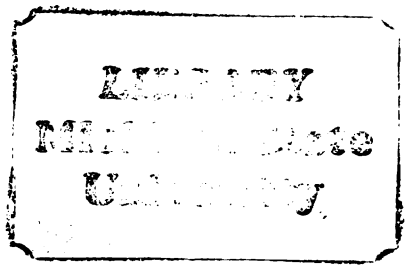

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CATTLE SLAUGHTERING IN MICHIGAN:
THE SUPPLY OF SLAUGHTER CATTLE AND THE POTENTIAL
FOR EXPANDING SLAUGHTERING FACILITIES IN MICHIGAN

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KRISTEN ALLEN

has been accepted towards fulfillment
of the requirements for

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Harold M. Riley

Major professor

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CATTLE SLAUGHTERING IN MICHIGAN:

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By

Kristen Allen

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ABSTRACT

CATTLE SLAUGHTERING IN MICHIGAN: THE SUPPLY OF SLAUGHTER CATTLE AND THE POTENTIAL FOR EXPANDING SLAUGHTERING FACILITIES IN MICHIGAN

By
Kristen Allen

The potential for new investment in cattle slaughtering facilities in Michigan is assessed by comparing present and projected supplies of slaughter cattle with existing and planned slaughtering capacity.

In recent years Michigan, Ohio, Indiana and Illinois have consumed more beef than they have produced. Linear projections of slaughter cattle supplies to 1990 point to continuing declines in fed cattle production in the region. Some qualitative aspects suggest a slowing or possible reversal of this trend.

The volume of fed cattle potentially available for three Michigan plants is estimated. The conclusion is that existing slaughtering facilities, including planned expansions, should provide sufficient capacity to handle projected Michigan cattle production through the 1980s.

Market organization changes which could facilitate or constrain an upswing in Michigan beef production and slaughtering and directions for future research and extension are suggested.

To David, Margo and Wick,
for support and perseverance.

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I. INTRODUCTION

The Michigan Governor's Conference on Agriculture in 1981 suggested several areas for expansion of productive capacity in Michigan. Because there is a deficit between production and consumption and because producers support the idea, beef cattle slaughtering and processing was suggested as one area warranting further study (Michigan Department of Agriculture, 1981).

An increasing percentage of the beef consumed in Michigan is imported, primarily from the High Plains and Western Corn Belt. Meanwhile, Michigan exports corn, soybeans and a significant proportion of the cattle it feeds. Slaughter cattle are sold in Ohio, Indiana, Pennsylvania, Illinois and Ontario. Over the past decade Michigan packing plants have found it increasingly difficult to compete with the large "new breed" packers in the midwest. A similar story can be told for packing plants in the other Eastern Corn Belt states (Figure 1.1) in particular in Ohio and Indiana. As cattle slaughtering plants in these states have closed, producers of fed cattle have seen the markets for their cattle weaken. Prices for Michigan Choice grade steers and heifers often have been $1 to $2.50 below prices at Omaha in the early 1980s, in contrast to earlier periods when Michigan prices were consistently higher than those in Omaha. The higher past prices reflected the pattern of movement of beef from midwest packers to eastern markets (Riley, Allen and Jackson, 1984).

The cattle slaughtering industry in Michigan cannot be considered in isolation from those in surrounding states for two reasons. First, there is free movement of live cattle and meat products between the states of the Unites States. Second, economies of size are generally recognized as being important in cattle slaughtering. In order to assemble enough cattle to operate a large plant at full capacity in Michigan some cattle would have to be purchased from outside the state. This study concentrates on the supply of cattle and the existing slaughtering capacity in the four states of the Eastern Corn Belt, and how these factors influence the possibility for expansion of cattle slaughtering facilities in Michigan.

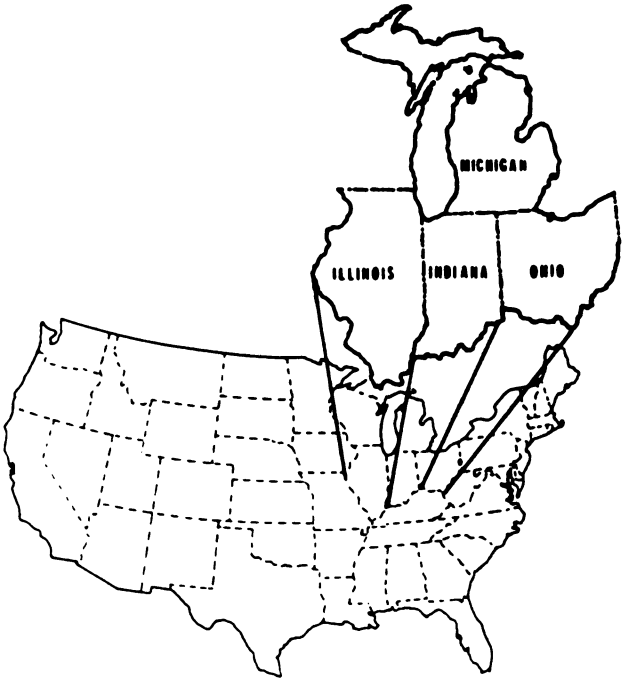

FIGURE 1.1: THE EASTERN CORN BELT STATES

Objectives

1. To map the geographic distribution of slaughter cattle (fed cattle and cows) within the four states of the Eastern Corn Belt.

2. To identify possible Michigan locations for future slaughtering plants or to identify those existing Michigan plants which could expand their operations.

3. To estimate the volume of fed cattle potentially available to Michigan-based plants.

4. To identify some of the factors which would facilitate expansion of slaughtering capacity in Michigan and some which could prove to be constraints. This includes a brief consideration of institutional and organizational arrangements for coordinating feeding and slaughtering of steers and heifers.

This thesis formed part of a study of the economic potential for investment in large, modern slaughtering facilities in Michigan, completed early in 1984 (Riley, Allen and Jackson, 1984). Riley et al described and analyzed the structure, location, and changes which have occurred in the U.S. cattle slaughtering industry over the past decade. They assessed the economic feasibility of investment in expanded slaughtering and processing capacity in Michigan, drawing on information on the potential supply of slaughter cattle, the existing slaughter capacity in the region and cost-volume relationships in cattle slaughtering, comparing Michigan with the other Eastern Corn Belt states and other regions in the U.S.

Choosing a site for a cattle slaughtering plant is assumed to be a multi-faceted decision-making process. Some of the more important determinants would include the supply of cattle (of the type to be slaughtered), the availability and cost of land or of existing, unused slaughtering facilities, labor availability and cost, environmental

and zoning regulations, the availability of financing and the size and location of the targeted consuming population. Once a general area is decided upon other factors such as highway access, unemployment and workers' compensation rates, taxes, utility rates and the extent of local support, both governmental and from citizens groups would determine the actual location of a new plant. In this thesis it is assumed that the decision making process has an hierarchical structure and that when making plant size and location decisions some factors will take precedent over others. The focus of this thesis is on the supply of cattle available for slaughter in the Eastern Corn Belt, the condition felt to be at the top of the hierarchy.

A major theme of both this thesis and the larger study is that very large plants realize economies of size in in-plant slaughtering costs. Some of the "new breed" packers in the High Plains and Corn Belt are designed to slaughter over 500,000 head of cattle annually. When live cattle assembly and meat distribution costs are included, however, some diseconomies may be realized by very large plants, especially when cattle are drawn from a sparse population.

Sources of Economies of Size

In large slaughtering plants equipment can be used more efficiently and cost-saving technologies can be employed. Cothern et al estimated the average total in-plant costs in 1976 for slaughtering and chilling to be $24.91 per head for a plant slaughtering about 98,000 head annually and $18.58 per head for a plant slaughtering 624,000 head annually (Cothern, Peard and Weeks, 1978). In large plants the labor force can be more specialized. Logan suggests two benefits arising from this specialization. First, the productivity of

labor increases because workers perform only one operation which enables them to become more skilled at particular jobs. In addition, less productive time is lost because workers are not continually switching jobs. A second benefit derives from wage differences for different jobs. When workers perform only one job they are paid at the rate for that job. When they perform more than one job they must be paid at the rate applicable to the highest paying job they perform even though that particular job may not account for the largest proportion of their time (Logan, 1966). A final source of size economies is in the expansion of operations. Large plants are more likely to be able to expand their operations to include some processing of carcasses, rendering of inedible by-products and curing of hides. By so doing they may be able to realize higher returns per head slaughtered than they would if they sold the "drop" to another firm for processing (Riley, Allen and Jackson, 1984).

Sources of Diseconomies of Size

In some instances very large plants may actually experience increasing average total costs. Transportation and assembly costs increase as slaughter cattle are purchased from more distant locations, especially when the cattle population density is low. The higher costs are due to several factors -- transportation over longer distances, tissue shrink, increased likelihood of animals being injured or stressed when transported over greater distances and a greater likelihood of competition from other, more strategically located, plants (Smalley, 1978). In addition to increased assembly costs, distribution costs will rise and market outlets for the product may become more difficult to find when production is greatly

increased. This could be of particular relevance in the beef market at present. Difficulties with scheduling slaughter, especially when cattle production exhibits both seasonal and cyclical fluctuations, may result in plants being operated at less than full capacity.

Size economies have been important in shaping the U.S. cattle slaughtering industry to date. Most of the efficient, "new breed" plants are able to take advantage of these economies. They have adapted to the changes in the U.S. beef subsector which are outlined in the next chapter. With the exception of the IBP Inc. plant in western Illinois there are no "new breed" mega-plants in the Eastern Corn Belt. In Michigan, Ohio and Indiana some of the in-plant size economies associated with very large plants would be partially or wholly offset by the diseconomies associated with a widely dispersed cattle population. The supply of cattle for slaughter and the characteristics of cattle production in the Eastern Corn Belt have important implications for existing and future plants in the region. The fifth chapter of this thesis focuses on estimating the potential supply of steers and heifers for slaughter in three Michigan plants, one of which is operating currently and two proposed alternative plants. To complete the study a description of the marketing channels for fed cattle, in the U.S. and in the Eastern Corn Belt, and a consideration of the importance of research, extension and product promotion in the U.S. beef subsector forms the substance of chapter six.

II. AN OVERVIEW OF THE UNITED STATES BEEF SUBSECTOR

The evolution of the cattle feeding and slaughtering industries in the U.S. has been influenced by technological and organizational developments within the industries and in the infrastructure which serves them. Developments in animal husbandry and management techniques and consequent locational shifts in cattle feeding activity have been major evolutionary factors. Improvements in transportation, especially the development of refrigerated transport, have had a substantial impact on the location and structure of the industries. There have been important changes in the economic and geographic concentration as well as the degree of specialization of slaughtering plants in the beef subsector. It is likely that the beef subsector will remain very dynamic as the many factors which influence it continue to change and evolve.

Animal Husbandry and Management

Cattle feeding operations evolved from the grass finishing practices of early cattle ranchers to modern confinement feedlots in response to changes in beef consumption and as a result of technological and managerial advances. The advances include improvements in disease control, animal genetics, animal nutrition, feedlot design, information and communication systems and personal business skills. Large numbers of animals now can be kept in close

proximity to each other, realizing rapid rates of weight gain on concentrated rations. Improved lot design, particularly with emphasis on waste disposal and pollution control, has expanded potential locations for feedlots. Ranch managers are no longer cowboys -- they now combine sound knowledge of animal husbandry techniques with cattle buying and marketing skills (Simpson and Farris, 1982).

Concentration in Cattle Feeding

Large feedlots are becoming increasingly important sources of cattle while smaller "family farm" type lots have declined in importance. In 1981 feedlots with a capacity of 1,000 head or more accounted for 72 percent of the fed cattle marketed in the U.S., compared to 58 percent in 1971 (U.S. Department of Agriculture, Statistical Reporting Service, 1971 and 1981)[1]. This reflects two significant trends in cattle feeding prevalent over the past three decades -- increasing firm and geographic concentration in cattle feeding.

Between 1970 and 1981 the number of cattle feedlots in the 23 major cattle raising states declined almost continually, from 177,300 in 1970 to 104,300 in 1981. Over the same period the number of fed cattle marketed declined from 24.8 million head to 23.0 million head (U.S. Department of Agriculture, Statistical Reporting Service, 1981). Simpson and Farris (1982) and Ward (1977) offer several explanations for the increase in feedlot firm concentration. The larger lots are more likely to realize significant economies of size in feeding and feedlot utilization. Simpson and Farris showed that the greater efficiency of larger feedlots derives from both lower average fixed costs and lower per head operating expenses. The initial investment

in the facilities for a large feedlot, however, are high. Ward suggests that the glamour and expectation of high profits attracts those with both the resources and, importantly, a willingness to bear the risk of feeding cattle (Ward, 1977). Those with the resources are often conglomerate corporations, and their investment in cattle feeding operations may enable them to integrate forward from grain operations or backwards from slaughtering operations. Of the top 20 cattle feeders in 1979, four had grain company ties, seven had meat packing house ties and seven had brokerage house ties. Five of the companies had affiliations in at least two of these areas and the number one cattle feeding company in terms of lot capacity, Caprock Industries, was owned by Cargill and had ties with Cargill associates in all three areas (Simpson and Farris, 1982).

Table 2.1 shows the location of the feedlots operated by the top 20 cattle feeders and indicates the concentration in the cattle feeding industry. Together, these cattle producers operate a total of 56 lots, of which 24 are in Texas and the remaining 32 are in ten other states, all but one of which are west of the Mississippi River. These lots have a combined total one-time capacity of 2.5 million head of cattle. Using an average turnover rate of 1.55 for these lots (and this is probably a conservative estimate) this translates into some 3.9 million head of cattle marketed by 20 cattle feeders in 1979. The total volume of fed cattle marketed in the 23 major cattle feeding states in that year was 24.6 million head from 120,136 feedlots. This means that 20 cattle feeders, operating 56 feedlots (0.05 percent of the total number of lots) marketed about 16 percent of the total number of fed cattle marketed in the major cattle raising states in

the U.S. in 1979. In comparison, the four Eastern Corn Belt states in that year had 26 percent of all feedlots in the U.S. but marketed only 7.33 percent of all fed cattle marketed.

Riley and Hiemstra suggest that the expansion in cattle feeding activity in the 1950s and 1960s was in response to increased consumer demand for grain-fed beef and the ready availability of relatively cheap feed grains (Riley and Hiemstra, 1981a). They note that most of this expansion occurred in the Great Plains, the Western Corn Belt and the Southwest, both because of increases in irrigated grain production in these regions and because of the growing west coast population (Riley and Hiemstra, 1981b). The distribution of cattle feeding operations throughout the U.S in 1978 is shown in Figure 2.1.

TABLE 2.1
TOP TWENTY CATTLE FEEDLOTS IN THE UNITED STATES, 1979

Summary: In 1979 the top twenty cattle feeders operated 56 lots with a combined one-time capacity of 2.5 million head. These lots could have marketed an estimated 3.9 million head in 1979, or 16 percent of the total number of fed cattle marketed in the U.S.

Rank	Company	Number and Location of Lots	One Time Capacity	Grain Company Tie	Packer Tie	Brokerage House Tie
1.	Caprock Industries	3 Texas 2 Kansas	216,000	Cargill Nutrina Feeds	MBPXL(a)	Cargill Investors
2.	Monfort of Colorado	2 Colorado	200,000		Monfort Packing	
3.	AZL Resources	4 Texas 1 Nebraska	186,500			Bromagen & Hertz
4.	Northwest Feeders Inc.	6 Washington	183,000		Iowa Beef(b) Processors	
5.	Hitch Enterprises	2 Oklahoma 1 Kansas	177,000		Booker Custom Packing	
6	Barrett-Crofoot	2 Texas	177,000			
7.	Catus Feeders	2 Texas 1 Oklahoma	153,000			One major stock holder with REFCO
8.	Western Beef, Inc.	2 California 2 Texas 1 New Mexico	124,000	Western Beef Grain Co.		One director is RB&H broker
9.	Frionia	3 Texas	112,000		Village Packing	
10.	Foxley & Co.	2 Nebraska 1 Texas	110,000			Agent for RB&H
11.	Allied Mills	2 Texas	105,000	Continental Grain, Wayne Foods		Conti Commodities
12.	Miller Feedlots	2 Wyoming 1 Texas 1 Colorado	104,000			
13.	Harris Feedlot	1 California	100,000		Diamond Meat San Jose Meat	
14.	Dekalb Ag. Research Inc.	1 Texas 1 Arizona 1 Kansas 1 Mississippi	96,000	Arizona Feeds		Heinhold
15.	Hi-Plains Feedyard	1 Texas	90,000			
16.	Red River Feedyard	1 Arizona	85,000			
17.	Valley View Cattle Co.	2 Texas	81,000			
18.	Fat City Feedlots	1 California	80,000			
19.	Wilhelm Co.	2 Colorado	80,000			
20.	Monson & Son Cattle-van Degraff Feedlot	1 Washington	75,000		Washington Beef Processors	

a. Now Excel
b. Now IBP Inc.

SOURCE: Richardson, 1981, cited in Simpson and Farris, 1982.

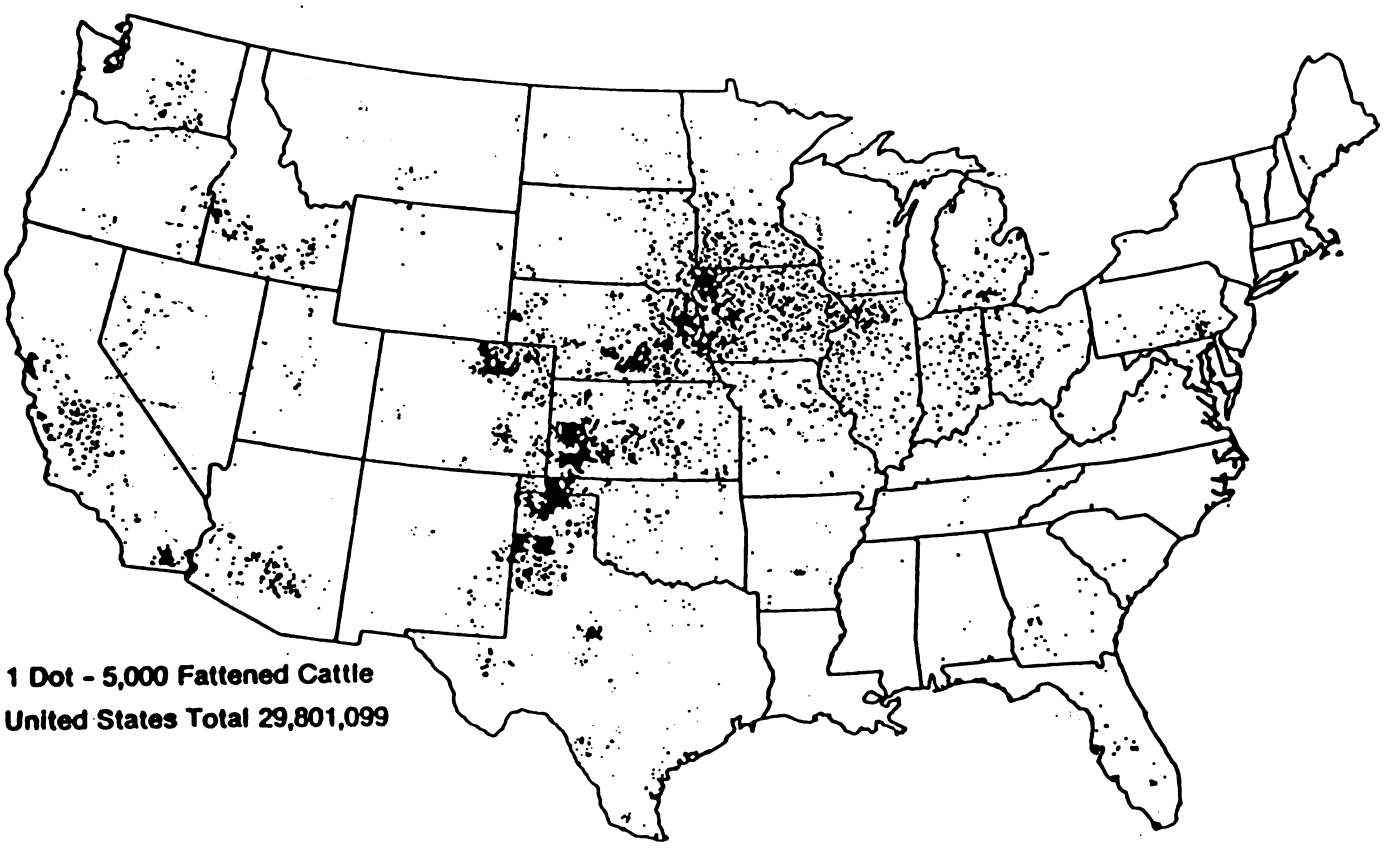

FIGURE 2.1:DISTRIBUTION OF CATTLE FATTENED ON GRAIN AND CONCENTRATES AND SOLD FOR SLAUGHTER, UNITED STATES, 1978

SOURCE: Census of Agriculture, 1978

Transportation and Refrigeration

The two-stage development of an efficient, interstate transportation system, first via railroads and later via the network of interstate highways, had a significant impact on the cattle feeding and slaughtering industries.

Railroads and Terminal Markets[2]

Originally, cattle were moved on foot from their pastures to slaughterhouses. This method of cattle movement favored direct buying arrangements between cattle producers and the packing houses. As the centers of livestock production shifted westward into the Corn Belt, eastern market interests pushed for improved transportation links between the producing and consuming centers. Railroads, canals and private and public roads formed these links. As the railroads expanded through the midwest and the south they enabled large-volume shipments of livestock and required holding facilities at their destination. The result was large public stockyards and terminal livestock markets which became central marketing points. One of the largest of these was the Chicago Union Stockyards and Transit Company which was incorporated in 1865. This single facility accommodated all railroad lines coming into Chicago and was in an ideal location for outgoing rail and water transport facilities for shipments of both live cattle and meat.

Terminal livestock markets remained dominant until after World War I. The continuing westward expansion of the cattle feeding industry and the development of a network of interstate highways, however, drew the cattle slaughtering industry west towards the newly opened cattle lands. This led, ultimately, to the demise of the large

terminal markets; Chicago's Union Stockyards ceased trading cattle in August 1971.

Refrigeration

Changes in the beef subsector brought about by advances in transportation technology would have been much less significant had it not been for the advent of refrigeration. The development of natural ice packing in 1857 enabled packers to slaughter and pack animals during the summer months (McCoy, 1979). This method of cooling meat was soon adopted, and by 1879 Gustavus Swift and Andrew Chase had finished blueprints for an insulated, ventilated and refrigerated railroad car (Yeager, 1981). This development met with a cool reception from the railroad companies, who had invested heavily in livestock cars, and from eastern market concerns who saw it as bringing potential competition from the west (Yeager, 1981). The fear on the part of the eastern markets was well founded. Refrigerated railroad cars enabled slaughtering plants to locate closer to terminal markets than to consumers, as they had traditionally. Refrigeration opened the way for storage and shipment on a year round basis and increased the quantity of meat available annually. Consumer demand for fresh meat was stimulated because refrigerated meat was of better quality than cured or unrefrigerated fresh meat (McCoy, 1979).

Interstate Highways

The interstate highway network further facilitated the westward relocation of cattle feeding and cattle slaughtering plants. Efficient road transportation, in refrigerated trucks, meant that cattle could be raised where feed grains were cheapest, slaughtered nearby and the meat shipped to centers of consumption at relatively

low cost to the beef consumer. As these locational shifts occurred so the structure of the industry changed. A result of these structural changes was a return to direct procurement methods by packers and a marked decline in the use of terminal markets (American Meat Institute, 1981).

Decentralization, Concentration and New Entrants in the Cattle Slaughtering Industry

Changes in the cattle feeding industry were paralleled by changes in the cattle slaughtering industry, resulting in both locational and structural changes throughout the 1950s and early 1960s (Riley and Hiemstra, 1981b). Important among these changes were decentralization and specialization of plants, the adoption of new federal inspection regulations, meat grading and the entry of new firms into the industry.

