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AUTHOR Heady, Earl O.; Sonka, Steven T.
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ABSTRACT

The relationship between size of farm and the welfare of farm and nonfarm society was examined in terms of total income in the farm sector, the number and size of farms, income per farm, secondary income generation, and consumer food costs using four alternative farm structures: large farm (gross farm sales of at least $40,000); medium farm (gross farm sales of $10,000-$39,000); small farm (gross farm sales of $2,500-$9,999); and typical farm (reflects the mix of the other three farm sizes in 1980 if recent farm size trends continue). Using a linear programming model, the location and quantity of production of feed grains, wheat, soybeans, and cotton were determined within 150 rural areas for each model alternative. National demands for major livestock products and for industrial and export uses of these crop commodities were estimated for 1980. Outcomes under the differing alternatives were compared nationally and specifically (the North Central Region). Results indicated: a system of all small farms would provide higher prices for farm outputs, higher returns to cropland, a higher total income for the farming sector, and increased economic activity in nonfarm sectors; a system of all large farms would lower consumer food costs, require fewer productive inputs, and allow a higher net income per commercial farm; the typical and medium farm alternatives would serve society similarly. (JC)

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Earl O. Heady and Steven T. Sonka

NORTH CENTRAL REGIONAL CENTER FOR RURAL DEVELOPMENT

Iowa State University
of Science and Technology
107 Curtiss Hall
Ames, Iowa 50010

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By

Earl O. Heady

and

Steven T. Sonka

North Central Regional Center for Rural Development

107 Curtiss Hall

Iowa State University

Ames, Iowa

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This study was made possible because of the existence of a set of RANN-ISU models and can be considered an auxiliary study of RANN Project GI-32990.

PREFACE

The concern over the welfare and social and economic viability of the nation's rural communities stems from two major forces. One of these forces is national economic growth in a country which already is wealthy. Starting from a high level of income, further economic growth especially tends to be in urban and population centers where growing demand for services is concentrated, scale economies and major investment in public facilities prevail, and the scientific and milieu for modern technology and production exists. The second major force is the technological transformation of farms which have greatly reduced labor requirements in the rural sector and injected a further stream of migrants into urban and industrial centers.

Due to evident or proposed diseconomies in physical social services and environmental problems, many urban persons have become interested in the plight of rural communities. Is restoration of the rural community a major means to solve the ills of large cities through dampening the rural-urban population flow? If so, how can it be accomplished: through rural industrialization? through local tax rebates? limits on farm size? by other means?

Residents of rural areas, both those of farms and rural towns are interested in these same phenomena and questions. They have felt a deep impact as employment has declined on both farms and the town and village service establishments which serve them. They have suffered somewhat

as rural community populations have declined and parallel erosion has taken place in recreation, schools, medical services, churches and other social services and institutions of the area.

This study has been made to compare just one major variable with rural welfare. The major variable is farm size. We examine the trade-offs that occur in rural areas and the consumer sector as size of farms relate to rural nonfarm income, farm employment, income per farm, number of farms, total income of the farm industry, consumer food costs and other economic and social variables. The study emphasizes the North Central Region of the U.S. and the varied local areas within this region.

Eldon Erickson contributed greatly to the research and analysis of this report.

The Authors

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

One of the major changes in the structure of American agriculture over the last three decades has been the trend toward larger farming operations. The size of the average farm has grown from 174 acres in 1940 to 389 acres in 1972. And cash receipts per farm grew by more than 1300 percent during this period. This growth in farm size resulted from a greater use of capital and the resulting increase in the productivity of farm labor. Greater capital use was encouraged by its favorable real price relative to labor and the greater availability of funds to purchase labor-replacing inputs. Increased labor productivity allowed the average farm worker to supply farm products to four times as many people in 1971 as in 1940. Therefore, fewer people are required to produce farm output now than in the past.

But the movement of people from rural to urban areas in search of nonfarm employment has not been without negative effects. As the rural population declines and the need for services in rural communities decreases, the value of capital assets in these areas also declines. In addition, the per person cost of many local government services increases as people migrate from rural areas. But only recently have these negative impacts on rural communities and institutions become a national concern. In the past, governmental policies dealing with agriculture primarily were designed to increase the productivity of farm labor and

increase net farm income.

A major farming area experiencing these changes is the North Central region. This region is composed of the 12 states shown in Figure 1, (which also presents its 62 rural areas). (The concept of rural area will be explained in a later section.) The North Central region accounted for 73 percent of the feed grains, 59 percent of the wheat and 65 percent of the soybean acreage harvested in the nation in 1971.

This region is composed of three farm production regions: the Northern Plains, Lake States, and Corn Belt. The Northern Plains region (North Dakota, South Dakota, Nebraska, and Kansas) is noted for wheat production and large cow-calf ranches. In 1971 the 22.9 million acres of wheat grown in this region accounted for 80 percent of the wheat acreage in the North Central region. However, even with this large amount of wheat production, the Northern Plains region is relatively more dependent on livestock production than is the North Central region as a whole with livestock production accounting for 66 percent of the Northern Plains region's total farm receipts in 1971.

Because of its very large dairy industry, the Lake States region (Michigan, Wisconsin, and Minnesota) is relatively more dependent on livestock production than the Northern Plains region. In 1971, 69 percent of the total cash receipts from farming in the Lake States was from this source. But crop production also is important in this region and in 1971, 13 percent of the soybean acreage, 7 percent of the wheat acreage, and 20 percent of the feed grains acreage in the North Central

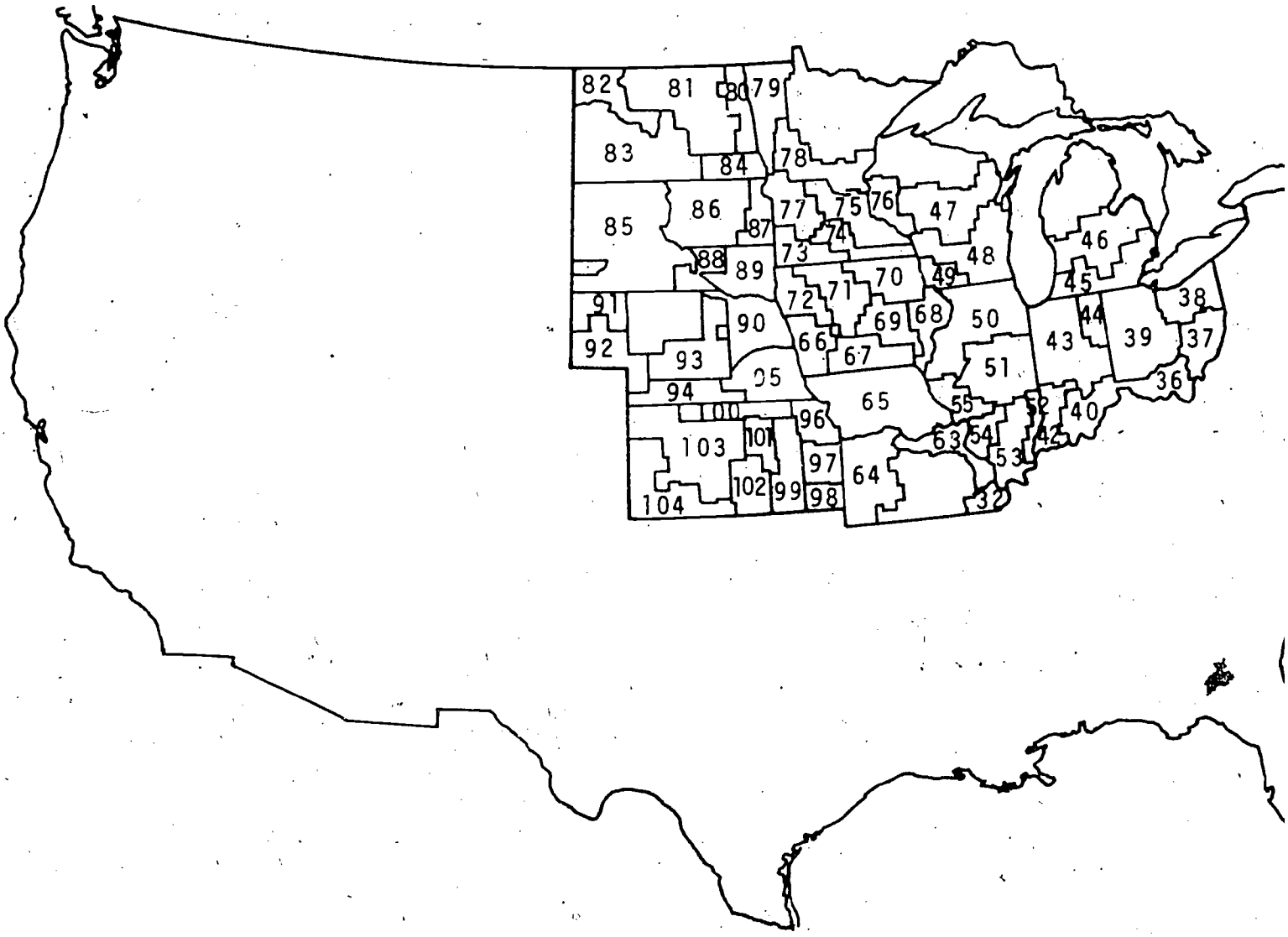


Figure 1. Location of the 62 rural areas within the North Central Region.

region were located here. In 1971 the region's 34.3 million acres of cropland was 11.3 percent of the national cropland acreage.

The Corn Belt region (Ohio, Indiana, Illinois, Iowa, and Missouri) generated 49 percent of the North Central region's total net farm income in 1971. This farm production region depends more on crop production than do the two just discussed. Compared to 38 percent for the entire North Central region, 43 percent of the cash receipts from farming in the Corn Belt region in 1971 was from crops. Although crop production is relatively more important here than in the other two farm production regions, livestock production also dominates the farming industry in the Corn Belt region--largely because of its large swine and fed cattle activities. In 1971 the region's livestock receipts, $6.5 million, comprised over 20 percent of the nation's total and 46 percent of the North Central region's livestock receipts in that year.

Average farm size in the North Central region has grown substantially over the last three decades. The average-size farm has grown from 185 acres in 1940 to 311 acres in 1969 (Figure 2). This growth did not occur uniformly throughout the period, however. During the 1940's, average farm size in the North Central region grew 15 percent to reach 212 acres in 1950; during the 1950's, 25 percent to 264 acres; and during the 1960's 18 percent to 311 acres.

Because of the different types of farming within the region, average farm size varies greatly among its three farm production regions. The Northern Plains region is more dependent on extensive farming activities

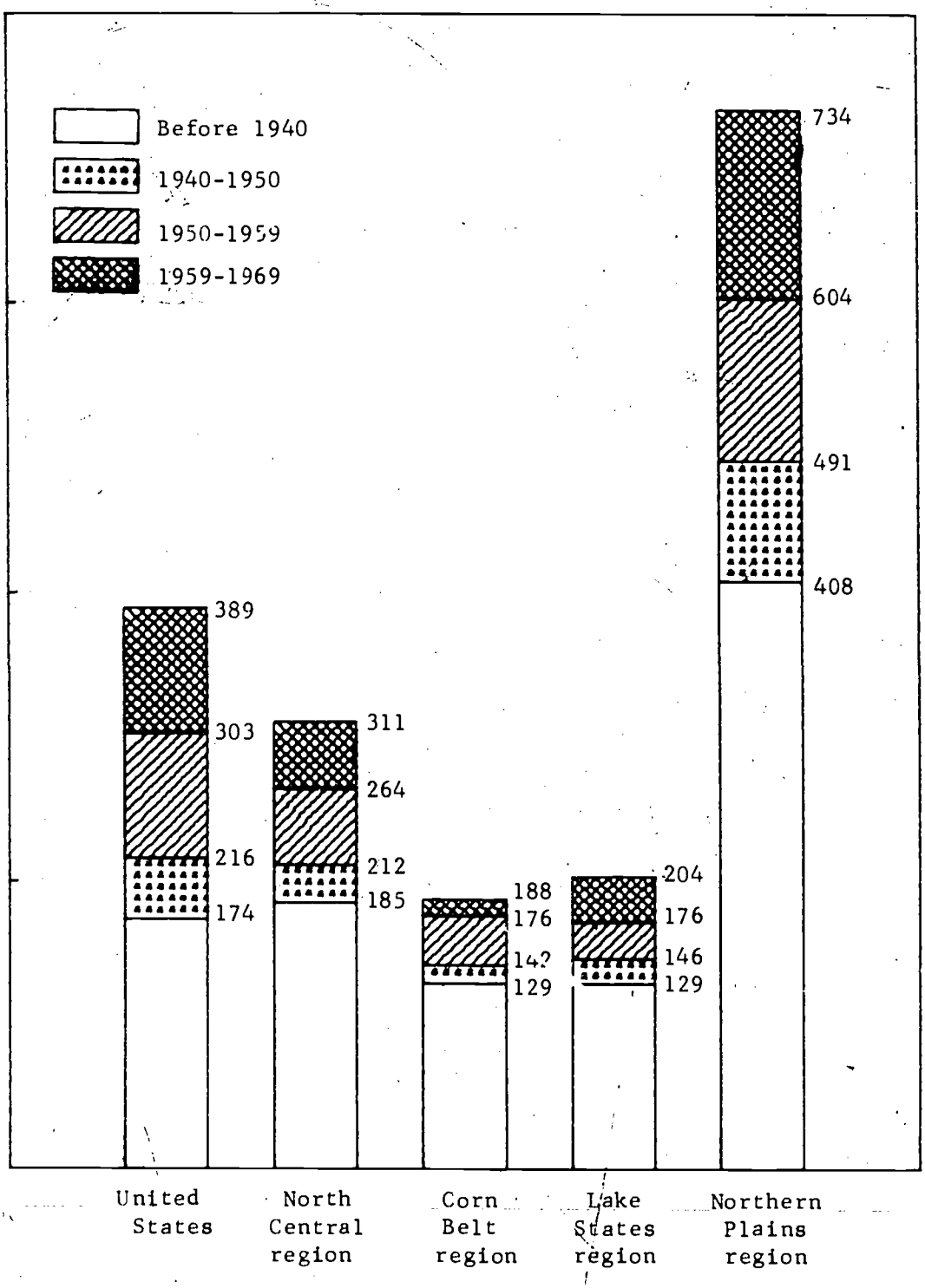


Figure 2. Average size of farm in 1940, 1950, 1959 and 1969 in the United States and in the three farm production regions in the North Central region.

Source: Statistical Abstract 1972.

and its farms averaged 734 acres in 1971. The Corn Belt and Lake States regions, with farm sizes which are much smaller, averaged 188 acres and 204 acres per farm, respectively.

In this study special emphasis is devoted to the North Central region for two reasons: (1) this region is a major farming area of the nation, and (2) rural people accounted for 28 percent of the region's population in 1970. Although two-thirds of these rural people are not farmers, the majority of them are directly affected by changes in the structure of the farming industry, and many earn their living by supplying goods and services to the farming sector. Even those rural people whose employment is not directly farm related are affected by changes in the farming sector. Since they rely on the same governmental and community services as does the farm community, changes in the farming sector which induce people to leave agriculture may shift a larger share of the cost of government services to nonfarm rural inhabitants. That these population shifts have been occurring is evident by examining the change in the region's metropolitan-nonmetropolitan population mix during the 1960's. While the total population of the region grew by 4,954,000 people from 1960 to 1970, the nonmetropolitan population of the region grew by only 645,000 people. On a percentage basis the nonmetropolitan population declined from 35.4 percent of the region's total population in 1960 to 33.4 percent in 1970.

OBJECTIVES

The overall objective of this study is to determine how size of farm is related to the welfare of both farm and nonfarm segments of society. Specifically, the study relates farm-size structure to total income in the farm sector, the number and size of farms, income per farm, secondary income generation, and consumer food costs. In addition, the impacts of differing farm sizes on one particular area, the North Central region of the nation, are emphasized. To examine the effect of differing farm sizes, alternative farm structures are developed which specify that only a certain size of farm may exist under each. Outcomes under these different situations are then compared to provide quantitative indications of farm-size effects nationally and in the North Central region.

Each of the variables mentioned above will first be summarized at the national level. Then the impacts of the different farm-size alternatives on the North Central region will be discussed in greater detail. This discussion will emphasize average farm size, acreage devoted to major crops, return to cropland, and secondary income generation.

The report's order of presentation is as follows: First, the methods and terminology used in the analysis are explained. Second, the parameters used in the study are presented. Then impacts of the farm-size alternatives at the national level are discussed, followed by a section summarizing impacts on the North Central region. Finally, some of the policy implications of the results are highlighted.

METHODS AND TERMINOLOGY USED

The four farm-size alternatives and some of the programming concepts used in this study are presented in this section.

Alternatives Analyzed

Four farm-size alternatives are analyzed in this study: (1) the Typical Farm Alternative, (2) the Small Farm Alternative, (3) the Medium Farm Alternative, and (4) the Large Farm Alternative. These alternatives are specified so that we can examine outcomes for farming and for rural areas if agriculture were composed of different farm sizes.

