Income Distribution in Virginia: The Effect of Intersectoral Linkages on the Short-Run Size Distribution of Income in Small Regions

by

G. Andrew Bernat, jr.

Dissertation submitted to the Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

in

Agricultural Economics

APPROVED:

Thomas G. Johnson, Co-Chairman

Brady J. Deaton, Co-Chairman

George W. Norton

Randall A. Kramer

Herbert H. Stoevener

July, 1985

Blacksburg, Virginia

Income Distribution in Virginia:
The Effect of Intersectoral Linkages on the Short-Run Size Distribution of Income in Small Regions

by

G. Andrew Bernat, jr.

Thomas G. Johnson

Agricultural Economics

(ABSTRACT)

The purpose of this study is to assess the role intersectoral linkages play in shaping the short-run size distribution of household income. Input-output models are constructed for four regions in Virginia using secondary data. Two distinguishing features of these models are that the household sector is disaggregated into 12 income classes and unemployment benefits are an endogenous component of household income. Using these models, it is concluded that: (a) As linkages increase, the effects on inequality of changes in different components of final demand converge. (b) Increasing the degree of linkage, with constant industry mix, will tend to increase inequality. (c) Although the degree and pattern of linkages among household groups varies from region to region, all income groups are more strongly linked to middle income households than to either high or low income households.

ACKNOWLEDGEMENTS

I would like to thank my advisory committee for their assistance throughout the course of this study. Drs. Herbert Stoevener and Randall Kramer provided helpful comments on earlier drafts. Dr. Brady Deaton provided the motivating ideas for the study. Dr. George Norton deserves special thanks, not only for his comments and encouragement during on the dissertation but for all his help thoughout my stay in Blacksburg. Dr. Thomas Johnson provided invaluable direction, advice, and encouragement and deserves much of the credit for the completion of the study. In addition, I want to thank my parents for their assistance during my graduate studies. Finally, I would like to thank my wife , without whom this project would never have come to fruition.

TABLE OF CONTENTS

LIST OF TABLES.

LIST OF ILLUSTRATIONS

1.0 INTRODUCTION

It is a widely accepted view that the way in which economic resources are distributed across the population is an important factor in the evaluation of the level of development and of the performance of an economy. A major difficulty with this view is that there is no satisfactory theory of the size distribution of income and, consequently, there is no completely satisfactory way to connect the process of economic development with the mechanisms underlying the formation of the size distribution. The purpose of this dissertation is to investigate some of the relationships between income distribution and regional economic structure. In so doing, it is hoped that a contribution can be made toward increasing our knowledge of income distribution mechanisms, and thereby further our understanding of the operation and behavior of regional economies.

1.1 OBJECTIVES AND HYPOTHESES

Specifically, the primary objective of the study is to assess the importance of intersectoral linkages in shaping the short-run distribution of household income in four regions of Virginia. Four types of linkages are of interest. Industry-industry (interindustry) linkages are the linkages among regional goods and service producing sectors. Household-industry linkages are household expenditures on regional output and are called consumption linkages. Industry-household linkages are embodied in the value-added arising from regional production that is distributed to regional households. These linkages are called value-added linkages. Household-household linkages (household linkages for short) measure the degree to which the spending of any given household affects the income of other households.[1]

Four hypotheses are tested in this study. Two of these apply to consumption and value-added linkages and employ the concept of sectoral inequality impact. The sectoral inequality impact of a particular sector is defined as the level of inequality of the distribution of household income arising from a unit change in the sector's level of output. This is to be distinguished from the impact on the overall level of inequality of a change in sectoral output. The latter depends upon the size of the change in income and the initial level of inequality, whereas the the sectoral inequality impact depends only upon the degree to which the sector is linked to the rest of the economy and the distribution of household value-added of the sectors to which it is linked.

---

[1] The four types of linkages, as well as the following hypotheses, are discussed in detail in Section 2.6.4, below.

The first two hypotheses are: 1) sectoral inequality impacts converge as the degree of linkage within the economy increases, and 2) the inequality impacts of the basic or export sectors differ in a systematic way from the inequality impacts of non-basic sectors.

The third hypothesis is that high-income households are more strongly linked to low-income households than are low- and middle-income households. The fourth hypothesis also applies to household linkages. This hypothesis is that the distribution of income arising from a change in the income of a particular household is a function of the income of the spending household.

In order to test these hypotheses, it is necessary to model both intersectoral linkages and income distribution. The secondary objective of this study is to construct such a model. In addition to making tests of the above hypotheses possible, such a model will represent an improvement over commonly used regional economic models.

1.2 ORGANIZATION OF STUDY

The dissertation is organized in the following way. The remainder of this chapter is taken up with a discussion of the major reasons for studying the size distribution of income and addresses a number of preliminary issues that any study of the distribution of income must resolve. These issues are the period of analysis, the definition of the income receiving unit, the definition of income, and the manner in which income distributions are compared.

The first part of Chapter Two examines some of the major strands of income distribution theory and concludes that, even though the short-run distribution of income is an important characteristic of any economy, little of the current income distribution literature deals directly with the relationship between the structure of an economy and the short-run distribution of income. The second part of the chapter makes an attempt to partially fill this lacuna; first, by showing how the industrial structure can be expected to contribute to the formation of the size distribution, and second, by developing some hypotheses about the relationship between intersectoral linkages and the short-run size distribution of income.

Chapter Three describes an input-output model that is used to investigate selected issues raised in the preceding chapter. The fourth chapter discusses data sources and construction of the models used in the study. Chapter Five discusses the results of this investigation. The final chapter summarizes the study and discusses some implications of the findings. It concludes with comments on how the model could be improved.

1.3 THE IMPORTANCE OF THE SIZE DISTRIBUTION OF INCOME

The size distribution of income is considered to be an important characteristic of an economy for two reasons. First of all, the size distribution of income is an important determinant of, and is in turn affected by, the level and mix of regional output. Consequently, accurate modeling of the regional economy requires an understanding of this interaction between the regional production of goods and services and the size distribution of household income. Secondly, many people believe that the level of inequality directly affects the welfare of society as a whole. These considerations are discussed in the following two sections.

1.3.1 INCOME DISTRIBUTION AND REGIONAL OUTPUT

A major reason for studying the size distribution is its effect upon the level and mix of output in an economy. As Engel first demonstrated in the nineteenth century, the types and quantities of goods and services consumed by an individual or a household are highly dependent upon the consuming unit's income level. Consequently, a given level of aggregate income, distributed differently over two otherwise identical populations will, in general, imply two different vectors of goods and services demanded by consumers. This difference in household consumption expenditures has a number of very important implications.

It is widely accepted that the marginal propensity to spend falls as income rises. To the extent that this is true, a change in household income will have a greater effect upon household demand for output, the lower the income of the household(s) experiencing the change in income. In the case of a regional economy, this differential effect will be magnified if the marginal propensity to consume locally produced goods and services falls as household income rises. If, on the other hand, the marginal propensity to spend on regionally produced goods and services rises with household income, the differential effect will be reduced.

Households differ not only in terms of their overall marginal propensity to spend, but also with regard to the type and quantity of goods and services consumed. From a distributional point of view, the key question is whether or not the marginal propensity to consume low-wage intensive goods and services varies according to income. Defining a low-wage intensive good to be one for which a large amount of unskilled or low-wage labor is required in its production, Williamson and Lindert (1976) conclude that the consumption bundle of high-income, urban households has a greater low-wage intensity than does the consumption bundle of lower-income households.[2] Their result has a number of important ramifications, especially with regard to government policies that have a redistributional component. For instance, a progressive income tax would have a much stronger redistributional effect if the low-wage intensity of consumer expenditures were a decreasing function of income than if they were an increasing function. To see this, note that to the extent that household tax liabilities lower household expenditures on all goods and services, every dollar of taxes paid by households can be expected to result in a decline in overall expenditures and thus in a decline in the demand for low-wage intensive goods and services. It then follows that for any given increase in the tax rate, the demand for low-wage workers will fall by more, the greater the low-wage intensity of consumption expenditures. The finding of Williamson and Lindert imply that household spending patterns mitigate the distributional effects of progressivity in the tax structure.

Williamson and Lindert point out another aspect of the possibility that the consumption patterns of certain household groups may be relatively intensive in the use of different types of labor. If goods with a high income elasticity exhibit a high degree of low-wage intensity, rapid

---

[2] See the second part of Chapter 2 for a more detailed discussion of this study.

growth in household income may bring about a corresponding increase in the demand for low-wage labor. Such a situation would, ceteris paribus, put upward pressure on wage rates at the low end of the wage spectrum and would tend to raise the incomes of lower-income households. If the reverse situation existed, that is, if goods and services with high income elasticities were relatively high-wage intensive, increasing household income could result in falling demand for lower-wage workers. In Williamson and Lindert's study, consumer durables were found to be relatively high-wage intensive. This result indicates that any shift of household expenditures towards consumer durables would tend to increase inequality (Williamson and Lindert, p. 192, 1976).

Related to the question of the income intensity of the consumption bundle of different income groups is the question of whether the income intensity varies across different components of final demand. Williamson and Lindert hypothesize that the increasing role of government in the post-war American economy was one reason for a lessening of inequality, at least through the sixties. If government expenditures on goods and services were relatively low-wage intensive, the egalitarian effects of government transfers would have been reinforced. Their finding was that government expenditures on goods and services were much more low-wage intensive than private investment expenditures (Williamson and Lindert, p.188, 1976). These issues will be addressed further in the final section of Chapter 2 where the relationship between inequality and intersectoral linkages are discussed.

Just as the shape of the size distribution affects current output, it also affects saving and, thereby, economic growth. It is generally accepted that the marginal propensity to save (MPS) is an increasing function of income. In other words, as income rises, the proportion of each additional dollar of income that is saved also rises. Increasing the incomes of the well-to-do by a given amount would raise the quantity of savings by more than would the same total change in the incomes of the poor. To the extent that there is a monotonic relationship between savings and investment, the higher MPS of the rich implies that a higher growth rate could be achieved if the incomes of the rich were increased than if the incomes of the poor were raised by an equal amount.

1.3.2 SOCIAL WELFARE AND THE LEVEL OF INEQUALITY

A second reason for studying the size distribution of income is that the level of income inequality is often considered to be an important argument in the social welfare function of an economy (See for example Fields, 1980; Adelman, 1975; Chenery et al., 1974). This study, while recognizing this point of view, makes no attempt to measure the effect inequality may have on social welfare. However, even though little attention will be paid to this issue in the rest of the study, some comments are in order concerning the reasons why inequality may be said to have welfare content.

First of all, the level of inequality in the overall distribution of income will affect the level of social welfare, regardless of the level of average incomes, if the level of inequality is an argument in at least one individual's utility function or if any individual's utility is a function of his or her income vis-a-vis other individuals' income. Implicit in the proposition that inequality must enter one or more individual utility functions is the assumption of a social welfare function composed of a weighted combination of individual utilities, each individual weight being positive. While this may be a rather restrictive view of the form that the social welfare function may take, it is a relatively common one.[3]

One way in which the overall level of inequality will appear as an argument in an individual's utility function is if the individual has some notion as to what level of inequality is optimal. In such situations, the individual will

---

[3] A complete treatment of the various ways in which inequality may affect social welfare would require a more thorough discussion of social welfare functions than is appropriate for a study in which measurement of welfare is not an issue. It suffices to demonstrate only that inequality affects social welfare under certain commonly held views of the world.

consider himself better off, the closer is the actual level of inequality to the optimal level, and worse off the greater is the difference between the actual level and the optimal level of inequality, ceteribus paribus (Thurow, 1971). Consider the following two examples of what is meant by the notion of an optimal distribution of income.

First of all, a not uncommon view, at least in the industrial West, is that people are equal in some fundamental sense, and that this basic equality calls for an equal distribution of income (e.g. Tawney, 1967; Meade and Hitch, 1967; Osmani, 1982; Kuttner, 1984). In other words, the uniform distribution is the optimal distribution of income. A person holding this position would view any differences in income levels to be an indication that the distributional mechanisms of the economy are not operating properly, i.e. that people are not being treated as equals. The utility of a person holding such a view would then be lower, the greater the difference between the actual distribution and the uniform distribution. Tawney (1967) argues for complete equality using the analogy that as the Western conception of justice requires equal treatment of individuals by the legal system, justice also requires equal treatment of individuals by the economic system. The weakness in this line of reasoning is that the principle of blind justice only requires that the law mete out punishment with regard for actions taken, ignoring individual characteristics such as wealth or social position. A similarly "blind" economic system would also bestow rewards in response only to specified rules. However, in the same way that a just legal system imposes increasingly severe punishments for increasingly serious crimes, a just economic system could reward more highly valued activities with higher incomes. In other words, equal treatment does not imply equal income.

Meade and Hitch (1967) argue for complete equality using the utilitarian principle of the maximization of total utility. However, the utilitarian argument of Meade and Hitch requires the rather strong assumption that the marginal utility of money is constant and equal across all individuals.

An opposing view of what level of inequality is optimal is based on the observation that individuals differ in terms of both their ability to perform certain tasks and in their preferences for certain types of activities. If workers are paid according to the value of their marginal product, individual earnings will vary according to their competence in productive activities - a function of both "innate" ability and ability acquired through investment in human capital - and according to their choice of occupation. This type of inequality would be acceptable because individuals are given equal treatment ("equal treatment of unequals," Johnson, 1975). A level of inequality greater than a level consonant with the differences in abilities and tastes would thus imply that some individuals have somehow achieved an unfair advantage over the others. In other words, inequality would be too high. By the same token, adherents of this position would say that government action forcing equality in wages would result in too low a level of inequality.

This is a very appealing line of reasoning, at least to a traditionally trained economist. A serious difficulty arises, however, in determining exactly how much inequality is attributable to differences in tastes and abilities and how much to market imperfections. There has been a great deal of effort expended in trying to show how abilities, generally assumed to be normally distributed, can give rise to a distribution of income which more closely resembles the lognormal or beta distribution. A perhaps more basic difficulty revolves around the definition of ability. In fact, not only is there little agreement about the source of ability (e.g. the nature vs. nurture debate), some of the recent research into the determinants of labor earnings questions whether ability plays much role at all in the distribution of economic rewards. (See the discussion of ability theories in Chapter 2, below.)

Another avenue by which social welfare can be affected by the overall level of inequality is if an individual's level of utility is based, at least partially, upon income comparisons with other individuals. For instance, the concept of relative deprivation says that an individual feels deprived the further below is her/his income from the income of a reference group. Curtin (1977) and Osberg (1984) provide evidence that this theory is applicable in the United States.[4]

Even if the overall level of inequality (as measured by the Gini index, for instance) does not affect social welfare, this size distribution of income is important because the level and extent of poverty may affect social welfare. In this view, the level of inequality in the distribution of income is irrelevant but the number of households whose income falls below a threshold is considered important.

It is probably safe to say that most people in America associate poverty with suffering and hardship. The argument that poverty should be eliminated from society is thus akin to the argument that society should strive to relieve or eliminate the suffering caused by natural disasters and by disease. Poverty is also linked to lower social welfare in that violence and crime are often associated, in the minds of the public at least, with poverty (Schur, 1974). It follows from this argument that reducing poverty rates would reduce the level of crime.

---

[4] Parallel to relative deprivation is what might be called relative aggrandizement: an individual feels better off the further his/her income is above some reference group. Curtin's work indicates that this effect is small or nonexistent.

Although the above discussion on the relationship between inequality and social welfare just touches upon some of the major views, it should be obvious that each view ultimately involves a statement about the form of the social welfare function. It should be just as obvious that there is little or no agreement about such matters, particularly with regard to the importance of overall inequality. The general attitude in the U.S. seems to be that inequality in income is not such a bad thing per se. Gilder (1981) and Kristol and Bauer (1977) are two, somewhat polemic, expressions of this attitude. On the other hand, the extensive welfare system is evidence that there is widespread support for the view that poverty lowers social welfare. However, there is by no means a consensus on how to measure poverty, much less on how much poverty is too much.

1.4 DEFINING THE SIZE DISTRIBUTION OF INCOME

Before inequality can be measured, it is necessary to define more precisely the concept of income and the units across which income is distributed. Income is a flow and thus requires the specification of both what is meant by income and the time period involved. These are discussed in the following two sub-sections. It is then necessary to define the units over which this income is distributed. This is done in the penultimate part of this section. The final sub-section is a discussion of the problem of measuring inequality.

1.4.1 INCOME

As explained above, a major reason for the interest in the regional size distribution of income is its implications for the level of regional welfare. However, the measurement of individual welfare, not to mention social welfare, has proven to be a most intractable problem. The intangible nature of the concept of welfare requires that some proxy be employed. Money income is commonly chosen as such a proxy. Theoretically, a person's level of satisfaction or utility is a function of his or her real consumption. A difficulty involved with the use of money income as a measure of real consumption possibilities is that many goods are of a non-market nature, the consumption of which does not depend directly upon income. For instance, there are situations in which a person would voluntarily give up some money income in order to consume certain locational amenities or externalities. Sole reliance on an income measure of welfare would indicate a lower level of welfare at the lower money income level when in fact utility is higher. Two examples of this are the choice of leisure over work made by many part-time workers and the lower incomes accepted by many urban to rural migrants (Deaton, Morgan, and Anschel, 1982). Another difficulty is that money income does not even accurately measure the possibilities of consuming market goods and services unless income is adjusted to reflect taxes, cash and in-kind transfers, and the fact that price changes do not uniformly affect the goods and services consumed by different population groups.

There is little question, then, that money income is, by itself, an inadequate measure of welfare. However, as stated previously, the purpose of this dissertation does not include the measurement of welfare. Rather, the purpose is to explore the ways in which households are interlinked with the entire regional economy. As the spending and receiving of money income constitutes these linkages, money income is the appropriate definition of income. Thus, the consumption of public-type goods are not considered. The models that are used in the following analyses are constructed in such a way that most taxes and certain government transfers are incorporated.

1.4.2 PERIOD OF ANALYSIS

A second issue is the period of analysis over which incomes are to be measured. The present study examines annual changes in regional income distribution. This perspective is in contrast to much of the recent literature on income inequality which argues that, from a welfare perspective, the distribution of lifetime incomes is the relevant measure of inequality (Friesen and Miller, 1983; Von Weizsacher, 1978; and Minarik, 1977). This position is based upon the claim that optimizing individuals maximize lifetime income and, as in Friedman's permanent income hypothesis, view the inevitable annual fluctuations as transitory departures from their permanent level of income. However, even if people do attempt to maximize lifetime incomes, and in so doing view deviations from their perceived permanent income stream as random, temporary events, it does not follow that these fluctuations have no affect on individual welfare. To a large extent, welfare is a function of the level of consumption. Any change in current income, random or not, will affect either current consumption, future consumption, or both. To argue that short-run fluctuations in income distribution do not matter implies, for example, that unemployment and wage cuts do not adversely affect welfare. Not only are wages not higher to compensate for periods of unemployment (Johnson, 1977), but the evidence is fairly strong that unemployment affects health and overall feelings of well-being.

It should not be construed from the above discussion that life-cycle considerations are unimportant, just that they are not all-important. For most individuals, income rises with age, peaking at, or sometime just before, retirement. For this reason, it is sometimes desirable to account for the age distribution of the population in analyses of income distribution.

1.4.3 RECEIVING UNIT

The definition of the income receiving unit is perhaps not as simple as it might seem at first glance. One alternative would be to use individuals as the basic income unit. This is the simplest procedure because income data is very often reported by individual earners or transfer recipients. Another alternative is to use the family or household as the basic income receiving unit. Most authors consider the household to be the relevant unit because many, if not most, of the important economic decisions appear to be based upon the principle of maximizing household or family welfare rather than maximizing individual welfare (Dervis et al., 1982). This is the position taken here.[5]

1.4.4 INEQUALITY MEASUREMENT

The purpose of measuring income inequality is to be able to compare different income distributions. Whether or

---

[5] Households differ widely in size, age, sex, and other characteristics which affect consumption requirements. In some situations, it may therefore be desirable to employ some sort of equivalent scale (Deaton and Meullbauer, 1980).

not the distributions being compared are of a single economy over time, of a number of different economies for the same time period, or of an actual economy and some ideal economy, measurement necessarily involves both some loss of information and some sort of weighting of individuals, and thus, at least implicitly, a particular social welfare function. The major implication of the loss of information involved in the construction of indices is that a one-to-one correspondence between a particular measure of inequality and a given income distribution does not, in general, exist. In other words, a particular value of a given inequality measure will be consistent with a number of different distributions. Inasmuch as indices are created for the express purpose of reducing the amount of information contained in a distribution to a manageable level, this loss of information is not only unavoidable but is, in fact, desirable.

More important than the loss of information is the fact that every index implies a particular form of social welfare function. This idea, attributed to Dalton (1920) and rigorously pursued by Atkinson (1970), Blackorby and Donaldson (1978, 1980), and Kolm (1976a,b), among others, is based upon the fact that each index is a weighted combination of the income of each receiving unit. Because income is used as a measure of the welfare of each individual or household, each index indicates how important the welfare of each individual is in total social welfare.

The problem of deciding which inequality measure (or measures) to employ involves establishing some criteria with which to judge the various indices. The literature is replete with discussions of the various properties of different indices and of what criteria should be considered the most important in choosing an index (See Bernat, 1985, for a brief summary of some of these). For the present purposes, three conclusions coming out of this literature are of particular importance. First, most of the criteria for choosing one index over another essentially involve deciding upon the form of the social welfare function because most of the different criteria are, in the final analysis, rules for weighting individual incomes. Second, although every inequality index implies a particular social welfare function (Blackorby and Donaldson, 1978), and so will, in general, give different rankings of the same income distributions (Atkinson, 1970), groups of indices will often result in very similar, if not identical, rankings. For this reason, many situations may arise in which it would not matter a great deal which of several indices were used. Table 1.1 presents the Spearman rank correlations of inequality rankings of the 136 cities and counties in Virginia using five different inequality indices (See Bartels, 1975, for a comprehensive comparison of inequality indices in the context of the Netherlands). Clearly, there are differences in the five indices but for many cases these differences are not large.

Table 1.1

Spearman Rank Correlations

	GINI	C.V.	THIEL	ATKN1	ATKN2	SDLY
GINI	1.00000	0.88470	0.93043	0.98943	0.93182	0.34377
C.V.	0.88470	1.00000	0.82718	0.87189	0.83850	0.67615
THIEL	0.93043	0.82718	1.00000	0.93538	0.80953	0.22589
ATKN1	0.98943	0.87189	0.93538	1.00000	0.93804	0.34373
ATKN1	0.93182	0.83850	0.80953	0.93804	1.00000	0.39172
SDLY	0.34377	0.67615	0.22589	0.34373	0.39172	1.00000

C.V. = Coefficient of Variation
ATKN1 = Atkinson's index with E = 0.5
ATKN2 = Atkinson's index with E = 1.5
SDLY = Standard Deviation of the Logarithm of Income
136 Observations
Source: Bernat, 1985.

In particular, the rankings for the Thiel, Gini, and two Atkinson indices are fairly similar.

The final consideration is that this study uses grouped data and therefore requires an index that permits a simple decomposition of overall inequality into between group inequality and within group inequality. Because the Thiel index (normalized to range from 0 to 1) is readily decomposed in this way, it is the equality index employed in the study. The evidence presented in Table 1.1 indicates that there is a relatively high correlation among the rankings produced by the Thiel index, the Gini index, and the Atkinson indices, giving us confidence that the general conclusions reached in this study would be corroborated using these other indices.

2.0 LITERATURE REVIEW

In the preceding chapter, a case was made for studying the annual size distribution of household income. The purpose of this chapter is twofold. In the first part, the income distribution literature is surveyed to see what some of the standard income distribution theories have to say about how the size distribution can be expected to behave over the short-run. Because of the extent of the literature on income distribution, and because there are a number of good surveys of this literature (e.g. Sahota, 1978; Blinder, 1974; Atkinson, 1975), this chapter is not intended to be a comprehensive review. Rather, only those theories which give some insight into the problem at hand are examined in any depth, others being mentioned solely for completeness.

The second part of the chapter discusses the ways in which the sectoral composition of an economy is expected to help shape the short-run distribution of income.

Figure 1, a schematic of the short-run income distribution process, is useful in visualizing how the various size distribution theories are related to one another, and thus is also useful as a framework for organizing the following discussion of income distribution theory.

Beginning with the distribution of family income, (9) in the figure, the short-run distribution process can be

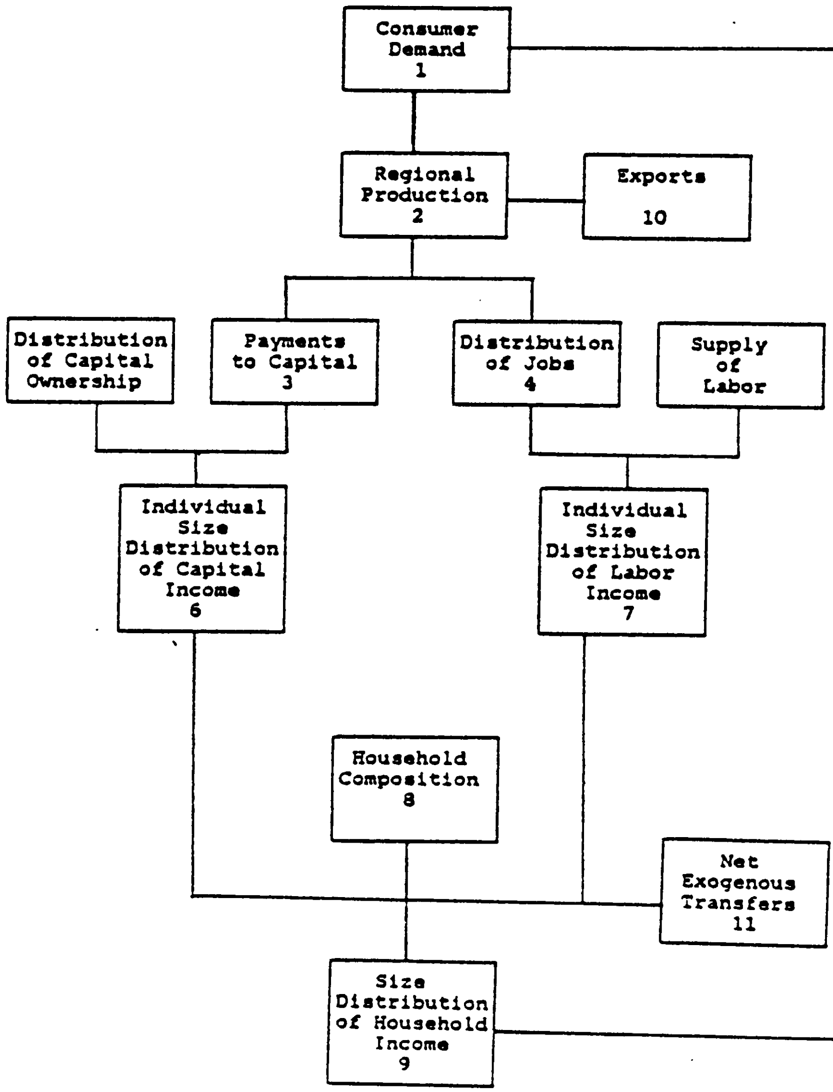

Figure 1. Size Distribution of Income: Short-Run

traced. The distribution of household income determines the demand for goods and services (1). This, together with the demand for the economy's exports (10), gives rise to the production of goods and services (2). The short-run nature of this model means that production technology and capital stock are fixed. Thus the level of (2) implies a particular distribution of jobs (4) and of payments to capital (3). The supply of labor, characterized by a distribution of skills, abilities, and other characteristics associated with productivity, are assigned to the available jobs to give the size distribution of labor earnings (7). Capital payments accrue to individuals according to capital ownership patterns to form the size distribution of capital income (6). The composition of households in terms of the number and type of workers and of capital ownership, together with net transfers from outside the economy (11), determines the size distribution of household income (9).