Decentralization

The closing of many terminal markets prompted the closure of many of the slaughtering plants associated with them. These plants were traditionally large, multi-storied buildings designed to kill several animal species (cattle, sheep and hogs). By the time these terminal plants closed they were operating with obsolete technologies while their replacements, in the cattle feeding centers, were large, modern plants specializing in the slaughter, and often processing, of one animal species (Riley and Hiemstra, 1981b). These new plants benefited from lower cattle procurement costs, lower operating costs -- due particularly to new labor contracts -- and more efficient slaughtering methods (Riley and Hiemstra, 1981b).

Concentration in the Cattle Slaughtering Industry

The trend towards decentralization in the meat packing industry during the 1950s and 1960s and the entry of new, innovative firms reduced the level of concentration in the industry. In 1930 the "Big Four" in cattle slaughtering (Armour, Cudahy, Swift and Wilson) accounted for 48.5 percent of the commercial cattle slaughter in the United States; by 1970 the market share accounted for by the top four firms had declined to 21.3 percent (U.S. Department of Agriculture, Agricultural Marketing Service, Packers and Stockyards Program, 1979, Appendix 13). New firms first entered the "top four" rank in 1957 and throughout the 1960s there was at least one firm other than the original "Big Four" in the top four ranking firms (U.S. Department of Agriculture, op. cit.). Throughout the 1970s the market shares of the "new breed" packers increased. In 1983 the top five beef packers, IBP Inc., Excel, Spencer Beef, Swift and Morrell, controlled almost 50 percent of the market (Harsch, 1983). The top four steer and heifer slaughtering firms in 1981, had a market share of 44 percent. The market for "boxed beef" is even more concentrated; in 1982 the top four firms held 65 percent of the market (Riley, Allen and Jackson, 1984).

There are two aspects to the issue of concentration in the cattle slaughtering industry. As buyers of fed cattle packers operate in a regional market. The size of the relevant market area varies depending upon the density of cattle feeding operations. In the Eastern Corn Belt the supply radius for a plant could extend as far as 400 to 500 miles from the plant. The other aspect is the level of concentration in the product market. The relevant market for many of

the products sold by meat packers, especially boxed beef, is the nation. This distinction was recognized in the recent court decision by the Colorado District Court to block Excel's acquisition of Spencer Beef. The reason for the decision in the case, brought by Monfort of Colorado, was that the acquisition would substantially lessen competition in both the regional market for fed cattle and the national market for boxed beef (U.S. District Court for the District of Colorado). Excel, which is owned by Cargill and which is the second largest cattle slaughtering firm in the U.S. subsequently attempted to purchase the Land O' Lakes plant at Oakland, Iowa (Anon, 1984) but this was enjoined in February 1984 (U.S. District Court, op. cit.). The court's decision may slow merger activity in beef packing but it is unlikely to stop the trend towards greater concentration in the industry in general.

Federal Meat Inspection Regulations and Federal Grading

The implementation of federal regulations regarding the inspection of all meat and poultry sold commercially and a suggested program for federal grading of carcasses had opposing influences on the cattle slaughtering industry. Federal inspection regulations embodied in the Wholesome Meat Act of 1967 had the effect of concentrating slaughtering into fewer plants (Riley and Hiemstra, 1981b). This Act tightened both facility and inspection requirements. States were required to upgrade their inspection service to meet federal inspection standards or plants had to submit to federal inspection (Riley and Hiemstra, 1981b). The result was that many small plants which were unable to comply with the requirements either ceased slaughtering or changed to "custom killing" operations

(Connaughton, personal communication)[3]. The use of federal grades for beef carcasses has facilitated trading by description rather than by visual inspection, and the development of a market information system. With the advent of a national system for describing carcasses the market for steer and heifer carcasses became a highly competitive, national market and the National Provisioner's "Yellow Sheet" became an important information and pricing instrument for forward contracting (Riley and Hiemstra, 1981b). Federal grading of carcasses enabled small packers to compete with large ones on the basis of quality if not volume (McCoy, 1979). The result was decentralization and lessening of concentration in the cattle slaughtering industry.

Grading and inspection of carcasses and meat are two distinct operations with different intentions. Grading refers to the separation of carcasses (or live animals) into uniform groupings in terms of certain, specified characteristics which are associated with market preference and value (McCoy, 1979). The aim is to facilitate trading by enabling the buying and selling of products by description. For beef carcasses (and live cattle) eight federal quality grades and five federal yield grades are recognized. Quality grades are subjective, having to do with the palatability of the lean, while yield grades reflect the percentage of boneless, closely-trimmed retail cuts obtainable from a carcass (McCoy, 1979). Grading, of either carcasses or live animals, is voluntary and firms may use federal (USDA), their own or no grading system.

Federal inspection is mandatory for any meat or meat products which move interstate or into foreign trade. The Meat Inspection Act of 1906 detailed five basic areas for concern -- diseased and unfit

meat, sanitary handling conditions, prevention of harmful substances in meat, application of an inspection mark and correct labeling of meat and meat products (Levie, 1979). The Wholesome Meat Act of 1967 was implemented with the intention of assuring consumers that the meat they bought would be wholesome, inspected and approved by the USDA or its designated agents (Levie, 1979). Under this Act states may opt to operate their own inspection service if it is equal or superior to the federal service. Federal regulations require that a federal (or federal-approved, state) meat inspector be on site whenever animals are being slaughtered and a veterinarian visit a plant at least once each day animals are slaughtered on the premises (Connaughton, personal communication).

New Entrants and Innovations

Ownership changes amongst packing plants resulted in the entry of new firms into the industry. Just as had the cattle feeding industry so the cattle slaughtering industry attracted conglomerate corporations. By 1977 merger and acquisition activity in the meat packing industry had resulted in such ventures as Armour and Greyhound, Cudahy and General Host, John Morrell and United Brands, Swift and Esmark and Wilson and the LTV Corporation (Ward, 1977). Not all these arrangements proved to be lasting, however, and by 1981 three, General Host, Esmark and LTV had decided to break the ties (Shellenbarger, 1981). Ironically, in July 1981 Occidental Petroleum Corporation agreed to acquire the giant in meat packing, Iowa Beef Processors (now IBP Inc.) for $800 million (Anon, 1981).

IBP's technological and organizational innovativeness enabled them, by 1981, to control almost 25 percent of U.S. steer and heifer

slaughter (Cook, 1981). IBP made a major break with the tradition of slaughtering cattle near terminal markets when, in the early 1960s, they built a slaughtering plant at Denison, Iowa (Cook, 1981). By so doing they lowered assembly and transport costs and reduced tissue shrink and animal losses due to death and injury. Two other important technological advances in the industry were on-line disassembly and "boxing". IBP revolutionized cattle slaughtering with the introduction of a single-storied plant in which cattle were killed and disassembled on a moving chain (Cook, 1981). This process obviated the need for a workforce of skilled butchers. Unskilled labor could be taught to make a few simple cuts or to remove one part before the carcass moved on to the next worker on the line. The first such plant had killing costs of $10 per head compared to conventional plant costs of between $15 and $20 per head (Cook, 1981). IBP further integrated their operations by moving into beef processing and since 1966 have lead the beef packing industry in the production and promotion of boxed beef (Hall and MacBride, 1980). Boxed beef production involves the disassembly of beef carcasses into primals and sub-primals which can be vacuum packed into plastic bags which are then packed into cardboard boxes for shipping. Unneeded by-products, fat and bone are separated from the primal and sub-primal units during the disassembly process. The process has several significant advantages for meat packers. Boxed beef spoils less rapidly and does not shrink as much during storage and transport as do carcasses, therefore boxing can extend the time that beef can be held in cold storage to between 26 and 28 days instead of a week or so which is more usual. Transport

and handling costs are reduced because less waste is shipped and because boxes fit more compactly into truck or container space than do carcasses (Hall and MacBride, 1980).

Entry and Exit Barriers

There are some substantial barriers to entry into the cattle slaughtering industry. The initial capital investment required to build a slaughtering plant and associated facilities is high -- between $15 and $20 million for a plant with killing, chilling and boxing capacity for about 250,000 head annually (Riley, Allen and Jackson, 1984). Size economies in slaughtering operations have, in general, mitigated against building small plants in recent years. In addition, a new packing company wishing to begin operation in an area would have to compete with existing plants for available cattle and for meat distribution outlets.

Structural changes at the wholesale and retail level have also been important in the industry. Vertical integration, from retail back to processing, has given supermarket chains both managerial control and greater bargaining power (McCoy, 1979). Ward cites such examples as Kroger, Winn-Dixie, Consolidated Foods, Acme Markets, American Stores, Beatrice Foods and Food Fair Stores, as retail outlets which have integrated back to animal slaughtering and meat processing (Ward, 1977).

Finally, the inflexibility in use of slaughtering plants presents an exit barrier for firms wishing to leave the industry. Slaughtering plant facilities and equipment are of use only for animal slaughtering and processing. A large amount of capital can thus be tied up in a plant designed to serve a mature market.

FIGURE 2.2:PER CAPITA CONSUMPTION OF BEEF, U.S.,1960-1981

SOURCE: American Meat Institute, 1982

Trends in Beef Consumption in the United States

Beef consumption in the United States reached a peak of almost 130 pounds per capita (carcass weight) per year in 1976, but has declined since then (Figure 2.2). In 1981 the average annual per capita consumption of beef in the U.S. was about 104 pounds. The U.S. market for red meats is a mature market -- per capita consumption has reached what is most probably its highest level and cannot be expected to expand further without some radical changes in the industry and/or in the American public's tastes. Beef is facing more competition from other meats and other protein sources than it did 20 years ago. The per capita consumption of pork has increased from 60.3 pounds in 1960 to 65.0 pounds in 1981, on a retail weight basis. The annual, per capita consumption of poultry increased from 34 pounds (retail weight) in 1960 to 62.4 pounds in 1981 and fish consumption increased from 10.3 pounds to 13.0 pounds (retail weight) per capita during that time (American Meat Institute, 1982). There are several important reasons underlying the decrease in per capita beef consumption in the United States -- the cost of beef relative to other sources of protein and to non-protein foods, the changing composition of the U.S. population and the American public's increasing interest in and awareness of diet-related health issues.

The price spread among meats has been growing over the past decade. The prices of pork and poultry have risen at slower rates than have beef prices, primarily because of efficiency gains in production and distribution in the hog and poultry industries (National Cattlemen's Association, 1982). The deteriorating relative

position of beef in terms of average retail price is shown in Table 2.2.

The level of beef consumption is not uniform throughout the population. Research by the National Cattlemen's Association shows that meat consumers can be subdivided into three categories -- "heavy, moderate and light" users of meat (National Cattlemen's Association, 1982). The "heavy" users, about 30 percent of the population who account for 53 percent of the meat consumed, tend to be middle to upper level income industrial workers. Shifts in the economy are decreasing the proportion of the population which these workers comprise. The recent recession and high levels of unemployment have had adverse effects upon their incomes. As they realize lower and less stable incomes their red meat consumption may decline. Amongst the "light" meat users are the elderly. As the average age of the U.S. population increases there will be an increasing proportion of older people who have smaller food requirements and who will, consequently, consume less meat.

TABLE 2.2
AVERAGE RETAIL PRICES OF CHOICE BEEF, PORK AND CHICKEN BROILERS, UNITED STATES, SELECTED YEARS.

Summary: Retail prices of chicken and, to a lesser extent pork, have declined relative to the retail price of beef.

	Beef	Pork	Pork as a Percent of Beef	Chicken	Chicken as a Percent of Beef
	(cents per pound)		%	(cents per pound)	%
1950	74.6	53.8	72	59.5	80
1960	82.1	55.4	67	42.3	52
1971	108.1	69.8	65	42.0	39
1976	148.2	134.0	90	61.1	41
1981	239.0	152.0	64	72.0	30

Source: National Cattlemen's Association, Beef Business Bulletin, March 5 1982.

The other major factor influencing the declining consumption of red meats in the United States is the "health" issue. There is by no means a clear cut set of arguments against beef consumption -- rather there are several key points each with proponents and opponents. The arguments center around cholesterol intake and the consumption of animal products in general. In particular, retail cuts of grain fed beef often have relatively large portions of visible fat which may prejudice those concerned with fat and cholesterol intake (National Cattlemen's Association, 1982).

In addition to an overall decrease in the amount of red meat consumed the types of meat products demanded will continue to change.

The demand for leaner cuts of meat is increasing, due to both health concerns and consumers' perception that fat on meat represents waste for which they must pay. New meat products, aimed at a more segmented consumer market, will become more prevalent. These could include more "convenience" meats -- pre-cut, pre-packaged and partly processed or cooked meats--, smaller portions of meats and "intermediate value" beef products which retain the taste characteristics of beef but are less expensive than steaks and roasts (National Cattlemen's Association, 1982).

The combined impact of these price, income and consumption effects imply that beef consumption in the United States is unlikely to return to the 1976 level in the foreseeable future. It is conceivable, however, that the annual per capita consumption of beef will plateau somewhere between 90 and 100 pounds on a carcass weight basis (Michigan State University, Agriculture Model, 1983).

Implications for the Eastern Corn Belt Beef Industries

Historically, the beef subsector has been characterized by a propensity to change to meet new environmental conditions. The maturing of the consumer market for beef is likely to promote further changes in the industry, especially in the type of beef and beef products available (National Cattlemen's Association, 1982). In the past decade the cattle and slaughtering industries in the Eastern Corn Belt have been left behind by the mainstream of the U.S. beef subsector. There are, however, reasons for expecting a more optimistic outlook for the region's cattle industries in the future. Changing consumer tastes, especially the move towards a preference for leaner meats, may result in an increase in the demand for the type of cattle which Michigan produces best. The rising energy costs, which influence transportation of cattle, meat and grains and the cost of drying grains, will tend to force more integration and self-sufficiency within regions (National Cattlemen's Association, 1982). Both trends may make the cattle slaughtering industry in the Eastern Corn Belt more competitive with the industries in the Great Plains and the Western Corn Belt. The next chapter provides a closer examination of recent trends in the beef subsector in the Eastern Corn Belt.

FOOTNOTES

1. For the 23 major cattle feeding states - AZ, CA, CO, ID, IL, IN, IA, KS, MI, MN, MO, MT, NE, NM, ND, OH, OK, OR, PA, SD, TX, WA, & WI.

2. Much of the material on the evolution of terminal markets was taken from McCoy, 1979, chapter 2.

3. Dr.H. Connaughton, Federal Meat Inspector, Michigan, Regional Supervisor of Meat Inspectors.

III. RECENT TRENDS IN PRODUCTION AND SLAUGHTERING IN THE BEEF SUBSECTOR: UNITED STATES AND THE EASTERN CORN BELT

The pattern of cattle production in the United States since 1970 reflects the underlying influence of the cattle cycle and some structural shifts in the beef subsector. The cattle industries in the Eastern Corn Belt states have followed a pattern similar to that of the nation as a whole but reflect a declining regional share of the United States cattle feeding and cattle slaughtering industries.

The purpose of this chapter is to focus on trends in the cattle industries in the Eastern Corn Belt states. This involves examining the absolute changes in the volume of cattle marketed and the changing relative importance of the region, vis-a-vis the rest of the country, as a cattle raising area . The data series used to measure the trends in cattle raising activity are the inventories of cattle on feed, the number of fed cattle marketed annually and the annual volume of commercial cattle slaughter. These data series are collected and published by the United States Department of Agriculture (USDA) on a regular basis. Estimates of beef consumption at the regional and state level have been made using national per capita consumption data for beef and population data for the four states. Combining these data series with qualitative information on cattle fattening and slaughtering industries aids in assessing the current and future competitiveness of each of the states and the region as a whole.

The Production and Slaughtering Deficits in the Eastern Corn Belt

The population of the Eastern Corn Belt annually consumes more beef than it produces or slaughters. The magnitude of the deficits for each state are shown in Table 3.1 for the years 1971, 1976 and 1981. Over that ten year period total consumption declined in each of the states, due to the decreasing per capita consumption of beef -- a trend which has been witnessed nationally since 1976. Production and slaughter of beef animals decreased in absolute terms and as percentages of consumption in the Eastern Corn Belt states between 1971 and 1981.

Michigan imported approximately 76 percent of the total volume of beef consumed in the state on a net volume basis in 1981. This included approximately 13 percent imported as live animals and approximately 63 percent as beef and beef products (Table 3.1). Michigan does, however, export live animals for slaughter outside the state and some boxed primals of manufacturing grade cow beef are also exported. This means that the volume of beef actually imported for sale in Michigan stores could be as high as 80 percent of the states's consumption. The deficit between consumption and slaughtering has been increasing since the mid-1960s (Figure 3.1). This deficit can be attributed to both the declining slaughtering capacity in Michigan and to the increased importation of boxed beef from large plants in the west.

TABLE 3.1
CONSUMPTION, PRODUCTION AND SLAUGHTER OF BEEF IN THE EASTERN CORN BELT, SELECTED YEARS.

Summary: In all states except Illinois production has remained a fairly constant percentage of consumption, but slaughter has decreased as a percentage of consumption in all states.

	a. Consumption (million pounds)	b. Production (million pounds)	Production as a Percent of Consumption (%)	b. Slaughter (million pounds)	Slaughter as a Percent of Consumption (%)
MICHIGAN					
1971	1,012.6	266.5	26.3	500.4	49.4
1976	1,179.7	282.0	23.9	489.5	41.5
1981	960.0	234.0	24.4	358.6	37.4
OHIO					
1971	1,211.8	371.1	30.1	691.0	57.0
1976	1,391.4	394.9	28.4	686.2	49.3
1981	1,124.5	330.4	29.4	387.8	34.5
INDIANA					
1971	592.3	338.4	57.1	353.7	59.7
1976	695.1	398.8	57.4	302.2	43.5
1981	570.3	312.4	54.8	197.8	34.7
ILLINOIS					
1971	1,264.6	633.0	50.1	852.5	67.4
1976	1,470.0	570.1	38.8	889.6	60.5
1981	1,195.5	502.1	42.0	683.8	57.2

a. Consumption calculated using per capita consumption averages for the United States (American Meat Institute, 1982) and state population figures (U.S. Department of Commerce, 1975 and 1982-1983 editions).
b. Production and slaughter data reported for individual states, U.S. Department of Agriculture, Statistical Reporting Service, various years.
Production = Liveweight (all cattle and calves) x 0.55 to account for calves and to convert to carcass weight.
Slaughter = Liveweight (commercial cattle slaughter) x 0.595 to convert to carcass weight.

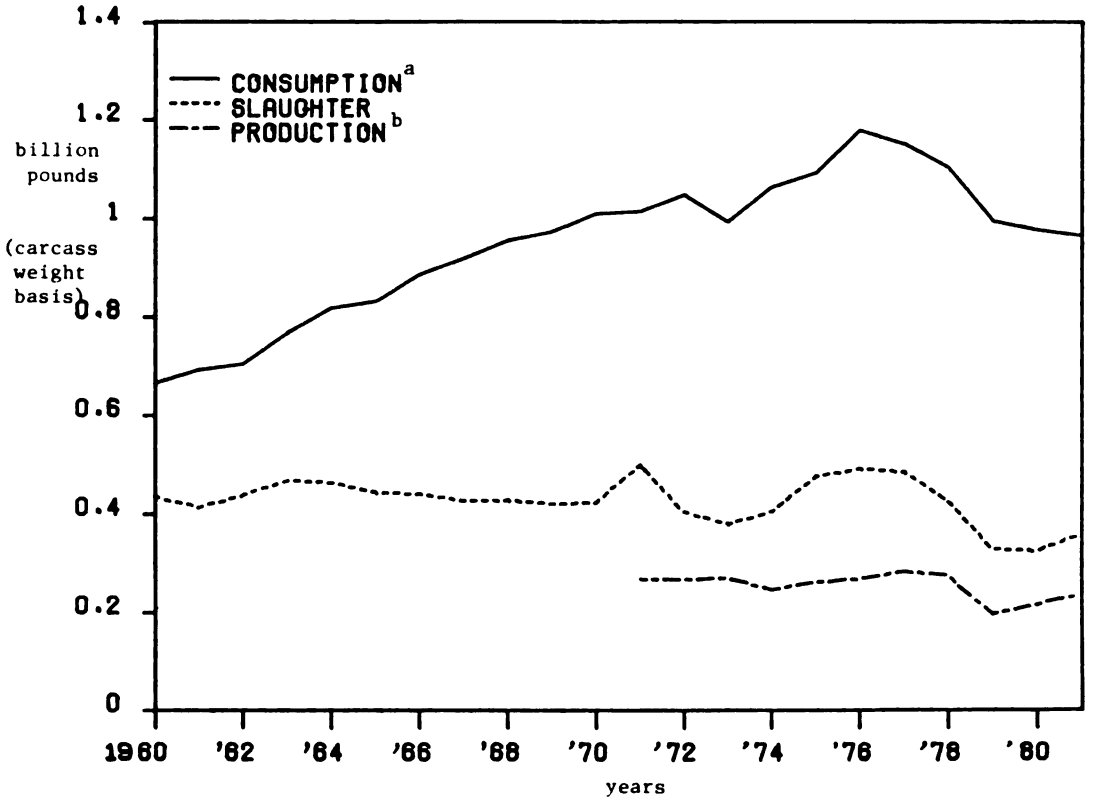

FIGURE 3.1: PRODUCTION, COMMERCIAL SLAUGHTER AND CONSUMPTION OF BEEF IN MICHIGAN, 1960-1981

a. Consumption calculated using average per capita consumption for the United States (American Meat Institute, 1982) and state population figures (U.S. Department of Commerce, Bureau of the Census, various years).
b. U.S. Department of Agriculture, Statistical Reporting Service, production and slaughter data reported for individual states but not prior to 1971 for production.
Production = Liveweight (all cattle and calves) x 0.55 to account for calves and to convert to carcass weight.
Slaughter = Liveweight (commercial cattle slaughter) x 0.595 to convert to carcass weight.

Trends in Production

All Cattle and Calves

The January 1 inventories of all cattle and calves in the United States just exceeded 112 million head in 1970; they rose from this to a peak of 132 million head in 1975. The liquidation phase which followed continued until 1979, at which time inventories were just below 111 million head nationwide. By 1983 the national cattle herd was about 115 million head (Figure 3.2). In the Eastern Corn Belt the Michigan and Ohio inventories of all cattle and calves reached peaks in 1975, but in Indiana and Illinois cattle inventories did not peak until 1976. For Michigan, Ohio and Indiana the following liquidation continued until 1979, but in Illinois inventories of cattle and calves did not stop decreasing until 1981. The U.S. as a whole and the Eastern Corn Belt, with the exception of Indiana, have had slow increases in inventories since 1979, but this trend is not expected to continue (Michigan State University Agriculture Model, 1983). Cattle and calf inventories in Indiana have continued to decline gradually since 1979.