Production coefficients used in the Small Farm Alternative represent the technology of commercial farms with gross farm sales of no more than $10,000.[1] This grouping corresponds to farms in economic classes IV and V of the Bureau of the Census. Nationally, commercial farms in this category had an average size of 232 acres in 1969. Farms in this category generally would be considered too small to provide an adequate farm family income if the family was dependent on farming as its sole income source. Because of this low income potential, 41 percent of the farm operators in this category were employed in off-farm work for more than 100 days in 1969.

[1]The farm-size production coefficients are based on data reported by Eyvindson (Roger Karton, Eyvindson: "A Model of Interregional Competition in Agriculture Incorporating Consuming Regions, Producing Regions, Farm-Size Groups and Land Classes," unpublished Ph.D. dissertation, Iowa State University, 1970).

The production coefficients for the Medium Farm Alternative represent the structure of commercial farms in economic classes II and III of the Census Bureau. Farms in these classes have gross farm sales of more than $10,000 but no more than $39,999. This farm-size category averaged 520 acres and $20,597 in gross farm sales in 1969. The economic viability of farms in this category is not determined solely by the absolute level of their gross sales. The location and type of farm operation involved would also greatly affect the net income of farm operators in this category.

Production data for the Large Farm Alternative characterize farms in economic class I, gross sales of more than $40,000, of the Census Bureau. For the nation, these farms averaged 1,603 acres and $113,552 in gross sales in 1969. Farm operators in this group are highly commercial and could depend entirely on farming operations for their family income.

American agriculture is not expected to be composed entirely of small, medium, or large farms in 1980. Hence, the Typical Farm Alternative, which represents the cost structure and productive technology of farming if recent farm-size trends continue to 1980, also is examined. Results for this alternative are used as a basis for comparison with the other three farming structures. The average size of farm under this alternative is similar to the average under the Medium Farm Alternative. However, farms of each of the three farm size categories (small, medium, and large) are incorporated within the Typical Farm Alternative.

Linear Programming Model

A linear programming model is used as the basic tool of the analysis. This national model incorporates an interregional comparative advantage analysis, a transportation submodel, and requires fulfillment of consumer demands in 31 market or consuming regions. Commodity supplies are generated endogenously in each of 150 rural areas and land in each of these areas serves as an internal restraint on supply of crop commodities. The model minimizes the cost of producing the crop commodities in 150 rural areas and of transporting them among the 31 consuming regions. The model simulates market equilibrium in the sense that factor prices must cover costs of production for each crop in each location and the quantity of each commodity supplied must equal demand for that commodity. Supplies of the crops included in the analysis are determined endogenously in the model while livestock demands are estimated exogenously. The demands for winter and spring wheat, feed grains, soybeans, and cotton (the commodities endogenous to the linear programming model) are the summation of estimated demands for these commodities for use as livestock feed, domestic food, industrial inputs, and exports, both in raw and processed forms. Production costs and crop yields of the model have been projected to 1980, and all demands are based on parameters estimated for that year.

The linear programming model contains 275 equations and 2,061 real variables. Land in each of the 150 rural areas and demands for 31 consuming regions serve as constraints for this quantitative model. The

real variables include not only the production of farm commodities but also transportation activities of farm commodities among consuming regions.

Secondary Impact Variables

To indicate nonfarm effects of the four farm-size alternatives, factors were developed which relate the value of wheat, feed grains, soybeans, and cotton production to the amount of income generated by production of these commodities. More formally, the income-generation factor for any farm sector equals the change in the total income of the U.S. economy due to a one dollar change in the value of output in that farm sector. For example, if wheat production in the Northern Plains region had an income-generation factor of 1.2, then a one dollar increase in wheat output in this region would generate an additional $1.20 of income throughout the U.S. economy. The income-generation factors calculated for each of the farm-size alternatives are presented in Appendix Tables A.1-A.4.

To indicate the total farm and nonfarm income-generation effects of alternative farming structures, the income-generation factors just defined are linked with the estimated value of output of the four endogenous commodities. To allow a more direct comparison between the farming structures, index values are calculated such that the Typical Farm Alternative's index value is normalized to equal 100 for each region. Index values under the other three farming structures can then be viewed as percentage changes from the Typical Farm Alternative.

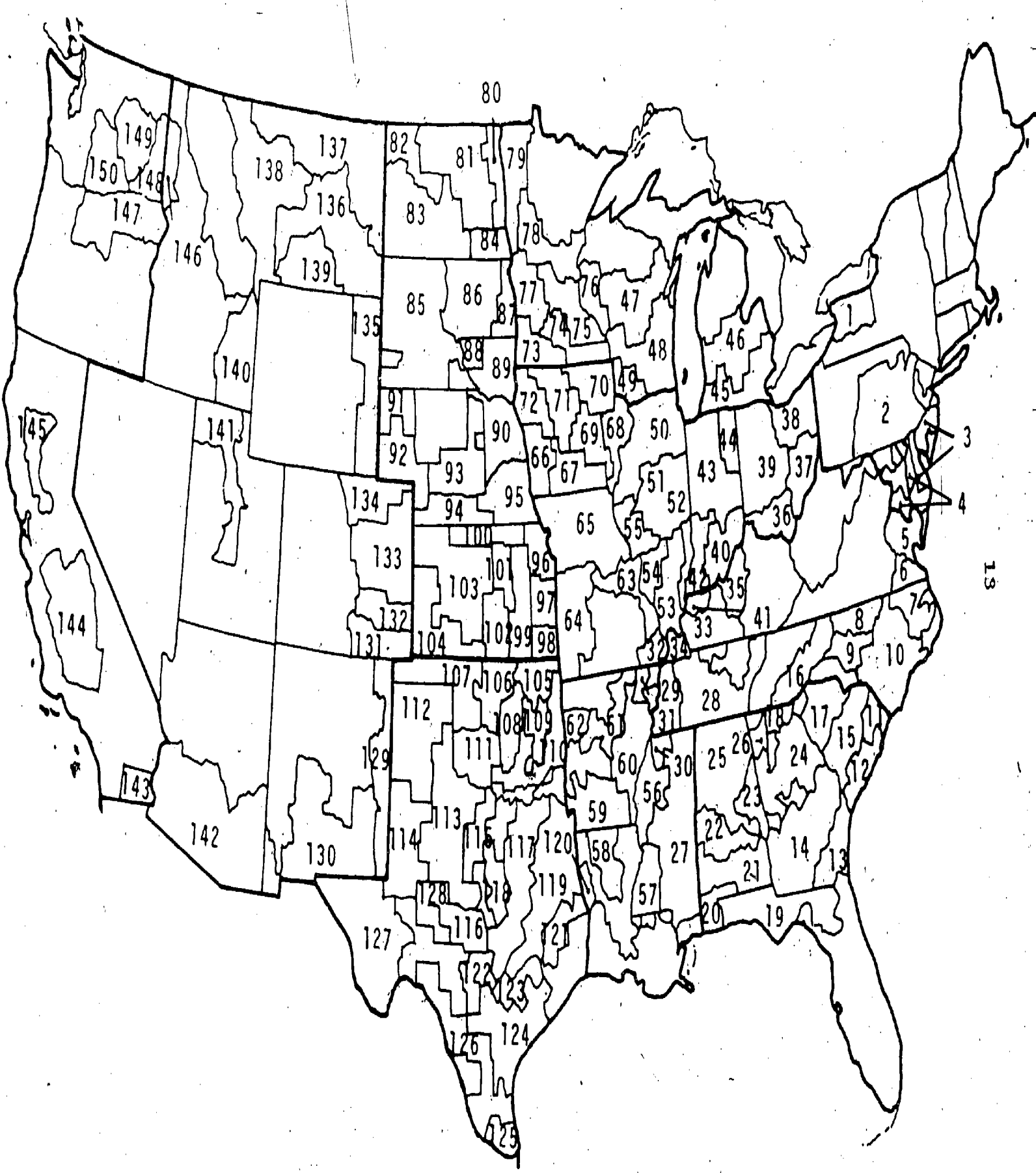
Therefore, if a region's index value is estimated to be 200 under the Small Farm Alternative, that index value would have the following meaning: the total income generated by production of the endogenous crops under the Small Farm Alternative would be twice that of the Typical Farm Alternative. This does not imply that the total income generated in a region would double under the Small Farm Alternative. Rather, it refers only to that portion of a region's total income which is generated by production of the endogenous crops.

A more extensive discussion of these programming concepts and their limitations is presented in Appendix A.

Regions Used

Both the linear programming model and the secondary impact variables used in this study relate to or are based on various regional concepts. Each of the 150 rural areas defined for this study represents a separate producing region for the four crop commodities of the programming model. These rural areas (Figure 3) follow county boundaries, are contained within the contiguous 48 states, and represent homogeneous areas of farm commodity production. While not all land of the continental United States is contained in them, they included 98 percent of the 1969 harvested acreage of the crops endogenous to the linear programming model. Production from the non-included areas is assumed equal to its 1969 level and is handled exogenously of the model.

Separate demand areas for winter and spring wheat, feed grains, and oilmeals are defined by 31 consuming regions (Figure 4) which follow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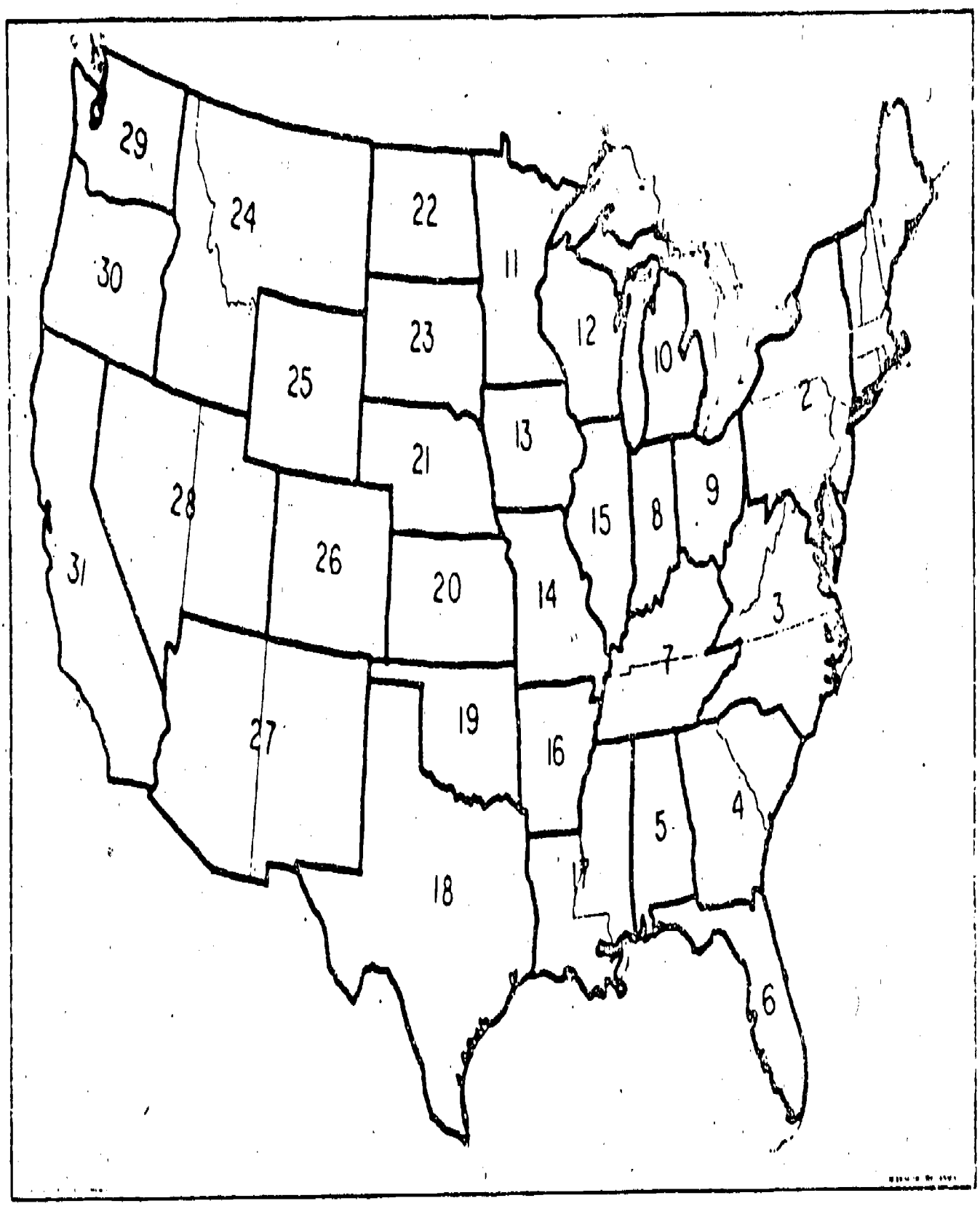

Figure 4. Location of consuming regions used in this study.

state boundaries and encompass the entire 48 contiguous states. Cotton lint demand, however, is determined on a national basis.

Certain results from the study are summarized by farm production regions, the third regional concept used in the study. These regions (Figure 5) coincide with the ten farm production regions used by the Economics Research Service, United States Department of Agriculture.

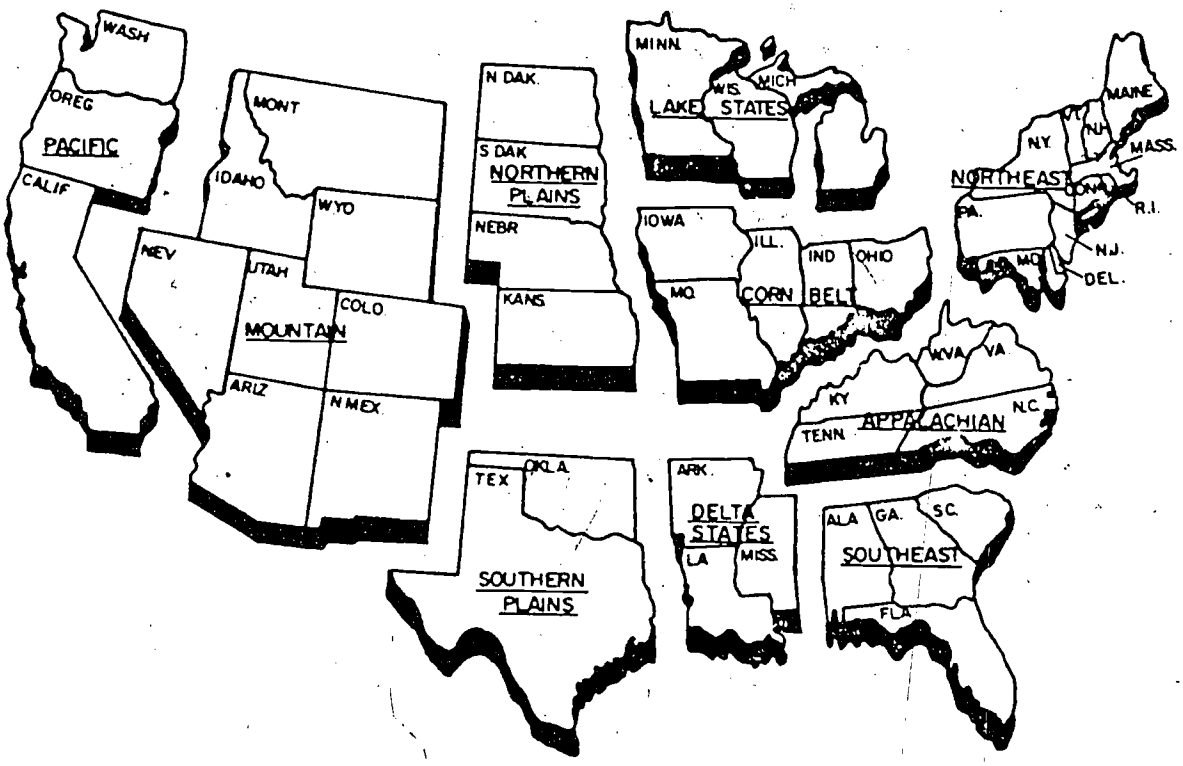

Figure 5. Ten farm production regions.

PARAMETERS USED

Of the four farm-size alternatives, only the demands specified for the Typical Farm Alternative are designed to simulate an equilibrium situation (i.e., livestock production and price levels determined outside the linear programming model specified to be consistent with the crop production and price levels determined within that model). This same demand level is then used for the other three farm-size alternatives. An alternative procedure would have been to re-estimate demand quantities for each of the Small, Medium, and Large Farm Alternatives. However, since the purpose of the analysis is to measure the effect of different farming structures, we chose to isolate this effect by forcing the quantity demanded to remain constant for each alternative.

Crop Exports

Figure 6 presents the export levels used in this study for each of the four endogenous crop commodities, along with their 1970-71 average levels. Exports of cotton lint are specified at two million bales. Reflecting the rising export demand for soybeans as protein and recent adjustments in international currency levels, soybean exports are estimated to be 69 percent higher than the 1970-71 average. While this represents a significant increase in soybeans delivered to foreign markets, soybean exports did increase by 300 percent during the last decade.