The above view of the distribution process is intended to show why there is as yet no satisfactory theory of the size distribution, despite the work by several generations of economists. Even in the short-run perspective embodied in Figure 1, a complete theory of the size distribution must include demand theory, production theory, a theory of the functional distribution of income, and a theory of household composition. The problem is greatly increased if a longer run perspective is taken because the complexity of the system increases and a number of simultaneities arise. For example, the distribution of household income affects not just current demand for goods and services but also future household composition, the distribution of capital ownership, and the distribution of labor skills.

The remainder of this part of the chapter is organized in the following way. The next section deals with the major approaches to modeling the size distribution of labor earnings, box (4) in Figure 1: stochastic theories, ability theories, human capital theories, and what can be called neoclassical theories for lack of a better name. While all of these are for the most part long-run theories and so are not directly applicable to an investigation of short-run phenomena, it is useful to review them. First of all, most of the work on the size distribution fall into these categories. Secondly, even though many of the following theories give but little insight into the way in which the size distribution may change in the short-run (over the business cycle, for example), they are helpful in understanding some of the underlying, long-run forces which help shape the observed, short-run size distributions.

In the third section, theories which attempt to explain the distribution of material wealth (6) are discussed. The fourth section looks at the effect family composition (8) has on the size distribution of income. The fifth section discusses the distributional aspects of government activities (11). The final section of this review discusses two areas of distribution theory not covered in the previous sections, namely macro theories and private transfers.

2.1 THE SIZE DISTRIBUTION OF LABOR EARNINGS

2.1.1 STOCHASTIC THEORIES

Stochastic theories are among the oldest theories of the size distribution. The distinguishing feature of stochastic theories is that they emphasize the importance of random processes in the formation of the size distribution of income. In other words, they attempt to explain box 4 without any reference to the other components of Figure 1. The early work in this area attempted to show how first-order Markov processes could, by themselves, result in the observed distribution of income (Brown 1976). Work by Mogridge (1973) and Shorrocks (1975, 1976) represents recent attempts to resurrect interest in this line of research.

Mogridge asserts that, because of the large number of people in an economy, only the process of interaction between individuals is important in the formation of the distribution of income. He attempts to show that just as the laws of motion of gas particles and the mean energy level of a thermodynamic system are all that are needed to describe the distribution of energy within a system, the distribution of income can be described with knowledge of only the number of interactions between people in the employment system and the mean income level.

Shorrocks, on the other hand, takes quite a different tack. He attempts to demonstrate that a second-order Markov process not only generates observed income distributions but is also consistent with the permanent income hypothesis. In showing how a purely stochastic theory of the distribution of income can be made compatible with received economic theory, Shorrocks tries to make a case for stochastic theories.

The work of these two economists points out the essential shortcoming of the stochastic theories. As already mentioned, stochastic theories are based upon the supposition that economic and behavioral factors are relatively unimportant in the distribution of income. Thus, to the extent that these theories are truly stochastic, they are by definition of little use to anyone interested in discovering how changes in "exogenous" factors such as government policy or technological change can be expected to alter the distribution of income. On the other hand, to the extent to which these theories of income distribution incorporate behavioral variables, they are no longer stochastic theories, but rather behavioral, nonstochastic theories (Sahota, 1978).

2.1.2 ABILITY THEORIES

The hypothesis that the observed differences in earnings among individuals are the result of corresponding differences in abilities is a venerable one. It is certainly an intuitively appealing proposition that the reason some people earn more than others is because they are more capable. The basic argument is a straight forward generalization from the observation that people differ in physical capabilities to the assertion that they differ as well in other attributes which are important in the determination of productive ability. Assuming that workers are paid according to their relative productivity leads directly to the conclusion that the distribution of earnings (box 4, Figure 1) can be explained by the distribution of skills (box 5) which in turn is due to differences in abilities, often considered to be essentially innate.

One difficulty with this view is that while abilities, however defined, are generally assumed to be normally distributed across individuals, the distribution of earnings is invariably skewed, more closely resembling either a lognormal or a beta distribution than a normal distribution.

At least two different reconciliations of this seeming contradiction have been proposed. Mincer (1970, 1976) and Becker (1967) both explain the difference between the distribution of earnings and the distribution of abilities by hypothesizing that the more able workers not only receive higher wage rates than workers with lower ability but also tend to work longer hours and to experience less frequent and shorter periods of unemployment.

The other major reconciliation makes use of the fact that the distribution of the product of normally distributed random variables is the lognormal distribution. Thus, if different types of ability combine multiplicatively to determine an individual's productivity, then normally distributed abilities will result in earnings being distributed lognormally, provided, of course, that workers are paid according to their productivity. This type of relationship is exemplified by the complementarity between education and ability (as measured by I.Q.). Lydall (1968,1976), for example, found evidence that abilities do combine proportionally. He also proposed a model similar to Simon's model of executive compensation (Simon, 1957), which he called the hierarchy model, for the upper tail of the earnings distribution. In this view, individuals are paid in proportion to the aggregate level of earnings of the workers below. An interesting implication of this theory is that an economy-wide trend towards larger, more complex firms and organizations could mean larger employee hierarchies and would, for this reason, result in increasing inequality (Nelson, 1982).

A fundamental problem with ability theories is that abilities are difficult to define, much less measure.

Sociobiology and the nature vs. nurture debate make it clear that there is much disagreement on the question of the relative importance of inheritance and environment in human behavior. While this may be irrelevant in the short-run, a complete ability theory of income distribution must address the question of how abilities are acquired by individuals.

Passing over the problem of determining how much of ability is learned and how much is due to innate capacity, as is usually done, the issue of measurement must be faced. A common proxy for ability in earnings models is I.Q. (Griliches, 1977). This obviously ignores other types of ability such as Lydall's D-factor (the D standing for doggedness, drive, and determination - Lydall, 1976), manual skills, and any of many other individual characteristics that affect productivity. It is thus not surprising that empirical tests of ability theories often have not been very successful. For example, Lillard (1977) and Taubman (1975) both found that accounting for ability in human capital models explains 30% or less of the variability in individual earnings, and thus would explain very little of the distribution of earnings.

2.1.3 INDIVIDUAL CHOICE THEORIES

The theories which fall into the individual choice category all share the basic hypothesis that differences in earnings among individuals are the result of differing preference structures of optimizing individuals.

Friedman (1953), in one of the first individual choice theories, examined how individuals' attitudes toward risk would affect the dispersion of incomes. His conclusion that the proportion of risk-lovers relative to risk-averters in a society determines the direction of skewness of the income distribution is still somewhat controversial. It has recently been challenged analytically by Kanbur (1979) and indirectly by Battalio et al. (1977) while being supported by Weiss (1972) and Johnson (1977), both of whom found evidence that some risks are compensated for with higher wages. In any case, Friedman's analysis laid the groundwork for much of the modern work by human capital theorists (Sahota, 1978, p.11).

The modern human capital approach, the origin of which is associated with T.W. Schultz and his colleagues at the University of Chicago, has generated a vast literature (see for example, the surveys of Mincer, 1970; Blaug, 1976; and Sahota, 1978). In its simplest form, human capital theory says that individuals choose to make investments in human capital in order to maximize their (expected) lifetime income streams. Earnings in any year are thus a function of the individual's basic earning capacity and of investments in human capital, compounded by the rate of return on such investments. In terms of Figure 1, human capital theory states that the distribution of labor skills (5) is the result of investment decisions made by optimizing individuals and that the distribution of skills in turn is the major determinant of the distribution of earnings (4).

Viewed broadly, any investment which increases future earnings can be considered a human capital investment. Sahota (1978) cites a number of studies that examine migration, health expenditures, and information acquisition from a human capital investment perspective. However, most of the work in this area has considered schooling and on-the-job training to be, if not the only forms of human capital investment, at least the most important.

A simple form of the basic schooling model can be expressed in the following way. Defining y_0 as the logarithm of earnings in the absence of schooling, c_{t-j} as the logarithm of the cost of schooling (including earnings foregone) in period t-j, r as the rate of return on human capital, and u_t as a random component, the log of annual labor earnings at time t is:

$$(2.1)\quad y_t = y_0 + r \sum_{j=1}^{t-1} c_{t-j} + u_t$$

Because data on the cost of schooling is seldom available, the standard way to estimate an equation such as (2.1) is to use years of schooling as a proxy for c_t.

This basic model can be expanded considerably. Mincer (1976) develops models which account for different rates of return and different depreciation rates on schooling and on-the-job training. Chiswick (1974) employs a similar model in his investigation of interregional income distribution.

While it would be difficult to overemphasize the importance of human capital in the determination of a person's earnings, the theory is not a complete theory of the size distribution of earnings. One important objection to the human capital theory as an explanation of income inequality is that it is a partial equilibrium theory attempting to explain a general equilibrium phenomenon, at least in the forms in which it is commonly employed. None of the models using this approach explain both the supply and the demand for labor (Sattinger, 1980). Furthermore, the wages received by individuals, and thus their earnings, are determined in a dynamic general equilibrium context, in which technological change and capital accumulation can be expected to alter wage differentials. Human capital theory, as it stands, does not look into these aspects of inequality (Sattinger, 1980, p.21).

Sahota (1978) lists four additional objections. The most important of these is the proposition of a number of theorists that schooling is no more than a screening device. In other words, "...it is not capital accumulated through education but ability and institutions that really account for what is attributed to education" (Sahota, 1978 p.17). Theories consistent with this view include Arrow's (1973) filter theory, the sorting uncertainty model of Taubman (1975), the hierarchy theories of Lydall (1976) and Simon (1957), the job competition model of Thurow (1975, 1980), and segmented labor markets (Cain, 1976).

Human capital theory is an attempt to show how income differences could arise among optimizing individuals. In some respects it falls under the category of ability models (Lydall, 1976). The theory asserts that individuals invest in human capital in order to maximize lifetime earnings. Thus each individual will invest to such an extent that the rate of return to human capital is equalized across all investment alternatives available to the individual (Becker, 1967). The reason, then, that two individuals with the same access to resources (and the same preference for income) will choose different levels of investment in human capital is that they experience different rates of return at any level of human capital invested. The only way to account for this difference is that the individuals differ in terms of some basic ability.

In the final analysis, it is not an adequate theory of the distribution of earnings because it does not explain why the economy puts different values on different levels of human capital. It should be emphasized that this is not to say that human capital is not an important part of a theory of income distribution but only that human capital theory, by itself, cannot explain the degree of inequality in an economy.

Tinbergen (1975) takes a very different tack in an attempt to overcome some of these problems. He posits a utility function for workers such that the level of utility is an increasing function of the wage rate and a decreasing function of what he calls the tension of the particular job. For each job, tension is zero if the worker has the required training and is positive if the worker has more or less than the required level. To model the demand for labor, he assumes an aggregate production function in which the inputs are different types of labor (distinguished by different years of schooling) and capital. Given: 1) values for the elasticity of substitution between workers with different years of schooling, 2) the distribution of human capital among workers, and 3) the economy's output level, he uses this model to compare actual, feasible, and optimal income distributions for the Netherlands.

As Sattinger (1980, p.27) points out, Tinbergen's major contribution is not the specific models he developed but rather his explicit recognition that the distribution of labor earnings, at least in the short-run, has three components: 1) the distribution of jobs, 2) the distribution of abilities and skills, and 3) the way in which individuals are assigned to jobs. This third component is called the assignment problem.

2.1.4 NEOCLASSICAL EARNINGS THEORIES

The two theories discussed in this section are related only in that they both take an essentially neoclassical perspective in the sense that factors of production are paid according to their marginal productivity in a world of perfectly competitive markets. The first, Williamson and Lindert's (1976), is a general equilibrium model. Its primary value in the present context is that it focuses on the interaction between the supply and demand for different types of labor. Taking a different approach but nevertheless an approach which can be called neoclassical, Sattinger(1980) builds a short-run model that relates the level of earnings inequality to the way in which productive capabilities and productive capital are distributed among workers.

Williamson and Lindert construct a model following the general equilibrium model proposed by Jones (1965). It has four factors of production: land, capital, highly skilled labor, and low skilled labor, and three producing sectors. By solving the simultaneous system of equations, which includes the production functions and output demand functions, the model is used to investigate how technological change and changes in the supply of the four factors affected the wage gap between skilled and unskilled labor in the nineteenth and twentieth centuries in the U.S.

This approach is not directly fruitful in answering questions about the form of the size distribution because the model is best suited for analyzing the functional distribution. However, Williamson and Lindert are able to use it because they were able to show a strong correlation between the difference in high-skilled wages and low-skilled wages and the level of inequality. In terms of Figure 1, the model thus explains the distribution of capital (3) and labor (4) earnings across sectors as a function of the demand for (1) and production of (2) goods and services and of the supplies of capital and labor.

The second theory in this category is that of Sattinger (1980). Using Tinbergen's tripartite division of the distribution problem, he develops a short-run model which emphasizes the importance of the assignment problem. His first step is to show that if the aggregate production function for an economy or industry can be expressed in a form which includes the average productive capabilities of the labor force as well as the total labor supply and the average capital to labor ratio, then the distribution of earnings is a function of the degree of capital intensity as well as the distribution of labor's productive abilities. Thus, depending upon the particular form of the production function, the degree of earnings inequality may be greater or less than the inequality in productive abilities. This part of the analysis, while not directly addressing the assignment problem, serves to emphasize the point that the inequality of earnings is a function of the value society places upon different abilities in addition to being a function of the inequality in abilities.

His next step is to show that in an economy in which perfect competition operates and in which individuals have only two ways to earn a living - either by entering the labor market and earning a wage proportional to her or his productivity or by renting machines (capital) and either working them or hiring others to work the machines - in equilibrium the more productive workers will be assigned to work the most complex, most productive machines. Thus, the greater the concentration of capital among workers the greater will be the inequality in earned income, ceteris paribus. In terms of Figure 1, this model attempts to explain (7) as a function of (4) and (5).

Sattinger's theory, like the human capital theory, is perhaps best suited for the task of explaining the size distribution of earnings at a point in time. However, because Sattinger shows how inequality is related to capital intensity and thus to industrial composition, his theory also sheds some light on how the size distribution of income can be expected to change over time.

2.2 THE DISTRIBUTION OF WEALTH

The effect of wealth on the distribution of income is one of the most complex aspects of the income distribution process, particularly if the period of analysis is very long. This is so even if the effects of non-material wealth (viz. ability and human capital) are not considered.

In the long-run, the issue of the perpetuation of inequality becomes a major issue. While the viewpoint that inherited wealth is not an important source of inequality over time is held by some (e.g. Gilder, 1981), it seems much more likely that inheritance of material wealth does make a difference, at least at the upper end of the distribution (Meade, 1976; Thurow, 1975). However, the highly progressive inheritance levies do mitigate this somewhat (Allen, 1980).

Perhaps even more important than the way wealth affects measured income inequality over either the short-run or the long-run are the effects that wealth may have upon individual behavior. For example, to the extent that Becker's hypothesis that human capital investments are constrained by an individual's access to loanable funds is true, higher levels of material assets would permit greater investment in human capital, ceteris paribus.

Likewise, holdings of wealth can be expected to affect an individual's labor-leisure choices. Blinder (1974) found that in a world in which individual utility functions were such that income from wealth was perfectly substitutable for labor income, inequality in lifetime income would be almost unaffected by inheritance because individuals with large inheritances would substitute at least part of their property income for labor income. While perfect substitutability is clearly an extreme assumption, it is likely that there is some degree of substitution between income from wealth and income from labor.

The relevant question for this study is much more circumscribed, namely how does material wealth affect the short-run distribution of family income. Material wealth gives rise to four different types of money flows in the short-run: rent payments, profits, interest payments, and capital gains. Thus, in order to analyze the effects of material wealth on the size distribution it would be necessary to: 1) determine how these four flows are distributed among families, and 2) determine how each of these flows behaves over the short-run.

Concerning the first point, Greenwood (1983) and Wolf (1980, 1983) estimate that, except for household durables, the ownership of material wealth among households is highly concentrated. For example, Greenwood found that in 1973, over 48% of corporate stocks held by households and 25% of total household net wealth were held by the top 11% of households, ranked by income.

In general, income from material wealth should lead to lower levels of inequality during general declines in economic activity and to higher levels during economic expansions. This conclusion is based upon: 1) the high level of inequality in ownership of financial assets and business equity, and 2) the fact that dividends and profits generally fluctuate more than labor income (Creamer, 1956). Regional income from wealth will depend upon the aggregate portfolio of regional wealth owners because the time path of these flows are not the same (Moore, 1983). To the extent that the aggregate regional asset portfolio differs across regions, the effect of wealth upon changes in the regional distribution of income will also differ across regions.

2.3 HOUSEHOLD COMPOSITION

There are two distinct aspects of the relationship between family composition and the distribution of family income. The first of these is the effect that family size has upon the level of welfare of family members. This in turn involves both short-run and long-run issues. In the short-run, the number of people in a family of any given income has obvious implications for the level of welfare of the individuals. Not surprisingly, the way in which family size is incorporated in measures of poverty or inequality affects the relative ranking of families (Kusnic and DaVanzo, 1982;

Deaton, 1982; Schultz, 1982). In the long-run, family size can have a significant effect upon the wealth, both human capital and material, that each child inherits (Becker, 1981; Smith and Orcutt, 1980).

The second aspect of family composition, namely, the fact that many families have more than one income earner, is the relevant issue for this study. Restricting the following discussion to labor earnings and assuming for expositional simplicity that only husbands and wives are in the labor force and that wives are the secondary workers, it is clear that the effect of wives' earnings upon the distribution of family income at a point in time depends upon four factors: the average income of wives relative to husbands, the variance in wives' income vis-a-vis the variance in husbands' income, number of families with working wives, and the correlation between husbands' and wives' earnings. In addition, labor earnings are a function of hours worked and wage rate, each of which may have different effects upon the above factors.

Available evidence indicates that in the United States working wives make family income more egalitarian than would be the case with only husbands working (Smith, 1979; Benus and Morgan, 1975). This equalizing effect of working wives is attributed to the negative correlation between husbands' and wives' earnings. Even though there is a positive correlation between the educational level, and thus wage rates, of husbands and wives, there is a negative correlation between the husbands' wage and the wives' annual hours of labor force participation (Smith, 1979).

A similar pattern appears to hold in both Great Britain (Layard and Zabalza, 1979) and Israel (Gronau, 1982). However, the fact that Smith found women's earnings to be an equalizing influence for white families but a disequalizing influence in black families serves to emphasize the potential problem in generalizing these results.

Important also to this study is the short-run labor supply response of wives vis-a-vis that of their husbands. Smith's (1979) research indicates that wives' labor force participation rates are negatively correlated with their husband's wages, implying some degree of substitutability between these two sources of family income. By this reasoning, a decrease in the husband's earnings, due to cutbacks in hours worked or to layoff, should bring about an increase in the wife's labor supply. To the extent that this holds true, women's earnings would tend to be a stabilizing force on the short-run distribution of family income.

2.4 THE ROLE OF GOVERNMENT

Government - federal, state, and local - has a very large role in the income distribution process. However, the myriad of different spending and taxing programs, in combination with the often difficult task of estimating their incidence, makes it very hard to determine the net distributive effect of government. Furthermore, considering the importance of state and local governments in the overall fiscal system, there is likely to be significant variation across states and regions.

Once again, the literature on this area is too extensive to be dealt with in detail here, being covered in public finance textbooks (e.g. Musgrave and Musgrave, 1976) as well as in numerous books and journal articles. However, it appears that overall, the net effect of government activity is progressive. Musgrave and Musgrave conclude that "The fiscal system results in a substantial redistribution toward the lowest end of income scale, but otherwise it has little effect on distribution" (p. 402). In other words, there is little redistributive effect within the middle and upper income groups. Okner (1975) concurs with this conclusion, at least with regard to taxes and direct transfers.

Specifically, the federal income tax is fairly progressive while payroll taxes and state and local taxes are generally considered to be, in net, slightly regressive. The major redistributive portion of the fiscal system is direct transfers, including social security, all types of welfare and low-income assistance, and unemployment compensation; and these appear to be strongly progressive (Danziger et al., 1981).

The distributive effects of government expenditures on goods and services are much harder to determine. Government expenditures affect the distribution of income according to both the income multiplier of the privately produced goods and services purchased, that is, the distribution of income arising from the production of these goods and services, and the wage structure of government itself. In the context of the discussion of linkages in section 2.6.4 (below), this says that the distributional effect of government activities is a function of the degree and pattern of linkages between the government and households. In addition, a complete accounting of these distributional effects should include the distribution of output of the government. However, much of government output consists of the provision of public goods such as the judicial system and defense, the difficulties in estimating the incidence of which are severe (see e.g. Brennan, 1976; Aaron and McGuire, 1970).

In concluding this section it should be pointed out that the above discussion ignores any effect government activity may have upon individual behavior. Much of the recent controversy over supply-side economics revolves around the way taxes affect economic activity. Likewise, the transfer economy is likely to affect individual behavior. For example, Danziger et al. (1981) estimate that under current income transfer programs labor supply is nearly 5% lower and savings anywhere from 0 to 20% lower than would be the case in the absence of government programs. Effects of this kind obviously have profound implications concerning the shape of the distribution of income in the longer run but are beyond the scope of this study.

2.5 OTHER THEORIES

The above discussion has ignored a number of theories pertaining to the distribution of income. For completeness, some of these are mentioned in the following section, with no attempt at a complete summary.

1) Macro Theories. A number of diverse theories fall under this category, all of which aim to explain the functional distribution of income, that is, the distribution of income between capital and labor. Perhaps the two names most commonly associated with this type of model are Kaldor and Kalecki, both of whom emphasized what might be called the class differences between capitalists and labor. Hedlund (1983) presents an empirical analysis of a recent synthesis of Kaldor's and Kalecki's models. Other examples can be found in Kaldor (1978), Ranadive (1978), Hahnel and Sherman (1982), and Hahn (1972). Howard (1979), Bronfenbrenner (1968), and Johnson (1973) also present good discussions of macro theories but with a greater emphasis on the neoclassical, marginalist aspects of the functional distribution.

2) Private Transfers. An aspect of the size distribution which is largely neglected is that of transfers of resources among individuals, which, according to one estimate, amounted to 30% percent of GNP in 1980 (Lillydahl and Singell, 1982). The most important type of transfer appears to be the transfer of resources by parents to children. The bulk of these transfers do not affect the distributions under study because the unit of analysis in this study is the household and so the distribution of resources within the household can be ignored. Inter-household transfers would, on the other hand, affect the distribution of income as considered here but these are probably rather small and can be ignored without altering the results of the analysis.

2.6 INCOME DISTRIBUTION AND INDUSTRIAL STRUCTURE

The most important conclusion, for the present purposes, to be drawn from the preceding discussion of income distribution theory is that very little work has been done in the area of the short-run distribution of income. With few exceptions, very little attention has been paid to the effects that economic structure may have on income distribution.[6] Instead, most theorists have concentrated on the

---

[6] Four exceptions to the above-mentioned lack of interest in short-run fluctuations in the size distribution of income are Beach (1976), Metcalf (1972), Mirer (1973),

relationships between personal characteristics (education, skills, etc.) and the distribution of income. In the short-run, however, all of these characteristics can be considered fixed so that most income distribution theories must be considered long-run in nature.

Two of the most important factors that do change over the short-run are the level and mix of regional output, and such fluctuations in regional output are a function of the industrial structure of the regional economy.

The remainder of this chapter, devoted to a discussion of how industrial structure affects the size distribution of income, is organized into four parts. The first section is a discussion of the factors affecting the distribution of jobs. Next is a discussion of possible relationships between the cyclical behavior of industries within the region and the size distribution. The third section examines the relationship between industrial structure and the distribution of

---

and Schultz (1969). However, none of these studies provide much insight into such problems as how the size distribution of income in regional economies can be expected to change over time and why such fluctuations differ from region to region, because all four approach the problem by looking at the time-path of the various components of personal income, e.g., wages, salaries, transfers, etc. The reasons that such an approach does not appear very fruitful is that it presupposes knowledge of the behavior of these income components over time. In the current state of regional business cycle theory, it is not possible to predict such changes with any accuracy (Domazlicky, 1980).

wealth. The final section discusses the way intersectoral linkages affect the size distribution of income.

2.6.1 THE DISTRIBUTION OF JOBS

Standard neoclassical distribution theory focuses upon the functional distribution of income while generally ignoring the size distribution. This is partly due to use of the assumption that labor can be described by efficiency units. In other words, labor inputs can be measured in a common, homogeneous unit of measure. In equilibrium each of these units would receive the same wage. The size distribution of earnings thus becomes a function of the quantity of labor demanded and the characteristics (in terms of the number of efficiency units) of individual workers. In this view, the type and mix of industries demanding labor is thus irrelevant in the formation of the size distribution - all that matters are the total number of efficiency units demanded and the distribution of efficiency units across industrial workers.

A number of authors (e.g. Tinbergen, 1975; Thurow, 1975) assert that the efficiency units assumption is unrealistic because employers desire individuals with specific qualities or abilities. In other words, it is not possible to standardize all labor into a single unit of measure. Under this view, it is the distribution of jobs which determines the distribution of earnings. To the extent that the occupational and wage structure of firms are more similar within each industry than across industries, the size distribution of earnings will depend upon the industrial mix of the region. This is expected to hold only for the short or medium term because the wage structure of a region will influence the locational decisions of new firms. This type of feedback effect is an example of the difficulty inherent in modeling general equilibrium phenomena such as income distribution.

Sattinger (1980) takes the above idea a step further by positing that the level of inequality varies directly with the level of capital intensity. Invoking the assumption that output per worker (Q) is a function of average productive abilities (g) and of capital intensity (r), Sattinger shows that earnings inequality is a function of the inequality in productive abilities and what he calls the inequality multiplier (p). He also demonstrates that p is a function of the elasticities of output with respect to g, and of output with respect to r. He then shows that $dp/dr > 0$ and $dp/dg < 0$ whenever (a) output per worker is homogeneous of a degree less than unity and (b) the elasticity of substitution between r and g is also less than one. In other words, increasing the level of capital intensity will tend to increase the level of inequality, whereas lowering the variance of workers' abilities will tend to decrease the level of inequality.

2.6.2 BUSINESS CYCLES AND INCOME DISTRIBUTION

The second characteristic of a region's industrial structure that is expected to affect the size distribution is the cyclical behavior of the major industries. The most obvious impact that an industry which experiences volatile changes in demand and output is the unemployment created when the industry is in a downswing. Just as firms differ in terms of the distribution of jobs that they offer, they are likely to differ in the way in which they lay-off and re-hire workers in response to fluctuations in the demand for their output. Creamer (1956), in a study of business cycles in the first half of the twentieth century, and Schultz (1969), in a study covering the second quarter of the century, both found that wage differentials tended to narrow during expansions as the labor market tightened and tended to widen with the softening of the labor market during recessions. In addition, lower wage workers experienced the bulk of any lay-offs. Consequently it is hypothesized that the industrial structure of a regional economy is not only an important factor in the formation of the size distribution at a point in time but it can also explain a large part of the short-run changes in the distribution.

Unemployment has important effects beyond the obvious effect of reducing, often drastically, the incomes of the unemployed. The uncertain nature of employment, and thus of income, may tend to reduce the level and quality of investments (e.g. financial and real property investments) made by workers in those industries with a record of periodic layoffs. The research on the firm's investment behavior in the face of stochastic prices and demand for output indicates that investment may be lower the greater the level of uncertainty (Sandmo, 1971; Hey, 1979). It seems reasonable that uncertainty would have similar effects with regard to an individual's investments. (See the discussion of the effect income variability has on consumer durable purchases in Mishkin, 1976.) If this is true, individuals and households will tend to invest less, in absolute terms, and to put what they do invest into more liquid assets, thus often earning lower rates of return, the greater the uncertainty of income and the greater their degree of risk aversion. Duncan and Duncan (1983), in a study of two Kentucky counties, found that the proportion of investment in new housing comprised by mobile homes was twice as high in a county dominated by the coal industry than in a non-coal county even though per capita income was higher in the coal county. While much of this difference may be due to both the unfavorable topography of the coal region and land ownership patterns, some of it may also represent an attempt on the part of coal miners and workers in allied industries to avoid large and extended financial commitments.

