SECONDARY EFFECTS OF UPSTREAM WATERSHED DEVELOPMENT: ROGER MILLS COUNTY OKLAHOMA

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Submitted to the Faculty of the Graduate School of
the Oklahoma State University
in partial fulfillment of the requirements
for the degree of
DOCTOR OF PHILOSOPHY
May, 1964

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OKLAHOMA

Thesis Approved:

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569769

PREFACE

This thesis reports the results of one phase of a research program on an economic evaluation of upstream watershed development in the Washita River Basin of Oklahoma. This research program is being conducted by cooperative arrangements between the Resource Development Economic Division, Economic Research Service, United States Department of Agriculture, and the Department of Agricultural Economics, Oklahoma Agricultural Experiment Station, Oklahoma State University. The participation of the Economic Research Service is made possible by a grant of funds from the Soil Conservation Service.

ACKNOWLEDGMENTS

I wish to express deep appreciation to Dr. W. Burl Back, Major Adviser, for his guidance throughout my graduate program. His intellectual challenges provided a stimulating environment for conducting research.

Appreciation is extended to Mr. M. L. Weinberger, Economic Research Service, for his counsel and assistance. The financial assistance provided by the Soil Conservation Service is gratefully acknowledged, as is the helpfulness of various personnel associated with that Agency.

This study would not have been possible without the cooperation and assistance of Mr. L. L. Males, President of the Security State Bank at Cheyenne, Oklahoma. His contribution is gratefully acknowledged. Assistance and suggestions were also provided by Mr. Charlie A. Burns, County Extension Director for Roger Mills County.

I wish to thank my colleagues in the Watershed Economics Research Laboratory, Dale O. Anderson, Neil R. Cook, and Burl F. Long, for their suggestions and criticisms throughout the course of this study. Also, a note of appreciation to the secretary of the Watershed Laboratory, Mrs. Barbara Oberlander.

A special note of thanks to Mrs. Claudia Anderson for her skill and efficiency in typing the final manuscript.

A deep debt of gratitude is owed to my wife, Vonna, for her encouragement and help during my graduate program.

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CHAPTER I

INTRODUCTION

The Federal Government's role in water resources development historically has been in four major types of activity--navigation, irrigation, power, and flood control. In more recent years, Federal activity has been expanded in such fields as recreation, pollution control, and municipal and industrial water supply.

In 1820, Congress provided an appropriation for a survey to determine the best way to improve navigation on the Ohio and Mississippi Rivers. Four years later an appropriation was made to provide the necessary works of improvement. The planning for these surveys and improvements required the services of professional engineers, and the Nation's only engineering school at that time was the military academy at West Point. Thus, the President assigned these tasks to the Corps of Topographic Engineers of the Army. Although their duties have been greatly expanded, the major function of the Corps of Engineers still is the navigational aspects of water resource development.

The extent of Federal activities in resource development generally was restricted to navigation until the mid-nineteenth century. Then, in 1850, Congress enacted the first Swamp Act which provided that certain unsold public swamp land could be given over to the States for sale. The proceeds from these sales were to be used to construct levees and other works of improvement to protect the land from flooding and for

their drainage and reclamation. This was the beginning of the Federal Government's activity in flood prevention.

In his first State of the Union message, President Theodore Roosevelt urged that the Federal Government provide irrigation facilities in the arid West. In response to this request, the Congress enacted the Reclamation Act in 1902. The Bureau of Reclamation in the Department of Interior, which was created to administer this Act, mainly has been restricted in activities to the development of irrigation and power facilities in the seventeen western states.

The Federal Water Power Act of 1920 contained provisions for the disposition of electrical energy developed in conjunction with the reclamation projects. In 1928, the first large scale project, the Hoover Dam, was designed to emphasize hydro-electric power as an integral part of a multi-purpose structure.

Although the Federal Government's participation in flood prevention activities date back to the passage of the Swamp Act in 1850, the Omnibus Flood Control Act of 1936 (The Copeland Act) greatly accelerated public planning and construction of works of improvement for flood prevention. This Act also authorized the installation of land treatment measures by Department of Agriculture specifically for purposes of flood control. The Flood Control Act of 1944 authorized works of improvement in eleven river basins to control run-off and to prevent soil erosion. The Soil Conservation Service of the U. S. Department of Agriculture was assigned primary responsibility for administering this program.

The Watershed Protection and Flood Prevention Act of 1954 (P.L. 566 and subsequent amendments thereto) greatly increased the activities of the Soil Conservation Service in flood control. Although the Act

authorized works of improvement for flood prevention, drainage, irrigation water, recreation, and municipal and industrial water, the flood prevention phase of the program has received the major emphasis. The public's acceptance of the "watershed approach" to resource development is exemplified by the fact that over 30 per cent of the total land area in Oklahoma is in some stage of development under this program.

This resumé of federal participation in water resource development has emphasized only the major activities (navigation, irrigation, power, and flood prevention) and the administering agencies. There are other agencies and other activities associated with water resource development. For example, the Public Health Service has become increasingly active in water pollution control during recent years.

Current Standards for Evaluating Projects

The Federal agencies responsible for water resource development have developed their own evaluation criteria. As a result, significant differences in economic criteria and evaluation procedures have been applied. A Subcommittee on Benefits and Costs of the Federal Inter-Agency River Basin Committee was formed to examine the evaluation procedures of the various Federal agencies and to develop "a systematic, consistent, and theoretically sound framework for the economic analysis of river basin projects and programs. . . ."[1]

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[1] Subcommittee on Benefits and Costs of the Federal Inter-Agency River Basin Committee, Proposed Practices for Economic Analysis of River Basin Projects: Report to the Federal Inter-Agency River Basin Committee (Washington, D.C., May, 1950), p. 1. (Due to the green cover of the report and its rather unwieldy title, the report is commonly cited as the Green Book.)

One of the basic suggestions of the inter-agency subcommittee pertained to evaluation criteria for maximizing net benefits from resources used in a project. The committee defined net benefits to be at a maximum when the benefits added by the last increment of development were equal to the cost necessary to add that increment to the project. The inter-agency report also provided precise definitions for evaluating the benefits and costs associated with development. The costs of the "inputs" used in development were based on the concept of "alternative use value". That is, the costs of resources used in a project were measured by the benefits which would accure from some alternative employment of these resources. Under conditions of relatively full employment, it was assumed that the market prices of the goods and services used in the project were an appropriate measure of the economic cost. The primary benefits were defined by the committee as the value of an "increase in production, reduction in cost, and the advantageous effects on time or certainty of income or cost accural" due to the project, net of associated costs.[2] Secondary benefits were defined as the increase in net income or other beneficial effect, over and above the value of primary benefits; which result from the project. These secondary benefits were further specified as those stemming from or induced by the project.[3]

There was substantial agreement among the various agencies that the concepts of primary costs and primary benefits were appropriate for use

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[2]Subcommittee on Evaluation Standards of the Federal Inter-Agency Committee on Water Resources, Proposed Practices for Economic Analysis of River Basin Projects: Report to the Inter-Agency Committee on Water Resources (Washington, D.C., May, 1958), p. 9.

[3]Ibid., pp. 8-9.

in the economic evaluation of projects. This agreement did not extend, however, to the evaluation of secondary benefits and costs. The criteria for evaluating secondary benefits have been a subject of controversy among the Federal agencies. The viewpoint of the majority of the agencies is expressed in the revised Green Book as follows:

> Although secondary benefits may be significant in the economic justification of projects from a local or regional point of view or in reimbursement and assessment considerations, . . . from a national public point of view such benefits usually have little significance in project formulation, economic justification, and array.[4]

Using this statement as a guide, the majority of the Federal agencies do not estimate the magnitude of secondary benefits, or include them in economic justification of projects. However, the Bureau of Reclamation dissents from this viewpoint and includes secondary benefits in project evaluation.[5] Although a reconciliation of viewpoints has been attempted, an apparent impasse continues to exist on whether secondary benefits should be included in project justification.

The report of the President's Water Resource Council in 1962 on the standards for evaluating water resource development stimulated all the agencies to develop criteria for estimating secondary benefits.[6] The

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[4] Ibid., p. 4.

[5] The Bureau of Reclamation uses a percentage of primary benefits by commodities, for estimating the "stemming from" secondary effects. The "induced by" effects are based on an average percentage ratio of total primary benefits. For the percentage relationships currently being used see the following publication: United States Department of Interior, Bureau of Reclamation, Series 110 - Project Planning: Part 116 - Economic Investigations (Washington, D.C., July, 1959), Chapter 4, p. 12.

[6] President's Water Resource Council, Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources, Senate Document No. 97, 87th Congress, 2d Session (Washington, D.C., May, 1962).

report indicates that secondary benefits may be relevant in project evaluation and it explicitly recognized differences in these benefits when viewed in national, regional, state, and local contexts. The report further stipulates that the project planning report must include:

> . . . an explanation of the nature of each type of secondary benefit taken into account from either viewpoint and the methods used in computation of each of their values.[7]

However, before the agencies can implement this general policy statement, it is necessary that they develop criteria for defining and measuring the various national, regional, state, and local secondary benefits.

Objectives of Study

The general objectives of this study were to (1) examine the economic criteria for evaluating secondary benefits, (2) develop methods for implementing these criteria in a local area, and (3) develop empirical estimates of the secondary impacts of resource development in one county of Oklahoma. More specifically, the objectives of the study were:

1. To provide a more precise delineation between the various kinds of secondary benefits;
2. To specify the economic criteria for distinguishing between the national and local secondary effects in resource development;
3. To formulate a conceptual model for estimating secondary effects of development to a local area; and,
4. To empirically estimate the magnitude and distribution of secondary effects in a specific Oklahoma county.

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[7]Ibid., p. 7.

Area of Study

The Flood Control Act of 1944, as indicated above, authorized works of improvement in eleven river basins for flood control and soil erosion prevention. One of the river basins authorized for works of improvement was the Washita River in Oklahoma and Texas (Fig. 1). The drainage area of the basin is nearly 6,500 square miles with over 90 per cent of its land area in Oklahoma. There are 915 flood-retarding structures planned for the basin's 48 subwatersheds, of which 524 were either contracted for or completed as of January, 1963.[8] The Soil Conservation Service reports the accumulative benefits from development in the Washita to be in excess of seven million dollars and an estimated annual benefit of nearly four million dollars when construction is completed.[9]

From this relatively large area, one county was chosen for a comprehensive study. The major criteria used in selecting the county were:

1. Availability of primary and secondary data,
2. An agriculturally oriented county with a relatively simple economic structure, and
3. A substantial amount of public investment in water resource development.

On the basis of these criteria, Roger Mills County in west-central Oklahoma was selected for this study. This County supports a population of slightly over five thousand and the total employment is reported as

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[8]United States Department of Agriculture, Soil Conservation Service, Progress Report. Presentation at Annual Meeting of Washita Council, Stillwater, Oklahoma, January 13, 1963 (Mimeo), p. 4.

[9]Ibid., p. 1.

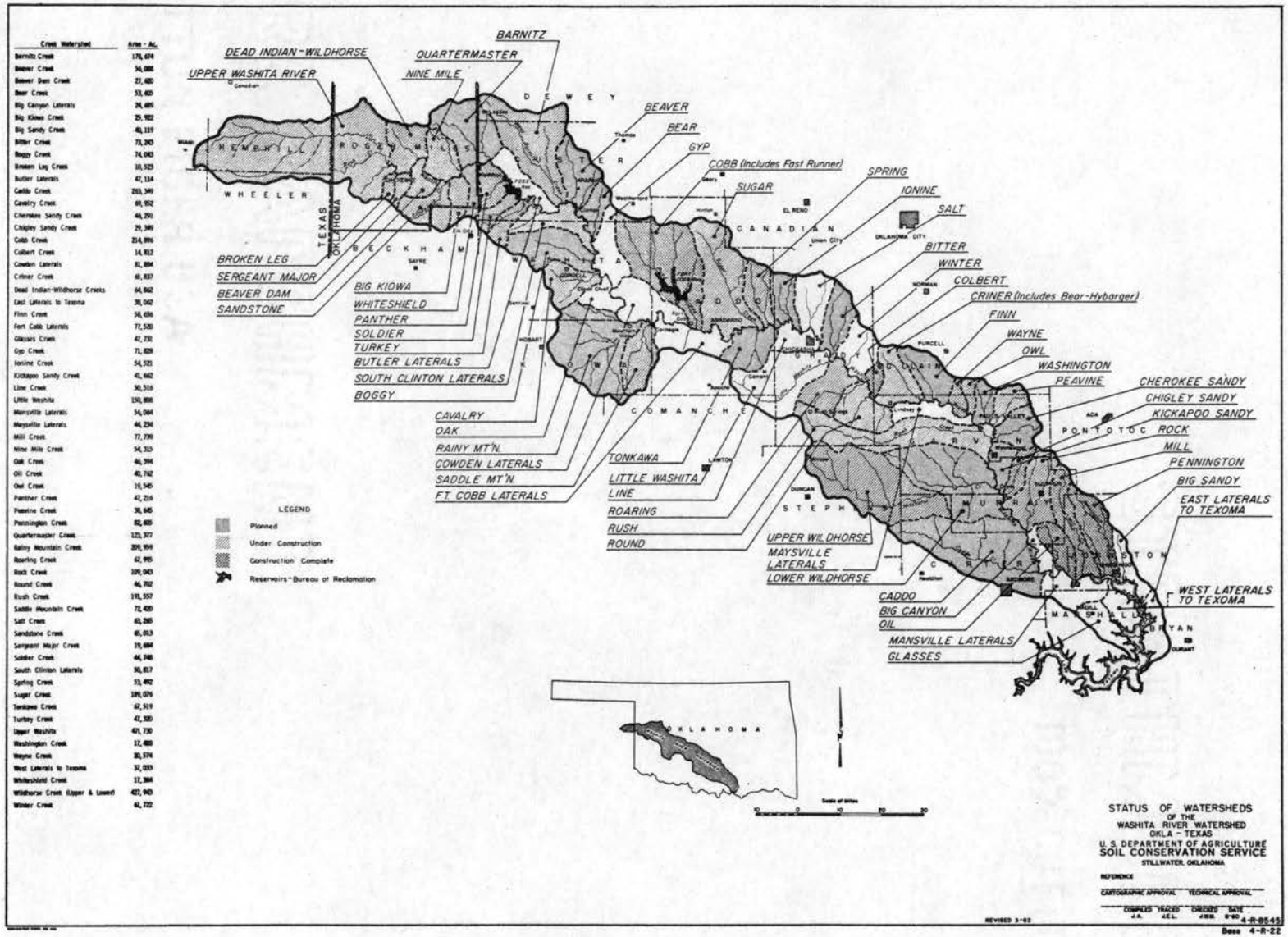

Figure 1. Washita River Watershed, Oklahoma and Texas.

slightly in excess of 2,000. Sixty-two per cent of the employment is in farming.[10]

Nearly 75 per cent of the County's total land area, or 540,000 acres, lies within the Washita Basin, which, for planning purposes, has been divided into 10 subwatersheds. Currently, there are plans for 130 structures in the County. As of January, 1963, 90 of these structures were completed.

Content of Study

The remainder of this thesis is divided into three major parts. The first part will be a survey of the concepts and principles associated with secondary effects of resource development. The views of various economists will be presented. The criteria for the existence of national and local secondary benefits will be specified, evaluated, and contrasted. The second part will be a discussion of a conceptual model and the procedural methods for empirical estimating secondary effects in the local area. The Leontief input-output model, as adapted by Nerlove and Leven, will be intergrated with the payments multiplier formulated by Boulding. The final part of the thesis will contain the empirical result of the study.

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[10]United States Department of Commerce, Bureau of Census, "General Social and Economic Characteristics," Census of Population: 1960, XXXVIII (Washington, D.C., 1960), p. 248.

CHAPTER II

A SURVEY OF CONCEPTS AND PRINCIPLES FOR ANALYZING SECONDARY EFFECTS OF RESOURCE DEVELOPMENT

The purposes of this chapter are to: (1) provide a heuristic survey of the evolution of the concept of secondary benefits, (2) define the various kinds of secondary benefits, (3) examine economic principles and concepts associated with the measurement of national and local secondary effects, and (4) review the literature on previous studies designed to empirically measure the secondary impacts of development in a local area.

