animals might one day be transferred to enucleated eggs which can then be induced to develop into normal fetuses which are genetically identical to the donor of the nuclei. Although such cloning has been achieved with frogs, the genetic organization of somatic cells of mammals appears to limit their ability to develop in a totipotent manner within the cytoplasm of a fertilized egg.

One area of embryo manipulation that has received some notoriety is the production of chimeric animals. Chimeras consist of mixed population of cells of different genetic background. They can be initiated either by allowing two or more cleavage stage embryos to fuse or by injecting one or more cells from one early embryo into the blastocoel (the fluid-filled space of the early spherical embryo) of another. In general these mixed populations of cells give rise to a fetus comprised of segments and patches of tissue derived from the different cell donors. Chimeras only develop successfully if the donors are closely related in genetic makeup. However, goat-sheep and sheep-cow chimeras have been raised successfully. The value of such intra- and interspecific chimeras is very limited. They have been useful in studying how cells pattern themselves in fetal development, and they may give some insight into the phenomenon of hybrid vigor (or heterosis). As far as the livestock industry is concerned chimeras are probably best regarded as experimental curiosities.

Production of Growth Factors and Other Proteins by Recombinant DNA Procedures

Over the last ten years or so it has become possible to isolate the DNA segments corresponding to a wide variety of mammalian genes and clonally expand these DNA's by inserting them into either viruses or bacteria. The cloned (or recombinant) DNA, in turn, when joined to suitable "promoters" and other controlling genetic elements, have been used to direct the large scale synthesis of their normal protein products in bacteria and a variety of other host cell types. Bacteria have been designed, for example, that can convert up to one-third of their total protein into the synthesis of a "useful" product such as human insulin or growth hormone. Such microbial "farming" procedures have allowed the very cheap production of protein hormones, potential anti-cancer and anti-viral products such as the interferons, and a number of blood clotting proteins. The one product which has attracted most attention in the livestock industry is recombinant growth hormone, largely because of its effects on milk production when injected into dairy cows.

The first effects of growth hormone were reported by Evans and Simpson in 1931 when it was noted that extracts of the anterior pituitary gland increased growth and feed efficiency in rats. The first experiments in farm animals were not carried out until much later, probably because of scarcity of the hormone and its cost. However, in experiments with natural growth hormone, positive effects on the growth of pigs were noted. Beneficial effects on feed efficiency have been observed in pigs, lambs, and heifer calves. With the introduction of recombinant growth hormone for limited experimental use many larger trials have been possible. The results confirm that growth hormone promotes increased growth in young animals, a dramatic increase in milk yield in the dairy cow, and a switch from fat deposition to muscle in all species tested. For example, the diameter of the eye of the loin is dramatically increased.

Not only is the use of recombinant growth hormone likely to reduce the cost of red meat production; it will also most likely provide a more palatable product, low in fat, to the present day consumer. Clearly the potential benefits of growth hormone use are not likely to be confined to the dairy industry.

It should be emphasized that the direct mediator of muscle and bone growth is not growth hormone but a group of hormones related to insulin, called somatomedins. The role of growth hormone is to induce the production of these growth factors by the liver. Because recombinant somatomedins are likely to become available for experimentation in the near future, it will soon be possible to test whether these compounds might also be potentially valuable products for increasing productivity in the livestock industry.

One great advantage of administering a protein such as growth hormone over a steroid hormone, such as diethylstilbestrol, is that proteins, unlike steroids, do not persist as toxic residues. That is, they turn over very rapidly in the body of the animal. Moreover, if ingested, they are immediately broken down by the proteolytic enzymes of the stomach and duodenum. They pose no threat, therefore, to the consumer. One disadvantage, however, is their delivery. At present there is no good alternative to regular (at least daily) injections of each animal. A major thrust in current research, therefore, is to develop slow-release implants to replace the regimen of injections which are impracticable for the producer.

Transgenic Animals

Within the last five years it has become possible to introduce cloned genes derived from one organism into another very different animal. Such a procedure allows the selective transfer of a single, potentially beneficial gene without any accompanying undesirable genetic material. In this manner the requirement for extensive backcrossing and selection might be avoided. The procedure also allows genes to be exchanged between different organisms which would not normally interbreed.

In 1981 several different laboratories reported the successful introduction of cloned genes into laboratory mice by injection of purified segments of cloned DNA into the nuclei of fertilized eggs at the one cell stage. The large size of the mouse oocyte makes it a relatively easy target for injection and, because this fertilized egg gives rise to the entire embryo, the introduced gene generally becomes integrated into all of the cells of the developing animal, including those of its gonads. Thus, the transferred gene can be passed on into subsequent generations.

The one cell embryos are held by suction on the tip of a micropipet and injected with a fine-tipped second pipet which can deliver approximately one picoliter (10^{-9} ml) of DNA solution into the male pronucleus (the nucleus derived from the sperm which will ultimately fuse with the female, egg nucleus). Several such eggs are then returned to a pseudopregnant surrogate mother which carries them to term. In a practiced laboratory usually up to 30 percent of the offspring carry one or more copies of the gene as permanent residents of their chromosomes.

In 1982 and 1983, the successful transfer of rat and human growth hormone genes to mice was reported. The gene was so constructed that it contained a special regulatory region that enabled its expression to be controlled by the level of heavy metals in the diet. Mice were born that contained several copies of the foreign growth hormone gene, and many of these mice grew to be of unusually large size. Moreover, the new genes were transmitted in a predictable Mendelian manner. New strains of giant, fast growing laboratory mice have thus been created.

Transgenic Farm Animals

More recently it has become evident that it is possible to transfer cloned genes to the eggs of species other than the mouse. Difficulties have been encountered with livestock because the cytoplasm of their eggs is opaque, and it is difficult to see the egg nuclei under the microscope. With pigs, this problem was partially circumvented by first gently centrifuging the eggs to "clear" the cytoplasm.

One goal of recent research, therefore, has been to introduce extra copies of the growth hormone gene into pigs in order to achieve the growth and feed utilization efficiency noted with animals injected with recombinant hormone. Although initial reports were disappointing, there are recent unpublished accounts of transgenic pigs reaching market weight in 17 rather than 24 weeks and showing the desirable low fat carcass characteristics described earlier. These animals, of course, do not have to receive injections since the hormone is overproduced endogenously.

Clearly this type of research might be extended to other animals, including cattle and sheep, and there is cautious optimism among animal scientists that new efficient breeding stocks might result from these experiments. Nevertheless, a number of likely difficulties have yet to be addressed. First, it is particularly important that there be some means of controlling the expression of the "extra" genes. A dairy cow overproducing growth hormone from birth might well turn into a freak of enormous stature but of little economic value. The producer would clearly want the hormone to be released only during periods of lactation and not to be activated early so as to induce precocious growth. In addition, the effects of excess growth hormone on the health and long term productivity of a dairy cow over several lactation periods have yet to be assessed. At the very least, the use of mass produced recombinant hormone or the development of new recombinant strains of livestock will require major changes in management techniques.

Other Areas

There are other areas of animal science that might be addressable by means of recombinant genetics. I have discussed how growth efficiency and milk production might be improved by the introduction of extra copies of a selected gene, such as the one for growth hormone, into new recombinant strains of animals. There are, in addition, other areas which hold promise. It is known, for example, that there is a strong genetic predisposition towards certain forms of disease

resistance. Once such genetic loci become better defined it may well be possible to transfer those "desirable" genes directly to the more susceptible strains of animal without creating undesirable crosses of lower productivity.

Possibly the greatest factor that limits efficiency of livestock production is that of reproductive loss. Pregnancy failure might well exceed 30 percent in cattle, sheep, and pigs. Unfortunately, we are far from understanding the genetic basis for these losses, and extensive biochemical and physiological studies will be required to define the gene products that might be limiting in such complex processes as implantation or maternal recognition of pregnancy. A major thrust of the Reproductive Biology Cluster in the Food for the 21st Century Program here at the University of Missouri is to define some of the factors that affect reproductive efficiency. We are, for example, defining hormones released by the embryo that trigger responses in the mother which allow the pregnancy to proceed. The aim of our work is to clone the genes for such products, attempt to understand how their expressions might be controlled and regulated, and, if deemed appropriate, to introduce extra copies of these genes into fertilized eggs.

We believe that the new approaches of recombinant DNA technology hold great promise for improving livestock efficiency, if not in this century, within the early twenty-first.

Safety Concerns in Genetic Engineering of Animals

Federal agencies are considering far reaching regulations of various kinds to protect the public from environmental and health problems that could potentially arise from release or escape of genetically engineered organisms. There are, in addition, individuals who are seeking to limit the development of recombinant organisms on the grounds that the experiments are by-passing the strictures of normal genetic interchange and constitute unwarranted meddling in natural life processes. The public rightfully fears the creation of environmental pollutants reflected in serious plagues of recent history caused by animal pests such as the gypsy moth, Japanese beetle, and European rabbit in Australia, or by plants such as Kudzu and Hydrilla. In all these examples the damage was created by introducing a highly successful organism into a new environmental niche, which lacked many of the checks and balances of the old habitat. In the case of recombinant organisms, the genetic changes introduced are likely to be few and of doubtful value to any pitiful escapee lost from the confines of the laboratory or farm. Indeed most of the plants and animals utilized in modern agriculture rely for their very existence on the care exercised on their behalf by their benefactor, the farmer.

My own view, therefore, is that the potential dangers to the environment imposed by recombinant organisms are few. We are, however, faced with a new technology that can likely raise productivity in a time of surplus and put further pressure for change on the patterns of "traditional" farming. Although the advantages of this technology must be weighed against its drawbacks, it is likely to be an inevitable component of future agriculture.

CRITERIA FOR SELECTION OF A NEW FEEDLOT

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What I will present regarding the subject of feedlot location is not very technical and perhaps not very scholarly. There's a reason. It's that all the money my organization has ever made has been made on the adoption of a simple concept, a major change in direction; and if that concept isn't right, there's no amount of work that will make it right. In other words, if a feedlot operation is in the right general location under the right general circumstances, it will be found pretty easy to make it work. If it is not in the right general location or circumstances, nothing can be done to fine tune it into a good idea.

Again, my approach will be very general. If I can get a couple of simple concepts across and if other persons' experience is anything like mine, recognition of the broad concepts is going to do more to identify things that we should do in the future than a more technical approach I might take.

I'll follow this general outline. First, I will explain a little more about who I am and who our company is, so that my bias can at least be understood. Second, I will talk about the basic differences between a good hog feeding location and a good cattle feeding location. They are very materially different. Third, I will mention very specific points to be considered in a good cattle location; and fourth, specific points regarding a good hog location. Fifth -- perhaps most important of all -- will be some of the worst reasons for selecting locations for hogs or cattle. Finally, I will summarize how we in my firm see the changing circumstances and conditions in the important decision process of location.

So that my bias can be understood -- you may believe or disbelieve it -- and so that you can know what motivates me to some extent in arriving at some of the positions I am going to take, I give some personal data. I am president of a large agricultural production company. We are not a management company managing for other people. We are owner-operators; we are farmers. We just happen to be farmers on a very large scale. I am a cattle feeder personally, feeding in custom yards in fairly large numbers. I am a small farm owner. I am owner and operator of a large ranch in the Flint Hills. I've been a director of such agriculturally related companies as the Kansas City Board of Trade, Butler Manufacturing, and a large agricultural bank (I am still a director of that bank). In summary, I am totally committed to making my living from production agriculture -- ownership and operation.

National Farms is a company that I help to run. It farms 131 quarters of corn in Nebraska. We farrow to finish 18,000 sows, and we finish something well over 300,000 hogs a year. We own and operate four large custom cattle feedlots, both custom and for our own account, in Kansas and Texas. We would like to expand that business dramatically. We farm 16,000 acres of corn and wheat in the Texas panhandle. It is under irrigation, as is our Nebraska grain. We own and operate 14,000 acres of tame grass in east Texas where we run alternately cow-calf and yearling operations. We own and operate a 10,000 acre rice and soft wheat farm in south Arkansas. In essence we are a large corporate agriculture company, in business to make money over the long run. And we are willing to change and relocate that business to accomplish that objective.

Hogs Versus Cattle

Let's try to understand some of the different factors that drive the location decision for us in hogs and cattle -- which should also be the decision making considerations for anyone who wants to be in those businesses. The answer is different for hogs and cattle, simply because consignment feeding works for hogs and does not work for cattle, on an economic basis -- at least we haven't been able to discover a way to do it with cattle. Given that my assumption is right, we are left with the fact that the cattle feeding site is driven by uncontrollable external variables such as weather, slope, drainage, and geographic conditions; and if we can't control those external variables we have to go with cattle in places where the variables are favorable. Usually for cattle, these factors are more important than having the lowest cost feed. In hog feeding, on the other hand, consignment production has become so efficient that we can control the external variables and make our location decision more independently of those uncontrollable things such as weather and drainage. In other words, with cattle we have to run away from the weather, and by weather we primarily mean rainfall and humidity, even if we are moving toward higher priced grain, but with hogs we can cost-effectively control the environment and select a location based more on low cost feed.

Hog Location

Let's look at the two questions separately, starting with hogs. Hogs have become my favorite, in view of the highest hog-corn ratio in history and the highest profitability and highest price of hogs. Hogs are looking pretty good owing to that combination of events, so I will let them come first. One day in 1977 I got a call from the First National Bank of Chicago asking me to meet with Don Tyson, chairman of Tyson Foods, one of the most successful agricultural companies that I know of anywhere in the world. He asked me to help select the best location in the United States at which to build a large confinement hog facility. My first reaction was that I didn't know anything about hogs; I knew nothing about hog confinement; and I surely didn't know anything about selection of a site. But the Bank prevailed on me to come and meet Don Tyson and visit with him. The day proved to be one of the most important I have ever spent in my life, because the only way I could approach answering the question for Don was to ask him, "What are the criteria that you consider to be important for selecting a site on which to build a very large confinement operation?" He was thinking in terms of the largest operation anyone had ever taken on. I remember clearly what he said, even after nine years. The first consideration, he replied,

for hog confinement operations on a large scale is remoteness from people. He was concerned with long term considerations such as odor and flies -- with people who would later move into the area, and the absolute unpredictability of what regulations, regulators, and the courts may decide to be an unsuitable nuisance. So the number one criterion was to be located so far from neighbors as to remove the close-down prospect for the future.

The second most important consideration, he said, was cheap feed. Sixty to eighty percent of the cost in finishing hogs is the variable cost of feed. (The exact percent depends on the dollar values of feed and hogs.) Let me add a comment about variable cost: in my mind all costs are variable. I don't have to be in any business; I can always start, I can always stop. I may not like to drop a capital investment, yet all of the costs are variable costs. Sixty percent of the total cost in our business at present -- it has been as high as 80 percent -- the cost of producing hogs, is feed; and so feed is one of the primary location factors.

Third in importance is the availability and suitability of ground, not for building the facility, but for disposal of the effluent. This problem sometimes seems to be the biggest problem of all, when there are as many as 160,000 or 170,000 animals in a confined location. A primary consideration is not a big area of ground but the crops that are raised and the nature of the soil. We happen to be in a very sandy loam that can be worked one day after a one-inch rain, and on which effluent can be applied 300 days in a year. It's a sandy loam soil in northern Nebraska. The situation is different from Iowa or Missouri, where bottom land restricts the number of access days. It is not, however, just a matter of ability to get on the ground for effluent disposal. It's also permeability of the soil, and slope, because it won't do any good to spread the effluent on the ground if the soil has a low degree of permeability, a steep slope, and a high runoff, thereby introducing the material into the waterways. In those conditions you won't get away with the disposal practice very long.

Fourth most important in hog site location is access to markets. This is extremely important. Markets are packers. I don't discount the importance of the ultimate consumer but I am talking about the market in the form of the packer. I want to relate, economically, how important that is. A dollar a hundredweight difference in what can be netted back in one market as against another is \$2.50 an animal and that is about equivalent to a 25 cent difference in the price of corn. Anytime we address these questions we have to weigh the economic relationships between any advantage in price received for hogs and the cost of corn.

The fifth most important consideration that Don Tyson explained to me is quality of labor supply. I want to stress strongly that it's quality of labor supply, and not just availability of labor at an odd time of the year or utilizing one's own labor at a season of feeling restless because of having nothing to do. But good quality labor -- people used to working in agriculture, with animals -- is absolutely imperative. The hog confinement business, from an economic standpoint, is not terribly labor intensive, but if the job is not done well, economic problems arise that go far beyond the point of the cost of labor itself.

Location obviously should be selected based on a combination of all these factors and not just one. Weights can be put on the cost effect of considerations such as markets and feed, but that is just arithmetic. Don't forget that nuisance from smell, flies, or inability to dispose of effluent properly can put an operation completely out of business. So there are two kinds of considerations: actual economic cost and availability of markets with any premium price, on the one hand; and on the other, those other factors such as location relative to neighbors that can put a firm completely out of business despite the cheapest corn and highest priced hogs in the world.

These, then, are the considerations Mr. Tyson told us to consider in the hog business. We did ultimately consider them. Incidentally, we put together on a napkin that afternoon a joint venture that never changed during the six or seven years we were in business with Tyson. Within a week we commenced to build facilities in Nebraska and it happened that one of our locations seemed to fit the criteria perfectly. We have never since changed our ideas on site selection criteria.

Cattle Location

Cattle feedlot location is driven by an entirely different set of circumstances. It should be driven primarily by performance potential based on weather and soil type. I base these observations on a lot of specific factors but there is nothing more important than longterm observation arrived at as a result of feeding many thousands of cattle in our own lots and in other lots, in places like Nebraska versus Kansas or the panhandle of Texas. No matter how cheap

corn may be in a northern location, the gain costs are always higher, year round, in a northern than a southern, arid location.

Anyone who has ever fed cattle has been tempted by the vision of cheap grain -- grain so cheap that surely it makes sense to feed cattle at that place. I can say unequivocally that during the last 12 years when I have been intensely involved, the cheapest gains have come from the southern arid locations almost irrespective of what the corn price is there. There are some special situations that will occasionally moderate that principle but the rule really pretty much prevails.

The general site selection toward the southwest is made even easier by the fact that over time the concentration of packers has made for a stronger finished market in the same areas as those where the costs of gain are cheapest. So in the semi arid southwestern locations we get the best of both worlds -- lowest priced cost of gain (gain, not feed) and the highest packer prices.

In a list of criteria for site selection for a cattle feedlot, number one thus is a dry arid climate with low humidity and low annual rainfall. If we compare that with the hog list, that criterion does not even show up for hogs.

The second most important criterion in site selection for cattle feeding is good natural drainage and a soil type that provides good footing in most kinds of weather. It doesn't matter if the annual rainfall is only 11 inches -- if four of the inches come in one week and drainage in the yard is poor, there will be a problem for several weeks to come. It probably will be enough of a problem to prevent making any money on that turn of cattle, even in a southwestern location.

The third consideration is good markets for the product.

All the way down in number four for cattle is cheap feed.

The fifth is remoteness from people. I can't understand all the reasons why people will be forgiving relative to the smell of cattle manure but not the smell of pig manure. The hog odor is a little offensive, I admit, but people are more sensitive to the smell of a hog operation than a cattle operation.

Number six is a good source of feeder cattle. We believe this is overrated; cattle will move around pretty well. We put it pretty far down the list for our consideration.

Number seven is a good labor market. Again, it's not the cost of the labor that will kill a firm in either cattle or hog feeding, but whether it's possible to get the job done right. There are a thousand details that make the difference between feeding cattle or hogs successfully and feeding them unsuccessfully.

I add a few observations that are worth careful attention because they are the opposite of what we usually suppose to be the case. Among the various sources of meat cattle are the best converters of grain. They are that because they seldom get their first bite of grain until they are of 700 to 800 pounds weight. If we take the total pounds of beef produced in the United States versus chicken or hogs we find that less grain is used in producing beef than in producing chickens and poultry. I think we tend to focus on the conversion during the feeding period and assume that cattle are inefficient converters when, in fact, in the total meat production chain cattle are our most efficient converters of grain -- for the obvious reason that they utilize the otherwise unusable roughages to provide the first 70 to 80 percent of their total finished weight. We really need to think about that when we consider the importance of feed relative to the cost of production of poultry versus hogs versus cattle.

Feed costs as a percent of total selling price of cattle are less than on other meats and therefore lower on a priority list for site selection. For weather can often make a 50 percent to 70 percent difference in cost of gain on cattle. In our operation cost of gain for hogs seldom varies more than 5 percent because of weather. Weather in hog production is a non-factor. Performance and daily gain are more important than feed costs in cattle because in today's market, feed is a 4-cents per pound variable, but finished cattle are a 64-cent variable. An eye must be kept more on the 64-cent product sold than the 4-cent product used.

To sum up, to us, in cattle feedlot selection, site selection, we must run from the performance-killing weather variables toward better markets as the two most important criteria. Feed is important but not nearly the most important.

Worst Reasons in Site Selection

My last topic is to point out some of the worst reasons for selecting a location. I may step on some toes. I think it necessary to report how things are, irrespective of what we may want to think. Livestock are an extremely capital-oriented business. The level of technology and economy-of-scale emphasis in deciding to feed livestock is of overwhelming importance. The most overrated, and in my estimation worst, consideration for selecting a feedlot location for either hogs or cattle is the utilization of available labor. Labor input in modern, commercial-sized and -scaled operations is too small a percentage of the value of the finished product to be much of a consideration. Maybe more important than the fact that the small percentage of the total cost is the fact that livestock production on an efficient basis is highly specialized and should not be considered as fill-in labor time for someone who has other more important things on his mind. So number one among wrong reasons for selecting a feedlot location is to utilize otherwise-unutilized labor.

The second worst reason for selecting a feedlot location is the use of available rough land that is not suitable for anything else. All of us have done this. Anyone who has ever farmed can't stand to see an acre, or five acres, or, heaven forbid! 80 acres remain unused all the time. The probability is -- and this is to be seen throughout the Platte valley -- that if a piece of land isn't suitable for other uses it is not suitable for feedlot location.

Let me offer an example of how ridiculous it is to run livestock -- hogs or cattle -- on a piece of land just because nothing else can be done with it. In 1981 we sold, at the top of the land market, \$25 million of land in Nebraska, 121 quarter sections of irrigated ground. Two years later we spent \$50 million to build hog facilities on two quarter sections of land. Land cost even at the top of the market was absolutely insignificant relative to the investment of getting into a livestock operation. Don't be driven by the urgency, the felt need, to use that poor 80 for something that puts you in the livestock business.

Worst reason number three is to add value to raised crops. The fact is that any time a crop can be sold and feed repurchased where it can be used more effectively in a professional location, that should be done. The question is not whether value can be added to a crop that is on hand because it has been raised. It is whether a person can use his own grain more effectively than grain can be acquired and fed in another location. In our experience the answer is almost never "yes." Value added to one's own grain is not a good reason to make an investment of five times the value of the grain in livestock, just to add value to the grain. The risks and technological problems involved overwhelm the possibility of getting another dime, 20 cents, or even 50 cents a bushel for the grain.

Small differences in the grain price seldom make for a compelling difference in the profitability. More importantly, bad decisions often are made in purchasing cattle or hogs based on the urgency to use a crop on the idea that not enough will be received for it by selling it.

I have made that mistake. I have taken silage and talked myself into buying cattle at the wrong time to use the silage. Anyone who has farmed and fed cattle has probably made the same mistake. He would have been better off to have buried the silage than to have bought the cattle at the wrong time. I have bought wheat pasture cattle time after time; I couldn't stand seeing that beautiful emerald green wheat growing up and not getting used; and I paid 80 cents a pound for calves that I sold for 60 cents, and it would have been cheaper to bush-hog the wheat than to put the cattle on it. Don't let availability of feed, which is a relatively small consideration, control your livestock-purchase decisions.

In summary, selection of a hog feeding operation should be driven by feed costs and remoteness. Maybe I should mention also the availability of capital; but assuming the capital is available, feed costs and remoteness from people are the two driving factors in hog site location. Cattle feedlot site location should be driven by weather conditions or other external, uncontrollable variables, and good packer markets. We should not make feedlot location decisions based on low value considerations such as available extra labor or unused ground. The decision absolutely should not be a life style selection but an objective economic consideration.