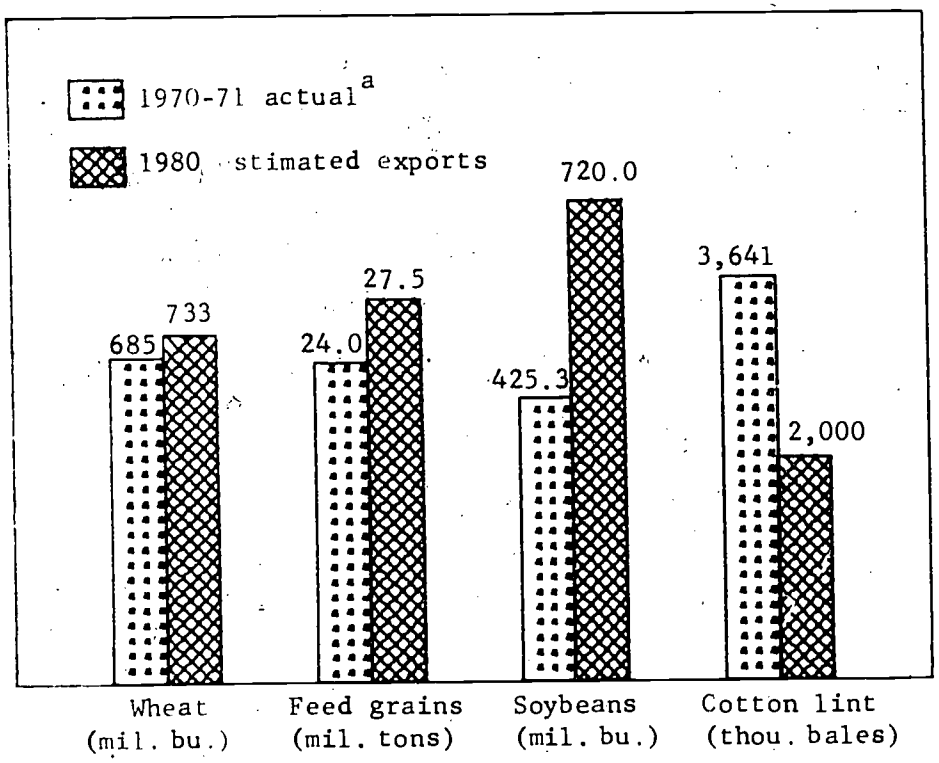

Figure 6. Estimated 1980 exports with 1970-71 exports for comparison.

[a]Source: for wheat: Wheat Situation, USDA ERS, August 1973;
for feed grains: Feed Situation, USDA ERS, August, 1973;
for soybeans: Fats and Oils Situation, USDA ERS, October 1973;
for cotton: Cotton Situation USDA, ERS, August 1973.

The demand for meat and livestock products increases as per capita income rises in other industrial nations. Therefore, exports of U.S. feed grains are projected to increase by 15 percent from the 1970-71 average of 24.0 million tons by 1980. Wheat exports in 1980 are estimated to be 107 percent of the 1970-71 average. Hence, the estimate of wheat exports also indicates a strong foreign demand for American farm products.

Per Capita Consumption of Livestock Products

Feed for livestock also comprises a major demand for the model's crop commodities. To account for this demand, estimates of per capita consumption of major livestock products were made.[1] Figure 7 presents the estimated per capita consumption of beef and veal, pork, and broilers along with 1970-71 average consumption levels. The estimated per capita consumption of beef and veal exceeds the 117 pounds consumed in 1970 and 1971 by more than 23 percent. This increase is expected because of estimated increases in per capita veal income by 1980 and an increasing preference of consumers for beef and veal. Per capita consumption of pork estimated for 1980 nearly equals the 1970-71 level. This represents a leveling off in pork consumption, as higher pork prices and increased beef consumption would provide downward pressure

[1]The estimates of per capita consumption are based on equations given by Heady, Madsen, Nicol and Hargrove: "Agricultural and Water Policies and the Environment," Center for Agricultural and Rural Development Report 40T, Iowa State University, 1972.

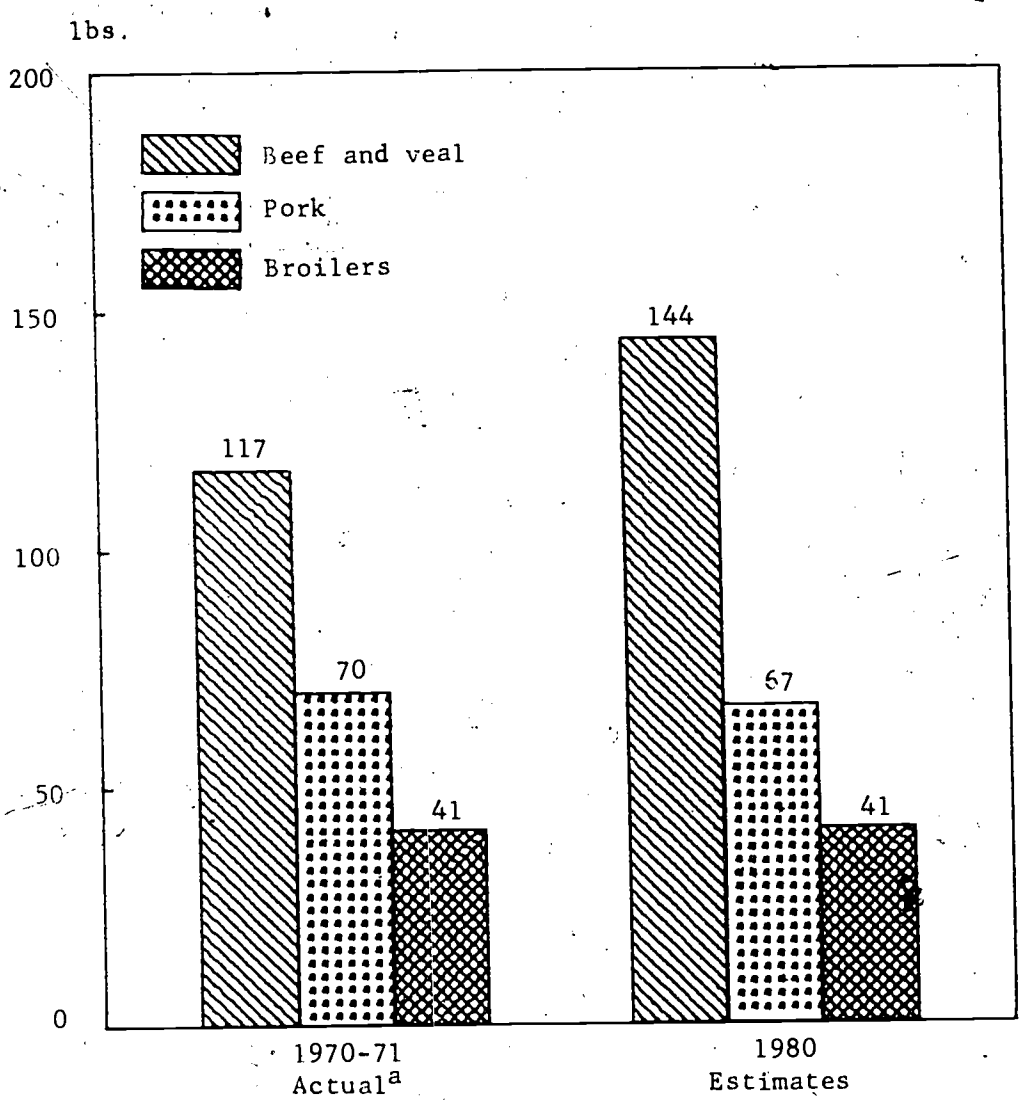

Figure 7. Estimated 1980 per capita consumption of livestock products with 1970-71 values for comparison.

[a]Source: National Food Situation, USDA ERS, November 1972.

on pork consumption but would be offset by increases in per capita income. Broiler consumption per person under the model alternatives is also estimated to approximate its 1970-71 level.

As seen recently, strong feed grain demands can lead to feed grain prices considerably higher than those of this analysis. These increased feedstuff price levels should then be translated into reduced livestock supplies and higher livestock prices. Since quantity of livestock produced limits its consumption, stronger feed grains export demands than adopted for this study should be associated with livestock consumption levels lower than those just discussed.

NATIONAL OUTPUT EFFECTS

The farm-size alternatives analyzed in this study have differing impacts on the quantity of production produced, the acreage required, and the regional location of that production. In addition, each alternative has a differing effect on the prices farmers receive and on farm income. While the data summarized in this section is primarily aggregated to the national level, presentation of these national variables can provide a clearer understanding of the impacts of the model alternatives within the North Central region. (In this section, the effect of these alternatives on regional harvested acreage is presented as a proxy for location of output.)

Output Effects

The demand levels for feed grains, wheat, soybeans, and cotton are held constant for the four structural alternatives--except that the quantity of wheat used as livestock feed is allowed to vary in each. The programming model re-estimates this quantity based on the price of feed grains and the price of wheat resulting under each alternative. Because of this flexibility, wheat production is 102 million bushels greater under the Large Farm Alternative than under the Small Farm Alternative (Table 1). Conversely, the production of feed grains is 3.2 million tons less under the Large Farm Alternative. These differences imply that the Large Farm Alternative, because of cost economies for

Table 7. Estimated production, acreages, and yields for each of the farm-size alternatives with 1970-71 average values for comparison.

Crop	Production, acreage, and yield per acre 1970-71[a]	1980 Estimated production, acreage and yield per acre			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
			Total production (thousands)		
Wheat (bu.)	1,484,673	1,553,154	1,483,587	1,516,016	1,585,738
Feed grains (ton)	180,291	219,647	221,838	220,817	218,620
Soybeans (bu.)	1,151,544	1,767,420	1,764,841	1,768,279	1,764,488
Cotton (480 lb. bales)	10,334	10,000	10,000	10,000	10,000
			Harvested acreage (thousand acres)		
Wheat	46,008	46,240	44,117	44,918	46,782
Feed grains	102,789	100,412	102,361	101,692	99,550
Soybeans	42,329	56,883	56,414	56,624	56,662
Cotton	11,307	8,596	8,521	8,407	9,212
			Yield per harvested acre		
Wheat (bu.)	32.3	33.6	33.6	33.8	33.9
Feed grains (bu.)[b]	62.6	78.1	77.4	77.6	78.4
Soybeans (bu.)	27.2	31.1	31.3	31.2	31.1
Cotton (lbs.)	438.0	558.4	563.3	570.9	521.0

[a]Source: Crop Production, 1972 Annual Summary, USDA SRS, January, 1973.

[b]Feed grains are reported in corn-equivalent bushels.

wheat, favors wheat production relative to feed grains production when compared to the Small Farm Alternative.

The demands estimated for the Typical Farm Alternative are considerably above the 1970-71 average production of wheat, feed grains, and soybeans. Significant increases are projected for soybeans and feed grain production under the model alternatives while estimated wheat production is only slightly greater than for 1970-71. For the Typical Farm Alternative, wheat production is estimated to be only 68 million bushels more than the 1970-71 average. Since wheat yields projected under the model alternatives are very similar to 1970-71 yields, the acreage in wheat is only slightly greater than in 1970-71. The greatest number of acres in wheat, 46.8 million acres, occurs under the Large Farm Alternative, since more wheat would be used for feed in this instance than under the other farm-size alternatives.

Feed grains production under the Typical Farm Alternative is 22 percent greater than the 1970-71 average. This increase in production results from projected increases in both domestic and foreign livestock consumption. Although the programming model incorporates restraints on the mobility of production, it still allows some production shifts among areas which have the greatest comparative advantage in producing a particular crop. Because of this flexibility, feed grain yields are higher under the model alternatives than during the 1970-71 period. For the Typical Farm Alternative, this increase is estimated to be 15.5 bushels per acre. (Part of this increase should be attributed to the

corn blight of 1970.) Higher feed grain yields allow greater production even though fewer acres would be required under the four farm-size alternatives than in 1970-71. The feed grains acreage estimated for the Typical Farm Alternative is only 98 percent of the 1970-71 acreage.

Because of the expanded export demands projected for soybeans in 1980, soybean production for the model alternatives is much greater than the 1970-71 average. For the Typical Farm Alternative, the estimated production of soybeans is 1.5 times that of 1970-71. This production increase requires a large increase in the number of acres in soybeans--even though 1980 soybean yields would increase by nearly four bushels per acre under the model alternatives. Soybean acreage under the Typical Farm Alternative is 14.5 million acres greater than the 1970-71 average.

Although grain production in 1980 would be higher than the 1970-71 average, the estimated production of cotton lint under the model alternatives, 10 million bales, is nearly equal to the 1970-71 average. The demand for cotton lint is based on a projected export demand of two million bales and a domestic demand of 17 pounds per person. Because some flexibility in the location of production exists in the programming model, cotton yields under the model alternatives are estimated to be much higher than the 1970-71 average. Cotton yields under the Typical Farm Alternative, 558 pounds per acre, are 120 pounds per acre greater than the two-year average. For this farm-size alternative, the acreage in cotton is only 76 percent of the 11.3 million acres in cotton in 1970-71.

Acreage Harvested

Table 2 presents estimates of harvested acreage for the four farm-size alternatives with 1970-71 average acreages for comparison.[1] Because of the increased grain production estimated for 1980, each farm-size alternative requires more acres than in the 1970-71 period. Nationally, the increase in acreage harvested over 1970-71 is 9.7 million acres for the Typical Farm Alternative. Harvested acreage varies by only 793,000 acres among the four farm-size alternatives. The fewest acres, 211.4 million, are required under the Small Farm Alternative and the most acres, 212.2 million, are estimated for the Large Farm Alternative. This difference is primarily due to the greater quantity of wheat used for feed under the Large Farm Alternative.

The distribution of harvested acreage within the 10 farm production regions remains fairly stable among the four model alternatives. A primary reason for this regional stability is the resource mobility restraints specified in the programming model. Each of the 150 rural areas is required to have at least 80 percent as many acres of wheat, feed grains, and soybeans and 67 percent as many acres of cotton in production as it had in production in 1969.[2] This procedure is used to

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[1] Appendix Tables C.1 through C.4 present the regional distribution of the harvested acreages of wheat, feed grains, soybeans and cotton.

[2] In the absence of these mobility restraints, the programming model would assume complete resource mobility among commodities and regions. This assumption was considered untenable in the context of a 1980 situation. Therefore the 80 and 67 percent restraints were arbitrarily chosen to force the model results to be influenced by past production patterns.

Table 2. Estimated harvested acreages of the endogenous crops for each of the farm-size alternatives for the United States and for the ten farm production regions with 1970-71 acreages for comparison.

	1970-71 Actual[a]	1980 Estimates			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
	(Thousand acres)				
United States	202,384	212,131	211,413	211,641	212,206
Northeast	4,261	4,097	3,989	3,989	4,097
Corn Belt	62,100	68,752	68,877	68,551	68,010
Lake States	20,001	22,291	22,421	22,352	22,342
Appalachian	8,888	5,382	6,223	5,389	5,785
Southeast	7,323	7,831	6,595	7,678	8,186
Delta States	12,786	12,360	11,633	11,573	11,936
Southern Plains	19,549	26,965	27,063	26,902	26,819
Northern Plains	46,892	46,484	47,174	47,432	48,135
Mountain	13,456	11,646	11,691	11,453	10,575
Pacific	7,128	6,322	5,747	6,322	6,322

[a] Source: Crop Production 1972, Annual Summary.

reflect the immobility over a relatively short period of time of some resources used in farming. This immobility reflects the considerable time lag required before all farm resources can be employed in non-farm occupations or be shifted to production of some other farm commodities. For example, if a farmer has already invested in the equipment necessary to produce cotton, he may not immediately be able to shift to soybean production--even though soybeans would be more profitable than cotton if that farmer possessed the equipment necessary to grow soybeans.

Even with these resource mobility constraints, the regional acreage distribution under the Typical Farm Alternative differs from the 1970-71 pattern. The Northeast, Southeast, Delta States, and Northern Plains regions are estimated to have nearly the same acreage in production under this alternative in 1980 as in 1970-71. However, the Corn Belt, Lake States and Southern Plains regions have marked increases in acreage while the Appalachian, Mountain, and Pacific regions have marked decreases in acreage. In the Corn Belt region, this increased acreage results from greater feed grains production and in the Lake States region it results from the production of more wheat and soybeans. For the Southern Plains region, the production of all three grains would increase under the Typical Farm Alternative while the region's cotton production is lower than in 1970-71. For the regions with estimated decreases in acreage, the reduction comes from decreases in wheat production in the Mountain region and primarily from decreases

in the production of feed grains in both the Appalachian and Pacific regions.

As noted previously, the regional distribution of harvested acres is relatively constant among the four model alternatives. The estimated acreage in the Northern Plains region is 1.6 million acres greater under the Large Farm Alternative than under the Typical Farm Alternative, reflecting the efficiency of larger farms in this region. In the Southeast region, the estimated acreage is 1.3 million acres less under the Small Farm Alternative--implying that in this region soybean production on smaller farms is less competitive than on larger farming operations.