Evolution of Concept of Secondary Benefits

The Green Book of May 1950, prepared by an Inter-Agency Subcommittee on Benefits and Costs was the first systematic statement on the principles and procedures for evaluating secondary benefits from resource development. In this report secondary benefits were defined as "The values added by incurring secondary costs in activities stemming from or induced by the project".[1] The report included examples of two conditions of where net national secondary benefits could accrue. The first condition for a positive national secondary benefit was that the market value of the project surplus be greater than the cost of producing an equivalent surplus in the absence of the project. The second condition required an

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[1] Green Book (1950), p. 10.

assumption of underutilization of resources in the absence of the project. In reality, the first condition also was based on the assumption of underemployed resources, because, if all the resources in the economy were employed fully in their highest use, a net project surplus would not occur. Although the subcommittee's position was accepted by the majority of the Federal agencies, there remained fundamental differences in the interpretation and application of these principles. Thus, two years later the subcommittee issued a Revised Statement on Secondary Benefits which was designed to clarify and supplement the earlier report.[2] The revised statement concluded that a favorable benefit-cost ratio was a prerequisite for the existence of national secondary benefits, except when underemployed resources were used in project construction. Thus, this statement retained the conclusion reached in the original report.

The Department of Interior did not accept, in its entirety, the report of the subcommittee. The fundamental disagreement was with respect to evaluation of the alternative uses of the project-required resources, that is, the opportunity cost of using resources for resource development.

A panel of three consultants from outside the Federal Service was engaged by the Department of Interior to supplement the work of the subcommittee. The report of the panel agreed, in the main, with the position taken by the majority of the subcommittee.[3] On the fundamental point of

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[2]Subcommittee on Benefits and Costs of the Federal Inter-Agency River Basin Committee, Revised Statement on Secondary Benefits (Washington, January, 1952).

[3]United States Department of Interior, Bureau of Reclamation, Report of Panel of Consultants on Secondary or Indirect Benefits of Water Use Projects (Washington, June, 1952).

disagreement, the panel concluded that alternative uses for the resources used in the project would arise and that the value of these alternative uses must be considered in the evaluation of the project. The panel indicated that the secondary effects may serve, however, as a basis for repayment contracts with local beneficiaries without regard to the offsetting benefits from alternative uses of the project resources.

The next major policy statement for guiding Federal agencies in the evaluation of secondary benefits was the subcommittee's revision, in 1958, of the original Green Book. The basic principles and concepts in the earlier work were retained and a distinction was made between national and local or regional secondary benefits. From the national viewpoint, the net secondary benefits attributable to the project for purposes of economic justification were the sum of the gross beneficial secondary activities minus the cost of these secondary activities and minus the secondary benefits which would have occurred from other uses of the resources required in the projects.[4] From the local or regional viewpoint, only the cost incurred in secondary activities needs to be subtracted from the gross secondary effects to obtain the net secondary benefit. The report further suggested that the regional or local secondary effects were appropriate for cost sharing determinations and for indicating repayment potentials, but not for the economic justification of projects.[5]

The most current statement of Federal policy, Senate Document 97, defines secondary benefits as any "increase in the value of goods and

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[4] Green Book (1958), p. 8.

[5] Ibid.

services which indirectly result from the project under conditions expected with the project as compared to those without the project".[6] The document also explicitly recognized, as does the revised Green Book, the conceptual difference between national and local secondary benefits.

The sequence of reports and statements regarding secondary benefits were consistent in basic concepts and principles. That is, the reports following the original Green Book have contained refinements rather than changes in the basic concepts. Thus a framework for evaluating secondary benefits has been developed by the Federal agencies. However, more precise definitions and improvements in procedural techniques are needed for applying these concepts in project evaluation.

Definition of Secondary Benefits

The controversy over secondary benefits has, to some extent, been due to the lack of an operational definition. The definition of secondary benefits as "the increase in net incomes or other beneficial effects as a result of the project" would permit including such diverse effects as preserving the democratic way of life to increasing an area's economic potential for future development as secondary benefits.[7] The confusion caused by the lack of a precise definition is readily apparent in the literature when terms such as secondary, indirect, extra-market, aesthetic, induced, triggered, and extended are used in various publications to indicate the "secondary benefits" of resource development. More explicit definitions are needed for the various types of secondary effects.

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[6] President's Water Resource Council, p. 9.

[7] The quoted phrase is from the revised Green Book, p. 9.

Kneese[8] suggests there are at least three types of secondary benefits as follows: (1) secondary benefits due to external economies, (2) dynamic secondary effects, and (3) the "customary" variety associated with those effects stemming from and induced by the project.[9]

The concept of external scale economies as related to resource development is based on the technical interrelationships existing among production units within an economy.[10] Specifically, an increase in the use of one resource (or combination of resources) may lower the cost or increase the production possibilities from other resources. For example, a surface water irrigation project may recharge the underground acquifers in the vicinity or pollution abatement may result from a navigation project.[11]

McKean discusses the possibility of negative secondary effects, or external diseconomies, in terms of changes in proximity of inputs and outputs.[12] He considers the plight of the blacksmith who is located near an arable area which has been inundated by a reservoir. The blacksmith can produce the same output with a given set of inputs except that his

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[8]A. V. Kneese, Water Resource: Development and Use (Kansas City, December, 1959), pp. 25-28.

[9]Another class of benefits resulting indirectly from the project are the intangible benefits which cannot be measured in monetary terms. These effects include such items as preservation of aesthetic, historical or cultural points of interest, or the value placed on the preservation of the private enterprise system of government. No effort was made in this study to identify these kinds of effects.

[10]For additional discussion of the concept of external economies see R. McKean, Efficiency in Government Through Systems Analysis (New York, 1958), pp. 134-50.

[11]Kneese, p. 26.

[12]McKean, p. 144.

services are now in the wrong location--thus a negative secondary effect.[13] Therefore, the magnitude of the benefit based on the external economies concept could vary substantially among projects and they could be either positive, negative, or zero for any specific project.[14]

The second type of secondary benefits in Kneese's classification, the dynamic secondary effects, are based on the assumption that the project will stimulate the development of more skilled labor and increase efficiency by introducing more advanced techniques and more capital.[15] This concept usually has been applied to economic development in underdeveloped countries, but it may have some relevance for less developed areas in the United States. Conceptually, dynamic secondary benefits are closely related to those based on the concept of external economies. For example, an increase in the number of skilled construction workers which might result from the development of a project would provide a more efficient labor force to other contractors in the area. Thus, this effect could also be considered within the framework of external economies.

The third type of secondary benefits in Kneese's classification, which also is the concept of secondary benefits presented in the

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[13] McKean, p. 134, stresses the point that these external effects must be uncompensated; if payment is made, these effects should be incorporated into the usual benefit-cost framework.

[14] For another concept of external economies see J. Margolis, "Secondary Benefits, External Economies and The Justification of Public Investment," Review of Economics and Statistics, XXXIX (1957), pp. 284-92. Margolis' concept of external economies is related to the more efficient use of existing facilities. The efficient use of schools, roads and other public facilities may help "justify" development in sparsely populated areas in the West.

[15] Kneese, p. 27.

Green Book, arise from the enhanced flow of goods and services into the general economy. The stemming from benefits result from increased supplies of goods to be worked on by the processing industries and from the increased amount of goods available to the ultimate consumer. Benefits induced by the project are defined as those that arise from added purchases as a result of the project. These added purchases result in increased profits by local business concerns who in turn pass their demands for goods back to the general economy. Thus, the total value of the benefits induced by the project is the sum total of the added profits and employments made available by virtue of this increased buying by people in the project area.[16]

The stemming from and induced by benefits accruing in a local area will provide the focal point for this study. Both these types of effects are measurable in terms of net income changes to people in the local area. Conceptually, there is no useful purpose to be served by a separation of changes in income to local residents, other than the direct beneficiaries, into induced by and stemming from effects. The kind of local secondary effect does not matter. What matters is who benefits, and by how much. A more useful classification of secondary effects from the standpoint of determining how local secondary income is distributed would relate to a classification of local economic units into as many types as can be handled operationally in a study. Such a procedure was adopted for this study.

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[16] M. M. Kelso, "Evaluation of Secondary Benefits of Water-Use Projects" (paper presented to Western Regional Committee on Research in Economics of Water Development, Berkeley, California, March, 1953).

Relevance of National Secondary Benefits to Resource Development

The basic criterion for evaluating a water resource development project from the national viewpoint is the contribution it makes in increasing national welfare. Thus, one should consider the dual criterion of economic efficiency and redistribution of income. The following analysis emphasizes the single criterion of economic efficiency, but it recognizes that considerations of redistribution of income may modify the use of the efficiency criterion.

Economic Efficiency

Economic efficiency has been defined as a situation in which resources are so allocated among alternative uses that any reallocation of resources cannot improve any individuals position and still leave other individuals as well off as before.[17] This concept of economic efficiency is interpreted broadly to encompass considerations of degree of employment of resources; that is, whether the resources in the economy are fully employed, or whether there exists unemployed or underemployed resources.

First, assume a national economy where resources are fully employed in their highest use and the single decision criterion is economic efficiency. There are probably no positive national secondary benefits under these assumptions.[18] Rather there is a high degree of probability that

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[17] J. Krutilla and O. Eckstein, Multiple Purpose River Development (Baltimore, 1958), p. 16.

[18] Under this restrictive assumption, it should be recognized there also would be no national primary benefits from resource development.

national secondary benefits under these assumptions would be negative. That is, an increase in efficiency by the projects is a necessary condition for occurrence of positive national secondary benefits, and, if projects cannot increase efficiency in resource use, they likely would decrease it. Thus, at least one of the following three conditions must be met to provide for a positive national secondary effect when the economic efficiency criterion is assumed: (1) employed resources are shifted from less to more productive use, (2) employed resources are employed closer to optimum capacity, and (3) unemployed resources may be employed as a result of the project.[19] However, the existence of one or more of these conditions is not sufficient for the occurrence of positive national secondary benefits from resource development projects.

Ciriacy-Wantrup argues that there is unused capacity in a "full-employment economy" because of differential growth rates.[20] Further, he states that these underemployed resources generally are concentrated in certain regions, and thus some projects may be more effective than others. The relevant economic question, therefore, is which of the various alternatives available for investing public funds provides the greatest net benefit to the national economy.

Folz contends that although all autonomous investments have secondary effects, the potential for realization of these secondary impacts are highest when a project emphasizes primary industries and is undertaken

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[19] Kelso, p. 7.

[20] S. V. Ciriacy-Wantrup, "The Role of Benefit-Cost Analysis in Public Resource Development," Water Resources and Economic Development of the West, Report No. 3 of the Western Agricultural Economics Research Council (Berkeley, California, 1954), pp. 17-28.

in a relatively underdeveloped area.[21] He suggests, for example, that the building of a railroad in an underdeveloped region would stimulate more secondary impacts than the same development in a "mature" economy. Folz's approach is primarily based on historical observation and tends to favor the reclamation type of development.

Ciriacy-Wantrup disagrees with Folz's position that the secondary effects from autonomous investment is greater in underdeveloped regions.[22] He suggests that the secondary effects would be higher when autonomous investment is directed into an economy's secondary and tertiary industries rather than into the primary industries. The basis for his position is that both the per-capita income and the propensity to consume is greater for the urban factory worker than for the rural population. Additionally, the employment opportunities associated with secondary industries probably increase faster and remain higher than in a primary industry such as agriculture.

Ciriacy-Wantrup's position is more consistent with economic principles than Folz's historical generalizations. The acceptance of Ciriacy-Wantrup's position requires, however, that a corallary position be accepted--there are rarely any national secondary benefits to resource development directly effecting primary industries in an expanding economy.

When there are unemployed resources in the economy, resource development projects may have important national secondary effects. However,

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[21]W. Folz, "The Economics of Water Resources Development: A Theoretical Analysis," Water Resources and Economic Development of the West, Report No. 0 of the Western Agricultural Economics Research Council (Ogden, Utah, 1951), pp. 25-55.

[22]Ciriacy-Wantrup, p. 64.

in measuring benefits from the utilization of unemployed or underemployed resources, one should recognize the possibility of double counting the benefits. The unemployed status of productive inputs is reflected in the market price at which they are available to the project and thus are accounted for in determining primary costs. If these same effects are considered as secondary benefits, the impact of employing these resources are counted twice. For example, the redevelopment benefits calculated for underemployed labor in the areas designated under the Area Redevelopment Act should not also be counted as secondary benefits. Ciriacy-Wantrup suggests that the most logical approach for evaluating the beneficial effects of using unemployed resources is through a reduction in primary cost rather than as a secondary benefit.[23] However, the employment of underutilized resources will tend to cause a net increase in the demand for additional goods and services, which, in turn, further reduces unemployment or underemployment of resources. This would be the familiar Keynesian multiplier effect.

Redistributional Constraints

To this point, the single criterion of economic efficiency has been used. Some economists believe that economic efficiency is an inadequate criterion for evaluating resource development projects. Maas et al suggest that a measure of national welfare is not limited to the size of the "economic pie" but also includes the division of the pie and the method by which it is sliced.[24] Garnsey argues that the economic

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[23]Ciriacy-Wantrup, p. 26.

[24]A. Maas et al., Design of Water Resource Systems (Cambridge, 1962), p. 18.

efficiency criterion is not valid because it neglects the redistribution effects of a shift in the allocation of resources from a given point to a "more efficient point".[25] Thus, he implies that different income distributions are valued differently. The fact that some income distributions may be preferable to others does not invalidate the efficiency criterion. Rather it presents the problem of reconciling two conflicting goals. It is recognized, therefore, that it may be necessary to place some restraint on the efficiency criterion in order to attain a "desirable" level of income distribution.

The major redistributional consequences of development is the reallocation of income among economic sectors and geographical areas. An understanding of the economic significance of this reallocation of income among local and regional economies is required in order that policy makers may have a more rational basis for making decisions. The basis for the existence of local secondary benefits mainly arises from the geographical redistributional effects created thereby. Further discussion of these effects is contained in the following section.

Relevance of Local Secondary Benefits to Resource Development

Although national secondary benefits usually are of little significance in evaluating the economic feasibility of resource development, they are significant to the local areas where the projects are constructed. With regard to the factors of production, the major difference

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[25] M. Garnsey, "Welfare Economics and Resource Development," Land and Water: Planning for Economic Growth (Boulder, Colorado, 1962), p. 193.

between national and local secondary effects is that it is unnecessary to subtract the alternative income opportunities available to the resources when assuming the local viewpoint. The creation of an increased demand for resources in a western reclamation project which displaces similar opportunities elsewhere is irrelevant if the evaluation criterion is limited to the economic impacts within the local community.

Regions are competitive in production of commodities for national markets, and if national demand remains unchanged, an increase in production in the project area is offset by a decrease in price or a decrease in output, or both, in regions not being developed. The fact that these effects occur in other areas is not considered when the unit of analysis is the local area. Thus the local secondary benefits associated with resource development generally are due to the redistribution of income in favor of the project area rather than an increase in national income. This, in particular, likely would be the case for resource development projects where the major purpose is to increase farm output in a local area.[26]

The local secondary benefits are widely dispersed among sectors and individuals within the local economy, and from the standpoint of

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[26]A recent study by Tolley provides empirical estimates of the geographical shifts in production caused by resource development. The basic premise of his analysis was that "agricultural production on a new reclamation project almost inevitably means that there is going to be less production somewhere else." He derives quantitative measurements of these shifts through the use of an acreage change matrix and concludes that western reclamation has displaced about $480 million worth of agricultural production in the South. For an excellent analysis of these distributional relationships see G. S. Tolley, "Impact of Public Resource Development on Agricultural Production and Income," Agricultural Economics and Rural Sociology Section, Proceedings of Association of Southern Agricultural Workers Convention held at Memphis, Tennessee, February, 1959.

allocating the cost of development among local residents, it appears important to identify these beneficiaries, as well as those who receive primary benefits. Also, it is as relevant to estimate the secondary effect as it is the primary, if the unit of analysis is a local area.

Review of Literature on Local Secondary Benefits

There is a dearth of literature pertaining to concepts and techniques for estimating local secondary effects. The various Federal policy statements present some general guidelines, but they fail to develop fully the concepts as they relate to a local economy. The Bureau of Reclamation uses local secondary benefits in project justification and, therefore, this agency has been especially interested in developing procedures for measuring such benefits.

A 1947 study by Marts, a resource economist for the Bureau of Reclamation, was designed "to measure the relationship between the direct and indirect benefits within a local trade area dependent on irrigation agriculture".[27] In this study, direct benefits were comprised of (1) net income to farm operators, (2) government payments to farmers, and (3) farm wages. The indirect benefits included all net nonfarm income, including (1) net entrepreneurial income, (2) labor income, and (3) property income. Then, assuming all income derived within the area was attributable to irrigation, a simple percentage ratio of direct to indirect income was computed. The result indicated that indirect income was 1.27 times the direct income, or a local economic multiplier of 2.27.

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[27] M. E. Marts, "Use of Indirect Benefit Analysis in Establishing Repayment Responsibility for Irrigation Projects," Economic Geography, XXXII (1956), p. 134.