Finally, to address Missouri site-specifics, I have to say that Missouri is probably not a very good place for livestock feeding. Weather is not very good. Rainfall is high, as is humidity. Markets are not readily available. Very few packer locations are readily accessible to the Missouri markets. Corn is in relatively good position for other uses such as export. The state is, however, infinitely better suited for the production of hogs, for reasons I have set forth, than it is for the feeding and finishing of cattle.

THE MISSOURI LIVESTOCK INDUSTRY --
HOW IT HAS CHANGED AND WHY

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In addressing the subject, "The Missouri Livestock Industry -- How It Has Changed and Why," my approach is to use a mixture of history and statistics, anecdotes and numbers.

The livestock industry is important in Missouri and conversely Missouri is important in the livestock industry (see table). I will show that this has been true for more than 100 years.

A quick overview of a national ranking indicates that livestock production in Missouri is certainly diversified, as it includes beef cattle, hogs, dairy, and turkeys, for all of which the rank is no lower than seven. For most of the items Missouri's percentage of the U.S. total is five percent or higher.

Missouri's Current National Ranking in Selected Agricultural Statistics

Item	Rank	Percent of U.S. total
Cattle operations	2	7
Beef cow inventory	2	6
Hog operations	2	6
All cow inventory	2	5
Calves born	2	5
Number of all farms	2	5
Milk cow operations	5	4
Turkeys raised	6	7
Breeding hog inventory	6	6
Pig crop production	6	6
Hog and pig inventory	6	6
Market hog inventory	6	6
All cattle and calves inventory	7	5

Source: Missouri Farm Facts 1986, Missouri Department of Agriculture.

The livestock industry has been a major contributor to the diet of Missourians for a great many years. A study which included Missouri that was done in the 1850s showed that the diet of the rural population consisted on the average of 183.9 pounds of meat, 13.2 pounds of lard, 15.1 pounds of butter, 205 pounds of wheat flour, and 29.7 pounds of sweetener. This diet was heavy on fats and salt and light on fluid milk, fresh fruit, and green vegetables. Meat consumption in the 1850s was close to record levels. (See Atach and Bateman.)

This level of consumption was made possible with little supplementary feeding. The supplemental feeding by species in corn equivalents for 1859 was estimated to be cattle, 3 bushels; dairy cows, 2 bushels per thousand pounds of milk; hogs, ten bushels; horses, 25 bushels; mules and oxen, 17 bushels; and sheep, 0.5 bushel.

The generally inadequate feeding standards were reflected in the low slaughter weights and poor yields that prevailed. Until the feeding practices were changed, livestock made little progress. But progress did get underway. From 1850 to 1910 a rise in milk yields was attributed to improved feeding; it did not result primarily from more productive breeding.

Why has the Missouri livestock industry changed over time? Missouri is a place. It is fixed geographically, with a fixed natural resource base. The people of Missouri with their abilities

are another resource. We will review the use of Missouri's resources in livestock production and also developments in the state related to the livestock industry.

- * Resources have value in terms of particular technology, both the technology of livestock production, and the technology of transportation, processing, distribution, and exchange.
- * Resources have value in terms of what the market demands -- fat versus lean, large versus small, young versus mature. In the history of the livestock industry in Missouri, the physical location of Missouri was an asset -- a resource -- at a particular time, and perhaps it is still an asset.
- * Resources have value in terms of the ability of entrepreneurs to use them profitably. This is reflected in:
 - Economic institutions.
 - Industry organization.
 - Financial resources and ability to manage risk.

To address the assigned subject effectively, it is necessary to consider the livestock industry specie by specie. The historical development of each is distinctive.

Swine

We will now focus our attention on developments in the swine industry. To get a feel for early hog production and marketing practices, I use a fairly lengthy quotation from Wallace's Farmer of 1928:

In the period between 1848 and 1872 there was carried on at Alexandria, Missouri, a pork packing industry, the extent of which marked it as the largest industry of its kind on the river above St. Louis. Alexandria is a small town in Clark County, lying on the Mississippi River about three miles below the mouth of the Des Moines. In the peak year of this industry, 1869-1870, there were 42,557 hogs slaughtered and packed there. Hogs came from southeastern Iowa and northeastern Missouri driven on foot in huge drives from sometimes as far as a hundred miles away.

The beginning of this industry came through the effort to remedy the unsatisfactory condition in which pork was being brought in for barter at the town. At this time, Alexandria was the river port of supply and exchange for a considerable part of northeastern Missouri and that part of southeastern Iowa not dominated by Keokuk. To it farmers from many miles around would come to bring their produce which they exchanged for New Orleans sugar and molasses, lumber, and other supplies.

In the early 50s, Andy Maxwell started up a slaughter house. For a time, farmers would band their hogs together and drive them to this slaughter house where they were butchered and sold to the merchants "off the hocks." Soon Maxwell instituted the practice of buying the hogs himself and slaughtering them and curing them.

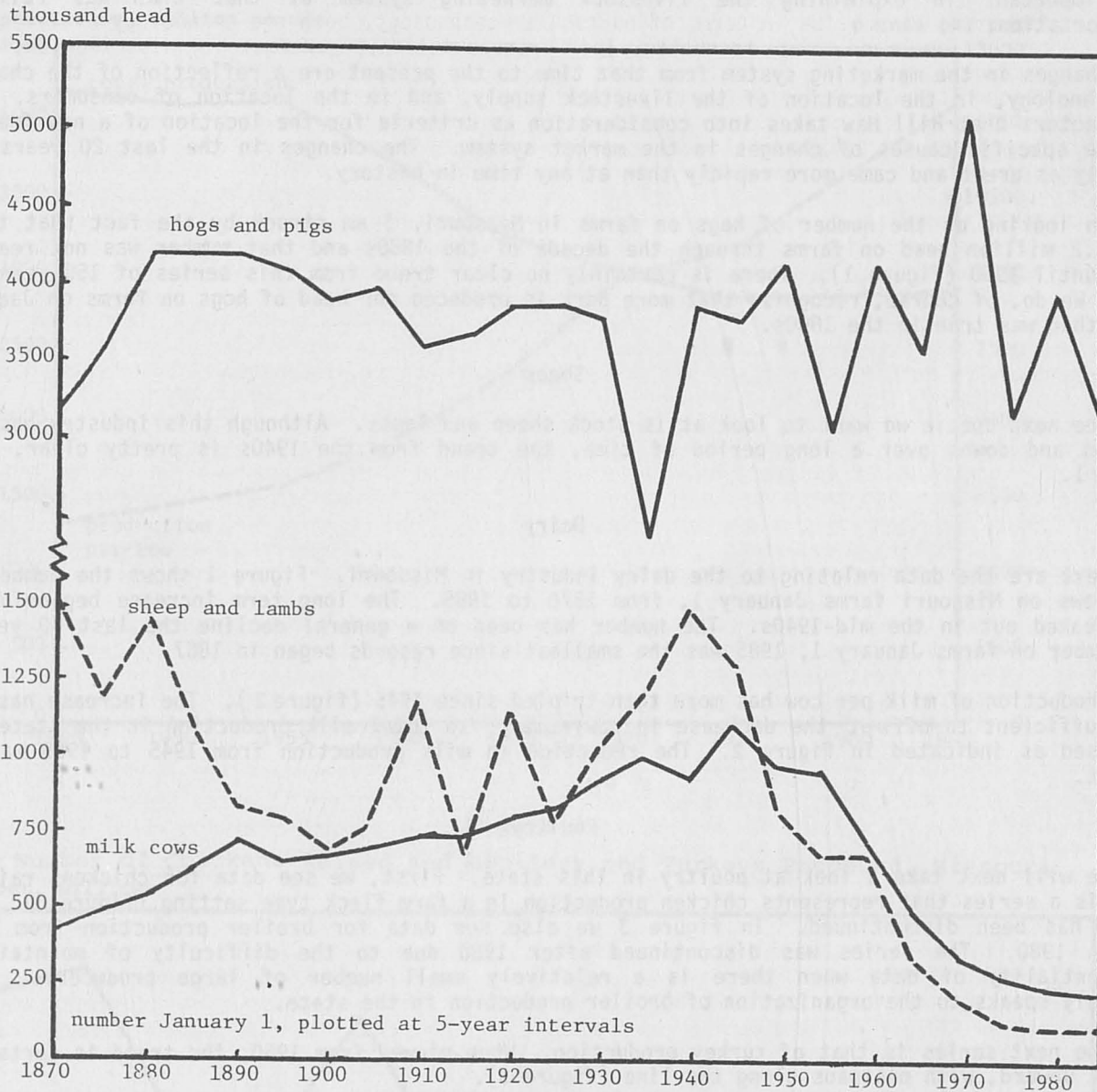
The Civil War brought an added demand for cured pork, so Maxwell went into the business of slaughtering and packing on a large scale. About the close of the War, he instituted a practice of sending out purchasing agents who bought the hogs, collected them into droves and drove them into the slaughter house.

Nathaniel Davis, of Scotland County, Missouri, was the general purchasing agent for his section of the state. Sometimes he would start building up a drive as far west as Putnam County and add to it as he went eastward to Alexandria. Sometimes there would be as many as a thousand hogs in the drove by the time Alexandria was reached. In those days, hogs were never marketed under 18 months of age and at that age they would weigh 300 pounds or more. There were no stock laws, so hogs ran on the open range. Some of them got very wild and handling them was much like handling a pack of wild animals. An 18 month old hog, weighing 300 pounds or over, and most of it muscle instead of fat, was a dangerous animal when it wanted to be and the men who handled the drive sometimes had experiences that read like African jungle hunts.

From the peak of business in 1869-70, the business declined until in 1872 it went out altogether. The coming of the railroads would probably have meant an exodus of Alexandria's packing industry had no other causes intervened. During the time it existed, it served its purpose well, but like many other pioneer industries it was shoved aside in the march of progress.

Figure 1

Hogs and Pigs, Milk Cows, and Stock Sheep and Lambs on Missouri Farms



Increased livestock production and settlement of western areas concurrent with the development of the railroad system resulted in changes in the relative importance of various cities as meat packing centers. Organized markets developed at Chicago in 1865, St. Louis 1872, Kansas City 1871, Omaha 1884, Sioux City 1894, and St. Joseph 1895. With the development and use of mechanical refrigeration and refrigerated cars, by 1880 the stage was set for a central livestock marketing system. Central markets that developed from 1865 to 1900 were generally on the north-south axis. In general they were located between producing areas to the west and consuming centers to the east. Livestock were thus concentrated in large numbers at one geographic location. This development gave rise to firms' providing the very specialized services necessary for a central marketing system.

Large volumes of livestock concentrated in one place, i.e., the central market, brought the development of large scale packing plants. At each of the central markets there were large volume packing plants designed to process the many head of livestock shipped to it. Most of the packing plants were suitable for slaughtering cattle, hogs, and sheep.

By about 1900, technological developments and reorganization of the packing industry made the central marketing system the dominant type of livestock marketing. The technological development most important in explaining the livestock marketing system at that time was railroad transportation.

Changes in the marketing system from that time to the present are a reflection of the changes in technology, in the location of the livestock supply, and in the location of consumers. The many factors that Bill Haw takes into consideration as criteria for the location of a new feedlot are the specific causes of changes in the market system. The changes in the last 20 years are probably as great and came more rapidly than at any time in history.

In looking at the number of hogs on farms in Missouri, I am struck by the fact that there were 4.2 million head on farms through the decade of the 1880s and that number was not reached again until 1950 (figure 1). There is certainly no clear trend from this series of 150 years of data. We do, of course, recognize that more pork is produced per head of hogs on farms on January 1 now than was true in the 1800s.

Sheep

The next specie we want to look at is stock sheep and lambs. Although this industry has had its ups and downs over a long period of time, the trend from the 1940s is pretty clear. See figure 1.

Dairy

Next are the data relating to the dairy industry in Missouri. Figure 1 shows the number of milk cows on Missouri farms January 1, from 1870 to 1985. The long term increase beginning in 1870 peaked out in the mid-1940s. The number has been on a general decline the last 40 years. The number on farms January 1, 1985 was the smallest since records began in 1867.

Production of milk per cow has more than tripled since 1945 (figure 2). The increase has not been sufficient to offset the decrease in cow numbers so total milk production in the state has decreased as indicated in figure 2. The reduction in milk production from 1945 to 1985 was 32 percent.

Poultry

We will next take a look at poultry in this state. First, we see data for chickens raised, which is a series that represents chicken production in a farm flock type setting (figure 3). The series has been discontinued. In figure 3 we also see data for broiler production from 1950 through 1980. The series was discontinued after 1980 due to the difficulty of maintaining confidentiality of data when there is a relatively small number of large producers. This certainly speaks to the organization of broiler production in the state.

The next series is that of turkey production. When viewed from 1950, the trend is certainly seen as upward, with plateaus along the line (figure 3).

Horses and Mules

The next series is that of horses and mules on farms. A peak in numbers was reached about 1915. The decline thereafter was steady until the series was discontinued, which was done in 1960. As I look at this series, I think of the fact that in 1859 it took 25 bushels of corn for each horse and 17 bushels of corn for each mule, and visualize the surplus of fuel for horse and mule power we have at this particular time.

Cattle

Cattle production in Missouri has its own history. Many settlers brought with them their best milk and stock cattle. Missouri was fertile country, well watered, with native grasses and timber; and the good salt springs in the Boonslick and Salt River country made it particularly attractive for cattle raising. As early as 1830 the agricultural leaders were urging farmers to improve their livestock. Missouri was developing as a source of supply of breeding stock. A stimulus to livestock improvement was county fairs, and I was interested to learn that the Boone County fair in 1835 was a prominent fair. In the 1840s, cattle trade to the west was started, as 38,000 head of cattle left St. Joe headed for Oregon. In the 1850s, cows could be bought in

Figure 2
Total Milk Production and Production per Cow, Missouri

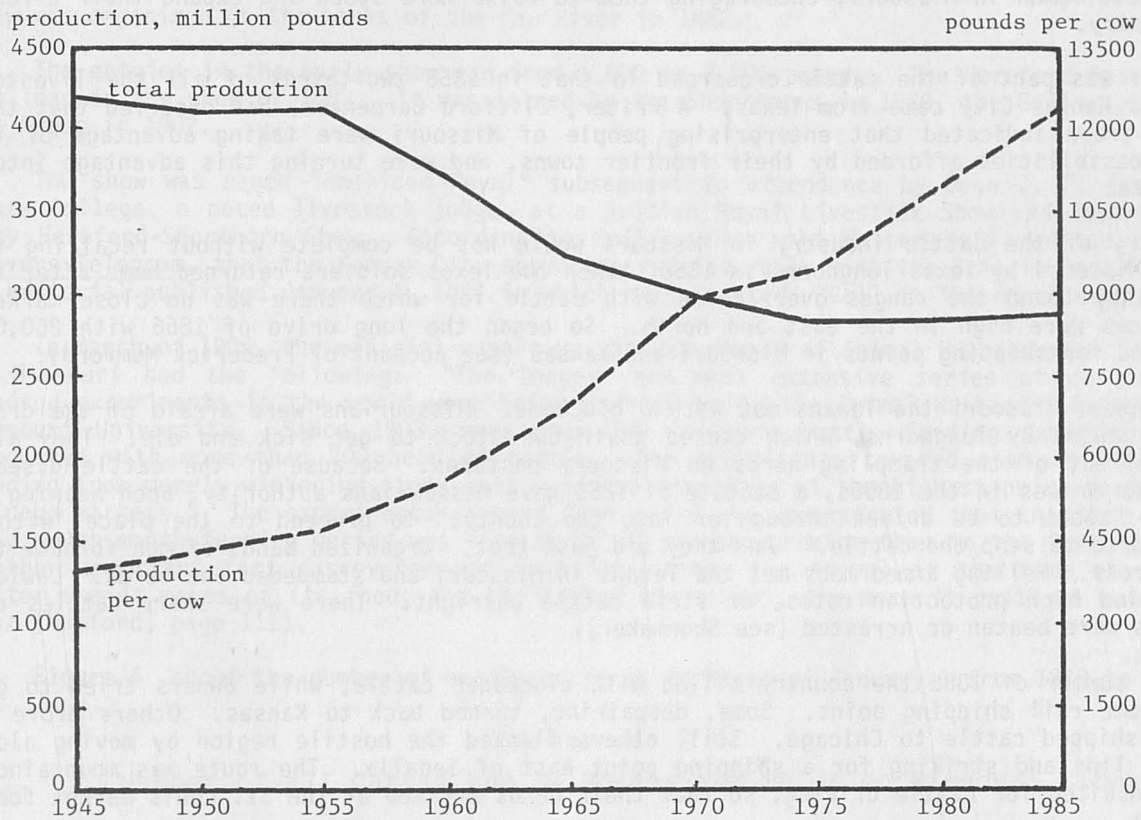
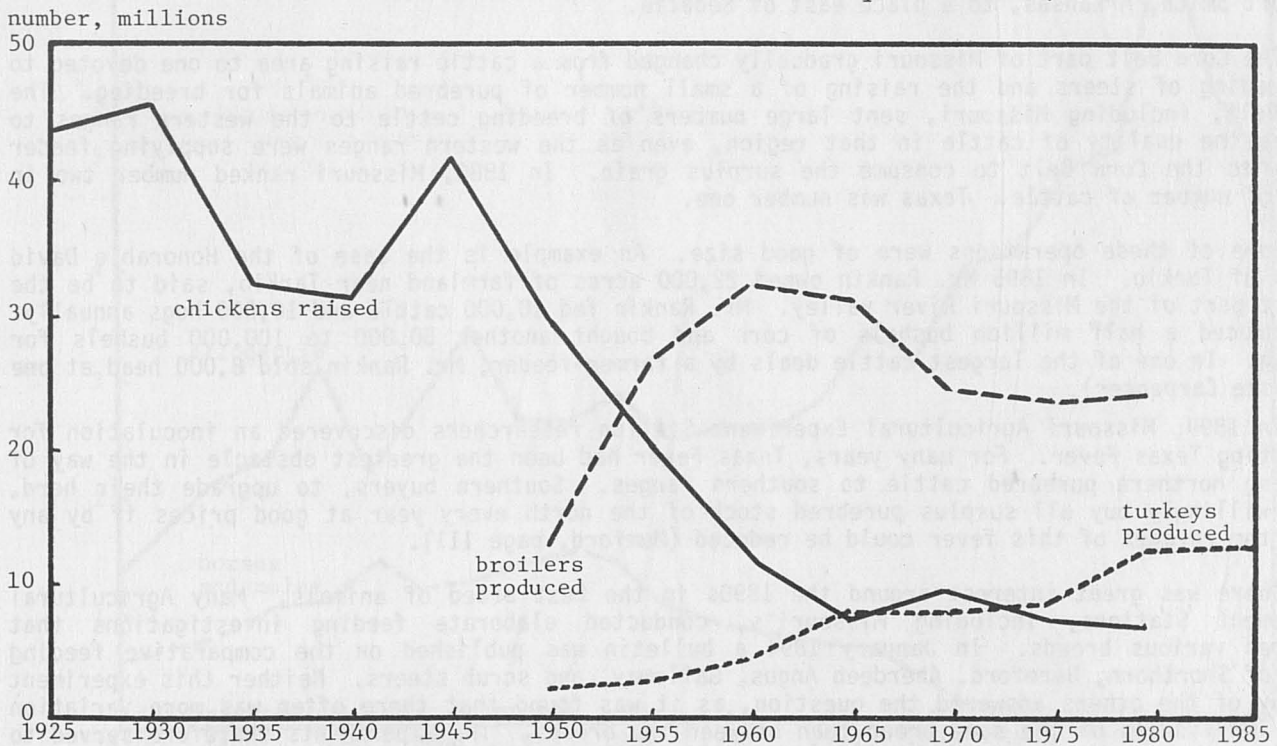


Figure 3
Number of Chickens Raised and Broilers and Turkeys Produced, Missouri



Missouri for \$10 a head and sold in California for \$100 to \$150 a head. So in 1857, 110,000 head of cattle moved from St. Joseph destined for California. This pre-war trade was a stimulus for farmers and cattlemen in Missouri, encouraging them to raise more stock and expand their already growing industry.

Missouri was part of the cattle crossroad in that in 1858 two-thirds of all the livestock which reached Kansas City came from Texas. A writer, Clifford Carpenter, has observed that this large Texas trade indicated that enterprising people of Missouri were taking advantage of the geographic possibilities afforded by their frontier towns, and were turning this advantage into a thriving trade.

A history of the cattle industry in Missouri would not be complete without recalling the invasion of Missouri by Texas longhorns in 1866. When the Texas soldiers returned home after the Civil War, they found the ranges overflowing with cattle for which there was no close market, although prices were high in the east and north. So began the long drive of 1866 with 260,000 steers, headed for shipping points in Missouri and Kansas (see account of Frederick Mumford).

In southwest Missouri the Texans met with a blockade. Missourians were afraid of the dread Texas Fever caused by longhorns, which caused their own stock to get sick and die. They also feared the effect of the trampling herds on Missouri pastures. Because of the cattle disease resulting from drives in the 1850s, a statute of 1851 gave Missourians authority, upon hearing of Texas cattle "about to be driven through or into the county," to proceed to the place "with a sufficient force to stop the cattle." And they did just that. Organized bands of men forbade the drovers to cross. Yelling armed mobs met the Texans in Missouri and stampeded the herds. Lawless elements levied high protection rates, or stole cattle outright. There were sharp battles and trail drivers were beaten or arrested (see Shoemaker).

All the summer of 1866 the country milled with blockaded cattle, while owners tried to get through to some rail shipping point. Some, despairing, turned back to Kansas. Others drove to St. Joe and shipped cattle to Chicago. Still others flanked the hostile region by moving along the Arkansas line and striking for a shipping point east of Sedalia. The route was mountainous and rocky, unsuited for cattle driving, so that their herds arrived at the St. Louis market foot-sore and thin.

The next year the cattle drive moved west. Missouri took precautions in 1867 by passing a stricter cattle inspection law. The cattle trail that ended near Sedalia was known as the Shawnee Trail. It began on the Texas gulf in the area of Corpus Christi and came up through Fort Worth and Fort Smith, Arkansas, to a place east of Sedalia.

The Corn Belt part of Missouri gradually changed from a cattle raising area to one devoted to the feeding of steers and the raising of a small number of purebred animals for breeding. The Corn Belt, including Missouri, sent large numbers of breeding cattle to the western ranges to improve the quality of cattle in that region, even as the western ranges were supplying feeder cattle to the Corn Belt to consume the surplus grain. In 1880, Missouri ranked number two in terms of number of cattle. Texas was number one.

Some of these operations were of good size. An example is the case of the Honorable David Rankin of Tarkio. In 1895 Mr. Rankin owned 22,000 acres of farmland near Tarkio, said to be the richest part of the Missouri River valley. Mr. Rankin fed 10,000 cattle and 10,000 hogs annually. He produced a half million bushels of corn and bought another 50,000 to 100,000 bushels for feeding. In one of the largest cattle deals by a farmer-feeder, Mr. Rankin sold 8,000 head at one time (see Carpenter).

In 1899, Missouri Agricultural Experiment Station researchers discovered an inoculation for preventing Texas Fever. For many years, Texas Fever had been the greatest obstacle in the way of shipping northern purebred cattle to southern ranges. Southern buyers, to upgrade their herd, would willingly buy all surplus purebred stock of the north every year at good prices if by any means the ravages of this fever could be reduced (Mumford, page 111).

There was great interest around the 1890s in the best breed of animals. Many Agricultural Experiment Stations, including Missouri's, conducted elaborate feeding investigations that compared various breeds. In January 1894 a bulletin was published on the comparative feeding tests of Shorthorn, Hereford, Aberdeen Angus, Galloway, and scrub steers. Neither this experiment nor any of the others answered the question, as it was found that there often was more variation among individuals of the same breed than between the breeds. The experiments therefore served to emphasize the importance of individual merit in breeding animals (Mumford, page 238).

In this setting we find the roots of the American Royal. The roots of the Royal came out of the arguments of cattlemen about the need for, and respective merits of, better livestock. To promote better meat types as compared to tough and stringy longhorns the Kansas City fat stock show was organized on the banks of the Kaw River in 1882.