High income variability may also result in a tendency for less investment in human capital, either in the form of formal schooling or on-the-job experience. Obviously the latter form of human capital investment does not take place when a worker is unemployed. To the extent that the loanable funds model of human capital is correct, there will be a tendency for less investment in schooling in areas with high income variability. The loanable funds variant of human capital theory posits that a major factor in the determination of an individual's level of investment in human capital is the availability of resources to finance education or training (Lucas, 1977; Becker and Chiswick, 1966). To the extent that unemployment adversely affects an individual's sources of funding for schooling, such investment will be reduced, in turn reducing her or his lifetime stream of earnings. In addition, unemployment may also increase the rate of depreciation of human capital, further reducing the individual's stock of human capital. Mincer and Ofek (1982) found human capital depreciation to be an increasing function of the length of time the worker is out of the work force.

The uncertainty in income associated with cyclical industries may tend to lead to fewer linkages between sectors and between households and the rest of the economy. This hypothesis is also based directly upon the research into the effects that uncertainty has on investment. The previously cited literature has shown that firms tend to invest less, the greater the uncertainty of demand for their products. Regions experiencing wide fluctuations in employment experience corresponding swings in consumer income which in turn leads to high variability in household spending (Tobin, 1980). As household spending represents demand for consumer goods and services it follows that high variability in employment may lead to low levels of investment in retail and other consumer-oriented establishments. Because retail establishments play an important role in linking households to the regional economy, less investment in the retail sector results in a household sector which is not very closely linked to the rest of the regional economy.

A third implication of the dominant industry in a region being subject to large cycles is that any public sector investment which is financed by local taxes is expected to be provided at relatively low levels. There would be little support for a level of public services that requires tax rates very much above a level sustainable during periods of high unemployment. A further implication of this is lower quality public education and consequently lower quality human capital investment.

Finally, there are the psychological impacts that a boom-or-bust economy may have on residents. Catalano and Dooley (in press) and Liem and Rayman (1982) both show that the stress of unemployment can lead to serious health problems. In addition, the knowledge that widespread layoffs may occur in the near future may lead people to set money aside for periods of unemployment and thus to lower their marginal propensity to consume out of current income. On the other hand, it also may be true that the expectation that good times will inevitably follow bad times will lead to less money being saved for the inevitable rainy day. In this case, if a business cycle has an extended period of high unemployment there could be widespread suffering.

A sense of fatalism and pessimism may also result from this sort of cycle. Such fatalism could result in a relatively low level of initiative and ambition on the part of large segments of the population which might, in turn, lead to a lower level of economic vigor. Qualified support for this hypothesis is Mirer's finding of a negative correlation between an individual's sense of efficiency and income variability (Mirer, 1977). Although these effects will not be pursued here, it is nevertheless important to recognize their possible implications.

2.6.3 INDUSTRIAL STRUCTURE AND WEALTH

The third way that the industrial structure may affect the size distribution of income is through the ownership of real wealth and property. The effect that uncertainty may have upon investment was mentioned previously. In addition, there are likely to be systematic differences across industries in the degree of local ownership of firms. Resource based industries such as coal and forestry tend to be dominated by a few large firms. In some areas, these firms own a large proportion of either the land surface or the mineral rights, which often also amounts to control over the surface. As an example, the Appalachian Land Ownership Task Force (1981) estimated that forty percent of the surface area and seventy percent of the mineral rights in an eighty county sample were owned by corporations. While corporate ownership per se means little, in the case of coal many of these firms are large national corporations. Thus, much of the land in Appalachia is controlled by absentee owners with, presumably, little interest in many aspects of local economic development. Such absentee owners may have relatively little interest in paying for public investments that do no directly benefit coal production.

2.6.4 LINKAGES AND THE DISTRIBUTION OF INCOME

The final aspect of the industrial structure which is expected to have an effect on the size distribution is the extent to which households and firms in a region are interlinked within the regional economy. Linkages can be classified into three groups according to the two components of the economy being linked: producing sectors linked to other producing sectors, households linked to producing sectors, and households linked to other households.[7]

The first group of linkages, linkages among regional goods and service producing sectors, are called interindustry linkages. A regional economy is said to have a high degree of interindustry linkage when regional producers either purchase a large proportion of their inputs from other firms within the region or when they sell a large proportion of their output within the region.

The second group of linkages, called household-industry linkages in this study, can be divided into two different types of linkages according to the direction of linkage. Households are linked to producing sectors by way of expenditures on regionally produced goods and services. This type of linkage will be called the consumption linkage. Households are also linked to producing sectors via wages, salaries, profits, and other value-added arising out of the regional production of goods and services. This type of linkage will be called the value-added linkage. An economy would thus be said to exhibit a high degree of household-industry linkage whenever the consumption bundle of regional households contains a high proportion of regionally produced

---

[7] A fourth type of linkage - interregional linkage - are the linkages among sectors and households in different regions. However, the inequality effects of these linkages will not be investigated in detail in this study.

goods and services or whenever the value-added of regional firms and businesses makes up a large proportion of the value of total output and, in addition, a large proportion of this value-added is distributed to households in the region.

The third type of linkage (household-household linkage or household linkage for short) connects the various household groups together. This connection involves all three of the previously discussed linkages. Household expenditures affect regional production via the consumption linkages. Other producing sectors are in turn affected by way of interindustry linkages, which in turn affect household through value-added linkages. In an economy with a high degree of household linkage, a given change in the income of households in one household group will have a relatively larger impact on the income of other households than would be the case in an economy with weaker household linkages.

All of the above linkages are expected to play important roles in the determination of the way in which changes in the output of any sector affect overall inequality in the economy. To illustrate this process, assume first that the economy under study has no interindustry or consumption linkages. In such a case, there will be no feedback effects - neither regional producers nor regional households purchase any regionally produced goods and services. The change in overall inequality due to a change in the final demand for a particular sector will be a function of: (1) the size of the resulting change in the value-added accruing to households from that sector relative to total household income - in turn a function of both the degree of value-added linkage and the size of the change in final demand, and (2) the level of inequality in the distribution of value-added for that sector (called the sector's direct inequality effect) vis-a-vis overall inequality.

Assume now that there is a second economy that has the same industry mix as the one just described, but which has strong interindustry linkages. In this case, the change in inequality arising out of a change in the final demand for any sector will be a function not only of the size of the final demand change, the direct inequality effects, and the degree of value-added linkages of the sector experiencing the change in exogenous demand, but also of the extent to which this sector is linked to other producing sectors, the extent to which these other sectors are also linked to the rest of the economy, and the direct inequality effects of these sectors. Thus, a change in the final demand of a sector that has a highly unequal distribution of value-added and is, in addition, strongly linked to sectors with similarly distributed value-added, would result in a much more disequalizing effect upon the overall distribution of income than would the same change in the exogenous demand for a less highly linked but otherwise similar industry.

In the same way, changes in the exogenous component of household income will have different effects upon overall inequality depending upon the extent to which households spend their income on regionally produced goods and services, and on the way such industries are linked to the rest of the regional economy. For instance, suppose that the marginal propensity to spend on regionally produced goods and services is 10 percent for upper-income households and 60 percent for low-income households. Suppose, further, that the high-income households purchase the output of regional firms that (1) have the greatest inequality in value-added of all regional firms, and (2) that are also highly linked only to other high-inequality firms. Low-income households, on the other hand, are assumed to purchase the goods and services of firms that use low-wage workers intensively and that are highly linked only to other low-wage intensive firms. Assume finally that all sectors are interlinked to the same degree (sectors differ in the type of sectors to which they are linked and not the extent to which they are linked). In such an economy, a given change in the exogenous income of the upper-income households would have a smaller overall effect on the regional economy than would an equal change in the income of low income households because the upper-income households have a lower marginal propensity to spend on regional output. In addition, the increase in the income of the high-income households would have a relatively less equalizing effect on the overall distribution than would be the case for the low-income households.

The nature and extent of these household linkages have some wide-reaching ramifications. Williamson and Lindert (1976) looked at several aspects of household linkages under the rubric of the factor intensity issue. Recalling the discussion in Chapter 1, factor intensity is defined as the degree to which a particular producing sector intensively utilizes high-wage (or low-wage) workers. In the context of linkages, a sector that has a relatively high degree of low-wage intensity is a sector that has high value-added linkages with low income household. Williamson and Lindert thus examined the question of whether or not workers in different income groups could be characterized as having high consumption linkages to sectors that have, in turn, high value-added linkages to lower-income households. Their conclusion that the consumption expenditures of high-income households are relatively low-wage intensive can be restated as saying that high-income households have relatively strong household linkages to low-income households. In the same way, their conclusions that consumer durables have an anti-poor bias and that government expenditures have a pro-poor bias are equivalent to the propositions that the consumer durable producing sectors have stronger value-added linkages to upper-income households than to lower-income households and that the government sector has strong linkages to lower-income households.[8]

These conclusions are based upon an analysis that has some important shortcomings. First of all, Williamson and Lindert used only two income classes. Using a finer classification would clearly provide a much better representation of the distributional process. Secondly, they employed an input-ouput model that was open with respect to the household sector. In other words, consumer income, and therefore consumer expenditures, were not included in their measure of linkages.[9] Finally, they did not employ actual data on the sectoral distribution of value-added for their measure of factor intensity. Instead, they assume that the low-wage content of a unit (in value) of output for any sector is equal to the total number of employees required to produce the unit of output times the average wage for unskilled labor, assumed constant across sectors. This is equivalent to the assump-

---

[8] This latter proposition is simply part of the larger question of whether or not different components of final demand differ with regard to low-wage intensity. While the implications of any component of final demand, such as government purchases or capital investment, being highly linked to different household groups are important, this aspect of the subject of linkages will not be examined here because of the difficulties involved in the estimation of the different components of final demand at the regional level.

[9] See the discussion of open and closed input-output models in the following chapter.

tion that industries have identical occupational structures, at least with regard to unskilled labor.

The above three characteristics of the Williamson and Lindert model may well be the result of the data limitations inherent in the long period of time their study examined. However, all three shortcomings are overcome in the model described in Chapter 3.

It can thus be seen that the precise way in which different sectors are interlinked is important in the determination of how regional inequality can be expected to change in response to changes in exogenous output or exogenous income. Furthermore, as an economy becomes increasingly interlinked, it is expected that differences across sectors in the impact on overall inequality of a unit change in sectoral output will become smaller (Weisskoff and Wolff, 1981). Defining the inequalit impact for a given sector to be the change in overall inequality due to a dollar's change in the output of that sector, this hypothesis can be restated as saying that the inequality impacts will converge as the degree of linkage increases.

The reasoning behind this hypothesis is that as linkages increase, a given change in the output of a given sector will bring about greater changes in the output of all of the sectors to which the initial sector is both directly and indirectly linked. The proportion of the total, economy-wide impact that is attributable to any initial change in sectoral output falls as the degree of linkage increases. The impact on overall inequality of a change in the output of a particular sector is directly related to the relative size of the corresponding change in value-added. Thus, the fact that the ratio of the initial change in output to the economy-wide change is smaller, the greater the degree of intersectoral linkage, leads to the conclusion that the level of inequality in the distribution of value-added of any particular sector is less important, the greater the degree of linkage. To the extent that this hypothesis is true, the greater the degree of linkage in an economy, the less important, in terms of changes in the overall distribution of income, will be the pattern or mix of changes in final demand. If convergence in inequality impacts were complete, a given change in output would result in a particular change in inequality regardless of which sector experienced the initial change in output.

A caveat is required at this point. Weisskoff and Wolff use input-output (I-O) analysis in showing that this hypothesis is supported, at least in the case of Puerto Rico. As they point out, the elements of an I-O multiplier matrix are weighted sums of all the elements of the initial coefficients matrix. Their hypothesis that sectoral inequality impacts converge and therefore, that the particular mix of final demand becomes less important a factor in shaping inequality as the degree of linkage increases, holds only if there is no positive correlation between the distribution of value-added of a sector and the distribution of value-added of the sectors to which it is linked. If such a correlation exists between, say, sectors with high, direct inequality impacts, then an increase in the degree of linkage among these sectors would lead to a divergence in inequality impacts. There is no reason to believe that such a correlation will exist but, by the same token, there is no reason to rule out the possibility that such a positive correlation will be found in a given situation.

As stated above, the convergence hypothesis requires that there is no systematic pattern of high-inequality sectors being strongly linked to other high-inequality sectors and/or low-inequality sectors being likewise linked to low-inequality sectors. It might thus appear that this hypothesis is equivalent to saying that linkages are random with regard to inequality effects. This, however, is too strong a statement because it is entirely possible that, even though the convergence hypothesis is supported, all secondary or service sectors (sectors for which most demand arises from linkages to other sectors rather than arising from final demand directly) exhibit higher (or lower) direct inequality effects than the basic or export sectors. In other words, linkages are not random with regard to inequality effects but all basic sectors are linked predominately to sectors with similar inequality effects. If this hypothesis were to hold, then overall inequality would either rise or fall as linkages increase, depending upon the degree of inequality in the secondary sectors relative to the basic sectors. If, for instance, the basic sectors were uniformly more unequal than the non-basic sectors, as linkages increase, overall inequality would fall.

In summary, up to this point we have discussed three primary hypotheses regarding the relationships between short-run inequality and intersectoral linkages. First, the consumption bundle of high income households has a more equalizing effect on the distribution of income than does the low income consumption bundle. Second, the greater the degree of overall linkage, the lower will be the variability in inequality impacts across sectors (convergence). This in turn means that there is no pattern of high linkages among sectors with like inequality effects (high-inequality sectors are not linked only with other high-inequality sectors, etc.) Third, the inequality effects of the basic or export sectors are greater than the inequality effects of the non-basic sectors. Thus, as linkages increase, inequality will fall.

3.0 MODEL DEVELOPMENT

The testing of the linkage hypotheses requires a model which enables the researcher to identify the flows of inputs among sectors. In addition, the general equilibrium nature of income distribution makes it desirable that the model chosen for such tests be a general equilibrium model. These two criteria lead to the choice of an input-output (I-O) model to test these hypotheses.[10]

The purpose of this chapter is to describe the I-O model employed in this analysis. Implementation of the model, along with a discussion of data sources, takes place in Chapter IV. The theoretical model is presented in the

---

[10] Mention should be made at this point of the class of economy-wide models called computable general equilibrium (CGE) models. These models are much more detailed than the I-O models considered in this study and thus possess the potential for more accurately modeling the income distribution process. In fact, standard I-O models can be considered a simple CGE in which relative prices are fixed and factor supplies are infinite. (These are only sufficient conditions and are not necessary. They are, however, commonly attributed to input-ouput models.) The richness of detail in a CGE is not, however, without its costs. To implement such a model requires, in addition to the basic I-O technical coefficients matrix, estimation of consumer demand equations, investment equations, and excess demand equations. CGE models may thus be more realistic representations of actual economies than are I-O models but the resource demands of constructing a CGE model places them beyond the scope of the present study. See Dervis et al. (1982) and Kelley, Sanderson, and Williamson (1983) for further details.

next section. As the theoretical development makes clear, there are three key sets of coefficients in the model: the technical coefficients, the household value added coefficients, and the household consumption coefficients. These are discussed in turn in sections 2 through 4. Testing of the linkage hypothesis developed in the first two chapters requires that a measure of the extent to which sectors are linked be developed. This is done in section 5.

3.1 THE BASIC MODEL

A useful way to characterize a regional economy at a point in time is with material balance equations. These equations express total regional output of each type of good and service x_i, $i=1,\ldots,n$, as a function of: the demand by industries within the region, the demand by households within the region, and a category called final demand which, among other components, includes exports, government demand for regionally produced goods and services, capital investment, and inventory accumulation. For compactness, these equations are often expressed in the following matrix form:

$$(3.1) \qquad x = Ax + Cy + f$$

The nx1 vector x is the value of output for each of the n regional sectors. The A matrix is the standard I-O technical coefficients matrix. In such a matrix each coefficient a_{ij} indicates the value of purchases from regional firms in sector i required by regional producers to produce one dollar's worth of output in sector j. C represents the consumption function of households in the region. If the household sector is not disaggregated into classes based upon income or some other characteristic, C is nx1, each element c_j being the average propensity of households to purchase the output of regional firms in sector j. When the household sector is disaggregated into k groups, C is nxk. Each element c_{ik} is then the average propensity of the k^{th} household group to purchase sector i's output. Household income, y, is a scalar if there is only a single aggregate household class. It is a kx1 vector if there are k household classes. The vector f represents the final demand for each of the n regional producing sectors. For ease of exposition, f is considered to be an n x 1 vector but it would be a very simple matter to construct a model in which final demand is disaggregated into however many components are required. The aggregated final demand vector f could be calculated from the disaggregated final demand matrix F by post-multiplying F by an appropriately dimensioned vector of units.

Just as equation (3.1) decomposes regional output according to the type of demand, equation (3.2) shows that regional income can be decomposed by source:

$$(3.2) \qquad y = Vx + g ,$$

where x and y have the same definitions as in (3.1). V is either a 1xn vector or a kxn matrix of value-added coefficients depending upon whether y is defined as a scalar or a kx1 vector. Each coefficient indicates the value-added accruing to the household sector (or household class) due to a unit change in the output of one of the n producing sectors. Vector g represents the income accruing to households from sources exogenous to the model. Equations (3.1) and (3.2) combine to form a system in which regional output and regional income are determined simultaneously.

Most of the I-O models employed in regional analysis treat household income in one of two ways: household income is considered exogenous to the model (open models) or household income is considered endogenous but households are aggregated into a single, sector (closed models). Models which are open with respect to households consider the household sector to be a component of final demand f, thereby removing the simultaneity between income and output determination. Equation (3.2) is essentially ignored so the open I-O model can be expressed by referring only to equation (3.1):

$$(3.3) \qquad x = (I-A)^{-1}(Cy + f)$$

where I is an appropriately dimensioned identity matrix. Open models ignore any feedback effects between output x and income y. The household income generated by changes in regional production does not affect regional output as would be the case if any income were spent within the region. Open models are sometimes referred to as Type I models.

The second common way to treat the household sector in the I-O framework is to augment the A matrix of (3.3) with a column vector of household consumption coefficients and a row vector of household value-added coefficients. Household consumption is then deleted from final demand. Such models, called Type II models, represent an improvement over open models because income and output are determined simultaneously. However, the assumptions, implicit in this formulation, that both the average propensities to consume specific goods and services and the value-added accruing to households are uniform across households for each sector, is rather strong. Furthermore, this type of model is inappropriate for the task at hand because it generates no distribution of income. This difficulty is overcome by following the procedure proposed by Miyazawa (1976) and employed by Weisskoff and Wolff (1981).

Miyazawa's model is a straightforward extension of the Type II model just described. Specifically, it treats the household sector as k distinct classes rather than as a single aggregated sector. Solving equations (3.1) and (3.2) in terms of this approach results in the I-O representation:

$$(3.4a) \qquad \begin{bmatrix} x \\ \\ y \end{bmatrix} = \begin{bmatrix} A & C \\ \\ V & 0 \end{bmatrix} \begin{bmatrix} x \\ \\ y \end{bmatrix} + \begin{bmatrix} f \\ \\ g \end{bmatrix}$$

Equivalently:

$$(3.4b) \qquad \begin{bmatrix} x \\ \\ y \end{bmatrix} = \begin{bmatrix} I-A & -C \\ \\ -V & I \end{bmatrix}^{-1} \begin{bmatrix} f \\ \\ g \end{bmatrix}$$

where I is an appropriately dimensioned identity matrix and all of the other elements are as defined in the discussion of the k-household case of equations (3.1) and (3.2) above. The inverse in equation (3.4b) can be solved in a partitioned form:

$$(3.5) \qquad \begin{bmatrix} x \\ \\ y \end{bmatrix} = \begin{bmatrix} B(I + CKVB) & BCK \\ \\ KVB & K \end{bmatrix} \begin{bmatrix} f \\ \\ g \end{bmatrix}$$

where $B = (I-A)^{-1}$ and $K = (I-VBC)^{-1}$. Miyazawa calls K the interrelational income multiplier. Each element k_{ij} indicates the total change in income of the i^{th} household group due to a dollar's change in the income of the j^{th} household group.

Looking separately at the output and income subsystems, (3.5) shows that regional output can be expressed as the sum of three groups of terms:

$$x = Bf + B(CKVB)f + BCKg \quad (3.6)$$

The first group Bf, isolates the interindustry demand relationships. It shows how regional output is affected by exogenous demand, abstracting from any demand generated by households. It is identical to the Leontief inverse of the open model (3.3). The second group captures the effects that the changes in household income and consumption induced by regional production to meet exogenous demand f have on regional output x. The third group, BCKg, represents the total demand for regional output that is created by changes in exogenous income g.

The income subsystem of (3.5) is expressed in a similar fashion:

$$y = KVBf + Kg \quad (3.7)$$

The first group of terms KVBf, represents total household income generated in the process of regional firms meeting final demand f. The second group Kg, represents the total income generated by the exogenous income received by regional households.

Equation (3.7), and consequently the system (3.4), are not entirely adequate representations of the income generating process. According to (3.7), household income arises from two distinct sources: from regional production and from sources unrelated to regional output, represented by g. Unemployment compensation and any other government transfer based upon income would, under this view, be included in g. However, the size of these transfers in the distribution of income at a point in time clearly depends upon the level of output. It follows that this model will overestimate the impact upon household income of changes in final demand. It is therefore desirable to endogenize unemployment benefits by tying them to the level of output in some way.

A simple solution is to append a labor supply equation to (3.4). Equations (3.8a), (3.8b), and (3.8c) are the resulting material balance equations for the regional economy.

(3.8a) $x = Ax + Cy + f$

(3.8b) $y = Vx + Uz + g$

(3.8c) $z = -\Phi x + l$

The new variables are the vector of unemployed workers, by occupation, z; the matrix of workers in each occupation per dollar of output by each sector, Φ, and labor supply, l. The system can also be expressed as:

$$(3.9) \quad \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} A & C & 0 \\ V & 0 & U \\ -\Phi & 0 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} + \begin{bmatrix} f \\ g \\ l \end{bmatrix}$$

Solving for x, y, and z:

$$(3.10) \quad \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} I-A & -C & 0 \\ -V & I & -U \\ \Phi & 0 & I \end{bmatrix}^{-1} \begin{bmatrix} f \\ g \\ l \end{bmatrix}$$

Models of this type are part of a larger class of activity analysis models of regional economies (Batey and Madden, 1981; Madden and Batey, 1983). These models can be used to model a variety of demographic processes which are not amenable to standard I-O analysis because these activities cannot be expressed in value terms. The labor supply component of (3.10) is an example of this. While it is often desirable to include these activities because of their importance as policy variables, their inclusion is necessary if variables such as income are to be modeled in an internally consistent fashion (Batey, 1983; Madden and Batey, 1983).

The activity analysis framework provides a very simple way of incorporating unemployment. An additional benefit is that it can be used to model aspects of a regional economy not commonly incorporated in an I-O framework. For example, if it were possible to model the way in which labor force participation rates of household members change in response to regional unemployment levels, an activity analysis model could conceivably permit adjustment of V to reflect this phenomenon.

However, because no activities other than employment (such as migration or commuting) will be considered in this study, and because the actual level of unemployment (z) is not of primary interest, the number of equations in the model can be reduced by substituting (3.8c) into (3.8b) to get a new expression for household income:

$$(3.11) \qquad y = Vx - (U\Phi x + Ul) + g$$

Combining this with (3.8a) gives:

$$(3.12) \qquad \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} A & C \\ V-\Phi & 0 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} f \\ g-Ul \end{bmatrix}$$

The only differences between the systems (3.4a) and (3.12) are the substitution in (3.12) of V - U$ and g - Ul for V and g, respectively, in (3.4a). For notational simplicity, V - U$ will be denoted by V^* and g - Ul by g^* resulting in:

$$(3.13a) \qquad \begin{bmatrix} x \\ \\ y \end{bmatrix} = \begin{bmatrix} A & C \\ \\ V^* & 0 \end{bmatrix} \begin{bmatrix} x \\ \\ y \end{bmatrix} + \begin{bmatrix} f \\ \\ g^* \end{bmatrix}$$

and

$$(3.13b) \qquad \begin{bmatrix} x \\ \\ y \end{bmatrix} = \begin{bmatrix} I-A & -C \\ \\ -V^* & I \end{bmatrix}^{-1} \begin{bmatrix} f \\ \\ g^* \end{bmatrix}$$

The ij^{th} element of the adjusted value-added matrix V^* (v_{iu}^* represents the market income of the i^{th} household group arising from the j^{th} producing sector less the unemployment benefit u_{ij}, the ij^{th} element of the matrix U. The next three sections discuss the construction of the matrices A, V, and C.

3.2 TECHNICAL COEFFICIENTS IN A REGIONAL I-O MODEL

Although the above model is presented as a regional model it just as aptly describes a national economy. However, though the forms of national and regional I-O models are the same, there is an important difference in the interpretation of the coefficients matrix A. As it turns out, this difference can be exploited to dramatically lower the costs of constructing regional models.

Input-output coefficients in regional models are usually viewed as a combination of production coefficients reflecting technological relationships and of coefficients representing the proportion of each required input that is supplied by regional producers. Defining a^*_{ij} as the amount of good i used in the production of j as determined by the particular production process employed, and r_{ij} as the proportion of this total requirement of i that is purchased from producers within the region, the regional technical coefficient a_{ij} is:

$$a_{ij} = r_{ij}a^*_{ij} \tag{3.14}$$

It is commonly assumed that r_{ij} is the same across purchasing sectors so that the matrix A corresponding to equation (3.14) is:

$$A = RA^* \tag{3.15}$$

where R is an nxn diagonal matrix with what will be called the trade coefficients r_i on the diagonal and A^* is the nxn matrix of production coefficients a_{ij}^*. The use of estimates of R and A^* to calculate A has a number of advantages over the alternative methods of using either the unadjusted production coefficients A^* directly (Hargrave and Buford, 1973) or estimating A without breaking it down into the components R and A^*.

The first alternative is not very well suited to impact analysis. Its use is limited largely to estimating regional import requirements for given levels of sectoral output. However, as Hargrave and Buford point out, employing the production coefficients A^* rather than the regional coefficients A avoids a potential problem which is often ignored when only the regional coefficients are used, as is the case in survey based models.

Regional I-O models are frequently used to investigate the effects of locating new industrial plants within a region. If the proposed plant is large relative to the regional economy it would be likely that some of the trade coefficients would change, thus changing the regional coefficients matrix A. In other words, changes in the mix of industrial output of a region will change the regional coefficients A, even though the underlying technological relationships embodied in A^* have not changed. Although survey based models are generally considered more accurate than models constructed from secondary data, models that do not distinguish between R and A^* may for this reason require more costly updating.

This problem is easily handled in models distinguishing between R and A^*. In most cases the technological relationships between sectors embodied in A^* change slowly whereas trade relationships can be fairly volatile (Dervis et al., 1982). To the extent that this proposition is true, updating a model in which R has been estimated will be easier and less costly than for a model in which the entire A matrix has to be re-estimated.

The use of (3.15) also allows the use of secondary data to construct the model. Invoking the assumption that the production technology employed in a region is identical or sufficiently close to the production technology represented by a national, survey based I-O model, the technical coefficient matrix from such a national model can be used as a proxy for A^* in equation (3.15). The regional coefficient matrix A is then constructed by estimating the vector of trade coefficients. The result is a low cost model which is very flexible in the sense that it is easy to update and for which it is a simple matter to adjust the trade coefficients as needed.