Marts emphasized that the major share of indirect benefits accrue locally, but the major portion of the indirect costs are national. Thus, the indirect benefit factors "can be used only with many reservations, if at all, for justifying national investment" in resource development.[28]

A study by Holje, and others, which was financed by the Bureau of Reclamation, also attempted to measure the indirect benefits of irrigation development within a local area.[29] The ratio technique as used by Marts was retained, but the emphasis was shifted from the income approach to the relationship between the number of farm to nonfarm workers. The report concludes that a ratio of 1:00 farm worker to every 1.3 to 1.4 nonfarm worker would be a "satisfactory benchmark". The increase in agriculture employment resulting from development is then used as a basis for computing nonfarm (indirect) employment.[30]

A new approach to the problem of measuring secondary benefit has been developed by Back.[31] The conceptual basis of his formulation was a payments matrix, adapted from earlier work by Boulding, to measure the economic interrelationships among the various sectors in a local economy.[32]

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[28]Ibid., p. 137.

[29]H. Holje et al., Indirect Benefits of Irrigation Development, Montana Agriculture Experiment Station Technical Bulletin No. 517 (Bozeman, 1956).

[30]The same ratio was used in a recent study in New Mexico to estimate indirect effects of development. See N. Wollman et al., The Value of Water in Alternative Uses (Alburquerque, 1962), p. 156.

[31]W. B. Back, "Economics of Development and Use of Water in Local Areas," Agricultural Economics and Rural Sociology Section, Proceedings of Association of Southern Agricultural Workers Annual Meeting held at Jackson, Mississippi, February, 1961.

[32]For a discussion of Boulding's theory of payments, see the next chapter, pages 28-33.

These interrelationships then were used to compute a series of gross multipliers expressing quantitative measures of local secondary impacts of development.

The approach suggested by Back was the general framework for this study. Other techniques in regional analysis were added in order to estimate the net local secondary effects of watershed development.

CHAPTER III

CONCEPTS, EMPIRICAL MODELS AND PROCEDURES

An analysis of local secondary effects of resource development requires measurement of the interdependent relations among the various sectors of a local economy and the economic transactions of these sectors with nonlocal units. A familiar economic concept, the multiplier, provides an appropriate general framework for conducting this type of investigation. There are, however, different ways of expressing the multiplier effects of an initial increase in income. The main purposes of this study are to formulate a local multiplier suitable to the purposes of this study and to present the methods used in estimating it. The chapter also contains the empirical procedures used in obtaining the data for the analysis.

Concept of Multipliers

Kahn-Keynesian Multipliers

The concept of a multiplier was first introduced by Kahn in 1931.[1] In general, the premise of his analysis was that, given the propensity to consume, one could estimate the quantitative relationship between primary employment and total employment. That is, an estimate could be

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[1] R. F. Kahn, "The Relation of Home Investment to Unemployment," Economic Journal, XLI (1931), pp. 173-198.

obtained on how much secondary employment would be created by increased employment in public works. He postulated that an increase in construction employment and in goods and services entering the construction sector would increase the demand for consumer goods and thereby cause an increase in secondary employment. Kahn placed emphasis on leakages in the economic system to explain why this process did not continue until full employment was attained. That is, a portion of the income is not spent and therefore is lost to the income stream.[2]

Keynes used the concepts formulated by Kahn, but he placed the emphasis on the relationship between an increment in investment and a corresponding increase in income.[3] Thus, the Keynes formulation produced an investment multiplier whereas the one developed by Kahn was an employment multiplier.[4]

The basic premise in the Keynesian multiplier analysis was the

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[2]Hansen believes that ". . . the most important of these leakages are the following: (1) a part of the increment of income is used to pay off debts; (2) a part is saved in the form of idle bank deposits; (3) a part is invested in securities purchased from others, who in turn fail to spend the proceeds; (4) a part is spent on imports, which does not help home employment; (5) a part of the purchases is supplied by excess stock of consumers' goods which may not be replaced," A. L. Hansen, A Guide to Keynes (New York, 1953), pp. 89-90.

[3]J. M. Keynes, The General Theory of Employment, Interest and Money (London, 1936), p. 115.

[4]For simplification of presentation, Keynes assumed that his multiplier was of the same magnitude as the one formulated by Kahn. He recognized, however, that the two approaches may provide different results. He stated that ". . . there is no necessary presumption that the shapes of the relevant portions of the aggregate supply function for different types of industry are such that the ratio of the increment of employment in the one set of industries to the increment of demand which has stimulated it will be the same as in the other set of industries" (Keynes, p. 115). He also provided an algebraic proof to show the two multiplier concepts were the same only when the elasticities of employment in industry as a whole was equal to that in the investment industries (Keynes, p. 116).

existence of a stable consumption function and a corresponding marginal propensity to consume.[5] That is, as the ". . . income of a community increases or decreases, its consumption will increase or decrease but not so fast. . . ."[6] The crux of the problem in the Keynesian analysis was the need to determine the magnitude of marginal propensity to consume, and therefore Keynes spent a considerable amount of time examining the "objective" and "subjective" factors affecting the relationship between consumption and income.[7] Given this relationship, the investment multiplier was defined as the reciprocal of one minus the marginal propensity to consume, or the reciprocal of the marginal propensity to save. Thus, Keynes provided a framework for obtaining an empirical measure of the relationships existing among consumption, investment and real income.

Boulding's Payments Multiplier

Boulding questions the assumed stable relation between real income and consumption in the Keynesian analysis. He suggests that the size and composition of the capital stock may be a more important determinant of the consumption than real income.[8] To support this thesis, Boulding formulated a "theory of payments" as an alternative method of measuring the total impact on the economy of an initial injection into the income

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[5]The significance of the marginal propensity to consume was recognized by Kahn, but developed in much greater detail by Keynes.

[6]Keynes, p. 114.

[7]For a lucid discussion of these factors see G. Ackley, Macroeconomic Theory (New York, 1961), pp. 267-307.

[8]K. E. Boulding, A Reconstruction of Economics (New York, 1950), pp. 206-42.

stream.[9] Within this framework, a payment is defined as a transfer of money from one person or account to another in exchange for an asset, and a payments table is developed for showing the movement of these payments among various persons or sectors. One other concept, the velocity of the circulation of money, is stated to be the ratio of the total volume of payments, within a specified accounting period, to the total stock of money. For example, if the velocity of circulation is seven times a year, then an increase in the stock of money by $100 will eventually increase the total volume of payments in the economy by $700.[10]

Boulding concludes his theory of payments by defining a payments multiplier as an expression of the ratio of "first round" expenditures to the total expansion in payments.

The Kahn-Keynesian and the Boulding multipliers represent two distinct approaches to measuring economic relationships. The basic determinant in the Kahn-Keynesian multiplier is the marginal propensity to consume and is essentially a "real" concept even though it is expressed in monetary terms. Conversely, Boulding's formulation is based on the concept of average propensity to spend as reflected by money flows associated with the inter-sectoral expenditure patterns.[11] Thus,

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[9]Boulding, p. 233, indicates that Keynes' investment multiplier is a useful concept even if a precise relationship between consumption and real income does not exist.

[10]Boulding, pp. 214-26, includes examples of the movement to a new equilibrium associated with various velocities of circulation.

[11]Boulding, pp. 227-28, explicitly states that his multiplier is based on the "marginal propensity to spend", but suggests that if one assumes the velocity of circulation is constant then it is equivalent to an "average multiplier". Although the marginal approach would be more realistic, its implementation would require substantially more empirical data and a complex procedure for estimation.

Boulding's approach includes all payments associated with the transfer of assets among sectors in the economy whereas the Kahn-Keynesian system is more closely related to the measurement of value added by the various sectors. In general, the Kahn-Keynesian multiplier is a net multiplier derived from changes in real income, whereas Boulding's is a gross multiplier.

Local Multipliers

The Kahn-Keynesian and Boulding multipliers apply to aggregate economic relations in an economy. However, the purpose of this study is to measure the local impacts of development. Thus, it is necessary to adopt the conceptual framework of these multiplier to obtain a multiplier relevant to a local economy (Figure 2).

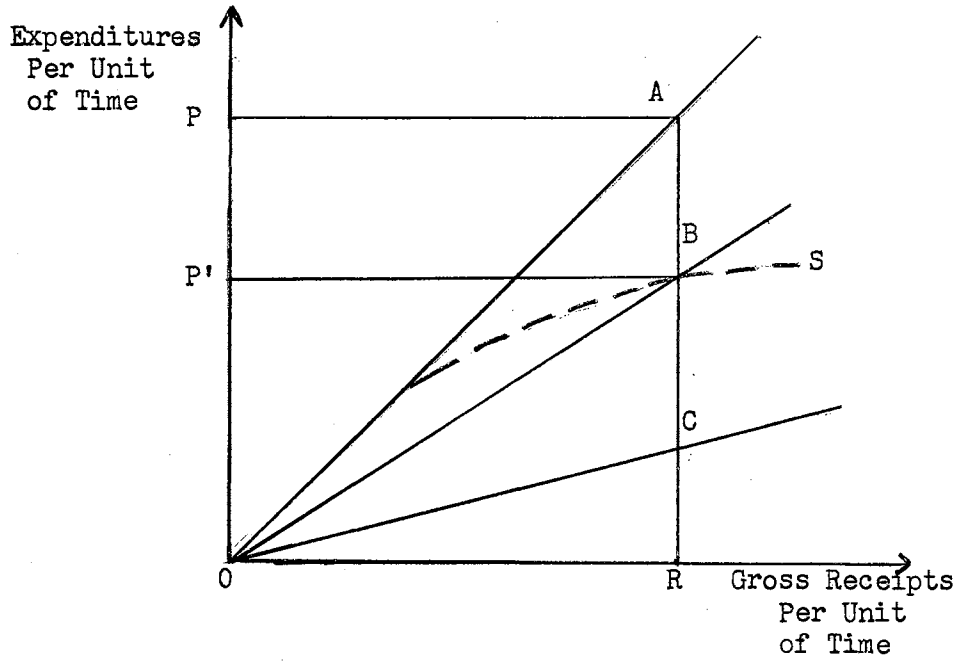

Figure 2. Graphical Illustration of Relations Between Expenditures and Receipts--National and Local.

The first step in the process of defining a local multiplier is to express more explicitly the meaning of one of the national multipliers. Boulding's payments multiplier is selected for this purpose. In Figure 2, the 45 degree line OA indicates a one to one relationship between gross receipts and expenditures--thus OR is equal to OP. In reality, the expenditures are a definite portion (RB) of gross receipts (OR). This relationship is determined by a spending function (OBS), the slope of which measures the marginal propensity to spend.[12] However, the average rather than the marginal propensity to spend is used in this study. This relation is expressed by the ratio RB/RA. If (RB) is 0.8 of (RA), then an increase in gross receipts of $10 will result in an increase in expenditures of $8. By defining (m) as the payments multiplier, (k) as the average propensity to spend (=RB/RA), and (e) as an initial increase in expenditures, then:

$$(1) \quad me = e + ke + k^2e + k^3e + \ldots + k^ne, \text{ and}$$

$$(2) \quad m = \frac{1}{1-k}$$

If one assumes an initial expenditure (e) of $100, and an average propensity to spend (k) of 0.8, then the payments multiplier (m) is 5 and the resulting total payments in the economy would be $500.

The next step is to express the relation between local and national payment multipliers. Local payments are some fraction of total payments by residents of a local area because some of their payments are nonlocal. If we assume total spending by people of a particular local area is

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[12]The relationship between (RA) and (RB) is determined by such factors as the amount of savings and unilateral transfers which do not re-enter the income stream. They are somewhat analogous to the leakages in the Keynesian analysis.

typical for the nation--that is, the average propensity to spend (k) is the same as that for the nation--then Figure 2 may be used to demonstrate the relation between a national and local payments multiplier. It now is assumed that OR is total gross receipts to people of a local area (=RA), and that RB is total expenditure by these people. Let the local expenditures be RC and the nonlocal expenditures be CB (the remainder of RB). Then, the average propensity to spend locally is RC/RA, which is some fraction of (k). If this propensity to spend is (k'), then the local payments multiplier (m') is:

$$(3) \quad m' = \frac{1}{1-k'}$$

and the difference between the national (m) and the local (m') payments multipliers would be accounted for by nonlocal expenditures.

Local economies will differ in the relation of local to nonlocal expenditures by residents therein, thus their multipliers will differ. The distance between B and C (Fig. 2) depicts trading relationships existing between the local economy and the "rest of the world". These trading relationships, in turn, are based on the diversity and amount of concentration of economic activity in a local area. It should also be recognized that the difference between (k') and (k) is, in Keynesian terminology, a leakage to the income stream. However, it is only a leakage to the local area and not to the economy as a whole.[13] That is, a

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[13]The relation of (k) to (k') is somewhat akin to the basic-service ratio concept associated with early attempts to estimate regional export multipliers. The basic determinant of these export multipliers was the relationship between employment in the area's export activities and employment which produced goods and services used locally. The export multiplier technique fails to consider the effect of interaction among the various sectors. By way of contrast, these interactions provide the focal point for the local multipliers formulated for this study. For a discussion of the regional export multiplier, see W. Isard and Associates, Methods of Regional Analysis (New York, 1960), pp. 189-205.

local economy's expenditures outside its boundaries are receipts to other local economies, and, as such, they provide the basis for a system of interregional multipliers. Within a local economy, individuals differ in the relation of their local and nonlocal expenditures. Thus, the local multiplier effect of an increase in receipts will depend upon who gets the initial increase in receipts. Another needed adaptation of the theory of payments developed by Boulding, therefore, is the introduction of a conceptual and empirically operational scheme for estimating (k') for the individual sectors of the local economy. This adaptation is facilitated by methods in regional analysis emphasizing interindustry relations.

In all of the multiplier concepts which have been considered (the Kahn-Keynesian, the Boulding, and the local multiplier), a central theme has been that one of the major determinants of the multiplier is the interdependent relations among the various sectors in the economy. An empirical expression of these interdependent relations can best be obtained through the use of an interindustry model. The use of interindustry approach also permits empirical estimates of the multiplier effects for each sector in the economy (local or national), whereas the other multipliers apply only to an aggregate of the sectors. The conceptual framework for this study is an integration of payments multipliers and interindustry relations as adapted to a local area. An expression of the nature of this integration requires a discussion of interindustry models in general and the model adopted for this study in particular.

Interindustry Models and Procedures

Interindustry economic analysis, in a broad sense, includes any empirical study accounting for the interdependence among the productive units of an economy. Quesnay, in his Tableau Economique, generally is considered the originator of the concept of inter-sectoral flows in the economy. However, Walras is credited with supplying the inspiration for much of the work currently being done in this field.[14] The Walrasian model contains equations specifying consumer income and expenditures, production cost, and demand and supply of both the commodities produced and the factors used in their production. A major criticism of the Walrasian approach is that it is too abstract to provide needed insights about economic reality. Walras' objective was to formulate a theoretical structure to show the general functional relationships among the infinite number of products and factors existing in the economy.[15]

The first empirical interindustry model was formulated by Leontief. His objective was to provide a procedure for empirically estimating the interrelationships among the various sectors in the national economy.[16] Beginning with the general equilibrium concept of Walras, he transformed it from an abstract theory to one of practical significance for which statistical data were obtainable. There were essentially two steps in this transformation. First, he aggregated the myriad of commodities

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[14] H. E. Chenery and P. G. Clark, Interindustry Economics (New York, 1959), p. 2.

[15] R. Dorfman, "The Nature and Significance of Input-Output," The Review of Economics and Statistics, XXXVI (1954), pp. 121-22.

[16] W. W. Leontief, The Structure of the American Economy, 1919-1939 (New York, 1951), p. 3.

specified in the Walrasian system into composite "outputs" representing the output of a specific sector of the economy. Second, he dropped the supply equations for unproduced raw materials and the demand equations for final consumption. In their place, he inserted production equations which relate the level of output in each sector with the level of production in the other sectors of the economy.[17] The end result of Leontief's reformulation is a set of linear equations connecting the level of economic activity in the various sectors of the economy.[18] This set of equations make up the input-output table which represents the basic interrelationships among the various sectors in the economy.[19]

The first step in constructing an input-output table is the development of a transaction matrix showing the intersectoral flow of goods and services. Each sector is represented by both a column and a row in the matrix. The rows account for the allocation of the output of each sector whereas the columns show the inputs used by that sector. Since each sector represents both a producer and a consumer, the number of rows equal the number of columns and the sum of the row and column for a specific sector are equal. Thus the transaction matrix provides a "double entry" accounting system and serves as a superstructure for a systematic classification of the data. This dual system of accounting also provides a systematic framework for evaluating the adequacy of the data available in relation to that required by the model.