The entries in the early show ran from 1,800 to 2,500 pounds. The Hereford Association took the lead in the show of 1888. It was joined by the Shorthorns in 1889, the Galloway in 1901, and the Angus in 1902.

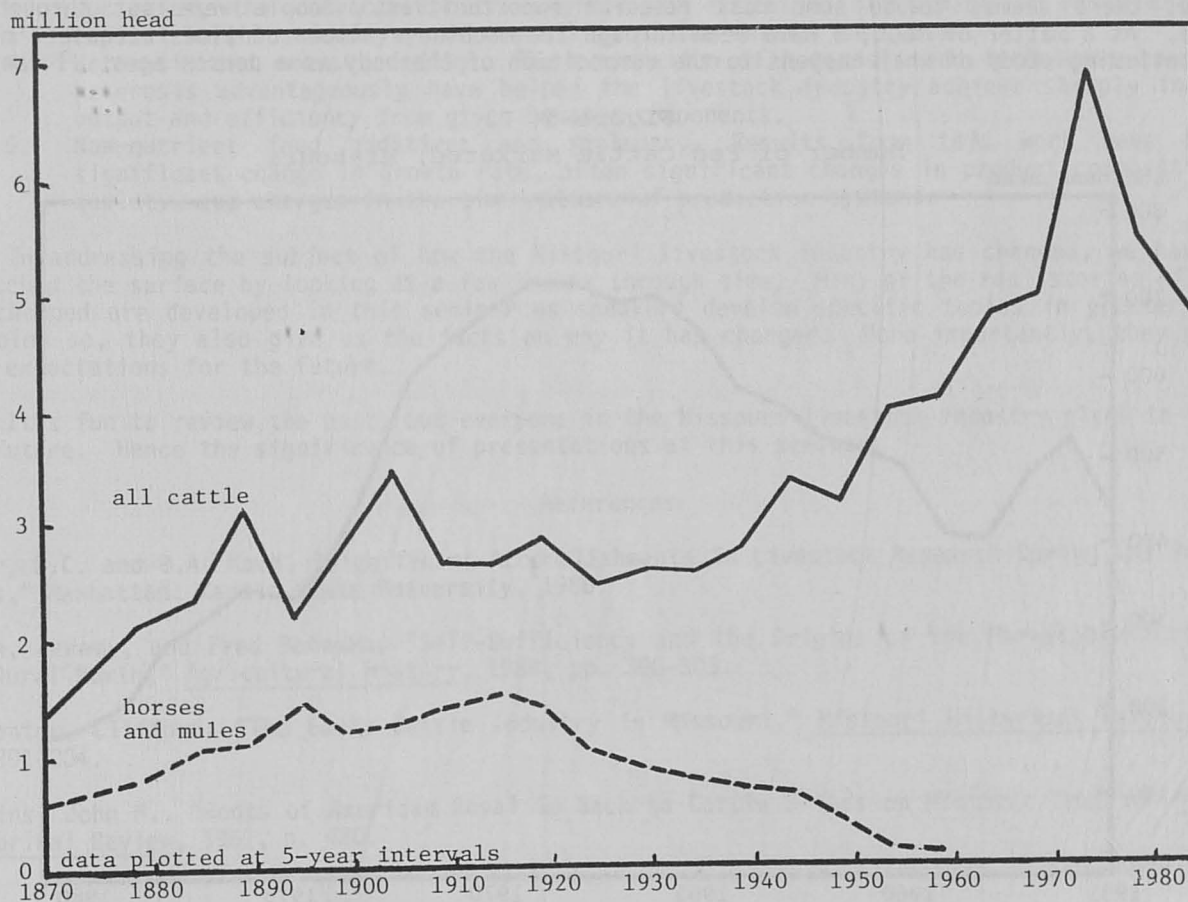
The show was named "American Royal" subsequent to attendance by Dean C. F. Curtis of Iowa State College, a noted livestock judge, at a British Royal Livestock Show and later, the Kansas City Hereford-Shorthorn Show. According to Collins, he told Walter Neff, editor of the Daily Drovers Telegram, that the Kansas City show compared favorably with the British Royal. Neff wrote an editorial published January 1, 1901 in which he suggested, "Call it The American Royal."

In March of 1909, the official report by the Department of Animal Husbandry of the University of Missouri had the following: "The longest and most extensive series of continuous cattle feeding experiments in the world were being carried on by the Animal Husbandry Department of the Missouri University. Since 1903, more than 130 separate cattle feeding experiments had been conducted with more than 700 head of cattle. The experiments covered a whole field of cattle feeding from merely wintering stock cattle to the finishing of the highest price beef sold on the Chicago markets." The experiments covered five years and demonstrated that the cost of the gains in a seven month feeding period was from 50 to 60 percent greater than in the first three months. Another important fact discovered was that the leaner the animal at the time of feeding, the better use it makes of its food; and the fatter the animal, the more it costs to make a pound of meat (Mumford, page 111).

Figure 4 shows the number of cattle on farms in Missouri January 1 from 1870 to date. There

Figure 4

Number of all Cattle and of Horses and Mules on Missouri Farms



were more cattle in this state in 1905 than in 1950. Cattle numbers in the state peaked about 1975.

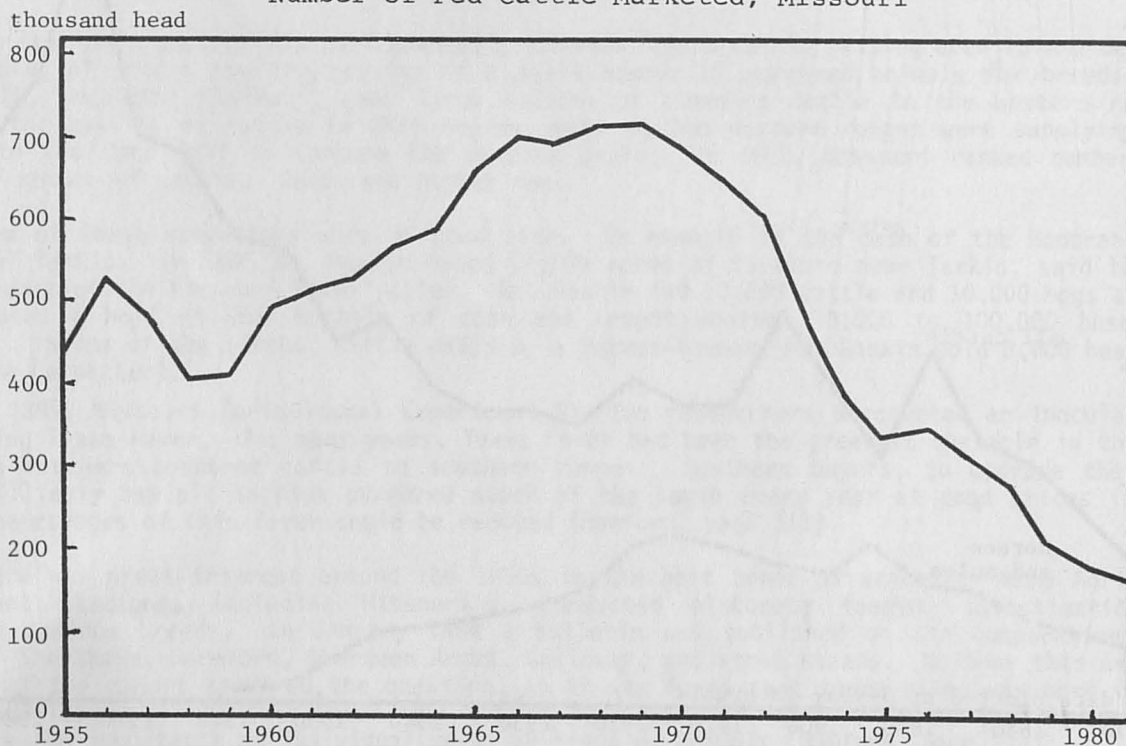
Another interesting series is the number of fed cattle marketed from Missouri. Figure 5 presents annual data from 1955 to 1981. Fed cattle marketings reached a peak in 1969 and then declined rather sharply to 1981, at which time the series was discontinued.

Since Missouri has been strategically located in the development of the livestock industry, it is only natural that there have been significant institutions in the state that relate to livestock. I mentioned earlier the development of the large terminal livestock markets and the associated meat packing centers. Within the state at least two livestock feed companies have developed that have grown into international operations. Nutrena started in Kansas City in 1922 and Ralston Purina started in St. Louis. In addition, there are to be found breed association headquarters, trade association headquarters, and manufacturers of products used by or derived from the livestock industry. The livestock industry is certainly an integral part of the economy of Missouri.

There are many ways in which the presence of a thriving livestock industry has had an impact on the culture of Missouri. One example that is perhaps obscure, but with which I am acquainted, is worth brief mention. That's the presence on this campus of the low level radiation (whole body) counter. Early interest on the part of livestock marketing executives in finding a means to determine lean/fat proportion of a live animal prompted them to contribute money to the establishment of a facility here at the University of Missouri. The machine counts the number of electrons given off, and since fat and lean differ in this regard it is possible to determine the fat/lean ratio. Business firms provided the seed money and a grant was obtained; and I understand that this is the only whole body counter in existence in the country that can be used for both humans and livestock. It has an obvious advantage in terms of selecting breeding livestock. By just putting the bull or the heifer or boar or gilt in this machine for five minutes, a researcher can get a reading and say that it is, say, 80 percent lean and 20 percent fat. Such non-destructive testing is very valuable.

Because on this campus there is a school of medicine as well as the Agricultural Experiment Station, there seemed to be some real research opportunities. People were put through the machine. As a matter of fact, I have been through the machine a number of times because I'm part of a continuing study of what happens to the composition of the body as a person ages. I can tell

Figure 5
Number of Fed Cattle Marketed, Missouri



you that it is a wonderful machine, although it sometimes tells you more than you really want to know. The data are accurate, but need interpretation. For example, athletes in good condition will have a body fat composition of five to ten percent. Homecoming Queen types, on the other hand, may run 35 to 40 percent fat. I just checked with the person operating the facility and learned that in addition to the usual good work with animals and people there are special people studies underway on treatment of diabetes, emphysema, and osteoporosis.

Early in this presentation, change in technology was identified as one of the most important causes of change in the livestock industry. I want to focus on changes in technology of livestock production. To do that I call attention to significant accomplishments in livestock research during the past 100 years. Obviously, these developments are not the only factors that have caused the Missouri livestock industry to change, but they were important.

Duane Acker and B. A. Koch presented a paper at the Animal Science meetings entitled "Significant Accomplishments in Livestock Research During the Past One Hundred Years." The paper summarized the judgments and perceptions of 101 society members who have received major awards of the Society for particular accomplishments in livestock research that were regarded as holding the most significance. The research accomplishments ranked as the top five by the 101 animal scientists were as follows: (1) artificial insemination; (2) cross breeding; (3) non-nutrient feed additives in non-ruminant nutrition; (4) non-nutrient feed additives in ruminant nutrition; and (5) embryo transfer.

The authors added their own choice of research accomplishments they believed were most significant:

1. The explanation of nutrients' role in animal metabolism. Much of this research was done in the late 1800s and the early 1900s.
2. The concept, measurement, and use of heritability. Permanent improvement in populations is achieved by selecting whole animals. Heritability estimates for economically important traits permit construction and utilization of selection indexes. Thereby, selection decisions can be made more accurate, precise, and economically advantageous.
3. Disease and parasite diagnosis, control and prevention. In all of agriculture, in all societies, the characteristics required for sustained investment of money and human capital is the security or dependability of the enterprise system.
4. Heterosis and cross breeding. The explanation of heterosis and techniques to utilize heterosis advantageously have helped the livestock industry achieve sharply increased output and efficiency from given genetic components.
5. Non-nutrient feed additives and implants. Results from this work have brought significant change in growth rate, often significant changes in product composition and quality, and changes in the time pattern of production systems.

In addressing the subject of how the Missouri livestock industry has changed, we have only scratched the surface by looking at a few trends through time. Many of the real stories of how it has changed are developed in this seminar as speakers develop specific topics in greater depth. In doing so, they also give us the facts on why it has changed. More importantly, they give us some expectations for the future.

It's fun to review the past, but everyone in the Missouri livestock industry plans to live in the future. Hence the significance of presentations at this seminar.

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THE PLACE OF LIVESTOCK IN MISSOURI AGRICULTURE

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Just after World War II Richard Rodgers and Oscar Hammerstein, III charmed audiences with a tilted line in the musical Oklahoma!, "The cowman and the plowman should be friends."

Most persons hearing it likely asked, incredulously, "Weren't they always?" The answer is, "No." They definitely were not friendly in pioneer years on the Plains. Herders of cattle and pushers of the chisel plow vied for land, for protective laws such as fenced enclosure (or freedom from it), and for social acclaim. And although relationships between animal and crop agriculture, for which Hammerstein's cowman and plowman are proxies, have seldom been as acrimonious as in old Oklahoma, some degree of contest between them has rarely been absent.

The animal and crop sectors of agriculture are distinctly different. They differ in resources employed, in the nature of demand for their product, in the origin of economic shocks to which they are subject, and in national policy applied to them.

In one respect, though, the two sectors have been about equivalent. As an average over many years livestock and their products, and crops and crop products, have been of roughly equal magnitude in terms of gross cash receipts from products sold. This broad equivalence can mask, though, the wave-like motions, historically, in relative contribution of the two sectors to gross income. For a number of years after World War II animal agriculture enjoyed a bright place in the farm-income sun. In the last 10 years it has been in the shadows. That, as the saying goes, is why we are here -- why this seminar is being held.

A matching cyclicity is seen in the prestige factor attached to animal versus crop agriculture. I once called it the snobbery coefficient.¹ Maybe Hammerstein's cowman and plowman had trouble being friendly because a girl had to choose between them. A prospective bride always assesses the social status of the bidders for her hand.

Anciently, the cowman, or cowboy, had the worse of it. In the annals of history the herding of animals has been regarded as lowbrow. In the biblical story of the heralding of the birth of Jesus, the shepherds in the fields were the first to know. This has been interpreted for 20 centuries as telling us that Jesus's mission was to ordinary people. The shepherds were ordinary indeed.

I could even make a case that high respect for livestock and livestock farmers is a development of modern times. And to carry this social register analysis one step further, animal agriculture has its own internal prestige ranking. Owing in part to glamorizing of the cowboy in movies and on TV, cattle have had the best of it. The old hen or caged broiler is at the bottom of the scale. Neither is popularized by anyone.

I sense that movies and TV aren't doing as well by cowpokes nowadays as they did a few years ago. If so, that could relate to the doldrums that surround the beef business. At least we can treat the idea as mind-pricking.

Crops and Livestock in Sequence

Crop and livestock/poultry enterprises are successive stages in the farm-and-food system. Almost 25 years ago I wrote an article titled, "The Three Economies of Agriculture." The first economy, I wrote, is the production of "primary products from that unique resource, the soil." The second is production of livestock and poultry. Irrespective of where it is done or by whom, it is a secondary enterprise. "It is a process of conversion of bulky raw materials into less bulky finished or semi-finished goods. . . ." The third economy, I explained, is marketing.²

¹Harold F. Breimyer, Farm Policy -- 13 Essays, Ames: Iowa State University Press, 1977, pp. 4-5. that Jesus's mission was to ordinary people. The shepherds were ordinary indeed.

²Harold F. Breimyer, "The Three Economies of Agriculture," Journal of Farm Economics, August 1962, pp. 679-99.

The sequential interconnection between crops and livestock goes far to account for both the economic situation in each sector and the policy issues that arise. Obviously, the livestock sector is closer to consumers and is the more sensitive to all that happens to them. The sector has hopes of being able to influence consumer preferences and demand. By the same token, that sector is strategically located to transmit back to crops some of the shocks, good or bad, that reach it from consumers. The crop sector, in turn, has long employed commodity programs to protect itself against unfavorable shocks as well as to enhance its status generally. But then, reciprocally, the terms of acreage and price support programs for feed grains and soybeans exert a feedback effect on livestock and poultry. It's an interesting interrelationship.

Structure of the Livestock and Poultry Sector

Even though the crop and animal sectors of agriculture are distinctive and sequential, the practice over many years has been to look at them together because they have been linked so closely on individual farms. The trend in our day is to disjoin them. A question is properly raised whether the separation now underway will continue. Professor Rhodes addresses it in his paper.

Still today animal agriculture retains enough identity with traditional agriculture that its ups and downs hold a lot of meaning to the income level and welfare of all agriculture. This is particularly true in the nation's heartland, including Missouri. Hence, again, the reason for this seminar.

But the progressive detachment of some parts of animal agriculture from farming as we have known it is also a part of the current scene and definitely an issue in policy.

As I have long had an interest in the organizational structure of agriculture I offer a few comments.

I confess to a mixed feeling as to how to characterize and classify some versions of today's animal agriculture. It is hard to call an egg city of a million hens, or a huge cattle feedlot, a "farm." The operation is more like a factory. Furthermore, calling those giants single farms confuses the statistics on size distribution of U.S. farms. Many of the multi-million-dollar farms the Census reports are large egg, cattle feeding, or hog installations. In addition, those operations try to milk the image of a farm for all it is worth. A decade or so ago integrated broiler producers sought to exploit the notion that inasmuch as they produced farm products (broilers), the Capper-Volstead³ law excused them from conforming to anti-trust rules. The U.S. Supreme Court set them straight.

If at some time in the future all livestock and poultry production is converted to factory mechanization, data for it will no longer be reported by the National Agricultural Statistics Service, but by the Census of Manufactures. The University of Missouri-Columbia might still hold a seminar on the economics of livestock, but it would be staged by the business school. Farm politics would be simplified, being confined to field crops. Animal enterprises would look for political support among business allies.

My own sentiments are traditional. I would not like to see all animal agriculture put in the hands of Tyson, General Foods, Occidental Petroleum, and DuPont. It's almost a matter that, to me, factories are appropriate for metals, plastics, and wood, but not for living animals. Also, I remain partial to the idea that that there is some economy in converting bulky feedstuffs into animal products close at hand.

³A Washington Post news item of August 8, 1986 reminds that the issue is not dead. Several integrated broiler firms complained loudly that two of the giants, Tyson and Perdue, were getting tax breaks of many millions of dollars on grounds they were "family farms." Reportedly, tax overhaul did not end their privilege.

Uncertainty About Exports Puts Focus on Livestock

The above comments are something of a digression. I return to the theme that animal agriculture is in economic trouble, and that its welfare is important to all agriculture. To repeat, here in the heartland animal and crop agriculture are still closely linked. Only poultry is essentially detached. Dairying remains traditional here and elsewhere except in a few places such as Florida and California. Beef cattle, hogs, and sheep are still more agricultural than industrial.

The fortune and future of the livestock sector still holds significance to all agriculture.

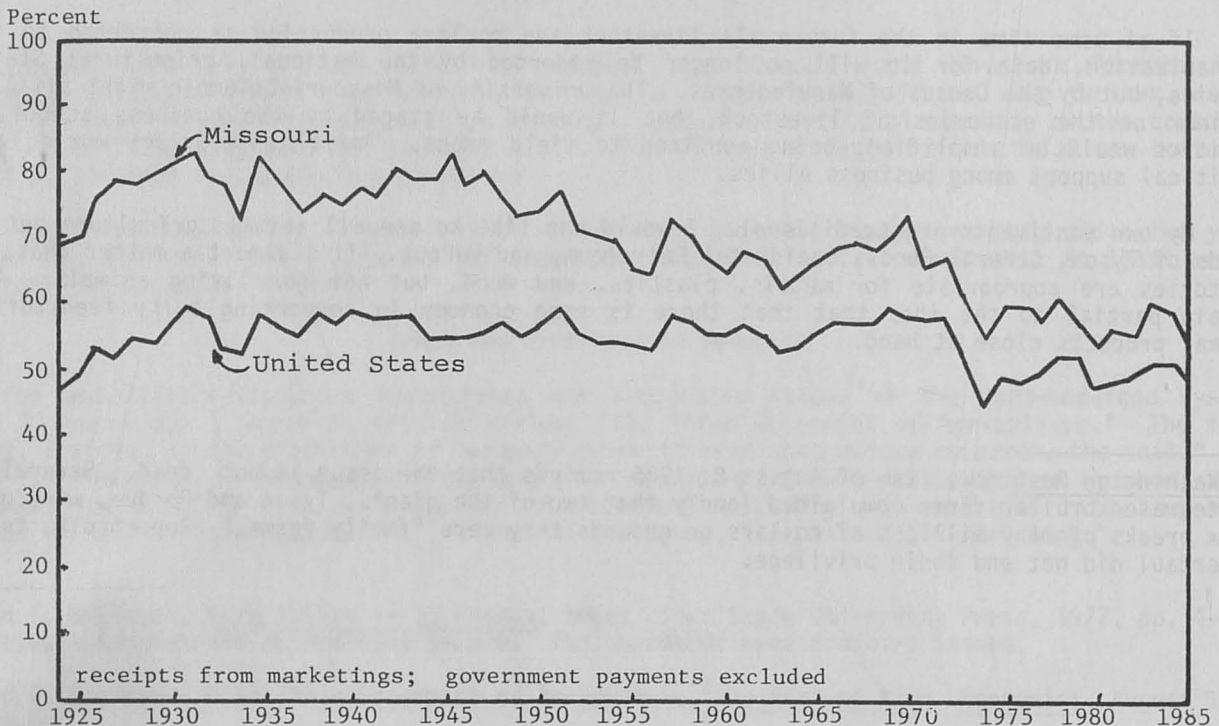
Prospects in that sector particularly get attention now, in the mid-1980s. It's not just a matter that both cattle and hogs have rarely been profitable in recent years, though hogs are paying off well at the moment; or that dairying is in a difficult spot. Even more significant is that the export markets for crops are proving unreliable. An old and disturbing question has re-entered the minds of many people. It is whether it will prove necessary to give up on export markets as the foundation of U.S. agriculture. If that should be the case, we will seek revitalization of agriculture via domestic demand, emphasizing demand for the high value foods of animal origin.

Livestock and Crops as Income Sources

Over the years, as I noted above, the animal and crop sectors have contributed about equal parts of all receipts from marketings of farm products in the United States. A more precise statement is that just a little more than half of all receipts have come from livestock and products in most years, and just under half from crops (see chart).

Crop sales, obviously, include many commodities in addition to feedstuffs. For that matter, income from livestock includes honey sold! Nevertheless, in a general sense the data for all crops and for all livestock and products reveal a lot about fluctuating relationships between feed crops and livestock.

PERCENT OF FARM CASH RECEIPTS COMING FROM LIVESTOCK
UNITED STATES AND MISSOURI



I begin with World War I (not charted). Booming wartime demand for all food was relayed faithfully back through livestock to crops, and receipts from crops were more than half of all gross income. In the following decade, though, consumer food demand weakened. By the time of the Great Depression, the crop share of all farm receipts was down to 42-43 percent. Livestock receipts were 57-58 percent of the total.

Data for years of World War II were affected by price controls. After the war, animal agriculture entered its glory days. There was little faith that wartime export demand for crops would hold up. There was a lot of faith that our own consumers would enjoy steadily rising incomes and that, further, they would spend a generous part of it for meat, milk, and eggs.

The late H.E. Babcock was the evangelist of an animal agriculture. I still have the plastic animal that was distributed widely as a promotion gimmick. The specimen with head of a hog, a chicken's comb, a steer's rear quarter, a pig's tail, and of course an udder could lay eggs, a stick of butter, or a quart of milk.

Confidence in animal agriculture stayed alive for a generation. True, the butter-margarine battle was lost; but beefsteaks were the mark of good living and cattle numbers climbed to ever higher peaks in each successive cycle. Meantime, crop exports increased at only a measured pace. P.L. 480 was necessary to shore them up.

Statistically, the momentum carried forward well into the 1970s. Total red meat consumption per capita kept going up until 1971. Some of us sensed, though, that the starch had begun to wash out of the livestock industry prior to that time.

In any event, the grain export boom that was initiated with the sudden sales to the Soviet Union in 1973 turned the tables fast. Since then, all the sentiment has been pro-crop. In the 1970s we were told that the United States was going to feed much of the world and that exports would henceforth underpin a prosperous agriculture. Animal agriculture slipped into the shadows. Even the cowboy was deglamorized on TV screens, as I observed above.