Cattle on Feed

There was a net decrease in fed cattle production in the U.S. between 1970 and 1981. The Eastern Corn Belt states have exhibited trends in cattle feeding and marketing similar to the country as a whole. Illinois leads the region, by a sizeable margin, in both beef cow and cattle on feed inventories. Michigan and Ohio trail the other two states in cattle on feed (Figure 3.3) but hold leading positions

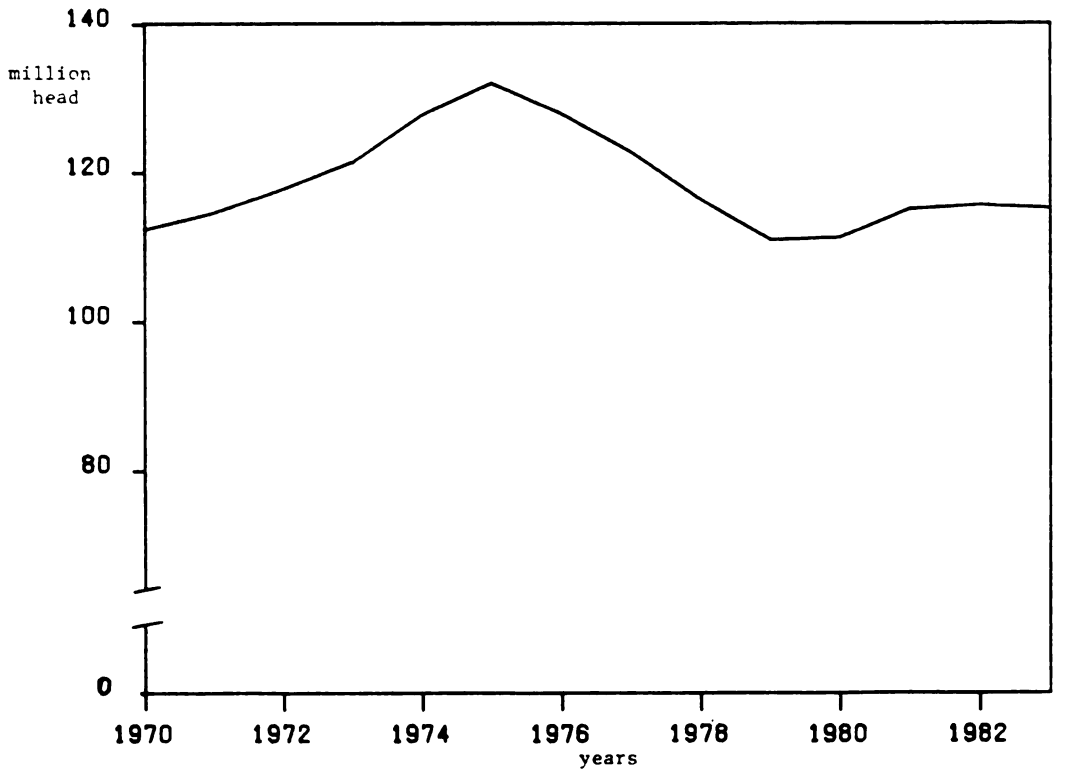

FIGURE 3.2: JANUARY 1 INVENTORIES, ALL CATTLE AND CALVES, UNITED STATES, 1970-1983

SOURCE: U.S.Department of Agriculture, Statistical Reporting Service, 1981

in dairy cow inventories. The year-to-year changes in cattle inventories over the 1970 - 1983 period show similarities among the four states reflecting, in part, the over-riding influence of the beef cattle cycle.

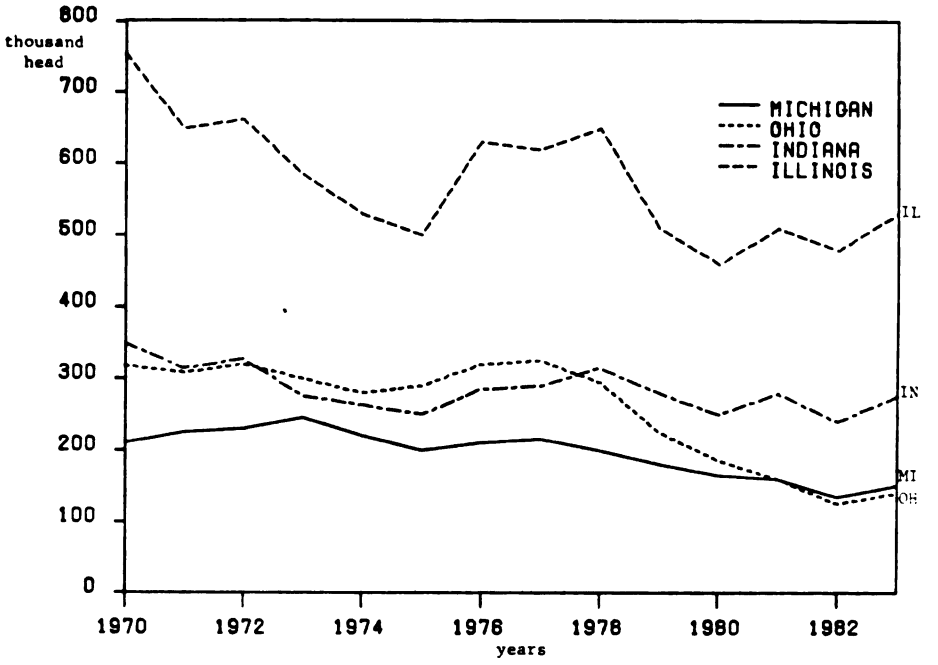

FIGURE 3.3:JANUARY 1 INVENTORIES, NUMBER OF CATTLE ON FEED, EASTERN CORN BELT STATES, 1970 - 1983

SOURCE: U.S. Department of Agriculture, Statistical Reporting Service, 1981

The region as a whole has been losing ground to the rest of the country in cattle production since 1970. Between 1971 and 1981 the region's share of the number of cattle on feed in the U.S. decreased from 11.7 to 9.6 percent (Table 3.2). The relative decline in the number of cattle on feed has differed between the states -- Ohio slipped furthest in both absolute and relative standings over the 1971 to 1981 period and Indiana had the smallest change. The loss in the Eastern Corn Belt's relative position of has been to the gain of the West North Central and South Central regions. The distribution of all cattle and calves and cattle on feed by regions in terms of their relative share of the U.S. total in 1982 is shown in Figure 3.4.

TABLE 3.2
JANUARY 1 INVENTORIES: CATTLE ON FEED, NUMBER OF HEAD AND NUMBER AS A PERCENT OF UNITED STATES TOTAL, EASTERN CORN BELT, SELECTED YEARS.

Summary: Cattle on feed inventories in all four states have declined since 1971, both in absolute terms and as a percent of the United States total.

	Michigan	Ohio	Indiana	Illinois	Area Total
1971					
1000 head	225	308	314	649	1,496
% of U.S. Total	1.8	2.4	2.5	5.1	11.7
1976					
1000 head	210	320	285	630	1,445
% of U.S. Total	1.6	2.5	2.2	4.9	11.2
1981					
1000 head	160	160	280	510	1,110
% of U.S. Total	1.4	1.4	2.4	4.4	9.6

SOURCE: U.S. Department of Agriculture, Statistical Reporting Service, various years.

Trends in Cattle Feeding

Much of the decline in the relative importance of the Eastern Corn Belt region as a cattle feeding area can be attributed to the increasing concentration -- both geographic and economic -- in the cattle feeding industry. Cattle feeding has been moving towards the center of the country, to the Western Corn Belt and the Central and High Plains. The major factors influencing this shift include climate (Van Arsdall and Nelson, 1983), the development of irrigation in the West which has produced large quantities of feed grains, a ready

supply of feeder cattle (Gee, Van Arsdall and Gustafson, 1979) and the growing demand for fed beef by the expanding Western population (Riley and Hiemstra, 1981 b). Climatically, the Central states provide an environment more conducive to cattle feeding than do the more northern and Lakes states. The colder and wetter conditions in the north contribute to lower feed conversion rates and make necessary larger investments in shelter facilities for cattle on feed, thus raising the costs of feeding cattle in these states compared to the South-central and South-western states (Van Arsdall and Nelson, 1983).

The trend in cattle feeding in the U.S. has been towards larger lots. Commercial lots (with over 1,000 head one-time capacity) comprised 1.2 percent of all feedlots in the 23 major cattle feeding states in 1970, the remaining 98.8 percent were farmer lots. The relative shares of fed cattle marketed were 55 percent and 45 percent for commercial and farmer lots respectively. By 1981 commercial lots represented 2.1 percent of the total number of lots and their share of the total number of fed cattle marketed had increased to 73.3 percent. The weighted average capacity of these lots is about 5,500 head. For comparison, in the Eastern Corn Belt commercial lots accounted for 0.6 percent of all lots and marketed 17.2 percent of the fed cattle marketed in 1981. The weighted average one-time capacity of commercial lots in the Eastern Corn Belt states is about 1,800 head (U.S. Department of Agriculture, Statistical Reporting Service, 1981).

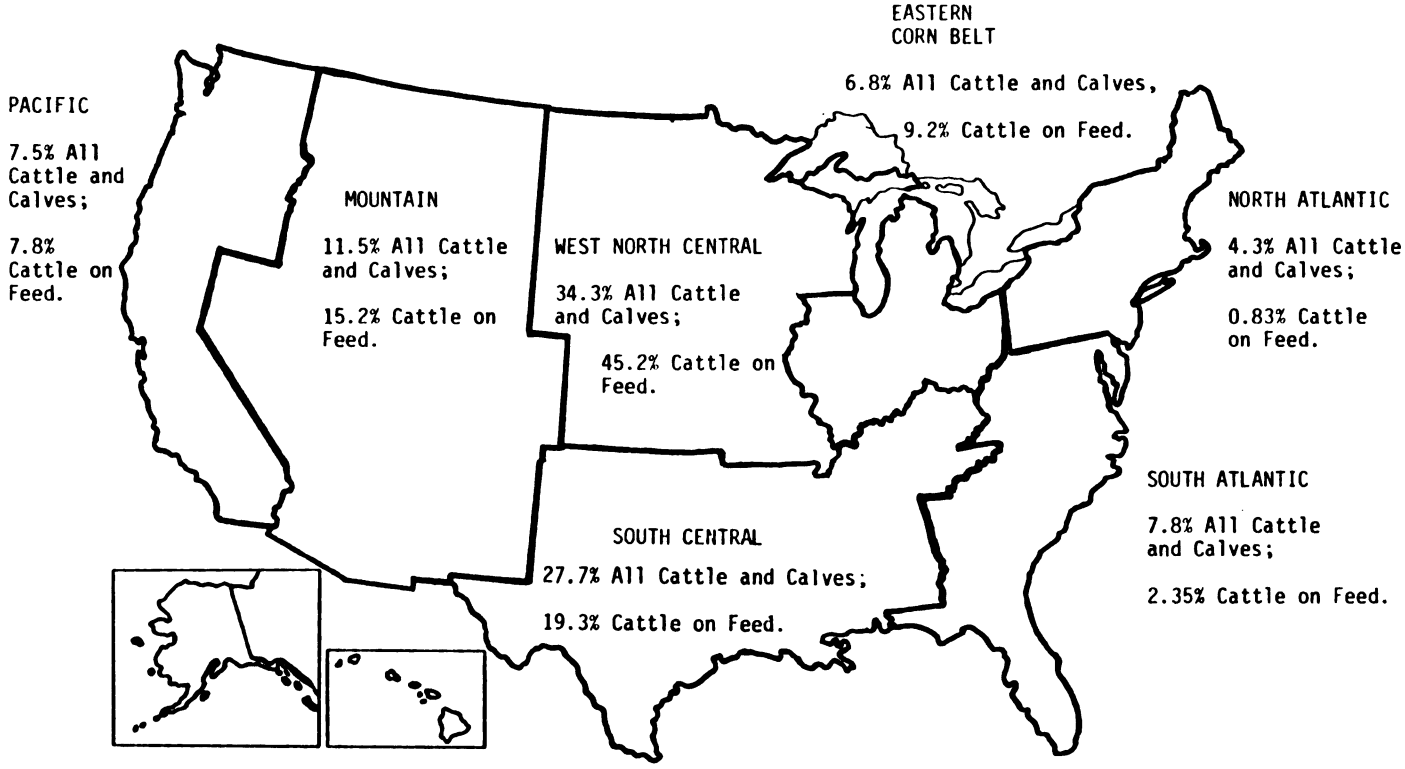

FIGURE 3.4: PERCENTAGE DISTRIBUTION OF ALL CATTLE AND CALVES AND CATTLE ON FEED, BY REGIONS, UNITED STATES, JANUARY 1 INVENTORIES, 1982

SOURCE: U.S. Department of Agriculture, Statistical Reporting Service, 1982

Cows

The trends in the cow populations are of relevance to this study for several reasons. The trends in the breeding stock populations tend to lead those of the cattle on feed by a year or so. Thus current trends in cow numbers can aid in projecting trends in cattle feeding in the future. Also, cows culled from both beef and dairy herds frequently are slaughtered commercially, their meat being sold as lower grade beef cuts and as manufacturing grade beef. This means that cow beef may compete with choice, grain-fed beef for consumers' meat dollars.

In the U.S. beef cow inventories have shown a small net increase since 1970. They reached a peak of 45.7 million head in 1975 but have been declining slowly since then. Inventories of dairy cows declined steadily throughout the 1970s and then made a very slight increase in the early 1980s (U.S. Department of Agriculture, Statistical Reporting Service, various years). This upswing has not been so large as to suggest that dairy herds are undergoing a major rebuilding at this stage. The trends in the Eastern Corn Belt cow populations have followed the national trends. Only Illinois had a net decrease in beef cow inventories from 1970 to 1983. Although the trends in the four states may at times lag a little behind those of the nation as a whole, there is no indication that either beef or dairy cow populations in the Eastern Corn Belt will exhibit cyclical patterns markedly different from those for the U.S. in general.

Trends in Cattle Slaughtering

The Eastern Corn Belt region has reduced its share of the total volume of cattle slaughtered commercially in the U.S. Over the ten years from 1971 to 1981 the share held by the region fell from 10.9 percent to 7.2 percent (Table 3.3). The most recent peak in commercial cattle slaughtering in the U.S. occurred in 1976 when over 42 million head were slaughtered in the twelve month period. All the Eastern Corn Belt states had a net decline in the volume of cattle slaughtered between 1970 and 1981 (Figure 3.5). Michigan had the smallest absolute decrease in the volume slaughtered and Ohio the largest. The volume of cattle slaughtered in Illinois has been and continues to be considerably greater than that in the other Eastern Corn Belt states. This declining share of the total number of cattle slaughtered has occurred as both cattle feeding and slaughtering operations have become concentrated in the Western Corn Belt and High Plains regions of the country. The technical and organizational changes which contributed to this concentration have been described in an earlier chapter.

TABLE 3.3
COMMERCIAL CATTLE SLAUGHTER, NUMBER OF HEAD AND PERCENT OF UNITED STATES TOTAL, EASTERN CORN BELT, SELECTED YEARS(a)

Summary:The volume of commercial cattle slaughter has decreased in all four states since 1971 both in absolute and relative terms. The decline has been smallest in Michigan and Illinois and greatest in Ohio.

	Michigan	Ohio	Indiana	Illinois	Area Total
	thousand head (percent of U.S. total)				
1971	779.5 (2.2)	1126.0 (3.2)	586.5 (1.6)	1398.0 (3.9)	3890.0 (10.9)
1976	745.0 (1.7)	1130.0 (2.6)	519.5 (1.2)	1516.0 (3.6)	3910.5 (9.2)
1981	502.9 (1.4)	611.3 (1.7)	330.6 (0.9)	1095.4 (3.1)	2540.2 (7.2)

(a) Includes slaughter in federally inspected and other slaughter plants but excludes animals slaughtered on farms.

SOURCE:U.S.Department of Agriculture, Statistical Reporting Service, various years.

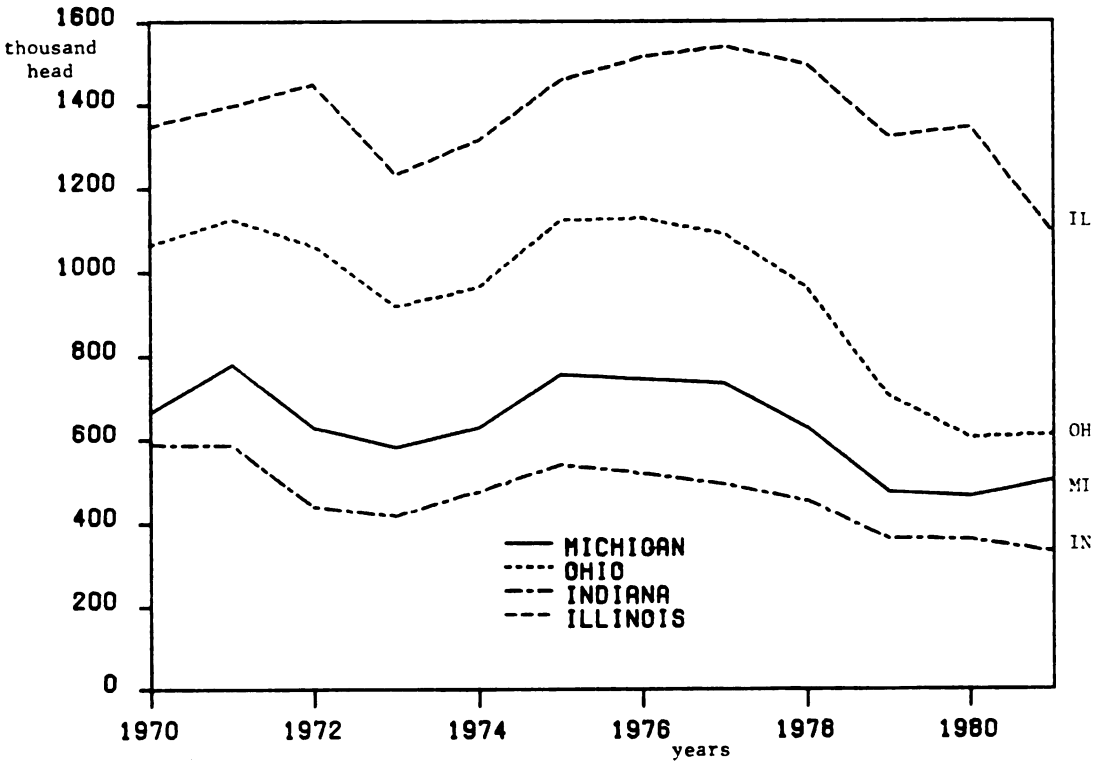

FIGURE 3.5:COMMERCIAL CATTLE SLAUGHTER, NUMBER OF HEAD ANNUALLY, EASTERN CORN BELT STATES, 1970 - 1981

SOURCE:U.S.Department of Agriculture, Statistical Reporting Service, various years.

IV. THE SUPPLY OF SLAUGHTER CATTLE IN THE EASTERN CORN BELT.

To estimate the volume of slaughter cattle available in the Eastern Corn Belt the annual marketings of fed cattle and January 1 inventories of cows multiplied by the cull rates for beef and dairy herds were used. Factors which influence the availability of fed cattle for slaughter include the size, type and geographic distribution of cattle feeding operations and seasonal marketing patterns. This chapter examines each of these factors and how they interact to influence the supply of cattle for slaughter at plants in the Eastern Corn Belt. Cattle feeding and the supply of fattened cattle is the primary concern, with special emphasis on cattle feeding in Michigan. Since cows are also a source of beef and because some plants in the region slaughter both fattened cattle and cows we have included a section on the supply of cows for slaughter in the region. Figure 4.1 is a flow chart showing the sources of slaughter cattle for Michigan plants and where potential slaughter cattle are lost to plants outside the state. Veal competes with fed cattle at two levels -- veal raising enterprises compete with steer feeding enterprises for young calves (almost no heifers are used in veal raising operations) and veal competes with beef for consumer dollars at the retail level. Because veal are produced, slaughtered and marketed under different conditions, however, the veal industry is not considered in this study.

The time series analyses in this chapter are based on data collected and published by the Statistical Reporting Service (SRS) of the United States Department of Agriculture and cooperating state agencies such as the Michigan Agricultural Reporting Service. Quarterly estimates of cattle on feed inventories and fed cattle marketings, however, were discontinued for the less important cattle feeding states, including Michigan, Ohio and Indiana, at the end of 1981. All time series analyses in this chapter using quarterly estimates are, therefore, based on data collected prior to 1982.

There is some discrepancy between the number of fed cattle marketed as reported by the two data sources used for this thesis. Unfortunately the SRS does not report data at the county level. To obtain county level estimates it was necessary to use 1978 Census of Agriculture data, which were the most recent data available. The Census estimated that 2.51 million fed cattle were marketed from farms in the Eastern Corn Belt states while the SRS estimated 2.05 million head sold. For the region this is a difference of 18 percent, but the difference between the two estimates for Michigan was only 7 percent. The Census data were used for mapping the geographic location of cattle feeding throughout the four states and for determining the potential supply of cattle for proposed plants (chapter five). It is possible that these data may overstate the actual fed cattle sales or include cattle which would not be considered "fed cattle" by the U.S. Department of Agriculture.

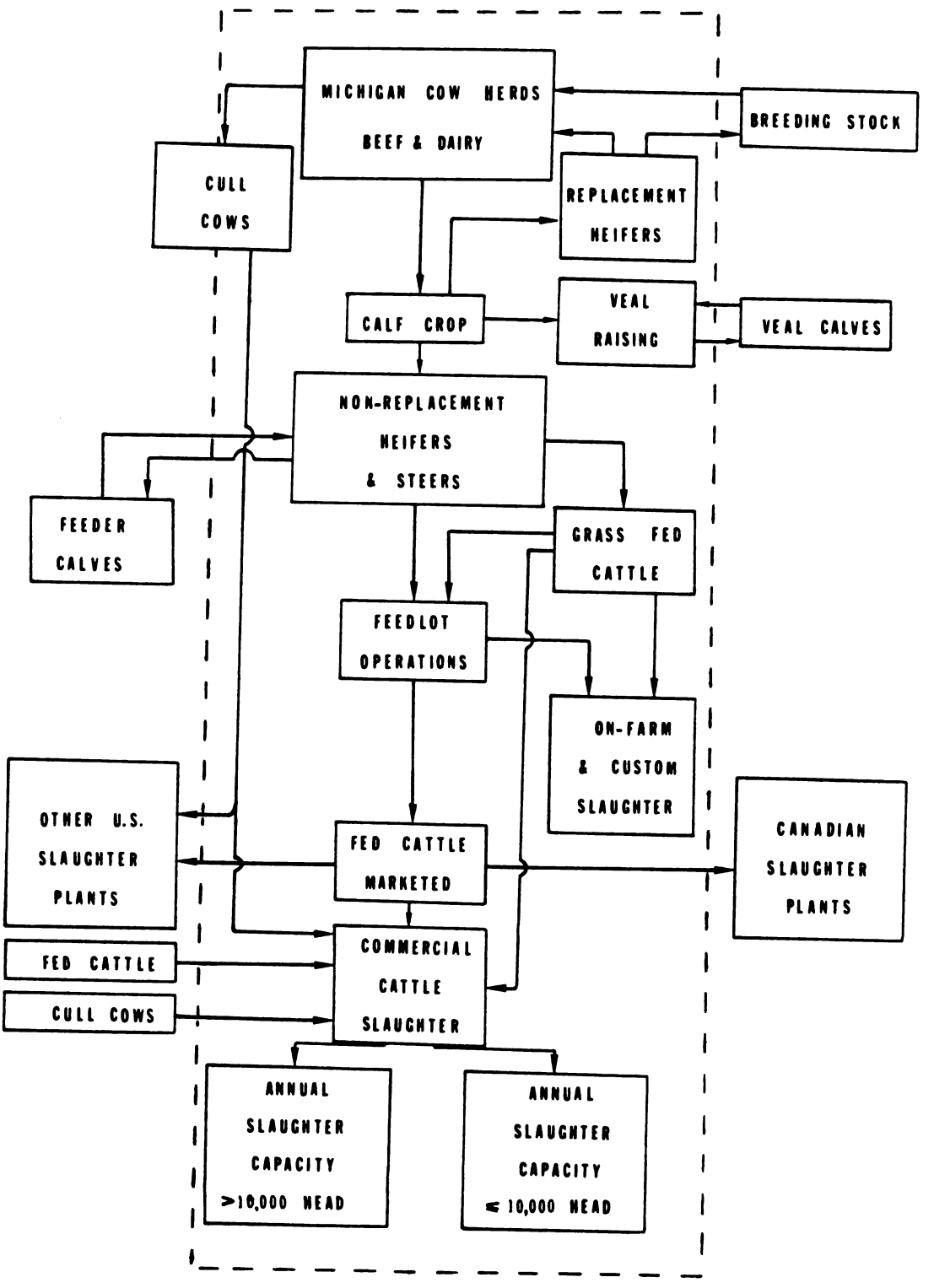

FIGURE 4.1:SOURCES OF CATTLE FOR SLAUGHTER IN MICHIGAN PLANTS

Cattle Feeding in the Four States of the Eastern Corn Belt

Location of Cattle Feeding

The density of cattle feeding activity in the Eastern Corn Belt states is relatively low except in the northwestern corner of Illinois and a few isolated counties in the other states (Figure 4.2). This distribution of cattle hinders coordination between producers and packers. The large number of small, widely dispersed lots raises assembly, transport and transaction costs for packers purchasing cattle in the region, making it more difficult for them to assemble a sufficient volume of cattle for an efficient sized plant.