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[17]Dorfman, p. 122.

[18]Although Leontief employs linear equations, Chenery and Clark, p. 34, indicate that the assumption of linearity is a matter of convenience. The only assumption necessary is that inputs purchased by each sector are a function of the level of output in that sector.

[19]A presentation of the mathematical formulation of these equations is shown in Appendix A.

Input-Output vs. From-To Approach

In the general Leontief input-output approach, the inter-sectoral flows shown in the transaction matrix indicate how the output of each sector in an economy is allocated to each other sector as an input or for final use. Thus physical units of outputs and inputs could be used, but, for operation reasons, the physical measurements are converted to monetary units.[20] For example, a relationship between two sectors might measure the output of fertilizer in one sector as a ratio of its use as an input for the production of corn in another sector. The empirical measurement of this ratio is based on a physical production function relating inputs of fertilizer to the output of corn.[21] Thus, although the measurement of the inputs and outputs are in monetary units, the basic relationships in an input-output model are physical.

Leven questions the appropriateness of using physical relationships for economies highly dependent upon foreign trade.[22] In a small, regional type of economy, many of the production inputs are imported, thus eliminating the relevance of the internal physical relationships among sectors. In place of the physical relationships, Leven suggests the use of a "from-to" approach where the inter-sector flows are based on trading relationships. Leven indicates the difference in these two concepts as

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[20]W. E. Martin and H. O. Carter, "Problems and Application of a California Interindustry Model," Proceedings, Western Farm Economic Association, Proceedings of Annual Meeting of Western Farm Economics Association held at Stanford, California, August, 1960, p. 128.

[21]Dorfman, p. 123.

[22]C. Leven, "Regional Income and Product Accounts: Construction and Application," Design of Regional Accounts, Ed. W. Hockwald (Baltimore, 1961), pp. 169-80.

follows: ". . . input-output focuses primarily on the stability of the technological coefficients, while from-to focuses primarily on the stability of the trade coefficients."[23] It should be noted, however, that this is only a change in the type of relationship examined. The general procedural techniques of the input-output model are retained. In deciding which of the two concepts to employ, Leven indicates the from-to approach would be preferable if the trade with the "rest of the world" is greater than half of the region's total production.[24] Roger Mills County fits this criterion, thus physical input-output relations were excluded from this study.

Payments Matrix

The receipt and expenditure patterns derived from the trading relationships in the from-to approach provide the basic data for a payments matrix. This matrix, the counterpart to the transaction matrix in the input-output formulation, shows the money flows associated with the trading which occurs among the sectors in the economy. This system of money flows is also the basis of Boulding's payments table; thus, one linkage point has been established for integrating the two approaches.

In a payments matrix the rows indicate receipts of each sector from all other sectors, and the columns indicate the expenditures of each sector to all other sectors (Table I). For example, sector A buys aa dollars of goods and services from other firms in the same sector, ba amounts of goods from sector B, . . ., na dollars worth of imported

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[23]Ibid., p. 170-71.

[24]Ibid., p. 171.

goods, and has a total expenditure of Ea. Similiarly, sector A obtains receipts of aa, ab . . . an for a total of Ra. Thus the payments matrix provides for a complete accounting of the trading which occurs among the various sectors.

TABLE I

PAYMENTS MATRIX FOR A LOCAL ECONOMY

From \ To		Local Sectors A	B	C	D	Non Local N	Total Receipts
Local Sectors	A	aa	ab	ac	ad	an	Ra
	B	ba	bb	bc	bd	an	Rb
	C	ca	cb	cc	cd	cn	Rc
	D	da	dd	dc	dd	dn	Rd
Nonlocal	N	na	nb	nc	nd	--	Rn
Total Expenditures		Ea	Eb	Ec	Ed	En	T

From-To Matrix

The payments matrix serves as a descriptive statement of the relationships within an economy, but it is insufficient for obtaining the measurements of interindustry relations needed for estimating local multiplier effects of resource development. As a first step in remedying this deficiency, the data from the payments matrix are transferred to a from-to matrix. The basic design of this matrix is shown in Table II. In this matrix, the payments (receipts and expenditures) in the economy are divided into four classes and placed into the four quadrants in

TABLE II

FORMAT FOR FROM-TO MATRIX

From \ To	Local Intermediate Users A - - - j - - - H	Local Receipts for Int. Inputs	Household (Consumption) K	Local Govt. L	Exports N	Receipts to Final Use	Total Receipts
	Quadrant II		Quadrant I				
A	X_{aa} - - X_{aj} - - X_{ah}	$\sum_{j=A}^{H} X_{aj}$	Y_{ak}	Y_{al}	Y_{an}	$\sum_{j=K}^{N} Y_{aj}$	$\sum_{j=A}^{H} X_{aj} + \sum_{j=K}^{N} Y_{aj}$
i	X_{ia} - - X_{ij} - - X_{ih}	$\sum_{j=A}^{H} X_{ij}$	Y_{ik}	Y_{il}	Y_{in}	$\sum_{j=K}^{N} Y_{ij}$	$\sum_{j=A}^{H} X_{ij} + \sum_{j=K}^{N} Y_{ij}$
H	X_{ha} - - X_{hj} - - X_{hh}	$\sum_{j=A}^{H} X_{hj}$	Y_{hk}	Y_{hl}	Y_{hn}	$\sum_{j=K}^{N} Y_{hj}$	$\sum_{j=A}^{H} X_{hj} + \sum_{j=K}^{N} Y_{hj}$
Total Expenditures for Int. Inputs	$\sum_{i=A}^{H} X_{ia}$ $\sum_{i=A}^{H} X_{ij}$ $\sum_{i=A}^{H} X_{ih}$	$\sum_{i=A}^{H}\sum_{j=A}^{H} X_{ij}$	$\sum_{i=A}^{H} Y_{ik}$	$\sum_{i=A}^{H} Y_{il}$	$\sum_{i=A}^{H} Y_{in}$	$\sum_{i=A}^{H}\sum_{j=K}^{N} Y_{ij}$	$\sum_{i=A}^{H}\sum_{j=A}^{H} X_{ij} + \sum_{i=A}^{H}\sum_{j=K}^{N} Y_{ij}$
	Quadrant III		Quadrant IV				
Households (labor) K	X_{ka} - - X_{kj} - - X_{kh}	$\sum_{j=A}^{H} X_{kj}$	Y_{kk}	Y_{kl}	Y_{kn}	$\sum_{j=K}^{N} Y_{kj}$	$\sum_{j=A}^{H} X_{kj} + \sum_{j=K}^{N} Y_{kj}$
Local Govt. L							
Imputed Returns M							
Imports N	X_{na} - - X_{nj} - - X_{nh}	$\sum_{j=A}^{H} X_{nj}$	Y_{nk}	Y_{nl}	Y_{nn}	$\sum_{j=K}^{N} Y_{nj}$	$\sum_{j=A}^{H} X_{nj} + \sum_{j=K}^{N} Y_{nj}$
Total Primary Inputs	$\sum_{i=K}^{N} X_{ia}$ $\sum_{i=K}^{N} X_{ij}$ $\sum_{i=K}^{N} X_{ih}$	$\sum_{i=K}^{N}\sum_{j=A}^{H} X_{ij}$	$\sum_{i=K}^{N} Y_{ik}$	$\sum_{i=K}^{N} Y_{il}$	$\sum_{i=K}^{N} Y_{in}$	$\sum_{i=K}^{N}\sum_{j=K}^{N} Y_{ij}$	$\sum_{i=K}^{N}\sum_{j=A}^{H} X_{ij} + \sum_{i=K}^{N}\sum_{j=K}^{N} Y_{ij}$
Total Expenditures	$\sum_{i=A}^{N} X_{ia}$ $\sum_{i=A}^{N} X_{ij}$ $\sum_{i=A}^{N} X_{in}$	$\sum_{i=A}^{N}\sum_{j=A}^{H} X_{ij}$	$\sum_{i=A}^{N} Y_{ik}$	$\sum_{i=A}^{N} Y_{il}$	$\sum_{i=A}^{N} Y_{in}$	$\sum_{i=A}^{N}\sum_{j=K}^{N} Y_{ij}$	$\sum_{i=A}^{N}\sum_{j=A}^{H} X_{ij} + \sum_{i=A}^{N}\sum_{j=K}^{N} Y_{ij}$

the matrix.[25]

Quadrant I includes the receipts by the various sectors for the final use of their goods for consumption, local government or exports. These entries have been defined by Isard as the "final bill of goods" or the exogenous components of the economy.[26] For example, Y_{ak} consist of the receipts to sector A for goods and services produced by that sector and consumed in the local area. Similiarly, the entry Y_{an} accounts for receipts to sector A for goods and services which it exports. The sum of the entries in quadrant I are shown as the receipts to final use.

Quadrant II comprises the "heart" of the model as it shows the receipts and expenditures among the processing or endogenous sectors of the economy. The columns indicate the expenditures by the various sectors for intermediate production inputs being supplied by other sectors in the local economy. In like manner, the rows account for the payments among sectors for these intermediate inputs. For example, the entry X_{ha} would specify the amount of expenditures by sector A for production inputs produced by sector H. This, of course, also represents a receipt to sector H of this amount. By way of contrast, the entry X_{ah} would account for the expenditures by sector H (and receipts to sector A) for production inputs produced by sector A. Thus, quadrant II provides for a complete accounting of the receipts and expenditures among the endogenous sectors for production inputs produced in the local economy.

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[25]The definition and description of the entries in the four quadrants are analogous to those provided for the input-output model in Chenery and Clark, pp. 16-17.

[26]W. Isard and Associates, Methods of Regional Analysis (New York, 1960), p. 335.

Quadrant III accounts for the primary "inputs" not produced by the endogenous sectors (quadrant II). This quadrant includes expenditures and receipts for labor inputs, local government, imports, and an imputed value for estimating entreprenural returns.[27] Thus this sector accounts for the inputs which are not produced by the endogenous sectors of the economy.

Quadrant IV shows the direct inputs of primary factors assigned directly to final use. The output of some sectors of the economy enters directly into final use without any intermediate processing. The services of household employees are, to a large extent, within this category. This type of output is considered of limited significance in the analysis but it is included to make the accounting system complete.

Computation of Trade and Interdependency Coefficients

The first step in the analysis of the interdependencies within a local economy is the development of the trade coefficients. These coefficients are computed directly from the payments matrix and represent the expenditures by sector j to sector i (receipts to sector i) divided by the total receipts in the jth sector. Thus, a trade coefficient is computed for each endogenous sector (quadrant II) which indicates the expenditures to each sector per dollar of receipts in a specified sector. In this way, the direct dependence of each sector on any other sector is empirically estimated.

These trade coefficients represent only the direct relationship

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[27]The expenditures for consumption and savings are assumed to be an approximate measure of the returns to management, family and operator labor, and fixed capital.

between the various sectors; it also is necessary to consider the indirect relationships among the sectors in the economy.[28] For example, an increase in receipts to one sector would increase its expenditures, which, in turn are receipts to other sectors. Thus, the total impact of an increase in receipts in one sector is some multiple of the initial amount. This total impact, the direct plus indirect effects, are expressed in the form of interdependence coefficients. The mathematical procedures for deriving the interdependence coefficients are presented in Appendix A.

A basic assumption associated with the use of these computational procedures is that the structure of trade coefficients are unaffected by income changes due (for example) to watershed development. That is, the coefficients describe conditions as they exist at a particular point in time and for a particular amount and distribution of local income. Thus, the model fails to consider any dynamic factors associated with changes in income levels or distribution. This assumption is not considered to be of crucial importance in this study of Roger Mills County because of the small change in receipts to any specific unit due to watershed protection. Operational alternative assumptions were nonexistent.[29]

The sum of the columns in the interdependence matrix have been

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[28]The direct and indirect relationships as discussed above are not comparable with the terms direct and indirect as used in benefit-cost analysis for watershed projects. These relations as related to the interindustry model express the first (direct) and subsequent rounds (indirect) of expenditures by the various sectors. In benefit-cost analysis, the direct effects refer to net income changes of those experiencing the services of the projects, or those bearing the costs of project services. Indirect effects refer to net income changes of all others affected.

[29]For further discussion of the assumed fixed structure of the trade coefficients in relation to the application of the results of this study see page 79.

defined as "multipliers" by Martin and Carter.[30] For example, if the "multiplier" for sector A is equal to 1.5, then for every additional dollars worth of final receipts for goods and services from sector A, there are total payments in the local economy of $1.50. These "multipliers" account for only the interrelationships in the production segment of the economy. They should be distinguished from the local multipliers, discussed earlier, which consider the interdependence of both the production and consumption phases of the economy.

Computation of Input Requirements and Net Incomes by Sectors

The discussion of the model thus far has focused on the receipts and expenditures for intermediate production inputs associated with the endogenous sectors of the local economy (quadrant II). The data in the from-to matrix also can be used to estimate the primary input requirements associated with an autonomous stimulus such as watershed protection. The procedures for empirically estimating these input requirements, as formulated by Nerlove, are based on the relationship between changes in receipts to final use (quadrant I) and primary input requirements (quadrant III).[31] The first step in implementing Nerlove's procedures is to derive a matrix of direct input requirements by dividing the expenditures for the various kinds of primary inputs by the total receipts in each sector. These input coefficients indicate the direct input requirement per dollar of gross receipts. The direct plus indirect

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[30]Martin and Carter, p. 134.

[31]M. Nerlove, "Discussion: Problems and Application of a California Inter-Industry Model," Western Farm Economics Association, Proceedings of Annual Meeting of Western Farm Economics Association held at Stanford, California, August, 1960, pp. 146-49.

input requirements are determined by multiplying the direct input coefficients by the matrix of interdependence coefficients. The direct plus indirect input coefficients measure the total input requirements associated with a change in receipts to final use in a specific sector.

The major contribution of the Nerlove approach to this study is that it provides methods for estimating changes in net income, by sectors, resulting from watershed development. Estimates can therefore be made of the net changes in entreprenural income, payments to local government, and the change in imports for each sector.

Empirical Procedures

The implementation of the conceptual framework for estimating secondary effects of watershed development requires sufficient data to estimate, within an acceptable degree of accuracy, the economic interrelationships among sectors of the local area. A common practice among regional economists and planners is to start with national coefficients and then adjust them to what is judged to be appropriate for the region being analyzed. This procedure requires the use of many arbitrary assumptions and such assumptions tend to discredit the results of these studies.[32] To overcome this limitation, the coefficients developed in this study are based on primary data collected within the County.

Classification of Sectors

The first step in the empirical part of the study was to aggregate the individual economic units in the County into a manageable number of

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[32]For a discussion of the limitations involved in using national coefficients see C. Leven, Theory and Method of Income and Product Accounts for Metropolitan Areas (Ames, Iowa, 1958), pp. 13-14.

sectors.[33] The economy of Roger Mills County was oriented mainly to agriculture and those establishments servicing agriculture. There was virtually no manufacturing or wholesaling activities carried on within the County. Thus, the classification system used by the U.S. Census of Business provided a general guideline for classifying the retail trade and selected services sectors, but the final determination of the number of sectors and the composition of each sector necessarily was somewhat arbitrary.

After experimenting with various classification schemes, the one selected for this study provided for a twelve sector model (Table III). A directory specifying the name of each of these economic units (farmer, wage earner, auto dealer, etcetera) was compiled by public leaders in the County. Therefore, it was possible to classify each household in the County into one of the specified sectors.[34]

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[33]The problems associated with aggregation of diverse economic units are encountered in all macroeconomic studies and alternative procedures have been formulated to minimize the aggregation bias. For a general discussion of the theoretical concepts related to the problems of aggregation see R. G. D. Allen, Mathematical Economics (London, 1959), pp. 694-724. The specific aggregation problems associated with interindustry models are outlined by H. E. Chenery and P. G. Clark, Interindustry Economics (New York, 1959), pp. 37-38. Their general conclusion is that the final decision on which economic units to combine should be based on the judgment and experience of the analyst.

[34]When a business establishment provided goods and services accounted for in two sectors, such as a general store which also sold gasoline, the business was classified on the basis of volume of business. It should also be noted that the household rather than individual members of the family was the basic economic unit in the classification scheme except where members of the family had full time employment in different sectors. For example, if a farmer's wife had steady employment teaching school, the household would be counted as two economic units, but if she only served occasionally as a substitute teacher, the household was counted as a single economic unit.