In the later 1970s, only 50 percent of all cash receipts came from livestock, the lowest percentage since the 1920s. In the 1980s it continues to hug the 50 percent mark.

Consumer Demand

There is little confidence these days in Babcock's prediction that U.S. consumers will have ever more money to spend and will be quick to spend it for good, tasty, nutritious red meat and other foods of animal origin.

The livestock sector has taken a double whammy. First, consumer incomes expressed in purchasing power have essentially been stagnant. They no longer trend steadily upward. Secondly, relative to those incomes the demand for red meat has weakened, and it has not been as strong as often supposed even for poultry.

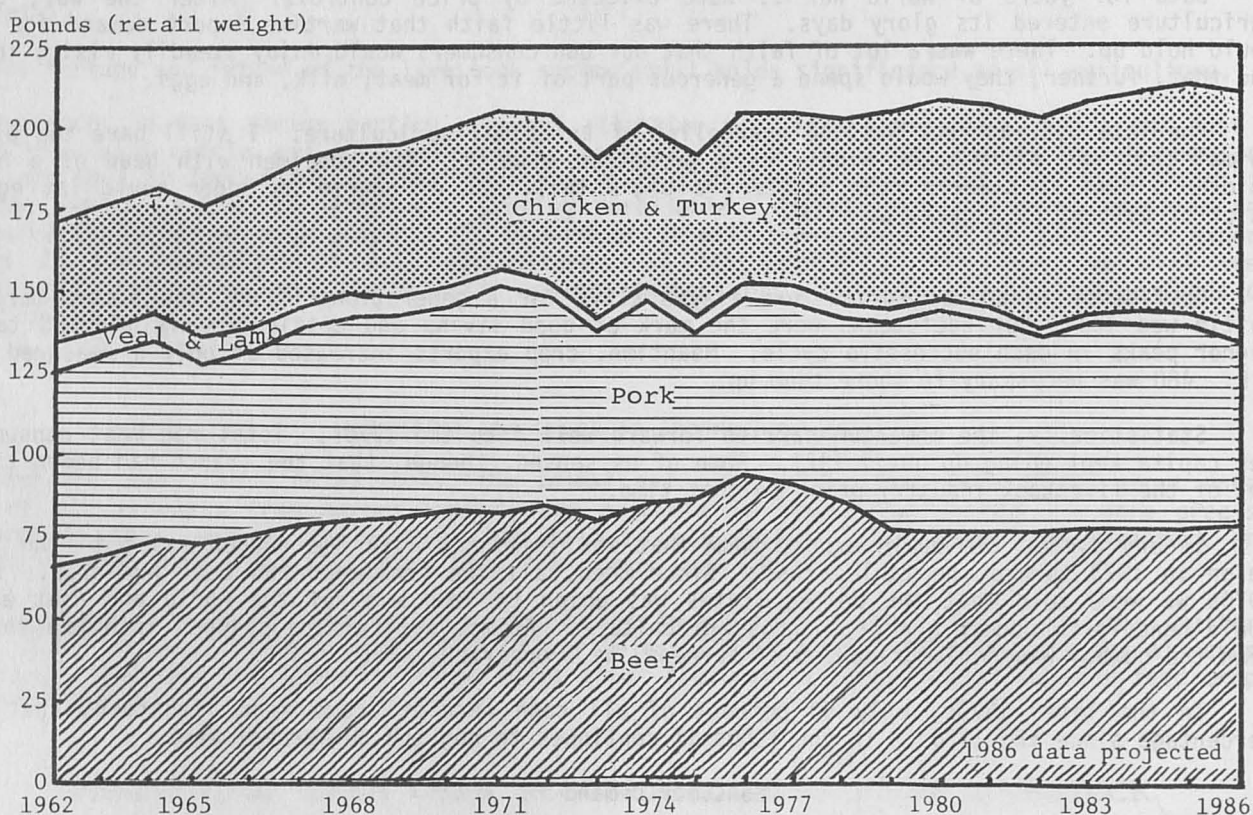
We begin with data on consumption rates. Total consumption of red and poultry meat combined leveled out about 1971 and has changed little since that year (see chart). But there has been a major shift from red meat to poultry. I will let partisans argue whether the two foods match well in taste or nutrition, but because poultry is cheaper the trend represents less consumer spending for all meats and less income to farm producers. Also, less feed is required to produce a pound of poultry than of red meat. Altogether, the shift from red meat to poultry is a net loss to agriculture.

Data on consumption rates do not tell much about consumer demand. After all, we eat all that is produced, and the quantity produced reflects, in large measure, the resources at hand. Some of us who have followed developments for many years have felt sure demand has weakened. My calculations, though, have been done with a pencil on an envelope (instead of the inside of a barn door that my father used).

Recently James Mintert and Professor Curtis Braschler in the department of agricultural economics at UMC have put not pencils but computers to work. Their findings are even more negative than my pencil pushings. Mintert reports that there has been a "structural shift" in demand for

beef and pork during the years 1950-84 that he studied.⁴ He means that relative to any specified level of income available to consumers, expressed in "real" (i.e., deflated) terms, consumers are unwilling to pay as much money for a pound of beef or pork as they did 20 or 30 years ago. Their demand has weakened.

CONSUMPTION OF RED AND POULTRY MEAT PER CAPITA



In a separate study, Professor Braschler gets astonishing estimates that if consumers' demand relative to their incomes were as strong now as in 1950-70, and if supplies put on the market stayed the same as now, the price of beef at retail last year (1985) would have been 50 percent higher than the actual price, and the price of fed steers at Omaha would have been almost three times the actual price received. If demand for pork were still as strong as in 1950-70, last year's retail pork price would have been twice the actual price and the price of hogs would have been four times the 1985 average.

Some of the previous demand for red meat has shifted to poultry. But that is by no means a complete explanation. Professor Braschler finds that demand for poultry meat also has weakened. If demand for broiler meat were unchanged, prices would be three times higher than actual prices for both broiler meat and live broilers.

Manifestly, if demand were still as strong now as earlier, production would have responded. Prices would likely be only moderately above their actual level. But feed use would be up, and feed grain surpluses appreciably smaller.

The analysis has, of course, an error term. But even if the findings are scaled back a bit, their impact remains impressive: the loss in demand for red meat has been substantial, and it has not been offset fully by increased demand for poultry.

Those of us who listened to H.E. Babcock and believed with him that red meats and in fact all livestock foods are a part of Americans' good life now find ourselves in an uncomfortable position. We dare to suppose that the U.S. livestock industry shares our discomfiture.

⁴James H. Mintert, "Beef and Pork Demand: An Examination of the Structural Change Hypothesis," Ph.D. Dissertation, University of Missouri-Columbia, 1986, p. 133.

Moreover, in spite of all the magic of computerized research, little analytical evidence explains what has happened, or foretells the future. For my part, all I can do is offer judgment.

A basic issue, to be sure, is whether our citizens' life styles and value systems have altered so much that good food is not appreciated. Are we in an era of junk food and soft drinks? I heard recently that we now drink more soda pop than water.

How much effect do demographic changes have? I know that as a senior citizen my consumption of all food, and of meat in particular, has been reduced appreciably. And we senior citizens are getting to be pretty numerous.

My thesis, or hypothesis, puts more emphasis on general economic trends. In capsule summary, for 15 years economic growth has lagged. That which has taken place has been almost confined to defense production and the arena of services including health services and taking care of old people. Income has been redistributed slowly away from rank and file employed middle class workers. All these trends militate against demand for the higher-valued foods.

Regarding the big military component in the economy, the guns versus butter issue is still valid. And with respect to incomes of the working population, the average income of the middle class or lower-middle class worker has been essentially static, in purchasing power. Henry Ford paid the people who made his model T car five dollars a day so they could afford to buy his car. It's not an idle quip that livestock producers, even as automobile manufacturers, have a lot at stake in the buying power of the rank and file of American citizens.

Livestock in Missouri Agriculture

The title assigned for this paper centers on Missouri agriculture, yet most of the above discussion relates to the nation. With regard to broad forces at work, there is nothing exceptional about Missouri. Missouri crop and livestock producers are subject to developments of national scope.

Moreover, in another paper Ronald Plain reviews the resource base for Missouri's animal agriculture.

We can say that Missouri is almost a microcosm of U.S. feed crop/animal agriculture. It has pastures and range land, feed crop production, and all species of livestock and poultry. It produces feeder calves and pigs, and fattens both species. Its climate may be less than ideal, yet is intermediate between the heat of the south and cold of the north.

Having admitted all that, I call attention once more to the chart showing the relative contribution of crops and livestock to gross farm receipts. Missouri was once primarily a livestock state. Now, the proportion of Missouri farm receipts coming from livestock scarcely exceeds the national average.

Apparently, Missouri farmers who once fed most of their feed crops to livestock were even quicker than their counterparts elsewhere to stop tending animals as soon as income from cash corn or soybeans proved lucrative enough. It is likely, too, that Missouri livestock feeders were less able to compete with the emerging commercial operations in other states. This is definitely true for cattle feeding. It is less clear whether Missouri has lost out in the trend toward confinement hog operations.

Not in doubt is that Missouri agriculture will be sensitive in the future to developments in export markets for crops, and in domestic demand for the products of animal agriculture. Missouri cannot disregard the question of the future structure of animal agriculture. Will Missouri livestock production remain linked with feed crops on individual farms, or move progressively to a more industrial status? Missouri remains important in dairying; it has much at stake in what happens in that troubled enterprise.

Issues in Policy

This paper is being given at a policy seminar, yet policy issues can only be flagged. The first issue, as always, is whether anyone cares what happens to animal agriculture, including whether much of it remains a part of farming or, instead, is removed entirely to the agribusiness

sector. The only suggestion I make at the top of my voice is that if people do care, they must address the more important considerations first, and not get lost in secondary matters such as imports of casein or whether to double a check-off rate for promotion.

The livestock sector is affected greatly by the terms of acreage and price support policies for feed grains and soybeans. The reflexive response is to favor low price support levels. Under the 1985 farm law, loan rates for those products are indeed low. Feed grain producers are protected by sizable deficiency payments.

If livestock producers could be sure the new level of supports on feed crops would stay put for several years, that level would indeed be attractive. My own judgment formed over many years is that the livestock and poultry sector is not affected so much by the precise level of feed price supports, as by their stability and dependability. My further judgment is that in recent years the feed programs have been undependable. They have been so changeable as to be, on balance, harmful to livestock.

What about the structure of animal agriculture? Is it to be a national policy at least to retard its detachment from farming as such? If that be the case, several policy tactics are available but the first is to end every income tax shelter. The new tax law ends some but not all. Enforcement of anti-trust laws would help. It is conceivable that farmers' cooperatives, never strong in animal agriculture other than dairy, could have a role to play. I am not sure. All I can add is that questions about the structure of animal agriculture cannot be answered until they are asked.

Livestock (including dairy) interests have devoted most of their policy attention to the two subjects of foreign trade and market development. With regard to foreign trade, efforts relating to animal products that are exported, such as broilers and some pork and beef, have been directed mainly to removing buyers' trade barriers including sanitary restrictions. More energy has gone, though, into pressing for our own import restrictions. Dairy producers have been in the forefront but beef people have wanted import quotas and hog producers have got in the act on occasion.

The foreign trade issue is complicated by the interest of agriculture as a whole in maximizing exports and keeping trade channels as unrestricted as possible. But even the livestock and poultry sector is essentially in balance in foreign trade, as in most years exports and imports are of about the same value.

Market development is, just now, front and center among policy issues in livestock. Check-off funding of promotion is on a roll. Economists admit to being of a mixed mind. If changing lifestyles of consumers are in fact a major negative factor and if adroit "education" can be effective, effort directed to that end can obviously pay off grandly. A renewed focus on quality in meat products, notably the minimizing of trimmable fat, surely goes hand in glove with market development. The other side of the coin is the skepticism of most economists regarding merely hawking one food product against another. When all foods get hawked equally, it's possible that the effects about cancel out. The least to be said is that sophistication, not high-decibel declaiming, should mark any market development effort that stands a chance of success.

Finally, a word on dairy policy. I have scarcely touched the topic. On the one hand, milk producers respond to feed price policy in the same way as all livestock and poultry producers. On the other hand, dairy price policy is so much an issue of its own, and so complex, that not only a separate paper, but a separate seminar, would be required to treat it fairly. I offer only one summary judgment. The capable economist of Cornell University, Kenneth Robinson, has said recently that for dairymen he sees "no realistic alternative to the existing programs but to consider a base-surplus plan with higher returns offered for base production and lower returns for any milk produced in excess of a fixed base."⁵ I find the idea persuasive.

My concluding remark is essentially to legitimize giving attention to issues in the animal agriculture of Missouri and of the nation. My private hunch is that although export markets will surely revive eventually, for a number of years agriculture may have a great deal at stake in the vitality of demand of our domestic consumers for the food products of the animal portion of our agriculture. It merits our attention.

⁵Kenneth L. Robinson, "Coping with Excess Capacity in Agriculture," Department of Agricultural Economics, Cornell University, April 11, 1986, p. 14.

THE PLACE OF LIVESTOCK IN MISSOURI AGRICULTURE --
THE DAIRY PERSPECTIVE

William Blakeslee
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Springfield, Missouri

It's a pleasure to share my thoughts on the dairy industry's perspective of the place of livestock in Missouri agriculture.

Harold Breimyer states that as the nation goes, so goes Missouri. That statement is generally true in regard to dairy with the possible exception of regional differences in milk production. Also, there are differences within a state. Dairying in southwest Missouri, for instance, differs somewhat from that in other parts of Missouri. At times, efforts have been made to lift prices of all Missouri farm products above the level of other states, even to 100 percent of parity, but that is not possible and nothing has materialized.

As the dairy industry in Missouri is impacted by national dairy policy and as that policy is reflective of the importance that Congress places on the dairy industry, it is important to review briefly the importance of the dairy industry to the nutritional well being of the consumer. According to a USDA publication released recently, dairy products excluding butter provided the following components of consumer diets nationally in 1984.

10.3 percent of all food energy
20.9 percent of protein
11.7 percent of fat
6.0 percent of carbohydrates
75.8 percent of calcium
35.8 percent of phosphorus
19.1 percent of magnesium
2.3 percent of iron
19.7 percent of zinc
11.6 percent of vitamin A
8.9 percent of thiamine
34.7 percent of riboflavin
1.6 percent of niacin
11.5 percent of vitamin B6
20.1 percent of vitamin B12
3.1 percent of ascorbic acid

Clearly, the dairy industry supplies a large portion of the nutritional needs of consumers nationally. The nutritional importance of the dairy industry has been recognized by the Congress of the United States for many years, as various pieces of legislation have been enacted to maintain a viable dairy industry capable of producing an adequate, stable, and dependable supply of domestically produced milk. The dairy industry is an important part of the U.S. economy and has a good future on a national and Missouri basis.

It is important that we recognize that this country must have a domestically produced food supply. We cannot afford to have our food supply dependent upon foreign countries in the same way that we have become dependent for a large portion of our energy needs.

We cannot assume that Congress will automatically enact the appropriate dairy policy. We plan to be there to help Congress at every opportunity.

Nationwide and within the state of Missouri, the dairy industry has been going through a reduction in the number of producing units. Dr. Cramer's paper describes accurately the historical changes in Missouri livestock including dairying. In 1975 there were about 233,000 commercial dairy farms nationwide. Currently, there are about 175,000, a decrease of 25 percent. While the number of dairy farmers was decreasing, the herd size and production per cow were increasing.

According to USDA statistics, the number of dairy farmers has fallen faster in Missouri than nationally. In 1975, 22,000 operations in Missouri had dairy cows. In 1985, 11,000 operations had milk cows, a decrease of 50 percent. It is likely that much of the decline in number of dairy farms can be linked to the reduction in number of small processing plants. In 1975, production per cow in Missouri was 9,873 pounds and in 1985, production had increased to 12,371 pounds, a gain of 25 percent.

Although an increase of 25 percent in production per cow is large, Missouri still lags considerably behind California. In 1985, California's production per cow was 16,667 pounds. However, production per cow of 20,000 pounds is not uncommon in southwest Missouri.

Production per cow in California is high as a result of the technology that has been adopted in California operations. The California dairy production technology has been migrating eastward into Arizona, New Mexico, and, recently, Texas. It is not unusual for operations in those states to maintain a milking herd of 10,000 head.

I was recently on a dairy farm located between Las Cruces, New Mexico, and El Paso, Texas, on Interstate 10. The particular farm I visited was only 40 acres in size. At that time, two milking barns were being utilized and the milking herd was just under 5,000 head. Plans were to expand it quickly to 10,000. The dairy farmer purchased all of his feed and most of it was grown along the Rio Grande Valley and was of extremely high quality. The dairy farmer had just purchased his first cutting of alfalfa hay at a cost of \$450,000.

The California style operations are highly specialized. Thus far the California dairy production technology has not proved adaptable to Missouri, primarily because of a difference in humidity and annual rainfall. Most of the nation's large operations are in areas of low humidity and low annual rainfall so that muddy barn lots are not a problem. Herd health problems also are reduced.

Another indicator of the future of the Missouri livestock industry is the profitability of each of the livestock enterprises. One measure of profitability is net income as a percent of cash receipts, or sales, of the various enterprises. During the period 1976 through 1985, the return on milk production was 22 percent of cash receipts and ranged from a low of 16 percent in 1984 to a high of 29 percent in 1978. For the most part, dairying has been stable, with small year to year variations. Beef and cow/calf operations during the same 10 year period, by contrast, have shown an 18 percent average loss, and the net ranged from a 21 percent gain in 1979 to a 35 percent loss in both 1977 and 1983.

Hog producers during the same 10 year period show a minus 3 percent net income as a percent of cash receipts. The range is from a minus 16 percent in 1981 to a plus 16 percent in 1978.

The October 27, 1986 issue of the Missouri Farm Management Newsletter states that in Missouri "over time hog farms probably show the greatest variation in profitability, while dairy farms on the other hand show the greatest stability of income and have been up to this point able to avoid both the extreme peaks and lows in profitability." Dairying has enjoyed stability and profitability for a number of years which likely is one reason why milk production has increased both from the individual producer standpoint and also by attracting assets from other agricultural enterprises -- assets not really needed in dairy.

Because of this influx of assets and the rising output per producer, national milk production began to increase in 1979 and has increased every year since then except 1984, when the Milk Diversion Program was in place. During that same period, purchases of dairy products by the Commodity Credit Corporation increased, as did the cost of the program. The CCC purchases and cost brought much criticism, and charges that instability had replaced the stability that the dairy industry had enjoyed for years.

During the last six years, five different pieces of dairy legislation have been enacted intended to bring about a balance in milk production and demand. The most recent law is the Food Security Act of 1985. This act provides for the Whole Herd Buyout program, and an assessment on all milk produced to help offset the cost of CCC purchases. It also contains reductions in support prices scheduled over the the next several years.

Milk production nationally is projected to be down between one and three percent in 1987 from 1986. While production will be decreasing, milk consumption continues to increase and since 1984 has maintained a three percent-per-year advance. In 1986, consumption through August was over 4 percent above the same period of 1985. Another increase in consumption can be expected in 1987.

The actual and projected consumption gains, including donations, indicate a good future for dairy nationally and in Missouri.

Projecting the production and consumption of milk and milk products to 1990 indicates that the industry should be in relatively good balance by 1990, with gradual increases each year between now and then. Reductions in the support price for milk are programmed, and will likely

take place during each of the forthcoming years. They will result in a total drop of \$2.00 per cwt in the support price, from the current \$11.60 to \$9.60. Prices will likely exceed the support level at least seasonally, thereby maintaining adequate dairy farmer income and resulting in slight increases in milk production.

Repeating Professor Breimyer's statement that as the nation goes, so goes Missouri, we can expect the dairy industry in Missouri to continue to be stable and profitable. It is likely that milk production units from the Lake of the Ozarks area north, and in the eastern part of the state, will continue to be reduced, and concentration in southwest Missouri will increase. The southwest Missouri area is ideally suited for the production of milk and has been a strong production area for a long number of years.

Although our national policy with regard to dairy is to bring production and consumption closer into balance, we must be cautious in Missouri not to ignore bringing about continued efficiencies in the production of milk in the state. We are going through a shake-out in milk production units nationwide. Some people have projected that by 1990 fewer than 100,000 farms will be producing milk. Whether that prediction will come true remains to be seen. But we can agree that dairy farmers will continue to be reduced in numbers, will continue to increase in size, and will continue to increase in the use of technology. It will be the efficient dairy producer who survives the shake-out.

It is incumbent upon all of us to work together to maintain a strong agricultural production unit in this nation. It is also incumbent upon university Extension to continue to work with dairy farmers, particularly in the southwest Missouri area, to help them to adopt new technology and become more efficient so as to survive and thereby contribute to the income of rural southwest Missouri and also to the state total.

If we take the attitude that there's too much milk nationwide and do nothing to improve efficiencies in the production of milk in this state, we may well end up losing a large number of dairy farmers, contributing to the economic demise of rural areas of the state of Missouri. If this happens, serious questions can and will be raised as to how the rural areas of the state will survive. Who will educate the children in those areas? Who will maintain county governments? Who will maintain county bridges and county roads?

In conclusion, as we are participating in a policy seminar, it is important that we examine and utilize the comparative economic advantages this state has in the various agricultural enterprises and pursue those comparative advantages to the extent of our ability. Although that admonition may seem inconsistent with a national dairy policy designed to reduce milk production, it should be noted that the national policy is not necessarily to reduce milk production but rather to bring milk production and milk consumption into closer balance, and to reduce government purchases and government cost.

Professor Breimyer quoted the musical line that the plowman and the cowman should be friends. I submit that the plowman and the cowman must be friends. They must work together.

There are about 2 million farmers in this country. The total population is about 240 million. A simple calculation reveals that farmers represent only 0.8 percent of the population. This statistic alone demands that farmers and farmer organizations work together to develop agricultural policy. We can not afford to have commodity groups fighting each other for a "preferred position." The Bible says that a house divided against itself will fall. An agriculture divided against itself could fall, and the fall certainly would not be very profitable.

THE PLACE OF LIVESTOCK IN MISSOURI AGRICULTURE -- THE PORK PERSPECTIVE

Lois E. Phillips
Phillips Farm
Drexel, Missouri

I have spent 20 years trying to decide whether I am a farmer, and in spite of a great many speeches, no one has answered the question for me. When my husband and I came to the farm in 1967 I didn't know we were "pioneers" in the area of agricultural specialization. I had grown up on a typical farm where we had a little bit of everything. After graduation from college I was away

from the farm scene for 13 years. As Jim, (my husband) and I made plans to buy a farm during those years, we discussed various enterprises. We saw that statistically, hogs made more consistent profit than any other enterprise. Then Farm Journal published a story about a producer in Illinois who was selling his plans for a confinement building with slatted floors, farrowing in one end and nursery/grower in the other. We sent for the plans and were convinced that was the way to go.

When we made our move in 1967 we owned 160 acres but did not plan to buy equipment to farm it ourselves. We had decided we could borrow enough money to build a 50-crate farrowing house and get in the hog business. We met with extension people and bankers. To them we were those "city people" with the funny ideas. The county extension specialist said, "It isn't usually done that way." We had not realized that we were not following the traditional method of growing crops first, then feeding them to hogs to convert them to more profit.

We got another rude awakening about our non-traditional ideas when we tried to borrow money from FmHA. We explained our plan for the farrowing house and 100 sows and showed that we could pay back a loan in a short period of time, thinking cash flow was important. The loan officer bluntly told us, "We're not here to support big business." We found out we weren't farmers. I never did hear anyone tell us exactly what we were but still we were not "farmers."

We talked to the banks and showed them our cash flow plan. But they were interested only in the fact that we didn't have much collateral to secure a note, so they weren't interested either. We finally mortgaged the first 80 acres that we had paid for when we were in the Air Force and got enough money to build the farrowing house. We grew from there, basically expanding as the cash came in.

It wasn't until the hogs had provided enough profit to buy land that we had collateral to borrow more money to buy more land, and as it increased in value we mortgaged it again to build more hog buildings and get into the crop farming business. Now we were really farmers! We just went about it backwards. How I wish for the "good old days." Now the bankers want me to show that my plans will cash flow and I can't do it as easily!