The Structure of the Cattle Feeding Industry

The industry is characterized by many small feeding operations. "Farm feedlots" (lots with a one-time capacity of fewer than 1,000 head) comprised 99.4 percent of the total number of lots and marketed 82.8 percent of the fed cattle marketed in the region in 1981 (Table 4.1a), compared to 97.9 percent of the total number of lots and 26.7 percent of the fed cattle marketed for the 23 major cattle feeding states as a whole . There were only 30 lots in the four states with one time capacities exceeding 2,000 head; 10 were in Michigan and 20 were in Illinois (U.S. Department of Agriculture, Statistical Reporting Service, 1981).

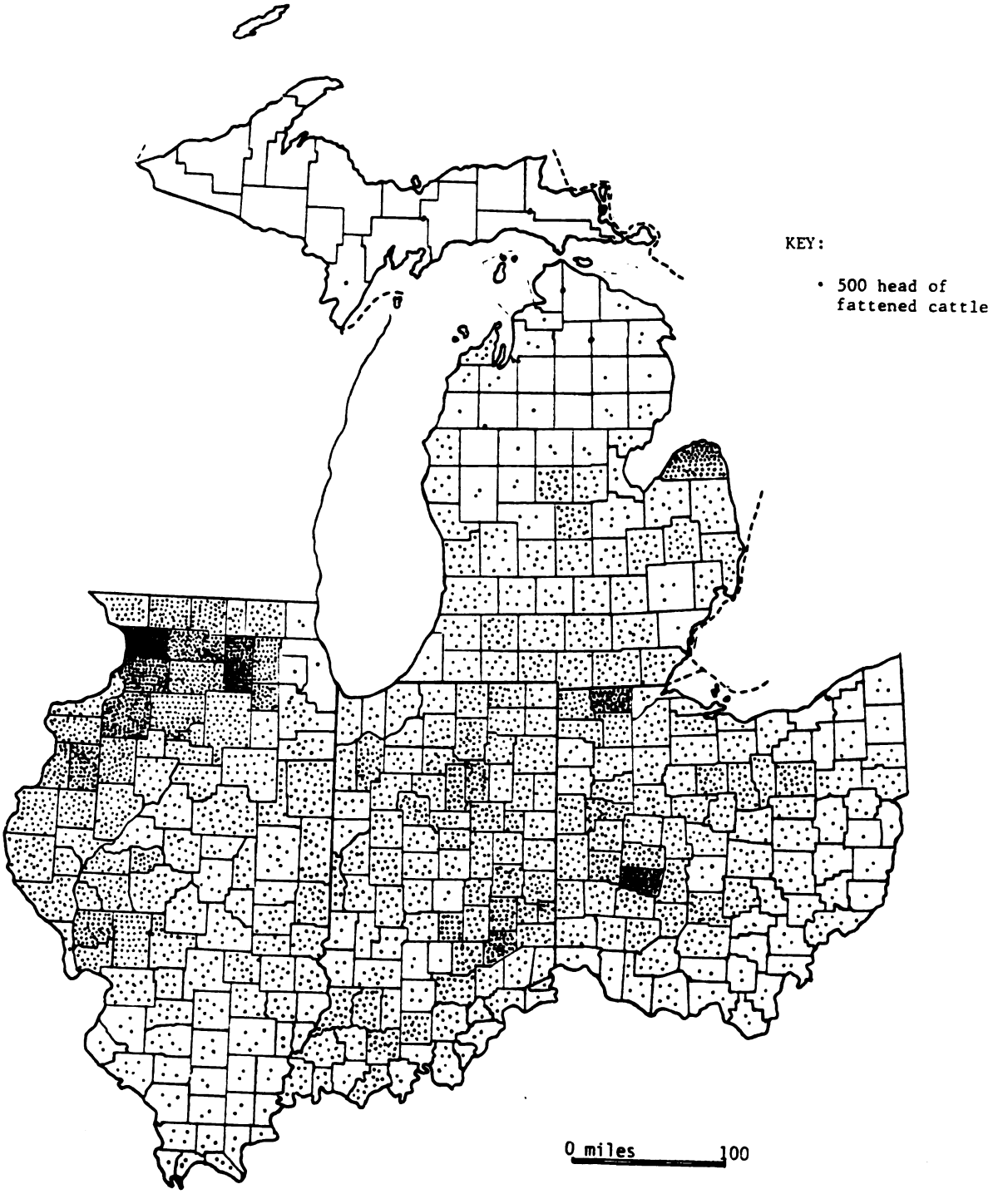

FIGURE 4.2:FED CATTLE MARKETED, EASTERN CORN BELT, COUNTY LEVEL SALES,1978

SOURCE: Census of Agriculture, 1978

The structural and behavioral characteristics of the region's cattle feeding industry give rise to some interesting performance results. It is generally acknowledged that there are economies of scale in cattle feeding, with both labor and overhead costs per unit decreasing with increasing numbers of units fed (Simpson and Farris, 1982). Hasbargen and Kyle observed, however, that small producers (family or farm lots) may enjoy some cost advantages due to the diversity of their operations (Hasbargen and Kyle, 1977). Cost savings arise from the ability of these smaller enterprises to utilize existing farm labor during slack periods and feedstuffs which would otherwise have only limited usefulness. They do not, therefore, need to purchase much feed or labor above that already available on the farm. The feeding of wet grains and silage may actually give the farm lots in the Eastern Corn Belt some feed cost advantages over cattle producers in the south-central states especially as energy costs rise, since drying and transportation account for a significant proportion of total grain costs (Hasbargen and Kyle, 1977). In addition, the manure disposal problem for smaller feedlots may be taken care of by simply spreading it as a fertilizer onto crop lands. Expansion of these small lots to commercial size may result in a rapid escalation of costs, as feed and non-family labor must be purchased and as waste disposal becomes a liability rather than an asset. Hasbargen and Kyle concluded that the small Northern Corn Belt feeder may not operate at such a disadvantage (compared to the large commercial feeders in the Southwest) because of their size, and that expansion in feedlot size may result in their becoming less competitive.

On the other hand, assembly, transport and transactions costs borne by these part-time producers and those with whom they deal are high because they deal in small volumes of cattle. Hasbargen and Kyle did acknowledge that larger lots (ie. commercial lots) may have some advantages in the buying and selling of cattle over the small and medium sized lots (Hasbargen and Kyle, 1977). One of the disadvantages of being small can be observed at the fall auctions in Michigan when these small scale cattle feeders, buying cattle to feed over the winter, drive up feeder calf prices (Tom Reed, personal communication[1]).

The relationship between the number of cattle on feed (January 1 inventories) and the number of fed cattle marketed throughout the year provides an estimate of the average feedlot turnover rate (Table 4.2). While there does not seem to have been a distinct and explainable trend in the rate of turnover in the Eastern Corn Belt during the period from 1971 to 1981 the differences between the states are important. The rate of cattle turnover from Eastern Corn Belt feedlots has been consistently below that of the United States. In 1981 the average turnover of cattle from feedlots in the four states was 1.44 compared to 1.98 for the United States as a whole. Illinois clearly leads the region but is well below the national rate. The rate of cattle turnover from lots in Michigan has, in general, been lower than that in the other three Eastern Corn Belt states. This may be due partly to Michigan feedlot operators purchasing feeder cattle which are younger than yearlings and which thus require longer on feed to reach slaughter weight than do the yearling feeder cattle purchased by lots in the High Plains states. Estimates using USDA data for

some of the major cattle feeding states in 1979 give average lot turnover rates of 1.79 in Colorado, 2.03 in Kansas, 2.15 in Nebraska, 1.6 in Texas and 2.1 in Washington (U.S. Department of Agriculture, Statistical Reporting Service, 1980).

The feedlot turnover rate and the percent of lot capacity used together give an indication of feedlot utilization. The high capital investment required to set up feedlot facilities and the price risks associated with feeding cattle necessitate a high degree of feedlot utilization. It is difficult to obtain data on the percent of feedlot capacity which is used in an area over any period but the turnover rate gives a good indication of the efficiency with which lots are used. A lower turnover rate would be expected where cattle feeding activity is of an "all-in-all-out" nature. Under such a feeding regime a 'lot' of cattle is purchased, fed for six to nine months and then sold. The feedlot is cleared out and the sequence repeated. This system, rather than a continuing rotation of cattle through the lot, has been the typical mode of operation for most smaller Eastern Corn Belt feeders. One result of this type of feeding system is that cattle marketings tend to exhibit marked seasonal fluctuations.

TABLE 4.1
NUMBER OF FEEDLOTS AND FED CATTLE MARKETED BY FEEDLOT SIZE, EASTERN CORN BELT, 1981

Summary: Farmer feedlots account for more than 99 percent of all feedlots in each of the Eastern Corn Belt states except Michigan. In all four of the states more than 80 percent of the fed cattle marketed come from lots with capacities for fewer than 2,000 head of cattle.

A. Farmer Feedlots - Percent of All Lots and of Fed Cattle Marketed

	Michigan	Ohio	Indiana	Illinois	Area Total	U.S. Average
% of All Feedlots	97.0	99.8	99.7	99.3	99.4	97.9
% of Fed Cattle Marketed	61.0	83.4	87.6	85.4	82.8	27.6

B. All Feedlots - Number of Cattle Marketed by Feedlot Size

Feedlot Size(a)	MI	OH	IN	IL	AREA
UNDER 1,000 HEAD					
No. of Lots	1,260	4,790	9,776	11,920	27,746
1,000 head marketed	120	196	305	790	1,411
1,000-1,999 HEAD					
No. of Lots	30	10(b)	24(b)	60	124
1,000 head marketed	40	39(b)	43(b)	80	202
2,000-3,999 HEAD					
No. of Lots	10(b)			20(b)	30
1,000 head marketed	37(b)			55(b)	92
TOTAL					
No. of Lots	1,300	4,800	9,800	12,000	27,900
1,000 head marketed	197	235	348	925	1,705

a. Number of lots with 1,000 head or greater capacity is the number of lots operating at any time during the year. The number with capacities under 1,000 head is the number operating at the end of the year.
b. Lots and marketings from other size groups are included to avoid disclosing individual operations.

SOURCE: U.S. Department of Agriculture, Statistical Reporting Service, 1981.

TABLE 4.2
RELATIONSHIP BETWEEN JANUARY 1 INVENTORIES OF CATTLE ON FEED AND THE NUMBER OF FED CATTLE MARKETED FOR THE YEAR, EASTERN CORN BELT STATES AND THE UNITED STATES, SELECTED YEARS

Summary: The average turnover from feedlots in the Eastern Corn Belt is lower than the national average; Illinois leads the region.

	1971	1976	1981
MICHIGAN			
Cattle on feed (January 1)	225,000	210,000	160,000
Fed cattle marketed	251,000	271,000	197,000
Average turnover	1.12	1.29	1.23
OHIO			
Cattle on feed (January 1)	308,000	320,000	160,000
Fed cattle marketed	431,000	387,000	235,000
Average turnover	1.40	1.21	1.47
INDIANA			
Cattle on feed (January 1)	314,000	285,000	280,000
Fed cattle marketed	476,000	365,000	348,000
Average turnover	1.52	1.28	1.25
ILLINOIS			
Cattle on feed (January 1)	649,000	630,000	519,000
Fed cattle marketed	1,049,000	935,000	925,000
Average turnover	1.62	1.48	1.80
UNITED STATES			
Cattle on feed (January 1)	12,770,000	12,941,000	11,593,000
Fed cattle marketed	25,281,000	24,170,000	22,894,000
Average turnover	1.98	1.87	1.98

SOURCE: U.S. Department of Agriculture, Statistical Reporting Service, various years

Seasonal Patterns

In each of the Eastern Corn Belt states cattle feeding is a seasonal enterprise. Young cattle are bought in the fall, fed over the winter and sold for slaughter in the spring or early summer at between 1,000 and 1,200 pounds. Labor is then available for the major cropping operations during the summer. This seasonal pattern of fed cattle production is indicated by the seasonal indices for fed cattle marketings as shown in Table 4.3 for each of the Eastern Corn Belt states.

TABLE 4.3
SEASONAL INDICES FOR CATTLE MARKETED IN THE EASTERN CORN BELT STATES, 1970 - 1981 (a)

Summary: All states in the Eastern Corn Belt show seasonal patterns of marketings, for Michigan, Ohio and Indiana April-September are high months, for Illinois the seasonal pattern is less marked but January-March and July-September are high periods.

	January-March	April-June	July-September	October-December
Michigan	0.894	1.184	1.160	0.815
Ohio	0.960	1.235	1.119	0.753
Indiana	0.926	1.084	1.094	0.910
Illinois	1.020	0.993	1.121	0.880

a Calculated from USDA data on quarterly fed cattle marketings from 1970 to 1981. A TSP package was used to generate the indices which are geometric moving averages.

Michigan and Ohio show the greatest seasonal variation in fed cattle marketings. In Michigan there is a 40 percent swing between the high in late spring-early summer and the low in early winter. The seasonal pattern of supply combined with small feedlot size contribute

to slaughtering plants in the region having to ship cattle in from other states during the autumn and winter months in order to maintain a stable slaughter volume. This is a relatively high-cost alternative both in assembly and transport costs and because of the greater competition for fed cattle in the expanded supply area.

The Michigan Cattle Feeding Industry

Location

Virtually all of Michigan's cattle feeding activity is located in the southern two thirds of the Lower Peninsula. The industry has tended to migrate toward the center of the Lower Peninsula and the Thumb area, away from major water and rail terminals where grains command premium prices (Wright, 1983). Higher grain prices both raise feeding costs for cattle operations and make grain growing a more attractive proposition than cattle feeding for those farmers who have the facilities and expertise to allow them to do either. There are, nevertheless, some relatively heavy concentrations remaining in the southern counties along the Ohio and Indiana borders (see Figure 4.2).

The Structure of the Industry

Cattle feeding in Michigan is characterized by relatively small sized lots; in 1978 the average number of cattle fed per farm was 38 head (Wright, 1984). Within the industry three groups are distinguishable on the basis of lot size. At the upper end are about 40 feeders who operate lots with one-time capacities of 1,000 head and greater. The largest of these lots has a one-time capacity in excess of 8,000 head. In 1981 these 40 lots represented 3.1 percent of the

total number of feed lots in Michigan and were responsible for feeding 39.1 percent of the cattle fed in the state (U.S.Department of Agriculture, Statistical Reporting Service,1981). These cattle feeders produce a relatively consistent volume of cattle each year, operating year round and marketing cattle almost every week. They rely on their cattle operations as a primary source of income and have invested heavily in cattle feeding and handling facilities. At the other end of the size range is another group which markets a relatively consistent volume of cattle each year. They are the producers with lots of less than 300 head capacity. They usually do not rely on feedlot operations as their primary source of income. According to a Telfarm analysis of five cattle feeding farms which fed fewer than 400 cattle annually in 1981, incomes to management and labor and return on owned capital were all negative (Schwab and Brown, 1982) [2]. These smaller farms may be able to sustain short term losses on their cattle feeding enterprises for several reasons. First, provided that fixed costs are covered then cattle feeders will lose less on their feeding operation if they continue production than if they cease feeding cattle and allow the facilities to remain idle. Second, depending on how inputs such as labor, feed and facilities are priced it may be that the farm as a whole can operate at a profit while the cattle feeding enterprise operates at a loss (Hasbargen and Kyle, 1977).

Between the "commercial" and "farm" feedlots are the medium-sized cattle feeding operations. These lots range from 300 to 1,000 head capacities, the average being about 700 head. These producers are often heavily committed to cattle feeding yet are not making sufficient income from the enterprise to be able to rely on it as their

prime source of income (John Waller, personal communication[3]). These farms have made investments in cattle handling facilities, albeit some time ago for some farms, and the operators have cattle handling experience. One industry person hypothesizes that these producers account for a varying number of cattle fed and marketed in Michigan and are likely to remain a volatile source of fed cattle for slaughter. He maintains that because of their debt load they must produce mostly commodities which will yield high cash returns -- most often corn and/or navy beans -- while cattle become a residual enterprise. In his view as long as these farms avoid bankruptcy they are unlikely to exit from the cattle feeding industry altogether (Tom Reed, personal communication).

Feedlot Utilization

While the percent of all feedlots accounted for by farmer lots was similar in the four states in 1981, Michigan marketed a considerably greater proportion of fed cattle from commercial sized lots than did the other three Eastern Corn Belt states (Table 4.1b). This was despite a lower average turnover rate for cattle from Michigan lots (Table 4.2). Recent discussions with people in the Michigan cattle industry suggest that fed cattle marketings are becoming less seasonal and that turnover rates are increasing (Bim Franklin, personal communication[4]). Such a trend could provide an added incentive to potential entrants into the cattle slaughtering industry in Michigan by lowering some of the uncertainty associated with fluctuating cattle supplies.

Types of Cattle

Michigan cattle feeders traditionally have fed Hereford and Angus cattle. In recent years, however, there has been a lessening of the bias against cross-bred cattle and there are now a greater variety of cattle being fed in Michigan (John Waller, personal communication). Cross-bred cattle have the advantage of "hybrid vigor" resulting in more rapid rates of gain than is usually attainable with pure-bred lines and are often cheaper to purchase as feeders.

There has been increasing interest in fattening Holstein and Holstein-cross animals by regional cattle producers. Some of the interest comes from dairy farmers looking for ways to supplement their incomes from milk. For beef producers in dairy areas Holstein and Holstein-cross calves are often cheaper to purchase than are the traditional beef breeds and frequently gain at a faster rate once on feed (John Waller, personal communication). Holsteins are large framed animals which suit the requirements of some of the meat packers in the region -- particularly cow slaughtering plants which also slaughter some fed cattle. For these plants Holstein types are more suited to their kill line than are the traditional British breeds such as Herefords and Angus (Tom Reed, personal communication). Holsteins and Holstein- crosses grow out to leaner animals which are ideally suited to the Canadian market, which has absorbed between 10 and 40 percent of the cattle sold for slaughter from Michigan lots in recent years. At least one Michigan cattle feeder with whom we have had contact is currently growing cattle specifically for the Canadian market -- leaner, heavier-framed animals and frequently Holstein-

crosses. He notes that to have to sell the same animals in Michigan, for a comparable price, he would have to feed them for an extra 30 days to have them grade low Choice.

Sources of Feeder Cattle

The total number of cows in Michigan herds on January 1 1981 was 530,000 head (Michigan Department of Agriculture 1983). Of these 140,000 were beef cows and 390,000 were dairy cows. Assuming average calving percentages of 70 percent for beef cows and 85 percent for dairy cows (Huber, personal communication [5]), these herds could have produced an estimated 430,000 calves in 1981. About 125,000 of the heifers may have been kept, or sold to other farms, for herd replacement and some of the male calves would have been sold for veal. Allowing for 100,000 calves to move into veal production (exact data on the number of calves from Michigan cow-calf and dairy operations were not available). This means that about 205,000 calves, from Michigan cow herds, could have been available for Michigan feedlots in 1982. Data on the number of fed cattle marketed in Michigan in 1982 are not available but in 1981 there were 197,000 fed cattle marketed in Michigan. In 1982, however, approximately 150,000 feeder cattle were imported from other states (Tom Reed, personal communication), while a portion of the feeder cattle raised in Michigan moved out of the state to feedlots elsewhere (exact data unavailable). Michigan cattle producers purchasing feeder stock for their lots from outside Michigan do so from locations primarily in the southeast -- Kentucky, Georgia, Tennessee, Alabama, North and South Carolina and Missouri. Bringing cattle from these distant locations represents considerable expense to Michigan cattle feeders. In addition to assembly and

transportation costs there are significant health-related "processing" costs which are necessary to ensure that healthy animals enter feedlots (Waller, Ritchie and Gibson, 1981).

Beef and Dairy Cow Inventories in the Eastern Corn Belt

The aggregate 1981 January 1 inventory for the region was 2.9 million cows, of which 1.7 million were beef cows and 1.2 million were dairy cows. Michigan and Ohio lead the region in dairy cow inventories while Illinois had the largest beef cow inventory (Table 4.4).

The total number of cows in the region has declined slowly since the cattle cycle peaked in the mid 1970s. The aggregate figure, however, masks the different trends in the beef and dairy herds. For the U.S. as a whole the number of dairy cows has been steadily declining since 1960. The dairy cow population in the Eastern Corn Belt has also declined. Beef cow numbers have fluctuated with the cattle cycle but show little net change over the 1970 to 1983 period (Figure 4.3).

The cow population is more evenly distributed throughout the region than is the population of fed cattle. The cows available for slaughter in the Eastern Corn Belt are animals culled from the region's beef and dairy herds. Figure 4.4 shows the number of cows available for slaughter in the four state region in 1978. The number of cows available for slaughter was calculated by applying cull rates to the December 31 inventories of beef and dairy cows. Since cull rates may vary with beef prices, grain prices, weather patterns

(particularly drought), pasture and range condition and government programs (eg. milk price supports) average cull rates have been used in the following formula to estimate the number of cows available for slaughter: [6]

Total number of cows available for slaughter =
(December 31 inventories of beef cows) x (0.20) +
(December 31 inventories of dairy cows) x (0.25)

TABLE 4.4
JANUARY 1 INVENTORIES OF BEEF AND DAIRY COWS, EASTERN CORN BELT STATES, 1981

Summary: Illinois leads the region in beef cow inventories, Michigan and Ohio lead the region in dairy cow inventories.