TABLE III

COMPOSITION AND NUMBER OF ECONOMIC UNITS IN EACH SECTOR, ROGER MILLS COUNTY, OKLAHOMA

Sector	Type of Economic Unit	Estimate of Number of Households Included in Sample
A	Farmers, ranchers and full-time farmer labor living on farms	550
B	Wage earners, welfare, social security, etcetera, (includes all those not owning or operating a business except for farming and local government)	213
C	Local government (includes all employees of the county)	105
D	Eating and drinking establishments, including cafes, grocery stores, taverns, and general stores	31
E	Department, drug, variety stores, and jewelers	15
F	Auto dealers, farm equipment, service stations, garages, and blacksmiths	26
G	Lumber yards, hardware, utilities, and construction companies	12
H	Elevators, feed and produce stores, livestock auctions, trucking, and custom work	15
I	Personal services - beauty and barber shops, cleaners, hotels and motels, and movie theatres	18
J	Professional services - insurance, lawyers, hospital, doctors, abstract, funeral home, bank, and publishing company	15
K	Social services - churches, ministers, and social and civic organizations	5
N	Nonlocal - exports and imports	--

Source of Data and Sampling Procedure

An agreement was reached with a local banker (the only bank in Cheyenne, the County seat of Roger Mills County) to record information available on microfilmed checks which had cleared his bank in 1960. This was the only bank centrally located in the County, and it accounts for a large percentage of the financial transactions in the various sectors.[35] Therefore, it was assumed that transactions in this bank were typical of those occurring in the County.[36]

A sampling scheme was designed to provide a "composite month" of 24 days from the sampling universe of 306 banking days available in 1960 (Table IV). The criteria for selecting the days to be included in the

TABLE IV

BANKING DAYS OF 1960 INCLUDED IN THE SAMPLE

Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
June 20	Nov. 1	Feb. 17	Aug. 11	Mar. 4	Aug. 27
Jan. 25	May 24	Apr. 16	Dec. 15	July 29	Sept. 10
Dec. 19	July 5	Nov. 9	Jan. 7	Sept. 30	Oct. 22
May 2	Oct. 18	June 15	Apr. 14	Feb. 26	Mar. 12

sample were as follows: (1) two sample days from each month; (2) four sample days for each day of the week; and (3) half of the sample days

[35] This bank provided banking services to about 50 per cent of the farmers in the County and for about 70 per cent of the other economic units in the County.

[36] Although there is one other bank in the County, the bank at Cheyenne accounted for over 80 per cent of demand and savings deposits in the County's financial institutions.

were from the first to the fifteenth of the month while the other half of the sample was from the sixteenth to the end of the month.[37]

The date, amount, and general purpose of each check written or deposited in the bank during the 24 sample days were recorded. The data were entered in the proper sector (Table III) on the basis of payer and payee of each check. For example, a check from a farmer to a machine dealer was entered on the A to F tabulation sheet and it represented a receipt to the F sector and an expenditure by the A sector. Farmers (sector A) wrote 800 checks to sector H (elevators, feed stores, etcetera) and received 195 checks in return from this sector (Table V). The local sectors wrote more than twice as many checks to nonlocal accounts (7,392) than they received in return (3,676) from the nonlocal sector. In all, nearly 26,000 checks were included in the sample.

The balancing out of the sample data in the payments matrix required only one adjustment of major significance (Table VI, p.54). This adjustment was due to the lack of sufficient data on the transfer of capital within the economy. For example, the loans made by the bank were credited directly to the checking account of the individual or business receiving the loan. This type of transaction was not included in the data recorded. The loan was normally repaid by check and included in the sample data. Thus the receipts to sector J (which includes the bank) were much greater than the expenditures of this sector. In addition, it was impossible to distinguish between expenditures to the bank for

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[37]The sampling technique employed was to list each of the possible 306 days on a slip of paper and then to draw these slips at random. If the result of the draw did not satisfy the criteria it was discarded and another drawing was made.

TABLE V

DISTRIBUTION OF NUMBER OF CHECKS IN SAMPLE, BY SECTORS

Exp. \ Rec.	Sectors											Local	Non-local	Total
	A	B	C	D	E	F	G	H	I	J	K			
A	696	65	163	24	8	21	20	195	10	20	44	1266	1020	2286
B	459	97	133	74	41	99	53	89	45	85	25	1200	593	1793
C	580	92	180	30	13	64	30	25	21	67	12	1114	447	1561
D	1664	342	300	34	19	66	57	69	16	77	15	2659	204	2863
E	1052	276	256	37	15	37	46	57	30	76	6	1888	191	2079
F	1760	255	231	21	18	104	73	70	17	76	12	2637	324	2961
G	317	83	90	30	13	34	37	23	19	47	15	708	103	811
H	800	39	46	2	1	3	1	28	--	9	2	931	208	1139
I	229	53	79	9	4	15	15	13	18	45	--	480	66	546
J	522	127	141	21	30	38	39	42	19	68	31	1078	493	1571
K	232	52	161	25	26	27	23	19	15	97	19	696	27	723
Local	8311	1481	1780	307	188	508	394	630	210	667	181	14657	3676	18333
Nonlocal	3728	911	729	426	184	417	211	268	110	312	96	7392	xx	7392
Total	12039	2392	2509	733	372	925	605	898	320	979	277	22049	3676	25725

services and payments to the bank for increasing an individual's checking or savings account. The influence of these two factors caused a large discrepancy in the expenditure column of sector J. This increase in capital was allocated to the various sectors for the purpose of adding a savings component to net income.

Two additional minor adjustments were required to balance out sector B and sector F. Sector B had receipts in excess of expenditures. A comparison of the type of expenditures made within this sector with expenditure patterns from secondary sources indicated the need to increase B's expenditures for food, utilities, and personal services. A minor adjustment also was required in sector F because an audit of the receipts and expenditures in this sector indicated more gas was sold retail than was purchased wholesale. The wholesale purchases were increased to remedy this discrepancy. These two relatively minor adjustments, plus the net change in capital position, were the only modifications made in sample data. The difference between receipts and expenditures remaining were presented as statistical discrepancies.[38]

Estimating Local Effects of Resource Development

In the preceeding statement of the conceptual orientation and accompanying procedures used in this study, an effort was made to integrate ideas underlying (1) the payments multiplier as adapted to a local area, (2) the input-output model in the context of trade relations, and (3) the extension of the usual procedures associated with input-output analysis to emphasis computation of changes in net income, by sectors, following

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[38] Appendix B contains an evaluation of the sample data.

changes in demand for the output of one or more particular sectors of the local economy. Primary data were obtained for implementing the conceptual model.

Local effects of resource development, such as watershed projects, may be placed into two general classes: primary and secondary. Primary effects, in the context of net benefits to the local area, accrue as increases in net income to those individuals or sectors directly experiencing the services of the projects. Secondary effects, as net benefits, are increases in the local area in net income to all other individuals or sectors in the local area as a result of the existing local net primary benefits.

In this study, no effort was made to derive defensible estimates of the primary benefits of watershed development in Roger Mills County. Rather, the emphasis was on methods of estimating the local secondary benefits, given the primary benefits. The methods developed for estimating local secondary benefits required the use of gross primary benefits, or increases in demand for the output of individuals or sectors directly experiencing the services of the projects. Net primary benefits then were computed in the same process as in the computation of the net local secondary benefits. The Soil Conservation Service did not provide estimates of gross primary benefits of watershed development in Roger Mills County. Their accounting procedure emphasized the estimation of net primary benefits directly, but they also included items in the net primary benefits that were partly nonlocal and partly unrelated to monetary payments for items used in production and consumption. Thus, direct use of their estimates of primary benefits to compute the local secondary benefits was not possible.

In view of the state of the data on primary benefits from watershed development in the county, the procedure of this study was to demonstrate, by examples, what the secondary benefits would be for different amounts and kinds of primary benefits. Some data from another study on receipts to the County from users of the lakes for recreational purposes were used in estimating the net income to the various sectors from this aspect of development.[39] Also, data from the work plans of the Soil Conservation Serivce were used to demonstrate the relationship between primary and secondary benefits of development in the County.

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[39]C. A. Burns, An Economic Appraisal of Recreation in Association with Upstream Flood Protection Reservoirs in Roger Mills County, Oklahoma (unpublished M.S. Thesis, Oklahoma State University, 1963).

CHAPTER IV

EMPIRICAL RESULTS

This chapter contains the result of the study as obtained through the application of the methods presented in the preceding chapter. The results are organized by major sections as follows: (1) structural relations among sectors in a local economy, (2) local secondary effects of primary income, (3) impact of watershed development on the local area, (4) relevance of the results for watershed planning, and (5) need for additional research.

Economic Structure

Payments Matrix

The first step in the analysis was to summarize information from the sample of checks into a table of payments (Table VI). Total payments in the sample exceeded $1,600,000, of which about two-thirds were payments to local accounts and one-third payments to nonlocal accounts. About 40 per cent of the local receipts were to sector A (agriculture). The total local expenditures by local sectors, were about $500,000, of which about one-half was expenditures by farmers.

From-To Matrix

The next step in the analysis was to transfer the data from Table VI (gross payments) to a from-to matrix (Table VII). In order to perform

TABLE VI

STRUCTURE OF PAYMENTS FROM SAMPLE CHECK DATA

Expend. \ Rec.	Sectors A	B	C	D	E	F	G	H	I	J	K	Local	Nonlocal	Discrep.	Total
A	45,437.42	1,651.72	5,263.40	592.41	258.43	1,272.40	286.54	60,905.96	353.26	395.82	240.95	116,658.31	289,380.30	-	406,038.61
B	13,517.77	1,617.17	3,292.65	3,336.47	1,071.48	5,188.58	2,226.39	3,089.17	682.64	3,277.09	538.71	37,838.12	38,051.58	-	75,889.70
C	17,505.47	1,121.46	8,583.39	671.68	528.87	1,338.57	701.66	365.10	188.12	589.56	140.87	31,734.75	62,334.99	-	94,069.74
D	16,730.20	12,450.75	5,550.21	1,421.68	1,447.04	850.51	704.18	1,132.96	184.88	1,108.96	318.14	41,899.51	3,476.05	1,081.42	46,456.98
E	9,959.92	8,936.22	1,941.91	287.09	743.79	389.59	380.51	425.34	278.58	884.93	18.85	24,246.73	3,374.59	2,746.67	30,367.99
F	47,058.14	3,671.58	5,587.40	908.90	610.29	6,878.42	2,916.95	2,712.73	234.37	1,347.97	288.17	72,214.92	31,012.51	-	103,227.43
G	12,866.36	4,051.82	2,176.61	817.59	413.85	622.16	3,470.16	2,336.82	425.67	1,303.61	181.45	28,666.10	9,713.58	3,923.59	42,303.27
H	56,576.89	637.22	944.88	10.75	1.83	184.65	166.72	11,916.25	-	830.16	24.59	71,293.94	62,103.39	7,166.04	140,563.37
I	1,118.68	2,308.54	329.81	27.46	53.28	168.00	32.65	66.69	791.72	169.74	-	5,066.57	1,273.36	2,018.87	8,358.80
J	12,486.56	4,137.06	18,759.41	523.41	2,073.96	1,287.77	831.75	6,881.85	238.67	3,421.38	1,933.03	52,574.85	27,722.22	-	80,297.07
K	2,380.61	173.91	1,371.15	145.00	241.50	229.75	142.00	148.50	139.63	1,323.50	206.17	6,501.72	240.00	892.08	7,633.80
Local	235,638.02	40,757.45	53,800.82	8,742.44	7,444.32	18,410.40	11,859.51	89,981.37	3,517.54	14,652.72	3,890.93	488,695.52	528,682.57	17,828.67	1,035,206.76
Non-Local	165,659.63	27,200.62	34,875.15	37,714.54	22,923.67	79,713.37	30,443.76	50,582.00	4,841.26	19,432.84	3,742.87	477,129.71	xx	51,552.86	528,682.57
Discr.	4,740.96	7,931.63	5,393.77	-	-	5,103.66	-	-	-	46,211.51	-	69,381.53	-	xx	69,381.53
Total	406,038.61	75,889.70	94,069.74	46,456.98	30,367.99	103,227.43	42,303.27	140,563.37	8,358.80	80,297.07	7,633.80	1,035,206.76	528,682.57	69,381.53	1,633,270.86

TABLE VII

FROM-TO MATRIX FOR SAMPLE DATA

Rec. / Expend.	Sectors A	D	E	F	G	H	I	J	K	QII Total	Exgenous Sectors (R & C)	Endogenous Sectors	Nonlocal (Export)	Discrep.	QI Total	Total Receipts
A	31,393.03	369.60	10.00	99.84	27.10	59,405.72	87.50	21.69	98.01	91,512.45	6,915.12	18,230.70	289,380.30	-	314,526.12	406,038.61
D	2,977.93	484.93	1,146.65	22.50	15.50	23.50	1.75	31.43	5.17	4,709.36	18,000.96	19,189.19	3,476.05	1,081.42	41,747.62	46,456.98
E	3,187.95	-	311.52	6.00	7.50	161.32	45.12	210.07	5.08	3,934.56	10,878.13	9,434.04	3,374.59	2,746.67	26,433.43	30,367.99
F	34,134.37	155.32	261.42	4,506.75	929.31	734.62	61.39	330.59	42.10	41,055.87	9,258.98	21,900.07	31,012.51	-	62,171.56	103,227.43
G	9,273.45	501.03	191.91	273.60	1,000.92	1,059.70	187.50	677.97	94.00	13,260.08	6,228.43	9,177.59	9,713.58	3,923.59	29,043.19	42,303.27
H	55,909.66	-	1.83	96.76	83.36	9,602.87	-	47.18	20.00	65,761.66	1,582.10	3,950.18	62,103.39	7,166.04	74,801.71	140,563.37
I	277.78	-	21.18	45.93	-	-	6.75	-	-	351.64	2,638.35	2,076.58	1,273.36	2,018.87	8,007.16	8,358.80
J	7,808.97	159.10	1,094.20	770.67	308.15	4,824.29	72.99	1,234.16	282.95	16,555.48	22,896.47	13,122.90	27,722.22	-	63,741.59	80,297.07
K	112.00	-	-	-	-	-	-	-	93.04	205.04	1,545.06	4,751.62	240.00	892.08	7,428.76	7,633.80
QII (Intermediate)	145,075.14	1,669.98	3,038.71	5,822.05	2,271.84	75,812.02	463.00	2,553.09	640.35	237,346.18	79,943.60	101,832.87	428,296.00	17,828.67	627,901.14	865,247.32
Wages																
Endogenous	(9,602.45)	(969.77)	(259.13)	(2,426.27)	(1,414.14)	(4,599.11)	(590.37)	(636.90)	(1,719.48)	(22,217.62)	-	-	-	-	-	-
Exogenous	9,643.47	3,341.80	1,024.35	4,983.93	2,163.32	3,044.65	653.04	3,108.69	517.71	28,480.96	5,548.71	-	-	-	5,548.71	34,029.67
Total	(19,245.92)	(4,311.57)	(1,283.48)	(7,410.20)	(3,577.46)	(7,643.76)	(1,243.41)	(3,745.59)	(2,237.19)	(50,698.58)	-	-	39,596.25	-	39,596.25	39,596.25
Imputed Inputs																
Endogenous	(49,937.19)	(2,094.54)	(2,546.13)	(3,634.93)	(5,245.48)	(6,115.97)	(1,593.41)	(7,596.08)	(851.52)	(79,615.25)	-	-	-	-	-	-
Exogenous	7,642.37	229.22	229.30	442.07	325.41	196.50	122.95	647.30	160.37	10,200.49	7,316.82	-	-	-	7,316.82	17,517.31
Total	(57,579.56)	(2,323.76)	(2,775.43)	(4,277.00)	(5,570.89)	(6,312.47)	(1,721.36)	(8,243.38)	(1,011.89)	(89,815.74)	-	-	51,460.46	-	51,460.46	51,460.46
Local Government	13,737.40	437.13	346.70	901.15	439.32	213.12	89.77	110.66	1.50	16,276.75	1,749.14	-	9,329.86	-	11,079.00	27,355.75
Nonlocal																
Production	115,732.92	33,202.34	21,272.64	69,706.48	26,722.45	46,977.56	2,494.28	11,737.53	1,668.62	328,594.82	-	-	-	-	-	-
Consumption	49,926.71	4,512.20	1,651.03	10,006.89	3,721.31	4,504.44	2,366.98	7,695.31	2,074.25	96,459.12	-	-	-	-	-	-
Total	(165,659.63)	(37,714.54)	(22,923.67)	(79,713.37)	(30,443.76)	(50,582.00)	(4,841.26)	(19,432.84)	(3,742.87)	(425,053.94)	62,075.77	-	-	51,552.86	113,628.63	528,682.57
Discrepancy	4,740.96	-	-	5,103.66	-	-	-	46,211.51	-	56,056.13	13,325.40	-	-	-	13,325.40	69,381.53
QIII (Inputs-Net)	201,423.83	41,722.69	24,524.02	91,344.18	32,371.81	54,036.27	5,712.02	69,511.00	4,422.45	525,068.27	90,015.84	-	100,386.57	51,552.86	241,955.27	768,023.54
QIII (Inputs-Gross)	(260,963.47)	(44,787.00)	(27,329.28)	(97,405.38)	(40,031.43)	(64,751.35)	(7,895.80)	(77,743.68)	(6,693.45)	(627,901.14)						
Total Expend. - Net	346,498.97	43,392.67	27,562.73	97,166.23	35,643.65	129,848.29	6,175.02	72,064.09	5,062.80	763,414.45	169,959.44	101,832.87	528,682.57	69,381.53	869,856.41	1,633,270.86
Total Expend. - Gross	(406,038.61)	(46,456.98)	(30,367.99)	(103,227.43)	(42,303.27)	(140,563.37)	(8,358.80)	(80,297.07)	(7,633.80)	(865,247.32)						

this transfer, each sector's expenditures were classified by local or nonlocal and by subclasses of purpose within production and consumption.[1] The major classes of expenditures were payments for intermediate inputs, primary inputs, consumption, and to nonlocal accounts. The expenditures in each of these categories were then assigned to the proper quadrant in the from-to matrix. A discussion of the entries in the sector A (agriculture) will be used to illustrate this procedure.