The above factors, primarily the low cost of construction, are responsible for the popularity of secondary source based regional I-O models. The major difficulty in constructing such models is the calculation of the trade coefficients. The importance of accurately estimating these coefficients is hard to over-emphasize. Studies by Stevens and Trainer (1978) and Park et al. (1981) demonstrate that errors in the trade coefficients have much larger impacts upon the accuracy of the results of the model than do errors of similar magnitude in the technical coefficients matrix A^*. For this reason the important methods of estimating the trade coefficients are discussed in depth in the following section.

The techniques used to estimate trade coefficients can be classified into four categories: location quotients, commodity balance methods, gravity based methods, and a group of miscellaneous techniques. It should be mentioned at this point that while this typology is useful in highlighting the differences among the various methods of estimating R, it is not the only typology available.

3.2.1 LOCATION QUOTIENTS

Location quotients, initially developed as a simple way to estimate the exports of a region (Isard, 1960), are probably the most widely used method of constructing secondary source regional I-O models. The basic premise common to all of the LQ variants is that a region's trade coefficient for any sector i is proportional to the share of total regional output made up by sector i relative to sector i's share of total national output. More often than not, employment is used as a proxy for output even though this requires the additional assumption that sectoral labor productivity is uniform across the nation.

The most popular variant of the LQ methods is the simple location quotient (SLQ). The SLQ for sector i, region r is defined as:

$$(3.16) \qquad SLQ_i = (e_i^r/e_t^r) \;/\; (E_i/E_t)$$

where e_i^r and e_t^r are employment in sector i and total employment for region r, respectively, and E_i and E_n are sector i and total employment at the national level, respectively. If $SLQ_i < 1$ then $r_i = SLQ_i$ so that from (3.14) $a_{ij} = SLQ_i a_{ij}^*$. $SLQ_i \geq 1$ is interpreted to mean that the region is self-sufficient in the production of i, thus $a_{ij} = a_{ij}^*$.

A number of modifications have been proposed to correct some of the deficiencies in the SLQ. In the purchases only LQ (CONSAD, 1967), total regional and total national employment are replaced by employment in sectors purchasing the output of sector i. Stilwell and Boatwright (1971) and Norcliffe (1983) propose procedures that may be useful when international trade is a significant factor. A third variant of the SLQ is the cross industry LQ (CLQ). As described by Miernyk (1968), the CLQ is an attempt to account for the size of both the regional purchasing sectors and the regional selling sectors vis-a-vis the corresponding national sectors:

$$(3.17) \qquad CLQ_{ij} = SLQ_i/SLQ_j$$

The final two location quotient methods to be considered here, the logarithmic CLQ (LCLQ) and the modified LCLQ (MSLQ), were designed to capture some of the effects that the relative sizes of the purchasing and selling sectors in the region have on the trade coefficients as well as the effect of the industrial mix of the region relative to the nation. The LCLQ is defined by Harrigan et al. (1981) to be:

$$(3.18) \qquad LCLQ_{ij} = SLQ_i/\log_2(1 + SLQ_j).$$

Round (1978) defines the MSLQ as:

$$(3.19) \qquad MSLQ_{ij} = \sigma_{ij}LCLQ_{ij}$$

where σ_{ij} is an adjustment factor whose purpose is to account for the likelihood that shipments will take place between subregions.

Critique of the Location Quotation Methods. While there is no denying that the calculation of any of the above location quotient variants has minimal data and computation demands, decided advantages in any empirical or policy work, the costs, in terms of the requisite assumptions, are high. In addition to the previously mentioned assumptions that regional production functions are adequately described by the national coefficients and that labor productivities in each sector are uniform across the nation, the LQ's assume that: 1) household expenditure patterns are identical in the region and the nation as a whole, and 2) the industrial composition of the regional economy is the same as the national industrial mix. In addition, cross-hauling is totally ignored and thus all the LQ methods tend to over-estimate regional independence (Round, 1983). Consequently, situations commonly arise in which the LQ for a sector is greater than unity but imports actually occur and in which LQ < 1 for a sector for which the region is a gross exporter. The LQ methods are thus theoretically unappealing, although some of the objections to such methods may be relaxed somewhat for models with a high level of sectoral disaggregation and for small regions (Norcliffe, 1983; Isserman, 1977).

Tests of the accuracy of the LQ methods indicate that their theoretical shortcomings are indeed important in practice. Round (1978) tests the accuracy of five LQ methods in estimating interregional trade flows and concludes that "...one should be cautious in according too much credence to these procedures for estimating interregional commodity trade flows"(p. 194). Harrigan et al. (1981) and Schaffer and Chu (1969) arrived at similar conclusions.

3.2.2 COMMODITY BALANCE OR POOL TECHNIQUES

Commodity balance or pool techniques are in the second category of trade coefficient methods. All of these techniques are based upon Isard's commodity balance method of calculating a regional input requirements table (Isard 1953). The procedure involves the following steps. First, estimate regional gross output x_i and final demand f_i. Next, estimate regional requirements or demand d_i by the formula

$$(3.20) \qquad d_i = \sum_{j=1}^{n} a^*_{ij} x_j + f_i$$

where a^*_{ij} is the i,j^{th} national technical coefficient. The third step is to calculate the regional balance b_i for sector i as the difference between supply s_i ($= x_i$) and demand:

$$(3.21) \qquad b_i = s_i - d_i = x_i - (\sum_{j=1}^{n} a^*_{ij} x_j + y_i).$$

$b_i \geq 1$ implies that the region is either self-sufficient in production of i or is a net exporter so $r_i = 1$. If $b_i < 1$ then the region is a net importer of i and trade coefficient $r_i = s_i/d_i$. Moore and Petersen (1955), Kokat (1966), Schaffer and Chu (1969), and Leontief (1953) are four studies that have utilized the commodity balance method in one form or another. The primary difference in the methods employed in the first two studies is in the manner in which regional production is allocated among purchasing sectors when production is insufficient to meet regional requirements.

Moore and Petersen (1955) allocate regional production according to the requirements of the purchasing sector relative to total requirements, including final demand:

$$(3.22) \qquad a_{ij} = a^{*}_{ij}(x_i/d_i).$$

Kokat on the other hand allocates production according to the requirements of the purchasing sector relative to demand by other sectors. In this specification, final demand is excluded because Kokat makes use of exogenous estimates of it.

$$(3.23) \qquad a_{ij} = a^{*}_{ij}(x_i - y_i)/(d_i - y_i)$$

where y_i is final demand for the i^{th} regional sector. Schaffer and Chu propose an iterative routine which first allocates regional output according to the national sales pattern and then, for sectors in which $b_i < 0$, reallocates output according to the relative requirements of the purchasing sectors. Final demand is treated as a distinct sector.

<u>Critique of Commodity Balance Methods.</u> Fewer tests have been done of the commodity balance methods than of the

LQ methods. Schaffer and Chu (1969) and Harrigan et al. (1981) both found these techniques to be marginally inferior to the quotient techniques. However, given the difficulty of evaluating the relative accuracy of these methods the difference between these two categories are probably not significant. This is not an unexpected conclusion considering the fact that both techniques implicitly assume that there is no cross-hauling. As Stevens and Trainer (1978) point out, available data indicate that cross-hauling is an important phenomenon.

3.2.3 GRAVITY TECHNIQUES

The use of gravity models in constructing regional I-O models is attributed to Leontief and Strout (1963). Two assumptions underlie this technique. First of all, "All interregional movements of a particular commodity or service within a multiregional economy can ... be visualized as shipments from regional supply pools to regional demand pools of that good "(Leontief and Strout 1963, p.20). In other words, producers are indifferent as to the location of the firms and individuals purchasing their output. Likewise, purchasers do not care where the goods and services which they purchase are produced. This reasoning implies that regional exports will be proportional to the size of the supply pool. Regional imports will, by the same token, vary directly with the size of regional demand. The second assumption is that the flow of goods and services is a function of distance.

The result of these two assumptions is that the larger the pool of demand or of supply in a region the greater the distance over which the attraction of the region will be felt. A simple formulation of this type of model (Richardson 1972, p.70) posits that the flow of good i from region r to region s, x_i^{rs} is a function of production in region r, x_i^r, demand in region s, D_i^s, and the distance between the two regions, d^{rs}:

$$(3.24) \qquad x_i^{rs} = k_i x_i^r D_i^s (d^{rs})^{(-a_i)}$$

$$\text{subject to } \sum_{s=1}^{k} x_i^{rs} = x_i^r$$

$$\sum_{r=1}^{k} x_i^{rs} = D_i^s$$

where k_i and a_i can be estimated from the equation:

$$(3.25) \qquad \ln(x_i^{rs}/x_i^r D^s) = k_i - a_i \ln(d^{rs}).$$

The above procedure requires knowledge of the intraregional flows, x_i^{rs}. Leontief and Strout suggest that these flows can be estimated in the following manner:

$$(3.26) \qquad x_i^{rs} = ((x_i^r D_i^s)/ \sum_{i=1}^{n} x_i^r) Q_i^{rs}.$$

Q_i^{rs}, reflecting the costs of transferring good or service i between the two regions, can in turn be estimated by the relation:

$$(3.27) \qquad Q_i^{rs} = (C_i^r + K_i^s) d_i^{rs}$$

where C_i^r and K_i^s are parameters reflecting the relative sizes of supply in r and demand in s.

The two final estimation procedures to be considered here were developed at the Regional Science Research Institute (RSRI) and are called regional purchase coefficients (RPC's). Even though these two procedures are not strictly gravity models - both contain elements of previously discussed procedures - they are discussed in this section because of the prominent role played by the gravity component.

In the first of RSRI's procedures (described in detail in Stevens et al., 1983), the RPC for sector i is defined as the proportion of total regional requirements for sector i's output that is met from regional producers:

$$(3.28) \qquad RPC_i = x_i^{rr} / \sum_{s=1}^{k} x_i^{sr}$$

where x_i^{sr} represents the flow of good or service i from region s to region r. Where data on the actual flow of goods and services both between and within regions is available equation (3.28) can calculated directly. Unfortunately, this data is generally unavailable for all but a few highly aggregated sectors and only at the state level.

The assumption that buyers are indifferent to the location of production of good i means that purchases by users of good i in region r are a function of the c.i.f. (cost including freight) price. In other words, purchases are a function of delivered price, not solely of the cost of production. In a perfectly competitive market, the c.i.f. price of good i shipped from region s to region r is equal to the cost of production in region s, c^s, plus the transfer costs t^{rs}. The ratio of the shipments between users and producers within region r to the shipments from producers outside the region into the region can thus be expressed:

$$(3.27) \qquad x^{rr}/\Sigma_s^k x^{sr} = (c^r + t^{rr})/\Sigma_s^k(c^s + t^{sr})$$

where the sector subscript i has been deleted to avoid notational clutter. Denoting average production costs in all regions other that r by c^o and the average transfer costs from all other regions to r by t^o, equations (3.28) and (3.27) indicate that

(3.28) $RPC = f(c^r/c^o,\ c^r/t^o,\ c^o/t^r,\ t^r/t^o).$

In order to derive an estimable form of this equation, Stevens et al. make the three following assumptions regarding these ratios.

(1) If transportation rates are the only transfer costs and if they are uniform throughout the nation for any given distance, then:

(3.29) $t^r/t^o = t(d^r/d^o)$

where d^r and d^o are the average shipment distances to destinations in region r from origins in r and origins outside r, respectively.

There are a number of difficulties associated with operationalizing the distance variable d^r/d^o. Conceptually, the distances d^r and d^o are the weighted average shipment distances for every individual producer, the weights being each shipment's share of total production. However, this type of data is unavailable even in survey based models. Stevens' solution is to view the ratio as a measure of expected shipment distances within the region, d^r, relative to the expected shipment distance from extraregional producers into the region d^o. The greater the number of producers in a given region relative to the number of users, the higher will be the probability that the shipping distance will be of a certain length. Similarly, the greater the number of producers relative to users nationally, the greater the probability that local needs will be supplied from extraregional sources. Finally, the larger is the region relative to the nation, the greater is the probability that regional demand will be supplied by regional production.

The above discussion suggests that the ratio d^r/d^o, and thus t^r/t^o, can be expressed as a function of the ratio of the relative number of regional producers, the relative number of national producers, and of the relative size of the region:

$$(3.30) \qquad d^r/d^o = d((n^r/N^r)/(n^o/N^o),\ A^r/A^o)$$

where n^r and n^o are the number of users in region r and in the nation, respectively; N^r and N^o are the number of producers in the region and the nation, respectively; and A^r/A^o represents the area of the region relative the area of the nation as a whole. The ratios of the number of firms in equation (3.30) are the correct variables only if firms are the same size. Rather than using some sort of size adjusted variable, employment ratios can be used so that (3.30) becomes

$$(3.31) \qquad d^r/d^o = d(SLQ, A^r/A^o)$$

where SLQ is the simple location quotient for sector i.

(2) As long as assumption (1) holds, the ratio of the cost of production to the transfer cost is a function of the distance shipped, d^t, and of the weight to value ratio of the good being shipped, W/V:

$$(3.32) \qquad c_i/t_j = h(d_t, W/V) \qquad i,j = r,o.$$

Neither of the arguments of this function is readily estimable. The effects of d_t will be captured by the distance proxies in equation (3.31), namely the SLQ and the ratio of the areas. The chosen proxy for the weight to value variable is the total tonnage shipped within the U.S. divided by the average annual wage bill for total U.S. production of good i. Equation (3.32) can be written for regions i and j;

$$(3.33) \qquad c_i/c_j = h(T/E_t w^o)$$

where T is national annual shipments, in tons, of good i, E_t is total national employment, and w^o is average national wages for sector i.

(3) Assume that the ratio of costs of production is a function of relative wages, w^r/w^c, the relative size of regional output, x^r/x^o, and the ratio of other costs of production, o^r/o^o:

(3.34) $c^r/c^o = c(w^r/w^o,\ x^r/x^o,\ o^r/o^o)$.

The inclusion of the second variable x^r/x^o, is an attempt to capture the presence of any scale or agglomeration economies. Data on average wages by sector are relatively easy to obtain so that the wage ratio presents few estimation problems. Output data is often more difficult to acquire and so Stevens uses the ratio of regional employment in sector i, represented by e, to national employment in sector i, represented by E, in place of x^r/x^o. The final variable, the ratio of non-wage costs is dropped, although it could be included as data permits. Thus:

(3.35) $c^r/c^o = c(w^r/c^o,\ e/E)$.

Combining equations (3.31), (3.33), and (3.35), the estimated form of (3.28) is derived:

(3.36) $$RPC = b_0(w^r/w^o)^{b_1}(e/E)^{b_2}(T/Ew^o)^{b_3}(SLQ)^{b_4}*(A^r/A^o)^{b_5}.$$

A two stage procedure is used to estimate the RPCs at both the substate level and for sectoral classifications at the three and four digit S.I.C. levels. First, the coefficients b_i; i=0,...5, are estimated using stepwise linear regression for all industries for which the trade coefficients can be calculated directly. The coefficients estimated from these equations are used in conjunction with the right hand side variables to calculate county trade coefficients for industries at the four digit S.I.C. level. The critical assumption here is that the parameters in the equations for the two digit industries adequately describe the relationships at the four digit level.

Stevens (1984) has recently proposed a new version of the RPC. The form presented in the above discussion was based upon the 1972 Census of Transportation. However, shipments of less than twenty-five miles were ignored in that survey. The 1977 Census corrected this deficiency, thereby greatly increasing the number of observations available for estimating the manufacturing RPCs. In addition to the form just described (equation 3.36), Stevens et al. tried a large number of different functional forms for the manufacturing sector RPC estimating equations. The form which had the best "fit" (in the sense of explaining the greatest amount of variation in the RPCs across sectors) was equation (3.37):

$$(3.37) \qquad RPC_i = D_i^{[(e^{-1/x})-1]}$$

$$\text{where } x = a_0(z_1)^{a_1}(z_2)^{a_2}\ldots(z_{18})^{a_{18}}$$

a_0 - a_{18} are the estimated coefficients; z_1 is the weight to value ratio for sector i; z_2 is the ratio of the region's land area to the nation's; z_3 is the number of establishments per employee in the region relative to the national ratio for sector i; z_4 is regional demand for sector i's output; z_5 is the ratio of regional supply to regional demand for sector i; z_6- z_9 are variables which are included only for certain regions; z_{10}- z_{18} are variables which are included only for certain sectors.

The weight to value ratio appears, in a slightly different form, in equation (3.36) and hence no additional discussion is necessary here. Likewise, the percent of national land area also appears in the first RPC equation. The demand variable and the demand - supply ratio are additions to the RPC estimating procedure that have the potential for greatly increasing the flexibility of RPCs because they provide the means whereby the RPCs could be made endogenous to the model. This capability, was not, however, included in the present model. The establishment to employee ratio is intended to capture the relative product diversity within the sectoral groupings (Stevens, p.10, 1984).

One of the most striking changes from equation (3.36) is that relative costs do not appear in equation (3.37). While this may at first appear unreasonable, recent evidence indicates that distance from sources of demand is much more important in the determination of industrial location than relative costs (see the literature cited in Bernat, 1984).

Stevens (1984) estimated equation (3.37) by transforming it to linear form and then using linear regression. Supply was estimated by dividing regional employment in sector i by the number of employees per dollar of output for the nation. Demand was estimated using a 500 sector national input-ouput model and sectoral supply, as estimated above. The estimated coefficients (except for the region and sector variables) are presented in Table 3.1.

Critique of Gravity Techniques. Gravity techniques share with the other techniques the assumption that the trade coefficients for each sector are the same for all purchasing industries and there is some evidence that this is not a very accurate assumption, at least for some regions (Ralston, Hastings, and Bruckner, 1984). However, gravity techniques appear to be superior to both the quotient and the commodity balance techniques for two reasons. First of all, they incorporate measures of the size of the regional market, thereby explicitly taking distance into account. Secondly, they utilize more information. This is particularly true of the two RPC methods. The trade-off is that the gravity techniques are more costly to implement.

Ultimately, the choice of technique should depend upon which method "works" best. As pointed out by Round (1983), no satisfactory technique of comparing the relative performance of these methods exists. With this caveat in mind, it appears that the second RPC method of RSRI performs better

Table 3.1
Estimated Coefficients for the RPC Equation

Variable	Coefficient	t-Statistic
Constant	3.06	-
Weight/Value	0.29	12.64
Percent of U.S. Area	0.27	8.46
Establishment/Employee	0.12	2.54
Demand	0.18	8.73
Supply/Demand	0.72	16.17

R^2 = 0.7413 (after transformation back to the form 3.37)
Degress of Freedom = 1348
Source : Stevens et al., p. 9 (1984)

than the quotient methods, as well as being theoretically more attractive.

3.2.4 MISCELLANEOUS TECHNIQUES

Other methods which deserve mention but which will not be considered in detail are the RAS technique, Vanwynsberghe's ROCOCO method, and Batten's entropy approach. RAS was initially proposed by Stone (1966) as a method for updating I-O models but has subsequently been used to generate regional I-O models from national tables (e.g. McMenamin and Haring, 1974; Morrison and Smith, 1974; Czamanski and Malizia, 1969; and Malizia and Bond, 1974). Both the ROCOCO method (Vanwynsberghe, 1976) and the entropy approach (Batten, 1982, 1983) were proposed as techniques for estimating interregional tables. From the standpoint of the present study, the most important characteristic shared by these three methods is that they require information on intermediate sectoral flows. In this respect they differ from the other methods discussed in this chapter. As this information is unavailable, these methods will not be considered further (See Round, 1983, for a discussion of these techniques.).

3.3 HOUSEHOLD VALUE-ADDED COEFFICIENTS

The construction of V, the matrix of value-added accruing to households, presents some of the most difficult estimation problems of the model. If the goal were to estimate the size distribution of income of individual workers, rather than of households, the task would be relatively simple. To see this, define Φ as the kxn matrix showing the number of jobs in each of k occupational categories required per unit of output in each of the n producing sectors, and W as a kxk diagonal matrix with w_{ii} being the annual income associated with the i^{th} occupation. The number of workers in each occupational group is given by Φx and the distribution of earnings by occupation is $W\Phi x$.

If each household had only one worker in the labor market, the above procedure could be followed in modeling the size distribution of household income as well as the size distribution of individual income. Both Miyazawa (1976) and Weisskoff and Wolff (1981) employ such a procedure. However, the fact that many households have more than one worker means that this technique is an unsatisfactory way to model households. In order to improve on this procedure, some way must be found for allocating the individual workers in each occupation to the various household units.

Two alternative procedures for constructing V are presented in the following sections. The first procedure was proposed by Dervis et al. (1982) and serves as the basis for the second method, the one that is employed in this study.

Turning now to the procedure proposed by Dervis et al. (1982), assume that there are t different occupations. Define the following variables:

- w = the vector of earnings for each of the t occupation groups (the diagonal of W),
- u = the vector of unemployment benefit payments for each of the t occupation groups (the diagonal of U),
- h = the vector of the number of households in each of the t household groups, households being classified by the occupation of the head of household,
- N = a t x t matrix of workers for which n_{ij} is the number of workers of the j^{th} occupation in the i^{th} household,
- y_m = the vector of average household income in each of the k occupation groups,
- Y_m = the t x t diagonal matrix with y_m on the diagonal,
- y = the vector of total household income in each of the t occupation groups,
- x = the n x 1 vector of regional output,
- Φ = the t x n matrix indicating the number of workers required by each sector per dollar of output,
- p = Φx, the vector of the number of individual workers in each of the t occupation groups, and
- Q = the average occupational profile and is calculated by dividing each element of N by the corresponding row sum.

Average household income for each occupation group is given by:

$$(3.38) \qquad y_m = Qw.$$

Total household income is identically equal to total income of individual workers:

$$(3.39) \qquad h'y_m = p'w,$$

where the prime (') denotes the transpose. Substituting (3.38) into (3.39):

$$(3.40) \qquad h'Qw = p'w.$$

Assuming Q is invertible, (3.40) implies that the number of households in each class is:

$$(3.41) \qquad h = (Q^{-1})'p = (Q^{-1})'\Phi x.$$

Total income by household group is the average income multiplied by the number of households in each group:

$$(3.42) \qquad y = Y_m h.$$

Noting that $Y_m = QW$, equation (3.42) can also be expressed as:

$$(3.43) \qquad y = QW(Q^{-1})'\Phi x.$$

The value-added matrix V is thus given by:

$$(3.44) \qquad V = QW(Q^{-1})'\Phi.$$

Unemployment benefits are allocated across household groups in the same way so that the adjusted value-added matrix V^* becomes:

$$(3.45) \qquad V^* = Q\,(W - U)\,(Q^{-1})'\,\Phi.$$

The problem with this construction of V^* is that the number and type of employed workers in each household group are constant. The average income for each group is also constant. Changes in y occur solely by way of changes in the number of households in each group. This is clearly unsatisfactory for a model of the short-run distribution of household income because the number of employed workers in a given household will change over time as some workers are laid-off and others rehired. In an attempt to overcome this problem, the following procedure will be used.

Grouping households into k groups according to total household income, y_m and y become k x 1 vectors. Define N to be a k x t matrix giving the number of workers in each occupation, by household group. The scalar λ_i is the total supply of workers of the i^{th} occupation and is equal to the

i^{th} column sum of N. The diagonal matrix λ has diagonal elements $1/\lambda_i$. The matrix Q is thus redefined to be:

$$(3.46) \qquad Q = N\lambda.$$

From (3.46) it follows that the vector of household income is:

$$(3.47) \qquad y = QW\Phi x.$$

The adjusted value-added matrix then becomes:

$$(3.48) \qquad V^* = Q\ (W - U)\ \Phi.$$

The key difference between this procedure and the one above is that this procedure assumes a constant number of households in each group, thereby allowing the number of employed workers, and hence the average income of each household group, to vary. In other words, changes in the vector of employed workers (p) change the number of employed workers in each household group but not the number of households in each group.

3.4 HOUSEHOLD CONSUMPTION COEFFICIENTS

The consumption function imbedded in the systems (3.4) and (3.12) is:

$$(3.49) \quad x_i^c = CVx = \sum_{j=1}^{k} c_{ij} \sum_{r=1}^{n} v_{jr} x_r$$

where x^c is the vector of goods consumed by local residents, c_{ij} is the amount of the i^{th} good consumed by households in the j^{th} income class, and v_{jr} is the income accruing to the j^{th} income class from production of the r^{th} producing sector (the asterisk will be dropped from the value-added matrix to reduce notational clutter). In other words, total demand for good x_i by the k^{th} income group is equal to the income of the k^{th} group ($y_k = \sum_{r=1}^{n} v_{kr} x_r$) times the ck^{th} coefficient of C.

Two characteristics of this consumption function stand out. First of all, the consumption function is linear in income. The linearity is a result of the standard I-O framework and as long as this is the modeling framework employed, the consumption function will be linear. Recent work indicates that household consumption is not a linear function of income (Martin and Henry, 1982; Pollack and Wales, 1978) so that there may be significant gains from incorporating a non-linear consumption function into the model. Such an endeavor is, however, beyond the scope of this study.

The second characteristic of the consumption function (3.49) is that nowhere do prices play a role. This would appear to be highly unrealistic but again, in the context of the I-O framework, it is a standard simplification. However, unlike the linearity assumption, there does not appear to be a reasonable alternative short of using a CGE model.

3.5 MEASURING THE EFFECTS OF LINKAGES

The central hypothesis of this study is that the size distribution of income is related to the degree of intersectoral linkages. Such a test requires some way to quantify the degree of linkage within an economy. The purpose of this section is to find such an index of the degree to which an economy is linked.

3.5.1 LINKAGES AND KEY SECTORS

Most of the work on the measurement of intersectoral linkages is in the context of identifying key sectors in stimulating growth in developing economies. Defining the backward linkages (BL) of sector i as the demand by enterprises in sector i for domestically produced inputs and the forward linkages (FL) of sector i as the use by the rest of the regional economy of sector i's output, Hirschman (1958) hypothesized that economic growth could be maximized by concentrating the use of scarce resources in sectors with strong BL and FL. The reasoning behind this hypothesis is fairly simple. Increasing the output of a sector with strong BL increases the demand for sectors producing its inputs, thereby creating opportunities for productive investments. For example, an increase in the demand for automobiles causes an increase in the demand for the output of all sectors producing the goods and services required in the construction of cars. Similarly, to say that a sector has strong FL means that an increase in the output of that sector, said output being used as an input in other production processes, will induce the sectors to which it is linked to also increase their level of production. An example of a sector with strong FL would be a steel producing industry. An increase in the production of steel may, under certain circumstances, induce sectors, such as autos or shipbuilding, that use steel as an input, to increase their own production levels. Implicit in both views is the assumption that local production possesses some advantage over imports.

FL are expected to be much weaker than BL because there is no direct relationship between the mere availability of an input and the use of that input in production. BL, on the other hand, are much more direct and therefore stronger. Clearly, any change in the output of a given sector will, ceteris paribus, result in a change its demand for inputs. For this reason, only BL are considered in this study.

Before proceeding with the discussion of the linkage literature, it would be well to mention that an important difference between key sector analysis and the present study is that key sector analysis has generally employed only open I-O models and consequently has focused only on output linkages. Little or no attention has been paid to the linkages between the household sector and the producing sectors. The model described earlier in this chapter permits analysis of the two types of household linkages. The industry - household linkage, called the value-added linkage in Chapter 2, refers to the way in which households are linked to producing sectors by way of payments to households in the form of wages, salaries, and profits. The household-industry or consumption linkage is a measure of the way households are linked to producing sectors via household consumption expenditures.

3.5.2 REVIEW OF LINKAGE LITERATURE

Yotopoulos and Nugent (1973), essentially following Chenery and Watanabe (1958), use the column sum of the technical coefficients matrix as an index of a sector's BL and the column sum of the Leontief inverse as an index of the total linkage, viz. BL + FL, for that sector.