	Beef Cows	Dairy Cows (thousand head)	Total
Michigan	140	390	530
Ohio	385	375	760
Indiana	483	207	690
Illinois	708	230	938
Area Total	1,716	1,202	2,918

SOURCE: U.S. Department of Agriculture,Statistical Reporting Service, 1981

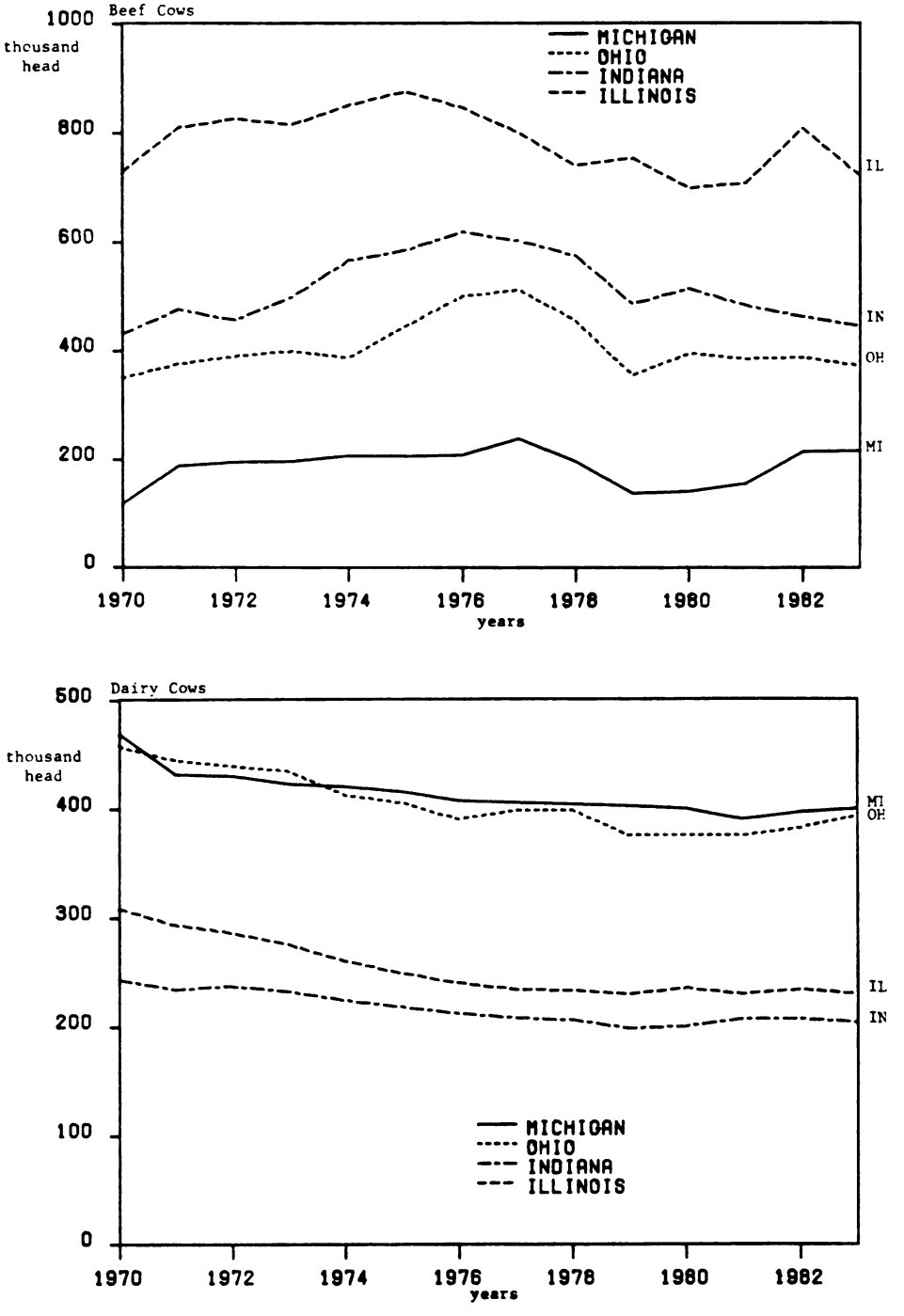

FIGURE 4.3:JANUARY 1 INVENTORIES OF BEEF AND DAIRY COWS, EASTERN CORN BELT STATES, 1970 - 1983

SOURCE: U.S. Department of Agriculture, Statistical Reporting Service, various years

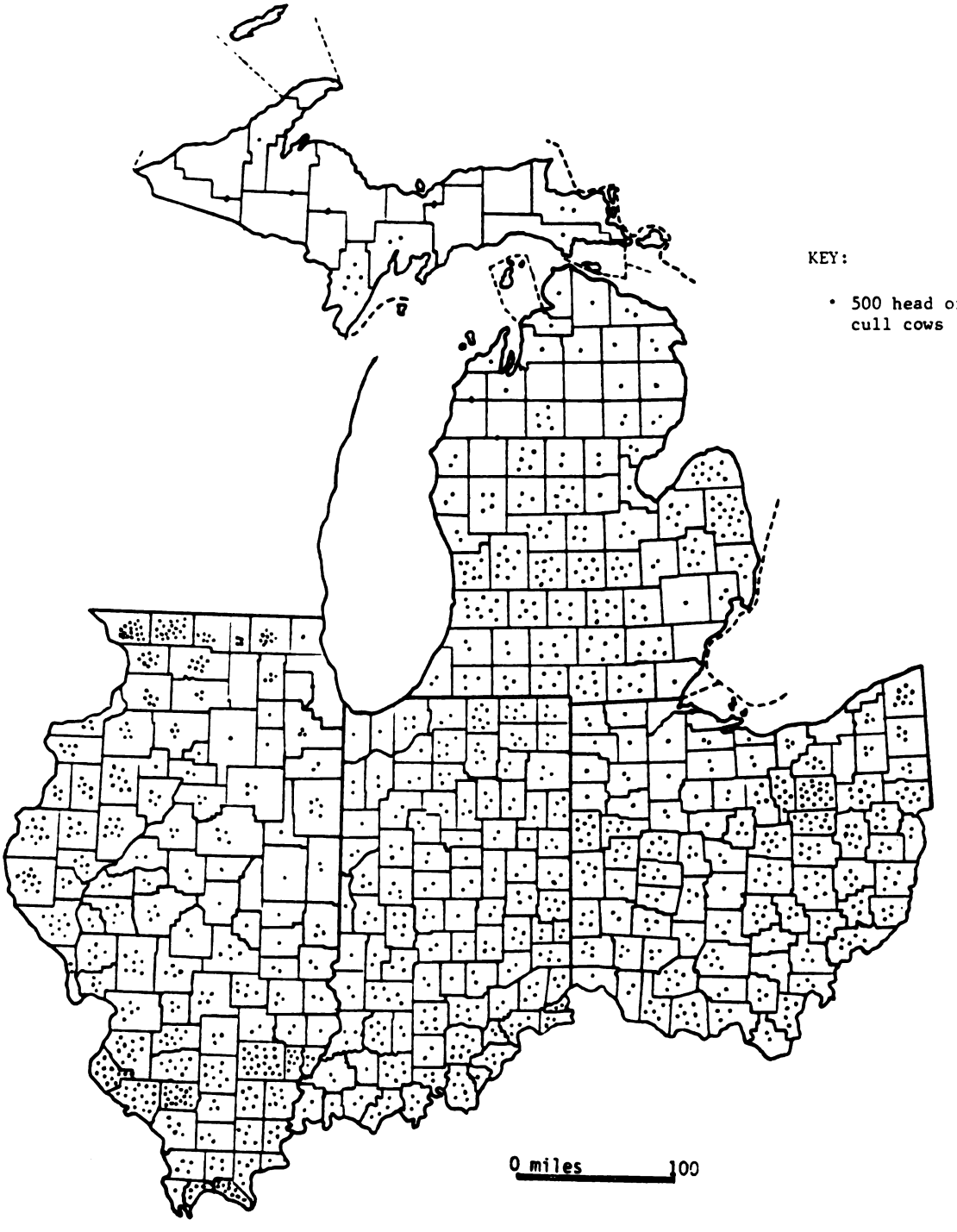

FIGURE 4.4: COWS AVAILABLE FOR SLAUGHTER, BASED ON DECEMBER 31 INVENTORIES, 1978

DATA SOURCE: Census of Agriculture, 1978

Projections of Future Supplies of Slaughter Cattle

It was shown in chapter three that cattle numbers in the Eastern Corn Belt have been declining since the peak in the cattle cycle in 1976 (Figure 3.3, p. 34). The number of cattle on feed in the region has declined over the past decade, as has the region's share of the number of cattle on feed in the nation. Projecting the downward trend in fed cattle marketings suggests that by 1990 the four states will market a combined total of 1.26 million head of fed cattle (Table 4.5). This would represent 5.85 percent of the U.S. total. Most of the decline would be in Ohio and Indiana, while Michigan, it appears, would stabilize at a little under 200 thousand head of fed cattle marketed annually.

TABLE 4.5
NUMBER OF FED CATTLE MARKETED, EASTERN CORN BELT, SELECTED YEARS, INCLUDING PROJECTIONS TO 1990

Summary: Simple linear trend projections to 1990 suggest a continuing decline in the number of fed cattle marketed in all four Eastern Corn Belt states.

	Actual Numbers(a) (thousand head)		Projections(b)		Percent of Decrease	
	1970	1976	1981	1990	1970 to 1990	1981 to 1990
Michigan	254	271	197	194	24	2
Ohio	429	387	235	123	71	48
Indiana	517	365	348	206	60	41
Illinois	1,167	935	925	738	37	20
Area Total	2,367	1,958	1,705	1,261	47	26

a. U.S.Department of Agriculture, Statistical Reporting Service, various years.
b. Projections estimated using linear trend analysis on TSP 3.5.

The Michigan State University Agriculture Model has projected cow inventories through until 1991 for the U.S. as a whole. For 1985 and 1990 their projections are as follows:

January 1 Inventories	1985	1990
	(thousand head)	
Beef cows	36,017	39,438
Dairy cows	11,085	9,655

(Michigan State University Agriculture Model, 1983)

Assuming that the percent share of the national cow herds for each of the Eastern Corn Belt states will remain at about the average for the past 14 years the corresponding projections for each of the states are shown in Table 4.6. These projections paint a rather gloomy picture of the future for the Eastern Corn Belt cattle industries; some consideration of the qualitative aspects may serve to brighten it a little.

Qualitative Aspects

The projections, for both fed cattle and cows, are based on 12 years of data, which is less than two complete cattle cycles. In addition, during the 12 years there were several changes in previously steady trends. These include changes in both demand and supply conditions for agricultural commodities, some of which may strengthen the competitive position of the Eastern Corn Belt industries. There are, however, other forces which may discourage increased beef production in the U.S. as a whole and in the Eastern Corn Belt.

TABLE 4.6
JANUARY 1 INVENTORIES OF BEEF AND DAIRY COWS, 1983 AND PROJECTIONS TO 1990, AND ESTIMATED NUMBER OF CULL COWS AVAILABLE FOR SLAUGHTER IN 1990, EASTERN CORN BELT

Summary: Simple linear trend projections suggest that beef cow inventories will decline in Michigan but will increase in the other three states resulting in an increase in the region as a whole. The projections suggest that dairy cow inventories will decline in all four states.

	Percent Share of National Total(a)	January 1 Inventories Actual 1983	Projected 1990	Number of Cull Cows 1990	Percent Change 1983 to 1990
		(thousand head)			
BEEF COWS					
Michigan	0.46	215	181	36	-16
Ohio	1.02	372	402	80	+ 8
Indiana	1.29	446	509	102	+14
Illinois	1.97	722	777	156	+ 8
	Total	1,755	1,869	374	+ 6
DAIRY COWS					
Michigan	2.68	400	355	89	-11
Ohio	3.60	393	348	87	-12
Indiana	1.92	204	185	46	- 9
Illinois	2.24	230	216	54	- 6
	Total	1,227	1,104	276	-10
	Total All Cows	2,982	2,973	650	---

(a) Averages calculated from data collected by U.S.Department of Agriculture, Statistical Reporting Service.

Some of the major changes in consumer demand for beef were discussed in chapter two. The shift towards leaner meats and more economical and convenient cuts could improve the position of cattle feeding in the Eastern Corn Belt relative to the High Plains. Beef raising systems in the Eastern Corn Belt can make use of forages and by-product feedstuffs to produce leaner beef at lower cost. On the other hand, the overall softening of consumer demand for beef could limit the region's advantage to be gained from the changes in consumers' preferences.

There are several interrelated factors on the supply side which are likely to have important and long-lasting effects on the beef subsector. With fuel price increases transportation becomes more expensive and regional self-sufficiency will increase (National Cattlemen's Association, 1982). Beef raising and slaughtering could shift closer to consuming centers on the east and west coasts and away from the High Plains. Cattle production could also shift toward areas of surplus grain production, especially those without easy access to export markets.

Several factors point to the possibility of increases in the price of grain, a major input in fed cattle production. Water for agriculture is relatively cheap at present; it is unlikely to remain so. The cost of pumping water to irrigate crops will increase with increases in energy prices. In addition, in many of the grain producing areas in the High Plains the water used for irrigation comes from underground water supplies which are being depleted. The effect of higher water costs in the High Plains could be to push feed grain

production to regions in which water is more abundant, for example the Lakes states. Deregulation of natural gas may also increase grain prices by raising the cost of nitrogen fertilizers (National Cattlemen's Association, 1982). If the amount of grain demanded on the world market outstrips supplies grain prices on the world market will rise. This could both raise domestic grain prices and shift agricultural resources into grain production and possibly away from livestock production. The net effect of increasing grain prices would be to limit livestock production in general, to decrease grain feeding of cattle and to shift relatively more of the available feedgrains to poultry and pork production (Riley, Allen and Jackson, 1984).

Economic trends, especially the trend in employment, could stimulate expansion of cattle feeding in Michigan. If unemployment in Michigan remains high there is an incentive for young people to stay in farming, where that is possible, rather than move to urban areas as has been the trend over the past several decades. Also, Michigan has, in the past, had higher wage rates than some southern states. As workers from the industrial north have moved south, wages in the "Sun Belt" have tended to come in line with those in the north (Beef Sub-committee, Michigan Governor's Conference on Agriculture, 1981). Increases in southern wage rates could increase costs for cattle feeders in that region and erode some of their competitive advantage in cattle feeding.

Michigan has long been a major dairy producing state. Continuation of the national downward trend in dairy cow numbers could leave many Michigan farms with un- or underutilized cattle handling facilities. These farmers may find cattle feeding a more palatable alternative than some of the other options.

The growing public interest in environmental issues may prove to have profound effects on the agricultural sector in general and the livestock subsectors certainly will not be untouched. Concerns about long-term use of agricultural chemicals, antibiotics and other drugs are raising searching questions about livestock production systems. More stringent regulations regarding their use could change the relative efficiencies of poultry, pork and beef production. Questions are also being raised about the disposal of wastes from intensive livestock production enterprises and about the long term viability of continued intensive cropping practices. In the future we may see a shift towards the combination of livestock production and cropping in a more diverse and ecologically stable farming system. These issues may not precipitate radical changes in the immediate future but they are likely to be significant forces of change in the agricultural sector in the long run.

FOOTNOTES

1.Mr.Tom Reed, Assistant Manager, Central Office, Michigan Livestock Exchange, Lansing Michigan. Mr. Reed was contacted on an irregular basis by this author throughout the course of this study. His assistance in the provision of information for this report is most appreciated.

2.Telfarm is a computerized records-keeping program available to Michigan farmers through the Cooperative Extension Service of the U.S. Department of Agriculture and Michigan State University. Enrollment is voluntary, therefore information obtained from Telfarm analyses of cattle feeding operations may not be representative of average cattle feedlot operations in Michigan.

3.Dr.John Waller, Professor, Department of Animal Science, Michigan State University.

4.Mr. Bim Franklin owns and operates the Howell Livestock Auction in Howell, Michigan. The author attended an auction there in July 1983. Mr.Franklin provided valuable information at that time, for which the author is most grateful.

5.Dr.J. Huber, Professor, Department of Animal Science, Michigan State University.

6. Estimated cull rates for regional beef herds, obtained from Dr. G.Schwab, Department of Agricultural Economics. and Dr. W. Magee, Department of Animal Science, Michigan State University. Estimated cull rates for regional dairy herds, obtained from Dr. S. Nott, Department of Agricultural Economics, Michigan State University and K. Potter, Michigan Dairy Herd Improvement Association. It should be noted that the cull rates will vary between building and liquidation phases in the cattle cycle and depending on various government programs. The rates used in this thesis are estimated averages for beef and dairy herds in the Eastern Corn Belt states.

V. AN ESTIMATION OF THE POTENTIAL VOLUME OF SLAUGHTER CATTLE FOR THREE MICHIGAN-BASED STEER AND HEIFER SLAUGHTERING PLANTS

This chapter examines the potential supply of fed cattle available for slaughter in three plants of different sizes in Michigan. The supply area from which it is assumed these plants could draw cattle is the three state region of Michigan, Ohio and Indiana. The Illinois cattle population has been excluded from this estimation of the potential supply of cattle for Michigan-based plants. It is unlikely that a plant in Michigan would be able to pull a significant number of steers and heifers from Illinois because there are several large plants in that state which draw heavily from Illinois and the other Eastern Corn Belt states as well as from states to the west. The supply of steers and heifers for slaughter is estimated for each of the three plants. One is the largest plant currently operating in Michigan, the Murco plant at Plainwell in Allegan county. The other two are possible future plants, one at Adrian in south-central Michigan and one at Flint in the Thumb-central Michigan area. The Adrian and Flint locations are viewed as two possible alternative locations for a steer and heifer slaughtering plant, should new slaughtering facilities be necessary some time in Michigan's future.

The viability of a new plant in the Eastern Corn Belt depends on many factors -- the supply of cattle available for slaughter, the plant size, transportation costs, competition for raw materials and outlets for the meat and meat products. The focus in this section is on the cattle supply within three supply areas for each plant, transportation costs and competition between plants for available cattle.

Estimation Procedures

To estimate the potential supply of cattle for slaughter in Michigan plants, county level data collected for the 1978 U.S. Census of Agriculture were used. The volume of fed cattle (steers and heifers) available for slaughter was taken to be the number of fed cattle marketed for the year from each county in the three state area. In addition, cows culled from beef and dairy herds in the region go to slaughter.

The 1978 annual sales volume for fed cattle and the December 31 inventories for cows were mapped, at the county level, for the four state area. Using information from the Packers and Stockyards Administration, the locations and approximate size of cattle slaughter plants (those with annual slaughter capacity over 10,000 head) were also plotted (Packers and Stockyards Administration, U.S. Department of Agriculture, unpublished data). By superimposing these two maps we identified the areas in which the supply of cattle for slaughter exceeded existing slaughtering capacity.

Selected Plant Locations

The goal of most plant size and location feasibility studies would be to identify the number, sizes and locations of plants which minimize the combined costs of cattle assembly, slaughter and product distribution. This thesis is not such a detailed feasibility study. Information has been drawn, however, from Huie's analysis of cattle slaughtering in the Michigan and northern Ohio and Indiana region (Huie, 1970). His analysis was based on cattle production and beef consumption projected for 1980. The production and consumption areas included all of Michigan's Lower Peninsula and the two northern tiers of counties in Ohio and Indiana. He used two models, one which took into account assembly and in-plant processing costs only (the "Stollsteimer" model) and one which also included meat distribution costs (the "Transhipment" model). Both models yielded similar solutions in terms of plant locations and total slaughter capacity. Minimum costs would be achieved with four plants, all located in the southern half of Michigan's Lower Peninsula, with a total annual slaughter volume of 1.2 million head (Table 5.1). Plants located at Alma, Sandusky, Adrian and Sturgis minimized cattle assembly and in-plant slaughtering costs. To minimize assembly, in-plant slaughtering and distribution costs the Sturgis plant was replaced by one in Lansing and the sizes of the other plants changed slightly.

Huie's study did not, however, take into account the existing slaughtering capacity in Michigan or the surrounding states. He assumed that all slaughter cattle available in the study region would be slaughtered in the new plants specified in the study. The effect of competition from existing plants was not considered. In the current

study the proposed plant locations and sizes have been based on the total supply of slaughter cattle in the three states, their geographic distribution through the region and the size and location of existing cattle slaughtering plants in the three states. The locations of Michigan plants operating in 1983, Huie's five proposed locations and the two possible locations considered in this study are shown in Figure 5.1.

TABLE 5.1
PLANT LOCATIONS AND SIZES FOR MINIMUM TOTAL SLAUGHTERING COSTS, MICHIGAN PLANTS

Plant Location	Annual Slaughtering Capacity, Steers and Heifers (1000 head)	
	Stollsteimer Model	Transhipment Model
Alma	295	172
Sandusky	170	154
Adrian	450	692
Sturgis	311	-
Lansing	-	208
Total	1,226	1,226

SOURCE: Huie, 1970.

The results of both the current study and of Huie's suggest that locations in south-central Michigan would provide the greatest opportunity for minimizing costs and ensuring a stable supply of slaughter cattle for a large Michigan-based plant. The importance of size economies and the maintenance of a stable supply of slaughter cattle must be stressed. The existing supply of cattle in the three

state region is insufficient to support a mega-plant capable of capturing all the size economies. Plants in the 150,000 to 300,000 head per year range, however, should be able to capture most of these economies in in-plant costs without running into very high assembly costs. The analysis, therefore, is for a plant with an annual slaughtering capacity of between 150,000 and 250,000 head of fed cattle for the Adrian location. The plant at the Flint location is viewed as being a special case -- with an annual slaughtering capacity of between 50,000 and 60,000 head of fed cattle it would probably have slightly higher per head in-plant costs. The location, however, would put the plant in a strategic position to draw cattle from the Thumb area of Michigan at relatively low assembly costs. With tight, prudent and astute management such a plant could probably obtain sufficient cattle to operate a plant of the size specified.

The other plant considered in this chapter is the Murco plant at Plainwell. Murco operate the largest cow slaughtering plant in the region and have recently added a steer and heifer slaughtering program. In January 1983 they were killing between 600 and 700 head of cows and between 200 and 300 head of steers and heifers daily. They encountered some transitional difficulties, however, and in January 1984 had reduced the steer and heifer operation to about 200 head slaughtered per week. When fully on line the plant expansion will give them a total potential killing capacity of 1,200 head per day, which they would like to be made up of between 500 and 700 steers and heifers and between 400 and 600 cows. Using a 260 working day year this represents a total potential annual kill volume of 312,000 head, of which between 130,000 and 182,000 head would be steers and

heifers and between 104,000 and 156,000 would be cows. We have assumed, for the purpose of this analysis, that Murco's steer and heifer slaughtering capacity will be about 156,000 head annually. The success of any of these plants depends very much on their ability to obtain, at competitive prices, cattle which are now going to other Michigan and regional slaughtering plants, to U.S. plants outside the region and to Canadian plants.

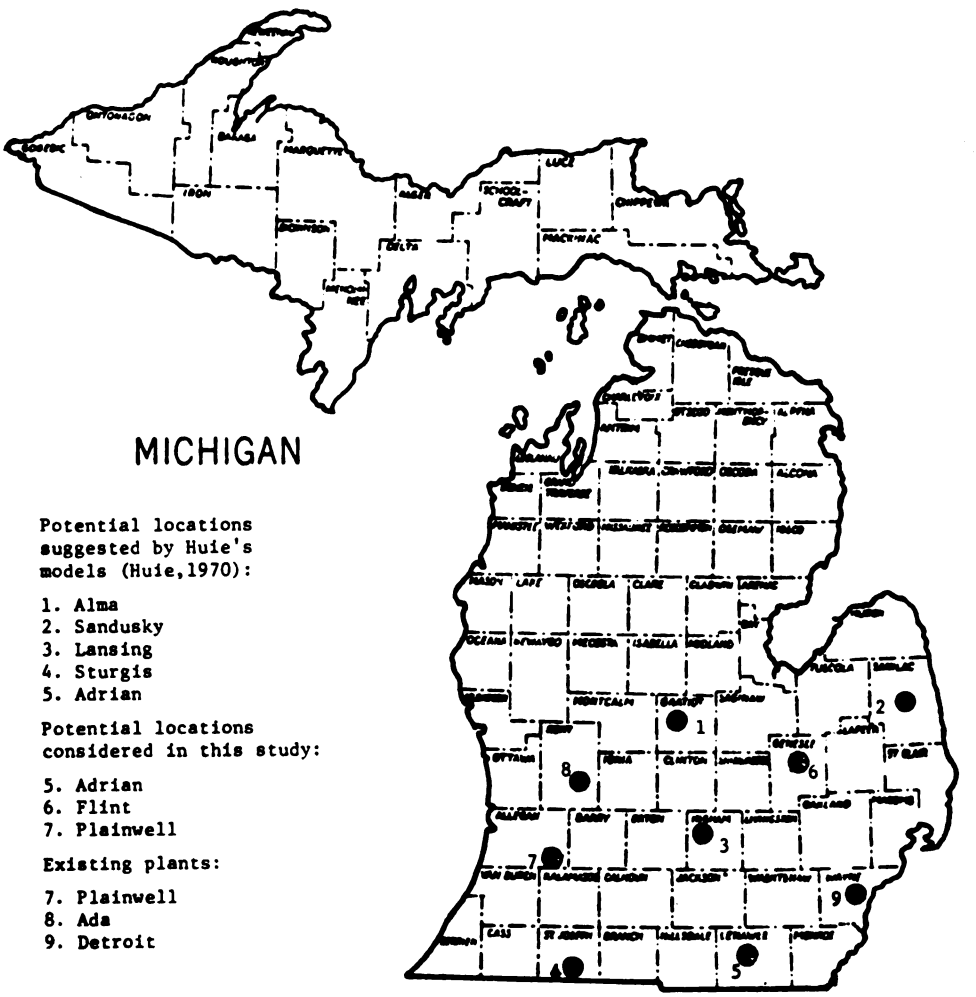

FIGURE 5.1: STEER AND HEIFER SLAUGHTER PLANT LOCATIONS IN MICHIGAN: PLANTS EXISTING IN 1983 AND PLANTS PROPOSED BY HUIE(1970) AND BY THIS STUDY

Supply Areas - Three Michigan Plants

The potential volume of fed cattle available for slaughter in the Michigan-Ohio-Indiana region in 1978 was about 1.3 million head (based on the 1978 Census of Agriculture survey of fed cattle marketings). We have defined primary, secondary and tertiary supply areas for each of the three plants and they are shown in Figures 5.2, 5.3 and 5.4 for Plainwell, Adrian and Flint respectively. Table 5.2 shows the volume of fed cattle which would be available to each plant, from each of the supply areas, if no other plant were competing with it for steers and heifers in the three state area. To assume that any of these plants would operate without competition is, however, unrealistic. Competition would come from existing slaughtering plants both within the region and outside. In estimating the potential supply of cattle available for each of these three plants certain assumptions have been made.