The total expenditures by agriculture (including the discrepancy) were $406,038.61. Of this amount, $145,075.14 (or about 36 per cent) was for intermediate production inputs purchased from other sectors in the local economy. For example, nearly $56,000 worth of production inputs were purchased from sector H. The majority of these payments were for commercial feed, seed, fertilizer, and other items associated with an agribusiness complex. Similarly, the $34,000 to sector F were for gas, oil, machinery, repairs, etcetera.

About 64 per cent of the farmer's purchases was included in quadrant III. The entries for wages and local consumption were classed by endogenous and exogenous components to retain consistent accounting relationships.[2] The consumption and production segments of nonlocal expenditures were also tabulated separately. This separation permits a more direct examination of the total consumption component in the economy. The

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[1] A discussion of the procedures used to delineate the production from the consumption items is presented in Appendix C.

[2] The payments for wages and consumption within the endogenous sectors appear as receipts to final use in quadrant I; thus these endogenous payments are placed within parentheses to indicate they are not in the horizontal summation to determine total receipts from quadrant III.

final component of quadrant III was the discrepancy, which was a combination of unallocated increases in savings and sampling error. The major portion of the discrepancy in sector J was due to the accumulation of assets in the local bank. This discrepancy was allocated among the various sectors as a savings component in determing the net returns per economic unit in each sector.

The entries in quadrant II represent receipts for intermediate production inputs as well as expenditures. Quadrant I includes receipts for goods and services consumed locally or exported. The summation of the totals for the two quadrants is the total receipts to each sector. Quadrant IV accounts for primary inputs, such as household labor, entering directly into final consumption.

Structural Interrelationships

The matrix of trade coefficients indicate the expenditures of each sector for local production inputs per dollar of its gross receipts (Table VIII). For each dollar of gross receipts in agriculture there is an expenditure of nearly $0.14 to sector H, $0.08 to sector F, $0.02 to sector G, etcetera.[3]

The matrix of trade coefficients was inverted to obtain the matrix of interdependent coefficients (Table IX). These interdependent coefficients express the direct and indirect effects in terms of gross receipts, per dollar increase in final demand, to the various sectors. Each dollar of receipts to final demand in agriculture (sector A) generates gross receipts of $0.10 to sector F, $0.03 to sector G, $0.17 to

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[3]These trade coefficients are computed by dividing sector A's expenditure to the various sectors by A's gross receipts of $406,038.61.

TABLE VIII

MATRIX OF TRADE COEFFICIENTS FOR SAMPLE DATA

Sectors	Sectors								
	A	D	E	F	G	H	I	J	K
A	.077315	.007956	.000329	.000967	.000640	.422626	.010468	.000270	.012839
D	.007334	.010438	.037758	.000218	.000366	.000167	.000209	.000391	.000677
E	.007851	.000000	.010258	.000058	.000177	.001115	.005398	.002612	.000665
F	.084067	.003343	.008608	.043658	.019604	.005226	.007344	.004117	.005515
G	.022839	.010785	.006319	.002650	.023661	.007539	.022431	.008443	.012314
H	.137695	.000000	.000060	.000937	.001971	.068317	.000000	.000588	.002620
I	.000684	.000000	.000697	.000445	.000000	.000000	.000808	.000000	.000000
J	.019232	.003425	.036031	.007466	.007284	.034321	.008732	.015370	.037065
K	.000276	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.012188

TABLE IX

MATRIX OF INTERDEPENDENT COEFFICIENTS FOR SAMPLE DATA

Sectors	Sectors A	D	E	F	G	H	I	J	K
A	1.162831	0.009377	0.000836	0.001711	0.001871	0.527530	0.012249	0.000663	0.016578
D	0.009057	1.010628	0.038582	0.000251	0.000410	0.004361	0.000531	0.000514	0.000874
E	0.009520	0.000089	1.010476	0.000101	0.000223	0.005665	0.005588	0.002693	0.000924
F	0.104013	0.004617	0.009622	1.045910	0.021215	0.053405	0.009347	0.004643	0.007781
G	0.029258	0.011441	0.007353	0.002973	1.024429	0.021915	0.023446	0.008842	0.013570
H	0.172044	0.001417	0.000238	0.001317	0.002469	1.151424	0.001876	0.000762	0.005358
I	0.000849	0.000009	0.000710	0.000467	0.000011	0.000389	1.000825	0.000004	0.000015
J	0.030114	0.003871	0.037270	0.008040	0.007872	0.051237	0.009631	1.015850	0.038816
K	0.000325	0.000003	*	*	*	0.000147	0.000003	*	1.012343
Total	1.518011	1.041452	1.105087	1.060770	1.058500	1.816073	1.063496	1.033971	1.096259

*Less than 0.0000005.

sector H, etcetera. The gross receipts multipliers for each sector are the sum of the coefficients in each of the columns of the interdependence matrix. These multipliers depict the increase in gross receipts to the local area per dollar increase in final demand for each sector. Thus, an increase of $1.00 in final demand in sector A generates local gross receipts of $1.52.

The economy's orientation to agriculture and the agribusiness complex is readily apparent from the relative magnitude of these multipliers. That is, the multipliers for sector A and sector H are higher than those for the other sectors. Receipts to final demand for any sector other than A and H has small indirect effects.

Primary Input Requirements and Estimates of Net Income

The primary input coefficients are estimates of the payments for wages, local government, imports and entrepreneural services per dollar of gross receipts in each sector (Table X).[4] Payments to the nonlocal account indicate the degree of first round "leakages" from the local economy. Only about $0.41 from each dollar of gross receipts to agriculture is spent outside the local economy, whereas more than $0.81 out of each dollar received by sector D (grocery stores and cafes) is spent outside the local area.

The expenditures for consumption (both local and nonlocal) serve as a partial measurement of the returns to management, fixed capital, and

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[4]These coefficients are computed by dividing the expenditures for primary inputs in each sector (quadrant III, Table VII) by gross receipts to that sector. The total wages expenditures by agriculture of $19,245.92 was divided by gross receipts to agriculture of $400,038.61 to derive the wage coefficient of 0.047399.

TABLE X

MATRIX OF PRIMARY INPUT COEFFICIENTS FOR SAMPLE DATA

Inputs	Sectors								
	A	D	E	F	G	H	I	J	K
Wages									
Endogenous	.023649	.020875	.008533	.023504	.033429	.032719	.070629	.007932	.225246
Exogenous	.023750	.071933	.033731	.048281	.051138	.021660	.078126	.038715	.067818
Total	.047399	.092808	.042264	.071785	.084567	.054379	.148755	.046647	.293064
Imputed inputs									
Endogenous	.122986	.045086	.083842	.035213	.123997	.043511	.190627	.094600	.111546
Exogenous	.018822	.004934	.007551	.006220	.007692	.001398	.015307	.008060	.021008
Total	.141808	.050020	.091393	.041433	.131689	.044909	.205934	.102660	.132554
Local government	.033833	.009409	.011417	.008730	.010385	.001516	.010739	.001378	.000196
Nonlocal inputs									
Production	.285029	.714689	.700496	.675271	.631688	.327806	.296009	.146176	.218583
Consumption	.122961	.097127	.054367	.096940	.087967	.032046	.283172	.095836	.271719
Total	.407990	.811816	.754863	.772211	.719655	.359852	.579181	.242012	.490302
Discrepancy	.011676	--	--	.049441	--	--	--	.575507	--
Total	.642706	.964053	.899937	.943600	.946296	.460656	.944609	.968204	.916116

operator and family labor. The consumption component was determined from the consumption coefficients as applied to the gross income of each sector. Estimates of the savings component of net income were based on an allocation of the discrepancy in sector J by arbitrarily assuming the same ratio of consumption to savings for each sector. If there were no savings in the economy, then consumption would equal net income. For agriculture, the consumption coefficients were $0.141808 for local and $0.122961 for nonlocal goods and services. Thus, an estimated $0.264769 out of every dollar of gross income to agriculture was spent on consumption.

The estimated net income, by sectors, is the sum of the consumption income and savings (Table XI). The discrepancy in sector J was 1.5 per cent of total consumption. Thus, it was assumed that savings were 1.5 per cent of the consumption component of net income for each sector.

The net incomes obtained by this procedure were compared with income data in the 1960 Census of Population.[5] The census estimate of average family income for farmers and farm managers in Roger Mills County was $2,535, whereas the net income per agricultural household in this study was an estimated $2,529. The average income per economic unit in the sample was $3,213. The median family income reported in the census for Roger Mills County was $2,976.

Although census income data were not available for sectors other than agriculture for Roger Mills County, the estimates derived for these sectors appeared to be realistic. The highest net incomes were to the

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[5]United States Department of Commerce, Bureau of Census, "General Social and Economic Characteristics," Census of Population: 1960, XXXVIII (Washington, D.C., 1960).

TABLE XI

ESTIMATED NET INCOME PER ECONOMIC UNIT BY SECTORS FROM SAMPLE DATA

Item	A	D	E	F	G	H	I	J	K
Consumption Coefficients[a]	0.264769	0.147147	0.145760	0.138373	0.219656	0.076955	0.489106	0.198496	0.404273
Gross Receipts (Dollars)[b]	5,176,992	592,326	387,192	1,316,150	539,367	1,792,183	106,575	1,023,788	97,331
Income to Management, Capital and Family and Operator's Labor (Dollars)[c]	1,370,707	87,159	56,437	182,120	118,475	137,917	52,126	203,218	39,348
Estimated Number of Economic Units in Sample	550	31	15	26	12	15	18	17	7
Consumption Component of Net Income Per Unit (Dollars)[d]	2,492	2,812	3,762	7,004	9,872	9,194	2,896	11,954	5,621
Estimated Savings Per Unit (Dollars)	37	41	55	103	146	136	43	176	83
Total Net Income Per Unit (Dollars)	2,529	2,853	3,817	7,107	10,018	9,330	2,939	12,130	5,704

[a] Sum of local and nonlocal consumption coefficients from Table IX.

[b] Estimated annual gross receipts for each sector.

[c] Consumption coefficients times gross receipts by sectors.

[d] Income to management, capital and operator's labor divided by estimated number of economic units in sample.

following sectors: (1) professional services, (2) lumber yards, construction companies, etcetera, and (3) elevators, livestock auctions, and trucking companies. The sectors receiving the lowest net incomes were: (1) agriculture, (2) personal services, and (3) grocery stores and cafes. The net incomes for the exogenous sectors B and C were computed by an iterative process. For this computation, it was assumed that gross receipts to the exogenous sectors were comparable to the net returns computed for the endogenous sectors. The estimates of the net incomes per economic unit derived in this manner were $2,607 for sector B and $3,846 for sector C.

Local Secondary Effects of Primary Income

In this section, the effect of comparable increases in final demands to agriculture and for recreational services will be estimated in terms of changes in gross receipts and net incomes by sectors. A total gross receipts increase to agriculture of $100,000 first is assumed, and, consistent with this change, a final demand increase of $85,997 is the resulting initial impact. For purposes of comparability it then is assumed that a final demand increase of $85,997 occurs to sectors servicing the recreation industry in the County.

Effect of Increases in Agricultural Income

Estimated increases in gross and net incomes to the County initiated by the $85,997 increase in receipts to final demand to agriculture were $177,845 and $43,324, respectively (Table XII). An indirect gross farm income of $14,003, when added to the direct, produced the $100,000 gross receipts increase to agriculture.

TABLE XII

ESTIMATES OF INCREASES IN INCOME TO THE VARIOUS SECTORS ASSOCIATED WITH $100 THOUSAND INCREASE IN TOTAL GROSS RECEIPTS TO AGRICULTURE

	Gross Receipts			Net Income		
Sector	Direct	Indirect	Total	Consumption	Savings	Total
A	85,997			22,769	335	23,104
		14,003		3,708	55	3,763
			100,000	26,477	390	26,867
B	3,330	311	3,641	3,440	51	3,491
C	4,310	54	4,364	3,690	54	3,744
D	4,120	779	4,899	721	11	732
E	2,450	819	3,269	476	7	483
F	11,590	8,944	20,534	2,841	42	2,883
G	3,170	2,517	5,687	1,249	18	1,267
H	13,930	14,795	28,725	2,211	33	2,244
I	280	158	438	214	3	217
J	3,080	2,590	5,670	1,125	17	1,142
K	590	28	618	250	4	254
Nonlocal	--	--	41,970	--	172	--
All local except sector A	46,850	30,995	77,845	16,217	240	16,457
All local	132,847	44,998	177,845	42,694	630	43,324
Local income per dollar of direct farm income			2.07	1.88	--	1.88
Local income per dollar of total farm income			1.78	1.62	--	1.62

First round (direct) gross receipts to the nonfarm sectors were obtained by use of the expenditure pattern of farmers in the from-to matrix as applied to the $85,997. Second and subsequent round (indirect) gross receipts to the various sectors, except for sector B and C, were determined in the following manner: first, the column of receipts to final demand in the from-to matrix was changed by increasing the agricultural entry by $85,997. Then, this new column was multiplied by the matrix of interdependence coefficients to obtain a gross receipts column containing (a) the direct and indirect gross receipts to agriculture, and (b) the indirect increases in gross receipts to all other sectors. These components of the increase in gross receipts, plus the increase in indirect gross receipt to B and C as computed by an iterative process, amounted to $130,995. The addition of the $46,850 representing increases in gross receipts to the local nonfarm sectors to the $130,995 resulted in the total gross receipts change to the County of $177,845. Nonlocal expenditures by farmers amounted to $41,970 per $100,000 increase in the total gross receipts. The largest increases in gross receipts other than for sector A, were in sectors H (elevators, livestock auctions, etcetera) and F (gas, oil, repairs, machinery). These results indicated a high degree of interdependency between agriculture and the general agribusiness complex in the County.

Total local gross receipts per dollar of direct gross receipts to agriculture amounted $2.07, and total local gross receipts per dollar of total gross receipts to agriculture amounted to $1.78. These were the estimated local gross receipts multipliers associated with an increase in farm income.

The next step in the analysis was to determine the net incomes

associated with the increases in gross income. The coefficients in Table X were used to determine the consumption components of net income for the different sectors. Total net income was determined by adding a savings component to net income. The computations indicated that there was an increase in local net income to agriculture of $0.27 for each dollar increase in gross receipts to that sector, but when the net incomes to the other sectors were included, this figure increased to $0.43 per dollar increase in agriculture's gross income.

There was an estimated $1.88 in net income to the local economy for each dollar of direct net income to agriculture. Similarily, there was a net income of $1.62 to the local economy for each dollar of total net income to agriculture. These were the estimated local net income multipliers.

Effect of Increases in Recreational Income

To provide a comparison with the agricultural example, the same procedures were used to determine the increase in income associated with an increase in recreational expenditures. Data from a recent study on recreation in the county provided estimates of payments to local businesses by nonresident users of the upstream reservoirs for recreational purposes.[6] These payments by nonresidents were exports, thus they were receipts to final demand in the affected sectors. In accordance with the results of this recreational study, receipts to final demand of $85,997 (recreational expenditures) were distributed among the sectors as follows:

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[6]C. A. Burns and W. B. Back, "Recreational Possibilities of Upstream Reservoirs," Oklahoma Current Farm Economics, XXXVI (1963), p. 8.

sector D - $46,516, sector E - $284, sector F - $27,915, sector G - $27,915, and sector I - $5,641.