It is important to note at this point that I-O models do not, as traditionally constructed, permit the measurement of FL in a behavioral sense. In the I-O framework, the driving force of the economy is the demand for output. An increase in the demand for a particular sector's output brings about sufficient production of all necessary inputs to meet that demand. No mechanism is built into the model whereby an increase in the output of a sector that produces intermediate inputs causes local producers either to increase their production or to replace imports. FL are embodied in input-ouput models only as an accounting identity. The rows of the A matrix reflect FL but only because a purchasing sector's BL are the selling sectors' FL. However, as pointed out in section 3.3.3, the RPC method has the potential of endogenizing the trade coefficients and this would be one way of modeling forward linkages.

Yotopoulos and Nugent's article resulted in interesting responses by Laumas (1976), Boucher (1976), Riedel (1976), and Jones (1976). All four of these authors correctly pointed out that the BL index employed by Yotopoulos and Nugent ignored indirect effects and that a more appropriate index could be constructed from the Leontief inverse. The four authors did not, however, agree on the best way to construct an index from the inverse.

A number of different indices can be calculated from the inverse. The simplest, proposed by Jones, is the column sum of the inverse. This is nothing more than the total output multiplier of an I-O model. Boucher argued that what matters is the strength of the linkages of a given sector relative to other sectors. He therefore proposed an index, based upon Rasmussen (1958), which is the ratio of the total output multiplier of a given sector divided by the unweighted average of all the total output multipliers. Laumas agreed with Boucher that the Rasmussen approach is superior but asserted that the equal weighting of sectors implicit in this index should be replaced by weights reflecting the relative importance of each sector in final demand.

Two additional BL indices have since been proposed. Cella (1984) proposed an index that is the same as Jones' except that the diagonal element of the Leontief inverse is subtracted from the total multiplier. Schultz's (1977) index, called hypothetical extraction, is, in the case of any sector j, the difference between the economy's output including sector j and the economy's output with sector j suppressed, viz., with the j^{th} row and column removed from the I-O model.

There is little question that a measure of total BL is what is needed for this study. Yotoupolos and Nugent's index will therefore not be given further consideration. Turning next to the two variants of the Rasmussen index, Boucher's and Laumas', it is clear that these indices are useful only in ranking sectors within an individual economy. Two sectors from two different economies can have equal index values according to either index but, if all the sectors in one economy have higher multipliers than the corresponding sectors in the other economy, i.e. if each column sum from the model for one economy exceeds the corresponding column sums for the other economy, the two sectors would not be linked to the same degree in an absolute sense. In other words, neither index can be used to compare sectors across economies.

An additional shortcoming of Boucher's method is that the value of the index depends as much on exogenous factors (embodied in the vector of final demand) as on the basic, underlying structure of the economy. According to this index, as the mix and level of final demand changes over time, the degree of linkage would also change because changes in final demand would, in general, change the relative weighting of the various sectors.

Neither of the measures proposed by Cella and Jones are totally satisfactory. Cella asserted that Jones' method overstates the extent of BL because, by including the diagonal element of the inverse, the index includes feedback effects upon the sector under analysis. Cella is correct in saying that Jones' index overstates the degree of linkage. He is also correct in pointing out that Jones' index includes what can be called own-feedback effects. However, he is incorrect in attributing the bias in Jones' index to the presence of these feedbacks. In fact, the own-feedback effects represent linkages which are as important as any other linkages and so should be included in any index of total BL. I-O sectors are representations of aggregations of similar firms and enterprises. To say that sector j is linked to itself, viz., that the j^{th} diagonal element of the Leontief inverse is greater than one, simply means that individual firms in sector j purchase inputs from other firms in the sector and/or purchase inputs which utilized, at some point in the production process, the output of other (or the same) firms in sector j. Consequently, Cella's index understates the true degree to which a sector, or group of sectors, is linked to the rest of the economy. A more acceptable index of BL falls between Cella's and Jones' indices. As it turns out, this index is equivalent to Schultz's.

To derive this measure of BL, observe that the technical coefficients matrix of an economy with no interindustry linkages would be composed entirely of zeros. The multiplier matrix, or Leontief inverse, would therefore be an identity matrix. Total output in such a model, keeping in mind that only open models are being considered at this stage, is:

$$x^{*} = (I-A^{*})^{-1} f = f \quad (3.47)$$

where the technical coefficients matrix A^{*} is composed of zeros. This is Schultz's hypothetical extraction. Total output in an economy which is identical to the above economy except for the presence of BL is:

$$x = (I-A)^{-1} f. \tag{3.48}$$

In this case, at least some elements of A are non-zero. The effect of backward linkages is the difference between x and x^*.

$$x - x^* = (I-A)^{-1} f - (I-A^*)^{-1} f = [(I-A)^{-1} - I] f \tag{3.49}$$

From (3.49) we conclude that more satisfactory linkage indices are the column sums of the standard multiplier matrix minus one. The measure of total linkage that will be used is the sum of the individual linkages indices divided by the number of sectors. Such a procedure permits the the comparison of economies with different number of sectors.

4.0 DATA SOURCES AND MODEL CONSTRUCTION

Before proceeding with the description of how the input-output models were constructed, a brief comment on how the four regions used in this study were chosen is in order. The ideal procedure would be to construct models for a large number of diverse regional economies. Unfortunately, available resources precluded the construction of more than a few models. Limiting consideration to regions within the state of Virginia, four regions were chosen (Table 4.1) for two reasons. First, these regions correspond to the regional coverage of the primary data source for constructing the value-added matrices (ICPSR, 1984; discussed below). Second, because it was not possible to construct models for all thirty-one county groups contained in the Microdata sample, it was desirable to choose county groups exhibiting a wide range of inequality in the size distribution of income. This consideration led to the choice of the county group with one of the most equal distributions of income (county group 24)[11], the county group with the most unequal distribution of income (county group 26), and a county group with about

---

[11] A couple of the Northern Virginia county groups had more equal distributions of income but these were excluded because they are so highly integrated with the entire Washington metropolitan area

Table 4.1
Counties in Study Regions

County Group
County Group 1
CLARKE
FREDERICK
PAGE
SHENANDOAH
WARREN
WINCHESTER CITY
County Group 8
BUCHANAN
RUSSELL
TAZEWELL
County Group 24
CHESTERFIELD
County Group 26
ACCOMACK
ESSEX
KING AND QUEEN
KING WILLIAM
LANCASTER
MATHEWS
MIDDLESEX
NORTHAMPTON
NORTHUMBERLAND
RICHMOND
WESTMORELAND

the median level of inequality (county group 1). To gain further diversity in the sample, a region with a large coal producing sector (county group 8) was included. The four county groups thus include a metropolitan, diversified economy, two agricultural economies, and an economy with a large coal mining sector.

4.1 COEFFICIENTS

4.1.1 THE TECHNICAL COEFFICIENTS MATRIX

As described in Chapter 3, each regional technical coefficients or A matrix can be viewed as being composed of two components: a matrix of coefficients representing the production relationships between producing sectors and a vector of coefficients representing the trade relationships between producers in the region and producers outside the region. For the production coefficients, an aggregated version of a 494 sector national input-output model was used. This matrix was included in a model of Virginia constructed by the Regional Science Research Institute (RSRI) under the direction of Dr. Benjamin Stevens and is an updated (to 1977) version of the 1972 United States Department of Commerce national input-output model. The original RSRI matrix was aggregated from 494 sectors to 72 sectors (corresponding to the two-digit SIC industries) using national sectoral output as weights.

The trade coefficients for the manufacturing sectors were calculated for each of the four regions using the second regional purchase coefficient method. Equation (3.7) is repeated here for convenience.

$$(4.1) \qquad RPC_i = D_i^{[(e^{-1/x})-1]}$$

$$\text{where } x = a_0(z_1)^{a_1}(z_2)^{a_2}\ldots(z_{18})^{a_{18}}$$

a_0 - a_{18} are the estimated coefficients; z_1 is the weight to value ratio for sector i; z_2 is the ratio of the region's land area to the nation's; z_3 is the number of establishments per employee in the region relative to the national ratio for sector i; z_4 is regional demand for sector i's output; z_5 is the ratio of regional supply to regional demand for sector i; z_6- z_9 are variables which are included only for certain regions; z_{10}- z_{18} are variables which are included only for certain sectors.

Other than the region and sector variables and the constant term, four variables are used to calculate the RPCs: the weight to value ratio, the percent of total United States land area, the ratio of establishments per employee in the region relative to the United States, regional demand, and regional supply divided by regional demand. The weight to value ratios were calculated from the 1977 Census of Transportation (USDCa, 1981). The establishments per employee ratios were calculated from County Business Patterns data (USDCb, 1981). This data source does not give total employment for any sectors that do not have enough firms in the county to meet certain disclosure criteria. For such sectors, it was necessary to estimate total employment by making use of the data on the number of firms of various sizes that are also reported in this source.

Total supply for each sector was calculated by dividing sectoral employment by the number of employees required per dollar of output in that sector. This latter ratio was taken from the RSRI input-output model of Virginia, mentioned above. Total regional interindustry demand for each sector was then calculated by multiplying the supply or output of each sector by the appropriate column of the national technical coefficients matrix to get the total intermediate demand for each sector. Household demand was calculated by multiplying total household income by a matrix of household consumption coefficients. Total demand was then the sum of household demand and interindustry demand. More compactly:

$$(4.2) \qquad d = A * s + C * y$$

where d is the vector of total regional demand, A is the national technical coefficients matrix, s is total regional supply, C is a matrix of household consumption coefficients (described below), and y is a vector of regional household income, by income class.

For all non-manufacturing sectors (52 out of 72 sectors) an alternative method had to be used in calculating trade coefficients because the Census of Transportation did not include adequate information to permit estimation of RPCs for these sectors. The method employed was the simple location quotient (SLQ). This method was chosen primarily because of its simplicity and wide use in regional analysis.

In most cases, the trade coefficients calculated in the above manner appeared reasonable. However, there were a few sectors in each of the four county groups for which the trade coefficients exceeded the calculated supply-demand ratio. Whenever this situation arose, the trade coefficients were set equal to the supply-demand ratio as this ratio represents the maximum proportion of regional demand that can be met from regional suppliers. This adjustment is similar to the one described in the section on commodity balance techniques (section 3.2.2, above).

4.1.2 CONSUMPTION COEFFICIENTS

The primary source for calculating the regional consumption coefficients (matrix C) was the Consumer Expenditure Survey (CES). This survey is carried out by the Bureau of

Labor Statistics every seven to ten years. While the latest survey was carried out around 1980, the complete data set was unavailable at the time the current work took place. Consequently, an earlier survey covering the years 1972-1974 (Bureau of Labor Statistics, 1977a, 1977b) was used here. The CES reports average household expenditures on goods and services by income class (of which there are 12) for the nation as a whole and for a number of different regions. Virginia is part of the 17-state southern region so this is the sub-sample that was utilized.

A four-step procedure was followed in calculating the C matrices. First, the CES expenditure categories had to be allocated to the 494 sectors of the unaggregated A matrix. This was accomplished by the use of a transformation matrix provided by RSRI. This matrix converts the household expenditure data from purchaser prices to producer prices by allocating transportation, retailing, and wholesaling margins to the appropriate I-O sectors. In the second step, all expenditures for each income group were divided by the group's average income. The third step was to aggregate this 494 x 12 matrix to a 72 x 12 matrix using the same weights as in the aggregation of the A matrix, described above. Finally, the regional consumption coefficients are arrived at by multiplying the aggregated consumption coefficients matrix by the RPCs.

4.1.3 VALUE-ADDED COEFFICIENTS

Equation (3.47) - reproduced here for convenience - shows that the calculation of the value-added matrix (V) involves four matrices:

$$(4.3) \quad V = Q\,(W - U)\,\Phi$$

The matrix Q allocates workers to households, W and U are diagonal matrices of wage rates and unemployment benefit payment, respectively, and Φ is a matrix that indicates the number of workers of each occupational type required in the production of a unit of output of each producing sector. The calculation of each of these matrices is discussed in turn.

The primary source of data for constructing Q was the 1980 Public Use Microdata tape (ICPSR, 1984). This data set consists of the responses to the Census' Long Questionnaire and is therefore a sample (5 percent) rather than a complete census. The advantage of using this data set is that it contains very detailed information at the household level. A disadvantage is that the geographical coverage is such as to ensure that there were at least 100,000 people in any region. This was done to avoid the possibility of identifying any individual household. This broad coverage precludes the calculation of value-added matrices specific to many of the counties in Virginia.

The first step in the construction of Q was to eliminate all individuals living in group quarters. Then, households were grouped into the same twelve income classes that the C matrices were divided into. The next step called for the allocation of the more than three hundred occupational categories in the Microdata sample, to the ninety categories that are in the matrix Φ (discussed below). Once this was accomplished, the number of workers in each occupation was calculated for each of the twelve household groups. This is matrix N in equation (3.45). All individuals who gave a primary occupation were included whether they were employed, unemployed, or self-employed in 1979. This was done in an attempt to measure the total available supply of workers of each occupation. The final step was to divide each element of matrix N by its column sum. Each element q_{ij} is the proportion of the total supply of workers of type j who are members of a household in group i. This can then be interpreted as the probability that any job of type j will be taken by a worker from household group i.

Matrices W and U were also calculated from the Microdata information. W was calculated by dividing the total earnings for each occupation by the total hours worked. This average hourly wage was then multiplied by 2080 to arrive at an average annual wage rate. U could then be calculated by using the formula in force in 1980 for determining unemployment benefit levels (Lindley, 1981). This formula specified that payments would be equal to 48% of weekly wages with a maximum payment of $138.00 per week. No benefits would be paid if weekly earnings were less than $84.00. Applying this formula to W resulted in U.

Matrix Φ was constructed by making use of the occupational matrix that was included by RSRI in the Virginia input-output model mentioned above. This matrix consists of ninety occupational categories and 51 industries. This matrix was updated for most of the non-manufacturing sectors to reflect more current information than was available when the RSRI developed their matrix (VEC, 1981, 1983).

4.2 IMPLEMENTATION

In the following analyses, four versions of each regional model are used. For each region, the first version is the model that would be used in ordinary impact analysis, that is, it is the model that best represents the regional economy and will be referred to as the Total model. The second model is derived from the first by removing all interindustry linkages and will be called the no interindustry linkage (N-I) model. In this model the A matrix is a matrix of zeroes. The third model is likewise derived from the Total model by removing linkages, but in this case the household consumption linkages are zeroed out. It will therefore be called the no consumption linkage (N-C) model.

The fourth model is called the Full model because it is constructed by setting all RPCs to unity. It thus represents an economy that is fully self-sufficient with regard to its particular industry mix.

Once the sixteen models (four models x four regions) were inverted, the multiplier matrices could be used to calculate the distributional impacts of changes in final demand and changes in exogenous income. From equation (3.7), the distribution of household income arising from any final demand vector f is:

$$(4.4) \qquad y^r_{ij} = KVB^r_i * f^r_j$$

where y and f are vectors of household income and final demand, respectively, and KVB is the lower lefthand submatrix of the partitioned inverse (3.5). The superscripts indicate the region while the subscript t denotes the version of the regional input-output model and subscript j denotes the sector. In other words, for each region r, an income vector was calculated for each version of the regional model ($i = 1,4$) and each sector ($j = 1,n$). Each of the n final demand vectors consisted of a single positive element corresponding to the sector under scrutiny. In this way, the inequality effect of each sector could be measured separately. In addition to the four versions of KVB, the distribution of income was also calculated using the regional value-added matrices V. The resulting income vectors can be viewed as representing the direct effect of a change in the output of a particular sector and will hereafter be referred to as the Direct model.

In the next step, the income vectors were used to calculate a normalized Thiel index of inequality of the following form:

$$(4.5) \qquad I = \{\Sigma P_k M_k [G_k + \log(n_k)]\} \,/\, \log(N)$$

where I is the index of inequality, the subscript k indicates the income class, N is the total number of households in the region, n_k is the number of households in income group k, G_k is the inequality within household group k, P_k and M_k are the ratios of income group population to total population and group mean income to total mean income, respectively. Superscripts indicating the region and model version have been deleted to minimize notational clutter.

4.3 COMPARISON OF MODEL WITH STANDARD I-O MODEL

An important step in the construction of any economic model is to verify, in some way, that the model is reasonably accurate. A common test of the accuracy of an input-output model constructed using secondary sources is to compare it to a survey-based (primary source) model of the same region. In the present case, such a comparison is not possible as no survey-based model of Virginia is available. Thus, no formal test of the accuracy of the model can be carried out at this time. However, it is appropriate at this point to see how a model of the form used here compares with the more standard I-O construction.

The major differences between the models used in this study and standard input-output models are the disaggregated household sector and the adjustment of the value-added coefficients to reflect unemployment benefits. Looking first at the effect of disaggregating the household sector, Tables 4.2 through 4.5 present multipliers of selected sectors from two versions of an input-output model of Virginia. Model A was constructed using the methods and data described above. Model B was constructed in an identical fashion except that the twelve household sectors were aggregated into a single sector.

Tables 4.2 and 4.3 show the effects a $100 change in the final demand for sector 50 and sector 69, respectively. These two sectors were chosen because they highlight the problem of using an aggregated household sector: sector 50 has a relatively high low-income multiplier and sector 69 a relatively high high-income multiplier. Table 4.4 and 4.5 show the effects of a $100 change in the exogenous income of low income households (Table 4.4) and high income households (Table 4.5).

Table 4.2
Impacts of a Change in the Final Demand for Sector 50

Sector	Model A	Model B
11 SPECIAL TRADE CONTRACTORS	1.44	1.38
54 INSURANCE CARRIERS	1.78	1.69
39 COMMUNICATION	2.24	2.21
12 FOOD & KINDRED PROD.	2.39	1.81
21 PETROLEUM & COAL PROD.	2.51	2.37
19 PRINTING & PUBLISHING	2.68	2.59
40 ELEC.,GAS,&SANITARY SERV.	3.88	3.61
61 BUSINESS SERVICES	4.36	4.26
56 REAL ESTATE	4.47	4.32
50 MISCELLANEOUS RETAIL	100.21	100.18
ALL OTHER SECTORS	21.08	18.79
TOTAL OUTPUT	147.04	143.21
INCOME GROUP 1 (Low)	2.04	-
INCOME GROUP 2	1.84	-
INCOME GROUP 3	2.28	-
INCOME GROUP 4	2.08	-
INCOME GROUP 5	2.25	-
INCOME GROUP 6	2.46	-
INCOME GROUP 7	4.61	-
INCOME GROUP 8	4.01	-
INCOME GROUP 9	4.42	-
INCOME GROUP 10	3.67	-
INCOME GROUP 11	1.50	-
INCOME GROUP 12 (High)	1.62	-
TOTAL HOUSEHOLD INCOME	32.77	32.18

Table 4.3

Impacts of a Change in the Final Demand for Sector 69

Sector	Model A	Model B
53 SECURITY, COMM. BROKERS	1.33	1.33
40 ELEC.,GAS, SANITARY SERV.	1.55	1.49
54 INSURANCE CARRIERS	1.70	1.65
49 EATING AND DRINKING PLACES	1.81	1.76
12 FOOD AND KINDRED PROD.	2.50	2.39
56 REAL ESTATE	3.38	3.35
39 COMMUNICATION	3.63	3.60
19 PRINTING AND PUBLISHING	4.46	4.44
61 BUSINESS SERVICES	4.91	4.88
69 SOCIAL SERVICES	100.00	100.00
ALL OTHER SECTORS	22.80	22.20
TOTAL OUTPUT	148.07	147.09
INCOME GROUP 1 (Low)	0.87	-
INCOME GROUP 2	0.73	-
INCOME GROUP 3	1.11	-
INCOME GROUP 4	1.33	-
INCOME GROUP 5	1.50	-
INCOME GROUP 6	2.14	-
INCOME GROUP 7	4.45	-
INCOME GROUP 8	4.76	-
INCOME GROUP 9	6.02	-
INCOME GROUP 10	7.60	-
INCOME GROUP 11	3.84	-
INCOME GROUP 12 (High)	5.07	-
TOTAL HOUSEHOLD INCOME	39.44	39.27

Table 4.4

Impacts of a Change in the Exogenous Income of Household Group 1

Sector	Model A	Model B
58 HOLDING-OTH. INV.. OFF'S	3.65	1.26
12 FOOD STORES	3.91	1.17
39 COMMUNICATION	4.00	1.50
21 PETROLEUM AND COAL PROD.	4.31	2.05
56 REAL ESTATE	4.45	1.46
42 WHLSALE-NONDURABLE GOODS	4.45	1.72
54 INSURANCE CARRIERS	5.46	4.09
52 CREDIT AGENCIES EX. BANKS	6.05	2.09
40 ELEC.,GAS,&SANITARY SERV.	8.66	2.89
12 FOOD AND KINDRED PROD	17.38	5.61
ALL OTHER SECTORS	69.51	32.71
TOTAL OUTPUT	131.83	56.55
INCOME GROUP 1 (Low)	100.75	-
INCOME GROUP 2	0.64	-
INCOME GROUP 3	0.94	-
INCOME GROUP 4	1.07	-
INCOME GROUP 5	1.18	-
INCOME GROUP 6	1.35	-
INCOME GROUP 7	3.05	-
INCOME GROUP 8	2.80	-
INCOME GROUP 9	3.31	-
INCOME GROUP 10	3.21	-
INCOME GROUP 11	1.39	-
INCOME GROUP 12 (High)	1.43	-
TOTAL HOUSEHOLD INCOME	121.12	109.44

Table 4.5

Impacts of a Change in the Exogenous Income of Household Group 12

Sector	Model A	Model B
42 WHSALE-NONDURABLE GOODS	0.90	1.72
46 AUTO. DEALERS-SERV. STAT.	0.94	1.79
15 APPAREL AND OTHER PROD.	0.97	1.41
21 PETROLEUM & COAL PROD.	1.07	2.05
52 CREDIT AGENCIES EX. BANKS	1.08	2.09
49 EATING & DRINKING PLACES	1.20	1.73
40 ELEC., GAS, & SANITARY SERV.	1.55	2.89
29 TRANSPORTATION EQUIPMENT	1.65	2.42
12 FOOD & KINDRED PROD.	2.66	5.61
54 INSURANCE CARRIERS	2.92	4.09
ALL OTHER SECTORS	18.98	30.75
TOTAL OUTPUT	33.92	56.55
INCOME GROUP 1 (Low)	0.20	-
INCOME GROUP 2	0.17	-
INCOME GROUP 3	0.25	-
INCOME GROUP 4	0.29	-
INCOME GROUP 5	0.32	-
INCOME GROUP 6	0.37	-
INCOME GROUP 7	0.83	-
INCOME GROUP 8	0.77	-
INCOME GROUP 9	0.92	-
INCOME GROUP 10	0.90	-
INCOME GROUP 11	0.38	-
INCOME GROUP 12 (High)	100.40	-
TOTAL HOUSEHOLD INCOME	105.82	109.44

Looking first at the effects of a change in final demand, the ratio of total generated output (indirect plus induced impacts), defined as total output minus the change in final demand, as estimated from model B and total generated output as estimated from model A is 0.919 for sector 50 (Table 4.2) and 0.980 for sector 69 (Table 4.3). The ratios of total household income are even closer: 0.982 and 0.996 for sectors 50 and 69, respectively. Thus, while the difference in overall impact between the two models may be relatively small, the disaggregated model clearly provides a much richer view of the effects that changes in sectoral output have on the household sector.

Tables 4.4 and 4.5 show that disaggregating the household has a much larger effect on the resulting multipliers when changes in exogenous income are analyzed than for final demand changes. For example, using model B to estimate the impact on total output of a change in the income of income group 12 would over-estimate the impact by nearly 4%. Using the aggregated model in the case of a change in the income of the lowest income group would result in an under-estimate on the order of 40%.

Adjusting the value-added coefficients in the fashion described in Chapter 3 is expected to result in lower multipliers than would occur in a similar model without such an adjustment. It is also expected that the impact will vary from sector to sector. A convenient way to evaluate the extent of these differences in multipliers is to generate the multipliers for two models - one with the unemployment adjustment and one without - and calculate the ratios of these multipliers for each sector. Table 4.6 presents selected ratios for the state model with a disaggregated household sector (model A, above) and a state model with an aggregated household sector (model B, above).

Clearly, there are large differences between the models just compared. Because the models used in the above comparisons differ only with regard to the number of household sectors and the adjustment of the value-added matrix, the judgement as to which model is superior rests upon the judgement of which model involves the most realistic assumptions about the structure of regional economies. The judgement here is that the model with a disaggregated household sector and with the unemployment adjustment is the most realistic one.

Table 4.6
Ratio of Output Multipliers for Most and Least Affected Producing Sectors[1]

Sector	Disaggregated Household Models	Aggregated Household Models
Least Affected:		
Real Estate	1.067	1.063
Comb. Real Est., Ins.	1.067	1.063
Business Ser.	1.081	1.076
Fishing,Hunting,Trapping	1.088	1.082
Forestry	1.088	1.082
Auto Repair, Garages	1.091	1.086
Agriculture	1.093	1.086
Food, Kindred Prod.	1.095	1.089
Communication	1.096	1.091
Pipe Lines	1.100	1.093
Most Affected:		
Bldg.Mat.-Garden Sup.	1.212	1.200
Misc. Retail	1.214	1.198
Agri. Services	1.215	1.203
Apparel, Access. Stores	1.216	1.202
Gen. Merch. Stores	1.218	1.206
Railroad Trans.	1.221	1.209
Auto Ser. Sta.	1.221	1.208
Security Brokers	1.236	1.227
Heavy Const.	1.247	1.234
Spec. Trade Const.	1.278	1.263

[1] Multiplier of model without unemployment adjustment divided by multiplier of model with unemployment adjustment.

5.0 ANALYSIS AND RESULTS

Before turning to an examination of the four hypotheses discussed at th e end of Chapter 2, we will discuss two related issues - 1) the possible relationship between the degree of overall linkage and overall inequality, and 2) the differences in degree of linkage among the four different types of linkage (interindustry, consumption, value-added, and household).

5.1 RELATIONSHIP BETWEEN THE DEGREE OF LINKAGE AND INEQUALITY

In their study of linkages and inequality in Puerto Rico, Weisskoff and Wolff (1982) propose that one possible explanation for Kuznets' observation that inequality follows an inverted U-shape over time - increasing in the early stages of development and then, at some point, decreasing - is that as linkages increase and the nation becomes more self-sufficient, inequality falls. Even though the inverted U pattern does not appear to apply as a universal rule of development (Fields, 1980; Chenery et al., 1974), and Weisskoff and Wolff's hypothesis clearly attempts to explain only the latter portion of the inverted U, i.e. the stage in development over which inequality falls, it is still of interest to see whether or not higher levels of inequality and low levels of intersectoral linkages are observed together.

Table 5.1 presents the linkage indices calculated for the four versions of each regional model. In all cases, county group 24 has the highest degree of linkage and county group 8 the lowest. Except for the no consumption linkage version, county group 1 is the second most highly linked economy, and county group 26 is third. In addition, the linkage index in county group eight is much lower than the indices for the other three county groups for every model save the model in which the RPCs were set to unity. This implies that the RPCs for county group 8 are uniformly lower than for the other county groups. The fact that coal mining, an industry that is characterized by wide fluctuations in output and employment, is an important industry only in county group 8, may have much to do with this apparent lack of regional self-sufficiency.

