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STAFF PAPER

**THE EFFECTS OF THE 1989 DROUGHT ON
THE KANSAS ECONOMY**

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Department of Agricultural Economics
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The Effects of the 1989 Drought on the Kansas Economy

by

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June 1, 1989
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The authors had the assistance of many individuals in both the private sector as well as local, state, and national public agencies. Extension beef specialists were particularly helpful in developing estimates of cattle numbers. However, the conclusions found in this report are the authors' alone.

Introduction

Recent rains may signal the end of the drought for parts of Kansas. Nevertheless, the drought's economic effects could linger on for several years. The impact of the drought varies depending on which economic sector is being examined. The purpose of this study is to identify, describe, and measure the drought's effects on both the agricultural and nonagricultural sectors of the Kansas economy. The economic projections contained in this report should be viewed as tentative for two reasons. First, the physical effects of the drought are not fully known nor is it certain that the drought is over. Second, the data available on agricultural production, agricultural prices, and farm income are incomplete. To develop as accurate a picture as possible of the drought's economic effects, the authors have used a wide variety of information sources. In addition to published materials, the authors have had numerous consultations with Cooperative Extension personnel, agricultural statisticians and USDA analysts, Kansas farmers and ranchers, agricultural lenders, crop insurers, agribusiness managers, and the professional staffs at Kansas producer organizations.

This report is organized in three parts. The first part is a description of the immediate effects of the drought on the state's wheat and cattle industries. This section will identify and measure the *change in the value* of sales and purchases made by each sector. The second part of this report will trace these changes through the rest of the state's economy and generate estimates of the drought's impact on the other economic sectors, as well as changes in the state's aggregate economic output. The last part of this report will assess the drought's implications for the survivability of Kansas farms and rural communities.

Changes in Price Vs. Changes in Output

A multi-sectoral, input-output model of the Kansas economy was used to keep track of the economic changes caused by the drought. The model provides an accounting framework by which dollar transactions (sales or purchases) can be recorded. The reader may be surprised to find that these *dollar figures* do not always fit one's initial expectations. That is because the public's attention has been focused on the extent of the *losses in agricultural production*. However, this loss in production has been accompanied by an *increase in commodity prices*.

An economy is driven by its total gross revenue. Gross revenue is the product of physical output multiplied by the market prices for that output. Consequently, an increase in output prices may mute the economic loss from a decrease in the quantity produced. In some markets, when the demand for a product is said to be "inelastic", a reduction in quantity produced will actually result in a proportionately greater increase in the total revenue received. Take hay and forage crops, for example. On May 1, pasture conditions in Kansas averaged 47 percent of normal, the second lowest on record. The USDA will not release an estimate of this year's Kansas hay crop until July, but agronomists expect that the crop will be down 15-20 percent. Over the last 12 months, while hay and forage crops have been drying up, hay prices have increased by 50 percent.

Factors That Are Not Fully Addressed

Another caveat associated with this type of economic analysis is that it may not adequately address the distributive, income, time, or policy effects of the drought. An illustration of these four effects is found in the cattle

industry. If more cattle are offered for sale because of the lack of hay and forage, this should bring about a higher level of activity in the cattle feeding and slaughtering industries but less activity in the cow-calf, stocker, or backgrounding operations (distributive effect). At the same time, forced liquidations of cattle herds should result in higher cash receipts this year for some ranchers (income effect) but reduced asset values and income earning potential in following years (time effect).

One other unknown associated with this analysis is that government programs may significantly alter the picture. Recently, emergency haying and grazing have been approved on 1½-2 million set-aside acres in Kansas (policy effect). Another 2.4 million acres of Conservation Reserve might also be opened. The quantity and quality of the forages available on this land are difficult to determine, though some producers have begun planting summer annual forage crops on set-aside acres to take advantage of the high hay prices. As of this date, no federal drought relief has been authorized for wheat producers. Under the current assumptions, gross revenue (cash + government payments) of Kansas wheat producers will be down by just over *\$600 million*.

Kansas farm income will certainly be supplemented by crop insurance indemnity payments. This year, 41 percent of Kansas wheat acres were covered by Multiple Peril Crop Insurance, up from just 27 percent last year. Total insurance payments are difficult to estimate, since many claims are just now being processed. However, crop insurance analysts estimate that final indemnity payments to Kansas wheat producers could be between \$127 to \$274

million. Because of these payments, the loss in gross farm revenue will not be as large as many people have expected.

More about Input-Output Analysis

Input-Output analysis (I-O) is a technique that economists use to study the interrelationships between different groups of economic agents (sectors) within an economy. Different sectors of the economy are related to each other in two ways. First, a sector may provide necessary inputs to another sector. For example, meat packers buy cattle from cattle producers, as a necessary input in the production of processed beef. Second, a sector may also be a market for the product of another sector. From the cattleman's perspective, meat packers are the primary market for their output (i.e., cattle). These two types of relationships as they exist between different sectors of the economy can be simultaneously represented by using an I-O technique.

A variety of multipliers can be measured to determine the effect of a dollar's worth of increased output in a given sector. For example, if the multiplier for the manufacturing sector is determined to be 1.5, that means that a dollar's worth of increased manufacturing output results in an additional 50 cents worth of output from other sectors of the economy. An I-O technique can be used to show the impact of increased or decreased output in the agricultural sector on the entire economy and on the economy's various sectors. The I-O model used in this analysis was developed by Dr. M. Jarvin Emerson at Kansas State University. The original model was developed for the year 1965 and a revision of the model was recently completed for 1985. This model includes 74 sectors, and it provides an excellent detailed description

of economic linkages within the state (see Appendix A for a more detailed description of I-O analysis).