Supply Prices

For each of the farm-size situations, the programming model generates an estimate of that price necessary to satisfy the model demands. These supply prices are basically an estimate of the per unit cost of production for each crop commodity. Because the model operates as if agriculture were a perfectly competitive industry, production costs in the highest cost rural area are the supply prices applicable throughout the rest of the industry (abstracting for the moment from price differentials due to transportation costs). Calculated in this manner, differences in supply price estimates between the farm-size situations indicate potential scale economies or diseconomies for the different alternatives.

Table 3 presents estimates of these supply prices at the farm level for each model alternative, along with 1970 prices for comparison. For the Typical Farm Alternative, the estimated price of feed grains and soybeans is lower than in 1970 but the price of wheat and cotton is higher. On a per bushel basis, the price decrease estimated for this alternative is 7 cents for feed grains and 41 cents for soybeans. The supply price of wheat, however, would be 47 cents per bushel higher than in 1970 and the price of cotton lint would increase by 15 cents per pound under the Typical Farm Alternative.

Farm prices under the Medium Farm Alternative are nearly equal to the prices estimated for the Typical Farm Alternative--indicating that production costs would be very similar for these two farm-size structures. Under the Small Farm Alternative, however, farm prices would be much higher than under the other farm-size alternatives and, also, would be higher than in 1970. Compared with the Typical Farm Alternative, the per unit price of wheat, feed grains, soybeans, and cotton lint would be 32, 19, 51, and 6 cents per unit higher, respectively, under the Small Farm Alternative. These higher prices result because of the higher production costs of smaller farming operations. Conversely, cost economies associated with larger farming operations are reflected in the lower farm prices estimated for the Large Farm Alternative. The farm price of all four commodities would be lower under this alternative than for any of the other model alternatives.

Table 3. Farm prices for each of the farm-size alternatives with 1970 prices for comparison.

Crop	Unit	1970 prices[a]	1980 Estimates[b]			
			Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
Wheat	dol./bu.	1.33	1.80	2.12	1.75	1.56
Feed grains	dol./bu.	1.33	1.26	1.45	1.24	1.07
Soybeans	dol./bu.	2.85	2.44	2.95	2.41	1.98
Cotton	cents/lbs.	22.0	37.0	43.0	39.0	33.0

[a]Source: Agricultural Statistics 1972, USDA, 1972.

[b]All prices for 1980 are measured in 1972 dollars and do not take into account inflation to 1980.

Income from Farming

Throughout this analysis, only the results of the Typical Farm Alternative represent an equilibrium market situation. Demand quantities determined for this alternative are then repeated in each of the other three farm-size alternatives. This procedure leads to difficulties when variables such as returns to farming and consumer food expenditures are estimated. For example, the farm price of feedstuffs is estimated to be much higher under the Small Farm Alternative than under the Typical Farm Alternative. In an equilibrium situation, higher feed prices eventually must result in higher prices to consumers for livestock products leading to a reduction in the consumption of livestock products. While we computed an equilibrium solution only for the Typical Farm Alternative, interesting comparable effects on farm income and consumer food expenditures can still be indicated. To allow these comparisons, we use the following estimation procedure. The ratio of (1) the farm value of a feed unit of feedstuffs (wheat, feed grains and soybeans) to (2) the farm price of cattle and calves, hogs, broilers and lambs for the Typical Farm Alternative is first computed. Then for each of the other farm-size alternatives, that relationship is combined with the estimated value of a feed unit of feedstuff under the other alternatives to estimate a new farm price for each of the livestock commodities. These newly calculated farm prices are then linked to livestock quantities fixed at the Typical Farm Alternative level. This procedure only applies to estimation of livestock receipts. As mentioned previously, the

same demand quantities are assumed for each farm-size alternative, therefore this section only refers to price and not supply effects of changes in farm-size.

Table 4 presents estimates of gross and net income in the farming sector as well as net farm income per commercial farm for each of the four farming structures. Results calculated for this section incorporate different livestock prices but relate to livestock quantities fixed at the same level for each of the farm-size alternatives. This procedure will overestimate cash receipts for the Small Farm Alternative and underestimate cash receipts for the Large Farm Alternative (as compared to expected cash receipts in an equilibrium situation). Cash receipts for the Medium Farm Alternative would nearly equal their value under an equilibrium solution, since the farm value of feedstuffs for this alternative nearly equals the Typical Farm Alternative results.

For each of the farm-size alternatives, both cash receipts and farm production expenses are estimated to be higher in 1980 than in 1970. The estimated increase in cash receipts exceeds the increase in expenditures for each of the farming structures, leading to higher net receipts for the farming sector under all of the model alternatives. Therefore, net returns to the farming sector under the Typical Farm Alternative would be $8.5 billion greater than in 1970. Net income of the farming sector, however, would increase by only $4.8 billion. The difference is that no government payments are included in the model results and $3.7 billion was paid to the farming sector from

Table 4. Total net farm income and net farm income per commercial farm for each of the farm-size alternatives with 1970 values for comparison.

	Net Farm Income 1970[a]	1980 Estimates			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
		(Million dollars)[b]			
Cash receipts from farm marketings	50,522.0	66,448.8	77,531.7	65,336.9	56,163.8
Production expenses[c]	41,091.0	48,910.7	53,813.9	48,596.3	44,152.8
Net receipts from farm marketings	9,431.0	17,538.1	23,717.8	16,740.6	12,011.0
Non-money income and inventory change[d]	3,677.0	4,050.0	4,050.0	4,050.0	4,050.0
Net returns from farming	13,108.0	21,588.1	27,767.8	20,790.6	16,061.0
Income from government sources[e]	3,717.0	0	0	0	0

Table 4. (continued)

	Net Farm Income 1970[a]	1980 Estimates			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
		(Million dollars)[b]			
Total net farm income	16,825.0	21,588.1	27,767.8	20,790.6	16,061.0
Number of commercial farms (thousands)[f]	1,930.0	1,633.8	5,871.7	1,775.6	1,048.3
Net farm income per commercial farm (dollars)	8,717.0	13,213.0	4,729.0	11,709.0	15,321.0

[a] Source: Farm Income Situation: Supplement to July 1972.

[b] All dollar values are measured in 1972 dollars with no adjustment for inflation to 1980.

[c] For the equations used to estimate production expenses for the Typical Farm Alternative, see H.C. Madsen and E.O. Heady, "Bargaining Power Programs", CARD Report 39, Center for Agricultural and Rural Development, Iowa State University, 1971. Production expenses for the other three alternatives were estimated by adjusting production expenses of the Typical Farm Alternative by changes in the value of the objective function of the other alternatives.

[d] Includes the value of home consumption and the rental value of farm dwellings.

[e] Includes ACP, Great Plains Conservation, Sugar Act, and Wool Act payments as well as payments under the Wheat, Feed Grain, and Cotton programs.

[f] Source: Statistical Abstract 1972.

various government programs in 1970.

Net income to the farming sector varies greatly among the four farming structures considered in the study. Net farm income would be highest, $27.8 billion, under the Small Farm Alternative and would be lowest, $16.1 billion, under the Large Farm Alternative. Net income for the farming sector under the Typical and Medium Farm Alternatives, however, only differs by $798 million. This modest income difference suggests that the farming sector as a whole could be nearly as well-off with a structure containing farms all of medium size (e.g., sales of $10,000 to $39,999) as with a structure containing farms of all three sizes.[1]

In addition to affecting the total net income of the farm sector, the four farm-size alternatives considered would affect the number of commercial farms required and, therefore, net income per commercial farm. As shown in Table 4, the number of farms required varies from slightly over one million farms under the Large Farm Alternative to over 5.8 million farms under the Small Farm Alternative. This is a direct result of the different size of farming operation associated with these alternatives. Nationally, the average farm size under the Small Farm Alternative is estimated to be 239 acres, 893 acres fewer than the 1,132

[1] Only four crop commodities are endogenous to the farm-size programming model of this study. Cost efficiencies for large scale production of other farm commodities (for example, fruits and vegetables) are specified to be equal to those estimated for the endogenous commodities. A similar specification is used for diseconomies of small scale production.

acres estimated for the Large Farm Alternative. Because of the relatively few commercial farms required under this alternative, net income per commercial farm under the Large Farm Alternative, $15,321, is estimated to be greater than in 1970 and also is greater than for the other farm-size alternatives. The opposite result is estimated for the Small Farm Alternative, where the per farm net income, $4,729, is $3,988 less than in 1970, $8,484 less than for the Typical Farm Alternative, and $10,592 less than for the Large Farm Alternative.

Average farm size under the Typical Farm Alternative is estimated to be 613 acres, requiring over 1.6 million commercial farms. This is 296,000 farms fewer than in 1970. Coupled with the greater net income of the farming sector estimated under this alternative, this reduction in farm numbers results in a $4,496 increase in income per farm for this alternative (over 1970 actual income). Per farm net income for the Medium Farm Alternative, $11,709, is also estimated to be higher than in 1970 but is $1,504 less than under the Typical Farm Alternative.

Consumer Food Expenditures

Another variable directly affected by the farming structure which exists in the American farming industry is consumer expenditures on food. Table 5 presents estimates of consumer expenditures for meat products, poultry and eggs for each of the farm-size alternatives, along with 1970 data.[1] Expenditures for these food products in 1980

[1] To estimate livestock prices for each alternative, the same process was used in this section as was described in the Net Farm Income section. The food costs discussed in this section relate to the cost of a fixed quantity of food for each alternative rather than reflecting a "real" world situation where both price and quantity would change for each farm-size alternative.

Table 5. Total and per capita expenditures for meat products, poultry and eggs for each farm-size alternative with 1970 expenditures for comparison.

	Consumer Food Expenditures 1970[a]	1980 Estimated Expenditures[b]			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
		Total Expenditures (million dollars)[c]			
Meat products	31,351	55,607	61,209	54,931	50,234
Poultry and eggs	8,620	8,685	9,002	8,646	8,385
Total	39,971	64,292	70,211	63,577	58,619
Per capita costs	199	283	309	280	258

[a]Source: Food Consumption, Prices and Expenditures, Supplement for 1971.

[b]For a summary of the equations used to estimate food expenditures, see: E.O. Heady and S.T. Sonka, "Income and Employment Generation in Relation to Alternative Farm Programs with Special Emphasis on the North Central Region," North Central Regional Center for Rural Development, Iowa State University, 1973.

[c]All values for 1980 are measured in 1972 equivalent dollars with no adjustment for inflation to 1980.

are projected to increase substantially over 1970 levels on both a total and a per capita basis. For the Typical Farm Alternative, total expenditures are estimated to be 161 percent of 1970 expenditures. This large increase reflects population growth and a shift by consumers to better quality, more expensive types of food by 1980--as well as the increase in returns to farmers discussed in the previous section.

Consumer food expenditures for these products vary among the four model alternatives but not by a large percentage. Expenditures under the Small Farm Alternative, $70 billion, are 9 percent greater than estimated for the Typical Farm Alternative. At the same time, expenditures estimated for the Large Farm Alternative, $59 billion, are 9 percent less than estimated for the Medium and Typical Farm Alternatives. The same relationships hold when consumer food expenditures are expressed on a per capita basis. Expenditures estimated for these products under the Typical Farm Alternative, $283 per person, are 142 percent of the 1970 expenditure. Per capita expenditures under the Small Farm Alternative, $309 are $29 greater than under the Medium Farm Alternative and $51 greater than under the Large Farm Alternative.

Return to Land

Because of the importance of cropland values to the farming sector and to rural institutions, the impact of each farm-size alternative on return to cropland is discussed in this study. Table 6 presents these estimates of return to cropland for each of the four farming structures.

Table 6. Estimated returns to cropland from the endogenous crops for the United States and for the ten farm-production regions for each of the farm-size alternatives.

Region	1980 Estimated Returns[a]			
	Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
	(Dollars per acre)			
United States	20.32	25.64	20.26	16.36
Northeast	8.62	9.76	6.90	13.99
Corn Belt	26.58	34.10	26.70	18.95
Lake States	13.63	19.44	14.50	11.04
Appalachian	15.62	18.49	17.14	13.83
Southeast	22.93	35.87	26.99	21.87
Delta States	22.75	21.27	20.60	16.75
Southern Plains	20.58	25.51	21.59	21.05
Northern Plains	15.13	19.71	15.17	11.64
Mountain	15.80	21.56	9.59	14.02
Pacific	24.89	21.68	24.90	23.21

[a]All prices for 1980 are measured in 1972 dollars and do not take into account inflation to 1980.

These values indicate the profitability of the four endogenous crop commodities under each of the model alternatives--after variable production costs have been paid. These estimates relate to the value of agricultural land based solely on the return to that land from crop production and, therefore, the estimates of Table 6 do not take into account any return to cropland based on nonagricultural or speculative purposes. Because of this, these estimates may be lower than the actual return a landowner would receive.

Because of the high farm prices of this farming structure, cropland returns at the national level are highest under the Small Farm Alternative. At $25.64 per acre, this is $5.32 more than under the Typical Farm Alternative and $9.28 more than under the Large Farm Alternative. The Medium and Typical Farm Alternatives have nearly equal cropland returns at the national level and the Large Farm Alternative would result in the lowest per acre return, $16.36, of the four alternatives.

Returns to cropland for each of the ten farm production regions generally follow the same pattern among the four model alternatives as exhibited at the national level. In seven of the ten regions, return to land would be highest under the Small Farm Alternative. In the Pacific region, however, the Small Farm Alternative results in the lowest return of the four model alternatives. This implies that in this region the higher farm prices of this alternative are offset by the increased production costs of smaller farming operations. In the Northeast region,

return to cropland is estimated to be highest under the Large Farm Alternative. Under this farming structure, the Northeast region would produce more feed grains than under the other three alternatives. The higher profitability of feed grains and the lower production costs of larger farms offset the lower prices of the Large Farm Alternative and generate higher returns to land in this region. The Delta States region is the third region in which cropland returns are not highest under the Small Farm Alternative. For this region, returns to cropland are estimated to be highest under the Typical Farm Alternative. Under that farming structure, the Delta States region would devote 465,000 more acres to cotton production than under any of the other farm-size situations

Returns to cropland in two other regions do not follow the pattern established at the national level. In the Southern Plains region, cropland returns are estimated to be higher under the Large Farm Alternative than under the Typical Farm Alternative. In this region, a very substantial shift from cotton to wheat production is noted between these alternatives. The greater profitability of cotton production under the Large Farm Alternative offsets the lower prices of this farming structure and results in higher cropland returns estimates for this region. In the Mountain region, the lowest cropland return, $9.59 per acre, is estimated for the Medium Farm Alternative. This is $4.43 lower than under the Large Farm Alternative, which has the next lowest estimate. This region would have fewer acres devoted to cotton production under the Medium Farm Alternative than under the other three alternatives inducing these

low cropland return estimates.

Secondary Income Effects

While it is important to relate the effects of the various farming structures to farm output and farm income, the nonfarm people who live and work in rural America also are affected by changes in the structure of American agriculture. To indicate the direction and magnitude of these changes, secondary income factors were developed and linked to the outcomes of the linear programming model.[1] As discussed previously, the product of the secondary income factors and the value of output of the programming model has been converted to an index form, with outcomes for the Typical Farm Alternative specified to equal an index value of 100. Use of this index form allows us to view the outcomes of the other three structural alternatives in terms of percentage changes from the Typical Farm Alternative. These indices are presented in Table 7.

Nationally, the income generation value is estimated to be 17 percent greater for the Small Farm Alternative than for the Typical Farm Alternative. Both farm output prices and the level of input usage are markedly higher for this alternative than under the Typical Farm Alternative, generating additional income throughout rural communities

[1]The income generation variable used in this study is defined as follows: the amount by which the total income in the United States economy will change because of a one dollar change in the value of output in a particular farm sector.

Table 7. Indices comparing the amount of income generated in the United States and in the 10 farm production regions under the Typical Farm Alternative with the amount of income generated for each of the other farm-size alternatives.

Region	1980 Estimated Index Values			
	Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
United States	100.0	117.4	98.6	84.4
Northeast	100.0	110.6	96.9	89.5
Corn Belt	100.0	116.7	98.3	82.9
Lake States	100.0	120.9	100.7	85.0
Appalachian	100.0	132.8	99.3	94.4
Southeast	100.0	111.4	102.8	90.5
Delta States	100.0	105.8	91.2	76.2
Southern Plains	100.0	115.8	96.4	89.0
Northern Plains	100.0	121.1	100.8	85.0
Mountain	100.0	122.5	93.1	83.1
Pacific	100.0	109.7	108.1	76.6

and agriculturally related industries. As with many of the other variabl analyzed, the national secondary income values for the Typical and Medium Farm Alternatives are very similar. In contrast, the lower farm prices of the Large Farm Alternative would lead to an estimated 16 percent decrease in income generation.