Table 5.2 presents Thiel inequality indices for each model that are based on final demand vectors calculated using the following equation (The detailed results are presented in Appendix B)

(5.1) $f = x - Ax - Cy.$

Table 5.1
Overall Linkage Indices

County Group	Total	No-C	No I-I	Full
1	0.745928	0.306426	0.504593	1.664046
8	0.531761	0.279896	0.371449	1.649200
24	0.785256	0.331443	0.540499	1.809059
26	0.684240	0.311828	0.443271	1.662104

The vector f is final demand, x is regional output, y is regional household income, A is the matrix of regional technical coefficients, and C is the matrix of household consumption coefficients. While this procedure may not be the most accurate way to estimate f, its simplicity and the fact that only a reasonable representation of what might be considered a typical final demand vector is all that is required at this point, led to its use here. Columns 2 through 5 of Table 5.2 present the inequality indices calculated from the four versions of each model using the same final demand vector. It would appear from this table that economies with low inequality have a high degree of intersectoral linkage. In all four versions, county group 24 was the most equal, county group 1 the next most equal, and county groups 26 and 8 the third and fourth most equal, respectively. This ranking corresponds almost exactly to the linkage rankings from Table 5.1. This is not the same ranking as when the inequality indices calculated from census data are used. Whereas county group 8 exhibits the highest level of inequality when calculated from the input-output models, county group 26 has the most unequal distribution of income when the actual inequality index is used.[12] However, although the data exhibit an

---

[12] The inequality rankings from the input-output models would seem to be the better rankings to use for the purpose at hand because they measure only the effect of linkages. The census inequality rankings are based on total income, many components of which can be expected

inverse relationship between inequality and the degree of linkage across economies, inequality appears to increase as linkages are strengthened within each economy, viz. inequality increases between the no consumption linkage models and the full RPC models.

Given this contradictory evidence, we conclude that a relationship between overall inequality and the degree of linkage is weak, if it exists at all.

5.2 DIFFERENCES BETWEEN LINKAGES

Indices of the different types of linkages are calculated from the partitioned representation of the I-O inverse (equation 3.5, reproduced here for convenience).

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} BINV & BCK \\ KVB & K \end{bmatrix} \begin{bmatrix} f \\ g \end{bmatrix} \qquad (5.2)$$

where BINV = B(I + CKVB).

to vary from region to region in ways unrelated to linkages. The difference between inequality calculated from the Total model and the census-based inequality indices is also attributed to differences in the definition of income. Household income in the above analysis only includes income generated from regional production. Census income includes all income from all sources and, therefore, it is not surprising that the distribution of census income differs from the distribution calculated in the above fashion.

Table 5.2
Overall Inequality Indices

County Group	Total	No I-I	No-C	Full
1	0.022006	0.021903	0.022034	0.022710
8	0.034419	0.034386	0.034279	0.035201
24	0.011050	0.010270	0.011037	0.011972
26	0.028929	0.028650	0.028903	0.030392

Submatrix BINV represents the interindustry linkages, BCK the consumption (household-industry) linkages, KVB the value-added (industry-household) linkages, and K the household (household-household) linkages. Linkage indices for each of these submatrices were calculated in the same way as the overall linkage index: the sums of the elements in each submatrix (the sum minus one for the matrices on the diagonal, BINV and K) were added and subsequently divided by the number of columns. The resulting indices are presented in Table 5.3.

One of the most striking features of these linkages is the way the linkages for county group 8 differ from those of the other regions. As was the case with overall linkages, this region exhibits a much lower degree of linkage for all versions except for the Full model, and for all types of linkages with the exception of the value-added linkages (KVB). Confining our attention to the Total version of each regional model, the indices for both the interindustry linkages and the consumption linkages for county group 8 are in the neighborhood of 60% - 70% of the corresponding linkage indices for the other regions. The value-added linkage index, however, is equal to 83% of county group 24's value-added linkage index and over 90% of the value of the indices for the other two regions. Because the same consumption coefficients were used in all four regions, the observed differences in linkage indices are attributable to differ-

Table 5.3
Linkage Indices from Partioned Inverse

County Group 1

	Total	No C	No I	Full
BINV	0.499918	0.072421	0.369136	1.311923
BCK	0.599064	0.423039	0.000000	1.490665
KVB	0.255090	0.196513	0.233120	0.344428
K	0.099948	0.077093	0.000000	0.213136

County Group 8

	Total	No C	No I	Full
BINV	0.305167	0.055953	0.224491	1.285699
BCK	0.401790	0.327398	0.000000	1.474864
KVB	0.238507	0.201234	0.223809	0.354737
K	0.072387	0.062260	0.000000	0.216693

County Group 24

	Total	No C	No I	Full
BINV	0.515894	0.074268	0.385247	1.401836
BCK	0.579494	0.418149	0.000000	1.541796
KVB	0.286703	0.222423	0.259865	0.408277
K	0.116172	0.092844	0.000000	0.261819

County Group 26

	Total	No C	No I	Full
BINV	0.429891	0.074194	0.301393	1.303816
BCK	0.591779	0.422261	0.000000	1.480693
KVB	0.251947	0.199843	0.229079	0.351013
K	0.104669	0.081673	0.000000	0.218387

ences in industry mix, the RPCs, and the value-added matrices.

5.3 CONVERGENCE OF INEQUALITY IMPACTS

We turn now to the question of whether or not the four economies we have modeled support Weisskoff and Wolff's (W-W) hypothesis that as an economy becomes increasingly interlinked, the sectoral inequality impacts converge. To test this hypothesis, the coefficients of variation (CVs) of inequality impacts for each version were calculated. If convergence is exhibited by the four economies under study, the CVs will fall as linkages are increased from the Direct models to the Full models. Table 5.4 presents the CVs for each model.

Clearly, the evidence from these four county groups supports W-W's convergence hypothesis. In every case, the coefficient of variation of the inequality impacts falls as one moves from the Direct model to the Full model.

The evidence presented in Table 5.4 supports the convergence hypothesis but it sheds no light on whether or not there is any systematic pattern in terms of the problem of the inequality effects of interlinked sectors. The pattern of increasing overall inequality that is exhibited in Table 5.1 indicates a general, albeit slight, tendency for the nonbasic sectors to have higher sectoral inequality impacts

Table 5.4
Coefficients of Variation of Inequality Impacts

County Group	Full	Total	N-C	N-I	Direct
26	0.501	0.639	0.698	0.752	0.802
8	0.342	0.471	0.498	0.553	0.580
1	0.398	0.509	0.553	0.633	0.669
24	1.034	1.230	1.332	1.287	1.363

than the basic or export sectors. Dividing each sectoral inequality impact by the direct inequality impact for the sector (from Appendix B) gives a more detailed view of the pattern of sectoral linkages (see Appendix C). These ratios indicate that, while nearly all inequality impacts are within 5% of the Direct impact, some sectors exhibit a pronounced increase or decrease in inequality impact, particularly when the Direct, Total, and Full models are compared. These sectors tend to be the sectors that had either the highest or lowest Direct impacts. The high inequality impact sectors are the ones showing the large decline in impacts as linkages are increased; the low inequality sectors showing an increase.

5.4 THE FACTOR INTENSITY ISSUE

As discussed in Chapter 2, one aspect of the factor intensity issue is the question of how the different household groups are interlinked. If, for example, higher income households are very closely linked to lower income households (in the sense that the consumption expenditures of the higher income households are composed largely of goods and services that are intensive in low-wage workers), an increase in the income of the higher income household groups may also benefit low income households.[13]

There are two distinct issues here: the size of the household linkages and the distributional impact of these linkages. With regard to the latter issue, Williamson and Lindert (1976) concluded that the low-wage intensity of consumption expenditures was an increasing function of household income. In other words, the linkages of other households to low-income households is an increasing function of household income. Defining low-income households to be household groups 1 - 3, this hypothesis would be supported by the models constructed here if the elements in each of the low-income rows of the household multiplier matrix (the first 3 rows of matrix K in equation 4.4) increase from left to right. Answering the question of the distributional effects that household linkages may have involves the relative size of the various elements in each column of K.

One way to approach the latter issue of household inequality (distributional impacts of linkages) is to calculate the household inequality impacts for each version of the four regional models. Equation (5.3) gives the formula for calculating the income vector.

---

[13] This is another way to look at the idea that it does not matter if high income groups receive greater direct benefit directly from economic growth because such growth will "trickle down" to the lower income groups.

$$(5.3) \quad y^r_{ij} = K^r_i * g^r_j - g^r_j$$

The matrix K is the lower righthand submatrix of the partitioned inverse (5.2) and g^r_j is the vector of exogenous income for the r^{th} region. The inequality index presented in (4.2) was then applied to each income vector. Exogenous income is subtracted so that the distributional effects of the spending pattern of the different household groups can be separated from the distributional effect of the exogenous income itself. The results for the four regional models are presented in Appendix D.

These results do not indicate that any household group has inequality impacts that are much above or much below the average for the particular region. Although the upper-income household groups do not exhibit the most unequal inequality impacts in every case, the household groups with the lowest inequality impacts are the household groups with the lowest income. For example, in county group 8, the household income generated by an increase in the income of the highest income group (group 12), would be more equally distributed than would the distribution of income arising from an increase in income of income groups 7-11. It is important to keep in mind that this applies only to the effects of the additional spending that would occur due to an increase in income. When the change in exogenous income is also included in the inequality calculation, the inequality effect of an increase in household income is, in all cases, an increasing function of income. Appendix D also shows the change in overall inequality that would result from a one million dollar increase in the income of each household group. Clearly, the inequality effects of the direct increase in income dominate the inequality effects of the household linkages.

The inequality impacts presented in Appendix D do not indicate whether or not any of the observed differences, either within each county group or between the county groups, are statistically significant.[14] In addition, because the Thiel index is mean independent (Bernat, 1985), the size of the elements of K do not affect the indices presented in Appendix D. This means that it is not possible to use these indices as a test of Williamson and Lindert's hypothesis that the low-wage intensity of household consumption is an increasing function of income.

One way to test this hypothesis and, at the same time, look at the distributional effects of household linkages, is to estimate the following regression model.

$$k_{ij} = b_0+b_1y_i+b_2y_j+b_3y_i^2+b_4y_j^2+ b_5y_iy_j^2+b_6y_jy_i^2+b_7y_iy_j \quad (5.4)$$

[14] Considering the wide use of inequality indices, it is a little surprising that no significance tests for such indices have been developed. As useful as such a test would be, it is beyond the scope of this paper to develop one.

The dependent variable, the ij^{th} element of K, is the change in income of the i^{th} household group resulting from a dollar's change in the income of the j^{th} household group. The variable y_i is the average income of the i^{th} income group (the i^{th} row of K), and y_j is the average income of the household group represented by the j^{th} column of K.

The hypothesis that the elements of each row of K increase in size from left to right (Williamson and Lindert's hypothesis) depends upon the values of all the terms in which y_j appears. If there is no interaction between the columns and rows (b_5 - b_7 are all equal to zero), the presence of a trend in the size of the row elements of K depends upon the coefficients b_2 and b_4. For example, a positive sign on b_2 at the same time that b_4 is zero would indicate that the size of the row elements increases in a linear fashion. A non-zero value for b_4 would indicate that there is a non-linear relationship between the size of the multiplier and the column of K. Non-zero interaction coefficients would indicate that patterns exhibited in any of the rows are not independent of the row index.

This equation can also be used to investigate the distributional properties embodied in K. A visual examination of the columns of K indicates that an inverted U pattern exists - the elements rise to a maximum and then decline from row 1 to row 12. In terms of the impact on different household groups, lower-income groups will be more favored, relative to upper-income groups, the more quickly the multipliers reach their maximum value. To find out at what income level (y_{max}) this maximum is attained, take the partial derivative of (5.4) with respect to y_i:

$$\text{(5.5)} \qquad \partial k_{ij}/\partial y_i = b_1+2b_3y_i+2b_5y_iy_j+b_7y_j$$

This expression is equal to zero when (5.4) is at its maximum. Solving for y_{max}:

$$\text{(5.6)} \qquad y_{max} = -(b_1+b_7y_j)/2(b_3+b_5y_j) \ .$$

This expression tells us that, for any column j, low-income households are more favored (in a relative sense), the smaller the numerator of (5.6) and the larger the denominator. Because of the negative sign in the numerator, this condition is equivalent to saying that low-income households will be favored the larger are the coefficients b_1 and b_3 and the smaller are b_5 and b_7. With no interaction between y_i and y_j, the maximum value of each column of K is at an income level equal to $-b_1/b_3$.

The estimated equations for each county group are presented in Tables 5.5 and 5.6. The results reported here are from models run after dropping variables with highly insignificant coefficients. Common to all county groups is that the coefficients on y_i and y_i^2 are positive and nega-

Table 5.5
Regression Results for County Groups 1 and 8

County Group 1

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|
b_0	0.00293504	2.19	0.0300
b_1	0.00096855	10.47	0.0001
b_2	-0.00020139	-2.98	0.0034
b_3	1.4275871E-05	-10.88	0.0001
b_4	2.7734345E-06	3.57	0.0006
b_5	1.5296927E-07	3.48	0.0007
b_7	-1.0315050E-05	-3.33	0.0011

R^2 = 0.66 F Value = 45.02 Degrees of Freedom = 143

County Group 8

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|
b_0	0.00127469	1.36	0.1772
b_1	0.00075485	11.62	0.0001
b_2	-0.00015499	-3.27	0.0015
b_3	-1.0271654E-05	-11.16	0.0001
b_4	2.3217557E-06	4.19	0.0001
b_5	1.1987899E-07	3.88	0.0002
b_7	-8.7662657E-06	-4.02	0.0001

R^2 = 0.70 F Value = 44.44 Degrees of Freedom = 143

Table 5.6
Regression Results for County Groups 24 and 26

County Group 24

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|
b_0	-0.00762351	-3.54	0.0005
b_1	0.00167038	8.70	0.0001
b_3	-2.1366670E-05	-7.14	0.0001
b_5	1.4097063E-07	1.78	0.0772
b_7	-1.1201307E-05	-2.71	0.0076

R^2 = 0.39 F Value = 21.78 Degrees of Freedom = 143

County Group 26

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|
b_0	0.00868702	7.28	0.0001
b_1	0.00041366	6.15	0.0001
b_2	-0.00031161	-4.65	0.0001
b_3	-5.4208308E-06	-5.73	0.0001
b_4	2.7386355E-06	2.89	0.0044

R^2 = 0.41 F Value = 23.83 Degrees of Freedom = 143 tive, respectively. This confirms the observation that the multipliers in each column rise and then decline. With regard to the hypothesis that the multipliers fall from left to right within each row, every county group except county group 24 has a significant and negative sign on b_2. However, in all three of these county groups, the coefficient on y_j^2 is significant and positive. This indicates a U shaped pattern across the columns - the elements of k_{ij} fall and then rise. In other words, a change in the income of the i^{th} household group has a greater impact on the low- and upper-income households than on middle-income households.

In terms of distributional impacts, it would appear that these models are consistent with the inequality rankings. County group 24 exhibits the largest value of b_1 and the smallest value of b_3, followed by county groups 1, 8, and 26. With regard to Williamson and Lindert's hypothesis concerning the relationship between the income of the spending household (y_j) and the size of the impact on lower-income households, only county group 24 exhibits a simple relationship. In order to better visualize the relationship between income and the size of the multipliers, income multiplier surfaces were generated using the coefficients in Tables 5.5 and 5.6 (Figures 2 - 5).

In each figure, the vertical axis gives the value of the element ij^{th} element of matrix K which is the change in the i^{th} household groups's income due to a change in the

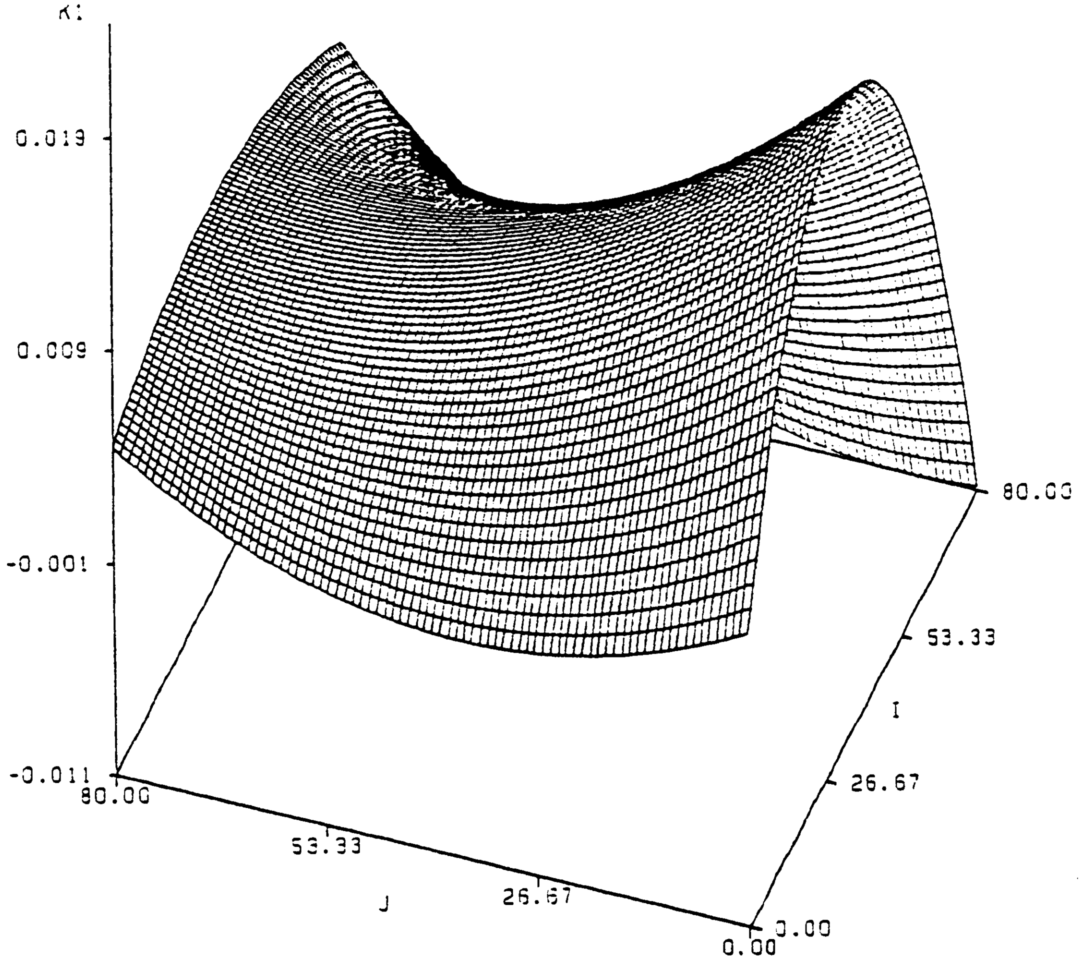

Figure 2. Multiplier Surfaces: County Group 1

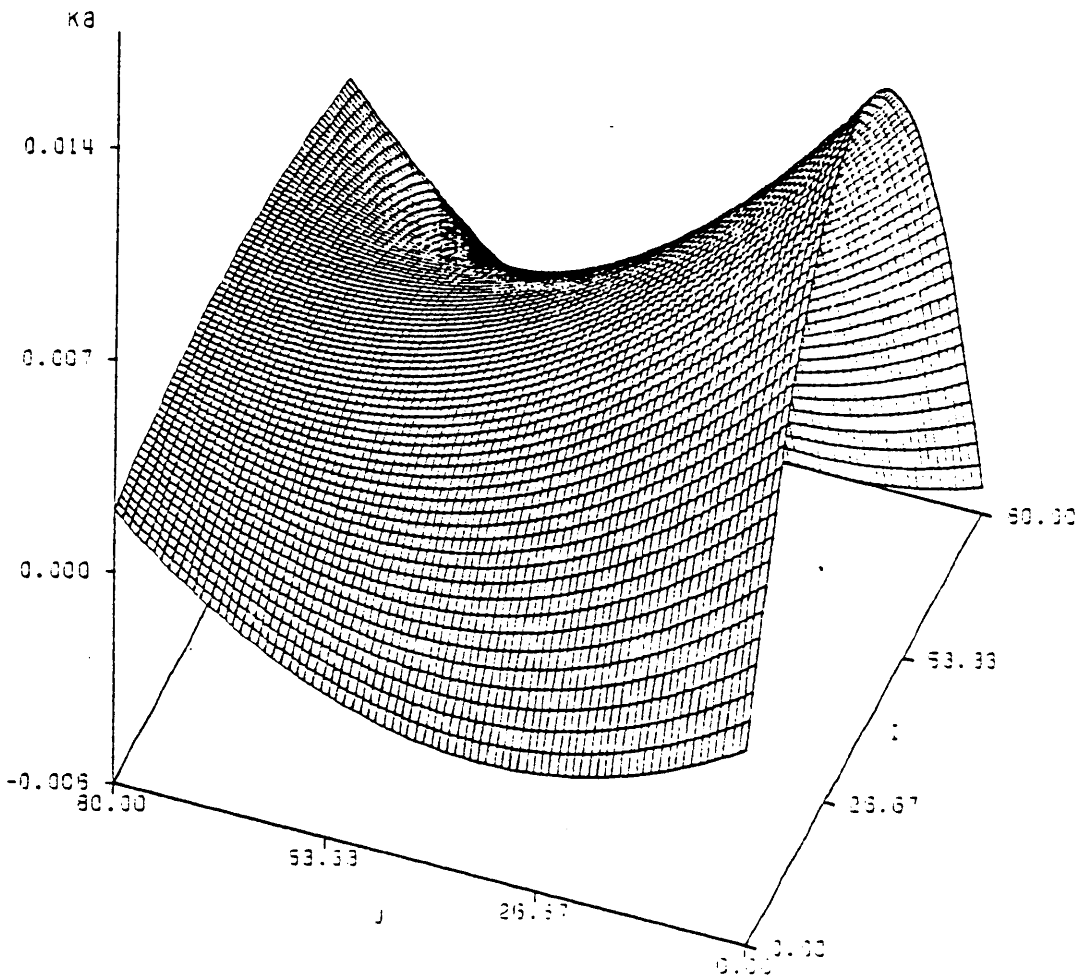

Figure 3. Multiplier Surfaces: County Group 8

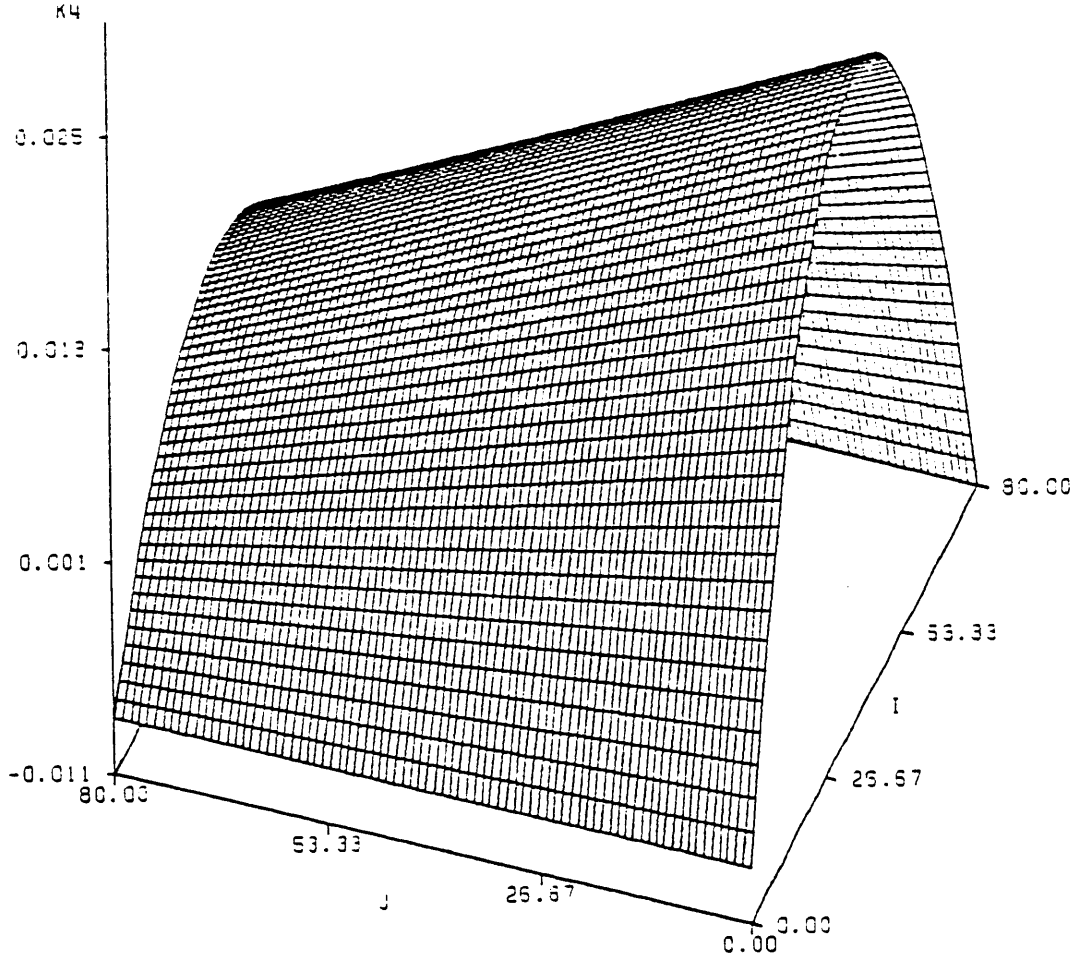

Figure 4. Multiplier Surfaces: County Group 24

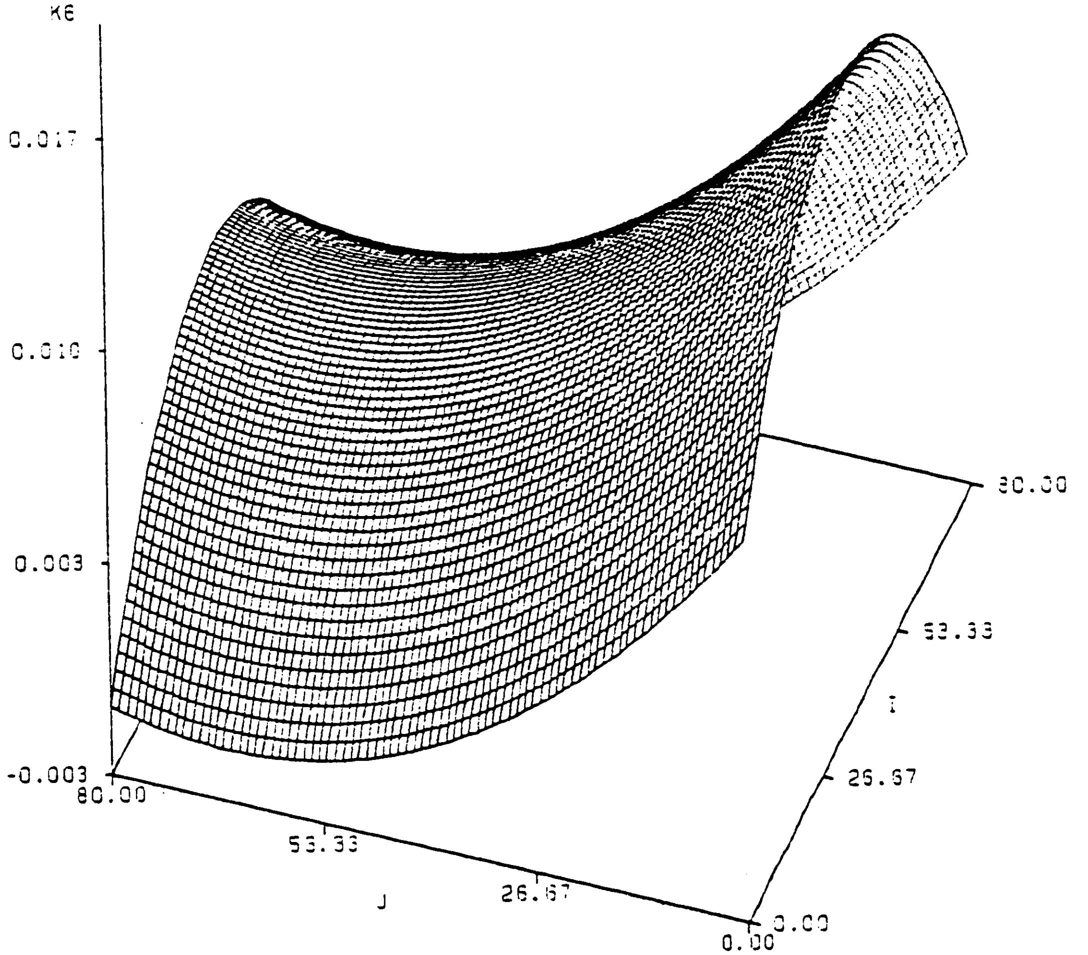

Figure 5.   Multiplier Surfaces: County Group 26

income of the j^{th} household group. On the x axis is plotted the income of the spending households (columns of K) and on the z axis is the income of the receiving households (rows of K). The height of the surface above any line parallel to the axis marked J gives the size of the multipliers for household with income I, the coordinate of the z axis. The multipliers for households with no income are given by the intersection of the multiplier surface and the vertical plane at I = 0.[15] These graphs indicate that Williamson and Lindert's hypothesis is only supported in county groups 1 and 8. County group 24 exhibits essentially no difference in low-income effects among spending groups. County group 26, on the other hand, shows that low-income multipliers fall as the income of the spending household rises.