Now 20 years later, as our buildings and equipment are wearing out we have been forced to analyze what the future holds for us as hog producers. I am now a large producer by the standards of 20 years ago, though perhaps not compared with some of the super large producers of today. We maintain about 475 sows. Do we remodel and continue to improve, or do we feel the end is near for producers like us and gradually get out?

As I first began thinking about our future as pork producers, a story came to mind from a book I read years ago about the wagon trains that hauled cargo overland to Santa Fe. It was one of those semi-historical books. There were two competing companies involved in the story. In the end one company saw that the railroad was going to replace them and sold out when it was still profitable. The other stayed. The railroads did take all the business and it failed.

The lesson for me was that one must not get so wrapped up in his business that he ignores changing technology and the outside influences that affect him. We can't close our eyes and stay in a rut just because we like it there.

Our initial decision to raise hogs, made from an objective point of view when we were not in the business, was easier to make. When a person is close to it and loves the business and it is his way of life, it is much harder to be objective.

There is another factor that makes it hard to see the changes that are coming in the industry. When we are so tied up in production, it is hard to have the time or energy to be out talking to people in the industry and finding out what is going on outside of our farm. I can't pretend to give any answers about what the future holds. I can only reveal some of the things I have thought about and observed.

I have observed how the number of hogs received in the Kansas City Stock Yard has gradually decreased over the years; still I look to the yard as my price making source. We shipped there for years, but when Wilson made us a good offer, we started going direct. Wilson says its price is not based on terminal markets but when buyers quote \$0.50 under K.C. one has to wonder how they can say that. Are we cutting our own throats in the long run when we sell direct? Are we getting ourselves one step closer to integration?

Evidently a lot of other producers are doing the same thing or there would be more hogs in Kansas City.

If we lose our terminal and country markets we will not have a price setting mechanism that we as producers believe to be a true one -- and we will lose them if we don't use them. The small producer relies on these markets. So if these markets cease to exist, most of the small producers will be forced to cease to produce.

Packers aren't interested in dealing with a lot of small in-and-out producers and generally they aren't close enough anyway. A friend in Arkansas who does live near a packer told me how her market with them was affected by a large producer. She had always got a premium from the packer. One day she delivered her hogs and was told the firm would buy the hogs but then was quoted a price lower than before. The packer didn't want her hogs any longer because it could buy all it wanted from one source. She was forced out by means of price. Fortunately she had enough volume to go further to market. A small producer couldn't do this.

In my immediate area I don't know of any collection points for market hogs but I understand they do exist in other parts of Missouri. They are operated by an intermediary such as IPLA, Heinhold, or MFA. They collect hogs from smaller producers and in turn provide a large lot to the packer. They are in the business for a profit but do fill a need for small producers. It may be that Missouri Pork Producers or Farm Bureau or some other specialized marketing group will have to get involved in a marketing program if our terminal markets fail.

The question always comes up about whether we are on the way to becoming integrated like the poultry industry. Is contract feeding a step closer to it? There are several reasons contract feeding is being used. So far, most of the contract feeding has been initiated by feed companies as a means of selling more feed. In this case, even if he doesn't make a profit on the hogs, the contractor still is making a profit on the feed.

Another reason is to provide a packer with a steady supply of hogs. This isn't done as much. One producer in Indiana said producers in his area had been approached by a packer who was considering locating there. This packer proposed to have some say about the breed of hog used and some other management factors. The packer wanted to be assured a steady supply of the quality of hogs it liked to kill but not be directly involved in contract feeding them.

A third reason for contract feeding is simply that a contracting company sees profit in hogs but doesn't want to invest in the facilities. In some areas financially stressed producers with empty facilities but no financing are being approached about contract feeding. The farmer sees it as a means of survival. He is paid a per-head price to finish the hogs.

This will look good in the short run but I think the producer will become disillusioned quickly. Maintenance on older buildings and equipment is great and I'm not sure the per-head fee will pay for this and provide a desirable cash flow. Also, I personally felt that farmers who have been independent at one time will not stick with contract feeding -- they will want the profit for themselves as soon as they are on their feet again. There will always be some who will be happy with contract feeding and there have been some in it for quite some time. I don't think it will be attractive to the majority of producers who have raised hogs as an occupation.

We have heard a discussion that meat consumption is on the decrease. I know the statistics show that less meat is being consumed. Maybe I am sticking my head in the sand but I have followed a lot of scare stories concerning food since my days in foods classes here at the University of Missouri and I can't get too excited about this one. I think the decrease has bottomed out.

Recently more and more newspaper articles are quoting heart authorities and others saying lean meat is good for you. A front page story in the Kansas City Star November 11 even stated that "a moderate reduction in fat in the diet may be nearly as effective in reducing blood cholesterol levels as a more drastic cutback, according to a study in the Journal of the American Medical Association." It further said, "People trying to lower their cholesterol levels by cutting down on fats shouldn't go to extremes because drastic reductions in fat intake might even have harmful side effects." Such a statement would not have been heard even a year ago.

I think the radicals have had their say and common sense is returning. People like meat and I believe consumers will buy lean meat.

However, we must provide pork in a form that is desired by our fast paced society. The precooked loins now available are but one step in this direction. There is an unlimited possibility for pork in the fast food and restaurant industry that has barely been tapped. National Pork Producers is working on it. I think we can increase pork demand. Even low prices are good for us sometimes. I had a friend who told me she never bought pork until it was so low in price that she couldn't pass it up. She tried it and found she liked it so much she still buys it.

Profit margins can probably be counted on to stay tight. This summer's runup in prices has given us a chance to pay off some principal but I think most of us by now are weaned from the idea that we will ever return to the relatively easy profit of the 1970s. We realize that we must get more efficient to stay in business. We were careless during the booming times. An English hog farmer told me rather scornfully last summer that we waste more feed than they consume. He is probably right.

A recent study by USDA's Economic Research Service says large hog units are more efficient than small ones, largely due to management. For instance, a unit selling 10,000 or more hogs a year made a profit over all costs even in a bad year. A small unit the same year lost over \$23.00 per hog. The conclusion was that the large scale unit can stay in business year after year in marginal times. Why can't small units have the same degree of management? Actually they can, but as I see it the smaller producer is diverted with other enterprises and can't put his best effort into each one. It takes fulltime attention to the business to achieve maximum profit.

To achieve this increased efficiency I think units will continue to increase in size in order to utilize a fulltime manager/expert. They will probably also utilize specialist consultants on a fee basis in areas such as marketing and in analyzing production statistics. We will see increased specialization in skills.

In summary: I think that we must maintain some effective marketing system that will allow the smaller producer to remain in business if he so chooses.

I think that the demand for meat will stop decreasing and that pork can fill this demand if we will market it in a form the consumer wants.

I think units will continue to get larger. They can continue to be family owned and diversified but both the crop and the hog enterprises will be larger.

I am not convinced contract feeding will be attractive to the majority of producers.

THE PLACE OF LIVESTOCK IN MISSOURI AGRICULTURE -- THE POULTRY PERSPECTIVE

Kim McAuliffe
Missouri Turkey Merchandising Council
Carrollton, Missouri

Poultry remains a significant part of the agriculture of Missouri, with broilers and eggs in the southwest and turkeys in the central part of the state.

Poultry presents a relatively bright picture in consumption rates. Since 1950, all red meat consumption increased from 131 to more than 150 pounds per capita, then slipped to 140-45 pounds. Poultry meat consumption has gone up from 29 pounds to more than 70 pounds.

Looking at the years since 1970, we see that beef consumption has decreased, pork consumption has been about constant, and poultry meat consumption has increased 60 percent.

Some of the more enthusiastic optimists see poultry meat as the primary meat as early as 1987, or for certain by 1990. A middle ground figure is that in 1988, poultry consumption will be 77 pounds, beef and veal 73 pounds, and pork 65 pounds.

Next we look at why we think the growth is there, currently, in poultry. The population is changing, and we are changing what we eat. We are becoming a more health-conscious society. It

almost scares me to see that in 1970, 44 percent of what we ate was meat or other animal products, but in 1984 the proportion was down to 40 percent.

Population data show that the largest single age group now is the one 65 years old and older. That age group is watching its cholesterol, and is concerned for heart attacks. The age group that buys and consumes the most food is the one of ages 35 to 44. That group also is becoming more attentive to what it eats. One optimistic note is that in 1972 our population was 210 million, and in 1985 it was 239 million; by 2000 the number will go up to 280 million, a large further increase. We will have to have more food.

What is happening in the broiler industry? I will comment on broilers, but the same thing is happening in turkeys. In broiler processing in 1980, 46 percent of the chickens were marketed as whole birds. We are now marketing 29 percent whole. We have had a big increase in further processing and cut-up. Consumers are demanding products different from the whole chicken. And the industry is providing those products. An example is white breast meat that can be cooked like a steak on a grill. Or frozen products.

The broiler industry established some goals for itself some 5 or 10 years ago. It asked itself, "What do we want to do?" One goal was to surpass beef consumption by 1995. In 1987 all poultry may exceed beef but it will include 13 pounds of turkey. Health and dietary concerns, and price, are the most important considerations. Broiler producers are going to watch the price; they are going to try to make their product healthful; and they are going to try to make their product fit the diet that consumers want. Broiler producers are seeking a sizeable share of the food service business -- I mean the food activities of McDonalds and similar places. They want 45 percent of that business. In Minneapolis a McDonald's that opened recently in a new shopping area serves strictly chicken and fish products -- no beef. It will sell various further processed items and will have a boom in breasts. That McDonald's is optimistic.

Another trend in broilers -- which is seen in turkeys too -- is to be 100 percent in-housing before too long. Of 13,500,000 turkeys grown in Missouri this year, only 100,000 are being grown outside. The industry is going to house all birds. The object is to get better control -- better control with respect to disease, and management. Labor is used less intensively. We have more "hands-on" management of the birds when they are in a house.

Our age-to-market for the broiler chicken was 9 weeks five years ago. Now it is 5½ to 6 weeks. In turkeys, in 1976 when I was with Banquet Foods if we wanted a 30-pound turkey for further processing we expected to market it in the 23rd week. Last week I shipped turkeys at 30 pounds that we had produced in 19 weeks and two days. We are shooting for 17 weeks.

Contracts. We like contracts. My firm no longer contracts with feed companies. We contract strictly with the processor. We negotiate our feed prices. If the feed man wants to supply us, he will have to do so on our terms, such as \$13.00 a ton over ingredients, or \$15.00 a ton over ingredients. We don't even talk about the price of feed. We use contracts with growers and with processors because the system provides market control. We are careful to insist on performance.

Consumption. We are getting more consumption of poultry meat and we think the uptrend will continue. To repeat, we have had in recent years a big increase in further processing. The turkey industry was at 42 percent processing; it is now 46 percent. When I worked for Swift, 70 percent of our birds were marketed whole and 30 percent cut-up. My friends in the company tell me the proportion this year is running the opposite: 30 percent whole birds, 70 percent cut-up.

Although I am more involved in turkeys, I will admit that chickens will surpass turkeys in feed conversion, in livability, and in the dressing -- evisceration -- operation. But once we move into the cut up room, where we talk about pounds per man hour, the turkey gobbles the chicken up. It's in that last stage that we have an advantage, which we hope to make the most of.

Eggs. Consumption of eggs has dropped off dramatically. Between 1960 and 1984, per capita consumption fell from 334 to 261 eggs. But egg producers have a lot of hope, and they have it because people are eating breakfasts again. Where are people getting their breakfasts? In the fast food places. They are eating sandwiches with egg, and the egg industry is booming as a result. The new trend is expected to grow fast.

The egg people are analyzing markets, with attention to fast foods, and they are accepting the concern for cholesterol and are going to do something about that. Egg producers need to look to new markets for growth, both food service and at retail.

THE PLACE OF LIVESTOCK IN MISSOURI AGRICULTURE --
THE BEEF CATTLE PERSPECTIVE

Daniel H. Campbell
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West Plains

When I was first asked to be a part of this seminar program, I didn't see how it could be much of a problem to discuss the future of the cattle industry in Missouri. When I received the program and saw all the previous speakers and their topics, I began to get a little tense. This presentation will be given by a southern Missouri boy who has cattle in his blood, and will have no figures, charts, or graphs to go with it.

To get a clear picture of where I'm coming from, remember that West Plains is in south central Missouri on the Arkansas line. We were once known as the feeder pig capital of the world. We had clean ground and a minimum of investment per sow unit. Those days are gone. We don't have any worries about the 1985 farm bill in regard to our crops, prices, diversion payments, and deficiency payments except as to how programs affect the price of grain that we ship in. Our principal harvests in the fall are black walnuts and persimmons. Our biggest concern is to find recipes that we can use to utilize our persimmons without letting them go to waste.

Other areas of the state worry during the spring about crops that are planted then, while we are digging sassafras roots to make tea to thin our blood from the winter so that we will be ready to go to work during the summer. If we could convince the world that sassafras root is an aphrodisiac we would have cash crops in south central Missouri with a great demand factor. What we do have available is rolling hills, permanent pasture (mostly fescue), water, and timber.

We hear a lot of discussion about alternative farming. I don't think our area is going to blueberries, strawberries, or truck farming.

That leaves our old "stand by" of beef cattle operations. Beef cattle are significant not only in south central Missouri but in the state as a whole. I will grant, having heard a previous poultry speaker, that I thought southwest Missouri had developed a new crop. Poultry buildings have been springing out of the ground as though people there were planting a crop and reaping a bumper harvest.

What I have to say, along with a quarter, will get anyone a cup of coffee at home, or with \$1.50 will get a cup in the hotel where I'm staying.

I see the cattle industry as likely to change somewhat from what it is now. I see two types of operations ending up in the state of Missouri. First are producers with rural backgrounds, small cattle operations, and non-farm jobs. Along with this group are weekend ranchers looking for release from stress and wanting to get back to the country. These are self-satisfaction beef operations. They don't have to provide the family a means of income.

I'm not well enough informed on all the ramifications of tax reform to be able to predict how the new law will affect those cattle operations that have been in business only for tax purposes. For my part, whenever I tried to pull a scheme to reduce taxes I ended up in a mess.

The farm crisis that we are going through will have a bearing on where the cattle industry will go. With the Farm Credit System, FmHA, local banks, and insurance companies getting farms back, there is going to be a resettlement such as we had in the 1930s. The best land doesn't seem to be a problem. Insurance companies can hold it, and the FmHA and Farm Credit agencies can lease it out. What presents a problem is the marginal cropland. It seems that we all have lost our concern for inflation and now are concerned with capitalization. Putting marginal land in a capitalization approach leads to roughage production, and the way to use roughage is through cattle.

Secondly, I see cattle operations getting larger in the future. Some real estate may be in outside ownership and be rented or leased to cattle operations. I think Missouri is going to be a roughage production state for cattle, and I'm referring to cow-calf units, and to backgrounding. I do feel we will continue to see cattle finished elsewhere. It appears to me that we will continue to utilize our land here in Missouri to grow cattle to the 700-900 pound weight.

I want to point out a couple of factors that give me hope for our industry.

The first comes from JoAnn Smith, the past President of the National Cattlemen's Association. While President, she was in Japan and the Far East working on opening up our industry to expand exports. The one experience that gives me hope comes from two people she dealt with, unrelated to trade negotiations. They were her interpreters. One was 35 years old or older, and traditional in habits, food and so on. The other was a young girl who wanted Levis and McDonald hamburgers and such. The younger generation may be breaking with tradition. With its changing demands and newer life style, that group, when it gets to the age of deciding policy and international trade, could cause our markets to be expanded by pressure it creates from within, and not by that from outside -- from the trading tables.

The second factor bearing on our cattle industry comes from a statement made by a young farmer from southern Illinois at a meeting at Hannibal, Missouri, last summer. He talked about his beef processing operation. He fed out his own cattle and ran them through a federally inspected processing plant located close to his home. He direct marketed. The selling point that made his operation work well was very simple. His beef tasted good. It was hung in the cooler and aged 14-plus days. He had never varied from his price from the time he started. What he said was simply, "My beef tastes good."

Look at the problems we have trying to find a decent steak today.

We must hold some hope for expanded foreign markets in developing countries that we have helped get on their feet with industry and American loan dollars. My hope is that as the people there get additional income, they will make dietary changes. The expectation is that they will go from mainly grains to more meat. My hope would be that we can have the beef cattle industry here in Missouri and other states, and expand our market into these nations of increased demand.

For Missouri to continue to be a viable beef producing state we have to compete effectively and economically. As I mentioned earlier, we can produce the roughage. In south Missouri we have fescue, and we need research to compensate for the endophyte problem. We can't plow up all the hills and rocks to redo pastures.

Our research and development should be toward the most cost effective way to utilize our pastures.

The state of Missouri has one of the better veterinary schools in the United States. It should be funded at a level that makes it possible to develop and test new products. The information would be utilized by our Missouri producers. Producers should be working hand in hand with our animal science and production classes.

It seems that we need to stress the importance of cow-calf operations and growing these cattle to maximum weight on pasture with a minimum of grain. If we can't get the taste, quality, and marbling to make our product desirable from grass, then we will send them to feedlot areas where packing plants are located.

The beef cattle industry is a viable operation. It will continue to be important to the state of Missouri. Let's quit ducking our heads and taking back seats to other areas of concern and take pride in the livestock area. Funding for the University Veterinary School, beef farms, animal science, and Department of Agriculture should be at a level commensurate with the importance of the industries to the state. Let's go out in front and be ahead of the producers, providing information that is economical and essential to cut their errors and resolve their problems.

Let all parts of the livestock industry make a united effort to get the proper recognition of our importance to the state. "United we stand, divided we fall."

THE RESOURCE BASE FOR A MISSOURI LIVESTOCK INDUSTRY
-- SOME SCENARIOS

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"It is very difficult to forecast . . . especially about the future."
-- Unknown

"I don't worry about tomorrow. I'm still hoping yesterday will
turn out better."
-- "Peanut's" Charlie Brown

"An economist is an expert who will know tomorrow why the things he
predicted yesterday didn't happen today."
-- Lawrence J. Peter

Introduction

When I look back on the past 10 years of American agriculture I am reminded of two books. The first is Charles Dickens's Tale of Two Cities, which begins with the immortal line, "It was the best of times. It was the worst of times. It was the summer of hope. It was the winter of despair." The second book is Alan Toeffler's Future Shock, in which the author describes modern society as characterized by accelerating rates of change with which people will have increasing difficulty coping.

American agriculture has been on a frightening roller coaster ride for the past decade. We have seen major upturns in productivity and efficiency along with devastating financial plunges. As a result, the confidence of the people involved in agriculture is not nearly what it was seven years ago. Events of the 1980s have virtually eliminated the overwhelming optimism of the 1970s.

Although most of the attention in the press and most of the benefits of the government's largess toward agriculture have been focused on crop farmers, those in the livestock businesses -- especially beef producers -- have suffered to an equal or greater extent. In 1985, the deflated farm price for hogs and for slaughter cattle was the lowest in over 30 years.

My purpose in this paper is to describe objectively, analyze, and predict. It is not to moralize. I leave that to the journalists. For I fear that goodness and fairness, like beauty, reside in the eye of the beholder.

Where We Are Today

Whether or not it is the state's largest industry, agriculture is very important to Missouri. With 115,000 farms and nearly \$4 billion in annual cash farm sales, farming is big business in this state.

Livestock and livestock products accounted for slightly more than 52 percent of total Missouri cash farm receipts in 1985, the same as in 1980 (see table 1). That percentage represents a tremendous drop from the 71 percent share livestock held in 1969.

In 1985, cash receipts from sales were smaller than in 1980 for every livestock category except turkeys, broilers, and "other."

Things That Won't Change

This is a rapidly changing world. We live in a time when nothing, not even the formula for Coca Cola, seems to be beyond the grasp of change.

Table 1
Missouri Cash Farm Receipts, 1980, 1984, 1985

Commodity	1980	1984	1985
	Thousand dollars		
Cattle & calves	999,176	912,962	746,511
Hogs	604,340	632,061	558,954
Dairy products	352,652	353,760	351,792
Turkeys	93,546	103,776	118,620
Eggs	63,733	68,117	45,647
Chickens & broilers	30,942	48,702	49,334
Other livestock	28,938	46,790	50,645
Total livestock	2,173,327	2,166,168	1,921,503
Total crops	1,976,632	1,562,349	1,738,457
Total livestock & crops	4,149,959	3,728,517	3,659,960

Source: Missouri Farm Facts, Missouri Department of Agriculture.

As for Missouri's future, there are three things that we can be assured won't change. At least they will not do so within the next thousand years or so. They are geography, topography, and climate.

Geography. Missouri is, and will continue to be, located in the middle of the country. We have two major rivers. Iowa is on our north and Illinois is to the east.

Topography. The Ozarks are rocky and hilly and the Bootheel isn't. North Missouri has some good soil but a great deal of it is washing away.

Climate. It gets hot in the summer, cold in the winter, and the humidity is high most of the time. Despite what we might hear or read about the greenhouse effect or the return of the ice age, there won't be enough change in Missouri's climate in our lifetimes to make any difference.

I mention these three factors because they are major determinants of the type of agriculture we have today and will be major constraints to what kind of agriculture we will have in the future.

No matter what tomorrow's technology might bring, grain will be more plentiful in north Missouri than south. As long as we export a major portion of our grain production, the price will be higher along the Mississippi in southern Missouri than it will be in northwest Missouri. As a result, any grain consuming livestock industry will have a tougher time prospering in southern Missouri.

All animals have a particular environment in which they perform best. This was a major contributing factor in the westward movement of cattle feedlots. Although we can use buildings to produce the desired environment artificially, buildings may prove to be too costly if nature provides the same environment in the next state for free.

Things That Might Change

Perhaps a more accurate title for this section is, "Things that will change, but I just don't know which way." Again, I have three items to offer -- demand, government programs, and institutions.

Demand. We are all aware that the demand for red meat has suffered a major decline in recent years. Regrettably, we are not sure why. If we cannot say why something is happening, it is difficult to predict with confidence when the trend will stop or whether it will reverse.

If red meat demand continues to drop, it follows that America's cattle and hog numbers will continue to decline. And if the national numbers are dropping, it will be difficult for Missouri inventories not to follow.

Government Programs. Under the Reagan Administration, USDA's budget is the fastest growing component of the federal budget. Federal government expenditures for farm price and income support are growing four times as fast as the defense budget. One thing is certain, that the growth in farm program costs will at least slow down. Otherwise, by the year 1998 the entire Gross National Product of the nation will be spent on farm programs.

After viewing last week's elections, I have to say I do not believe the end to massive government farm programs is right around the corner. Throughout the Midwest, farm policy was a major election issue and Congressional candidates vied to outdo each other in being the most supportive of the family farm. The oft predicted backlash to the enormous cost of current farm programs is nowhere in sight. At least it is not seen among the people who write farm policy.

Institutions. The experiment stations of our Land Grant universities and the Cooperative Extension Service have played a major role in the development of our nation's agriculture. The ability of these two institutions to play the same role in the future is threatened by declining governmental financial support and an increasing shift away from the applied problems of the state's farmers and toward the basic research problems of whatever large business has the money to pay the bills.

Midwestern agriculture is built around the widespread availability of low-cost, low equity credit to "small" farms. The current financial crisis on these farms may have a major long-term impact on the financial institutions providing that credit. Farmers may recover from the current financial crisis only to find their bankers have not.

Most poultry farmers are such only because they are close to their contractor and the corresponding processing plant. The locations of these are the prime determinants of where future broiler and turkey enterprises will be located.

Likewise for hog producers, being located close to a large packing plant is a major plus. Missouri has two such plants, at Marshall (Wilson) and St. Joseph (SIPCO). These two plants will probably operate for many years to come. But that is not a certainty. A relatively new packing plant stands idle at National Stockyards. But I hear reports that it may be reactivated in the near future.

Things That Will Change

The biggest change agent on the horizon today is the same one that has been responsible for most of the changes in life for the past three centuries -- technology.

