

*Resource Demand  
and Structure of the  
Agricultural Industry*



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Iowa State University Press, *Ames*, Iowa, U.S.A.

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Library of Congress Catalog Card Number: 63-16673

## Preface

RETURNS TO CAPITAL and human resources in agriculture have been low relative to resource returns in nonfarm sectors a greater part of the time since 1920. On the surface, these income problems appear to be caused by large output and by low commodity supply and demand elasticities. Major farm policies have been initiated accordingly with attempts to support prices and restrain output. More fundamentally, however, the commercial farm problem rests on resources. The magnitude of farm output, and hence of commodity prices, is determined by the quantity and productivity of resources employed in agriculture. The elasticity of agricultural output in both the short run and long run similarly has its foundation in resource demand and supply elasticities. Hence, if the basic cause of large output and low commodity prices and resource returns is to be explained, it must be tackled at the level of resource use.

The organization of agriculture, i.e. the number and size of farms, employment and farm population and use of capital inputs rests importantly on the factor demand functions. The size of the nonfarm sector in rural communities depends on the number of farmers and their purchases. As farms become larger, fewer farm families are available to purchase consumer goods. Substitution of capital for labor also changes the mix of inputs supplied to farmers by local merchants. Obviously, then, the structure of resource demand in agriculture has wide ramifications for both farm and nonfarm sectors.

The operating techniques in agriculture are a reflection of the resource structure. Evidently cultivators in less advanced countries use labor methods and less productive techniques because of the prices of capital items, or because of inadequate knowledge of the productivity coefficients of capital resources. Economic development which changes the relative supply price of various resources and gives rise to greater knowledge of productivity coefficients evidently leads to a capital intensive industry resting on larger and more specialized units. A major goal in development evidently is to change production functions and factor supply elasticities in order that the resource demand structure of agriculture will change. In countries at the level of development in the United States, the problem is to lower the commitment and increase flexibility of resources in agriculture, causing commodity supply to be

lower and more elastic. In other countries, the goal is to shift capital supply and demand to the right, thus substituting capital for labor in order that farming will depend less on human effort; thus workers can be made more productive and will be freed for nonfarm employment. In still other countries, extension of the use of agricultural capital items representing improvements in technology is vital to lessen the drag of food supply on population and economic growth.

A number of the terms used in this study have no generally accepted meaning. Hence, at this point it seems desirable to clarify the meanings of some of the terms most commonly used in subsequent sections. The structure of agriculture is defined as the demand, supply and production functions which reflect more basic concepts such as technology, goals, values, laws, etc. The parameters such as demand and supply elasticities in the structural relationships determine the organization of agriculture, i.e. farm size and numbers, prices, quantities, cost and returns. A change in structure is a shift in the magnitude and/or number of parameters in the structure. Demand or supply in general refer to the simple schedule (curve) of prices and quantities. A demand function includes not only the price-quantity relationship, but also includes influences which shift the demand schedule.

Because of the relevance of the resource structure to the U.S. farm problem, the over-all research project reported in this volume was initiated in 1955. Its emphasis was on resource demand functions, since these relationships are extremely important in determining the quantities of resources employed in the industry and the magnitude of farm output. The nature of resource supply functions is equally important in determining the quantities of resources employed, the magnitude of farm output and the level of factor returns. Part of the analysis has been devoted to input-supply relationships but major emphasis has been on single demand functions for resources in farming. An interdependent system will focus on resource supply functions and their interrelationships with demand functions in explaining the prices and quantities in agriculture.

Several other studies relating to resource demand were initiated at approximately the time of this study. These studies, by Cromarty, Griliches and Shuh, are discussed in the text. However, since the models and specifications employed are not identical, the results of this current study which parallel those of other studies (and which were generally in process at the same time) are reported in some detail in the text. Some estimates from early phases of the study are brought up to date, but for others the "cut off" date is the time of their completion. Emphasis in the study, however, is in a fairly comprehensive analysis of demand for major input aggregates and revolves around a more or less central model. Some other aspects of resource demand also are included since they have previously had little analysis and do provide some insight, even if remote, to conditions surrounding resource demand. In this vein, a chapter which includes static demand and supply functions based on experimental data is presented. We are,

of course, aware of the fact that these data do not particularly provide a representative sample for U.S. agriculture, and do not necessarily reflect the setting for farmer decisions. Yet we look upon them as being useful in providing some information on the technological foundation of an ultra short-run resource demand and product supply framework. Similarly, Chapter 5 is designed to illustrate the possible magnitudes of resource substitutions underlying change in the structure of agriculture. While the data are meager, they begin to provide more basic knowledge than has previously existed.

The early chapters provide a descriptive summary of the major changes taking place in the resource structure and organization of agriculture. The descriptive chapters provide insights sometimes unavailable from econometric techniques. That is, the econometric analysis of later chapters essentially identifies and measures the parameters in the resource structure in recent years. Although time variables and other techniques are used to accommodate a dynamic structure, rigidities of econometric models restrict the analysis and often only allow single-valued estimates of parameters. The early descriptive sections provide useful insight into the structure itself by indicating (a) forces which have generated the resource structure (e.g. education, research, etc.) and (b) the "product" of the resource structure, i.e., the organization of agriculture. The various approaches used in the study supplement each other, and we attempt to provide, within the limitations of the data and methods, the basis for a broad understanding of forces underlying the structure and organization of agriculture. We hope that the analysis also can be useful for persons other than those interested in formal and technical quantitative tools.

As an aid to reviewers, we add that the study does not provide "the final answers" in resource structure. It has limitations in the models, specifications, aggregations and quantitative techniques employed. It rests largely on conventional least squares single equation estimates when simultaneous equations in some instances would seem more logical. Perhaps too little is attempted with simultaneous models in the sense that more small interdependent models might be attempted for subsystems of the over-all structure analyzed; or too much is attempted in assuming a higher degree of interdependence than necessary within the over-all system. Too much perhaps is aggregated under time variables. The degree of intercorrelation between this and other variables is great enough that some bias occurs in estimating the parameters relating to resource and product prices and other economic or explanatory variables. The independent variables are not all measured without error, with estimational biases arising accordingly. The study may be too heterogeneous in the sense that it includes analysis ranging from normative and static demand for a single resource to a predictive demand for extremely broad aggregates. In another sense, it may be too homogeneous in the sense that a general model is formulated and applied repeatedly to various categories of input aggregates. Some of the criticisms are those which apply to all studies based on time series

data and devoted to economic structure. In most cases, of course, these are the only types of data available. We believe that we do provide useful predictions and analysis subject to the restrictions of data availability. On the other hand, we consider this study to be only one step in a more complete and continued analysis of the phenomena considered.

The authors sincerely appreciate the cooperation of many individuals who helped to make this publication possible. Glen Barton and Don Durost of the USDA were very helpful in providing data. Stanley Johnson serves as co-author of Chapter 9, and Harold Carter as co-author of Chapter 17. The authors also wish to thank Glenn Helmers, other graduate students and also members of the statistical computing services at Iowa State University who helped make computations and aided in preparation of the manuscript. Finally, appreciation is expressed to the Iowa Agricultural and Home Economics Experiment Station for funds allowing research to provide certain of the estimates and the W. K. Kellogg Foundation which partly provided opportunity for the study through the Center for Agricultural and Economic Development of Iowa State University.

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