Regional secondary income effects for the Small Farm Alternative are very similar to the increase cited at the national level. No farm production region would have a lower income index value under the Small Farm Alternative than under the Typical Farm Alternative. In only two regions are regional income index values not within 10 percent of the national estimate of 117 percent. These are the Appalachian and Delta States regions. The 32 percent increase estimated for the Appalachian region results from an 841,000 acre increase in acreage harvested betwee the two farm structures. This additional acreage would be devoted to wheat, feed grains, and soybeans production, indicating a relative advantage in grain production for small farms in the Appalachian region compared to small farms in the other farm production regions. In contrast, the income index value in the Delta States region for the Small Farm Alternative increases by only 6 percent over the Typical Farm Alternativ This increase is 11 percent less than the national increase estimated for this farm structure. Under the Small Farm Alternative this region would produce considerable less wheat and cotton than under the Typical Farm Alternative, resulting in the smaller increase in income generation noted for this region.

At the national level, the income index values estimated for the Medium and Typical Farm Alternatives are very similar. This similarity is also reflected at the regional level as the regional index values do not vary by more than 10 percent among the 10 regions and varies by more than 5 percent in only three regions; the Delta States, Mountain, and Pacific regions. In the Delta States region, fewer acres would be required under the Medium Farm Alternative than under the Typical Farm Alternative. Since farm prices are similar for the two alternatives, this decrease, primarily in wheat and soybean production, leads to a regional income index value of 91 under the Medium Farm Alternative. The Mountain region also would have fewer acres in production under the Medium Farm Alternative than under the Typical Farm Alternative, again inducing a lower income index value for this region under the former alternative. In the Pacific region, however, harvested acreage is estimated to be constant for the two farming structures. This region's income index value, however, is estimated to be 8 percent larger under the Medium Farm Alternative. In this region, wheat production decreases and cotton production increases under the Medium Farm Alternative. Since cotton has a larger secondary income factor than wheat in this region, the increase in cotton production would generate a higher income index value for this region under the Medium Farm Alternative.

The national income index value for the Large Farm Alternative is estimated to be 16 percent lower than for the Typical Farm Alternative. Results at the farm production region level, again, are very similar to

the national result. Only the Appalachian, Delta States, and Pacific regions would have income index values which differ by more than 5 percent from the national value. Under the Large Farm Alternative, the Appalachian region is estimated to produce more feed grains and cotton than under the Typical Farm Alternative. These production increases nearly offset this alternative's lower farm prices, so that this region's income index value would only be 6 percent lower than under the Typical Farm Alternative. In contrast, the Delta States region would have fewer acres in production under the Large Farm Alternative resulting in a 24 percent decrease in this region's index value. Although the Pacific region would have the same number of acres in production under the Typical and Large Farm Alternatives, this region would have a much lower income generation value for the latter alternative. Because of the efficiency of large wheat farms in this region, 450,000 acres would be shifted from cotton production under the Typical Farm Alternative to wheat production under the Large Farm Alternative. This shift in the regional output mix results in a 23 percent decrease in the value of this region's income index because of the lower secondary income-generation potential of wheat.

IMPACTS ON THE NORTH CENTRAL REGION

One of the goals of this study is to highlight impacts that differing farm structures could have within the North Central region.[1] This region was chosen for emphasis because it is a major producer of farm output and because a relatively large proportion of the people living there would be affected by changes in the structure of agriculture. This section of the report highlights the effects of the different farm-size alternatives on average farm size, crop production, return to cropland, and secondary income generation within the North Central region.

Effects on Farm Size

The North Central region can be subdivided into three farm production regions--the Corn Belt, Lake States, and Northern Plains regions. Table 8 presents estimates of average farm size for each farm-size alternative for the nation, the North Central region, and the three farm production regions within it. Nationally, average farm size under the Typical Farm Alternative is estimated to increase by 58 percent from the 1971 average of 389 acres. Within the North Central region, average farm size would also increase under this farming structure but by 42

[1] For this study the North Central region is composed of 12 states: Ohio, Indiana, Illinois, Iowa, Missouri, Michigan, Wisconsin, Minnesota, North Dakota, South Dakota, Nebraska and Kansas.

Table 8. Estimated average farm size for the United States, the North Central region, and the three farm-production regions within the North Central region for 1971 and for each of the farm-size alternative.

Region	Average Farm Size 1971[a]	1980 Estimates			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
		(Acres)			
United States	389	613	239	502	1,132
North Central	318	450	173	385	736
Corn Belt	215	312	132	289	563
Lake States	206	294	156	259	494
Northern Plains	720	912	302	700	1,013

[a]Source: Statistical Abstract 1972.

rather than 58 percent. Farms would be larger under the Large Farm Alternative than under any of the other model alternatives. Nationally, the average-sized farm would contain 1,132 acres, 519 acres more than for the Typical Farm Alternative. Under the Small Farm Alternative, the national average farm size, 239 acres, is by far the smallest size estimated for the four alternatives. Under the Medium Farm Alternative, the average-sized farm would have 502 acres, 111 acres less than estimated for the Typical Farm Alternative.

In 1971 and also for the four model situations, the Corn Belt and Lake States regions have farms of nearly equal average size, but the average farm size in the Northern Plains region is much larger than in the other two farm production regions. Larger farming operations presently exist in the Northern Plains region because of this region's reliance on more extensive types of agricultural production (e.g., wheat farming and cow-calf ranches). This relationship is estimated to continue under each of the four model alternatives as average farm size in the Northern Plains region is more than twice that of the Corn Belt or Lake States regions for each model situation.

Cropland Acreage Effects

Historically the North Central region has been one of the major grain producing areas of the nation. In 1971, 73 percent of the feed

grains acreage, 59 percent of the wheat acreage, and 65 percent of the soybean acreage in the entire nation were located in this region. This region is expected to continue its role as a major grain-producing area of the nation for each of the four farm-size alternatives. Under the Typical Farm Alternative, for example, this region contains 50, 76, and 67 percent of the national wheat, feed grains, and soybean acreage, respectively (see Appendix Tables C.1-C.4).

Under the Small Farm Alternative, Corn Belt farms would be better able to compete with farming operations in other regions, resulting in an increase in wheat acreage for this region over the other farm-size alternatives. In contrast the Northern Plains region, which would have more acres in wheat than any other region for all of the model alternatives, attains its greatest wheat acreage under the Large Farm Alternative. The relative efficiency of large wheat farms in this region compared to large wheat farms in other regions induces this shift in wheat acreage.

For each of the model alternatives, the Corn Belt region would have more acres devoted to feed grains production than any other region. In this region, feed grains acreage would reach its largest estimate, 43.3 million acres, under the Typical Farm Alternative. The Lake States and Northern Plains regions, however, would have more acres in feed grains under the Small Farm Alternative than under the other model alternatives. In these regions, the production of feed grains would be relatively more profitable under a structure of all small farms, and

therefore, the production of feed grains would increase under this farm-size alternative.

Soybeans would continue to be a major cash crop in the North Central region as two-thirds of the national soybean acreage is located in this region for all of the farming structures considered. The Corn Belt region, which is the major producer of soybeans for all of the farm-size situations, would have its largest soybean acreage, 22.1 million acres, under the Small Farm Alternative. This indicates a relative advantage for soybean production on small farms in this region over the other farming structures considered. Conversely, soybean production on large farms would have a relative advantage over the other farming structures in the Northern Plains region--as this region would have its largest soybean acreage, 11.8 million acres, under the Large Farm Alternative.

Very little cotton would be grown in the North Central region under any of the model alternatives. Cotton acreage in this region is limited to 199,000 acres in southeastern Missouri. This acreage estimate remains constant for the four farm-size alternatives.

Return to Land

In any region where agriculture is a major industry, the value of cropland is an economic factor of considerable interest. Investment in cropland has traditionally been a method used by the American farmer to accumulate wealth. In addition, property taxes are a major

source of revenue for local governments, and any shift in the relative position of farm and nonfarm assets affects the viability of these local governments. Because of the importance of the value of cropland to residents of the North Central region, we have included estimates of cropland returns under the four model alternatives in this section of the report.

Per acre cropland returns for the four farm-size alternatives are presented in Table 9 for the three farm production regions of the North Central region and estimates for each of its 62 rural areas are presented in Appendix Table D.1. Figure 8 presents estimates of return to cropland for each of the 62 rural areas of the North Central region.[1] The nine rural areas with returns that would exceed $30 per acre are rural areas 39 in west-central Ohio, 43 in central Indiana, 50 and 51 in northern Illinois, 68 in eastern Iowa, 69 and 71 in central Iowa, and 94 and 95 in southern Nebraska. In contrast, those rural areas with the lowest estimated returns tend to be located along the outer edges of the region. The 18 rural areas with returns of less than $10 per acre are rural areas 37 and 38 in eastern Ohio, 46 in central Michigan, 47 in central Wisconsin, 75 and 77 in central Minnesota, 79 in northwestern Minnesota, 80 in eastern North Dakota, 32 in southeastern Missouri, 92 in Nebraska, and 97, 99, 100, 101, 102, and 103 in Kansas.

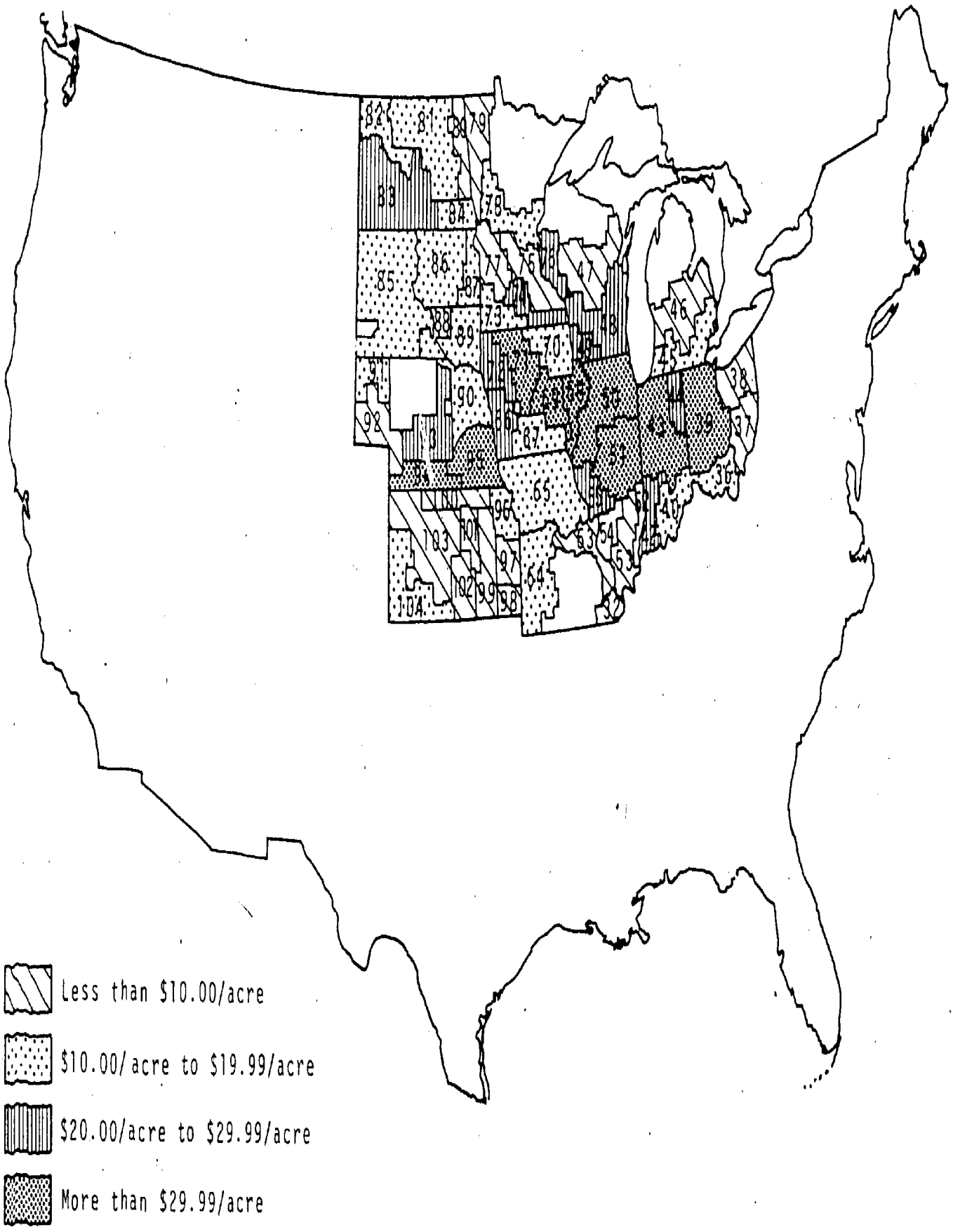
[1]Here, return to cropland refers only to the estimated returns to land from production of the four crop commodities endogenous to this study. This estimate does not take into account any return to cropland for nonagricultural or speculative purposes.

Table 9. Estimated returns to cropland from the endogenous crops for the United States and for the North Central region for each of the farm-size alternatives.

Region	1980 Estimated Returns[a]			
	Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
	(Dollars per acre)			
United States	20.32	25.64	20.26	16.36
North Central	20.61	26.82	20.77	15.13
Corn Belt	26.58	34.10	26.70	18.95
Lake States	13.63	19.44	14.50	11.04
Northern Plains	15.13	19.71	15.17	11.64

[a]All prices for 1980 are measured in 1972 dollars and do not take into account inflation to 1980.

Figure 8. Estimated return to cropland per acre for the Typical Farm Alternative.



For the Typical Farm Alternative, 18 rural areas in the entire region would have cropland returns of less than $10 per acre, 24 between $10 and $20 per acre, 11 between $20 and $30 per acre, and 9 of more than $30 per acre. The regional cropland return under this alternative is $20.61 per acre. This average return does not fully reflect variations within the region, however. No rural area in the Lake States region would have estimates of cropland return of more than $30 per acre, although the Corn Belt would have seven. For this farming structure, every rural area in South Dakota would have estimated cropland returns of between $10 and $20 per acre and no rural area in Kansas would have a return of more than $20 per acre.

Because of the higher prices for farm output, regional cropland returns under the Small Farm Alternative generally are higher than under the Typical Farm Alternative. The average return estimated for the region under the Small Farm Alternative, $26.82 per acre, is $6.21 more than under the Typical Farm Alternative. For this alternative, Figure 9 depicts estimates of cropland returns in the 62 rural areas of the North Central region. The higher returns indicated for the entire region under the Small Farm Alternative are generally repeated in each of its 62 rural areas. For this farm-size alternative, 15 rural areas would have estimated cropland returns of more than $30 per acre. Along with the nine noted for the Typical Farm Alternative, rural areas 55 in west-central Illinois, 66 and 72 in western Iowa, 93 in central Nebraska, 74 in southeastern Minnesota, and 76 in west-central Wisconsin would have re-

and Large Farm Alternatives, this region would have a much lower income generation value for the latter alternative. Because of the efficiency of large wheat farms in this region, 450,000 acres would be shifted from cotton production under the Typical Farm Alternative to wheat production under the Large Farm Alternative. This shift in the regional output mix results in a 23 percent decrease in the value of this region's income index because of the lower secondary income-generation potential of wheat.

region.