Immediate Effects of the Drought

Wheat

The USDA's May crop report estimated the 1989 Kansas wheat crop at 202 million bushels (Figure 1). Given normal trend yields, the state's crop could have been 430 million bushels. The price of wheat is projected to be \$.65/bu. higher because of the 228 million bushel reduction in wheat production in

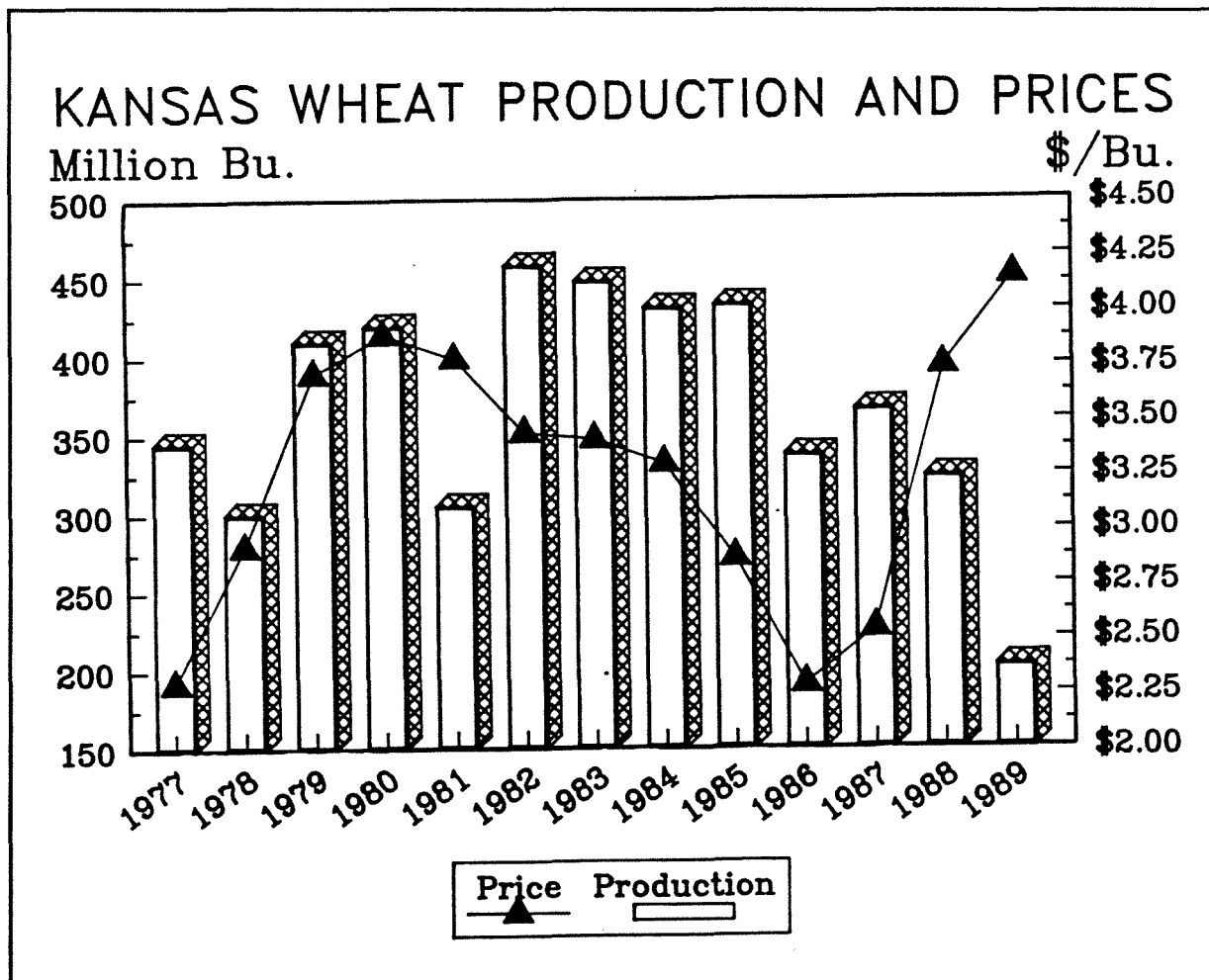


Figure 1

Kansas and losses in other wheat growing states in the Central and Southern Plains. If this region had had normal weather this year, Kansas wheat prices would be \$3.50 a bushel. Because of the drought, wheat prices are projected to be \$4.15/bushel.

For many wheat farmers, the increase in wheat prices is a mixed blessing. About 87 percent of the state's wheat acreage has been enrolled in the government's 1989 acreage reduction program. In return, these producers are eligible for deficiency payments on wheat (the difference between the \$4.10 target price and average market prices). Approximately \$80-\$85 million in advance deficiency payments has already been paid out to Kansas wheat producers. Now, because of the higher market price, it's likely that no deficiency payments will be earned on the 1989 crop. Those producers who received advance payments could be held financially liable and may possibly be required to refund the money (or else have the amount debited against any deficiency payments paid on their 1990 crops).

A widely quoted estimate of the value of lost wheat production in Kansas is \$800 million. This estimate is probably based on a loss of 200 million bushels x \$4.00/bushel. This assumes that the price of wheat in Kansas is independent of the production of wheat in Kansas. In most years, this is a reasonable assumption. However, a KSU econometric model of U.S. wheat prices indicates that wheat prices this year are *unusually sensitive to small changes in U.S. wheat production*. Furthermore, it is unreasonable to ignore the fact that the drought in Kansas is part of a wider regional phenomenon and that the drought's impact on total Hard Red Winter (HRW) wheat production should be taken into consideration when calculating *the net effect of lower HRW wheat production and higher Kansas wheat prices*.

Table I summarizes the initial changes in the value of 1989 wheat sales that are due to the drought. The first column shows the projected change in the value of wheat sales and exports from Kansas. The second column shows the cumulative loss in wheat revenues should the crop be reduced another 25 million bushels. This column has been added, since many market observers expect that the final crop could be 20-35 million bushels lower than the projection in May. Because of higher prices, wheat sales revenue earned from flour mill purchases and seed sales will be up by almost \$60 million.

Table I. Initial Changes in the Value of Sales by Kansas Wheat Producers Due to the Drought

Sales	May Crop Report (202 Million Bu)	Cumulative Losses if Wheat Crop Is Reduced by Another 25 Million Bushels
	-----	-----
	(Million \$)	
Sales to Other Wheat Producers (seed)	+11	+12
Grain Milling Industry	+47	+50
Exports from Kansas	-415	-494
Other Sales (wheat fed, placed under loan, etc.)	-60	-61
 Total Sales	 -417	 -493
Government Payments (Earned)	-188	---
Insurance Indemnity Payments	+127 to 274	+154 to 305

However, higher prices can't make up for the reduction in exportable supplies and shipments of wheat out of Kansas. These sales will decline by over \$415 million. When all revenue losses and gains are factored in, Kansas wheat producers could see their gross revenue drop by \$605 million. Insurance indemnity payments may compensate for 20-45 percent of this revenue loss.

Table II summarizes the initial changes in the value of purchases by wheat producers due to the drought. These figures represent agriculturally related purchases made for the wheat enterprise and do not account for changes in household purchases due to the loss of farm income. Again, there will be an additional \$3 million decline in purchases, if the size of the wheat crop is reduced by another 25 million bushels. Particularly hard hit will be farm machinery sales (down \$13 million) and agricultural services (down \$7 million). The decline in machinery sales would have been greater except that farm incomes have been improving over the last few years and many producers can no longer wait to replace worn out equipment.