To me, one of the most fascinating and wonderful revelations is the impact of technology on mankind. I enjoy a quality of life that is better than that enjoyed by anyone on the face of the earth 100 years ago. Why? Because I live in a society that utilizes more technology than any other in history and because my government does not prevent the benefits of that technology from flowing through to consumers.

Although the adoption of technology offers enormous benefits for consumers, this is not the case for producers. In a competitive environment, the benefits of the new technology for the producer are bid away in an attempt to remain competitive. There is no better example of this than agriculture. Every decade since the founding of our republic, virtually without exception, has seen the American public enjoying a larger and more diverse food supply and spending an ever smaller portion of its income to buy it. At the same time, every decade has seen an ever declining portion of America's population engaged in farming. These two events are inexorably linked. It's not possible to maximize one without minimizing the other.

One pervasive characteristic of new technology is that it is never size neutral. It always benefits the big guy most. That is the primary reason we keep eliminating farms. If we continue to adopt new technology we will continue to reduce the number of commercial farms. There is only one way to stop this process -- by using the police power of the state. Government, if it so chooses, can use its power to fine or imprison people so as at least to slow the transition.

Comparative Advantage of Missouri in Livestock Production

Very early in my economics training I learned about the four factors of production -- land, labor, capital, and management. Over the years these four factors have proved to be a useful tool for analyzing what a farm business needs to be successful.

Land is a fixed resource, and the land in Missouri is surely no match for that of Iowa or Illinois when it comes to producing grain. But we do have a competitive advantage in grass production.

Labor. As long as incomes are lower in Missouri than in, say, Illinois, we will enjoy a comparative advantage in livestock enterprises that are labor-intensive. In addition, the new immigration law may lessen some of the comparative disadvantage Missouri has had relative to southern states that have been able to make greater use of illegal aliens.

Capital is normally a very liquid resource. It flows to whatever location offers the greatest returns with the lowest risk. However, we have recently seen the development of a new source of capital for agriculture that is not mobile. The state treasurer's MoBUCKS program gives a slight comparative advantage, albeit very small, to Missouri agriculture. In addition, some of the farm foreclosure moratorium-type efforts that Iowa, Minnesota, and certain other states have taken should make Missouri agriculture appear relatively a little more attractive as a loan customer.

Although both of these items are so far quite small, there is potential for them to grow to levels that will be significant, especially for small loans, if the state legislature is willing to make the effort.

Management. Although managers can move from state to state, in the case of agriculture most are home-grown. The quality of management in Missouri's livestock industry is a function of the training and support that the managers receive. This training is largely dependent upon our public schools, the College of Agriculture, and the Cooperative Extension Service. Compared to some states we are in good shape, but I believe we are several notches below the front runners.

This is another area in which state government can make a difference. Enhanced financial support of agricultural education, applied research, and Agricultural Extension can be crucial components in Missouri's competitive advantage, or lack of it, in agriculture.

Missouri has made a major commitment to basic research with the Food For The 21st Century program. But we must remember that basic research is extremely mobile. New discoveries at UMC in basic research may benefit Iowa or European farmers equally as much as Missouri farmers. The benefits of applied research and Extension, however, are very localized, and some would suggest Agricultural Extension has been de-emphasized in recent years in Missouri. Extension's new program for eminence in commercial agriculture may reverse this trend, if it receives funding.

I am no expert on California agriculture; but, as an interested observer, I am struck by the difference I perceive in the imagination and innovativeness of the state's farm operators as compared with those in Missouri. Innovators serve a very valuable role. Granted, four out of five of the ideas these risk takers are trying may not work and may lead to their financial failure. But that fifth idea, the one that does work, can be adopted rapidly by the neighboring farms to improve the efficiency of the industry. Being an innovator is risky, but innovators are great people to have for neighbors.

Resource Base -- What Livestock Enterprises Appear to be Best Suited?

In analyzing Missouri's future in the livestock business, I will first present what I see as the national trend for the industry and then emphasize three major factors influencing the opportunities in Missouri -- low cost feed supply, weather, and markets. The relative importance of each of these varies with the type of livestock.

The national trend for cattle is definitely down. Since 1975 we have reduced the number of cows and calves in the United States from 132 million to 100 million, a 24 percent decline. The reason for this decline is simple. The cattle business has been spectacularly unprofitable in recent years. It has been unprofitable primarily because cattle prices are low. In 1985,

deflated slaughter cattle prices were the lowest since the 1930s. The low prices are caused by declining demand. I attribute the low demand for beef to health concerns, convenience, and a diversification of America's diet. I suspect that the influence of these factors on America's food consumption has not yet peaked. In addition, for as far as I can see into the future, millions of Americans will be fighting a continuing battle to reduce their calorie consumption. Therefore, I think the future will see fewer cattle in America, not more.

The cheapest source of feed for a cow-calf enterprise is grass. Currently, it is practically the only economical feed. Missouri will continue to produce large amounts of grass and cattle will continue to be the primary consumer. Our relatively mild winters will continue to give us an edge on some northern and western states that require large amounts of hay to get through the winter. The unprofitable nature of the cattle business has caused, and will continue to cause, a decline in stocking rates as cattlemen forego fertilizer, pasture renovation, and hay production.

During the past 25 years, large areas of the Ozarks have been converted from timber to pasture. Low profits in the beef business have dramatically slowed this land conversion. The 1986 Tax Reform Act should slow it further. Land clearing expenses are no longer deductible under the new law.

I believe the cow-calf industry in Missouri will continue to be primarily a small farm and supplemental enterprise. This is because most smaller farmers enjoy working with cattle and I do not foresee its becoming profitable enough to attract large investors.

On the surface it might appear that Missouri has real potential to expand in backgrounding. Forage supplies, location, and weather are all somewhat positive factors. However, problems with fescue toxicity and the small size of most of our grass farms may well prevent this potential from becoming a major reality. Most of our small, part-time, diversified cattle farms will stay with cow-calf operations. They are less risky and do not require as high a level of management skills as backgrounding does. However, as farm size grows, backgrounding becomes an increasingly attractive alternative.

Cattle finishing has left Missouri and will return as soon as we improve our weather. In order to save what little cattle feeding remains in the state, Missouri bankers and cattle feeders need to develop better financing and risk management arrangements.

The U.S. dairy industry has made great strides in improving its productivity per cow. New technology, spelled BGH, promises even greater advancements. I think we are rapidly moving toward the day when continuous milking will be the rule rather than the exception. This necessitates that the number of dairy farms in the future will be a small fraction of today's number.

As to where these large dairy farms will be located, two factors are important -- people to drink the milk and alfalfa to feed the cows. Missouri will continue to support a few large dairies around our metropolitan areas, but the large milk production area in southwest Missouri is at great risk.

The bright spot in pork's day has to be breakfast. It is breakfast that has accounted in the past, and continues to account now, for the bulk of pork consumption. So far, chicken, turkey, and fish have been unable to make a major dent in America's breakfast diet of ham, bacon, and sausage. Even the fast-food hamburger chains that have added poultry and fish to their dinner menus continue to stay exclusively with pork for breakfast. As long as pork can maintain its strong grasp on breakfast, the demand for pork will remain fairly strong.

Economies of size in swine production may be substantial. In a December 1985 USDA Technical Bulletin, Roy VanArsdall and Kenneth Nelson estimated that a Midwest farrow-to-finish operation, marketing 10,000 head annually, can produce hogs \$2.00 per cwt cheaper than a firm marketing 3,000 head annually, and \$9.00 per cwt cheaper than a firm marketing 650 head annually. If the actual magnitude of the cost differentials is even half of what VanArsdall and Nelson estimate, it will lead to the practical elimination of the small sow herd.

For Missouri, a competitive position in the nation's swine industry depends on low-cost grain, proximity to packing plants, and technical support, in order to selectively incorporate new technology rapidly enough to grow bigger while remaining cost-competitive. Currently, we are highly competitive in only one of these areas.

For over 25 years poultry meats have been able to expand their position in America's diet. They have accomplished this by introducing new products and promotion, but mostly by keeping their costs down and being increasingly efficient.

We often hear farm "activists" warn about the day when a few corporations will control the production of America's food. If poultry can be used as an example, that day will bring higher and more stable production, lower prices, and greater product variety.

For Missouri, poultry may offer the greatest opportunity for growth. The nation's broiler and turkey industry is not located in the regions with the cheapest feed or the best weather. It is located in rural areas having low cost labor. But the primary determinant is proximity to a processing plant. If Missouri can continue to attract processing plants as we have done recently in southwest Missouri, we will grow in poultry production.

Sheep. I fear that Missouri has lost the critical mass needed for a viable sheep industry. This may also be true for the nation. It is very difficult to be the only producer of any product in a region. The supplies, service, and consultation necessary to run the business well just won't be available.

Conclusion

Missouri will never rival Iowa and Illinois in grain production, but the state will continue to produce some grain. If it isn't all exported (and that appears to be a safe bet), feeding it to livestock is the next logical use. Missouri should maintain a livestock industry at least large enough to consume the difference between the grain it produces and what it exports. But if grain production falls, as it appears it must, livestock will be pressured.

Large amounts of the farmland in this state are well-suited for little other than grass production. The grass will continue to grow and cattle will continue to be the most economical method of harvesting it.

The biggest change I see coming in the livestock business in Missouri is not a shift of livestock production in or out of the state. The biggest change, and the biggest challenge, is how we adapt to much larger farm businesses. If Missouri is unable, or unwilling, to provide the legal, financial, and technical support such large businesses need, Missouri's livestock industry in the next century may consist of beef cows and not much else.

I suspect the days of the small, diversified, family farm are numbered. It is being eliminated by new technology and the resulting economies of size. Although it sounds like heresy, the traditional family farm just may not be efficient enough to compete with well-managed corporate agriculture -- particularly in the livestock arena.

TRENDS IN THE ORGANIZATION AND STRUCTURE
OF THE LIVESTOCK INDUSTRY

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Concerns about the structure of agriculture are not new. Almost 30 years ago, as the outline of the revolution in broiler production was becoming evident, many people asked if a similar vertical integration was the wave of the future for the rest of agriculture and especially for livestock. Some 18 years ago, I asked in a paper if we might be moving toward a Corporate Farmhand agriculture in which much of farming would be owned and managed by large corporations. Two years ago, at this seminar, a white-haired agribusinessman from Kirksville asked if we are moving toward a landlord/peasant agriculture.

May I call your attention to four major structural trends that have been observed in the past quarter century.

1. The emergence of a dual agriculture with larger-than-family farms at one end of the spectrum and over a million part-time farmers at the other end.
2. The growing dominance of the part-owned, part-rented farm.
3. The increasing number of factory-type enterprises in poultry, hogs, cattle feeding, and even dairy.
4. The growth of contract production in broilers and turkeys and to a very limited extent elsewhere.

According to some observers, these trends have already made the traditional family farm an endangered species. The trends have certainly been watched with interest by related agribusinesses. The rise of a dual agriculture has been commented on quite widely in the past three or four years. Agribusiness firms must be concerned with volume and thus they usually focus on the top seven or eight percent of the farms that market 50 percent of farm output.

Let me raise one caution about this picture of a dual agriculture. The inflation of the 1970s exaggerates some of the numbers. When one deflates data on value of farm sales, the increase between 1974 and 1982 in the number of farms with sales above \$250,000 is only one-half as great as it appears in the Census. It is true that between the two years, the number of mid-sized farms as measured in acres fell while the number of very small and very large size farms rose. However, the changes are not as striking as one might expect. The number of farms from 100 to 259 acres fell 17 percent, those from 260 to 499 acres fell 13 percent, and the number of farms of 2000 or more acres rose only 4 percent. One hears a great deal about farms selling a half million dollars or more of product, but it is important for Midwesterners to realize that two-thirds of those operations were poultry, cattle (feedlots and a few big ranches), fruits and vegetables, and nursery stock. In other words, although there is a dual agriculture, it is developing more slowly and more unevenly than often believed.

Less attention has been given to the rise of the part-owned and part-rented farm. Philip Raup called it to our attention at last year's seminar. At the last census part-owners owned 26 percent of the land in farms and rented an additional 27 percent. They are today's typical farmers. Only 11 percent of the land was in the hands of full tenants. Since WWII full tenancy has declined as much as partial tenancy has risen (see Raup's paper given at the 1986 annual meeting of the American Agricultural Economics Association). Many of the non-farmer landlords inherited their ownership or are retired farmers who now rent to relatives or to neighbors. There are some large investor landlords as well; sketchy evidence indicates their national holdings are relatively small. Thus these data do not support the fears of our agribusiness friend that we are moving toward a landlord/peasant agriculture. I concur with Professor Raup's argument that partial ownership may be a most effective way of keeping some off-farm capital in crop farming while holding down the leverage of the operator. However, in the leasing of livestock and poultry facilities, which is less common, the leasing arrangements are usually different from those in crops.

When one looks at the animal end of agriculture the trends are seen to be different and more dramatic. A corporate farmhand type of farming may be developing. Certainly, an industrial type of agriculture is found in eggs, turkeys, hogs, and cattle feeding, and even in dairy in a few regions. An Irish firm has made headlines with its plans to start a dairy unit in Georgia involving several thousand cows. Southern California has long had large factory-type dairies.

Cattle feeding went industrial in the 1960s. The first year of data on feeding by size of lot was 1962. In that year one-third of the cattle fed were in commercial lots (those of 1000 head capacity). In that year only five lots in the country had a capacity of 32,000 head or more. In contrast, today about four-fifths of the feeding is in commercial lots, and half is in lots of 16,000 head or greater capacity. Anyone who has visited a large feedlot has surely been impressed with the factory-like operation. Cattle feeding is a high-capital, high risk business and the ins and outs of financing and income taxes are a fascinating story.

Custom feeding is a way for the feedlot to hold down its price risks by attracting equity capital from outside. It is pretty obvious that income tax policy has been good to the custom feeders and to the big lots that service those customers. I doubt seriously that tax reform will have sufficient impact to lead to any significant restructuring back toward farmer feeders. Returns per head can average pretty low over time and still make the business attractive to a feedlot company feeding 30,000 or 100,000 head. Those same per-head returns to a 500 head farmer-feeder won't do much for the bank account.

Some of you may have seen an article in the Wall Street Journal of October 1 in which the writer argued that tax reform was going to alter drastically the nature of both cattle feeding and cow-calf operations. Some analyst with a large brokerage firm was even quoted as saying "ranchers will sign supply contracts with packers even before their calves are born, the same way chicken producers do." That broker knows even less about the beef business than about the chicken business.

It remains to be seen whether the tax shelters in cattle feeding are effectively closed. Certainly they will be used for the next 14 months by people anxious to postpone income into the lower tax rate structure of 1988. I expect loopholes to remain. Even if there is total closure, my judgment is that those custom lots will still find the capital to feed cattle. The margin on cattle feeding will need to be a little larger if the tax subsidy is gone, but it will not be a disaster for the cattle industry.

Missouri cattle feeding is a tiny part of the national scene, particularly if one separates out the backgrounding. The reasons for this have been rehashed many times but they are not convincing to those who feel that much more feeding should be done here. Nevertheless, it's difficult in a general survey of Missouri's entire livestock industry to give much time to cattle feeding.

Hogs were once found on almost every farm in the country. In 1900, 93 percent of all farms -- some 4.3 million of them -- reported having some hogs. Even at mid-century, 3 million farms had hogs. I call the years from 1950 to 1974 the era of commercialization of hog production. The number of farms fell from 3 million to 474,000 -- only one farm in five was reporting hogs in 1974. Only 374 of those farms reported sales exceeding 5,000 head, as another 10,000 reported sales exceeding 1,000 head. The large 5,000 head unit (or larger) was just beginning to prove itself in those days. Several operations had failed earlier because they couldn't handle breeding or mortality problems. Quite a lot of the larger operations avoided many problems by buying all their feeder pigs and simply running finishing floors.

The period since 1974 can be called the industrialization era of hog production. Growth in output has been almost entirely in units marketing 1,000 head or more, as the number of smaller units has fallen rapidly. The general prosperity of Cornbelt crop farming in the 1970s was an important factor. The 10 to 30 sow operation so common on many Cornbelt farms quickly became a nuisance that was either expanded into a major enterprise or was shut down. As the management problems of confinement operations came under control, there was a rapid trend toward total confinement. The hog factory was clearly the trend of the times. The 1970s were generally a prosperous time for hog producers and the income tax policies of the period certainly encouraged a plowing back of earnings into more facilities.

The 1982 Census recorded 315,100 hog producers. Whereas in 1974 the producers selling 1,000 or more hogs annually had a market share of only 25 percent, by 1982 they had grown to a 48 percent share. The market share of the units of 5,000-plus head tripled from about 4 percent in 1974 to about 12 percent in 1982.

For various reasons, Missouri typically trails structural trends in farming by several years rather than being in the forefront or even being contemporary. Hence, we typically have to look outside Missouri to spot the trends.

Missouri's structure of hog production lags one census period behind the changing scene at national level. Our structure in 1982 was almost a carbon copy of the national structure for 1978. As a fringe area, our farming has been more diversified and so we lag in the swing toward a more specialized agriculture.

Glenn Grimes and I have documented the evolution of the large unit in the hog industry. Since our first study 12 years ago, we have used the subscription lists of a major hog magazine to learn as much as we could about the larger units. We are planning another such survey this winter.

Our studies indicate that about two-thirds of the marketings of hogs from units of over 5,000 head come from units having 10,000 head or more. We know there are numerous units in excess of 50,000 head. Of course, the progress of the two giants -- Tyson Foods and National Farms -- is well known.

According to a recent study of economies of size by Van Arsdall and Nelson, the larger hog producers realize substantial economies of size because they are typically more efficient as judged by several physical measures as well as by their price performance and input costs. According to their studies, units producing 10,000 head in the 1980-83 period had total costs of production about \$8.50 per cwt less than the industry average. Not surprisingly, they concluded that size will continue to shift upwards.

A confinement hog unit with a 5,000 head capacity needs to operate at full capacity to minimize its average costs. Such a unit cannot play in-and-out games on the basis of expected hog-corn ratios. Our studies have shown that these units have a strong tendency to keep expanding in size -- their only adaptation to expected bad prices may be to postpone expansion until the future looks brighter. These units have a high proportion of cash costs for purchased feed, labor, utilities, and interest. When prices get really bad, the red ink can flow pretty deep. We don't know how many big overleveraged units have bit the dust in the 1980s. Certainly the present high hog/corn ratio should revive many producers who have been hurting. It is my judgment that large factory operations have sufficient advantages that these long run trends will continue, albeit with some interruption here in the mid 1980s.

This does not mean that a really good small operator cannot still get started in the hog business. But such superior managers cannot afford to remain small because competition will make small the returns per hog. Thus the small superior hog producers will ordinarily get big or get out. Either way the large units will produce most of the country's hogs.

New technology may give a further boost to the larger specialized producers. Stories are published frequently about porcine somatotropin -- a natural protein hormone regulating the growth process. It appears quite possible that by the early 1990s, this substance that dramatically increases feed efficiency and leanness will be commercially available. Pork may be able to compete more effectively with poultry on both a cost and leanness/health basis. Such innovations tend to be used earliest and most advantageously by the largest producers.

The changes in the hog business, as those in cattle feeding and poultry, qualify as major structural revolutions in agriculture. A few economists have argued that any such structural revolution requires a shift in scenery -- a migration to another region. Their logic is that new, large operations will be more readily started in a new area where the old ways are not embedded. They point to the shift of broilers south and cattle feeding west as examples. They have not used turkeys as an example, because the shift to new areas was fairly minor. It is now clear that the hog industry does not fit the model. Large units did get off to a faster start outside the Cornbelt and large units have a larger share of area total output outside the Cornbelt than in it. However, the percentage of all hogs produced in the North Central Region has been about 80 percent for the past quarter century. There has been a slow shift from east to west within the region. Hogs are tied closely to cheap feed, so I expect them to continue to be produced in the same areas as now. Between 1974 and 1982 the percentage share of large hog units grew more rapidly in the Cornbelt than outside it. The structural revolution in hogs is not by-passing the Cornbelt.

The fourth major shift in postwar agricultural structure was the rise of contract production in poultry and to a limited extent in other enterprises. Ninety percent of broilers and 60 percent of turkeys are produced under production contracts and the rest are produced directly by the processors. They are the prime examples of production contracts. A few other examples are found, though, as in vegetables for canning.

There has been much confusion on this topic because people often fail to distinguish between marketing and production contracts. The USDA even published a table a few years ago that treated all contracts as production contracts. A marketing contract is simply a sale/purchase before delivery with the farmer retaining control of production and assuming product risks until the product is delivered to the processor. Marketing contracts have only a minor impact on farm structure and farm decision making. A production contract with a processor puts the processor into farm production -- he provides most of the inputs, owns the growing plants or animals, and takes most of the production risks and all the price risks during the full production period. A production contract agriculture such as broilers has far fewer risk takers and decision makers than the type of agriculture that most of us know.

The latest thing in hogs is the putting-out system. The outside firm with capital furnishes pigs and feed to the hog farmer and pays a piece-wage for feeding out. This exercise in production contracts seems mainly to reflect the presence of cash-starved farmers with unused facilities, although there are also stories that some new facilities are being financed. I doubt that this system can compete in the long term against a National Farms or any well run large unit. However, it's too new for us to be sure. Today's good hog prices are encouraging the expansion of these systems. I should note that Gold Kist seems to have run a version of this structure successfully in the Southeast for several years.

I may be too skeptical of the prospects for production contracting in hogs because I remember the enthusiasm with which these schemes were promoted some 20 years ago. At that time almost every large packer and feed company was peddling some sort of production contract or had one on the drawing board. Outside the South, those early attempts failed. Generally the type of Midwestern farmers who would sign up were not the ones the integrators wanted. There may now be more good producers who will raise someone else's hogs because they cannot get the capital to finance their own.

Dairying, and beef cow-calf operations, have been the animal enterprises least affected by structural changes. I'm quite confident that the typical cow-calf herds of the 1990s will be nearly as small as today's. The average beef cow herd in 1982 had only 36 cows, down from 40 head in 1974. About 70 percent of the beef cows were in herds of less than 200 head. The beef cow herd utilizes mainly pasture and forages that have little or no alternative value. These forage supplies are split up into hundreds of thousands of ownership units. A majority of the smaller herds are associated with part-time farming. Although significant economies of size are possible in larger herds managed as units, in most regions east of the 100th meridian there is no economical way to assemble the pasture land into large ranches. Hence the present structure of widely varying sizes of cow-calf operations will continue.

It's more difficult to project the future for dairying. The thousand head milk factory has long existed in Southern California and Hawaii. Presumably the factory has not spread into more humid areas such as Wisconsin because of the abundance of cheap forage there. But what of new technologies? There has been much talk about bGH, the bovine growth hormone, ever since new gene splicing techniques made its commercial production feasible. A maximum increase in milk yield of 25 percent per cow over the entire lactation is believed possible. The commercial use of bGH within a few years will put intense pressure on the present price support program that already suffers from surpluses. It will also increase the ratio of concentrate feed to forages and may contribute to economies of size in dairy herds. On the other hand, bGH could also spark some sort of production quota system that could hinder the structural evolution of dairying. Family farmers and their cooperatives are more in control of their industry in dairying than anywhere else in agriculture. While technology and economics suggest the possibility of some radical structural change in dairying, I'm inclined to think it is at least 10 to 20 years down the road.

To sum up, I've argued that the structure of agriculture can only be understood commodity by commodity. Generally, the part of animal agriculture that can be put efficiently into factories -- which is sizeable -- is either there or is being put there. Farmers, as we have understood the term, may have few special advantages in operating factories. As yet, outside poultry, most producers own only single factories, but there seems to be no reason why multiple-factory firms of considerable size will not emerge. That trend has already emerged in cattle feedlots. Harold Breimyer suggests that some future seminar on livestock will be held by the business school, because the manufacturers who dominate livestock production will feel more comfortable there. That is not as far-fetched an idea as it may seem at first.

Gradual separation of animal agriculture from cropping is of major consequence for numerous aspects of farming, such as the seasonality of labor requirements, the reduced diversification of enterprises, and greater sensitivity to what happens to prices and yields of two or three crops,

greater variability of farm income, the difficulties farmers have in coming together in the political process, and so on.