Effects on Farm Size

The North Central region can be subdivided into three production regions--the Corn Belt, Lake States, and Northern P[1] Table 8 presents estimates of average farm size for each fa alternative for the nation, the North Central region, and th production regions within it. Nationally, average farm siz Typical Farm Alternative is estimated to increase by 58 per 1971 average of 389 acres. Within the North Central region farm size would also increase under this farming structure

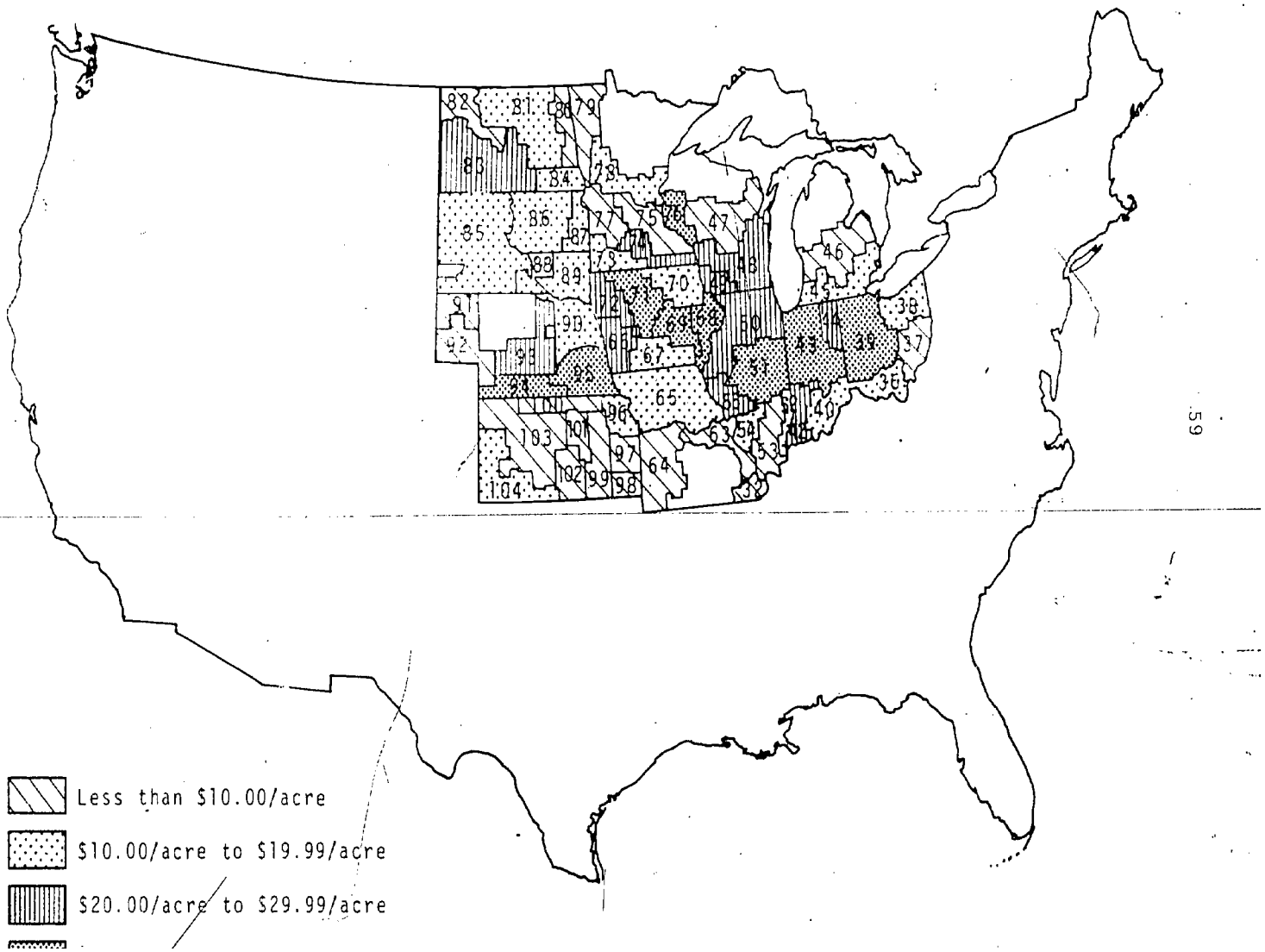
[1] For this study the North Central region is composed Ohio, Indiana, Illinois, Iowa, Missouri, Michigan, Wisconsi North Dakota, South Dakota, Nebraska and Kansas.

turns of more than $30 per acre under the Small Farm Alternative. For the remaining 47 rural areas, 10 would have returns between $20 and $30 per acre, 24 between $10 and $20 per acre, and 13 with returns of less than $10 per acre.

The estimated increase in cropland return between the Small and Typical Farm Alternative would be larger for the Corn Belt region than for the Northern Plains or Lake States regions. The per acre differential in cropland returns between these two farm-size alternatives is estimated to be $7.52 for the Corn Belt region, $5.81 for the Lake States region, and $4.58 for the Northern Plains region. Three rural areas in the Northern Plains region (rural areas 82 in northwestern North Dakota, 87 in northeastern South Dakota, and 91 in northwestern Nebraska) have significantly lower per acre returns in spite of the higher farm prices of this alternative.

Because farm output prices are very similar between these two farm-size alternatives, the regional return to cropland under the Medium Farm Alternative, $20.77 per acre, is nearly equal to the estimate under

Figure 10. Estimated return to cropland per acre for the Medium Farm Alternative.

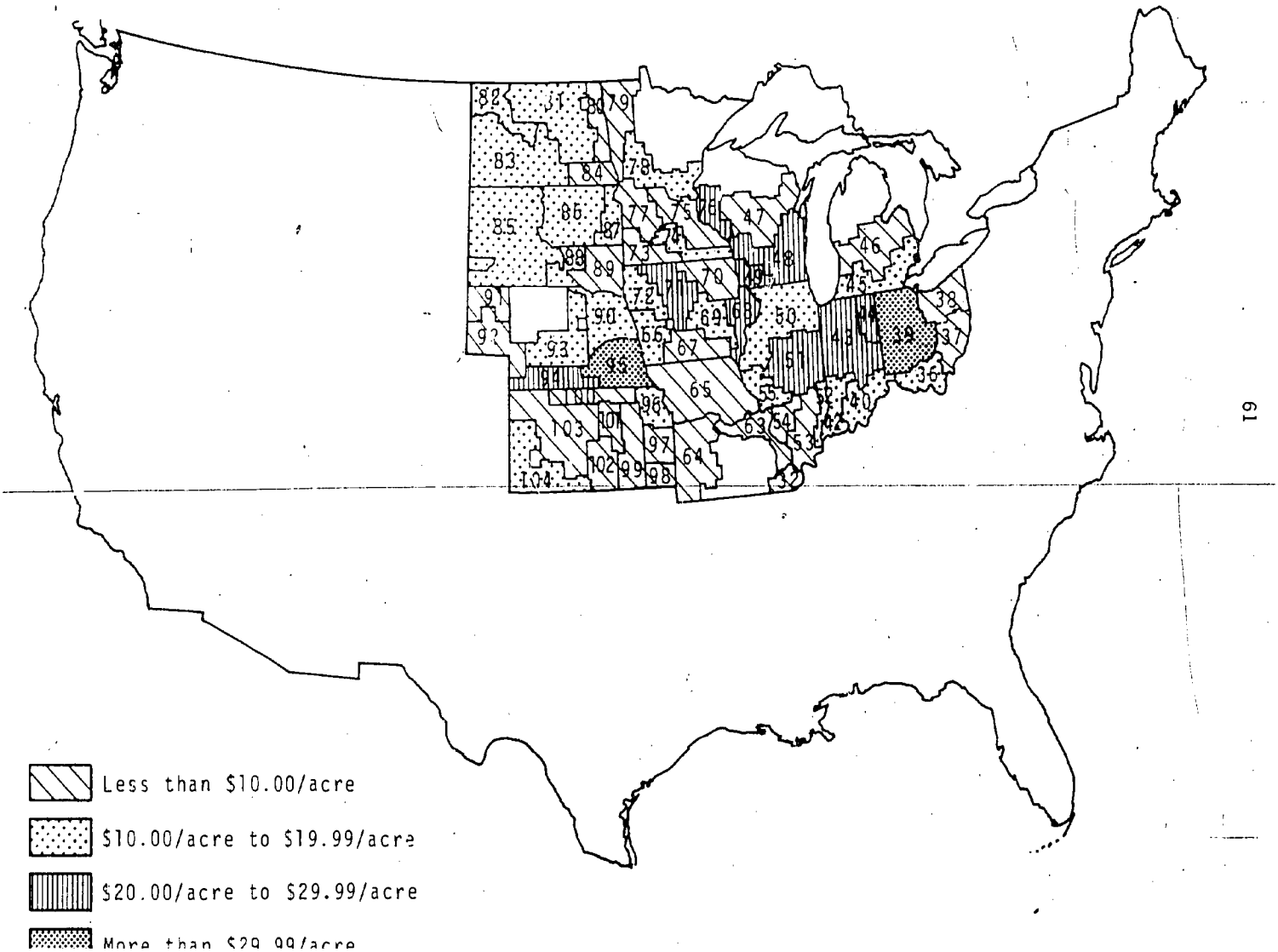


three farm sizes are present).

Figure 11 presents estimates of cropland returns under the Large Farm Alternative for the 62 rural areas in the North Central region. The regional return to cropland under the Large Farm Alternative, $15.13 per acre, is $11.69 lower than for the Small Farm Alternative and $5.48 lower than for the Typical Farm Alternative. This decrease in cropland return is due primarily to the lower price of farm output estimated for this farm-size alternative. Regionally, the difference in estimated returns to cropland between the Typical and Large Farm Alternatives is $7.63 per acre for the Corn Belt region, $2.59 per acre for the Lake States region, and $3.49 per acre in the Northern Plains region.

For the Large Farm Alternative, only two rural areas in the North Central region (rural areas 39 in northwestern Ohio and 95 in southeastern Nebraska) have returns to cropland which are estimated to be more than $30 per acre. In addition only nine rural areas would have cropland returns between $20 and $30 per acre. These nine are rural areas 43 and 44 in northern Indiana, 51 in east-central Illinois, 68 in eastern Iowa, 71

Figure 11. Estimated returns to cropland per acre for the Large Farm Alternative.



in the region were classified as rural farm residents. These 16.1 million people accounted for over one-fourth of the population of this region in 1970 and are directly affected by the farming industry that surrounds them. However, the interests of all of these rural people have seldom been given a high priority when policies which affect the farming sector have been considered. Instead, the effect these policies would have on the level of production and the price of farm output have generally been considered to be of more importance. In this study, however, we attempt to link the value of production of four crop commodities with the amount of income those commodities generate throughout the economy.[1] While the resulting indices can only be viewed as indicators of the non-farm impacts of the model alternatives, they do emphasize that different farming structures would affect more than just the farm population of the North Central region.

For each farm size alternative, Appendix Table B.1. presents the income index value calculated for each of the 62 rural areas of the North Central region. In this section we will directly compare the secondary income effects of the Typical Farm Alternative with those of the other

from the Typical Farm Alternative.

Figure 12 compares the amount of income generated under the Small Farm Alternative with the results of the Typical Farm Alternative. Regionally, the income index value would increase by 18 percent under the Small Farm Alternative. This increase also holds for the three farm production regions within the North Central region, with the 21 percent increase estimated for the Northern Plains region being the largest increase noted for the three regions. The higher farm prices and increased labor requirements of the Small Farm Alternative are the primary factors inducing these rather significant increases.

The majority of the region's 62 rural areas would experience increases of 10 to 20 percent--which is very similar to the increase in income generation noted for the entire region. Under this alternative estimated income index values for two rural areas in the Corn Belt, five in the Lake States, and eight in the Northern Plains region are more than 20 percent larger than under the Typical Farm Alternative. For most of these 15 rural areas, higher index values under the Small Farm Alternative are the result of higher farm prices and a shift in their output mix to

Figure 12. Comparison of the amount of income generated under the Small Farm Alternative with the amount of income generated under the Typical Farm Alternative for the North Central region.

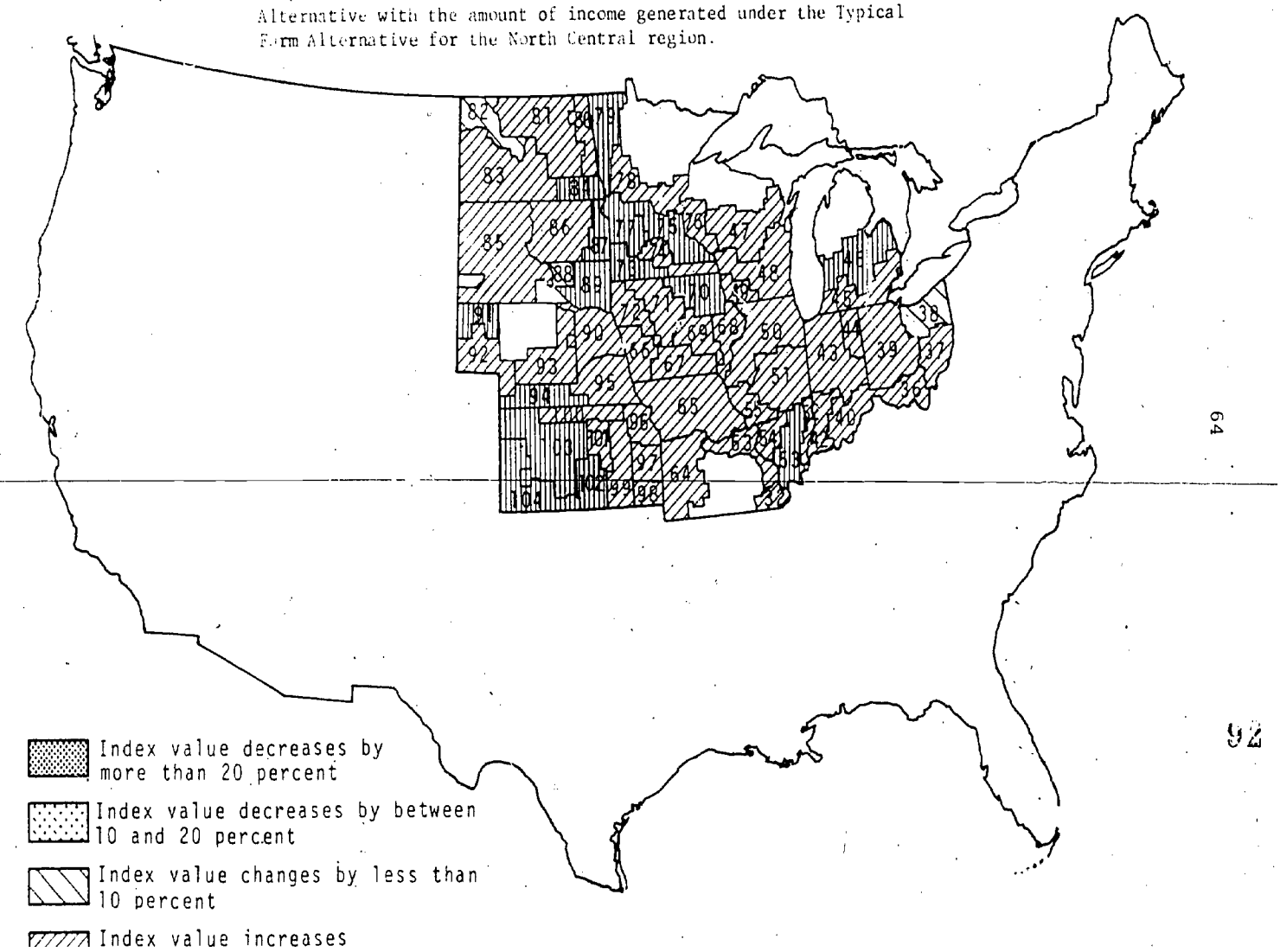
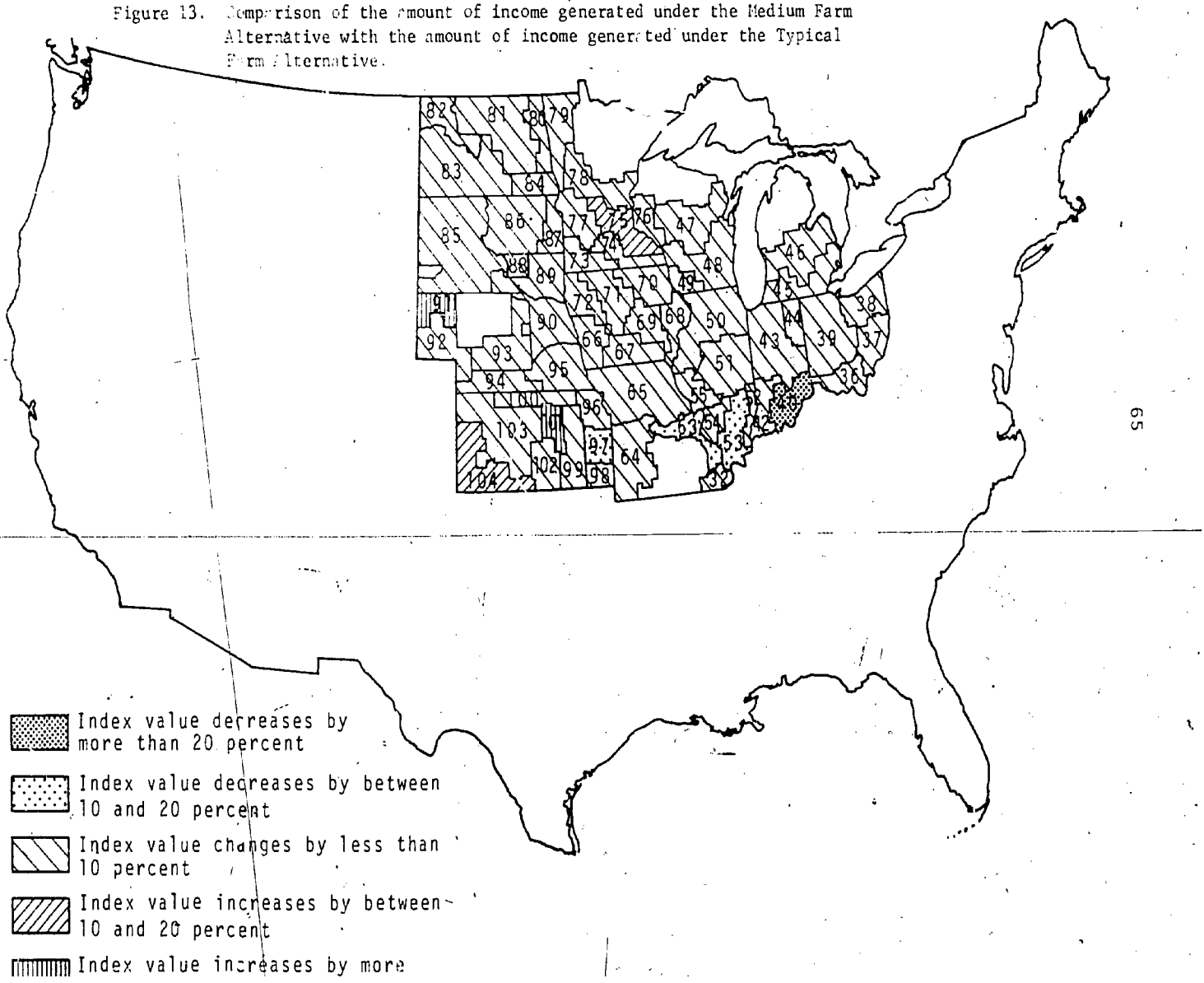


Figure 13. Comparison of the amount of income generated under the Medium Farm Alternative with the amount of income generated under the Typical Farm Alternative.



region, and $4.58 for the Northern Plains region. Three rural areas in the Northern Plains region (rural areas 82 in northwestern North Dakota, 87 in northeastern South Dakota, and 91 in northwestern Nebraska) have significantly lower per acre returns in spite of the higher farm prices of this alternative.