Assumptions

Each plant has a primary and secondary supply area with radii of 50 and 100 miles respectively. These areas are based on the guidelines proposed by Smalley, but the secondary area has been contracted from a 120 mile radius to a 100 mile radius, and a tertiary supply area added (Smalley, 1978). The tertiary supply area for each plant is bounded by the outer boundaries for the three state area (see Figures 5.2, 5.3 and 5.4).

It is assumed that there are upper limits to the percent of available cattle that any slaughtering plant can draw from each of the supply areas because of competition for available cattle supplies. Because competition may fluctuate with entry and exit of firms, the following upper limits have been assumed when estimating the percent of the available cattle each plant could draw from each of the supply areas:

Primary supply area.....70 percent
Secondary supply area.....50 percent
Tertiary supply area.....30 percent
(See Tables 5.3, 5.4 and 5.5).

Cattle numbers may continue to fluctuate with the national cattle cycle, but it is assumed that there will not be an increase in cattle feeding activity in the three state area in response to the increased slaughtering capacity.

Estimated Potential Supply of Cattle for Slaughter

Tables 5.3, 5.4 and 5.5 present some combinations of rates of acquisition and the resulting volume of cattle (both number of head and percent of plant capacity) which could be available to the Murco, Adrian and Flint plants respectively. The totals represent what we consider to be the bottom, middle and top of the range of cattle potentially available to each plant. Given the proposed capacity for each plant it can be seen that even at the bottom of the range there would be a sufficient volume of cattle for each plant when considered individually. The critical factor is the procurement pattern; the larger plants (Murco, and Adrian with 250,000 head slaughtering capacity) could be forced to procure a larger proportion of their total kill volume from the secondary and tertiary supply areas. Reliance on more distant supplies of cattle to fill slaughtering schedules raises both assembly costs and uncertainty for plants. The most apparent direct cost, transport, is discussed in the next section but there are other costs which must also be recognized. These include the cost of assembling a truckload of cattle which may vary between different methods of buying/selling, increased possibility of injury to animals if multiple loadings are required, a greater

possibility of heat stress, shrinkage and even death during the summer months and the costs associated with having cattle buyers at several distant locations. Inconvenience and uncertainty are increased as procurement distance increases -- synchronizing cattle delivery and slaughter is more difficult when long travelling distances are involved and purchasing cattle from more distant markets increases the likelihood of cattle being lost to more strategically located plants (Smalley, 1978).

TABLE 5.2
POTENTIAL SUPPLY OF FED CATTLE FOR THREE MICHIGAN-BASED PLANTS; PRIMARY, SECONDARY AND TERTIARY SUPPLY AREAS.

Summary: A total of 1.29 million head of fed cattle in Michigan, Ohio and Indiana were potentially available for slaughter in 1978.

Supply Area:	Total Volume of Fattened Cattle Potentially Available for Slaughter.		
	Plainwell (Murco)	Adrian Area	Flint Area
Proposed Annual Slaughter Volume (1,000 head)	156	150-250	50-60
Primary Supply Area, 50 mile radius.	70,863	128,737	71,090
Secondary Supply Area, 100 mile radius.	235,757	250,168	179,287
Tertiary Supply Area, state boundaries, MI(a) OH & IN.	980,367	908,082	1,036,610
Total	1,286,987	1,286,987	1,286,987

a. Lower Peninsula only.
DATA SOURCE: U.S. Census of Agriculture, 1978

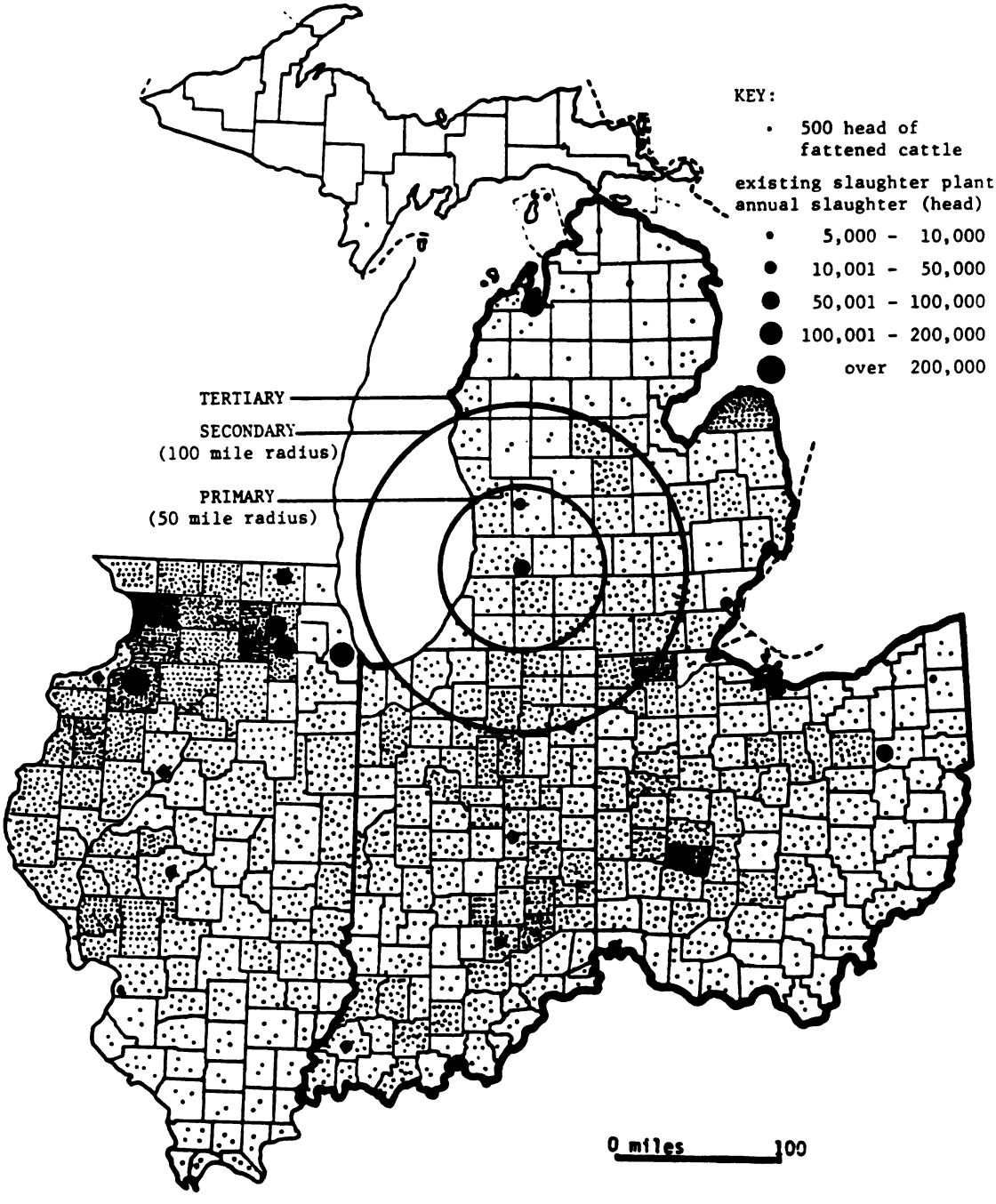

FIGURE 5.2: PRIMARY, SECONDARY AND TERTIARY SUPPLY AREAS FOR THE MURCO PLANT AT PLAINWELL

Map shows the county level fed cattle marketings for 1978

DATA SOURCE: U.S. Census of Agriculture, 1978

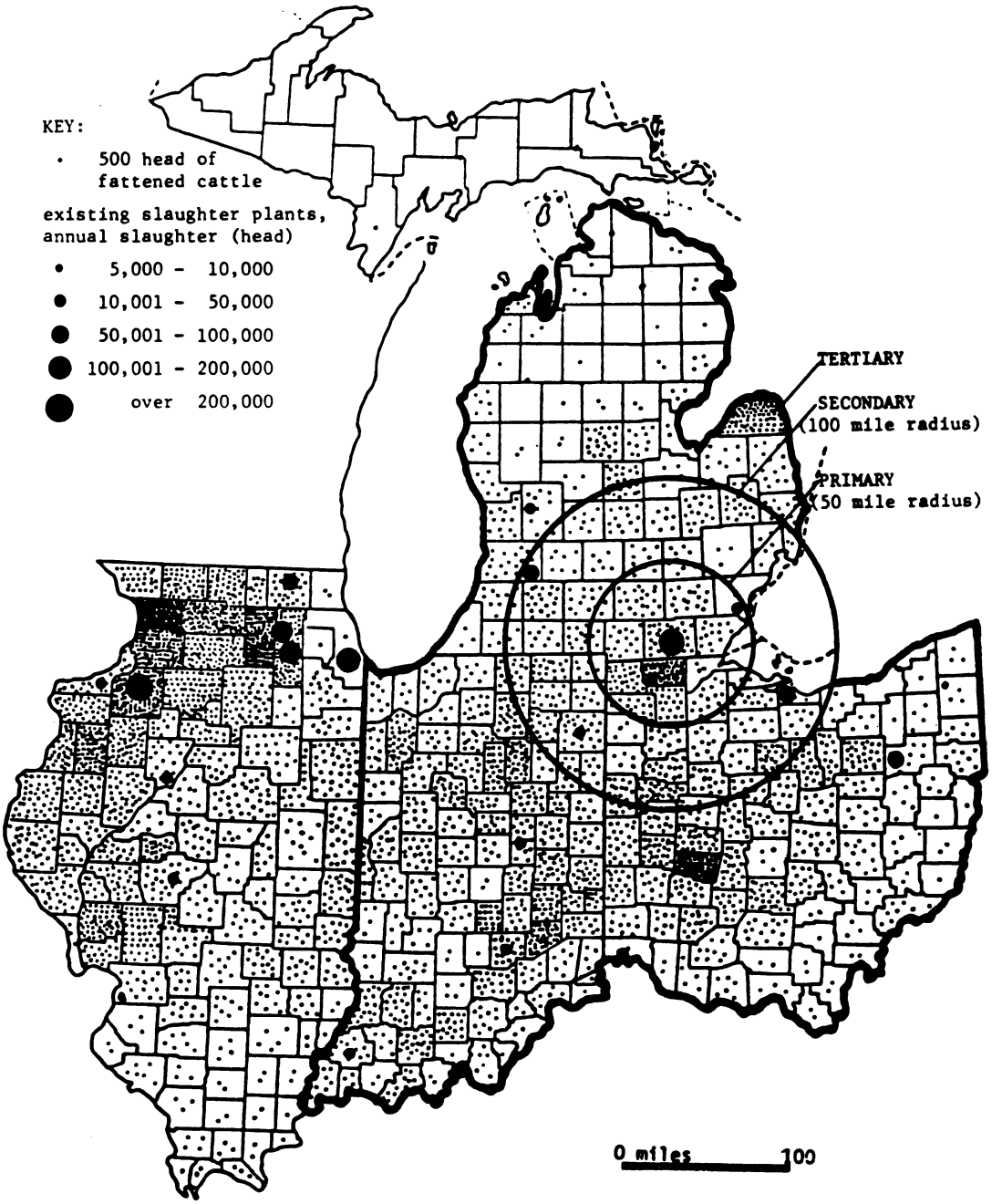

FIGURE 5.3: PRIMARY, SECONDARY AND TERTIARY SUPPLY AREAS FOR A NEW STEER AND HEIFER SLAUGHTERING PLANT AT ADRIAN

Map shows the county level fed cattle marketings for 1978

DATA SOURCE: U.S. Census of Agriculture, 1978

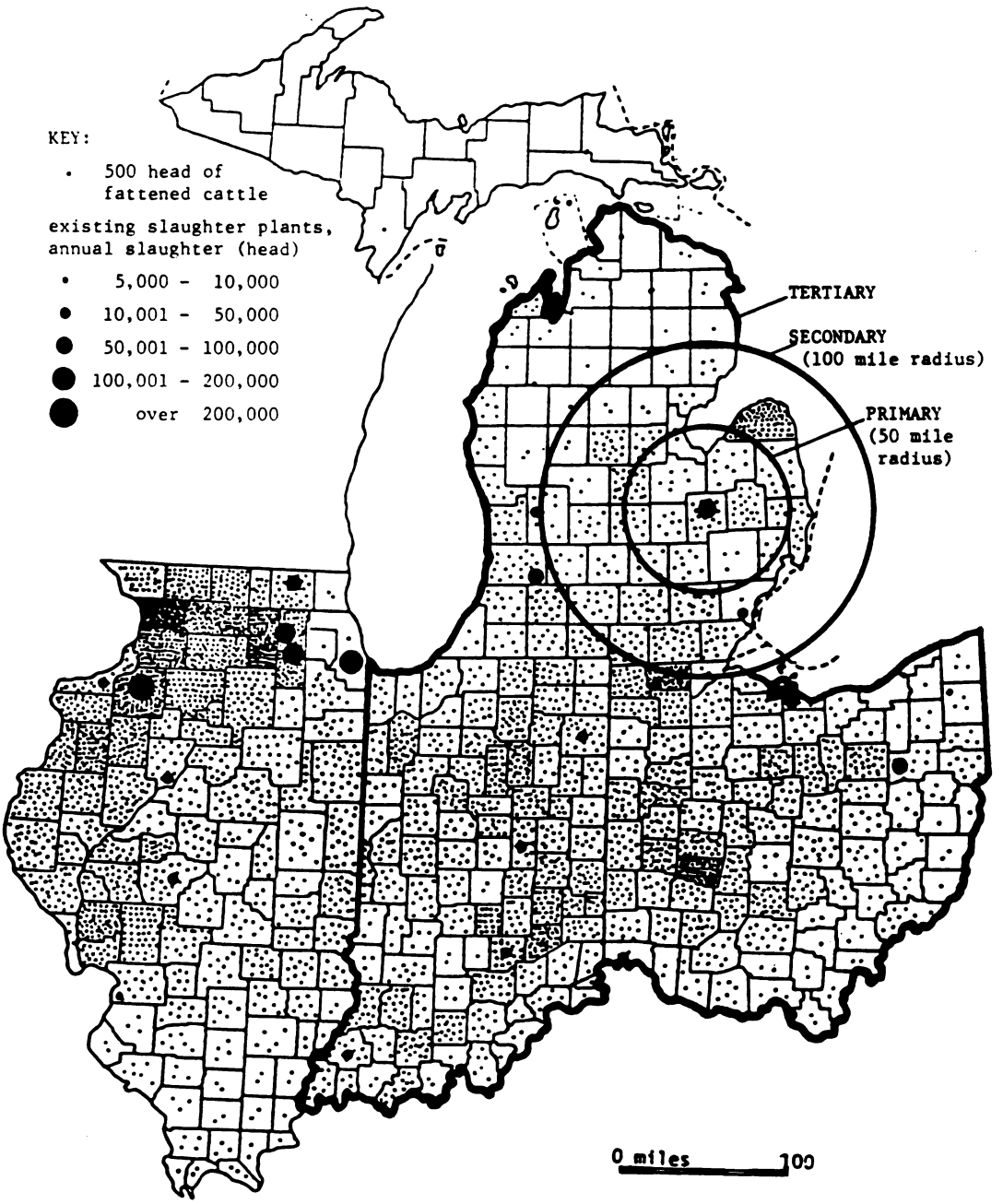

FIGURE 5.4: PRIMARY, SECONDARY AND TERTIARY SUPPLY AREAS FOR A NEW STEER AND HEIFER SLAUGHTERING PLANT AT FLINT

Map shows the county level fed cattle marketings for 1978

DATA SOURCE: U.S. Census of Agriculture, 1978

TABLE 5.3
POTENTIAL SUPPLY OF FED CATTLE FOR SLAUGHTER AT THE MURCO PLANT AT PLAINWELL (PLANT VOLUME: 156,000 HEAD OF FED CATTLE ANNUALLY).

	Total Number of Fed Cattle	Cattle Acquired, Number of Head at Three Acquisition Rates for Each Supply Area.		
Supply Area:				
Primary	70,863			
Acquisition Rate, Percent of Total Cattle Available.		50	60	70
Number of Head.		35,431 (23)	42,518 (27)	49,604 (32)
Secondary	235,757			
Acquisition Rate, Percent of Total Cattle Available.		30	40	50
Number of Head.		70,727 (45)	94,303 (60)	117,878 (76)
Tertiary	980,367			
Acquisition Rate, Percent of Total Cattle Available.		10	20	30
Number of Head.		98,037 (63)	196,073 (126)	294,110 (189)
Totals		204,195	332,894	461,592

a. Numbers in parentheses are the percentage of plant capacity obtained in the given supply area at the specified rate of acquisition.

DATA SOURCE: U.S. Census of Agriculture, 1978

TABLE 5.4
POTENTIAL SUPPLY OF FED CATTLE FOR SLAUGHTER AT A PLANT AT ADRIAN (PLANT VOLUME: 150,000-250,000 HEAD OF FED CATTLE ANNUALLY).

	Total Number of Fed Cattle	Cattle Acquired, Number of Head at Three Acquisition Rates for Each Supply Area.		
Supply Area:				
Primary	128,737			
Acquisition Rate, Percent of Total Cattle Available.		50	60	70
Number of Head.		64,368 (43-26)	77,242 (51-31) a.	90,116 (60-36)
Secondary	250,168			
Acquisition Rate, Percent of Total Cattle Available.		30	40	50
Number of Head.		75,050 (50-30)	100,067 (67-40)	125,084 (84-50)
Tertiary	908,082			
Acquisition Rate, Percent of Total Cattle Available.		10	20	30
Number of Head.		90,808 (61-36)	181,616 (121-73)	272,425 (182-109)
Totals		230,226	358,925	487,625

a. Numbers in parentheses are the percentage of plant capacity obtained in the given supply area at the specified rate of acquisition.

DATA SOURCE: U.S. Census of Agriculture, 1978

TABLE 5.5
POTENTIAL SUPPLY OF FED CATTLE FOR SLAUGHTER AT A PLANT AT FLINT (PLANT VOLUME: 50,000-60,000 HEAD OF FED CATTLE ANNUALLY).

	Total Number of Fed Cattle	Cattle Acquired, Number of Head at Three Acquisition Rates for Each Supply Area.		
Supply Area:				
Primary	71,090			
Acquisition Rate, Percent of Total Cattle Available.		50	60	70
Number of Head.		35,545 (71-59)	42,654 a. (85-71)	49,763 (99-83)
Secondary	179,287			
Acquisition Rate, percent of Total Cattle Available.		30	40	50
Number of Head.		53,786 (108-90)	71,715 (143-119)	89,643 (179-149)
Tertiary	1,036,610			
Acquisition Rate, Percent of Total Cattle Available.		10	20	30
Number of Head.		103,661 (207-173)	207,322 (415-345)	310,983 (622-518)
Totals		192,992	321,691	450,389

a. Numbers in parentheses are the percentage of plant capacity obtained in the given supply area at the specified rate of acquisition.

DATA SOURCE: U.S. Census of Agriculture, 1978

These analyses show that the Adrian location would have the greatest potential supply of cattle for slaughter in its primary area, with over 128,000 head of fed cattle. Both the Plainwell and Flint locations would have about 71,000 head of fed cattle available in their primary supply areas. Looking at the competition each of the plants would face we find that both Murco and the Adrian plants would have to compete for available cattle in their primary supply areas (see Figures 5.2 and 5.3). For Murco competition comes from Ada Beef which slaughters between 25,000 and 30,000 head of fed cattle annually, and several smaller plants which kill several hundred head annually. A plant at the Adrian location would face competition from plants in the Detroit area and in northern Ohio. In 1982 and 1983 the plants in this area had a combined slaughter capacity of about 100,000 head of fed cattle annually. A very recent entry into steer and heifer slaughtering in the region is the Top Line Beef Company which purchased and reopened a plant in Coldwater, in south-central Michigan, early in 1984 (not shown on the maps)[1] . The Coldwater location is a good substitute for the Adrian location; the supply of cattle and competition encountered would be similar for both plants. If Top Line's initiative proves successful it is unlikely that Adrian would be considered as a potential location for a steer and heifer slaughter plant. There are no plants which slaughter more than 10,000 head annually within the primary supply area for the Flint location but the Monarch plant in Detroit's Eastern Market area is very close and could be expected to compete for fed cattle with a plant in Flint. The Monarch plant was slaughtering about 750 head per week (39,000 head annually) early in 1983 (Riley, Allen and Jackson, 1984).

The secondary supply areas for all three plants encompass other slaughtering plants in the three state region. In addition to competition from each other (hypothetical, since only the Murco plant is currently operating), the supply areas for both Murco and the Adrian location would include plants in northern Indiana and Ohio, while that for the Flint location would encompass most plants in central and eastern Michigan and some in the northern-most counties of Ohio. If we consider a "bottom of the range" scenario in which each plant drew only 50, 30 and 10 percent of the available cattle in the primary, secondary and tertiary supply areas respectively, we see that Murco and a plant at the Flint location most likely would be able to achieve their slaughter capacities, but a plant at the Adrian location would not achieve an annual slaughter volume of 250,000 head.

Competition From Outside the Three State Area

An estimated average of 30 to 50 percent of the fed cattle marketed in Michigan in the late 1970s were subsequently slaughtered in plants outside Michigan. In 1982 and 1983 outshipments of fed cattle from Michigan, to plants in Ohio, Pennsylvania, Illinois and Ontario, may have been as high as 60 or 70 percent of the annual marketings (various industry sources). In 1982 there was a significant entry into the Eastern Corn Belt market for fed cattle with IBP's acquisition of a plant in Joslin in northwestern Illinois. The location of the plant and its supply areas is shown in Figure 5.6. At the time of acquisition the plant had a slaughtering capacity of about 375,000 steers and heifers per year. They are remodelling and expanding the slaughtering capacity of this plant and it is projected that when completed it will handle about 600,000 head annually

(Occidental Petroleum, 1981). In addition, they are adding facilities which will enable them to produce "boxed beef" which will add to regional meat supplies a significant volume of meat processed using this new technology. While most of the cattle slaughtered in this plant will probably come from Illinois, Iowa and Wisconsin it is possible that some portion of the total slaughter volume will be purchased in the Michigan-Ohio-Indiana region. According to people in the Michigan cattle industries some cattle producers in Michigan have sold cattle to IBP during the past 12 months.

If we assume that IBP will expand the slaughter capacity of the plant to 600,000 head annually and that two thirds of the total slaughtering capacity, 400,000 head, will be obtained within the Eastern Corn Belt, we can estimate the potential supply volumes in the same manner as was done for the Michigan plants. The potential supply of cattle from locations within the Eastern Corn Belt states for the Joslin plant is shown in Table 5.6. Because of the size of the plant four supply areas have been identified; the primary and secondary supply areas have similar radii to those for the Michigan plants but the tertiary area has a 250 mile radius and the quaternary supply area a 400 mile radius. If IBP could draw middle range percentages or higher of cattle from within the primary, secondary and tertiary supply areas it could obtain enough cattle to meet its capacity without having to extend its procurement practices as far as the quaternary supply area. If a smaller proportion of the total

capacity were to be acquired in the Eastern Corn Belt, say one half, then it is possible that their buying activities would not extend beyond the secondary supply area.