Table II. Initial Changes in the Value of Agricultural Purchases by Kansas Wheat Producers Due to the Drought

Purchases	May Crop Report (202 Million Bu)	Cumulative Losses If Wheat Crop Is Reduced By Another 25 Million Bushels
	----- (Million \$) -----	
Ag Services	-7	-8
Transportation	-6	-7
Ag Inputs	-2	-2
Energy	-8	-8
Farm Machinery & Equipment	-13	-14
Insurance, Real Estate, & Financial Services	+3	+3
Other Services & Wholesale Trade	-10	-11
Wheat Producers (seed)	+11	+12
Total Purchases	-32	-35

The \$32 million decline in agricultural purchases is about 7 percent less than what would have occurred had there been no drought. This relatively small decline is due to the fixed nature of many agricultural expenses and the

rather large wheat acreage that is expected to be planted next fall (approximately 13 million acres vs. 12.4 million in this year). Wheat producers will likely seed all the acreage that they are permitted to plant under the 1990 wheat program. The set-aside requirement for the 1990 crop was recently announced and is to be 5 percent. The set-aside this year was 10 percent. Farm income this year should have little effect on farmers' planting decisions or their purchases of inputs that will be needed to get the 1990 crop seeded.

Cattle

Kansas State University extension cattle specialists estimate that approximately 225,000 beef cows will be culled from Kansas cattle herds this year. If accurate, that figure would represent 16 percent of the January 1 cow inventory. Sale barn managers report that up to three-quarters of these cows are going to slaughter. In addition to the decline in cow numbers, between 400,000 to 600,000 head of cattle were never placed on pasture (wheat or grass). In a year with normal pasture conditions and over 12.4 million acres of wheat pasture available in the state, industry analysts estimate that between 1.8-2.0 million head of cattle would have been placed on pasture. But the drought has so depleted pasture and forage supplies that stocking rates are expected to be down 25-30 percent in the Flint Hills and 30-40 percent in the rest of the state. At the same time, recent placements of cattle on feed have been at record numbers, with the April 1 number at 1.67 million head, up 12 percent from the previous year (Figure 2).

The reduction of the cow and calf inventory, the high cost of forage and hay, and the increase in cattle on feed will not necessarily lead to an

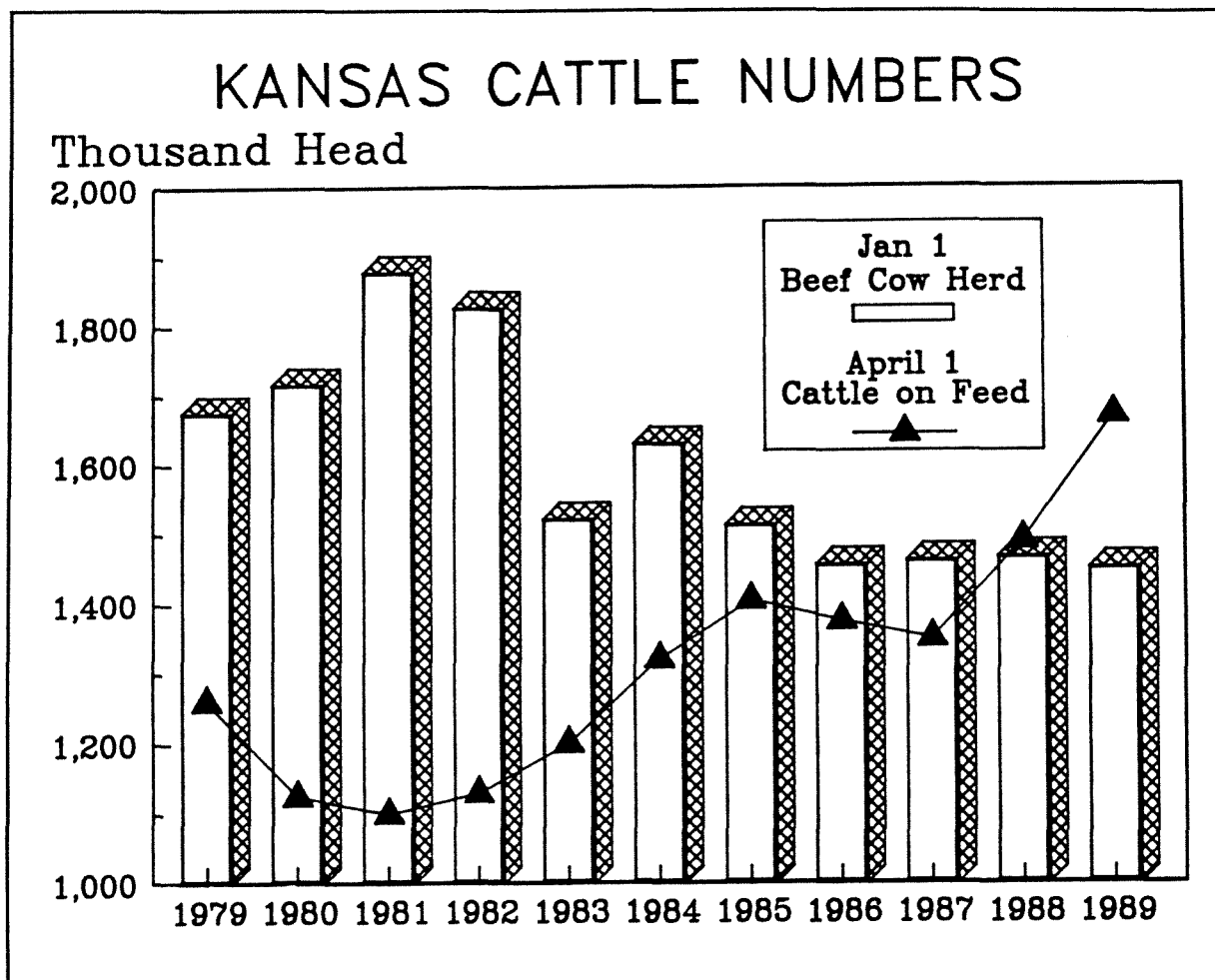


Figure 2

increase in grain consumption. Cow-calf and background operators may increase their per animal grain use to replace some hay, pasture, or forage. However, fewer stockers were purchased this year due to the drought, so overall grain usage by this segment of the industry may actually decline. While considerable press coverage has been given to the increase in feedlot placements, many of these animals have been lighter-weight cattle. Their rate of grain consumption per head will be slightly lower, and they will require a longer feeding period.