Another way to show the same information is with contour graphs of the multiplier surfaces (Figures 6 - 9). From these figures it is clear that the total income multipliers decline with increases in the income of the spending group. This pattern is linear in the case of county group 24 and nonlinear, with some upswing at the highest incomes, for the other county groups. Finally, a pronounced flattening of the

---

[15] Care must be used in interpreting these surfaces toward their edges because the edges represent multiplier values not in the sample. Such extremes are, however, useful for expository purposes.

distribution of impacts at the highest incomes is evident in county groups 1 and 8.

The above analysis indicates that there are important differences in household linkages among county groups. In order to test the significance of some of these differences, equation (5.7) was run on all four county groups combined.

$$(5.7) \qquad k_{ij} = b_0+b_1y_i+b_2y_j+b_3y_i^2+b_4y_j^2+ b_5y_iy_j^2+b_6y_jy_i^2+b_7y_iy_j+ b_8D1+b_9D8+b_{10}D24+b_{11}INCI1+ b_{12}INCI8+b_{13}INCI24+b_{14}ISQRD1+ b_{15}ISQRD8+b_{16}ISQRD24.$$

The variables D1, D8, and D24 are dummy variables for county groups 1, 8, and 24, respectively. INCI1, INCI8, and INCI24 were constructed by multiplying y_i by the county dummies. In the same manner, ISQRD1, ISQRD8, and ISQRD24 were constructed by multiplying y_i^2 by the county dummies. These additional variables were added in order to test whether or not the aforementioned differences in distributional effects were statistically significant. Table 5.7 presents the results of this regression. The results of Table 5.7 show that the distributional impacts in county groups 24 and 1 are significantly more equal than county group 26. However, the fact the INC8 and ISQRD8 are not significantly different from zero indicates that the distributional impacts embodied in county group 8's household multiplier matrix are not significantly different from those in county group 26.

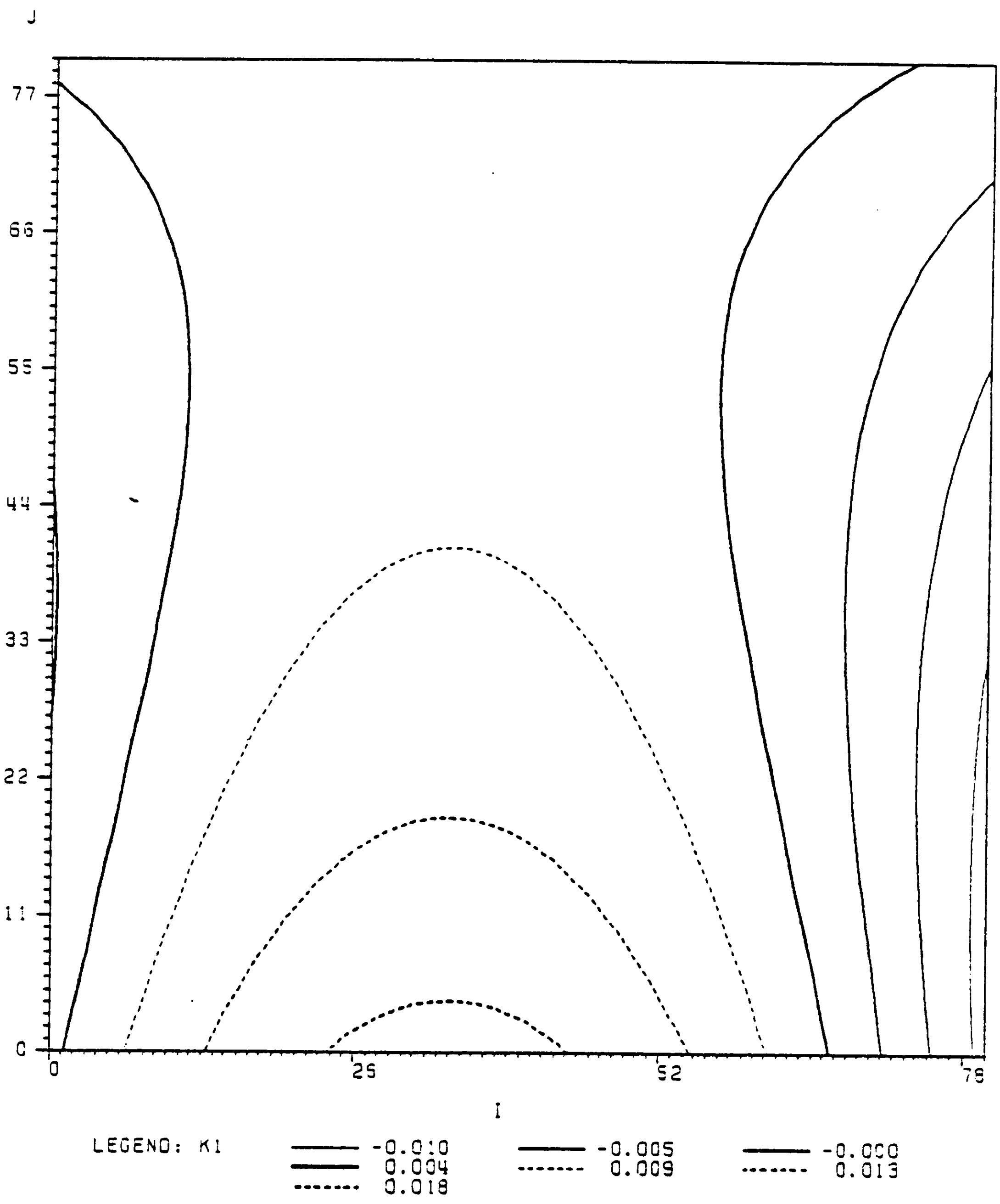

Figure 6. Multiplier Contours: Group 1

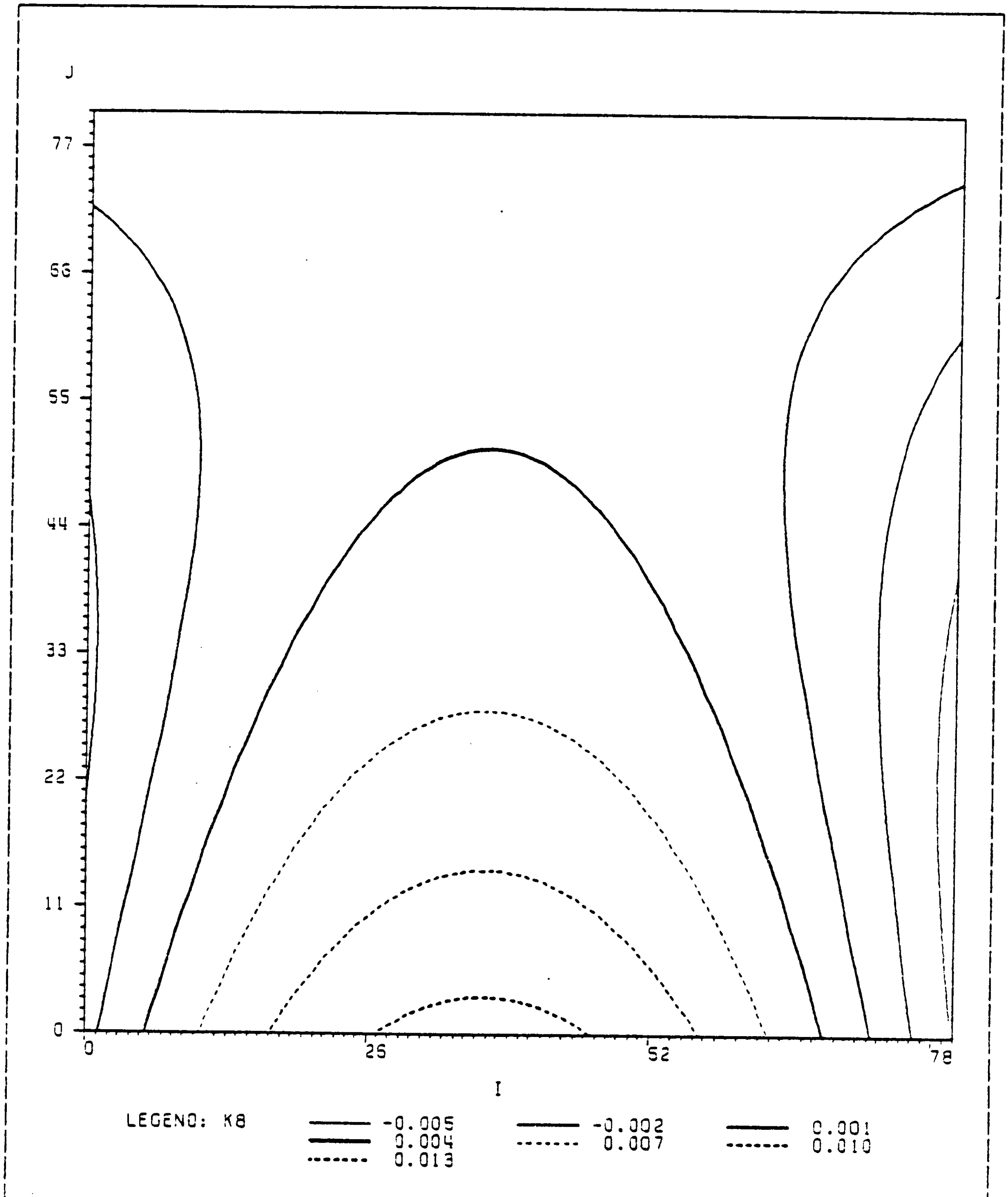

Figure 7. Multiplier Contours: Group 8

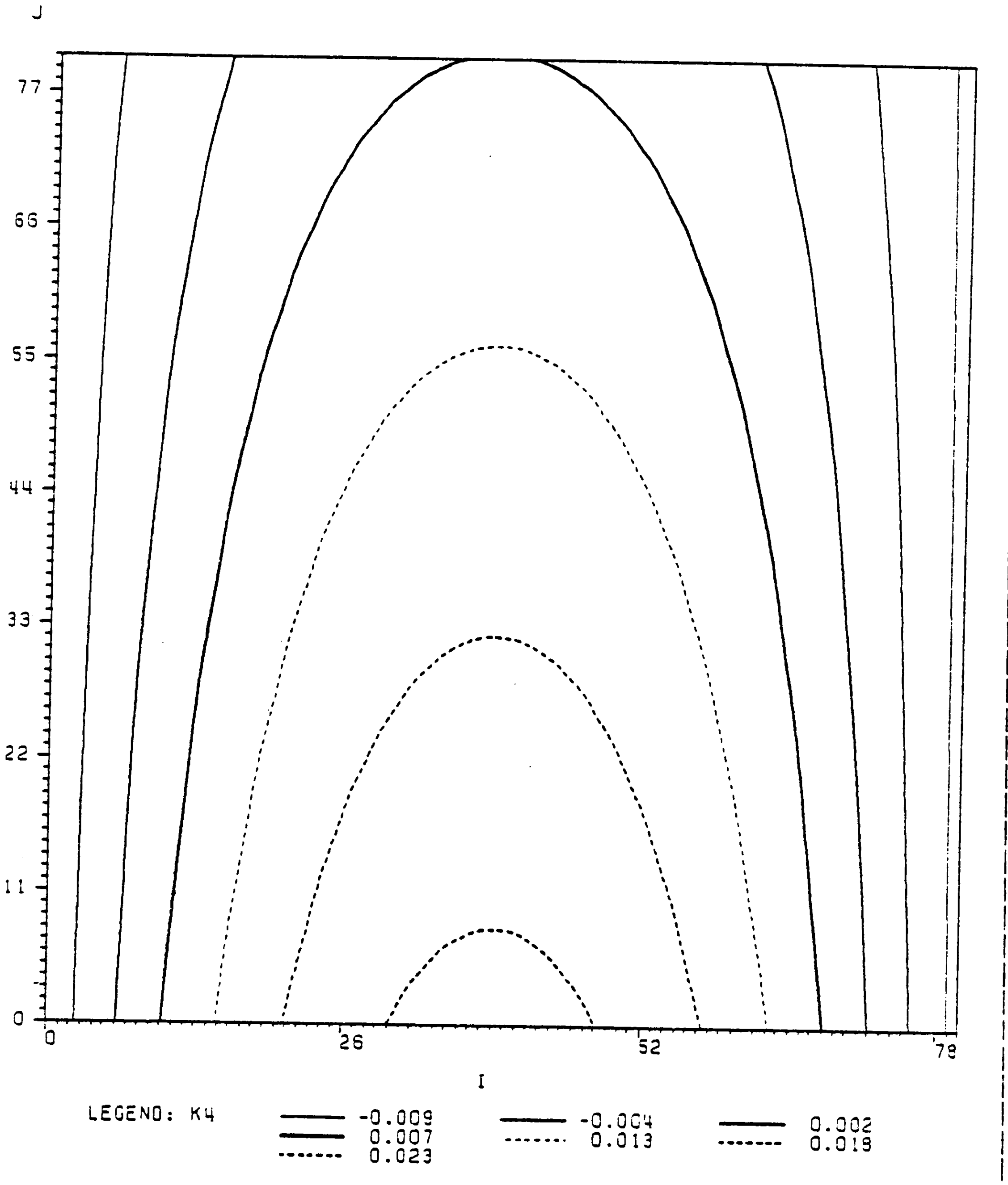

Figure 8. Multiplier Contours: Group 24

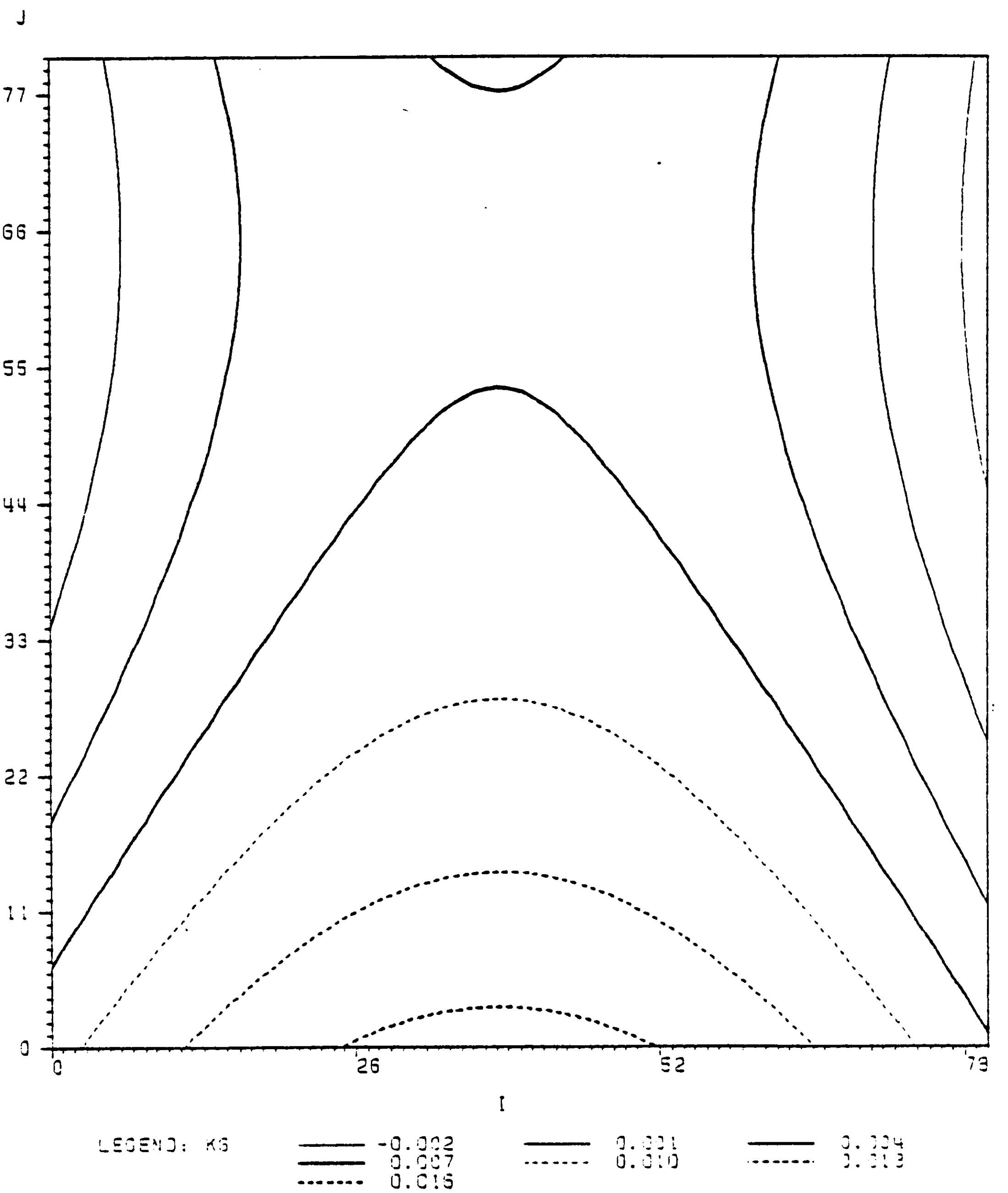

Figure 9. Multiplier Contours: Group 26

Table 5.7
Regression Results for All Four County Groups Combined

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|
b_0	0.00527322	3.13	0.0019
b_1	0.00067390	5.78	0.0001
b_2	-0.00014995	-1.81	0.0709
b_3	-8.7927328E-06	-5.49	0.0001
b_4	2.2623893E-06	2.05	0.0413
b_5	1.4204759E-07	3.83	0.0001
b_6	1.5497642E-08	0.42	0.6761
b_7	-1.1544186E-05	-3.17	0.0016
b_8	-0.00310464	-1.77	0.0766
b_9	-0.00406546	-2.32	0.0205
b_{10}	-0.01135043	-6.49	0.0001
b_{11}	0.00031004	2.31	0.0212
b_{12}	0.00013310	0.99	0.3215
b_{13}	0.00099083	7.39	0.0001
b_{14}	-5.2238816E-06	-2.76	0.0060
b_{15}	-2.0051557E-06	-1.06	0.2903
b_{16}	-1.2599288E-05	-6.65	0.0001
R^2 = 0.47 F Value = 30.98 Degrees of Freedom = 575			

Table 5.7 only tells us whether or not the intercepts and the coefficients on y_i and y_i^2 for county groups 1, 8, 24 differ significantly from the corresponding coefficients for county group 26. In order to test for the statistical significance of differences in these coefficients among county groups 1, 8, and 24, t ratios were calculated for the 9 possible pair-wise comparisons. Each comparison is a test of whether or not the coefficient from the significantly different, in a statistical sense, from the coefficient for the second county group.

While the intercept for county 24 is significantly [16] lower than all other intercepts, indicating that the impact of spending by the lowest income households (income close to zero) in this county group has a very small impact on households with similarly low income, the fact that the coefficient on y_i is significantly higher and the coefficient on y_i^2 is significantly lower than for the corresponding coefficients for the other regions means that household linkages in county group 24 have a larger and a more egalitarian impact on household income than do household linkages in the other regions. These results support the previously presented evidence that the household linkages for county group 24 are

---

[16] This assumes, of course, that the coefficients themselves are statistically significant. Such an assumption must be made because it is not possible to perform statistical tests of I-O coefficients when the model has been constructed from secondary sources.

the highest of the four regions (Table 5.1) and that these linkages are more egalitarian (Table 5.2). In contrast, the fact that none of the comparisons between county groups 1 and 8 proved to be statistically significant indicates that the strength and distributional impacts of household linkages in county groups 1 and 8 are fairly close.

6.0 SUMMARY AND CONCLUSIONS

6.1 MAJOR FINDINGS

As argued in Chapter 2, a major shortcoming of the literature on the size distribution of income is that very little attention has been paid to the effects that the sectoral composition of an economy has upon the formation of the size distribution of income. Thus, the motivating purpose of this study was to help fill this gap by investigating the relationships between inequality and the degree and type of intersectoral linkages in four regional economies.

The input-output model that served as the vehicle for this investigation was developed in Chapter 3 and embodies two important improvements over standard regional input-output models. The first of these improvements is the disaggregation, by income, of the household sector. This is not a new technique, having been proposed by Miyazawa (1976) and used by Weisskoff and Wolff (1981) and Dervis et al. (1982), but it is a relatively neglected enhancement to input-output modeling. In addition, the method used in this study to construct the household value-added matrix represents a major improvement over the methods employed by either Miyazawa or Weisskoff and Wolff. This study has demonstrated that the construction of such a model is quite feasible using widely available data sources. The second improvement embodied in the input-output model used here is the adjustment of the value-added coefficients to take into account of means-tested income transfer programs. Thus, in this model, a portion of household income that other input-output models consider exogenous is endogenously determined. To the author's knowledge, no input-output model has been constructed that incorporates this interrelationship between market household income and transfer income.

Turning to the results of the study, four major hypotheses were examined. First was the proposition, set forth by Weisskoff and Wolff (1981), that as linkages increase, the inequality impacts of the individual sectors converge. The results presented in Chapter 4 support this hypothesis for the four regions studied. A major implication of this finding is that the more closely interlinked is an economy, the less important is the mix of final demand in terms the shape of the size distribution of income. For example, in an economy that has very weak linkages, an increase in government expenditures for goods and services can be expected to have quite different effects on inequality than the same absolute change in private investment expenditures because these two categories of final demand have different sectoral compositions. In contrast, in an economy with identical industrial composition but with a much higher degree of intersectoral linkages, the inequality impact of a change in government expenditures will be much more similar to the impact of an equal change in private investment expenditures.

Similarly, if policy makers in a region are interested in increasing regional economic activity, either by attracting new industries or by encouraging increased exports of existing regional industries, but are at the same time concerned about the level of inequality in the region, the confirmation of the convergence hypothesis implies that policy makers would need to choose their target sector (or sectors) with care if the region has relatively weak linkages. If, on the other hand, the regional economy has very strong linkages, the choice of target industry is not as important, at least in terms of inequality impacts.

The second hypothesis was that basic industries exhibit greater inequality than non-basic industries. The finding here was that not only was this not the case for the four study regions, but the non-basic industries tended to have slightly higher inequality impacts. Thus, as the degree of linkage increases in an economy, the results of this study indicate that there will be a slight drift towards a more unequal distribution of income, other factors being held constant. This conclusion applies only to increasing the linkages within an individual economy and only with regard to income arising directly from regional production. When overall inequality - calculated on all types of income - was compared with an index of overall linkages no relationship was evident.

One implication of this result is that inequality is likely to increase, ceteris paribus, in any regional economy that experiences an increase in linkages. However, this conclusion is highly dependent upon the condition that all other things remain unchanged. Unlike the experiments carried out in this study, as an actual economy's linkages are strengthened, the sectoral mix can be expected to change. Such changes may counteract the relationship observed in this study between inequality and the degree of linkages.

Tests of the third and fourth hypotheses gave mixed results in the sense that the four economies exhibited different patterns of household linkages. With regard to the hypothesis that the size of the low-income household linkage increases with the income of the spending household, only two regions (county groups 1 and 8) exhibited such a pattern, even over a portion of the income range. In all regions, linkages to low-income households were weaker for middle income households than for low-income households. In county groups 1 and 8, the strength of linkage then increase with the income of the spending households. In county group 24, low-income linkages declined in a nearly linear fashion throughout the income range. County group 26 exhibited a very rapid decline in low-income linkages as the spending household's income increased from low- to middle-income and a slight increase at the upper-income levels.

These results imply that the redistributional effects of transfers to low-income households will be re-enforced by household linkages. The results also imply that for county groups 1 and 8 an increase in the income of upper-income households will benefit low-income households more would an equal increase in the income of middle-income households. By the same token, the results presented in this study demonstrate that while low-income households benefit from any increase in the incomes of middle- and upper-income households, the size of such benefits are small relative to the size of the initiating change in income. Thus, even though a tax cut for upper-income households will lead to some benefits "trickling down" to low-income households, the direct benefits, which accrue to upper-income households, would dominate the benefits that "trickle down" so that inequality would be expected to increase.

All regions exhibited an inverse relationship between the size of the total impact on household income and the income of the spending households. Likewise, in all regions, most of the impacts of low-income spending was concentrated in the middle income groups. However, the relationship between the income of the spending household and the distribution of household impacts differed from region to region. In county groups 1 and 8, the distribution of household impacts was flatter for upper-income groups than for lower-income groups. In contrast, the distribution of household impacts exhibited a distinctive inverted U-shape for all spending groups in county groups 24 and 26. These results indicate that the spending patterns of upper-income households are moderately more equalizing than the spending patterns of other household groups only in county groups 1 and 8.

Thus, the major policy implication arising from the tests of the final two hypotheses is that the distributional impact of any policy directly affecting household income (e.g., taxes and transfers) will to a large degree be determined by which households experience the direct effects. Household linkages will, in some cases, offset the distributional impacts of such policies. In other cases, linkages will re-enforce them. In every case, however, it is expected that whether a transfer or change in the tax rate increases or reduces inequality will depend upon which income group is directly affected and not on household linkages.

6.2 FURTHER WORK

The input-output model employed in this study promises to be a fertile framework for analyzing income distributional issues. However, there are three factors limiting the usefulness of the present model that could be improved upon in future work.

The first concerns the data used in constructing the household consumption coefficients. As pointed out in Chapter 4, the only data available at the time the models were constructed was fairly old. Using the more current survey, when available, would be a simple task. More importantly, the data set used is not specific to the regions under scrutiny but rather is applicable to a much broader geographical area. It is quite possible, however, that there are systematic differences in consumption expenditures across regions.

To the extent that relative prices of goods and services differ between the regions under study and the larger region from which the consumption data are drawn, the consumption patterns of households are also expected to differ. Consumers are expected to purchase relatively greater amounts of goods and services produced locally, and relatively less of goods and services that must be imported. Because at least a portion of any differences in relative prices will be due to the fact that some goods and services are not produced within the region, the use of the CES data implies some degree of under-estimation of the consumption linkages.[17] The only way to capture these difference would

---

[17] Such under-estimation in the degree of linkages is part of the broader issue of the relationship between the

be to carry out a survey of the households within the regions under study.

The second two shortcomings of the models involve the employment information that was utilized. As with the consumption expenditure data, it was necessary to resort to a second-best source for information on employment. The two draw-backs with this data set stem from the fact that there were many instances, even at the level of sectoral aggregation used in the study, in which employment was not reported due to disclosure problems. Employment for such sectors had to be estimated in a rather ad hoc manner. Thus, not only is there a certain amount of error incorporated in the RPC calculation due to this need to estimate employment, but it was not feasible to disaggregate the A matrix to more than the two-digit SIC level. A more complete data set would remove the estimation error and also permit a more disaggregated model, thereby reducing aggregation errors.