There are eight other cattle slaughtering plants in Illinois which have a combined slaughtering capacity of about 550,000 head of steers and heifers annually. These plants compete with IBP for Illinois cattle and with IBP and plants in the Michigan-Ohio-Indiana region for cattle in those three states. In 1983 Illinois plants may have been able to acquire cattle from Michigan, Ohio and Indiana locations with a transportation advantage not available to plants in the three state region. Trucks were coming to Michigan, carrying hogs to be slaughtered in Detroit and these trucks back-hauled cattle at rates which were somewhat lower than the regular shipping rates. This may have been only a temporary phenomenon but it allowed IBP, and possibly other Illinois plants, to compete with slaughtering plants in Michigan, Ohio and Indiana with the advantage of discounted shipping rates for live cattle.

TABLE 5.6
POTENTIAL SUPPLY OF FED CATTLE FOR SLAUGHTER AT THE IBP PLANT AT JOSLIN, (PLANT VOLUME: 600,000 HEAD OF FED CATTLE ANNUALLY)(a)

	Total Number of Fed Cattle	Cattle Acquired, Number of Head at Three Acquisition Rates for Each Supply Area.		
Supply Area:				
Primary,	371,223			
Acquisition Rate, Percent of Total Cattle Available.		50	60	70
Number of Head.		185,612 (46)[b]	222,734 (56)	259,856 (65)
Secondary,	416,664			
Acquisition Rate, Percent of Total Cattle Available.		30	40	50
Number of Head.		124,999 (31)	166,666 (42)	208,332 (52)
Tertiary,	734,210			
Acquisition Rate, Percent of Total Cattle Available.		10	20	30
Number of Head.		73,421 (18)	146,842 (37)	220,263 (55)
Quaternary(c)	785,067			
Acquisition Rate, Percent of Total Cattle Available.		5	10	15
Number of Head.		39,253 (10)	78,507 (20)	117,760 (29)
Totals	2,307,164	423,285	614,749	806,211

a. It is assumed that about 2/3 of the total plant capacity, 400,000 head per year, will be drawn from the Eastern Corn Belt region so for the purposes of this analysis 400,000 will be used as plant capacity.
b. Numbers in parentheses are the percent of plant capacity obtained in the given supply area at the specified rate of acquisition.
c. The quaternary supply area has a radius of 400 miles and is included only for the IBP plant because its annual slaughter volume is so large.

DATA SOURCE: U.S. Census of Agriculture, 1978

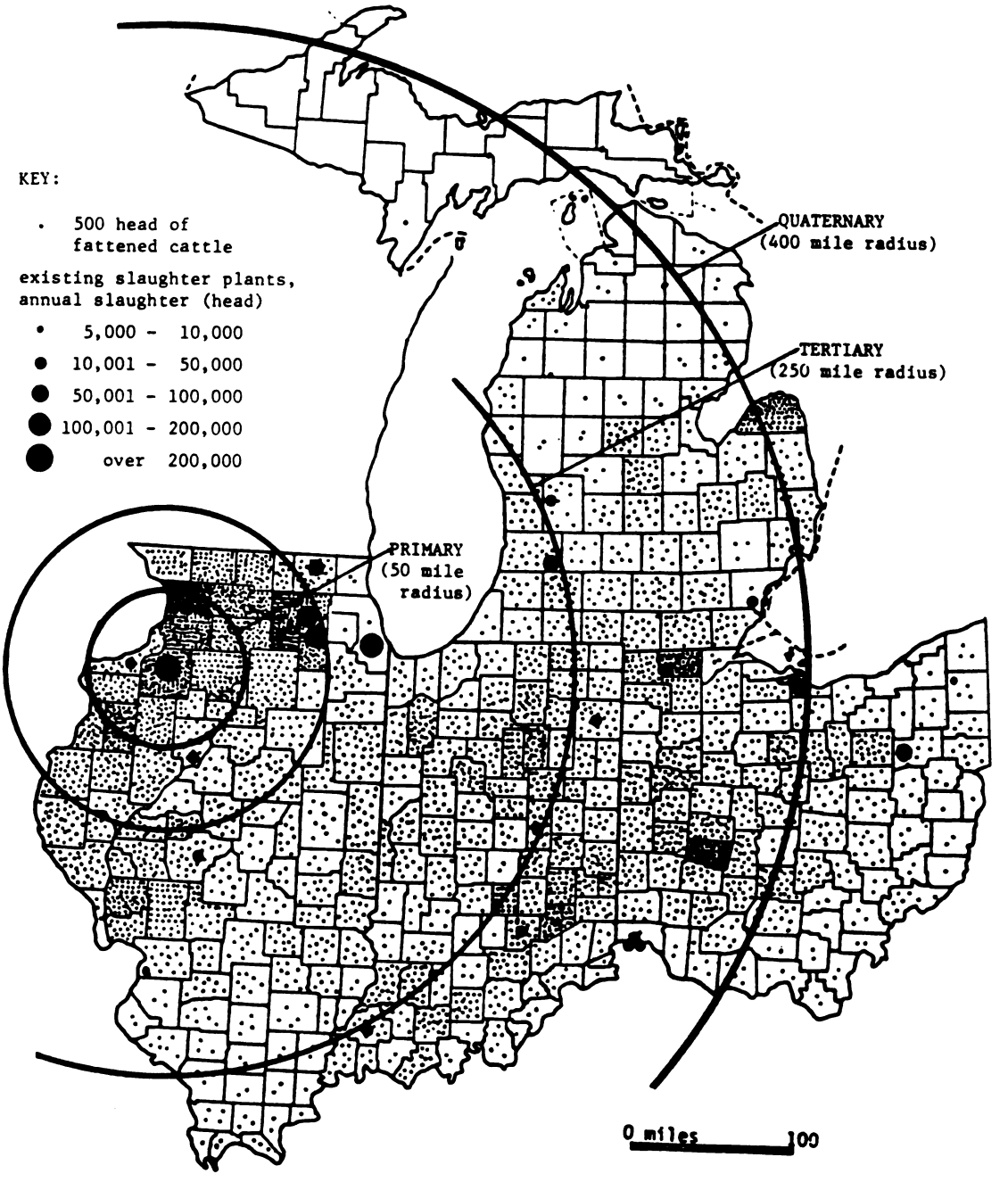

FIGURE 5.5: PRIMARY, SECONDARY, TERTIARY AND QUATERNARY SUPPLY AREAS FOR THE IBP PLANT AT JOSLIN

Map shows the county level fed cattle marketings for 1978.

DATA SOURCE: U.S.Census of Agriculture, 1978

Competition From Within the Three State Area

Small plants (those slaughtering fewer than 10,000 head of cattle annually) traditionally have slaughtered a significant number of cattle in the three states -- in Michigan and Ohio about 10 percent of the fed cattle marketed but about 20 percent of the total volume of steers and heifers slaughtered. In Indiana small plants slaughter a smaller share of the total volume of steers and heifers slaughtered in the state. In 1981 Michigan switched from state to federal meat and plant inspection services for all slaughtering plants. It is anticipated that this will result in fewer cattle being slaughtered in the smaller plants. Several larger, commercial plants in the region have ceased operations since 1980. These include a plant in Detroit's Eastern Market and three plants in Ohio. In southern Michigan the Coldwater plant mentioned previously, was closed for several years between 1980 and 1984 but recently changed hands and reopened in January 1984.

The potential slaughter volumes for the two new plants -- the Adrian and Flint locations -- are based only on the supply of fed cattle, ie. steers and heifers. The recent expansion into steer and heifer slaughtering by the Murco plant at Plainwell suggests that they hope to achieve some economies of size by operating two shifts, slaughtering steers and heifers on one and cows on the other. The Murco management also could gain some flexibility in their cattle buying practices by operating dual shifts. By slaughtering both fed cattle and cows they can avoid some of the short term rigidities associated with a single 'type' plant trying to slaughter between 95 and 100 percent of its capacity at all times. There are three plants

in Michigan which currently slaughter over 10,000 head of cows annually -- Murco, Allendale Beef and Top Line Packing at Grand Rapids. Murco has the largest established cow slaughtering operation in the Eastern Corn Belt region. There are also other plants in the region which slaughter cows. No consideration has been given, therefore, to the possibility that either the Adrian or Flint plant would slaughter cows in addition to steers and heifers.

It is important to consider also that these calculations are based on data collected in 1978. The number of fed cattle in the region has declined since then, from an estimated 1.29 million head to about 780,000 head of fed cattle marketed in the three state region (U.S. Department of Agriculture, Statistical Reporting Service) (see Figure 3.3, p.34), and is anticipated to decline further (see Table 4.5, p.62). Even with favorable changes in trends it is unlikely that more than about 900,000 fed cattle will be marketed annually from the three states for the remainder of the 1980s. This means that for any of these plants to achieve the slaughter capacities specified here they may have to acquire a greater percentage of the available cattle in each supply area and/or extend their buying activities further afield. The cost implications of drawing more cattle from greater distances are shown in the next section.

Live Cattle Assembly Costs

Transportation costs are an important factor to be taken into account in making plant size and location decisions. As noted in chapter one, when the cattle population is sparse assembly costs for live cattle may limit the size of the plant. The costs of shipping meat and meat products can also influence plant location decisions but detailed coverage of this aspect of costs is beyond the scope of this thesis (see Huie, 1970).

Live cattle transportation rates vary quite markedly even within Michigan, depending on the size of the truck, the total distance animals are carried and, possibly, by the volume of business transactions between shipper and client. For the two types of vehicles most commonly used for hauling cattle over longer distances (over 50 miles) shipping costs in 1983 were roughly estimated at 3.8 cents for "pots" and 5.2 cents for "straights" on a per head per mile basis[2]. For short hauls (up to 100 miles) or for small numbers of cattle alternatives include fifth-wheel trailers which can carry eight to ten head and which charge between $8 and $10 per head. Using the shipping rates for "pots" the average per head transportation costs for animals within each of the supply areas can be estimated (Table 5.7).

TABLE 5.7
MINIMUM AVERAGE TRANSPORTATION COSTS FOR SHIPPING CATTLE FROM FOUR SUPPLY AREAS (PRIMARY, SECONDARY, TERTIARY AND QUATERNARY).

Supply Area:	Estimates of Per Head Transportation Costs
Primary	D(a) = 33.33 miles @ $0.038 per head per mile, transport cost $1.27 per head
Secondary	D = 66.67 miles @ $0.038 per head per mile, transport cost $2.53 per head
Tertiary(b)	D = 166.67 miles @ $0.038per head per mile, transport cost $6.33 per head
Quaternary(c)	D = 266.67 miles @ $0.038per head per mile, transport cost $10.13 per head

a. D = 2/3(wr) where: r is the radius of the supply area and w is a factor for converting air distances to road distances (French, 1960), here w is assumed to be 1. Therefore, D represents the average distance any animal in the supply area is shipped, and $0.038 is the per head per mile shipping rate for "pots".
b. r = 250 miles is an approximation since the tertiary supply area does not have a constant radius for the three Michigan based plants.
c. Quaternary supply area; r = 400 miles, for the Joslin plant only.

Transportation costs will have a significant bearing on the location and size of a new plant in Michigan. Table 5.8 shows some annual transportation costs for the Plainwell plant. Similar tables for the other plants are in Appendix I. The costs were calculated assuming all animals travel the average distance within each supply area (ie. "D" from Table 5.7) and that transportation was in "pots", with an average per head per mile shipping rate of $0.038. The tables show how transport costs can escalate as the plants have to draw more of their annual slaughter volume from more distant supply areas.

TABLE 5.8
ESTIMATED TRANSPORTATION COSTS FOR ASSEMBLING CATTLE AT THE MURCO PLANT AT PLAINWELL (PLANT CAPACITY: 156,000 HEAD OF FED CATTLE ANNUALLY)

Supply Area:	Primary	Secondary	Tertiary(a)	Transportation Costs($) Total Per Year	Per Head
Total Number of Fed Cattle Available:	70,863	235,757	980,367		
Percent of Plant Capacity Drawn From Area	25.0	70.0	5.0		
Thousand Head	39.0	109.2	7.8		
	(55.0)[b]	(46.3)	(0.8)		
Transport Cost($)[c]	49,530	276,276	49,374	375,180	2.40
Percent ofPlant Capacity Drawn From Area	30.0	60.0	10.0		
Thousand Head	46.8	93.6	15.6		
	(66.0)	(39.7)	(1.6)		
Transport Cost($)	59,436	236,808	98,748	394,992	2.53
Percent of Plant Capacity Drawn From Area	25.0	50.0	25.0		
Thousand Head	39.0	78.0	39.0		
	(55.0)	(33.1)	(4.0)		
Transport Cost($)	49,530	197,340	246,870	493,740	3.16
Percent of Plant Capacity Drawn From Area	30.0	40.0	30.0		
Thousand Head	46.8	62.4	46.8		
	(66.0)	(26.5)	(4.8)		
Transport Cost($)	59,436	157,872	296,244	513,552	3.29

a. Since the tertiary supply area does not have a constant radius 250 miles is an approximation.
b. Numbers in parentheses are the percentage of the total number of fed cattle available in each supply area.
c. Total transportation cost calculated using average transportation rate per head for cattle from each of the supply areas (Table 5.7) times the number of head acquired from each supply area.

Summary and Conclusions

The three plant locations used for the analyses in this chapter do not necessarily represent the "best" configuration for slaughtering facilities in Michigan or the three state area. Adrian and Flint represent potentially suitable plant locations and sizes which could be considered if increased slaughtering capacity is deemed necessary in Michigan or in the Michigan-Ohio-Indiana area. Adrian and Flint were used as examples for the analyses because in 1982-1983 they were in areas where there were larger populations of fed cattle than there was local slaughtering capacity. Since that time there have been some changes in the cattle slaughtering industry in Michigan. Murco, despite some transitional difficulties, appear to be committed to continuing with their planned entry into steer and heifer slaughtering. Top Line's initiatives in steer and heifer slaughtering will further increase the competition for slaughter cattle in southern Michigan and expand the outlets for cattle feeders in the three state area. If both these firms slaughter in excess of 100,000 fed cattle per year it is unlikely that there would be need for a large plant at Adrian.

The conclusion drawn from this study is that would be uneconomic to initiate investment in a <u>new</u> slaughter plant in Michigan at this time. Murco and Top Line have some significant advantages over a new firm trying to enter the cattle slaughtering industry in Michigan. By using their own, or purchasing idle, slaughtering facilities they avoid the substantial cost of building a new plant. Since both firms have been operating in Michigan for a number of years they have

contacts within the cattle feeding industry and established outlets for their products. A new firm may have to sustain very low or negative returns in their first years of operation, after having made very large investments in a plant and equipment. It is, therefore, probably more important to support the existing plants than to try to attract investors to build plants in Michigan. Only if Murco and Top Line fail to achieve their goals should a new plant be seriously considered.

FOOTNOTES

1. Top Line Beef Company, a meat packing firm from Grand Rapids, Michigan, purchased and reopened the plant in Coldwater in January 1984. The plant had been closed for several years and there were rumors that all the equipment had been removed and that the Coldwater City Council was opposed to the plant being reopened because of waste disposal problems. The rumors proved to be only partly true; much of the equipment was in the plant and Top Line reached some agreement with the Coldwater Council regarding waste disposal.

Top Line operates a cow slaughtering and processing plant in Grand Rapids, producing and selling boneless beef in bulk. In mid 1983 they purchased a large warehouse in Grand Rapids, and moved their processing facilities there, at the same time expanding their processing to include steer and heifer carcasses purchased from other slaughterers (Riley, Allen and Jackson, 1984).

Their purchase of the Coldwater plant gives them steer and heifer slaughtering capacity. They will continue to process all carcasses at the Grand Rapids warehouse in the near future but long-term plans include building steer and heifer processing facilities in Coldwater (Information obtained from The Coldwater Daily Reporter, January 1984 and personal contact with Top Line personnel).

2. "Pots" are double-decker trailers which have a capacity of 50,000 pounds, about 45 head. "Straights" are single level trucks with a capacity of 32,000 pounds, about 29 head. The current average rates in Michigan for "pots" are about $1.75 per loaded mile and for "straights" about $1.50 per loaded mile, assuming that each operates at full capacity. The rates per head are calculated using an 1,100 pound animal.

VI. SOME INSTITUTIONAL AND ORGANIZATIONAL CONSIDERATIONS

As the beef subsector continues to evolve, so the opportunities and problems confronting the participants change. In chapter two some of the key trends evident in the subsector were outlined. So far this thesis has concentrated on the physical aspects of the beef subsector in the Eastern Corn Belt. To lend a more rounded perspective to the study this chapter addresses some of the institutional and organizational opportunities, challenges and constraints facing the cattle feeding and slaughtering industries in the region. To address them all is far beyond the scope of this study; the areas which are covered are believed by this author to be of particular relevance to the cattle industries in Michigan, Ohio and Indiana, in the context of the potential for expanding cattle slaughtering facilities. The areas examined are the avenues for marketing fed cattle and the directions for research, extension and product promotion in the beef subsector.

Marketing Channels for Slaughter Steers and Heifers

There are a number of ways by which the producing and slaughtering activities in the beef subsector can be coordinated. They include public auctions, terminal markets and privately negotiated arrangements between cattle feeders and packers (or agents for either party). The purpose of this section is to outline the characteristics of various marketing channels, to emphasize some of

the costs and benefits associated with each for each of the major parties involved and to indicate the relative importance of the different channels in the Eastern Corn Belt states.

Terminal markets are central livestock handling facilities, especially those at transportation terminals. Cattle for sale are assembled at the market by the seller and the sale is negotiated by a firm which then receives a commission (Nelson, 1984). The use of terminal markets for the exchange of slaughter cattle has declined since the mid 1920s. In 1923 almost 90 percent of all cattle purchased by packers were purchased through terminal markets, by 1977 the percent share of slaughter cattle sales through terminal markets had declined to 12 percent (U.S. Department of Agriculture, Agricultural Marketing Service, Packers and Stockyards Program, 1979) and by 1984 less than ten percent of the slaughter cattle in the U.S were sold through terminal markets (Nelson, 1984). Auction markets also provide physical handling facilities for livestock. At auctions sales prices are established by public bidding. Bids tend to be made on the basis of visual inspection of animals and bits of information collected prior to and during the sale. The exchange price at auctions is public knowledge. Price reports from terminal markets are based on a representative sample of traders. Prices reported from public markets (terminal and auction markets) tend to be comparable because the costs, services and terms of trade are standardized and widely understood (Petritz, Erickson and Armstrong, 1982). As a result public markets have long been regarded as primary sources of price information (Schneider and Leuthold, 1979).

Direct marketing covers a variety of exchange arrangements of varying complexity. The simplest arrangement is direct selling wherein the sale is negotiated between the cattle feeder and the packer almost immediately prior to the actual cattle shipment. Others include sales to dealers and agents of various kinds; agents for sellers include country commission firms and bargaining associations while order buyers act as agents for buyers (Nelson, 1984). Sales also may be contracted some time in advance of shipment and possibly extend over several months. Even closer coordination between feeding and slaughtering may be achieved by joint ventures between feeders and packers, cooperative slaughtering ventures undertaken by cattle feeders and packer feeding of cattle for slaughter.

Direct marketing has become the dominant method of selling slaughter cattle in the U.S. as a whole, particularly for steers and heifers. In 1978, 73 percent of all slaughter cattle sold moved through direct marketing channels (U.S. Department of Agriculture, Packers and Stockyards Administration, 1967 and 1979). In 1980 direct marketing accounted for 87 percent of the steer and heifer sales to packers, but for slaughter cows and bulls 52 percent moved through auction markets (Nelson, 1984). Direct marketing arrangements are distinguished by a privately negotiated price and the movement of cattle from feedlot to slaughtering plant after the terms of sale have been finalized. The exchange price of a lot of cattle may never become public knowledge.

The major distinction between the marketing channels is in the terms of trade and the services associated with each method. Petritz et al note that there are variations both between and within methods of selling (Petritz, Erickson and Armstrong, 1982). The common variations which they list are individual animal sales versus sales of lots; time, method and place of weighing; time of payment for live cattle; and carcass weight versus carcass grade and weight methods. It is important for buyers and sellers of cattle to understand the differences between selling methods as increasing numbers of cattle are sold through non-public channels. Petritz, Erickson and Armstrong (1982) suggest that the terms of trade may be as important in determining the net returns from a transaction as is the quoted price. In addition to the sale price in direct sales, information passed between buyer and seller may also be kept private. Such information may pertain to the history and condition of the cattle, the feeding regime and other treatments the cattle have received and the conditions of the sale (Ward, 1977). As more cattle are sold through direct channels, such information on which other participants may base their negotiating position becomes less available. Public sales of cattle then become "thin markets".

The services associated with the various methods of marketing, particularly with auctions and terminal markets, influence their use by different parties. Both auction and terminal markets provide facilities for assembling and sorting livestock which originate from several sources. Cattle are sorted into homogeneous groups on the basis of sex, age, weight and/or other distinguishing criteria. When cattle are marketed at auctions or terminal markets the timing of the

sale of a group of animals is determined by the producer. This gives the producer more flexibility in production timing decisions. Once the cattle are transported to the auction yards or terminal market facilities, however, the producer is obliged to accept the best offer or to take the cattle back to the lot. The latter alternative often may be infeasible.

There are benefits in direct selling for both cattle producers and packers. Producers gain a stronger bargaining position since the sale is consummated before the cattle leave the feedlot. Packers gain some control over the timing of the sale which enables them to schedule slaughtering with greater certainty. Cattle need be transported only once so tissue shrinkage and the possibility of injury are reduced. There are no yardage fees since cattle do not need to be housed in public stockyards. Depending on the particular arrangement, sales commissions may be smaller or nonexistent (if an agent is employed to arrange the sale there will be some fee assessed). With direct marketing it is more likely that a trust relationship will develop between the buyer (packer or agent) and the seller (producer or agent) as the number of successful exchanges increases. This is important because trust reduces the transaction costs of future exchanges. Direct sales, on a regular basis, between a packer and a cattle feeder, may be particularly attractive to packers who have contracts for their products and require cattle of a relatively consistent quality.

Direct marketing arrangements are more likely to be undertaken by larger, commercial cattle feeders than by farmer feeders. Commercial lots have large groups of animals rotating through the lot on a continual basis. They are more likely to be able to assemble a truckload of similar cattle (in terms of weight, age and quality) than are farmer feedlots (Petritz, Erickson and Armstrong, 1982). The smaller feedlots usually market most of their cattle at one time or in small lots and are more likely to sell them through an auction or terminal market. Another reason is the difference (actual or perceived) in access to price information. When sales are direct prices are negotiated privately between the buyer and the seller. Each draws on outside information and knowledge of current market situations to form their bargaining position. In a public auction sale prices presumably are set by competitive forces -- by buyers bidding against each other. As Ward notes, however, when there are only a few buyers at an auction it is not clear that the prices set there are any more competitively set than are privately negotiated prices (Ward, 1977). Packers and commercial feedlot operators are involved in cattle exchanges on a regular basis thus they negotiate prices from positions of approximately equal strength. Farmer feedlot operators buy and sell cattle infrequently. They may or may not follow cattle price movements on a regular basis. In a bargaining situation they often may feel that the packer has access to more

information and hence the upper hand (Petritz, Erickson and Armstrong, 1982). This, understandably, makes them reticent to deal directly with packers and they prefer to take their chances at auction or terminal markets or to rely on a commission agent to arrange the transaction.

The relative importance of auctions, terminal markets and direct marketing channels varies between regions in the U.S., reflecting differences in the systems of cattle production (Table 6.1). Schneider and Leuthold suggest that the increased use of direct marketing since the 1960s has been due to changes in size and location of slaughtering plants and feedlots, improved communication and transport facilities and the relative marketing costs incurred by the different outlets (Schneider and Leuthold, 1979).