Starting with the direct gross income of $85,997 as in the agricultural example, the direct, indirect, and total gross receipts to the various sectors were computed (Table XIII). The local gross income per dollar of direct and total recreational income was much smaller than for agriculture. That is, there was only $1.17 in gross income to the economy per dollar of direct recreational receipts and $1.13 per dollar of total recreational receipts. This indicated there was a greater amount of leakage from the local area associated with expenditures for recreational services than was the case for receipts to agriculture.[7]

The net incomes associated with increases in receipts from recreation were determined in the same manner as those associated with increases in agriculture income. The large amount of leakage associated with recreation expenditures was readily apparent in that only $0.17 of net income was obtained per dollar of gross receipts to sectors selling recreational services, and total net income to the local economy was $0.26 per dollar of gross receipts from recreation. The comparable figures in the agricultural example were $0.27 and $0.43, respectively. The ratio of the increase in net income to the sectors selling recreational services to the local economy was $1.57. A comparable figure for agriculture was $1.88.

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[7]The sources of the leakages in income to the local area are partly evident from the balance of payments table presented in Appendix D.

TABLE XIII

ESTIMATES OF INCREASES IN INCOME TO THE VARIOUS SECTORS ASSOCIATED WITH AN INCREASE IN RECREATION EXPENDITURES

	Gross Receipts			Net Income		
Sectors	Direct	Indirect	Total	Consumption	Savings	Total
D	46,516	518	47,034	6,921	102	7,023
E	284	43	327	48	1	49
F	27,915	1,671	29,586	4,094	60	4,154
G	5,641	888	6,529	1,434	21	1,455
I	5,641	19	5,660	2,768	41	2,809
Total of sectors directly affected	85,997			14,748	217	14,965
		3,139		517	8	525
			89,136	15,265	225	15,490
A	1,237	564	1,801	477	7	484
B	5,596	531	6,127	5,789	85	5,874
C	1,305	60	1,365	1,154	17	1,171
H	101	127	228	18	--	18
J	1,217	514	1,731	344	5	349
K	315	--	315	127	2	129
Nonlocal	--	--	71,978	--	288	--
All local except sectors directly effected	9,771	1,796	11,567	7,909	116	8,025
All local	95,768	4,935	100,703	23,174	341	23,515
Local income per dollar of direct recreation income			1.17	1.57		1.57
Local income per dollar of total recreation income			1.13	1.52		1.52

Impact of Watershed Development on the Local Area

The analysis of the proceeding section expresses in general, the relations of primary and secondary income to the local area from projects with agricultural and recreational developmental purposes. A more specific expression of these relations requires knowledge of the local primary benefits. Estimates of primary benefits to the projects in the area by the Soil Conservation Service are not intended to be estimates of net (or gross) monetary income to local primary beneficiaries. However, the work plans do include some information about these benefits. To demonstrate further the application of the procedures of this study, selected information from the watershed work plans, together with the information on recreational receipts referred to earlier, are used to derive some specific estimates of primary and secondary income to watershed development in the area.

The increase in agriculture receipts due to the reduction of crop and pasture damage was estimated from data in the work plans for ten watersheds in the County. Estimates of the annual monetary benefits from reduction of crop and pasture flood damage contained in the work plans were adjusted for the ten watersheds by the percentage of the watershed in the County (Table XIV).[8] It then was necessary to find the relationship between the reported benefits from the reduction of crop and pasture damages and the resulting gross receipts to agriculture. This adjustment was made by using the percentage relationship between the gross and

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[8]The crop and pasture benefits account for about 30 per cent of the total average annual benefits shown in the work plans. Thus, they are only being used as an illustrative example rather than an estimate of total primary benefits of watershed development in the County.

TABLE XIV

ESTIMATED INCREASES IN LOCAL INCOME ASSOCIATED WITH DECREASES IN CROP AND PASTURE DAMAGE FROM WATERSHED DEVELOPMENT IN ROGER MILLS COUNTY (DOLLARS)

Watershed	Benefits from Reduction of Crop and Pasture Damage	Gross Receipts to Agriculture	Net Income				Total
			Primary	Secondary			
				First Round	Subsequent Rounds	Total	
Beaver Dam	3,165	3,798	1,020	209	416	625	1,645
Big Kiowa	2,618	3,142	844	173	344	517	1,361
Broken Leg	4,127	4,952	1,330	273	542	815	2,145
Dead Indian-Wildhorse	6,934	8,321	2,236	457	912	1,369	3,605
Nine Mile	5,845	7,014	1,884	386	769	1,155	3,039
Quartermaster	34,509	41,411	11,125	2,276	4,539	6,815	17,940
Sandstone	30,325	36,390	9,777	1,999	3,989	5,988	15,765
Sergeant Major	1,692	2,030	545	111	223	334	879
Upper Washita	7,759	9,311	2,501	511	1,021	1,532	4,033
Whiteshield	5,695	6,843	1,838	376	750	1,126	2,964
Total	102,669	123,203	33,100	6,771	13,505	20,276	53,376

net flood damage factors used by the Soil Conservation Service.[9] This ratio indicated that the gross receipts were about 1.2 times the annual monetary benefits; thus, the increase in gross receipts to agriculture was $123,203.[10] The relationships presented in Table XII were used to derive a total net income to the local area of $53,376.[11] The relationships in Table XII also indicated that 62 per cent of the increase in net income was the primary benefits and 38 per cent the secondary benefits. The increase in secondary net income was further classified as income resulting from first round expenditures by farmers to other local sectors and income arising from subsequent rounds of expenditures by all local sectors. The ratio of net primary income to total net income was 1.62.[12] The primary component was 62 per cent of the total net income to the local area.

The various kinds of benefits then were allocated to the ten water-

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[9]The Soil Conservation Service's gross and net flood damage factors, for each crop, were used to determine a weighted adjustment factor. This factor was used to increase the annual benefit shown in the work plan to a gross income equivalent.

[10]This ratio is relevant for crop and pasture benefits only. A different ratio would need to be derived for each category of benefits appearing in the work plan.

[11]The percentages relationship between local net income and gross receipts to agriculture in Table XII is 0.43324. This coefficient was multiplied by the gross receipts to agriculture resulting from a reduction of crop and pasture damage to determine the total net income to the local area.

[12]This multiplier is based on the presupposition that all changes in gross receipts to farmers in the local area are accounted for in the data of this example. That is, any multiplier effects within the agricultural sector are ignored. When watershed projects directly affect a high percentage of farmers in the local area, as in the case for the area of this study, inclusion of the within farm sector multiplier effects in the secondary benefits may be a questionable practice.

sheds with project plans in the County on the basis of the percentage the gross receipts in each watershed were of the total. Thus, for a specific watershed, Sandstone, the total local benefits would be $15,765, with $9,777 of primary benefits and $5,988 of secondary benefits.

The local primary benefits for the ten watersheds of $33,100 accrue only to agriculture sector (Table XV). The secondary benefits accrue to all the other sectors in the economy, with sectors B, C, F, and H being the major recipients of this income. The agricultural sector, the direct beneficiary, receives only 62 per cent of the total net benefits. This distribution of benefits could provide a basis for determining an assessment to each sector for sharing the local cost of development.

The same procedure was used to determine the increase in primary and secondary net income associated with recreational development. In a recent study, Burns estimated expenditures for water oriented recreational services by nonresidents to be $61,000.[13] Using the relationships derived in Table XIII, it was possible to estimate the gross and net income associated with the export of recreational services (Table XVI). The net income resulting from the sale of recreational services was only 26 per cent of the gross income. A comparable figure for agriculture was 43 per cent. Of the total net income from recreation of $17,921, 66 per cent was primary and the remaining 34 per cent was secondary. The local multiplier of net primary recreational income was 1.52, compared to 1.62 for agriculture. The net benefits from recreation appears to be more evenly distributed among local sectors than benefits from agriculture (Table XVII). However, this result may be purely illusionary. About

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[13]Burns, p. 8.

TABLE XV

DISTRIBUTION OF INCREASE IN NET INCOME DUE TO THE REDUCTION OF CROP AND PASTURE DAMAGE IN THE STUDY AREA

Sectors	Net Income					
	Primary		Secondary		Total	
	Dollars	Percent	Dollars	Percent	Dollars	Percent
A	33,100	100.0	-	-	33,100	62.0
B	-	-	4,301	21.2	4,301	8.1
C	-	-	4,612	22.8	4,612	8.6
D	-	-	902	4.5	902	1.7
E	-	-	595	2.9	595	1.1
F	-	-	3,552	17.5	3,552	6.7
G	-	-	1,560	7.7	1,560	2.9
H	-	-	2,765	13.6	2,765	5.2
I	-	-	269	1.3	269	0.5
J	-	-	1,407	6.9	1,407	2.6
K	-	-	313	1.6	313	0.6
Total	33,100	100.0	20,276	100.0	53,376	100.0

TABLE XVI

ESTIMATED INCREASES IN NET INCOME ASSOCIATED WITH AN EXPORT OF RECREATIONAL SERVICES, ROGER MILLS COUNTY (DOLLARS)

Watershed	Export of Recreational Services	Gross Income to Economy from Recreation	Net Income				
			Primary	Secondary			Total
				First Round	Subsequent Rounds	Total	
Beaver Dam	1,867	2,079	361	160	27	187	548
Big Kiowa	1,867	2,079	361	160	27	187	548
Broken Leg	1,867	2,079	361	160	27	187	548
Dean Indian-Wildhorse	4,984	5,550	964	428	72	500	1,464
Nine Mile	6,844	7,622	1,325	588	98	686	2,011
Quartermaster	13,072	14,558	2,530	1,123	188	1,311	3,841
Sandstone	9,339	10,400	1,808	802	134	936	2,744
Sergeant Major	3,733	4,157	722	321	54	375	1,097
Upper Washita	16,183	18,022	3,132	1,389	233	1,622	4,754
Whiteshield	1,244	1,386	241	107	18	125	366
Total	61,000	67,932	11,805	5,238	878	6,116	17,921

TABLE XVII

DISTRIBUTION OF NET INCOME FROM RECREATION ASSOCIATED WITH WATERSHED DEVELOPMENT IN STUDY AREA

Sectors	Net Income					
	Primary		Secondary		Total	
	Dollars	Percent	Dollars	Percent	Dollars	Percent
A	-	-	369	6.0	369	2.0
B	-	-	4,476	73.2	4,476	25.0
C	-	-	893	14.6	893	5.0
D	5,352	45.3	-	-	5,352	29.9
E	37	0.3	-	-	37	0.2
F	3,166	26.8	-	-	3,166	17.7
G	1,109	9.4	-	-	1,109	6.2
H	-	-	14	0.2	14	0.1
I	2,141	18.2	-	-	2,141	11.9
J	-	-	266	4.4	266	1.5
K	-	-	98	1.6	98	0.5
Total	11,805	100.0	6,116	100.0	17,921	100.0

40 per cent of the population of Roger Mills County is rural, yet the agricultural sector receives only about two per cent of the net recreational benefits. Furthermore, the lakes being used for recreational purposes mainly are located on privately owned farms and ranches.

There appears to be a major disassociation of local costs and local returns in small watershed projects. All local people share in the benefits of these projects, but the local costs are bore mainly by farmers. More attention to the development of "equitable" local cost sharing arrangements appears to be warranted.

Relevance of Results for Watershed Planning

This study was designed to select procedures and to apply them in estimating secondary effects of watershed development to a local area. A basic premise of the study was that local primary benefits did exist, otherwise there would be no local secondary benefits. Further, it was assumed that knowledge of local secondary benefits was as relevant as knowledge of local primary benefits if the objective of the projects were to develop local areas. It should be emphasized, however, that the results obtained were not relevant as measures of national secondary benefits. The study did not consider the geographical distributional effects of the projects; rather, the unit of analyses was the local area. Thus, the local secondary benefits estimated in this study are irrelevant to benefit-cost analysis intended to be national in perspective.

The procedures developed in this study are intended to apply to relatively small regions. Other methods would be more appropriate for measuring the impacts of larger projects with widely dispersed economic effects. The use of a county for the unit of analysis enhances the

usefulness of the results because the sponsoring organizations for small watershed projects often are contained within the boundaries of a county. Also, there are advantages of defining a local area as the boundaries of a local governmental unit from the standpoint of using secondary data or inclusion of a local public sector in the accounting.

The practice of local cost sharing by primary beneficiaries only, in relation to their benefits, is one source of a major disassociation of local costs and returns to watershed projects. This procedure excludes the secondary beneficiaries and all their benefits amount to windfall gains. The results of this study indicate, that for this area, net secondary benefits are about 62 per cent of the net primary benefits for agriculture. Only about two per cent of the total primary and secondary benefits from recreation accrue to the agricultural sector, yet the structures used for this purpose are located mainly on farms and ranches. The results of the study may have more empirical validity in the measurement of the relative than the absolute magnitude of local benefits by economic sectors. If so, they could be used as a basis for changing the local cost sharing procedures.

The results of this study could be applied, with caution, to other local areas with a similar economic structure. The basic economic characteristics of a local economy are complex; thus, no single characteristic, such as size or population, provides an adequate criterion for making direct application of these results to other local areas. In addition to the variability among local areas in economic characteristics at one point in time, local economies change over time, and consideration must be given to dynamic factors affecting the basic structural relations of local economies. After all, projects are planned for periods of 50 to

100 years. Recognition of the dynamic forces also applies in the estimation of local primary effects.

Often the intent is to include a combination of purposes and scale of development to maximize the influence of the projects upon local economic development. This study demonstrates that, for purposes with the same local primary benefits, the local secondary benefits will differ. Although local costs by purposes also needs to be taken into account in implementing this objective, the results of this study are expected to be useful in project planning for local economic development.

Need for Additional Research

This study demonstrated the dependence of local secondary benefits upon: (1) the primary benefits by project purposes; and (2) the characteristics of the local economy. Additional research is needed to permit more accurate estimates of the local primary benefits to provide a benchmark for determining secondary impacts. Also additional research is needed to determine the relation of economic characteristics in local economies and local secondary benefits and changes in these characteristics. That is, how do local economies differ and how do these differences affect the amount and distribution of the local secondary benefits resulting from alternative designs of watershed development? The results from such research would be important in estimating the local primary as well as the local secondary benefits of resource development.

The large amount of data required for use of the current methods in regional analysis suggests the need for developing low cost methods of estimating local secondary benefits. An advantage in this study was a cooperative local banker who permitted use of microfilmed copies of

checks of his clients. Such an advantage may be absent in other studies of this kind. Although this study was empirical in orientation, the results are point "estimates", and research is needed to design procedures for measuring the empirical validity of these estimates. In particular, research is needed to determine how the results of this study could be adjusted for making estimates of local secondary benefits to resource development in other local areas.

CHAPTER V

SUMMARY

Resource development projects such as upstream watershed development as administered by the Soil Conservation Service have local economic consequences generally classed as primary and secondary. The local primary benefits accrue to those directly experiencing the products or services of the projects. Local secondary benefits are increases in incomes of all others in the local area as a result of the existence of local primary benefits. A limited amount of knowledge exists on the magnitude of the local secondary benefits of the projects.

This study was undertaken for the general purpose of developing and applying methodology for estimating the local secondary benefits of watershed development. More specifically, the major objectives of the study were (1) to formulate a conceptual model and accompanying procedures for estimating the local secondary effects of resource development, and (2) to apply the procedures by empirically estimating the magnitude and distribution of secondary effects for a specific county in Oklahoma. The unit of analysis for the study was the local area. With positive national secondary benefits to resource development being small or nonexistent, local secondary benefits to the projects as well as the local primary, arose from a geographical redistribution of income in favor of the project areas.

Roger Mills County was selected for this study. The general model

for the study was an adaptation of the theory of payments as conceived by Boulding to a local economy. Selected techniques in regional analysis were used to estimate net incomes associated with the gross payments. The model used contained eleven local economic sectors and one nonlocal sector. Data on the receipt and expenditure patterns among the twelve sectors were obtained from microfilmed copies of checks of the major bank in the County for 1960. Nearly 26,000 checks were included in the sample data. These checks accounted for all the bank's transactions for a sample of 24 days, a "composite month" for the year.

For the area of the study, local net secondary benefits from increases in income to farmers through watershed development was estimated to be about 38 per cent of total local net benefits arising from this source. Thus, the net local multiplier for increases in farm income was 1.62. It was estimated that the county gained $1.78 in total gross receipts per dollar increase in gross receipts to farmers. For each dollar of gross receipts to the County, there was an estimated $0.27 in net primary income and $0.16 in net secondary income. A major part of the secondary income accrued to the agribusinesses of the County such as elevators, farm machinery dealers, and farm supply stores.