Because farm output prices are very similar between these two farm-size alternatives, the regional return to cropland under the Medium Farm Alternative, $20.77 per acre, is nearly equal to the estimate under the Typical Farm Alternative. Figure 10 presents the estimated per acre returns for the region's 62 rural areas under the Medium Farm Alternative. Estimates of cropland return are also very similar for the Typical and Medium Farm Alternatives in most of the 62 rural areas within the region. These very similar results for the two farm-size alternatives indicate that restrictions on both the maximum and minimum size of farms may have little effect on cropland value (when compared to a situation where all

natives is $7.63 per acre for the Corn Belt region, $2.59 per acre for the Lake States region, and $3.49 per acre in the Northern Plains region.

For the Large Farm Alternative, only two rural areas in the North Central region (rural areas 39 in northwestern Ohio and 95 in southeastern Nebraska) have returns to cropland which are estimated to be more than $30 per acre. In addition only nine rural areas would have cropland returns between $20 and $30 per acre. These nine are rural areas 43 and 44 in northern Indiana, 51 in east-central Illinois, 68 in eastern Iowa, 71 in north-central Iowa, 94 in southwestern Nebraska, 48 and 49 in southern Wisconsin, and 76 in west-central Wisconsin. Cropland returns in the remaining 51 rural areas are estimated to be less than $20 per acre under the Large Farm Alternative.

Secondary Income Effects

In 1970, 12.1 million people were classified as rural nonfarm residents of the North Central region. An additional four million people

the amount of income those commodities generate throughout the economy.[1] While the resulting indices can only be viewed as indicators of the non-farm impacts of the model alternatives, they do emphasize that different farming structures would affect more than just the farm population of the North Central region.

For each farm size alternative, Appendix Table B.1. presents the income index value calculated for each of the 62 rural areas of the North Central region. In this section we will directly compare the secondary income effects of the Typical Farm Alternative with those of the other three farm alternatives. To accomplish this, the income index value for each region is set at 100 for the Typical Farm Alternative and the outcomes for the other model alternatives are expressed as percentage changes

[1] The income-generation variable used in this study is defined as follows: the amount by which the total income in the U.S. economy would change because of a one dollar change in the value of output in a particular farm sector.

inducing these rather significant increases.

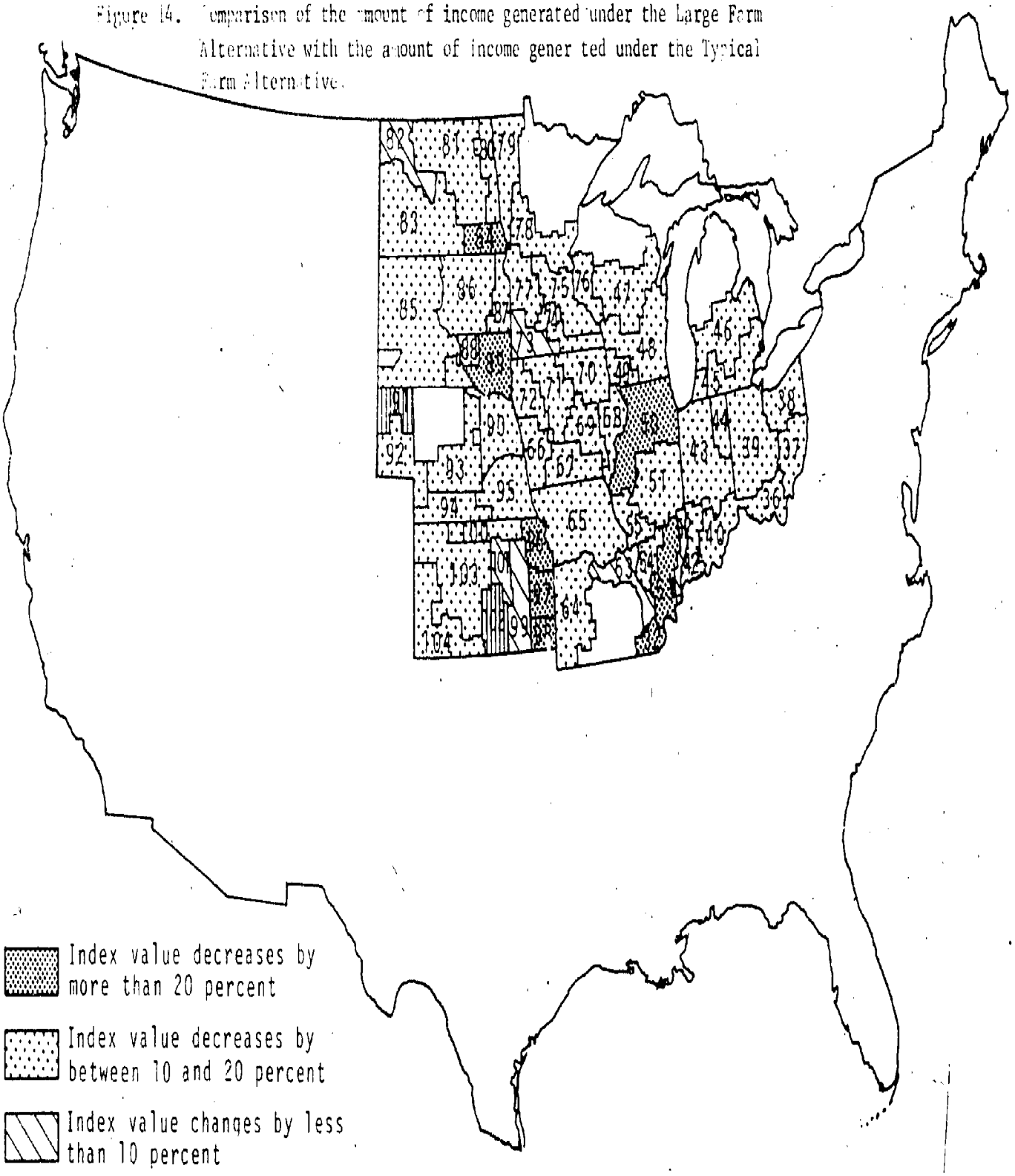
The majority of the region's 62 rural areas would creases of 10 to 20 percent--which is very similar to th income generation noted for the entire region. Under th estimated income index values for two rural areas in the in the Lake States, and eight in the Northern Plains reg 20 percent larger than under the Typical Farm Alternativ these 15 rural areas, higher index values under the Smal are the result of higher farm prices and a shift in thei commodities with higher income-generating potential.

Figure 13 compares the amount of income generated Farm Alternative with the amount generated under the Typ native. For most rural areas in the North Central regic values estimated for the Medium Farm Alternative would n Typical Farm Alternative outcomes. Since prices and prc

of farm output are nearly equal under those two farming structures, the income index values estimated for most rural areas also are very similar.

For the entire region, the amount of income generated under the Large Farm Alternative would be 16 percent lower than under the Typical Farm Alternative. As can be seen in Figure 14, this result is repeated in most of the rural areas within this region. This decrease in income generation is primarily the result of the lower farm prices and reduced input requirements of the Large Farm Alternative. In only two rural areas (rural areas 91 in northwestern Nebraska and 102 in south-central Kansas) are income index values under the Large Farm Alternative more than 10 percent higher than under the Typical Farm Alternative. Both rural areas would have more acres in production under a farming structure of all large farms than under the Typical Farm Alternative.

Figure 14. Comparison of the amount of income generated under the Large Farm Alternative with the amount of income generated under the Typical Farm Alternative.



SUMMARY

In this study, we have examined some effects of four different farming structures on various farm and nonfarm variables. Each of these structures implies a different size and scale of individual farming operation within the agricultural industry. The four farm-size alternatives considered are the:

Large Farm Alternative: farming operations with gross farm sales of at least $40,000 per farm;

Medium Farm Alternative: farming operations with gross farm sales of at least $10,000 and no more than $39,999 per farm;

Small Farm Alternative: farming operations with gross farm sales of at least $2,500 and no more than $9,999 per farm;

Typical Farm Alternative: contains farming operations of each of the three farm sizes defined above and reflects the mix of these farm sizes in 1980 if recent farm-size trends continue.

Using a linear programming model, the location and quantity of production of feed grains, wheat, soybeans and cotton are determined within 150 rural areas for each model alternative. National demands for major livestock products and for industrial and export uses of these crop commodities are also estimated for 1980. Based on the programming results, estimates are made of the effect of the four farm-size alternatives on such factors as farm income, food costs, cropland value, and economic activity in rural areas.

Because of estimated increases in exports and a larger domestic population in 1980, production of the three grain commodities (wheat,

feed grains, and soybeans) would be greater for almost all of the farm-size situations than under the 1970-71 average. The only exception would be wheat production under the Small Farm Alternative, which is estimated to be slightly less than the actual figure. Although all other demands are held constant, the quantity of wheat used for livestock is re-estimated by the programming model based on the relative cost of producing wheat and feed grains under each farming structure. Because of the cost efficiencies of large wheat farms, 102 million more bushels of wheat would be produced under the Large Farm Alternative than under the Small Farm Alternative. This additional wheat production is substituted for feed grains production which decreases by three million tons under the Large Farm Alternative. The production of soybeans and cotton lint is held constant for each of the farming structures. Soybean production is estimated to be over 50 percent greater under the model alternatives than the 1970-71 average, primarily because of greatly expanded exports estimated for 1980. In contrast, the estimated production of cotton lint, 10 million bales, is slightly below the 1970-71 average.

Because of yield increases projected for 1980, the only commodity requiring more acreage than in 1970-71 would be soybeans. At least 14 million more acres of soybeans are required under each of the model alternatives than the 42 million acres of soybeans harvested in 1970-71. While the average per acre yield of soybeans is estimated to be higher than in 1970-71, the additional production estimated for the model alternatives necessitates increases in soybean acreage. The net effect of

the yield and production increases estimated for 1980 is that at least nine million more acres are required for the four crop commodities than in 1970-71.

For the Typical Farm Alternative, the estimated farm price for wheat and cotton lint is above 1970 levels but the price of feed grains and soybeans would be lower than in 1970. The Medium Farm Alternative, with farms all of moderate size, is estimated to have nearly the same farm prices as the Typical Farm Alternative, with farms of all three sizes. The higher costs of production of the Small Farm Alternative lead to markedly higher supply price estimates than do the other three farming structures. In contrast, scale economies associated with larger farming operations lead to the lowest farm prices of the four model alternatives for the Large Farm Alternative.

Income of the farming sector also varies greatly among the four farming structures. Total net farm income is estimated to be almost $21.6 billion for the Typical Farm Alternative, $4.8 billion more than farm income in 1970. This difference would be even greater except for the $3.7 billion in government payments paid to the farming sector in 1970--which is not included for any of the model alternatives. The largest estimate of farm income is $27.8 billion under the Small Farm Alternative. The lowest estimate of farm income of the model alternatives occurs under the Large Farm Alternative. For this alternative, total sector income, $16.1 billion, would be slightly less than in 1970 and $11.7 billion less than under the Small Farm Alternative.

For each of the farm-size alternatives, the number of commercial farms required varies considerably. The Typical Farm Alternative requires 296,000 fewer farms than in 1970 which, when coupled with the total income estimate of this alternative, leads to a much higher per farm income than in 1970. Net income per commercial farm for this alternative is estimated to be $13,213, which is $4,496 more than in 1970. While total farm income is highest under the Small Farm Alternative, the per farm income estimate for this farming structure is much lower than for the other alternatives and is $3,988 less than in 1970. This lower per farm estimate results because of the large number of farming operations required in a situation where all farms were small. In contrast, net income per farm under the Large Farm Alternative, $15,321, is much higher than for the other alternatives primarily because only slightly over one million commercial farms is required for this farming structure.

For each of the model alternatives, consumer food expenditures for meat products, poultry and eggs are estimated to be higher in 1980 than in 1970. These increased expenditures result from increases in population by 1980, shifts in consumer preference for higher quality, more expensive foods, and estimated increases in returns to the farming sector. On a per capita basis, the Small Farm Alternative would have the highest expenditure estimate, $309. This is $26 more than for the Typical Farm Alternative and $51 more than for the Large Farm Alternative.

For this study, the effect of the four model alternatives on return to cropland has also been quantified. The value of this variable

for each of the alternative farming structures provides an indication of the profitability of farming and the financial health of many rural institutions. The estimate of return to land presented here only relates to the value of land when devoted to the four crop commodities of the programming model. Any return which in reality would accrue to farmland from speculative or nonagricultural use is not included in these estimates. Nationally, the per acre return to cropland is estimated to be nearly equal for the Typical and Medium Farm Alternatives--at slightly over $20 per acre. Because of the higher prices of the Small Farm Alternative, however, the national return for this situation, $25.64 per acre is considerably higher than for the other farming structures. In contrast, the per acre return to cropland for the Large Farm Alternative, $16.36, would be much lower than for the other farm-size alternatives.

To emphasize that the farming structure existing in rural America has impacts on more than just the farming sector, indices are developed which compare the amount of income generated by the production of wheat, feed grains, soybeans and cotton under the Typical Farm Alternative with the amount generated under the other farm-size alternatives. Of the four farming structures, the Small Farm Alternative would have the highest national income index value. Because of higher farm output prices and increased labor requirements, the income index value estimated for this farm-size alternative is 17 percent larger than for the Typical Farm Alternative. The reverse is noted for the Large Farm Alternative, as its in-

come index value would be 16 percent lower than for the Typical Farm Alternative.

One of the purposes of this paper is to highlight the effects of alternative farming structures on the North Central region of the nation. For each of the model alternatives, this region would continue to be a major grain producing area. For example, 50, 76, and 67 percent of the national wheat, feed grains and soybean acreage, respectively, would be located in this region under the Typical Farm Alternative. However, only a small percentage of the national cotton acreage is located in this region under any of the farm-size alternatives.

For the North Central region, the average farm size in the region ranges from a low of 173 acres under the Small Farm Alternative to a high of 736 acres under the Large Farm Alternative. Average farm size for the Medium and Typical Farm Alternatives remains between the two extremes at 385 and 450 acres, respectively. For all of the model alternatives, the average size of farm in the Northern Plains region would remain much larger than the regional average while the average farm size in the Corn Belt and Lake States regions would remain much smaller than for the entire region.

Return to cropland within the North Central region is very similar to the national estimate for each of the farming structures. For the region, the highest per acre return would be $26.82 under the Small Farm Alternative. This falls to $20.77 for the Medium Farm Alternative, then to $20.61 for the Typical Farm Alternative, and reaches a low of $15.13

for the Large Farm Alternative. Of the three farm production regions, the Corn Belt region would have the highest per acre return. Return to cropland remains nearly equal in the Northern Plains and Lake States regions for all four farming structures.

The income index values estimated for the North Central region vary in almost the same manner as do the national estimates. The higher farm prices and increased input requirements of the Small Farm Alternative induce an 18 percent increase in secondary income generation for the region over its Typical Farm Alternative results. Regionally, the Medium Farm Alternative would have nearly the same income index value as under the Typical Farm Alternative. And for the Large Farm Alternative, the 16 percent lower income index value noted at the national level is repeated in this region. The income index results for the three farm production regions within the North Central region and for most of its 62 rural areas follow very closely the regional results.

POLICY IMPLICATIONS

Each of the farm-size alternatives analyzed in this study represents a different structure for the American farming industry. None of these farming structures, however, are presented as a recommended goal for American agriculture. Rather they represent directions in which the structure of the nation's farming industry could move in the future. Therefore, the outcomes presented in this study can be viewed in the context of providing relationships which exist between different structures of agricultural production. Further, if the American public perceives that adoption of certain policies would lead to a farming structure similar to one discussed in this paper, the study's results could provide information to be used in evaluating that policy.