Table III summarizes the initial changes in the value of 1989 cattle sales that are due to the drought. When all segments of the cattle industry are taken into account, the net effect on 1989 sales is insignificant. *This should not be interpreted to mean that there have not been extensive losses in farm income (Income = Sales - Expenses).* The reader should keep in mind that the sale of cows this year represents a loss in ranchers' productive assets and subsequent revenue flow in following years. Also, the reduction in stocker numbers now will result in lower revenues next fall and in the spring of 1990. This analysis of the drought's effect on the Kansas cattle industry is for 1989 only. There will undoubtedly be "drought aftershocks" felt in 1990 and beyond, but the information that is available today is insufficient to forecast those impacts with any reasonable degree of certitude.

Table III. Initial Changes in the Value of Sales by Kansas Cattle Producers Due to the Drought

Sales	Million \$
Sales to Dairy and Other Cattle Producers	-90
Sales to Meat Producers	+69
Exports from Kansas	+27
Total Sales	+6

Table IV summarizes the initial changes in the value of purchases by the cattle industry due to the drought. Although total purchases are expected to be down by \$130 million, the cost of producing cattle, at each stage in the industry, will be up. For example, on a per animal basis, ranchers will have higher transportation costs because they have to pay for moving some cattle to pastures that will sustain them. Ranchers also will purchase greater

quantities of hay at higher prices, and, in some cases, they will have to ship in water. Feedlot operators will have to pay more for hay, and they may have less efficient operations due to the large number of light-weight cattle they have on feed. Table IV has tried to take into account the effect of federal assistance in the form of emergency feed programs and transportation allowances.

Table IV. Initial Changes in the Value of Agricultural Purchases by Kansas Cattle Producers Due to the Drought

Purchases	Million \$
Corn, Sorghum, Wheat and Other Farm Products	-15
Hay	+55
Cattle	-90
Ag Services	-7
Insurance, Real Estate & Financial Services	-10
Farm Machinery & Equipment	-3
Transportation	+1
Grain Mill Producers	-52
Other Wholesale Trade	-9
Total Purchases	-130

Looking down the road a few years, it is increasingly difficult to forecast the long-term effects of the drought on the Kansas cattle industry. In all likelihood, the feedlots will remain full, even if they have to import a larger share of cattle from out of state. Some industry analysts believe that most cow-calf producers that liquidated or reduced herds this year could be back in business within 2 years. Other market observers worry that the drought came at a critical juncture in the cattle cycle. The U.S. cattle industry has been liquidating herds for over 10 years. Only recently have they begun to rebuild herds. Of particular concern is the potential loss of

genetic quality. It is possible that the rebuilt herds of the next few years may be less efficient than the existing herds.

As the state's cow herds have declined over the years, the demand for pasture also has slipped. Average pasture rental rates in the state have dropped from \$13.30/ac. in 1983 to just \$11.80/ac. in 1988. The average age of the Kansas rancher is estimated to be 62 years old. If some of these older ranchers sell off their herds and then become reluctant to rebuild in the next few years, what will they do with their pastures? Kansas State University agronomists estimate that 3-5 million acres of Kansas pastures could be tilled. As long as the land is not highly erodible, the rancher would not lose his eligibility for government programs. Even if it was highly erodible, there would be little incentive to comply with conservation provisions, if the rancher currently received very few government agricultural benefits. Consequently, a perverse and unforeseen impact of the 1988/89 drought could be a conversion of some Kansas pastures to cropland over the next few years. This happened in the 1970's when grain prices were high. However, ranchers would have to perceive that there is a long-term advantage for grains relative to grazing value. A massive shift of pasture to crops is not likely to occur, unless crop prices stay high over the next few years.

Aggregate Economic Effects of the Drought

The immediate effects of the drought will be felt most strongly in the agricultural and ag-related sectors and in the state's rural communities. Beyond this, the drought also will impact nonagricultural sectors. There will even be a weak "echo" effect as lower incomes and reduced economic activity in nonagricultural sectors bounce back in the form of slightly lower demand for

food. Table V summarizes the aggregate effects of the drought on the various sectors of the Kansas economy. Keep in mind that *the initial economic "shock" was a \$411 million loss in agricultural sales* (\$6 million gain in cattle and a \$417 million loss in wheat). This was accompanied by a *\$162 million decline in purchases* by wheat and cattle producers, *a \$34 million loss in grain merchandising activity* counterbalanced by a small (\$6 million) increase in value added by the meat processing industry, and *a reduction of \$188 million in government deficiency payments*. The total aggregate loss resulting from this drought-induced jolt is \$1.61 billion. If there is an additional 25 million bushel decrease in the state's wheat crop (relative to the May estimate), the loss will increase by another \$172 million.

Table V. Aggregate Effects of the Drought on the Kansas Economy

Sector	May Crop Report (202 Million Bu)	Cumulative Losses if Wheat Crop Is Reduced by Another 25 Million Bushels
	-----	-----
	(Million \$)	(Million \$)
Agricultural Production	-449	-528
Agricultural Inputs	-78	-81
Ag Processing & Distribution	-107	-118
Other Manufacturing & Wholesale Trade	-70	-72
Energy & Industrial Materials	-111	-123
Transportation	-22	-26
Retail Trade & Personal Services	-207	-231
Financial & Business Services	-105	-115
Households	-456	-483
Total Cost to the Kansas Economy	-1605	-1777

At first glance, these losses appear to be considerable. A loss of \$449 million in agricultural production is nearly 19 percent of the state's 1988 total gross farm product. However, relative to the state's total gross

product, the drought's aggregate impact is less severe. Since 1982, agriculture's share of the state's gross product has averaged 6 percent (and ranged between 7.4 to 5.3 percent) (Figures 3 & 4). Earlier this year, the Governor's Report on the Kansas economy indicated that the Kansas 1989 gross product would be around \$48 billion. Consequently, a drought-induced loss of \$1.61 billion would represent a drop of about 3.3 percent in gross product.