The Structure of Meat Packing

Meat packing is, of course, a vital part of the livestock industry and its structure has been changing in recent years. The very term, meat packing, has long been outdated. "Meat packing" once described the Midwestern packers of the early 19th century that packed cured pork in barrels for shipment to eastern markets. Today's industry is described better in terms of slaughter, fabrication, and further processing. Someday we may see most of the retail packaging added to that list of functions.

The structure of the packing industry has been changing. Anyone who has not paid much attention to it for the past quarter century can be lost today. Twenty-five years ago the Big Three were still Swift, Armour, and Wilson. They had a lot of smaller competitors but they still dominated both beef and pork, much as they had done for half a century. Their brand names continue today but the companies have gone through so many changes as to be hard to recognize. Armour was taken over by Greyhound, which eventually gave up and sold it to Con-Agra after dispersing some of the plants. Wilson was taken over by LTV, only to be spun off. Later Wilson went through bankruptcy. Several of its plants have been sold or closed, and today Wilson is a shadow of the giant of 25 years ago. Swift moved into a conglomerate called Esmark, then went through a series of complex splits and takeovers. We now see the Swift brands in one company, but another company, the Swift Independent Packing Company (SIPCO), is still big in both beef and hog slaughter. The headquarters of SIPCO was shifted recently from Chicago to Dallas after a Texas investor acquired control. That investor also controls Val Agri, a new name in the beef business. So of the three old giants, only Swift has survived under new ownership as a major player in the packing industry.

Most plants and many firms are now single specie in contrast to the old days. New firms are now among the principal players. The big firms in beef these days are IBP, Excel, SIPCO, Spencer Foods, and Monfort. These five firms probably slaughter 50 to 55 percent of the nation's fed cattle. IBP is the biggest one by far. This concentration of the beef business in the hands of a few big firms is the greatest in the last 60 years or more, and could become a policy issue in the future.

In hog slaughter the giants these days are SIPCO, Wilson, Morrell, Hormel, and IBP. The market share of these big firms is not as concentrated as in cattle -- perhaps 35 percent for the Big Five.

This summary does not begin to cover all the recent structural changes in meat packing in terms of plant closings, plant sales, new plants, firm mergers, bankruptcies, etc. What forces underlie so much structural change? I list four:

1. Growing economies of plant size.
2. Wage differentials as a competitive advantage.
3. New technology in new firms.
4. The shift west of cattle feeding.

Packing plants are getting bigger and fewer. Many of us in Missouri grew up in a day when two or three large plants were accessible in each of our three nearby cities: St. Louis, Kansas City, and St. Joseph. Now there are only two large hog slaughter plants in the state. They are at St. Joseph and Marshall. There are no large cattle slaughter plants in Missouri.

The most efficient hog slaughter plant has an annual capacity of about two million head or 8,000 head per day. The Wilson plant at Marshall is larger than two million while the SIPCO plant at St. Joe is smaller. There are at least 40 plants in the country that can slaughter more than a million head -- those 40 plants probably slaughter three-fourths of the nation's annual hog kill.

The most efficient beef slaughter plant is probably one million head per year. This is the kind IBP has usually built recently. Only in areas away from a high density of available cattle would one consider building a smaller plant. The reason is that keeping a million-head plant busy would require hauling cattle long distances. When a single large plant can account for 4 percent of the nation's slaughter, it is not surprising that aggressive new firms could gain market share rapidly by building these new plants. The area of opportunity for new plants in the past quarter century has been the High Plains, where cattle feeding grew rapidly in the 1960s and early 1970s.

Why didn't the old giants build new plants in the developing High Plains? In fact they did. But they had difficulty competing with new firms such as IBP and Excel. Why? There probably are several reasons but the one I focus on was the use of wage differentials as a competitive factor. The president of a large packing company remarked to me a few years ago, "Within reason, I don't care what wage level we pay our workers so long as it is the same as my competitors pay." When we consider that half of the operating costs of a packer is wages, that makes sense, doesn't it? By the same token, a 20 percent advantage in labor costs translates into a doubling of net income, or into a nice net income for those with the labor advantage and zero net income for those without it.

For years most of the industry had been on a "master contract" with the same union that called for essentially the same wages industry wide. The new breed of beef packers in the 1960s generally managed to avoid that contract and to operate at significantly lower labor costs. This wage disparity was a very important factor in plant closings, plant sales, and eventually the exit of Wilson and Armour from the beef business.

About 5 years ago IBP announced its intention of becoming a large scale pork packer. There was consternation on the part of pork packers who had watched the structural transformation of the beef industry. They resolved not to be defeated by wage differentials. Pork firms began to demand wage cuts from unions. When that didn't produce much except strikes, firms began to close plants and sell them to competitors. Fairly frequently, those plants later reopened with a partially new work force, no union, and lower wages. Wilson's bankruptcy of 1983 successfully lowered the company's wage scale.

The United Food and Commercial Workers union has been hit very hard. The recent strike at Austin, Minnesota's big Hormel plant, with its prolonged struggle between the local and the international union, is indicative of the troubles that many blue collar unions face in the mid 1980s.

There may be a rise in pork industry concentration before this current upset-the-fruit-basket episode is finished. Hog producers in Missouri will likely not worry unless the plants at St. Joe and Marshall and a couple of Southern Iowa plants should arrive in the hands of a single packer.

What could farmers do if someday they face a serious lack of competition among packer buyers? Farmers have traditionally turned to cooperatives. There are of course a couple of livestock marketing coops in Missouri. There is only one large meat-packing cooperative in the country. Its hog plants are in Iowa. My judgment is that in any future pinch, livestock marketing coops would carry more of the load for farmers than meat-packing coops would.

Could farmers obtain antitrust relief from a severe lack of competition if it should develop? Currently the answer, I think, is no. This Administration rarely objects to greater concentration in any industry. Perhaps by the 1990s that pendulum will be swinging back.

As a summary, the structure of packing has been changing fairly rapidly as a result of the entry of new firms that exploited new technology, greater economies of size, and the advantages of lower labor costs. As a result of larger and fewer plants and firms, producers face fewer alternatives in selling their livestock. I regard packer competition as generally quite workable, but the recent trends toward greater concentration should worry us a bit.

STRUCTURE, ORGANIZATION, AND CONCERNS IN POULTRY

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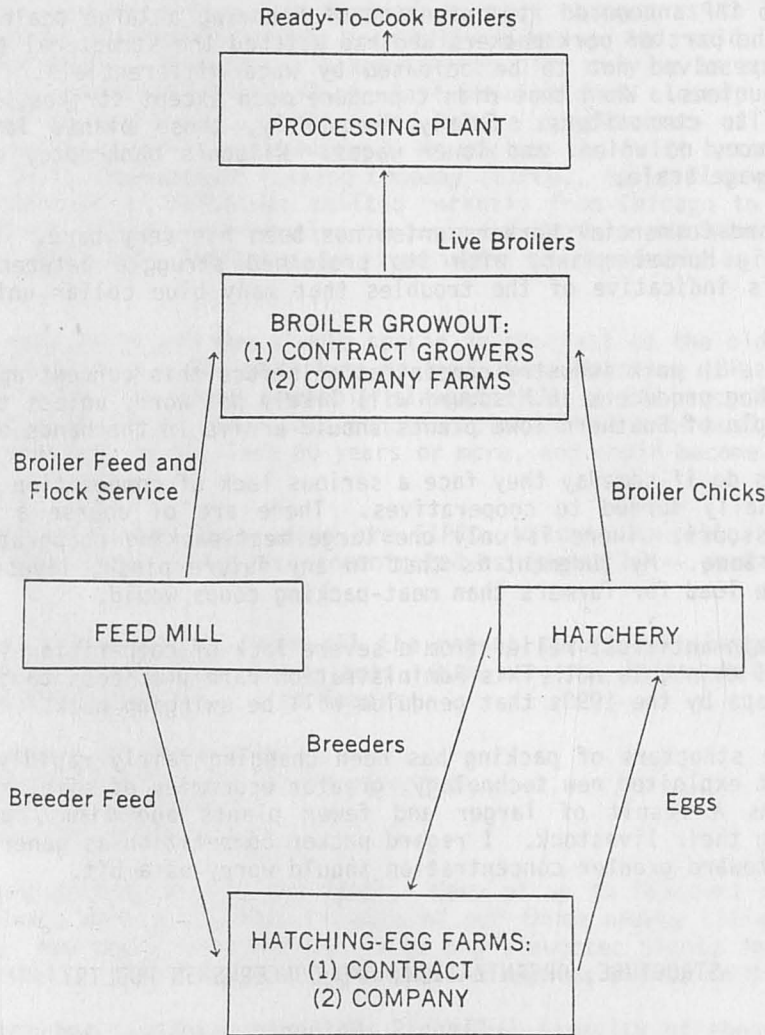
The poultry industry is comprised of three, possibly four, major segments -- broiler (young chickens), turkey, and egg production. Started pullets (ready-to-lay birds) are produced by specialists and are sold to the commercial egg producer. All of these segments are, to varying extent, vertically integrated and have been described in various ways, such as factory farming, contract farming, or company owned farming. Almost all the birds are raised in total confinement, under roof, and production is continued year around. Production units are either owned by

contract farmers or by the integrated firm. Broiler production is, in most situations, located within a 20-30 mile radius of the processing plant. Turkey production has been located a greater distance from processing. The trend is to develop new units near processing. Egg production usually develops in concentrated areas.

Most contracts provide for the farmer to provide housing, equipment, labor, and utilities, with the contractor providing the birds, feed, and supervision. Brooder-fuel allotments and bonus incentives may be part of the contract structure.

The chart outlines the function of a typical integrated broiler or turkey firm.

**FUNCTIONS OF
A TYPICAL INTEGRATED BROILER FIRM**



USDA

NEG. ERS 8225-77 (7)

Table 1

Share of Broiler Processors' Volume Shipped Directly to Various Markets, 1985

Outlet	Percent
Distributor	37.6
Chain stores and independents	32.3
Public eating places	12.1
Further processors	6.2
Institutions	2.8
Export	2.7
Government	1.8
Other	4.5
Total	100.0

Source: National Broiler Council survey representing 85% of the major broiler firms.

Table 2

Final Destination of Broilers (Whole Broilers, Parts, and Products), 1985

Destination	Percent
Retail stores	50.5
Public eating places (Fast food)	27.6 (17.9)
Further processors	6.7
Export	2.8
Institutions	3.8
Government	3.4
Other	5.2
Total	100.0

The egg industry is not as totally integrated as are the poultry meat segments, yet it continues to become concentrated into larger units. According to a 1985 survey of the egg industry by Poultry Tribune, 61 companies were each identified with one million or more layers. These companies controlled 56 percent of the nation's flock of 249 million layers. It was estimated that there may be only 1,725 companies in the United States with flocks larger than 10,000 layers.

A second diagram illustrates the organization of the vertically integrated egg industry. (See next page.)

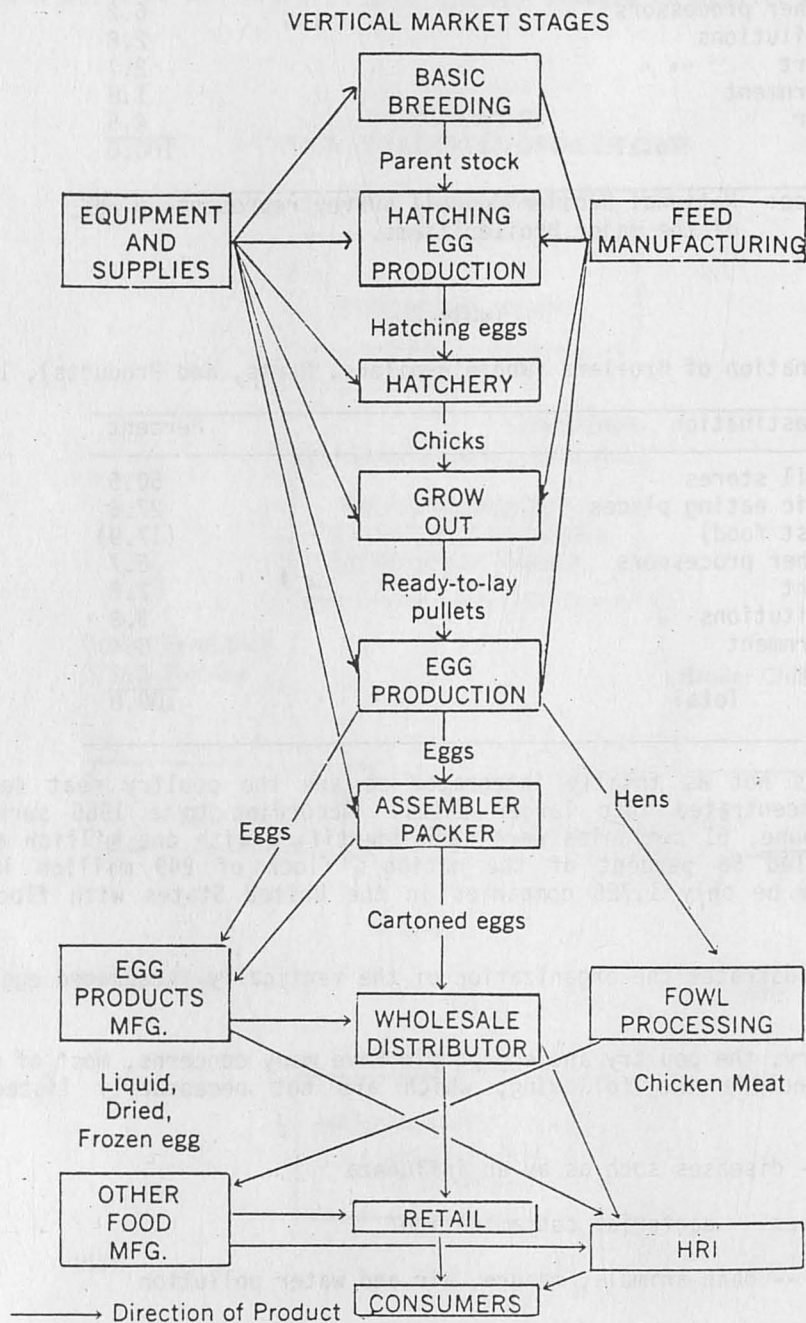
As any other industry, the poultry and egg people have many concerns, most of which relate to public policy. They include the following, which are not necessarily listed in order of importance:

1. Flock health -- diseases such as avian influenza
2. Chemical residues -- bacterial contamination
3. Waste disposal -- dead animals, manure, air and water pollution
4. Animal welfare groups (egg producers especially are concerned)
5. Production control and prices (again, egg producers are most sensitive)
6. Financing production
7. Feed ingredients -- quality, prices
8. Cholesterol issues (an egg industry issue)

9. New product development (an egg industry issue)

10. Government policy dealing with the above issues

Missouri is experiencing growth in the poultry industry. In 1986 mergers, acquisitions, and new construction have promised increases in production, processing, and hatchery capabilities, particularly in the turkey and broiler industries in central and southern Missouri.



DAIRY PRODUCTION CONCERNS

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The dairy enterprise is a major contributor to Missouri's agricultural economy. In 1985, dairy product sales were 9.6 percent of total agricultural receipts. When the dairy enterprise's appropriate share of beef sales is credited, total enterprise sales contributed 11 to 12 percent of Missouri's cash receipts in 1985.

Nationally, the regional location of milk production is shifting. From 1978 to 1985, total U.S. milk production increased 18 percent. Missouri's production increased only 5 percent, while the Pacific region's increased 41 percent. Table 1 shows the change in milk production for selected individual states located in several regions.

Table 1
Milk Production, 1978 and 1985

Region and State	1978	1985	Percent change
	(million pounds)		
United States	121,609	143,667	18
Upper Midwest			
Minnesota	9,089	10,840	19
Wisconsin	21,252	25,109	18
Pacific			
California	11,859	16,734	41
Washington	2,669	3,750	41
Northeast			
Pennsylvania	7,881	9,983	27
New York	10,408	11,746	13
Southern Plains			
Texas	3,433	3,968	16
Cornbelt			
Missouri	2,746	2,870	5
Illinois	2,403	2,814	17
Iowa	3,960	4,058	2
Indiana	2,178	2,415	11

It's obvious that the Cornbelt is increasing its production at a slower rate than other regions. Illinois is the only state within the Cornbelt that has increased production at approximately the same rate as the national average.

The question and concern arise: why is the Cornbelt and specifically Missouri not increasing milk production as rapidly as other regions?

A recent USDA regional costs and returns study for the period 1975-84 provides an economic explanation as to why this shift in milk production is occurring. USDA research reported that the Appalachian and Cornbelt regions had the highest production costs of the six regions studied. Their low production per cow and less intensive use of resources were reasons given for the higher costs. The Pacific region had the lowest total economic costs each year from 1975 to 1984, remaining more than \$1.00 per cwt lower than any other region. The Northeast, Southern Plains, and Upper Midwest costs fluctuated within \$0.52 per cwt of each other, except in 1981 when costs in the Upper Midwest were \$1.06 per cwt below the Southern Plains. The Pacific region's 10-year average return to risk and management was \$2.71 per cwt compared with the Cornbelt's 10-year average of \$0.04 per cwt.

The University of Missouri's Mail-In Record dairy enterprise data support USDA's total economic production cost analysis. A two-year comparison, 1983 and 1984, is shown in table 2.

Table 2
Dairy Enterprise Economic Costs Per Cwt

	1983	1984
USDA data, Cornbelt region	\$15.17	\$14.85
M.I.R. data, Missouri	14.84	14.81
Difference	\$ 0.33	\$ 0.04

The relatively small difference certainly supports the accuracy of the USDA study. USDA figures reflect statistical averages (on a per cow basis) of all dairy farms surveyed each year for whole-farm data and some farms every five years for detailed cost of production data.

Missouri's average milk production per cow of 12,371 pounds is 94 percent as high as the national average of 13,024 pounds. The dairy industry continuously supports the idea that more production per cow is the key to profit within the dairy herd. And California's (Pacific region) production per cow of 16,667 pounds and higher return to risk and management as reported by the USDA study provide further support. Yet when we compare the costs and returns reported by dairymen cooperating with the University's Mail-In Record program, questions arise that contradict the idea that more milk per cow means more profit.

For a seven-year period, the M.I.R. data show that cows averaging 13,080 pounds of milk produced as much cash income per cow over total economic costs as cows averaging 15,469 pounds. In fact, they averaged \$10 more cash income over total costs for the seven-year period. (Those seven-year average data are simple averages and not weighted averages.)

Also the data have shown that the average producing herds (13,080 pounds) have:

- * sold 32 percent of their herd (cull cows) annually compared to 38 percent for higher producing herds (15,469 pounds). This means if it costs 80 to 90 cents per pound to raise a producing cow and if she is sold early in her production cycle for 40 cents per pound, a loss occurs. This loss in animal value has to come out of the value of additional milk produced.
- * received for milk sold an average of 26 cents per cwt more than the price received by higher producing herds. Can the lower price for higher-yielding herds be explained by a lower butterfat test?

In summary, as indicated by the USDA study, on the average Cornbelt dairy producers have to overcome a higher cost disadvantage. How can Missouri producers overcome these problems? Perhaps an answer to the question, "Why have average producing herds been as profitable as higher producing herds?" would provide some insight on better cost control. Research is badly needed to provide answers to these questions and concerns.

A BRIEF REVIEW OF CONCERNS AND ISSUES IN THE BEEF INDUSTRY

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The preeminent concern in the beef industry is still the abrupt and unforecast decline in consumer demand for beef. Although some academic people may still question whether such a decline has occurred, a few empirical facts may suffice for most of us. Over the six years 1979-85, the real (deflated) retail price of beef dropped over 30 percent despite only a 1.1 percent increase

in per capita supplies -- which of itself should have been offset fully by a 7.3 percent increase in real per capita disposable income. The real live price of Choice steers at Omaha declined a still bigger 41.8 percent, to register in 1985 the lowest real price since the depression year of 1934.

Many hypotheses have been offered for this decline in demand. Among them are changes in life style; Yuppie predilections for ethnic and exotic culinary creativity with "white meats," food fads, fantasies, and phobias; widening income distribution; and animal rights and vegetarianism. Other arm-chair contributive factors, perhaps plausible, have been cited, but we have no solid quantitative analysis of their net impact.

I make a further observation. Despite all the hypotheses that have been offered to explain a decline in demand for beef, much of that decline has little or nothing to do with consumer preferences for beef. In short, beef at the live and wholesale level has merely been one specific victim of so-called disinflation among a much broader and general class of victims characterized as market priced crude materials. Since monetary policy was directed at reversing the accelerating inflation of the 1970s, disinflation has indeed been achieved -- primarily at the cost of DE-flation of the more vulnerable market-priced raw materials.

Over the four years 1981-85, the CPI (consumer price index) increased a total of 18.3 percent (a 4.3 percent compounded annual rate, compared with an 11.7 percent annual rate in 1978-81). But while the four-year total increase in the CPI was 18.3 percent, and prices of services went up more, finished goods prices rose less than half as much, 8.9 percent; intermediate goods increased less than a fourth as much, 4.1 percent; and crude materials declined 6.9 percent! In real terms, all crude materials from farms, mines, oil fields, and forests declined a hefty 21 percent!

Livestock and livestock products including beef cattle and beef are caught in this deflation in the raw material sector.

The apparent cause of much of this raw product depression lies in the policy dilemma forced on policymakers by the OPEC oil cartel in the early 1970s; and in the political and policy responses generated by it. Instantaneous quadrupling of world oil prices in 1973 followed by further increases during the rest of the 1970s posed a very difficult choice between "letting it pass through" and the danger of unemployment if we didn't. The compromise that was struck permitted accelerating inflation up to the double-digit peaks of 1979-81 -- which placed inflation control high on the national agenda of those years. Later came a surprisingly strong monetary policy effort at disinflation, which produced a less surprising depression in raw product prices.

Bearing heavily on the blunt instrument of aggregate demand, the abrupt disinflation of the 1980s took effect primarily through the more vulnerable market priced commodities. The less, or more slowly, responsive administered prices of many services were not affected as much, nor were retailing and processing margins, which continued to reflect expectations based on the accelerating inflation of prior years.

Thus, we should avoid overreacting to the decline in beef demand. It may not be lodged as much in consumer preferences as might be supposed. The beef industry should, nevertheless, invest substantially in study of consumer perceptions and preferences, and look also into grades and grading systems as they interpret and reflect these consumer preferences. Diverse and conflicting notions now cloud these issues. It is vital that the beef industry realize that it depends for economic survival on an exaggerated consumer preference, since it cannot compete with chicken in price or in cost of production. It's not even in the same ballpark! The really relevant question should be ". . . what product attributes have caused . . . and will continue to cause, the housewife to pass up 49¢ chicken to buy \$2.50 beef?" Empirical tinkering with the grading system prior to answering this question could only aggravate present weaknesses in demand.

Now I ask, despite disappointing demand is there a small boomlet ahead?

Even though the futures markets presently suggest only a continuing decline in beef prices (1987 October and December live cattle futures \$6 to \$8 below November 1986 cash prices), the contrarian in this writer forecasts a price boomlet over the next couple of years. The rationale for this sticking-out-of-one's-neck lies in the behavior and responses of the cattle cycle over the past six decades and six cattle cycles. After what will have been a 15 million head liquidation by January 1, 1987, a leveling of numbers is expected under the stimulus of incredibly cheap feed grains. Prior history suggests a leveling and bottoming of numbers by 1988 -- which

would require a five to six million head reduction in yearly slaughter. This whiplash in marketings will be the result of a change in the rate of change in the numbers cycle. First will come an extended period of prosperity in cattle feeding (that started in August 1986) which ultimately will be passed on through higher feeder prices, and still higher calf prices. Non-feds will become unattractive for slaughter as feeder prices move above fed prices -- and cows will be more in demand as calf prices rise more than feeder prices.

If the above scenario develops as expected, an interesting irony will accompany it. It is that the first two leaders in agriculture in bringing income improvement might well be two products not directly assisted by government -- beef and pork! It may well have something to do with corrective adjustments having been made in prior years precisely because no help was expected!

Caution should be noted. Only a boomlet and not a boom is foreseen. It will eventually be judged to have been sweet but short. This optimistic scenario is based solely on a supply-side phenomenon. Longer-run prosperity in cattle will depend on a longer-run improvement in demand.