The structure of the cattle feeding industry in each of the four Eastern Corn Belt states is reflected by the relative use of each of the marketing channels (Table 6.2). Illinois has the largest number of cattle on feed and commercial feedlots and a considerably greater proportion of the fed cattle marketed go through direct channels than is the case in the other three states. In Michigan only a small proportion (13.8 percent in 1978) of the fed cattle are marketed directly. Auction markets are the dominant marketing channel, reflecting the large number of farmer feedlots and probably the strength of the cooperative, Michigan Livestock Exchange, which operates auction sales. Also, packers buying slaughter cattle in Michigan may prefer to purchase cattle through auctions because the auctions provide a sorting service. Michigan cattle feeders, especially those with larger lots, tend to feed diverse groups of

TABLE 6.1
STEERS AND HEIFERS PURCHASED BY PACKERS THROUGH DIFFERENT MARKET OUTLETS, NUMBER AND PERCENT, U.S. BY REGIONS, 1978

Summary: Direct marketing channels account for most steer and heifer purchases by packers for the U.S. as a whole but there was a difference between regions in 1978.

Region[c]	Direct, Country Dealers, etc.[a] Number (1000 Head)	Direct, Country Dealers, etc.[b] Percent	Terminal Markets Number (1000 Head)	Terminal Markets Percent	Auction Markets Number (1000 Head)	Auction Markets Percent	Total Number (1000 Head)
North Atlantic	161	30.4	271	51.2	97	18.3	529
E-N Central	1,300	45.7	808	28.4	736	25.9	2,844
W-N Central	10,632	85.0	1,603	12.8	268	2.1	12,503
South Atlantic	250	54.2	27	5.9	184	39.9	461
South Central	386	70.4	62	11.3	100	18.2	548
Southern Plains	5,018	95.1	31	0.6	229	4.3	5,278
Mountain	3,750	96.1	4	0.1	149	3.8	3,903
Pacific	2,173	97.7	0	0.0	52	2.3	2,225
Alaska & Hawaii	39	100.0	0	0.0	0	0.0	39
United States	23,709	83.7	2,806	9.9	1,815	6.4	28,330

a. Totals do not add in some cases due to rounding.
b. Percentages calculated from unrounded numbers.
c. Regions are as follows:- North Atlantic: ME,NH,MA,VT,RI,CT,NY, NJ,PA; East North Central:OH,IN,IL,MI,WI; South Atlantic:DE,MD,VA, WV,NC,SC,GA,FL; South Central:KY,TN,AL,MS,AR,LA; Southern Plains:OK, TX; Mountain:MT,ID,WY,CO,NM,AZ,UT,NV; Pacific:WA,OR,CA.

SOURCE: U.S. Department of Agriculture, Packers and Stockyards Administration, 1979

TABLE 6.2
STEERS AND HEIFERS PURCHASED BY PACKERS THROUGH DIFFERENT MARKET OUTLETS, NUMBER AND PERCENT, EASTERN CORN BELT STATES, 1978

Summary: Direct marketing accounted for almost one half of the steer and heifer purchases by packers in the region as a whole in 1978, but in Michigan fewer than one fifth of the steers and heifers purchased by packers moved through direct channels.

State	Direct, Country Dealers, etc.[a]		Terminal Markets		Auction Markets		Total
	Number (1000 Head)	Percent[b]	Number (1000 Head)	Percent	Number (1000 Head)	Percent	Number (1000 Head)
Michigan	35	13.8	64	25.2	155	61.0	254
Ohio	273	42.3	137	21.2	235	36.4	645
Indiana	117	40.1	138	47.3	37	12.7	292
Illinois	594	53.0	335	29.2	192	17.1	1,121
Region	1,019	44.1	674	29.1	619	26.8	2,312

a. Totals do not add in some cases due to rounding.
b. Percentages calculated from unrounded numbers.

SOURCE: U.S. Department of Agriculture, Packers and Stockyards Administration, 1979

cattle, in terms of type, weight and age (John Waller, personal communication). As a result, packers may be less interested in direct purchases of cattle from feedlots because of the difficulty of assembling a homogeneous truckload of cattle from a single feedlot.

The large financial investments required for cattle slaughtering plants and the high volume-low margin nature of the industry necessitate high levels of plant utilization. In addition, labor contracts frequently guarantee plant workers a minimum number of hours per week, whether or not cattle are slaughtered. Packers are interested, therefore, in maintaining a steady flow of cattle through the plant. They also are interested in turning out beef products of consistent quality.

The use of the different marketing channels has implications for this study. The heavy reliance on auction markets for moving cattle suggests that should a large slaughter plant locate in Michigan, it could have difficulty in obtaining a steady supply of slaughter cattle of consistent quality. Large fluctuations in the supply of slaughter cattle or variations in the type of cattle purchased could impede the ability of a large plant to maintain slaughtering levels at near full capacity. In this respect Murco may have an advantage in slaughtering both fed cattle and cows, as it allows them greater flexibility in the scheduling of slaughtering and in their slaughter cattle purchases.

The reliance on auction markets by Michigan cattle feeders should not be viewed as a permanent constraint to the possibility of expanded slaughtering facilities in the state. There are some indications that direct sales are increasing among cattle feeders in Michigan (Bim Franklin, personal communication) and this may continue if Michigan Livestock Exchange expands its role as an agent for private negotiations between producers and packers. It is important to note,

however, that the use of different marketing channels is another factor to be considered when making slaughter plant size and location decisions.

Future Directions for Research and Extension

The future of the cattle feeding and slaughtering industries in Michigan will be influenced by the adjustments made by cattle feeders and packers in response to recent changes in the subsector. As participants in the national industries, Michigan packers and feedlot operators will be influenced by the major trends in the subsector. these include the trends toward larger firms, greater economic concentration in both cattle feeding and steer and heifer slaughtering and closer coordination between cattle production and slaughter. Other trends also are likely to have an impact on the cattle feeding and slaughtering industries. Of particular importance is the overall softening of consumer demand for beef and shifts in consumer preference towards leaner beef and more economic and convenient beef products (National Cattlemen's Association, 1982). Increasing energy prices are expected to have far reaching impacts throughout the subsector; not only will transportation costs increase but the cost of producing dry grains will also increase, which may change the competitive positition of today's large cattle feeders in the central states.

Linear projections of recent trends indicate declines in cattle feeding and slaughtering in Michigan, both in absolute terms and in their share of the national industries. If this decline in Michigan's competitive position in cattle and beef production is to be slowed or

reversed it is likely that research and extension efforts will need to continue to address the problems faced by Michigan cattle feeders and packers. For cattle feeders this may mean aligning their production to meet market demand in terms of product characteristics and the timing of production. For packers it means trying to realize some economies of size in their slaughtering and processing operations in an environment characterized by small feedlots and seasonal fluctuations in marketing.

It is anticipated that future research and extension efforts would focus on alternative production regimes which could enable cattle feeders to lessen the seasonal fluctuations in their fed cattle marketings and possibly to finish cattle on forages as well as concentrates to produce a leaner but high yielding carcass. The feeding of dairy calves to produce lean carcasses may also warrant research and extension efforts.

Improved coordination of cattle feeding and slaughtering could reduce risks for cattle feeders and packers. A joint effort, between cattle feeders, packers, research and extension personnel and other participants involved in the beef subsector, such as Michigan Livestock Exchange and Michigan Cattlemen's Association, is needed to identify and promote marketing methods which more closely align producing and slaughtering activities. At present Michigan Livestock Exchange does perform some coordinating functions, both through auctions, which are held regularly, and by acting as an agent for direct sales. A slaughtering firm from Pennsylvania has used custom feeding contracts with cattle feeders in Michigan and elsewhere to ensure a steady supply of slaughter cattle (John Waller, personal

communication). The advantages and disadvantages, for both packers and cattle feeders, of direct marketing arrangements such as direct selling, selling through agents, contracting or joint ventures between cattle feeders and packers need to be explored. Marketing methods such as these may be important to the future of Michigan's beef industries.

The summary results of a 1982 survey of Michigan cattle feeders showed that the marketing of slaughter cattle, particularly forward pricing of slaughter cattle, is an area in which more research, extension and information provision was needed (Jim Robb, unpublished survey report[1]). Since Michigan cattle feeders predominantly market their slaughter cattle through auctions, this raises a question which could be addressed by future research: is the reliance on auction markets by Michigan cattle feeders a result of their methods of production, a tribute to Michigan Livestock Exchange's organizational ability and loyalty to them on the part of cattle feeders, cattle producers' basic distrust of packers, the packers' lack of interest in direct purchases from Michigan cattle feeders or a combination of all of these and some other factors?

Petritz et al suggest some adjustments which may be necessary in the cattle and beef marketing system (Petritz, Erickson and Armstrong, 1982). Important among the adjustments is the provision of market information to all participants. Others include methods for carcass identification and evaluation and some means by which sellers can identify and assess the value of their own products. These adjustments are applicable to the Michigan situation if the beef subsector is to avoid declining to the status of a few vestigial

industries. Among the questions in these areas which arise from this study would be the question of what influences packer demand for particular cattle and for what characteristics (both physical and organizational) are they prepared to pay a premium? A similar question could be asked of consumer demand for beef. Finding answers to these questions could influence significantly the future of the cattle feeding and slaughtering industries in Michigan.

FOOTNOTE

1. Jim Robb, Ph.D. candidate in Agricultural Economics, Michigan State University, unpublished results of survey conducted as part of his dissertation research.

VII. SUMMARY AND CONCLUSIONS

The trends and changes in the national beef subsector since the middle of the 19th century lead one to conclude that only change is certain and that the cattle industries will continue to evolve and adapt to changing supply and demand conditions in the future as they have in the past. The subsector in the Eastern Corn Belt has tended to respond to changes in the economic environment in a similar manner as has the national subsector. Continuing evolution and occasional non-evolutionary fluctuations make long term predictions and enduring conclusions difficult. Nevertheless, the following summary and conclusions about the U.S. beef subsector in general and in particular the opportunities for investment in new plants or expansion of existing Michigan firms in the mid 1980s can be made:

- In the first half of the 20th century meat packing was characterized by a high level of firm concentration. The entry of "new breed" packers, in the early 1960s, who operated large, efficient single species slaughtering plants, the trend towards industry decentralization and the changes in transportation and information technologies resulted in a decrease in the industry concentration and the market power of the large "old line" packers.

- The advent of "on-line" slaughtering which obviated the need for a workforce of skilled butchers, the development of boxed beef and changes in federal inspection regulations increased the minimum efficient size of cattle slaughtering and processing plants. The trend towards decreased concentration reversed in the early 1970s. There were, however, a new group of firms who held the major share of the market.

- Size economies for modern specialized steer and heifer slaughtering plants may extend up to annual slaughtering capacities of 500,000 head in areas where the density of cattle feeding activity is high. When the costs of assembling live cattle and of distributing the end products are included, the minimum efficient size of a slaughtering plant may decrease. This is the case where the density of cattle feeding is low and plants must procure cattle from extended supply areas.

- The total cattle population, the rate of turnover from feedlots and the geographic distribution of slaughter cattle in the Eastern Corn Belt states limit the opportunities for a very large specialized steer and heifer slaughtering plant in the region. The only plant in the four state area which slaughters in excess of 250,000 steers and heifers per year currently is the IBP Inc. plant in western Illinois. It is located in the densest cattle feeding area in the four states and is also able to draw cattle from outside the Eastern Corn Belt states. Because of the IBP plant and other large steer and heifer slaughtering plants in the state, most of the Illinois fed cattle population is considered to be unavailable for slaughter in plants in Michigan, Ohio and Indiana.

- In recent years there has been a net movement of slaughter cattle into Michigan and the three state region of Michgan, Ohio and Indiana. There were 197,000 fed cattle marketed in Michigan and 780,000 head in the three states in 1981. The number of cows available for slaughter, estimated by applying cull rates of 0.2 for beef herds and 0.25 for dairy herds to the January 1 inventories, was 125,500 cows in Michigan and a total of 444,600 in Michigan, Ohio and Indiana combined. The number of non-fed cattle marketed for commercial slaughter is not reported but it is estimated to be negligible compared to the numbers of fed cattle and cows. There were 502,900 cattle slaughtered commercially in 1981 in Michigan and 1,444,800 in the three states.

- Although Michigan is a net importer of slaughter cattle, in the late 1970s and early 1980s many slaughter cattle from Michigan have been sold to plants in Ohio, Pennsylvania and Ontario. Canadian packers have purchased cattle from Michigan feedlots as a residual source. They buy cattle most actively from Michigan during the autumn and winter. The total volume purchased annually has fluctuated markedly in the past several years making it difficult to project future demand from Canadian buyers.

- Linear projections of the number of fed cattle marketed and cow inventories both in the Eastern Corn Belt and the three state region indicate a substantial decline in the volume of slaughter cattle available by the end of this decade. These simple trend projections indicate that 523,000 fed cattle would be marketed in Michigan, Ohio and Indiana in 1981. There are, however, some qualitative consideration which suggest that the decline may not be as severe as indicated. These include increasing real prices for energy which raises transportation costs and the cost of irrigating and drying grains, changing consumer tastes -- particularly the increasing preference for lean beef --, equalization of wage rates in the "Sun Belt" with those in the northern states and increased scrutiny of meat packing firms for violations of anti-trust regulations.

- At the present time further investment in new slaughtering facilities in Michigan is probably not required. Recent initiatives by two Michigan cow slaughtering firms (Murco at Plainwell and the purchase of facilities at Coldwater by Top Line) in expanding their operations to include slaughtering of fed cattle will provide extra steer and heifer slaughtering capacity in Michigan. This, combined with existing steer and heifer slaughter plants, should be sufficient to handle projected cattle production in Michigan throughout the 1980s.

- The initial investment required to purchase land and build a new, efficient sized slaughtering and processing plant is estimated to be between $15 and $20 million. A new plant would also have to compete with existing firms for available cattle supplies and for market outlets for their product. It has been suggested that in the Eastern Corn Belt this could include aggressive competition from IBP for both slaughter cattle and beef distribution outlets. Considerable capital reserves would be necessary to withstand such competition. One advantage which Murco and Top Line have over a new entrant in steer and heifer slaughtering in Michigan is that they have (or purchased existing) slaughtering facilities, some processing facilities and product outlets.

- Should either the Murco plant at Plainwell or Top Line's Coldwater plant fail to achieve their goal for steer and heifer slaughtering, and depending on the reason for the failure, investment in a new slaughtering plant in Michigan could become feasible. The proposed Michigan locations with the greatest potential for acquiring slaughter cattle are in the south and central counties and in the Thumb area. The

specific locations considered in this study were Adrian in Lenawee County and Flint in Genessee County. For the Adrian location it was suggested that a plant slaughtering between 150,000 and 250,000 head of fed cattle annually could capture many of the in-plant size economies. The overall economic viability of the plant would depend largely on the percent of the available cattle it could acquire from within its primary and secondary supply areas.

- One alternative to new investment in a large modern slaughtering and processing plant would be investment in a smaller, more specialized plant which could serve a segment of the market not now adequately served by the larger plants. Flint was considered as a possible location for a smaller plant, one with an annual slaughtering capacity between 50,000 and 60,000 steers and heifers. The smaller plant size would probably raise in-plant costs, but it is possible that these could be partially offset if the plant acquired most of its cattle from within its primary and secondary supply areas. Even allowing for a 30 percent decline in the number of fed cattle marketed since 1978 this would mean acquiring about 50 percent of the fed cattle available in the primary supply area and about 30 percent in the secondary area.

- The Murco plant has greater flexibility in its cattle purchases and slaughtering schedule because they slaughter steers and heifers as well as cows. By operating two shifts they could make greater use of the plant facilities but it should be recognized that there are technical problems associated with slaughtering steers and heifers in a plant designed for cow slaughter. Such a combined slaughtering operation was not considered for either the Adrian or Flint locations because there is sufficient cow slaughtering capacity in Michigan.

- In addition to the total supply and geographic distribution of slaughter cattle and the extent of competition from existing plants, the method of selling slaughter cattle could be of significance in size and location decisions for those interested in investing in new slaughter plant facilities. The importance of maintaining a steady supply of slaughter cattle of relatively consistent quality means that direct marketing channels -- direct purchases, purchases through an agent, contracted sales or vertical integration -- can significantly lower the uncertainty facing packers. In an industry so dependent upon high volume, a steady flow of cattle and high levels of plant utilization to maintain profit levels, decreased uncertainty in purchasing activities could be quite valuable.

The goal of this study was to assess the economic feasibility of new investment in beef slaughtering and processing in Michigan by comparing current and projected supplies of slaughter cattle with the existing slaughtering capacity, and already-planned expansion, in Michigan and the Eastern Corn Belt. Analysis of the feasibility of new investment in plants outside Michigan was beyond the scope and mandate of the study. Projections of the supplies of slaughter cattle in the region and the long-term outlook for the U.S. beef subsector in general do not favor investment in new slaughtering and processing facilities at the present time, but expansion of existing plants and renovation and use of previously idle plants may prove to be economically feasible.

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APPENDIX

ESTIMATED TRANSPORTATION COSTS FOR ASSEMBLING CATTLE AT THE ADRIAN AND FLINT, MICHIGAN, LOCATIONS AND FOR THE IBP PLANT AT JOSLIN, ILLINOIS

TABLE A-1

A NEW PLANT AT ADRIAN (150,000 STEERS AND HEIFERS ANNUALLY)

Supply Area:	Primary	Secondary	Tertiary(a)	Transportation Costs($) Total Per Year	Per Head
Total Number of Fed Cattle Available:	128,737	250,168	908,082		
Percent of Plant Capacity Drawn From Area	60	30	10		
Thousand Head	90,000	45,000	15,000		
Transport Cost($)[b]	114,300	113,850	94,950	323,100	2.15
Percent ofPlant Capacity Drawn From Area	50	40	10		
Thousand Head	75,000	60,000	15,000		
Transport Cost($)	95,250	151,800	94,950	342,000	2.28
Percent of Plant Capacity Drawn From Area	40	40	20		
Thousand Head	60,000	60,000	30,000		
Transport Cost($)	76,200	151,800	189,900	417,900	2.79
Percent of Plant Capacity Drawn From Area	30	40	30		
Thousand Head	45,000	60,000	45,000		
Transport Cost($)	57,150	151,800	284,850	493,800	3.29

a. 250 miles is an approximation since the tertiary supply area does not have a standard radius.
b. Total transportation cost calculated using average rate per head for cattle from each of the supply areas (Table 5.7) times the number of head acquired from each supply area.

DATA SOURCE: U.S. Census of Agriculture, 1978

TABLE A-2

NEW PLANT AT ADRIAN (250,000 STEERS AND HEIFERS ANNUALLY)

Supply Area:	Primary	Secondary	Tertiary(a)	Transportation Costs($) Total Per Year	Per Head
Total Number of Fed Cattle Available:	128,737	250,168	908,082		
Percent of Plant Capacity Drawn From Area	35	50	15		
Thousand Head	87,500	125,000	37,500		
Transport Cost($)[b]	111,125	316,250	237,375	664,750	2.66
Percent ofPlant Capacity Drawn From Area	25	50	25		
Thousand Head	62,500	125,000	62,500		
Transport Cost($)	79,375	316,250	395,625	791,250	3.16
Percent of Plant Capacity Drawn From Area	30	40	30		
Thousand Head	75,000	100,000	75,000		
Transport Cost($)	95,250	253,000	474,750	823,000	3.29
Percent of Plant Capacity Drawn From Area	20	40	40		
Thousand Head	50,000	100,000	100,000		
Transport Cost($)	63,500	253,000	633,000	949,500	3.80

a. 250 miles is an approximation since the tertiary supply area does not have a standard radius.
b. Total transportation cost calculated using average rate per head for cattle from each of the supply areas (Table 5.7) times the number of head acquired from each supply area.

DATA SOURCE: U.S. Census of Agriculture, 1978

TABLE A-3

NEW PLANT AT FLINT (50,000 STEERS AND HEIFERS ANNUALLY)

Supply Area:	Primary	Secondary	Tertiary(a)	Transportation Costs($) Total Per Year	Per Head
Total Number of Fed Cattle Available:	71,090	179,287	1,036,610		
Percent of Plant Capacity Drawn From Area	80	10	10		
Thousand Head	40,000	5,000	5,000		
Transport Cost($)[b]	50,800	12,650	31,650	95,100	1.90
Percent ofPlant Capacity Drawn From Area	70	20	10		
Thousand Head	35,000	10,000	5,000		
Transport Cost($)	44,450	25,300	31,650	101,400	2.03
Percent of Plant Capacity Drawn From Area	60	30	10		
Thousand Head	30,000	15,000	5,000		
Transport Cost($)	38,100	37,950	31,650	107,700	2.15
Percent of Plant Capacity Drawn From Area	50	30	20		
Thousand Head	25,000	15,000	10,000		
Transport Cost($)	31,750	37,950	63,300	133,000	2.66

a. 250 miles is an approximation since the tertiary supply area does not have a standard radius.
b. Total transportation cost calculated using average rate per head for cattle from each of the supply areas (Table 5.7) times the number of head acquired from each supply area.

DATA SOURCE: U.S. Census of Agriculture, 1978

TABLE A-4

NEW PLANT AT FLINT (60,000 STEERS AND HEIFERS ANNUALLY)

Supply Area:	Primary	Secondary	Tertiary(a)	Transportation Costs($) Total Per Year	Per Head
Total Number of Fed Cattle Available:	71,090	179,287	1,036,610		
Percent of Plant Capacity Drawn From Area	75	15	10		
Thousand Head	45,000	9,000	6,000		
Transport Cost($)[c]	57,150	22,770	37,980	117,900	1.96
Percent ofPlant Capacity Drawn From Area	60	30	10		
Thousand Head	36,000	18,000	6,000		
Transport Cost($)	45,720	45,540	37,980	129,240	2.15
Percent of Plant Capacity Drawn From Area	50	30	20		
Thousand Head	30,000	18,000	12,000		
Transport Cost($)	38,100	45,540	75,960	159,600	2.66
Percent of Plant Capacity Drawn From Area	40	40	20		
Thousand Head	24,000	24,000	12,000		
Transport Cost($)	30,480	60,720	75,960	167,160	2.79

a. 250 miles is an approximation since the tertiary supply area does not have a standard radius.
b. Total transportation cost calculated using average rate per head for cattle from each of the supply areas (Table 5.7) times the number of head acquired from each supply area.

DATA SOURCE: U.S. Census of Agriculture, 1978

TABLE A-5

IBP PLANT AT JOSLIN (400,000 STEERS AND HEIFERS ANNUALLY)

Supply Area:	Primary	Secondary	Tertiary	Quaternary	Transportation Costs($) Total Per Year	Per Head
Total Number of Fed Cattle Available:	371,223	416,664	734,210	785,725		
Percent of Plant[a] Capacity Drawn From Area	50	30	15	5		
Thousand Head	200,000	120,000	60,000	20,000		
Transport Cost($)[b]	254,000	303,600	379,800	202,600	1,140,000	2.85
Percent ofPlant Capacity Drawn From Area	40	30	20	10		
Thousand Head	160,000	120,000	80,000	40,000		
Transport Cost($)	203,200	303,600	506,400	405,200	1,418,400	3.55
Percent of Plant Capacity Drawn From Area	30	25	30	15		
Thousand Head	120,000	100,000	120,000	60,000		
Transport Cost($)	152,400	253,000	759,600	607,800	1,772,800	4.43
Percent of Plant Capacity Drawn From Area	25	25	25	25		
Thousand Head	100,000	100,000	100,000	100,000		
Transport Cost($)	127,000	253,000	633,000	1,013,000	2,026,000	5.06

a.It is assumed the IBP plant will draw approximately 2/3 of its total annual kill (400,000 steers and heifers) from the Eastern Corn Belt, the remainder coming from states to the west of Illinois. For this analysis plant capacity is therefore considered to be 400,000 steers and heifers annually.

b.Total transportation cost calculated using average rate per head for cattle from each of the supply areas (Table 5.7) times the number of cattle acquired from each supply area.