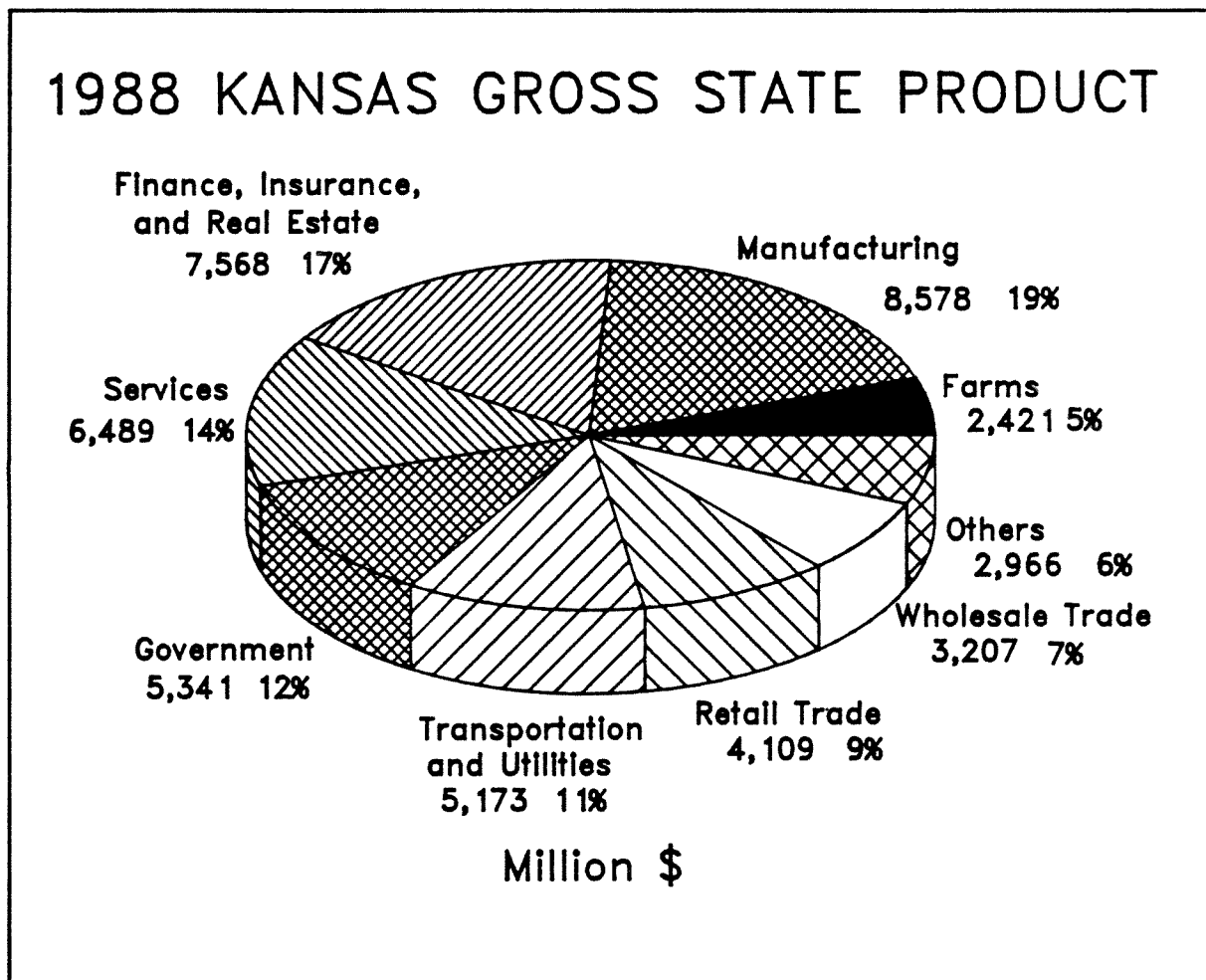


Figure 3

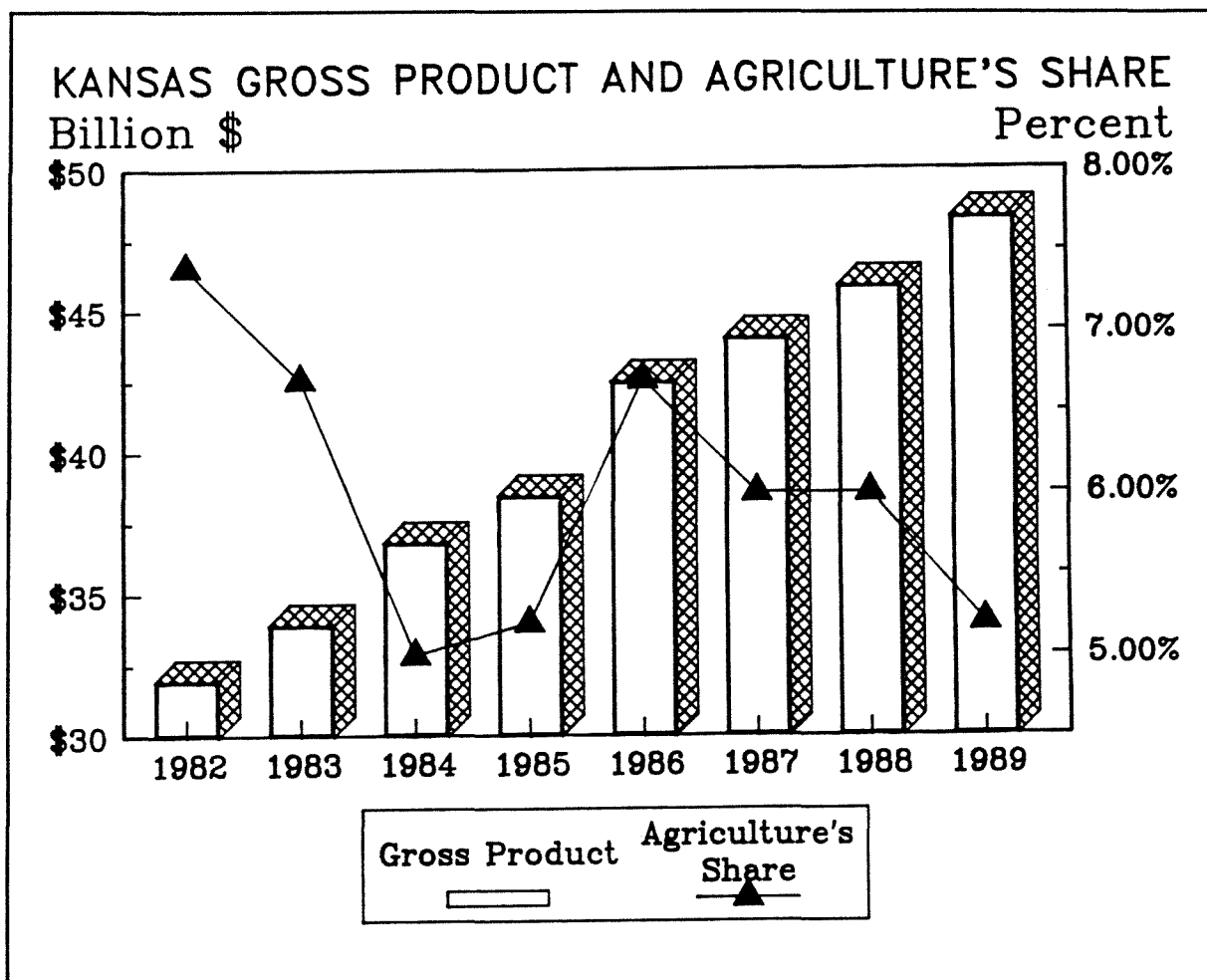


Figure 4

Factors That Would Soften the Drought's Economic Effect

Two factors may soften the impact of the drought on the Kansas economy. They are crop insurance indemnity payments and benefits resulting from a possible extension of the 1988 Drought Relief Act. Table VI summarizes the aggregate effects of a \$50 million increase in payments made to Kansas farmers. The multiplier effect of an increase in farm household incomes would be about 1.9. Consequently, the total effect of a \$50 million payment would be a \$94 million increase in the Kansas economy.

Table VI. Aggregate Effects of a \$50 Million Payment to Kansas Farmers

Sector	Million \$
Agricultural Production	1.6
Agricultural Inputs	3.5
Ag Processing & Distribution	3.6
Other Manufacturing & Wholesale Trade	7.5
Energy & Industrial Materials	5.6
Transportation	1.5
Retail Trade & Personal Services	5.1
Financial & Business Services	3.6
Households	61.9
Total Increase in the Kansas Economy	93.9

The Drought's Effect on Farm Finances and Rural Communities

Will the Drought Start a New Farm Financial Crisis?