A Note on Structural Trends

The beef industry is composed of two of the most diverse and unlike sectors that can be imagined. The feedlot sector is a very intensive, un-natural, hot-house, large-scale, regionally-specialized, high-tech, professionally-managed, factory-type production. Trends of the past are still intact as cattle feeding continues to drift toward concentration in ever larger firms highly concentrated in four states in the Great Plains.

The forage and range-based feeder cattle production sector remains basically a natural production system operated on a relatively small scale wherever land is not demanded for more intensive employment. Feeder cattle production is often more fruitfully viewed as a forage-harvesting operation with cattle the harvest machine. It is generally an extensively managed enterprise, and is only very modestly responsive to yield and performance enhancing technologies. Cost control is typically more important than output maximization. Management levels sometimes approach benign neglect.

Being a natural as opposed to hot house or artificial production system such as eggs or milk, beef cattle pose a paradox in animal selection and breeding. While highly sophisticated technologies are available and are employed in reproducing what is believed to be superior germplasm (ET, frozen embryos, heat synchronization, etc.), confusion promises to reign supreme in the determination of just what superior germplasm really is. Means now exist to replace every cow in the United States with direct maternal descendants of a single super cow in only 12 to 13 years; yet we don't really know what we want in the original super bovine species. The reason basically is that feeder calves are still produced in a natural system in which most desired traits are not much different from those that had survival value under natural selection for hundreds of thousands of years prior to man's domestication of the cow. Until an un-natural system becomes economically advantageous, this paradox is expected to continue -- and with it a generally extensive and low-tech system of management.

THE SITUATION AND CONCERNS IN SWINE

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Most of my observations on the situation in pork will repeat what has already been said at this seminar. My remarks will be somewhat repetitious. I suppose I should admit that they will carry my slant or bias. I want to refer to two or three major points about the swine industry. Certainly swine is very important to Missouri. I am hoping it will continue to be very important. We have pork producers in this state who can compete with anyone. If we had more producers with the competence of Lois Phillips and her husband, I would have less concern as to how important the swine industry will be a number of years down the road.

A remark made yesterday suggested that a producer attending this seminar who was no better than average might not want to go back home. Our object here, though, is not to discourage but to describe what the opportunity may be and help a producer to adjust.

My report on demand for pork is almost the same as what Vic Jacobs tells us about beef. Weakness, or uncertainties, about demand are one of the major concerns for the next few years. For some reason we don't really understand, demand and price relationships among meats seem to have changed. In price analysis done 10 or 15 years ago we gave more attention to what was happening to poultry as an influence on pork prices than we did to the effect of poultry on beef. It's interesting that some of our work now is showing the possibility that beef and poultry have more cross demand relationships than pork and poultry do.

Could this new picture be associated to some degree with the fast food industry? Think about chicken nuggets. I'm not certain of my data but I understand that McDonalds is now the second largest user of young chickens -- broilers. I read that McDonalds only lags the Colonel (Kentucky Fried Chicken) in use of young chickens. So maybe we have a phenomenon that answers some of the questions about demand for beef.

With regard to demand, those of us associated with red meats hope that the extra money to be spent in meat promotion or development the next few years will have some influence on consumers' attitudes relative to both beef and pork. We don't know for sure what the money spent that way will accomplish but I doubt there is any alternative. I think we have to try.

I want to emphasize a point Professor Rhodes makes in his paper, a matter that bothers me as I look into the future. I could almost make a statement that if the VanArsdall data on costs in confinement hog operations prove only one-third correct -- if the advantages in those operations are only a third as great as VanArsdall says -- they are very significant and have much bearing on what will happen in the swine industry the next several years. My question is whether Missouri can, in the future, lag behind the industry one census period and continue to keep hogs as important in the state as they are now. My concern is whether we can somehow, in some way, put the resources together so that we speed up and are only one or two years behind the industry. If we look at what has happened the last few years, I am not sure we will have the time in the future to continue to lag one census period behind, yet keep hogs economically viable in our state.

For the short run, there is good reason for optimism in hogs even as in cattle. It's nice to talk about a good price and profit picture in hogs just now. But I want to point out an example of what possibly might happen to the swine industry as we look at some of the changes in structure.

I don't know whether the average farrow-to-finish swine producer who keeps records with our department is more efficient than the average of the industry. Hog numbers in the country have been reduced substantially the last 12 months. Yet during the preceding two years our record keepers showed modest profits. For example, in 1984, if our data are correct, the average farrow-to-finish producer who kept records with us made about \$1.60 per cwt. In 1985 he made over \$2.50. I do not remember hog numbers ever having been reduced as much as appears to have been done the last 12 months, following even one year of profits for the average producer, much less two. What appears to have happened, that finally reduced numbers? My hypothesis is that we have to look at performance differences among hog producers and question whether our record keepers are typical or average. We have data, as do Iowa and Illinois, suggesting that there is a cost difference in the vicinity of \$10.00 per cwt between the most efficient one-third of our producers and the least efficient one-third. What this suggests, if that is true, for the total industry, is that for a quite large number of producers we had one year of profit between the years 1978 and 1986. So apparently what we finally did, even though good producers were making some money, was to wash out a relatively large number of producers. As we look at the next 5 to 10 years, we can expect that same kind of environment to be the most likely. To producers in the business, my data seem to say that you have one more year or so in which to get well. It would be wise to plan carefully.

SUMMARY OF THE SEMINAR

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I have been asked to carry out an impossible task. Ideas presented at this seminar cover a wide range. It is not possible in half an hour to do justice to all the excellent papers. Instead, this summary will reflect some of the highlights that triggered my antenna or that reminded me of problems or of opportunities that I thought significant.

The most pervasive aspect of discussions at this seminar has been the major relocation of the beef cattle feeding industry. Other things have happened that are important, and I would rank the concentration in hog feeding close behind the change in cattle feeding. But it is in second place; it has not carried the feeding enterprise in hogs to the level of concentration that has been reached in cattle. First place in terms of major transformations of the last two decades has to be accorded the move of cattle feeding out of the Corn Belt into a rather circumscribed area of the Southern Great Plains.

Why did this happen? We need to look at fundamentals. Some of these have been mentioned at this seminar but others were treated superficially or not at all. Surely the most important explanation is that this move occurred when many would-be farmers who wanted to get started in farming were enamored of the potentials of mechanization in crop farming and did not want to be tied down with the care of animals. We were having a generational change in the life styles of farmers and especially of those who could be identified as family farmers. It was the farm family that was changing, and with it the family farm. We now have many young people and middle aged people on farms who do not intend to be tied down by the care of cattle or hogs or dairy cows.

A majority of the people in agriculture today very much like the idea of part-time farming, even though many might be called full time commercial farmers. By any definition many cash crop farmers are seasonally unemployed a good portion of the year. In some places employment is seven months and in some other places such as northern Minnesota it is closer to six. As a consequence, we have had underemployment consciously selected as a life style in agriculture. For a few short years the sudden expansion in export demand for American grains made it possible to shift from livestock agriculture to cash grain agriculture to advantage. There was a market for the cash grain.

That occurred piggyback with another development that no one planned but was serendipitous in that the two augmented each other. Water and irrigation technology were made available and artificially cheap in the Great Plains atop the Ogallala aquifer. Center pivot irrigation was perfected in the late 1950s and the 1960s; well-drilling techniques were improved; and the effect of the control of the price of natural gas was to make natural gas an artificially underpriced energy source. All these came to fruit at the same time. We had an artificially underpriced source of energy, and an artificially underpriced source of water, with no charge for withdrawal, and even at that time no permit system to limit withdrawal. There wasn't even any systematic monitoring of the water table.

This created a sudden opportunity for enormous capital gains to be made by buying up cheap dust-bowl quality scrub land, brush land and sand land, putting down wells, and making the desert blossom like a rose. Capital value could easily be increased five times, and without much trouble, ten times. That's the way the sandhills of Nebraska were opened up. That's the way the high plains of western Kansas, above 2500 feet, were placed under irrigation. The same was true in the Texas and Oklahoma panhandles and in parts of Wyoming and northeastern Colorado.

This was a capital-gains-driven application of new technology that was artificially underpriced, and that was making use of a fund resource in the sense that the water being pumped out of the Ogallala is geologic in origin. There is some recharge in the northern Ogallala and more in the Platte River valley, but in the Ogallala as accurately defined, if there is recharge we do not know how to measure it. At best it is very slow. The presumption is that the Ogallala is geologic water, and when once pumped out it is gone.

That recognition was slow in coming. I am not sure anything would have been done about it if the depletion had been recognized earlier but the fact is that it was not. So we encouraged the tapping of this geologic water source by providing cheap credit, and a well developed technology fueled with underpriced fuel.

The result was a gold mine, a windfall of cheap feed, in an area that had formerly been beyond the margin of crop farming. If anyone wanted to buy cheap and sell dear, this was the biggest opportunity in the history of American agriculture since the opening of the West with the construction of the railroads.

At about the same time, institutional credit sources changed their rules. The Federal Land Banks were most prominent but some other institutional credit sectors -- insurance companies, for example -- did so too. Likewise some of the commercial banks, which were lending nominally on chattels, were looking at possible appreciation in value of real estate and bent their rules in making chattel loans. The loans were non-collateralized by real estate collateral, but the banks might not have made the chattel loans if real estate had not been appreciating in value as back-up. Credit was suddenly made available on a scale and with a degree of leveraging that had not previously been possible.

Another event was a change in life style on the part of urban residents that affected tremendously their expanded use of space for purposes of conspicuous consumption. As income goes up, the income elasticity of demand for space rises. At some point a person becomes satiated with material things and even vacations in the Swiss Alps. Buying space around oneself is the most conspicuous form of using a scarce resource. Anyone who wants to live lavishly in this culture buys a remote vacation home or a remote ranch or goes into horse farming or does some other things that involve the use of space. At the middle income level this means moving to the suburbs and putting a rambler on a half-acre lot. A person higher on the income scale chooses a three-acre lot. But if a person has a really high income he buys a ranch and flies into Amarillo, Laramie, or Billings for a weekend in order to go out and look at his spread. These aspects of demand for space associated with rising income are most dramatically exhibited in the way in which we have converted much of the West to a support system for pleasure horses. Many of the irrigation projects that were funded initially by the Bureau of Reclamation in order to produce food crops are now producing feed for the horses that give people an excuse to go to ranches in the West and that support a surprising portion of the farm population of the mountain states.

In the 1950s Harold Breimyer reported the number of acres that were gained as food producing land when we shifted to tractors from horses. It is now time that he, or someone, repeat this study in reverse, because we are rapidly losing large numbers of acres of food producing land to provide feed for horses. I estimate, roughly, that the city horse takes two times as many acres for its support as did a farm horse, in the days when we used farm horses. Adding pet food demand to horse support demand accounts for a significant element of demand for agricultural products, for what our veterinarian friends insist we call companion animals.

This "companion animal" support system has also affected areas around our cities and the kind of livestock that people are willing to care for. A branch of the University of Minnesota at Waseca has a major program in light horse management. The program is supported well; class size is limited, with many students waiting to enroll, and the majority of students are female.

This aspect of demand for land is a part of the syndrome that is associated with nurturing behavior that in an earlier generation was devoted to the care of economic animals but that in this generation is devoted to care for horses and other recreational animals. The life style change has altered the willingness of farm couples, especially of the younger generation, to be tied down to the endless chores of always being available to be sure farm animals are fed, watered, or milked. More could have been said about these aspects of the livestock economy, in this seminar.

One other long term trend came to fruition in the 1970s. It was a consequence of rapid population growth in the Caribbean and especially in Mexico. It had been underway for some years but did not reach massive proportions until about the same time the other things happened that I have described -- access to the Ogallala, availability of cheap credit, and a shift to cash grain and out of livestock. Suddenly there was an influx of cheap labor. The result was predictable. Labor intensive forms of livestock production would go where labor was cheap, energy was cheap, the feed supply was suddenly expanded, and there was no previous record of committed capital so that it was not necessary to destroy an existing system. One could build from the ground up on a greenfield site. As a result, perhaps half of all beef cattle are now fed in a very restricted, sharply defined area of southwestern Kansas, northern Texas, western Oklahoma, eastern Colorado, and western Nebraska. That area is now feed deficient, according to the estimate of a feed dealer in Dodge City, Kansas. Also, the large slaughter plants that have been constructed in the area are fed-cattle deficient. Cattle for slaughter are trucked in from outside the area. Not enough fed cattle are available close by to permit the slaughter plants to operate at a scale of highest efficiency. Carcasses also are trucked in, from other parts of the Middle West, so that their

breakers and trimmers -- an intensive and expensive part of the slaughter operation -- can be kept fully occupied.

We have seen cattle feeding shifting to the Southern Great Plains where it is dependent on fragile resources, especially water, and is highly suspect in terms of its permanence. The industry has now grown so large that it cannot be supported from its local, that is, its most economically located, resources. In Nebraska the same phenomenon of cheap feed and irrigated exploitation of the Platte river valley and the Ogallala aquifer provide a partial explanation for the expansion of hog feeding there. As we have been told at this seminar, hogs tend to gravitate to cheap feed. Feed was made cheap by the sudden expansion of irrigated agriculture in the Sandhills and the dry western counties of Nebraska. Something similar to what happened in the Southern Great Plains for cattle happened in Nebraska for hogs, but it did not lead to the same degree of concentration, primarily because of disease control problems. Disease control is much more expensive in hogs than cattle, requires higher levels of technical skill, and can wipe out an operation quicker. The risk factor in concentrated hogs is very high. I do not believe that risk factor was adequately stressed at this seminar.

A lot was said about the weather determinants of location for beef feeding. Questions raised during open discussion, though, imply some doubt about the emphasis placed on weather. I am sure weather led some feeders to go into the Southern Great Plains, but I am impressed by some other considerations that were not mentioned and need to be brought into the equations. For example, when Cargill decided to enter the beef feeding and meat packing business, the president of the company was a native of Kansas, and was well acquainted with the cattle feeding operations in his home state. I think the geographic origin of the Chief Executive Officer of Cargill at the time Cargill's decision was made had as much to do with that decision as any hardnosed, cold-blooded analysis based on weather factors or market orientation. Much the same applied to the development of the beef slaughter industry. Armand Hammer of Occidental Petroleum bought into cattle slaughter in the Southwestern Great Plains. Hammer is an immigrant from Russia who came to this country contemporarily with a Mr. Chelowitz, who became one of the largest exporters of cattle hides to the Soviet Union. Chelowitz used his knowledge of Russian to develop that part of our export market. It was mentioned at this seminar that sale of hides is a major part of our agricultural exports. A good portion of the hide export to the Soviet Union has been organized by Mr. Chelowitz's firm. Mr. Chelowitz bought into Colorado Dressed Beef and into Ceres Land Company that once had large holdings north of Wray. I have no doubt that Mr. Hammer and Mr. Chelowitz crossed paths someplace. The fact that Armand Hammer and Occidental Petroleum are now owners of Iowa Beef Processors and therefore have operating responsibility for one of the largest beef slaughtering plants in the world may well be a consequence of personal relationships as much as of cost-benefit analysis. We should not neglect the non-quantifiable dimensions of these decisions that were made.

But the decisions were made. As a consequence, we now have a livestock industry, particularly a cattle feeding industry, in the United States that faces a new ball game. Land prices have collapsed. The prospects of making a fast buck from capital gains in land are very poor right now. Not many location decisions with respect to cattle will be made in the hope of getting rich from land value appreciation. When the decisions were made to locate cattle feeding where it is now located, those were realistic prospects, and they were influential in the decisions. The situation is different now.

The export market for feed grain is weak and feed grain stocks are piling up. Although that may make temporarily for cheap feed grain it also holds the prospect that a lot of people in the grain production business are going to have to find something to do with their grain. Even though the use of surplus labor time on grain farms to feed livestock may not seem economic when costed out in a commercial setting, a grain farmer who has wet corn that will be lost if it is not fed -- and there are many such grain farmers just now -- may make a loss-minimizing calculation. He may be back in the feeding business. Whether that occurs, and whether there are enough farmers who decide they would like to employ themselves more months of the year than cash grain will offer, could influence some relocation of cattle feeding activities. Some grain farmers may decide any added income is better than getting nothing for the months of underemployment and for them this may be a rational decision. There is unlikely to be a major move of cattle feeding back into the Corn Belt but there could be a weakening of the dominant position currently exercised by the feed-importing sector of the Southern Great Plains.

Another thing that has happened is that tax policy has changed. Not much was said about this at the seminar. Perhaps the issue is so apparent that there was no need to say much about it, but I should like to have seen more emphasis on tax policy. I think the issue is misunderstood and underestimated. With regard to the livestock industry the feature that is important is the

attraction the previous policy gave to people with large incomes to put their incomes in tax shelters that involved some aspects of cattle feeding, or other kinds of livestock. It might have been breeding horses. The tax shelter that has been possible in breeding horses has been enormous. It's one reason we have had an explosion in horse numbers. Breeding cow herds, of course, have been notorious for their tax shelter advantages. The President of the United States, when he was Governor of California, had breeding cow herds registered in his name in several different states. They were managed for him by Oppenheimer and Company in Kansas City, Missouri. This is well documented. This use of tax shelters is authorized from on high!

Not all those shelters have been wiped out but the tax reform act of 1986 certainly changes them. We aren't yet quite sure just how. The change in tax law is coupled with another development that was not anticipated. The oil price collapse has suddenly reduced the number of Texas, Oklahoma, and other oil millionaires hunting for tax shelters in cattle feedlot operations.

On the demand side for tax shelters we have had a big decline, and on the supply side we have had a tax policy change. When the two are put together, I predict that a lot of the cattle that had been carried in feedlots by the taxpayers of the United States through the deductibility features of the tax shelters that involved investment by wealthy owners will no longer be carried by those taxpayers. That source of tax shelters will not be available, and the income to be sheltered has suddenly diminished.

The cost of carrying cattle to finished weight is principally a capital carrying cost. Feed is important. The labor is not very important. But the interest on the capital tied up is very important. This is why, when interest rates are high, it is not profitable to hold cattle on grass. As interest rates fall, grass feeding of cattle increases in attractiveness. Holding cattle on grass as long as possible and putting a fine finish on them at the last minute becomes more attractive. If the availability of investment funds for putting cattle in feedlots suddenly declines, if the interest rate falls, and if incomes to be sheltered from the oil patch disappear, then cattle feeding in the Great Plains will be different in the next decade from the last. It will be different in measurable and significant proportions.

As a question I posed to Mr. Haw suggested, another dimension that could perhaps be most important is that we are overdue for our periodic drouth in the Great Plains. We have not had a severe drouth in the Great Plains since 1954-55. Drouths are periodic; they do recur. It's just a question of time. What will it mean when it turns out, as will be discovered, that we have half the fed beef cattle capacity in the United States squarely in the middle of what was once defined as the dust bowl, and will again be a dust bowl when we get that kind of drouth?

My question was answered as though it dealt with the adequacy of the feed supply. That is not my concern. Anyone who lived through the dust storms of the 1930s knows that feed can be brought in. What I am concerned about is animal health. It is impossible to raise animals in dust storm conditions. They get dust pneumonia. I believe the risk exposure of big cattle feedlots in the Southern Great Plains is very high. If I were involved in that business I would be hedging some of my risk. I suspect that some of the people who have their money in those big cattle feedlots might be questioning seriously whether they want to keep it there.

I now come to another feature that may be more significant than the physical and geographic dimensions that I have commented on thus far. Much of the capital invested in the corporations that have recently bought into the livestock sector is private capital in corporations not publicly traded. There are exceptions; some of the corporations are publicly traded. But Mr. Haw made it clear that the freedom of movement he enjoys in managing a non-publicly-traded source of corporate capital is a major part of the advantage of his system. It may be that private corporate capital is the only kind of corporate capital that can survive in the livestock business. Publicly traded corporate capital might not survive a seven year cattle cycle. A dividend would be demanded by the stockholders; the stock market could downprice the stock; management would be relieved of responsibility; and a new managerial team would be brought in. It seems quite likely that publicly traded corporations are unsuited to the livestock producing business. If we do have large scale corporate capital in livestock it will almost certainly be of the corporate type represented by a Cargill, or by another privately-held and -dominated source of capital in which a few wealthy investors call the tune. All this suggests that the character of corporate agriculture will be a rather strange form of corporate structure. We can ask -- I am asking -- how impermanent, how transient, is that capital source? How long will those sources hold still during the tough times? Is that capital likely to be migratory? We have lost many farmers in the last several years. But the great strength of a small farm system is that individual farms can go broke at low social cost. I commented on this point at previous seminars. The danger of the kind of system we are now developing, especially in beef cattle feeding, is that

we now have firms so big that they approach the kind of social problem that is created when we contemplated bankruptcy for Chrysler or for Lockheed. In that sense, I think there is no doubt that we have lost flexibility and resilience in our cattle feeding industry. It is now more fragile because it is more rigid. It could do more damage if it breaks, or fails.

One other thought drilled into me by this seminar is that in addition to the numerous ways we have subsidized and directed the kind of livestock industry we now have, there is a dimension that has not been discussed but would be appropriate. It is the fact that without plan, without design, and in the absence of any illegal or diabolical intent, agricultural research in the agricultural universities is increasingly focused on the kind of research product that will be of greatest use to large firms. Every Experiment Station Director in the Association of Land Grant Colleges and Universities will deny this statement. But I think I can defend my allegation.

An ambitious young graduate student or a faculty member bucking for tenured promotion will be aware of the fact that the rewards flowing from a grant of money to supplement the regularly scheduled source of support coming from the state or the federal government will be greatest if the research supplies something that is of interest to a large corporation. The student or faculty member will almost inevitably direct research to something that is most salable in a market that would be of interest to a large firm -- to a large corporate source of employment for the graduate student and of support funding for the faculty member. Again, this will not be planned, it will not be diabolic, but it will be very pervasive.

We must add to that the increased drive for funding from non-traditional sources in our universities. This amounts to an instruction, "Go out and get yourself a grant, and then we'll give you a job, or if you have a job and want to be promoted, get yourself a grant and then we'll promote you." Where does one go to look for grant funds? The answer shows that we are adrift toward research that is not scale-neutral. We do not now have scale neutral research in the agricultural universities, and the pattern will get worse.

This is an aspect of the kind of slanting or biasing or direction-setting that determines the size of firm and the structure of farms in agriculture that is within our control -- within the realm of policy decisions that could be made within the agricultural universities.

Another dimension of the economic forces that will shape our future will probably soon be taken out of our control. This has to do with the economics as well as the politics of using public subsidies and diminishing agricultural resources to produce grains for storage that are unsalable. It must be acknowledged that in a world in which we now face the prospects of cutting back on grain production, little is to be said for subsidizing the withdrawal of water from the Ogallala aquifer to produce grains that are already in surplus. If one is sensible and takes a rational course, the first thing that should be cut back is grain produced with subsidized irrigation water. This advice, of course, will not fly in the Southern Great Plains. The fact remains that we have a livestock industry for fed beef production that is dependent for its feed supply on the politically least defensible exhaustion of an exhaustible resource that one can imagine. Land irrigated with geologic water should be the first candidate for retirement.

Missouri is in pretty good shape. The state has land that has limited uses but can produce grass for a cow-calf unit. There is a lot of it, and some of it has been in grain crops that probably should come out. I am not talking about the Ozark ridge; I am looking north, not south. If we do withdraw land sensibly in order to cut back on grain production, quite a lot of Missouri's land should go into a support base for the cow-calf industry. The big ranches and the support system that put the cattle out in the Great Plains are not working right now. I suspect that a return of cattle to the Corn Belt, even if only to the Nebraska part of the Corn Belt, would further emphasize the skewed nature of the system that now supplies the frames to the feedlots in the Southern Great Plains on which they put meat. The last time I looked at the data, the major source of supply of feeder cattle for feedlots in western Kansas was, not surprisingly, Texas; but an important secondary supplier was Mississippi. If one drives southern interstates he passes tractor-trailer after tractor-trailer loaded with thin cattle coming out of the South and going into those feedlots. That is uneconomic transport of livestock. More of the thin feeders ought to come out of areas that have good grass and are closer to the slaughter plants. Missouri is one of those places.