Estimates were made of the relation of primary to secondary income arising from receipts for recreational services in the County to compare with this relation for increases in farm income. The local gross receipts multiplier for recreational expenditures was 1.13 and the local net income multiplier was 1.52. Nearly all the income from recreational expenditures of nonresidents of the County accrued to the local retail business establishments. Those establishments receiving the "first round" effects obtained about 66 per cent of the total net income to the

County from recreation. Farmers received only about two per cent of the net recreational income. The smaller local multipliers and net incomes arising from receipts from recreation as compared with receipts from farming was due to a greater amount of "leakage" of recreational income from the County in the form of nonlocal expenditures than occurred for farm income.

The results of the study revealed the possibility of major dis-associations of local costs and local returns to watershed projects. Cost sharing procedures were applied mainly to primary beneficiaries in case of development for agricultural purposes. However, net primary income was less than two-thirds of the total to the local area. Farmers (landowners) incurred the costs (if any) of recreational services provided by the reservoirs, yet they obtained an insignificant portion of the local net income from recreational receipts.

The results of this study are irrelevant as estimates of national secondary benefits to watershed development. They have limited usefulness in application to watershed planning in local areas differing in economic characteristics to the one of this study. Additional research is needed to estimate how local secondary benefits are related to particular characteristics of local economies.

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A P P E N D I X E S

A P P E N D I X A

APPENDIX A

FORMAL STATEMENT OF MODEL AND COMPUTATION PROCEDURES

The local economy is classified into (n + 1) sectors; n of these are the processing or endogenous sectors and the remaining sector is a composite of the payments to the exogenous sectors. The transactions which occur in the exogenous sectors are for intermediate production inputs which are used by other local sectors in the production of goods and services. The composite exogenous sector (local consumption, local government, and exports) includes payments for final use in the sense that these inputs are not re-used in the production process.

Let the gross receipts of the i^{th} endogenous sector be specified as X_i. Some of these receipts are for goods purchased by other endogenous sectors (including the i^{th} sector) for further processing. The amount sold by the i^{th} sector to the j^{th} exdogenous sector is designated as X_{ij}. The remainder of the receipts to the i^{th} sector are payments from the exogenous sector for final use of the goods and services from that sector. The quantity delivered for final use is designated as Y_i. The system of linear equations for the entire economy can be specified as follows:

$$
\begin{aligned}
X_1 &= X_{11} + X_{12} + X_{13} + \cdots + X_{1n} + Y_1 \\
X_2 &= X_{21} + X_{22} + X_{23} + \cdots + X_{2n} + Y_2 \\
&\vdots \\
X_n &= X_{n1} + X_{n2} + X_{n3} + \cdots + X_{nn} + Y_n
\end{aligned}
\qquad (1)
$$

In the first equation, the total receipts to sector X_1 are equal to the receipts from the other endogenous sectors (including sector 1) plus the receipts from the exogenous component. Thus, the system of equations provides a systematic set of equations for indicating the flow of goods and services for the processing sector of the economy.

It is then assumed that the expenditures by any given endogenous sector to other endogenous sectors is a function of purchasing sectors total receipts. Thus, the explicit assumption that a sectors expenditures are a fixed portion of that sectors receipts. In symbolic notation, the expenditures of the j^{th} sector from the i^{th} sector (designated above as X_{ij}) is proportional to the gross receipts of the j^{th} sector. Thus,

$$(2) \qquad \frac{X_{ij}}{X_j} = a_{ij} \text{ or } X_{ij} = a_{ij} X_j.$$

Substituting from equation (2) into equations (1), the following set of equations is derived where the a_{ij} are defined as the from-to trade coefficients.

$$(3) \qquad \begin{aligned} X_1 &= a_{11} X_1 + a_{12} X_2 + - - - + a_{1n} X_n + Y_1 \\ X_2 &= a_{21} X_1 + a_{22} X_2 + - - - + a_{2n} X_n + Y_2 \\ &\vdots \\ X_n &= a_{n1} X_1 + a_{n2} X_2 + - - - + a_{nn} X_n + Y_n \end{aligned}$$

Equation (3) can be rewritten in matrix notation as follows:

$$(4a) \quad X = AX + Y, \text{ or}$$

$$(4b) \quad X - AX = Y.$$

From equation 4a, one can determine the portion of total gross receipts allocated to both the endogenous and exogenous sectors of the economy. Equation 4b provides the framework for determining the gross receipts associated with a specified allocation to the exogenous sector.

Thus, equation 4b can be restated as follows where I is an identity matrix of the same dimension as the A matrix:

$$(5) \qquad X\,(I-A) = Y \quad \text{or} \quad X = (I-A)^{-1}Y$$

Then let $(I-A)^{-1} = A^*$, and the resulting equation is:

$$(6) \qquad X = A^*Y$$

In this form, specified changes in final demand can be inserted into equation (6) to solve for the level of gross receipts.

This formulation permits one to solve for the amount of gross receipts generated in the economy by, say, an increase in the export of recreational goods and services.

A similar approach can be used to measure the direct and indirect primary input requirements. First, a matrix of input coefficients is computed which indicates the functional relationship between a sector's expenditures on primary inputs (quadrant III of the basic model) and the sector's gross receipts. The coefficients in this matrix account for only direct input requirements. To determine the direct plus indirect effects, the input matrix is multiplied by the inverse matrix above (A*). The resulting coefficients are a measure of the direct plus indirect inputs required per dollar increase in final demand for each sector.

For a more detailed presentation of the mathematical procedures associated with this type of analysis, the following references are recommended:

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A P P E N D I X B

APPENDIX B

EVALUATION OF PRIMARY DATA

The primary data on which this study was based was information from 26,000 microfilmed copies of checks clearing the Security State Bank at Cheyenne, Oklahoma in 1960. All checks were recorded, according to sector, for 24 banking days. There were 306 banking days in 1960; thus, the sample data accounted for about 7.8 per cent of the total banking transactions for the year.

In Roger Mills County, the percentage of bank clients was lowest for the agricultural sector. Further, the agricultural sector had the highest ratio of in-county expenditures. Thus, the data used in the study probably causes a downward bias in the local multiplier obtained.

It was assumed that the sample days were representative of the financial transaction being conducted by checks in the County. However, the data did not consider the possible bias introduced by not including the inter-sectoral flow of currency within the economy. Thus, it was necessary to consider the "measurement errors" inherent in the sample data. Although a bias is fairly apparent in the data (an adjustment was required in the expenditures for sector B which would probably have a high degree of cash transactions) its magnitude seemed to be relatively unimportant.

An analysis of the distribution of the size of the checks provided one method for assessing the reasonableness of the data. Appendix Table I

APPENDIX TABLE I

DISTRIBUTION OF EXPENDITURES BY SIZE OF CHECKS

Interval	Local Expenditures To Local Sectors			Local Expenditures To Nonlocal Sectors		
	No. Checks	% of Checks	Accum. Percent	No. Checks	% of Checks	Accum. Percent
$ 0 - 5.00	6488	44.3	44.3	1879	25.4	25.4
5.01 - 10.00	2890	19.7	64.0	1500	20.3	45.7
10.01 - 25.00	2343	16.0	80.0	1766	23.9	69.6
25.01 - 50.00	1166	8.0	88.0	788	10.7	80.3
50.01 - 100.00	838	5.7	93.7	575	7.8	88.1
100.01 - 200.00	437	3.0	96.7	416	5.6	93.7
200.01 - 300.00	172	1.2	97.9	149	2.0	95.7
300.01 - 500.00	125	0.8	98.7	121	1.6	97.3
500.01 - 1000.00	96	0.6	99.3	93	1.3	98.6
1000.01 +	102	0.7	100.0	105	1.4	100.0
Total	14657	100.0	xx	7392	100.0	xx

Interval	Nonlocal Expenditures To Local Sectors			Expenditures By All Sectors		
	No. Checks	% of Checks	Accum. Percent	No. Checks	% of Checks	Accum. Percent
$ 0 - 5.00	685	18.6	18.6	9052	35.2	35.2
5.01 - 10.00	381	10.4	29.0	4771	18.5	53.7
10.01 - 25.00	490	13.3	42.3	4599	17.9	71.6
25.01 - 50.00	430	11.7	54.0	2384	9.3	80.9
50.01 - 100.00	650	17.7	71.7	2063	8.0	88.9
100.01 - 200.00	479	13.0	84.7	1332	5.2	94.1
200.01 - 300.00	150	4.1	88.8	471	1.8	95.9
300.01 - 500.00	156	4.2	93.0	402	1.6	97.5
500.01 - 1000.00	139	3.8	96.8	328	1.3	98.8
1000.01 +	116	3.2	100.0	323	1.2	100.0
Total	3676	100.0	xx	25725	100.0	xx

shows the distribution of expenditures by the various classes in the economy. About 54 per cent of all checks recorded were for ten dollars or less, and 35 per cent were for five dollars or less. If one considers only the within county payments (local expenditures to local sectors) these percentages were 64 and 44 per cent, respectively.

Seventy one per cent of the checks written by sector B were for less than ten dollars, and 48 per cent for less than five dollars (Appendix Table II). In comparison, about 29 per cent of checks written by the nonlocal sector (payments to local sector) were for less than ten dollars. Sectors D and E received the largest number of checks for less than ten dollars as 78 per cent of all checks they received were for less than this amount. The President of the Cheyenne Bank suggests the lack of a service charge for writing checks in his bank as one reason for the high percentage of small checks. Although the evidence is not conclusive, it seems fairly safe to assume that a relatively large percentage of the County's financial transactions were accounted for in the check data.

Due to the relative importance of agriculture in the model, additional primary data were obtained on agricultural expenditures for selected items by directly interviewing 28 farmers in the county. The purpose of this survey was to provide comparison with the check data. The results indicated that the magnitude of within County expenditures was substantially lower in the check data than indicated from the survey (Appendix Table III). On the average, the survey data was about 15 per cent higher on in-county purchases than the check data. This suggested a tenative hypothesis that the direct interview technique was biased toward the underreporting of expenditures on nonlocal goods and services.

APPENDIX TABLE II

NUMBER AND PERCENTAGE DISTRIBUTION OF CHECKS OF LESS THAN TEN DOLLARS IN SAMPLE BY RECEIPTS AND EXPENDITURES AND BY SECTORS

Sector	Expenditures					Receipts				
	No. of Checks	No. <$5.	% <$5.	No. <$10.	% <$10.	No. of Checks	No. <$5.	% <$5.	No. <$10.	% <$10.
A	12039	4747	39	7229	60	2286	479	22	745	33
B	2392	1155	48	1703	71	1793	342	19	599	33
C	2509	1038	41	1576	63	1561	677	43	879	56
D	733	137	19	217	30	2863	1558	54	2225	78
E	372	73	20	119	32	2079	1074	52	1612	78
F	925	190	21	331	36	2961	1317	44	1844	62
G	605	217	36	315	52	811	243	30	427	53
H	898	222	25	376	42	1139	237	21	431	38
I	320	116	36	185	58	546	404	74	472	86
J	979	358	37	542	55	1571	460	29	648	41
K	277	114	41	164	59	723	404	56	596	82
Total Local	22049	8367	38	12757	58	18333	7213	39	10478	57
Nonlocal	3676	685	19	1066	29	7392	1879	25	3379	46
Total	25725	9052	35	13823	54	25725	9092	35	13857	54

APPENDIX TABLE III

COMPARISON OF WITHIN COUNTY EXPENDITURES FOR SELECTED ITEMS IN THE AGRICULTURE SECTOR

Item	Percent of Expenditures Within County	
	Farm Survey	Check Data
Livestock Purchases	75	52
Autos, Farm Mach., and Equip.	79	49
Cash Rent	52	40
Hired Labor	92	96
Feed, Seed, Grain, Hay, and Fert.	97	75
Family Living Expenses	71	64

One reason for this possible bias may be related to the social stigma of not trading in one's "home town". Another factor which may be significant is that the checks written to the nonlocal sector are 50 per cent larger than those to local sectors. The relatively small size of the survey should also be considered in evaluating the comparison between the two approaches.

A P P E N D I X C

APPENDIX TABLE IV

PRODUCTION AND CONSUMPTION COMPONENTS OF LOCAL AND NONLOCAL AGRICULTURAL EXPENDITURES: ROGER MILLS COUNTY, OKLAHOMA

Item	Local Sector		Nonlocal Sector	
	Prod.	Cons.	Prod.	Cons.
Labor	$ 19,245.92	$ 1,917.90	$ 613.73	$ 68.20
Rent	4,302.58	1,297.63	6,521.42	2,025.66
Grain, Cotton, Feed, Seed, and Fertilizer	47,645.60	-	16,064.79	-
Livestock	31,975.88	-	30,008.67	-
Custom Work and Hauling	6,580.81	-	2,052.49	-
Gas and Oil	16,736.45	6,147.76	4,392.01	1,624.44
Repairs and Parts	10,203.22	2,576.92	6,247.63	1,581.48
Lumber and Plumbing	8,934.67	2,322.94	2,627.78	685.94
Machines and Autos	9,368.87	4,037.16	13,151.31	4,483.94
General Supplies	2,967.32	-	3,627.71	-
Veterinary and Drugs	2,101.69	564.94	7.76	-
Utilities	308.11	1,232.44	1,025.39	4,101.56
Insurance	504.37	1,053.12	2,020.75	6,842.18
Grocery and Cafes	-	14,421.87	-	5,155.15
Medical and Funeral	-	1,274.21	-	4,309.42
Other Professional Services	1,569.52	367.15	888.05	184.47
Books, Subscrip., and Educ.	-	753.90	-	1,734.15
Personal Services	-	1,570.95	-	346.96
Furniture and Appliances	-	2,557.64	-	2,953.93
Clothing	-	4,521.41	-	3,804.05
Mail Order Stores	-	-	1,505.81	1,963.80
Gifts and Contributions	-	2,596.88	-	453.91
Taxes	10,591.54	3,145.86	17,240.91	5,120.64
Cash and Misc.	5,021.91	5,218.88	7,736.71	2,486.83
Total	178,058.46	57,579.56	115,732.92	49,926.71

A P P E N D I X D

APPENDIX TABLE V

BALANCE OF PAYMENTS FOR ROGER MILLS COUNTY, 1960

Item	Expend. from Local Sectors to Nonlocal Sectors	Receipts to Local Sector from Non-Local Sector	Net Balance of Trade
	$(000)	$(000)	$(000)
Labor	38	714	676
Rent	153	71	-82
Grain, Cotton, Feed, Seed, and Fertilizer	625	557	-68
Livestock	544	2,194	1,650
Livestock Products	-	1,012	1,012
Custom Work and Hauling	38	226	188
Gas and Oil	589	179	-410
Repairs and Parts	330	49	-281
Lumber and Plumbing	405	60	-345
Machines and Autos	407	133	-274
Gen. Supplies	213	-	-213
Veterinary and Drugs	69	14	-55
Utilities	153	31	-122
Insurance	236	82	-154
Groceries and Cafes	459	23	-436
Medical and Funeral	101	24	-77
Other Professional Services	32	14	-18
Books, Subscrip., and Educ.	69	1	-68
Personal Services	27	-	-27
Furniture	56	-	-56
Clothing	219	14	-205
Mail Order Stores	67	-	-67
Gifts and Contributions	34	13	-21
Taxes	499	119	-380
Govt. Pmts. (ASC, etc.)	-	228	228
Soc. Security and Welfare	-	436	436
Oil Leases	-	192	192
Cash and Misc.	721	355	-366
Total	6,084	6,741	657
Balance of Trade and Discrep.	657	-	657
Total	6,741	6,741	-

[1]These estimates of the balance of trade are based on check data and thus account for only the trade area of the bank. However, it is assumed this area is representative of the entire County.

VITA

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Doctor of Philosophy

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Biographical:

Personal Data: Born in Sibley, Iowa, February 5, 1933, the son of Frank and Dena Jansma.

Education: Attended high school in Sibley, Iowa, graduating from Sibley Public High School in May, 1951. Received the Bachelor of Science Degree from Iowa State University, Ames, Iowa in June, 1955, with a major in Agricultural Business and Rural Administration. Received the Master of Science Degree from Iowa State University in May, 1958, with a major in Agricultural Economics. Engaged in graduate study toward the Degree of Doctor of Philosophy at Oklahoma State University, Stillwater, Oklahoma from September, 1960, to August, 1963.

Professional Experience: Employed as a Research Assistant in the Department of Agricultural Economics, Iowa State University from September, 1955, to February, 1957, except for the period June, 1956 to September, 1956, when employed as special assistant to County Assessor, Osceola County, Iowa. Served in United States Army from February, 1957 to August, 1957. Employed by Central Intelligence Agency from August, 1957, to November, 1958. Since November, 1958, employed as an Agricultural Economist with the United States Department of Agriculture.