Farm income and asset values have been rising over the last few years. Farm financial records of over 2,000 members of the Kansas Farm Management Association indicate that members' average net farm income has increased by \$43,000 since 1985. At the same time, prices for agricultural land have appreciated nearly \$56/acre. That's up almost 15 percent from their low of \$380/acre, set just 2 years ago (Figure 5). Kansas farmers have taken advantage of their higher incomes and have been reducing their debt load. In 1985, the average debt of these farmers was \$192,000. By 1988, that figure had fallen to \$169,000, and the ratio of farmers' loans to net worth had improved from .72 in 1985 to .57.

Given the recent improvement in farm finances, it seems reasonable to assume that the average Kansas farmer should be able to weather this year's drought. However, there are two additional factors that should be considered. First, not all Kansas farmers are members of the associations. Generally speaking, association members run farm operations that are larger than average. The average sales of association members was \$179,000 in 1987.

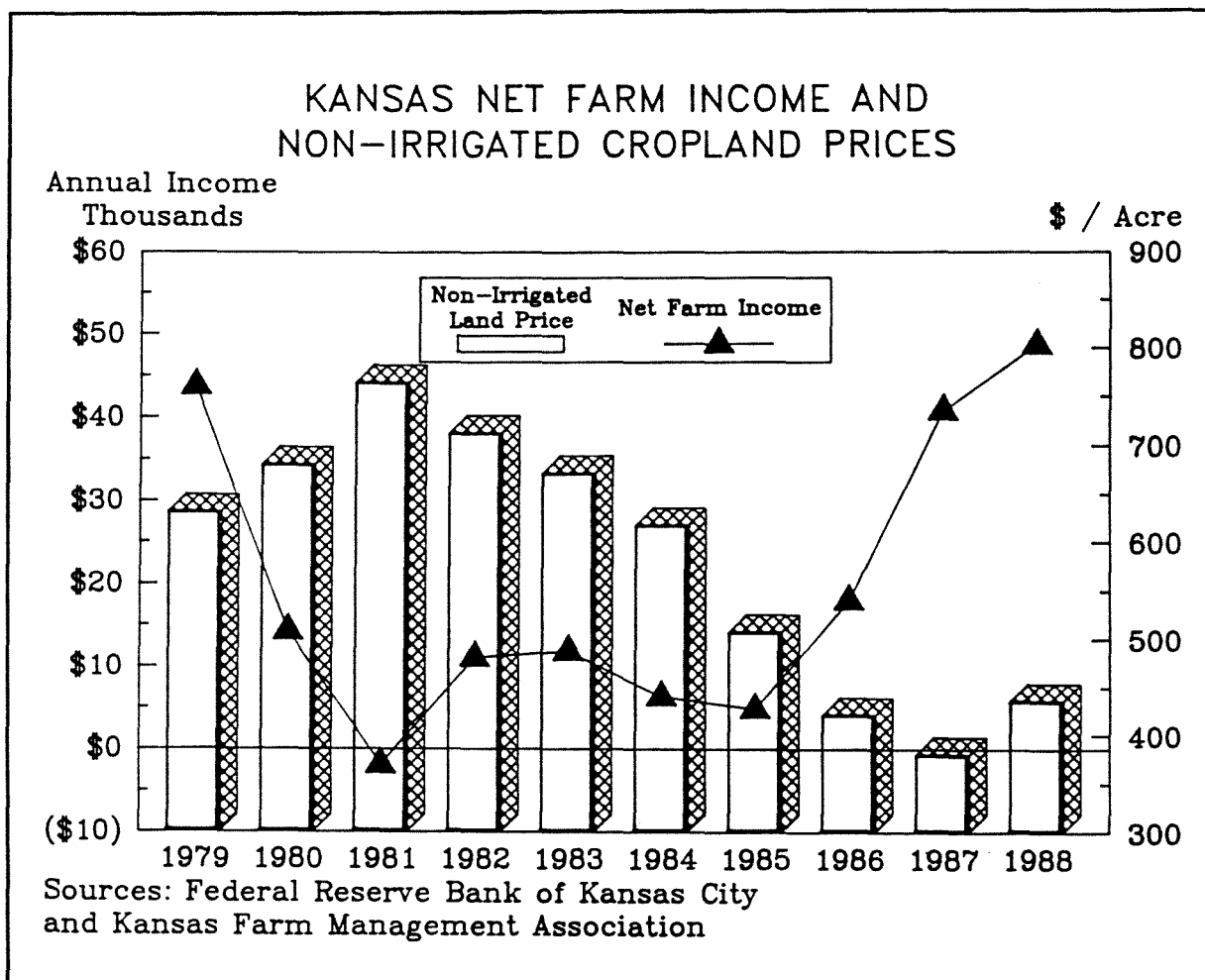


Figure 5

However, in 1987, only 13 percent of the 69,000 farms in Kansas had sales greater than \$100,000.