Some very clear-cut contrasts are depicted in this study. Its results indicate that (when compared to the other farming structures) an agricultural system composed of all small farms would provide higher prices for farm outputs, higher returns to cropland, a higher total income for the farming sector, and increased economic activity in those nonfarm sectors dependent on agriculture. While these are all positive results to some economic groups, some outcomes of the Small Farm Alternative would be negative. The higher food expenditures and the very low estimate of net income per commercial farm associated with this farming structure are important examples of these negative results.

In contrast, a farming structure of all large farms would imply

lower food costs to consumers, would require fewer productive inputs--thus freeing those inputs for other uses, and would allow a much higher net income per commercial farm. If the freed resources are not used in the rural community, however, fewer rural businesses may be required. Also, the lower per acre returns to cropland of this alternative indicate potential financial difficulties for many rural institutions.

Estimated results for the Typical and Medium Farm Alternatives are less extreme than the results of either the Small or Large Farm Alternatives. In most instances, these two farming structures would provide outcomes which are very similar. This implies that society possibly could be as well served by an agriculture of all medium-sized farming operations as by one with a wide range of sizes of farming operations.

It should also be noted that policies with the explicit objective of altering the existing farm-size structure have seldom been enacted. But policies adopted to accomplish other goals, such as lowering food costs or providing additional credit to commercial agriculture, can alter the nation's farm-size structure. Therefore the results presented in this report should not necessarily be used only to evaluate policy actions designed to affect the nation's agricultural structure. Rather these results could also provide information when evaluating policies which affect that farm-size structure even though designed to achieve some other goal.

APPENDIX A: SECONDARY INCOME ANALYSIS

One goal of this study is estimation of the effects of each structural alternative on the income levels of agriculturally related communities and industries. Hence, factors were developed which relate output of each endogenous crop to income generated in agriculturally related communities and industries throughout the nation.[1] These factors will be referred to as income-generation factors. The value of the income-generation factor in any particular sector equals the change in total income for the U.S. economy due to a one dollar change in the value of output in that farm sector of the model. (The sector of relevance is a specific farm commodity produced in a specific rural or production area.)

This change in total income has three components: (1) the income received or lost by the producers of that farm output, (2) the change in income resulting from changes in the activity of agri-business firms (both input suppliers and output processors), and (3) the change in income resulting from changes in sales of consumer goods to farmers and

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[1] The crop commodities endogenous to this study are wheat, feed grains, soybeans, and cotton. The basic coefficients used in developing these variables were reported by Schluter (Gerald Emil, Schluter, "An Estimation of Agricultural Employment Through an Input-Output Study." Unpublished Ph.D. dissertation, Iowa State University, 1971). For a discussion of the procedure used to calculate the income-generation factors, see E.O. Heady, and Steven T. Sonka, "Income and Employment Generation in Rural Areas in Relation to Alternative Farm Programs with Special Emphasis on the North Central Region." North Central Regional Center for Rural Development, Iowa State University, 1973.

workers in agri-business industries and rural communities. For example, a wheat activity with an income-generation factor of 1.2 in the Northern Plains region will generate, as well as the dollar's worth of wheat in that region, $1.20 of income throughout the U.S. economy.

Different technological coefficients or input mixes exist for each farm-size alternative. Hence, the income-generation factors must be recalculated for each alternative analyzed. To accomplish this, the basic input-output matrix is adjusted to reflect the mix of inputs relevant for each farm-size alternative.

Although each crop activity for each size alternative in each rural area has its own unique cost or input coefficients, the income-generation factors are summarized for the ten farm production regions. These factors were developed from data based on the ten farm production regions and relate to these regions. Appendix Tables A.1 through A.4 present the income-generation factors estimated for each of the farm-size alternatives.

Although the income-generation factors reflect changes in the mix of inputs purchased, they do not reflect changes in the proportion spent on producer versus consumer goods by farm families. As the price of farm output varies between farm-size alternatives, however, the income position of farmers also changes and could therefore lead to a change in the expenditure pattern of farmers. Ideally, the income-generation factors would be recalculated for each farm-size alternative to reflect these changes in the mix of items purchased by farmers. This, however,

could not be accomplished because of the unavailability of data. Therefore, we mention this limitation of the method used and stress the need for additional data relating to expenditure patterns in rural America.

These income-generation factors relate to the secondary income effects of one dollar's worth of farm output. To estimate the total secondary income effect, these factors are multiplied by the value of output determined in the linear programming model for each endogenous crop in each rural area and then are summed for each farm production region. These results then can be presented in index form in the sections of the report dealing with secondary income effects. In developing the indices, the value of income generated under the Typical Farm Alternative represents 100 in each region. If the income index is 200 under the Small Farm Alternative for a particular region, that index value would have the following meaning: The total income generated by production of endogenous crops under the Small Farm Alternative would be twice that of the Typical Farm Alternative. This does not imply that the total income in a region under the Small Farm Alternative would be twice that of the Typical Farm Alternative. Rather it refers only to that portion of a region's total income which is generated by production of the endogenous crops.

Appendix Table A.1. Factors expressing the amount of income generated per dollar of output for the Typical Farm Alternative for each of the ten farm-production regions.

Region	Estimated Income-Generation Factors			
	Wheat	Feed grains	Oilmeals	Cotton lint
	(dollars generated per dollar of output)			
Northeast	1.40	1.29	1.43	--
Corn Belt	1.32	1.28	1.07	1.58
Lake States	1.38	1.36	1.18	--
Appalachian	1.37	1.43	1.23	1.72
Southeast	1.28	1.45	0.94	1.61
Delta States	0.82	1.40	0.99	1.60
Southern Plains	1.00	1.39	0.95	1.65
Northern Plains	1.21	1.37	1.17	--
Mountain	1.20	1.37	1.31	1.61
Pacific	0.90	1.37	1.31	1.62

Appendix Table A.2. Factors expressing the amount of income generated per dollar of output for the Small Farm Alternative for each of the ten farm-production regions.

Region	Estimated Income-Generation Factors			
	Wheat	Feed grains	Oilmeals	Cotton lint
	(dollars generated per dollar of output)			
Northeast	1.41	1.30	1.45	--
Corn Belt	1.34	1.29	1.08	1.58
Lake States	1.39	1.37	1.19	--
Appalachian	1.37	1.45	1.24	1.86
Southeast	1.29	1.47	0.95	1.67
Delta States	0.83	1.43	1.00	1.65
Southern Plains	1.01	1.40	0.97	1.67
Northern Plains	1.22	1.39	1.18	--
Mountain	1.21	1.37	1.31	1.63
Pacific	0.92	1.37	1.31	1.62

Appendix Table A.3. Factors expressing the amount of income generated per dollar of output for the Medium Farm Alternative for each of the ten farm-production regions.

Region	Estimated Income-Generation Factors (dollars generated per dollar of output)			
	Wheat	Feed grains	Oilmeals	Cotton lint
Northeast	1.40	1.30	1.44	--
Corn Belt	1.32	1.28	1.07	1.57
Lake States	1.38	1.36	1.18	--
Appalachian	1.36	1.42	1.22	1.65
Southeast	1.28	1.45	0.94	1.54
Delta States	0.82	1.40	0.98	1.55
Southern Plains	1.00	1.38	0.97	1.65
Northern Plains	1.22	1.37	1.18	--
Mountain	1.20	1.37	1.31	1.60
Pacific	0.90	1.36	1.31	1.62

Appendix Table A.4. Factors expressing the amount of income generated per dollar of output for the Large Farm Alternative for each of the ten farm-production regions.

Region	Estimated Income-Generation Factors (dollars generated per dollar of output)			
	Wheat	Feed grains	Oilmeals	Cotton lint
Northeast	1.40	1.29	1.44	--
Corn Belt	1.32	1.27	1.07	1.59
Lake States	1.37	1.36	1.19	--
Appalachian	1.35	1.41	1.21	1.61
Southeast	1.26	1.43	0.93	1.54
Delta States	0.81	1.38	0.98	1.56
Southern Plains	0.99	1.37	0.98	1.65
Northern Plains	1.21	1.36	1.17	--
Mountain	1.20	1.37	1.31	1.62
Pacific	0.90	1.36	1.31	1.62

Appendix Table B.1. Indices comparing the amount of income generated in the 62 rural areas of the North Central region under the Typical Farm Alternative with the amount of income generated for each of the other farm-size alternatives.

State	Producing Area	1980 Estimated Index Value			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
Ohio	36	100	115	99	86
	37	100	115	99	86
	38	100	96	99	85
	39	100	115	98	86
Indiana	40	100	116	79	85
	42	100	116	99	85
	43	100	116	99	85
	44	100	117	99	85
Illinois	50	100	118	100	74
	51	100	112	94	89
	52	100	119	100	98
	53	100	130	85	72
	54	100	119	99	83
	55	100	119	99	83
Iowa	66	100	118	99	83
	67	100	120	99	82
	68	100	118	99	83
	69	100	120	108	85
	70	100	120	99	81
	71	100	119	99	83
	72	100	120	99	82
Missouri	32	100	115	101	53
	63	100	114	88	105
	64	100	118	98	80
	65	100	116	102	83
Michigan	45	100	115	99	85
	46	100	122	99	86
Wisconsin	47	100	112	97	88
	48	100	115	97	86
	49	100	115	97	86

Appendix Table B.1. (continued)

State	Producing Area	1980 Estimated Index Value			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
Minnesota	73	100	121	99	91
	74	100	119	99	82
	75	100	134	117	82
	77	100	125	100	82
	78	100	112	99	87
	79	100	126	100	83
North Dakota	80	100	118	95	82
	81	100	114	97	86
	82	100	106	97	91
	83	100	115	98	81
	84	100	121	100	80
South Dakota	85	100	113	99	85
	86	100	115	99	84
	87	100	281	100	87
	88	100	109	99	90
	89	100	125	101	80
Nebraska	90	100	119	98	89
	91	100	428	368	317
	92	100	112	103	88
	93	100	119	99	82
	94	100	121	99	80
	95	100	117	98	83
Kansas	96	100	115	98	69
	97	100	115	88	73
	98	100	119	95	73
	99	100	119	95	109
	100	100	118	97	83
	101	100	119	178	95
	102	100	123	96	129
	103	100	124	100	84
	104	100	132	111	85

Appendix Table C.1. Estimated wheat acreage for the four farm-size alternatives for the United States and for the ten farm production regions.

	1970-71 Actual[a]	1980 Estimates			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
	(thousand acres)				
United States	45,957	46,240	44,117	44,918	46,782
Northeast	573	309	309	309	309
Corn Belt	3,582	3,882	4,424	3,905	4,010
Lake States	1,741	2,861	2,107	2,922	2,801
Appalachian	822	568	957	568	419
Southeast	413	249	195	226	617
Delta States	463	1,626	1,363	1,224	1,667
Southern Plains	5,519	10,483	9,275	9,123	9,156
Northern Plains	21,388	16,118	16,262	17,065	17,435
Mountain	7,890	5,883	5,653	5,653	5,653
Pacific	3,566	4,261	3,572	3,923	4,714

[a]Source: Crop Production 1972, Annual Summary.

Appendix Table C.2. Estimated feed grains acreage for the four farm-size alternatives for the United States and for the ten farm production regions.

	1970-71 Actual[a]	1980 Estimates			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
	(Thousand acres)				
United States	102,782	100,413	102,361	101,692	99,550
Northeast	3,230	3,185	3,077	3,077	3,279
Corn Belt	36,318	43,393	42,153	42,570	42,475
Lake States	14,659	13,656	15,105	14,542	14,461
Appalachian	4,375	1,994	2,238	1,994	2,324
Southeast	3,261	2,019	2,019	2,019	2,019
Delta States	1,017	356	356	356	356
Southern Plains	8,444	10,165	10,361	10,352	10,230
Northern Plains	23,440	19,326	20,734	20,365	18,928
Mountain	5,139	5,141	5,141	5,241	4,301
Pacific	2,899	1,177	1,177	1,177	1,177

[a] Source: Crop Production 1972, Annual Summary.

Appendix Table C.3. Estimated soybean acreage for the four farm-size alternatives for the United States and for the ten farm production regions.

	1970-71 Actual[a]	1980 Estimates			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
	(Thousand acres)				
United States	42,326	56,883	56,414	56,622	56,662
Northeast	458	603	603	603	509
Corn Belt	21,919	21,277	22,101	21,877	21,325
Lake States	3,601	5,774	5,209	4,888	5,079
Appalachian	3,109	2,471	2,679	2,478	2,382
Southeast	2,409	4,813	3,630	4,682	4,799
Delta States	8,468	8,192	8,192	8,272	8,192
Southern Plains	298	2,711	3,821	3,821	2,602
Northern Plains	2,064	11,040	10,178	10,002	11,773
Mountain	--	--	--	--	--
Pacific	--	--	--	--	--

[a]Source: Crop Production 1972, Annual Summary.

Appendix Table C.4. Estimated cotton acreage for the four farm-size alternatives for the United States and for the ten farm production regions.

	1970-71 Actual[a]	1980 Estimates			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
		(Thousand acres)			
United States	11,264	8,596	8,521	8,407	9,212
Northeast	--	--	--	--	--
Corn Belt	280	199	199	199	199
Lake States	--	--	--	--	--
Appalachian	581	349	349	349	660
Southeast	1,240	750	750	750	750
Delta States	2,837	2,185	1,720	1,720	1,720
Southern Plains	5,238	3,606	3,606	3,606	4,829
Northern Plains	--	--	--	--	--
Mountain	462	623	898	561	623
Pacific	662	884	998	1,222	431

[a] Source: Crop Production 1972, Annual Summary.

Appendix Table D.1. Estimated returns to cropland from the endogenous crops for the 62 rural areas in the North Central region for each of the farm-size alternatives.

State	Producing area	1980 Estimated Returns[a]			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
		(dollars per acre)			
Ohio	36	16.46	17.05	15.82	18.44
	37	6.55	4.34	8.14	5.33
	38	8.80	10.50	10.05	7.58
	39	43.67	46.23	42.86	41.62
Indiana	40	13.10	19.83	12.78	13.08
	42	20.09	16.68	20.20	15.06
	43	33.94	35.28	33.12	26.08
	44	23.21	24.84	23.88	21.34
Illinois	50	30.13	44.73	29.82	19.08
	51	37.94	49.52	37.79	29.05
	52	13.34	19.05	11.84	10.24
	53	6.66	12.02	7.87	6.11
	54	10.12	14.17	10.18	5.02
	55	26.00	31.16	27.85	17.30
Iowa	66	21.97	32.71	21.66	11.82
	67	12.83	25.52	15.06	6.27
	68	39.40	48.85	33.86	23.14
	69	32.11	47.47	32.28	19.10
	70	14.91	24.71	14.49	5.38
	71	35.30	50.59	35.50	21.36
	72	24.48	38.21	24.73	13.05
Missouri	32	7.58	12.86	9.82	4.93
	63	3.46	4.42	3.69	7.42
	64	10.07	14.17	9.03	5.60
	65	17.46	18.04	19.86	9.52
Michigan	45	13.68	14.70	17.59	13.91
	46	9.18	15.15	9.93	8.55
Wisconsin	47	4.49	3.46	3.84	4.65
	48	25.20	28.09	25.92	22.96
	49	27.80	29.31	29.05	29.67
	76	28.21	44.73	31.11	25.83

Appendix table D.1. (continued)

State	Producing area	1980 Estimated returns[a]			
		Typical Farm Alternative	Small Farm Alternative	Medium Farm Alternative	Large Farm Alternative
		(dollars per acre)			
Minnesota	73	13.41	21.65	15.75	7.39
	74	24.86	37.30	23.29	16.24
	75	6.57	15.64	9.95	6.31
	77	9.68	16.41	8.67	6.87
	78	13.01	11.70	12.64	13.11
	79	2.49	3.52	1.88	1.28
North Dakota	80	9.80	10.04	8.54	9.06
	81	12.73	12.13	12.23	12.87
	82	10.29	7.72	9.85	11.99
	83	23.69	25.30	23.12	19.71
	84	16.25	20.22	18.29	9.58
South Dakota	85	18.83	17.63	19.41	18.19
	86	16.83	17.54	17.02	15.63
	87	11.14	4.88	12.06	11.78
	88	18.46	17.64	18.61	18.39
	89	15.45	25.65	16.73	5.34
Nebraska	90	16.98	24.57	16.72	12.37
	91	10.36	5.92	2.83	3.67
	92	1.91	0.66	6.07	4.84
	93	26.13	37.63	26.89	17.53
	94	32.82	46.77	31.08	21.38
	95	37.41	48.56	37.04	30.85
Kansas	96	12.18	10.07	11.34	12.55
	97	1.52	1.80	4.48	6.59
	98	10.07	13.29	6.95	1.29
	99	8.82	12.36	6.11	1.18
	100	5.07	7.28	3.83	2.88
	101	6.20	9.23	2.08	2.32
	102	3.77	8.52	1.68	0.62
	103	3.58	8.19	5.30	3.81
	104	12.57	19.66	14.51	11.23

[a] All prices for 1980 are measured in 1972 dollars and do not take into account inflation to 1980.

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