Not only is the Farm Management Association skewed towards larger operations, but within the membership of the association, there is a wide gap between the average incomes of members in the bottom income quartile and members in the top income quartile (Figure 6). For those members in the bottom income quartile, this year's drought will certainly cause increased financial hardship.

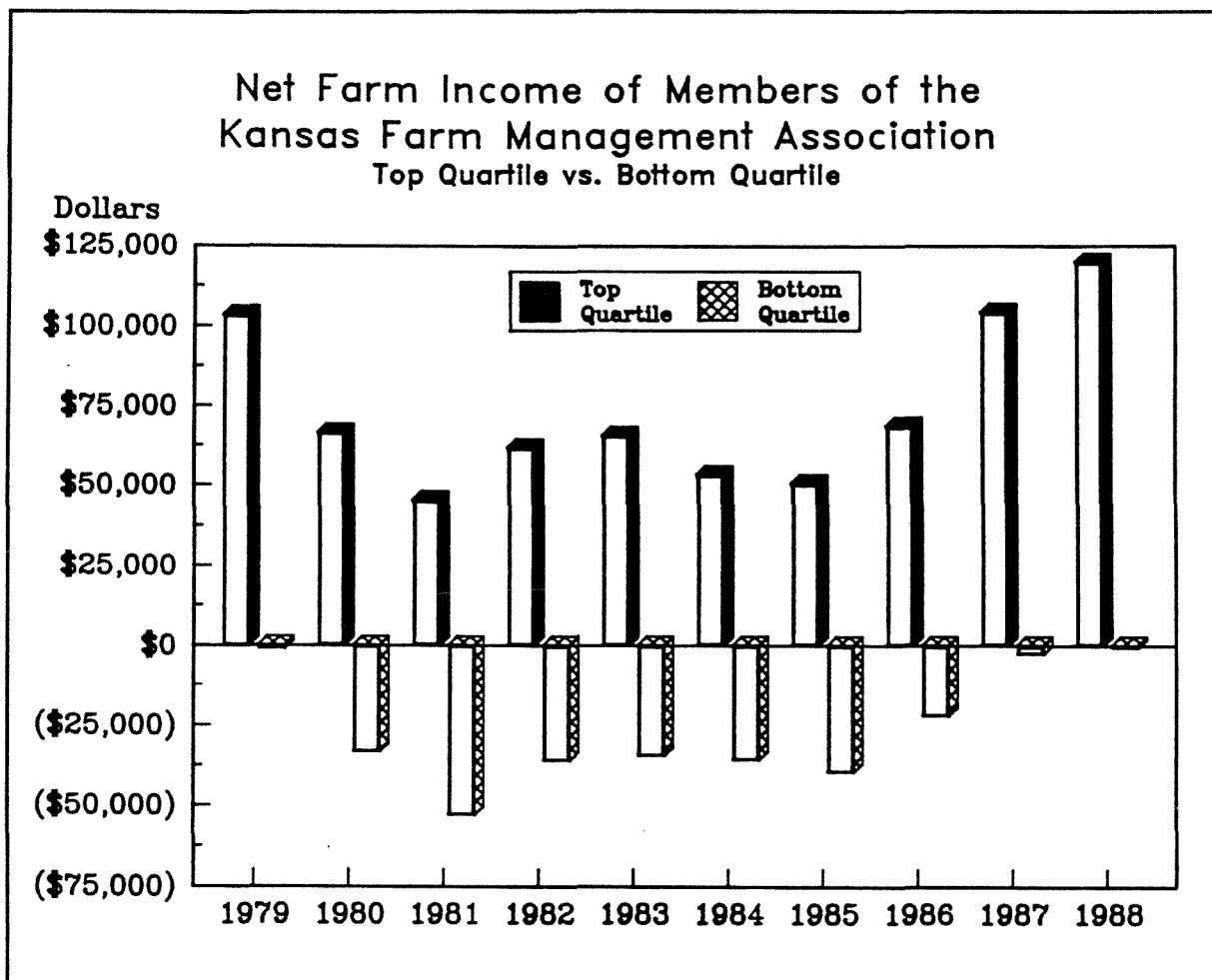


Figure 6

To get an idea of how severe an impact it may have, we should look at the farm income situation the last time there was a major crop disaster in Kansas. In 1981, the Kansas wheat crop was hit by a late spring freeze. Wheat production dropped by over 130 million bushels. Obviously, other factors contributed to changes in farm income that year. Nevertheless, farm income for all association members dropped by \$16,000 that year. This year's drought will result in a greater loss of wheat production, as well as a reduction in income from cattle operations. On the other hand, more wheat

farmers have crop insurance, and there is the potential for a good harvest of spring sown row crops. The bottom line is that Kansas farm income will be down next year, and those farmers in the weakest financial shape will have difficulty coping with this added burden.

What Will Be the Drought's Impact on Rural Communities?

Agriculture makes a substantial contribution to the economic welfare of many rural Kansas counties. However, because of the diffused nature of agricultural activity, its role is often less visible than manufacturing, mining, or other industries, for which large investments and large numbers of people are concentrated at one site.

In order to estimate the impact of the drought on one rural community, it was decided to first analyze the role of production agriculture in a representative county in central Kansas. Data from several sources, including the 1987 U.S. Census of Agriculture, provided the information needed to analyze the size of production agriculture in the study area.

In 1987, production agricultural firms in this county sold about \$60 million of cattle, wheat, sorghum, soybeans, hogs, and other products. In order to generate \$60 million in sales, farm firms spent about \$48 million to buy all their inputs and pay other costs such as labor and debt service. The difference between sales and expenses, \$12 million, was the net income earned by farm households. These farm households also earned another \$4 million from wages and salaries paid workers and from government deficiency payments paid to owners of farmland.

Because of the spending patterns of farm households, another \$6.7 million was earned by nonfarm households selling groceries, cars, and other

household goods and services to farm-related families. Also, because of the expenditures of farm firms in the county, an additional \$11.7 million was earned by people selling farm supplies to farm firms. In summary, the income generated by the farm sector in 1987 amounted to about 30 percent of all personal income in the county.

It is estimated that 1989 farm income in this same county will be \$-4.7 million. This is primarily the result of the wheat crop loss. This county's economy is heavily dependent on wheat, and the county is expected to suffer a nearly 90 percent loss in production. The cattle industry in this county will also feel the effects of higher feed costs, poor pasture, and low water in the stock ponds. If this county had received adequate rain, farm income could have been +\$20.9 million.

Other firms in the county are directly hurt by the drought. Local elevators will lose about \$840,000 in business. Farm implement sales will drop, as well as sales of new and used vehicles. Farm households will spend less for clothes, shoes, home improvements, and other like expenditures.

This loss in farm income will reverberate through other parts of the local economy. Farm households will have less to spend. Farm firms also will spend less on inputs and equipment. Usually, people and firms cut back on durable good purchases but they can't cut back on normal everyday needs. Somehow, money will be found to buy food, pay utility bills, and purchase gasoline to run the family car. Even more money will be needed to buy seed, fertilizer, and feed for the cattle and hogs. In the short term, we estimate that at least \$7 million less will be spent by farm households. This will have a significant impact on Main Street businesses.

The initial \$7 million loss will cause an additional and indirect income

loss of almost \$3 million. This \$10 million would usually be spent in the county and in nearby trade centers. The spending patterns of these people depend on whether they live in the county seat town or outside of it. In general, about 84 percent of all household expenditures are made in the county by county residents. Thus, 16 percent of household income leaks out (See Appendix B for more details).

In summary, the loss of income to farmers will ripple down Main Street and through the agricultural service economy, resulting in a large decline in personal income. How big the decline will be is impossible to calculate precisely because of changes in other sectors of the local economy, plus the positive effects of insurance payments and/or the extent to which expenditures are maintained by the depletion of savings or increased borrowings.

Conclusion

It may seem premature to try to estimate what effect the 1988/89 drought will have on the Kansas economy. However, the fact of the matter is that government officials at the local, state, and national levels are now reviewing their policy options in response to this drought. Although this report does not claim to be the definitive statement concerning the economic impact of the drought, it does incorporate the most recent information available and provides for several different contingencies.

There are several major physical effects of the drought. They are: (1) a 50 percent loss in wheat production, (2) a 16 percent cut in cow-calf numbers accompanied by a 20-33 percent drop in stocker and backgrounding operations, and (3) a 15-20 percent loss in hay production and a 30-50 percent loss in the carrying capacity of pastures. Such large decreases in production

(both in Kansas as well as throughout the Central and Southern Plains) have resulted in sharply higher prices for some commodities -- wheat is up \$.65/bu. and hay is up \$30-\$40/ton. The drought is not expected to change cattle prices by much, but there have been record placements of cattle on feed.

Using an input-output model of the Kansas economy, it is possible to estimate the aggregate effects of the drought. The estimated value of lost agricultural production is \$449 million, and agricultural-related sectors will lose another \$185 million. All other sectors will suffer a reduction of \$515 million, and households will lose \$456 million. The total drought-induced change in gross state product is estimated at \$1.61 billion or about 3.3 percent of the state's 1989 total gross product. The loss in aggregate output as well as the reduction in farm incomes could be alleviated partially by crop insurance indemnity payments as well as any drought relief payments that may be authorized by Congress.

Recent improvements in farm incomes and asset values have provided many Kansas farmers with sufficient financial reserves to weather this disaster. However, there are still a significant number of farmers who have only recently gotten their operations out of the red. The drought is likely to push some of these operations back into financial difficulty, particularly if they were not covered by crop insurance and/or do not receive federally mandated drought relief aid.

Many rural communities in Kansas are vulnerable and could suffer the most from this drought. In one representative central Kansas county, farm income is projected to be negative in 1989. In 1987, nearly 30 percent of all income earned in the county was derived from agriculture. Such a drastic cut in purchasing power will have severe repercussions for many Main Street

businesses, even though most farm households will maintain a modicum of consumption through increased borrowing or the depletion of savings. Farmers also will buy the needed inputs to support production, but nearly all discretionary purchases will be postponed.

APPENDIX A

Input-Output (I-O) models have been developed to represent national and regional economies as well as metropolitan areas. Within the area in question, the economy is divided into various sectors. Some I-O models include only a handful of sectors while others, such as models of the entire U.S. economy, may include 500 or more sectors with each sector consisting of one or more industries.

The mathematical mechanism for manipulating these relationships is called a transactions matrix. Every transaction matrix consists of a horizontal and vertical set of numbers. The horizontal row represents the sales of a particular economic sector to all sectors of the economy, whereas the vertical column represents a particular sector's purchases from all sectors of the economy. The following is a very simple transactions matrix for an imaginary economy made up of four sectors:

	<u>Agriculture</u>	<u>Manufacturing</u>	<u>Services</u>	<u>Households</u>
	----- (Million \$) -----			
Agriculture	10	5	2	4
Manufacturing	3	15	7	7
Services	0	8	10	10
Households	8	4	9	3

The column for the agriculture sector shows that agriculture purchases \$10 million worth of inputs from within its own sector, \$3 million worth of inputs from manufacturing, nothing from services, and \$8 million worth of inputs from households (labor and property rental). The agriculture sector's row shows that \$10 million worth of output is sold within the sector, \$5 million worth of output is sold to manufacturing, \$2 million worth of output is sold to services, and \$4 million worth of output is sold to households.

APPENDIX B

To show how a loss in purchases traces through the local economy, the following equation is provided.

$$\$7 \text{ million} \times \frac{1}{1 - (.84 \times .35)} = \text{Total Impacts}$$

where .84 is the average proportion of household income spent in the county, and .35 is the estimated amount of a new dollar brought into the local economy that ends up as household income.

Thus, $\frac{1}{1 - (.84 \times .35)} = 1.42$, which is the estimated income multiplier

$\$7 \text{ million} \times 1.42 = 9,940,000$ or \$7 million in direct loss plus \$2,940,000 in indirect income loss.

The following table shows how people spend their incomes. The first column shows the way town people spend their income on selected goods and services. The second column shows the way out-of-town people spend their income. Both columns present the percentage of an item bought in the county seat town. The data is based on a 1987 area-wide survey of households.

Appendix Table I. SPENDING PATTERNS ON SELECTED ITEMS

Purchases	Percent of Purchases Made in County Seat Town	
	People Living in County Seat	Area People
1. New and Used Vehicles	82.1	29.4
2. Food for Home Consumption	85.9	16.5
3. Shoes	40.1	12.2
4. Clothes for Women	49.8	18.2
5. Clothes for Men	50.8	16.7
6. Car and Truck Repairs	90.6	17.0
7. Physician's Services	85.1	40.9
8. Banking Services	91.9	15.3
9. Lumberyard Products	66.4	6.0
10. Agricultural Inputs	90.6	17.5

Source: KSU Extension Survey of households in the county seat town and surrounding area, 1987.