6.3 CONCLUDING REMARKS

This study represents an advance in the modeling of the income of the income distribution process in regional economies. The findings that sectoral inequality impacts

---

geographical size of region and the degree to which its economy is interlinked.

converge and that the degree and pattern of household linkages differ, sometimes markedly, among regions are important findings to anyone interested in the behavior of the regional size distribution of income. In addition, because the models constructed in this study explicitly incorporate the linkages between households of different income levels and the rest of the economy, they promise to be better tools for regional analysis than the single household sector I-O models that are so commonly employed.

APPENDIX A

Inequality Rankings of Virginia Cities and Counties
(1 = Lowest Inequality 136 = Highest Inequality)

City or County	GINI	THIEL	CV	ATK1	ATK2	SDLY
MANASSAS PARK	1	4	1	1	1	102
PRINCE WILLIAM	2	1	2	2	2	7
MANASSAS	3	5	3	3	3	59
CHESTERFIELD	4	3	5	4	4	8
FAIRFAX	5	2	4	5	5	1
FAIRFAX CITY	6	9	7	7	10	50
COLONIAL HGTS	7	12	6	8	8	57
YORK	8	6	8	6	6	29
STAFFORD	9	7	9	9	12	28
BUENA VISTA	10	26	12	10	7	106
POQUOSON	11	19	10	11	9	95
NEW KENT	12	29	11	14	30	103
FALLS CHURCH	13	20	13	12	11	81
PRINCE GEORGE	14	18	15	13	13	58
BLAND	15	50	14	16	39	122
CRAIG	16	58	17	15	17	133
LOUDOUN	17	15	19	17	21	19
CHESAPEAKE	18	11	18	19	28	12
ROANOKE	19	16	37	18	14	15
SPOTSLYVANIA	20	30	47	22	22	39
POWHATAN	21	48	35	27	44	96
HENRICO	22	10	30	20	16	3
FREDERICK	23	23	23	23	27	37
AMHERST	24	36	58	29	26	47
VIRGINIA BEACH	25	8	27	24	32	2
HOPEWELL	26	27	16	26	53	53
BEDFORD	27	21	22	21	19	34
HANOVER	28	22	29	32	45	23
HENRY	29	25	59	25	15	16
WARREN	30	34	20	31	43	55
CAMPBELL	31	24	28	28	31	26
PULASKI	32	32	40	33	20	33
ALLEGHANY	33	45	25	34	34	83
ALEXANDRIA	34	14	24	30	29	9
GREENE	35	78	42	48	65	120
FRANKLIN	36	35	45	36	25	36
COVINGTON	37	64	55	35	18	91
MADISON	38	63	31	38	47	98
BOTETOURT	39	40	51	44	46	54
HAMPTON	40	17	41	41	48	11
KING GEORGE	41	60	21	46	77	105
ARLINGTON	42	13	26	37	42	4

AUGUSTA	43	33	53	40	36	22
AMELIA	44	77	46	43	40	112
GILES	45	56	61	42	24	66
GLOUCESTER	46	43	33	49	61	67
ISLE OF WIGHT	47	51	39	57	90	70
APPOMATTOX	48	70	48	50	54	88
JAMES CITY	49	42	32	51	63	62
FLUVANNA	50	69	36	39	23	93
ROCKBRIDGE	51	53	49	45	37	68
SHENANDOAH	52	41	56	47	35	42
CARROLL	53	49	62	56	55	45
CAROLINE	54	59	44	55	68	82
CHARLES CITY	55	91	43	59	98	132
RUSSELL	56	38	34	54	59	43
ORANGE	57	57	38	52	50	69
DINWIDDIE	58	67	60	60	66	75
WYTHE	59	66	95	58	33	48
PAGE	60	61	64	53	38	63
ROCKINGHAM	61	44	90	61	52	20
NEWPORT NEWS	62	28	68	65	73	10
TAZEWELL	63	39	67	63	58	24
FAUQUIER	64	46	54	62	81	41
STAUNTON	65	68	76	64	57	56
FLOYD	66	79	52	67	87	94
DICKENSON	67	76	81	66	60	71
KING WILLIAM	68	92	70	68	84	113
PITTSYLVANIA	69	55	110	71	56	18
HALIFAX	70	65	80	69	62	46
WISE	71	54	78	70	64	31
SMYTH	72	89	129	83	41	38
WAYNESBORO	73	95	119	81	51	73
LOUISA	74	81	82	74	72	79
SOUTH BOSTON	75	102	69	73	76	119
ESSEX	76	97	79	72	67	110
NOTTOWAY	77	85	71	78	91	85
BEDFORD	78	103	57	75	89	123
LUNENBURG	79	90	74	76	71	89
PORTSMOUTH	80	37	73	87	112	14
HIGHLAND	81	119	50	86	99	136
CULPEPER	82	80	83	80	80	64
PATRICK	83	31	72	123	83	74
FREDERICKSBURG	84	82.5	75	77	70	80
MATHEWS	85	100	77	79	78	109
SUFFOLK	86	71	98	94	115	35
SCOTT	87	75	66	89	96	60
CLIFTON FORGE	88	113	65	85	86	129
BATH	89	111	63	82	88	128
BUCHANAN	90	87	113	102	117	44
LYNCHBURG	91	52	84	84	74	17
BUCKINGHAM	92	101	87	88	82	97
SALEM	93	99	124	91	49	49

BRUNSWICK	94	105	109	93	75	84
MECKLENBURG	95	82.5	93	97	105	52
MONTGOMERY	96	62	88	90	85	21
RICHMOND	97	117	97	98	107	124
PRINCE EDWARD	98	98	89	95	100	87
EMPORIA	99	125	104	100	95	134
DANVILLE	100	73	99	99	94	27
HARRISONBURG	101	96	96	92	69	78
MARTINSVILLE	102	93	92	96	93	77
CUMBERLAND	103	115	86	101	109	121
CHARLOTTE	104	110	101	104	111	100
GREENSVILLE	105	120	122	108	113	108
BRISTOL	106	94	91	103	102	72
SUSSEX	107	114	100	109	125	111
WESTMORELAND	108	106	85	106	129	92
GRAYSON	109	84	127	131	79	76
SURRY	110	135	134	118	97	127
ALBEMARLE	111	88	118	107	104	25
CHARLOTTESVILLE	112	86	112	105	92	32
WASHINGTON	113	104	128	120	101	30
NORFOLK	114	47	107	110	123	5
LEE	115	107	121	119	118	61
ROANOKE	116	74	117	112	108	13
RAPPAHANNOCK	117	128	108	114	114	126
NORTHAMPTON	118	109	94	113	119	86
WILLIAMSBURG	119	127	116	111	110	116
NORTON	120	129	103	116	120	135
WINCHESTER	121	108	114	115	106	65
MIDDLESEX	122	124	106	117	116	117
FRANKLIN	123	126	102	121	131	125
NELSON	124	122	120	122	122	99
CLARKE	125	133	130	128	132	114
RADFORD	126	131	133	126	103	101
RICHMOND	127	72	123	127	127	6
LANCASTER	128	121	111	124	130	107
SOUTHAMPTON	129	118	126	135	136	90
NORTHUMBERLAND	130	132	131	129	121	104
PETERSBURG	131	116	132	133	134	40
LEXINGTON	132	130	105	125	126	130
KING AND QUEEN	133	136	135	132	124	131
ACCOMACK	134	112	115	130	133	51
GOOCHLAND	135	134	125	134	135	115
GALAX	136	123	136	136	128	118

GINI = Gini Index   Thiel = Thiel's index
CV = Coefficient of Variation   Atk1 = Atkinson's index E = 0.5
ATK2 = Atkinson's Index E = 1.5
SDLY = Standard Deviation of the Logarithm of Income
Source: Bernat, 1985.

<u>APPENDIX B</u>

This appendix presents results from final demand experiments for each version of each regional model. The first column presents the sectoral inequality effects calculated according to equation (4.5). The second column presents the percent of total inequality attributable to each final demand sector. The third column is the share of final demand for each sector. The procedure for calculation of final demand is described in Section 5.1, above.

County Group 1
Total Model

		SECTHL	CONTRIB	FDSHR
36	MISCELLANEOUS RETAIL (59)	0.013984	0.005596	0.013479
46	PERSONAL SERVICES (72)	0.016434	0.004278	0.005459
11	LUMBER & WOOD PROD. (24)	0.018263	0.024319	0.031573
49	MISC. REPAIR SERVICES (76)	0.018284	0.000441	0.000582
52	LEGAL SERVICES (81)	0.018316	0.003111	0.003952
50	AMUSEMENT & RECREATION (79)	0.018661	0.003604	0.003328
3	BITUM. COAL & LIGNITE (12)	0.019296	0.000121	0.000170
13	PRINTING & PUBLISHING (27)	0.019317	0.012651	0.016363
5	GENERAL BLDG. CONTRACTORS (15)	0.019485	0.051803	0.091205
4	NONMETAL MIN.-EX. FUELS (14)	0.019566	0.009407	0.014067
17	PRIMARY METAL PROD. (33)	0.019612	0.000267	0.000400
10	APPAREL & OTHER PROD. (23)	0.020052	0.061451	0.064537
29	BLDG. MAT.-GARDEN SUPPLY (52)	0.020055	0.002436	0.002036
31	FOOD STORES (54)	0.020075	0.004460	0.004172
37	BANKING (60)	0.020370	0.010728	0.010667
9	TEXTILE MILL PROD. (22)	0.020744	0.002807	0.003045
47	BUSINESS SERVICES (73)	0.020775	0.001380	0.001774
16	STONE, CLAY, & GLASS (32)	0.020959	0.051114	0.057026
32	AUTO. DEALERS-SERV. STAT. (55)	0.020977	0.024022	0.020493
51	HEALTH SERVICES (80)	0.020977	0.060564	0.049441
35	EATING & DRINKING PLACES (58)	0.021153	0.023886	0.027676
18	FABRICATED METAL PROD. (34)	0.021542	0.020512	0.021405
7	SPECIAL TRADE CONTRACTORS (17)	0.021565	0.023698	0.013136
30	GENERAL MERCH. STORES (53)	0.021789	0.009302	0.007698
19	MACHINERY, EXCEPT ELEC. (35)	0.021950	0.022273	0.021995
8	FOOD & KINDRED PROD. (20)	0.022092	0.093289	0.132306
20	ELECTRIC & ELEC. EQUIP. (36)	0.022215	0.100260	0.093971
6	HEAVY CONST. CONTRACTORS (16)	0.022686	0.006115	0.003795
34	FURNITURE & HOME FURNISH. (57)	0.022767	0.004621	0.004125
33	APPAREL & ACCESS. STORES (56)	0.022778	0.005127	0.004246
14	RUBBER & MISC. PLASTICS (30)	0.023360	0.065015	0.059143
48	AUTO REPAIR,SERV.,GARAGES (75)	0.023602	0.012946	0.017537
28	WHLSALE-NONDURABLE GOODS (51)	0.023649	0.006144	0.004915
24	TRANSPORTATION BY AIR (45)	0.023868	0.000136	0.000124
23	TRUCKING & WAREHOUSING (42)	0.025129	0.007493	0.007409

2	AGRI. SERVICES (07)	0.025136	0.000480	0.000304
15	LEATHER & LEATHER PROD. (31)	0.025275	0.008997	0.007026
21	TRANSPORTATION EQUIPMENT (37)	0.025858	0.022778	0.017982
22	LOCAL PASS. TRANSIT (41)	0.026714	0.002109	0.002304
38	CREDIT AGENCIES EX. BANKS (61)	0.026886	0.005915	0.003844
55	MUSEUMS,BOTAN-ZOO.GARDENS (84)	0.027446	0.000045	0.000034
1	AGRICULTURE	0.031489	0.017273	0.020143
56	MEMBERSHIP ORGANIZATIONS (86)	0.035926	0.006345	0.003972
26	COMMUNICATION (48)	0.036319	0.055871	0.046197
57	MISCELLANEOUS SERVICES (89)	0.037725	0.002589	0.001594
12	FURNITURE & FIXTURES (25)	0.041899	0.024106	0.013773
45	HOTELS & OTHER LODGING (70)	0.043752	0.009549	0.003889
39	SECURITY, COMM. BROKERS (62)	0.045350	0.001242	0.000508
42	REAL ESTATE (65)	0.046586	0.010672	0.022632
53	EDUCATIONAL SERVICES (82)	0.047777	0.010692	0.006184
40	INSURANCE CARRIERS (63)	0.050218	0.006601	0.002509
43	COMB. REAL ESTATE, INS. (66)	0.051233	0.000645	0.001403
25	TRANSPORTATION SERVICES (47)	0.051752	0.003575	0.001148
27	WHLSALE-DURABLE-GOODS (50)	0.057842	0.039195	0.017822
41	INS. AGENTS, BROKERS (64)	0.070740	0.008692	0.004642
44	HOLDING-OTH. INV.. OFF'S (67)	0.074056	0.001547	0.000700
54	SOCIAL SERVICES (83)	0.082258	0.025701	0.008140

County Group 1
Direct Model

		SECTHL	CONTRIB	FDSHR
36	MISCELLANEOUS RETAIL (59)	0.014108	0.004183	0.013479
46	PERSONAL SERVICES (72)	0.015836	0.004481	0.005459
11	LUMBER & WOOD PROD. (24)	0.017495	0.016116	0.031573
47	BUSINESS SERVICES (73)	0.017681	0.000473	0.001774
49	MISC. REPAIR SERVICES (76)	0.017815	0.000399	0.000582
50	AMUSEMENT & RECREATION (79)	0.017893	0.003821	0.003328
52	LEGAL SERVICES (81)	0.017950	0.003321	0.003952
17	PRIMARY METAL PROD. (33)	0.019015	0.000198	0.000400
10	APPAREL & OTHER PROD. (23)	0.019385	0.049408	0.064537
29	BLDG. MAT.-GARDEN SUPPLY (52)	0.019456	0.003092	0.002036
13	PRINTING & PUBLISHING (27)	0.019463	0.009187	0.016363
3	BITUM. COAL & LIGNITE (12)	0.019547	0.000133	0.000170
4	NONMETAL MIN.-EX. FUELS (14)	0.019611	0.009634	0.014067
5	GENERAL BLDG. CONTRACTORS (15)	0.019966	0.040729	0.091205
31	FOOD STORES (54)	0.020008	0.005495	0.004172
37	BANKING (60)	0.020279	0.013217	0.010667
32	AUTO. DEALERS-SERV. STAT. (55)	0.020811	0.030587	0.020493
9	TEXTILE MILL PROD. (22)	0.020824	0.002346	0.003045
51	HEALTH SERVICES (80)	0.020898	0.071713	0.049441
16	STONE, CLAY, & GLASS (32)	0.021211	0.050903	0.057026
7	SPECIAL TRADE CONTRACTORS (17)	0.021780	0.030057	0.013136
8	FOOD & KINDRED PROD. (20)	0.021841	0.058244	0.132306
30	GENERAL MERCH. STORES (53)	0.021899	0.011959	0.007698

35	EATING & DRINKING PLACES (58)	0.021993	0.020765	0.027676
18	FABRICATED METAL PROD. (34)	0.022114	0.019510	0.021405
19	MACHINERY, EXCEPT ELEC. (35)	0.022272	0.021169	0.021995
6	HEAVY CONST. CONTRACTORS (16)	0.022949	0.007871	0.003795
33	APPAREL & ACCESS. STORES (56)	0.023108	0.006702	0.004246
20	ELECTRIC & ELEC. EQUIP. (36)	0.023442	0.096293	0.093971
34	FURNITURE & HOME FURNISH. (57)	0.023461	0.005900	0.004125
48	AUTO REPAIR,SERV.,GARAGES (75)	0.023809	0.008354	0.017537
24	TRANSPORTATION BY AIR (45)	0.023885	0.000155	0.000124
28	WHLSALE-NONDURABLE GOODS (51)	0.023907	0.007813	0.004915
14	RUBBER & MISC. PLASTICS (30)	0.025521	0.068143	0.059143
2	AGRI. SERVICES (07)	0.026442	0.000558	0.000304
15	LEATHER & LEATHER PROD. (31)	0.027841	0.009710	0.007026
23	TRUCKING & WAREHOUSING (42)	0.027897	0.007778	0.007409
21	TRANSPORTATION EQUIPMENT (37)	0.027974	0.023732	0.017982
38	CREDIT AGENCIES EX. BANKS (61)	0.028848	0.007152	0.003844
22	LOCAL PASS. TRANSIT (41)	0.029099	0.002496	0.002304
55	MUSEUMS,BOTAN-ZOO.GARDENS (84)	0.029777	0.000054	0.000034
57	MISCELLANEOUS SERVICES (89)	0.042123	0.003424	0.001594
56	MEMBERSHIP ORGANIZATIONS (86)	0.042123	0.008008	0.003972
1	AGRICULTURE	0.044156	0.014040	0.020143
39	SECURITY, COMM. BROKERS (62)	0.050762	0.001733	0.000508
45	HOTELS & OTHER LODGING (70)	0.052539	0.012980	0.003889
53	EDUCATIONAL SERVICES (82)	0.057722	0.014319	0.006184
40	INSURANCE CARRIERS (63)	0.058421	0.007682	0.002509
26	COMMUNICATION (48)	0.060481	0.053715	0.046197
25	TRANSPORTATION SERVICES (47)	0.060482	0.004912	0.001148
27	WHLSALE-DURABLE-GOODS (50)	0.067197	0.056348	0.017822
12	FURNITURE & FIXTURES (25)	0.068371	0.027895	0.013773
42	REAL ESTATE (65)	0.084682	0.010286	0.022632
41	INS. AGENTS, BROKERS (64)	0.094812	0.010904	0.004642
43	COMB. REAL ESTATE, INS. (66)	0.097606	0.000606	0.001403
44	HOLDING-OTH. INV.. OFF'S (67)	0.097612	0.001939	0.000700
54	SOCIAL SERVICES (83)	0.097813	0.037356	0.008140

County Group 1
No-C Model

		SECTHL	CONTRIB	FDSHR
36	MISCELLANEOUS RETAIL (59)	0.013994	0.004345	0.013479
46	PERSONAL SERVICES (72)	0.016144	0.004027	0.005459
11	LUMBER & WOOD PROD. (24)	0.017980	0.023553	0.031573
49	MISC. REPAIR SERVICES (76)	0.018024	0.000425	0.000582
52	LEGAL SERVICES (81)	0.018189	0.002963	0.003952
50	AMUSEMENT & RECREATION (79)	0.018359	0.003502	0.003328
13	PRINTING & PUBLISHING (27)	0.019168	0.012322	0.016363
3	BITUM. COAL & LIGNITE (12)	0.019242	0.000117	0.000170
5	GENERAL BLDG. CONTRACTORS (15)	0.019253	0.050804	0.091205
17	PRIMARY METAL PROD. (33)	0.019423	0.000263	0.000400
4	NONMETAL MIN.-EX. FUELS (14)	0.019494	0.009187	0.014067

29	BLDG. MAT.-GARDEN SUPPLY (52)	0.019779	0.002402	0.002036
10	APPAREL & OTHER PROD. (23)	0.019824	0.060698	0.064537
31	FOOD STORES (54)	0.019995	0.004317	0.004172
37	BANKING (60)	0.020296	0.010441	0.010667
47	BUSINESS SERVICES (73)	0.020587	0.001366	0.001774
9	TEXTILE MILL PROD. (22)	0.020595	0.002778	0.003045
16	STONE, CLAY, & GLASS (32)	0.020898	0.050669	0.057026
51	HEALTH SERVICES (80)	0.020916	0.060091	0.049441
32	AUTO. DEALERS-SERV. STAT. (55)	0.020927	0.023523	0.020493
35	EATING & DRINKING PLACES (58)	0.021055	0.023536	0.027676
18	FABRICATED METAL PROD. (34)	0.021488	0.020423	0.021405
7	SPECIAL TRADE CONTRACTORS (17)	0.021517	0.023582	0.013136
30	GENERAL MERCH. STORES (53)	0.021838	0.009138	0.007698
19	MACHINERY, EXCEPT ELEC. (35)	0.021936	0.022246	0.021995
8	FOOD & KINDRED PROD. (20)	0.022007	0.093304	0.132306
20	ELECTRIC & ELEC. EQUIP. (36)	0.022315	0.100013	0.093971
6	HEAVY CONST. CONTRACTORS (16)	0.022700	0.006126	0.003795
33	APPAREL & ACCESS. STORES (56)	0.023005	0.005040	0.004246
34	FURNITURE & HOME FURNISH. (57)	0.023189	0.004481	0.004125
14	RUBBER & MISC. PLASTICS (30)	0.023566	0.065294	0.059143
48	AUTO REPAIR,SERV.,GARAGES (75)	0.023683	0.013034	0.017537
28	WHLSALE-NONDURABLE GOODS (51)	0.023859	0.006137	0.004915
24	TRANSPORTATION BY AIR (45)	0.024068	0.000137	0.000124
2	AGRI. SERVICES (07)	0.025430	0.000484	0.000304
15	LEATHER & LEATHER PROD. (31)	0.025646	0.009115	0.007026
23	TRUCKING & WAREHOUSING (42)	0.026091	0.007372	0.007409
21	TRANSPORTATION EQUIPMENT (37)	0.026179	0.023038	0.017982
22	LOCAL PASS. TRANSIT (41)	0.027254	0.002129	0.002304
38	CREDIT AGENCIES EX. BANKS (61)	0.027395	0.005979	0.003844
55	MUSEUMS,BOTAN-ZOO.GARDENS (84)	0.028067	0.000045	0.000034
1	AGRICULTURE	0.032569	0.017618	0.020143
56	MEMBERSHIP ORGANIZATIONS (86)	0.037594	0.006495	0.003972
26	COMMUNICATION (48)	0.037973	0.057187	0.046197
57	MISCELLANEOUS SERVICES (89)	0.039645	0.002655	0.001594
12	FURNITURE & FIXTURES (25)	0.044457	0.025025	0.013773
45	HOTELS & OTHER LODGING (70)	0.046358	0.009940	0.003889
39	SECURITY, COMM. BROKERS (62)	0.048160	0.001289	0.000508
42	REAL ESTATE (65)	0.049653	0.010770	0.022632
53	EDUCATIONAL SERVICES (82)	0.050911	0.011014	0.006184
40	INSURANCE CARRIERS (63)	0.053491	0.006864	0.002509
43	COMB. REAL ESTATE, INS. (66)	0.054951	0.000648	0.001403
25	TRANSPORTATION SERVICES (47)	0.055561	0.003701	0.001148
27	WHLSALE-DURABLE-GOODS (50)	0.062993	0.040884	0.017822
41	INS. AGENTS, BROKERS (64)	0.076673	0.008848	0.004642
44	HOLDING-OTH. INV.. OFF'S (67)	0.080697	0.001557	0.000700
54	SOCIAL SERVICES (83)	0.090187	0.027055	0.008140

County Group 1
No-I Model

		SECTHL	CONTRIB	FDSHR
36	MISCELLANEOUS RETAIL (59)	0.013939	0.005584	0.013479
46	PERSONAL SERVICES (72)	0.015983	0.004760	0.005459
11	LUMBER & WOOD PROD. (24)	0.017557	0.016882	0.031573
47	BUSINESS SERVICES (73)	0.017858	0.000487	0.001774
49	MISC. REPAIR SERVICES (76)	0.017891	0.000417	0.000582
52	LEGAL SERVICES (81)	0.017970	0.003504	0.003952
50	AMUSEMENT & RECREATION (79)	0.018112	0.003938	0.003328
17	PRIMARY METAL PROD. (33)	0.019086	0.000203	0.000400
13	PRINTING & PUBLISHING (27)	0.019226	0.009532	0.016363
3	BITUM. COAL & LIGNITE (12)	0.019409	0.000136	0.000170
4	NONMETAL MIN.-EX. FUELS (14)	0.019525	0.009875	0.014067
10	APPAREL & OTHER PROD. (23)	0.019557	0.050056	0.064537
29	BLDG. MAT.-GARDEN SUPPLY (52)	0.019689	0.003135	0.002036
5	GENERAL BLDG. CONTRACTORS (15)	0.019818	0.041753	0.091205
31	FOOD STORES (54)	0.020043	0.005672	0.004172
37	BANKING (60)	0.020316	0.013570	0.010667
32	AUTO. DEALERS-SERV. STAT. (55)	0.020839	0.031221	0.020493
9	TEXTILE MILL PROD. (22)	0.020852	0.002372	0.003045
51	HEALTH SERVICES (80)	0.020902	0.072253	0.049441
16	STONE, CLAY, & GLASS (32)	0.021182	0.051285	0.057026
7	SPECIAL TRADE CONTRACTORS (17)	0.021771	0.030177	0.013136
8	FOOD & KINDRED PROD. (20)	0.021837	0.058452	0.132306
30	GENERAL MERCH. STORES (53)	0.021841	0.012167	0.007698
35	EATING & DRINKING PLACES (58)	0.021897	0.021184	0.027676
18	FABRICATED METAL PROD. (34)	0.022061	0.019576	0.021405
19	MACHINERY, EXCEPT ELEC. (35)	0.022210	0.021200	0.021995
6	HEAVY CONST. CONTRACTORS (16)	0.022898	0.007860	0.003795
33	APPAREL & ACCESS. STORES (56)	0.022900	0.006809	0.004246
34	FURNITURE & HOME FURNISH. (57)	0.023075	0.006077	0.004125
20	ELECTRIC & ELEC. EQUIP. (36)	0.023138	0.096479	0.093971
48	AUTO REPAIR,SERV.,GARAGES (75)	0.023602	0.008345	0.017537
24	TRANSPORTATION BY AIR (45)	0.023659	0.000156	0.000124
28	WHLSALE-NONDURABLE GOODS (51)	0.023715	0.007834	0.004915
14	RUBBER & MISC. PLASTICS (30)	0.025127	0.067702	0.059143
2	AGRI. SERVICES (07)	0.026100	0.000554	0.000304
23	TRUCKING & WAREHOUSING (42)	0.026740	0.007918	0.007409
15	LEATHER & LEATHER PROD. (31)	0.027327	0.009570	0.007026
21	TRANSPORTATION EQUIPMENT (37)	0.027559	0.023479	0.017982
38	CREDIT AGENCIES EX. BANKS (61)	0.028276	0.007088	0.003844
22	LOCAL PASS. TRANSIT (41)	0.028467	0.002476	0.002304
55	MUSEUMS,BOTAN-ZOO.GARDENS (84)	0.029093	0.000054	0.000034
57	MISCELLANEOUS SERVICES (89)	0.040348	0.003358	0.001594
56	MEMBERSHIP ORGANIZATIONS (86)	0.040349	0.007854	0.003972
1	AGRICULTURE	0.042054	0.013739	0.020143
39	SECURITY, COMM. BROKERS (62)	0.048279	0.001682	0.000508
45	HOTELS & OTHER LODGING (70)	0.049865	0.012539	0.003889
53	EDUCATIONAL SERVICES (82)	0.054599	0.013972	0.006184
40	INSURANCE CARRIERS (63)	0.055141	0.007420	0.002509
25	TRANSPORTATION SERVICES (47)	0.056950	0.004780	0.001148
26	COMMUNICATION (48)	0.056950	0.052274	0.046197

27	WHLSALE-DURABLE-GOODS (50)	0.062635	0.054439	0.017822
12	FURNITURE & FIXTURES (25)	0.063707	0.026826	0.013773
42	REAL ESTATE (65)	0.078989	0.010196	0.022632
41	INS. AGENTS, BROKERS (64)	0.088512	0.010771	0.004642
54	SOCIAL SERVICES (83)	0.090769	0.035816	0.008140
43	COMB. REAL ESTATE, INS. (66)	0.090795	0.000605	0.001403
44	HOLDING-OTH. INV.. OFF'S (67)	0.090796	0.001935	0.000700

County Group 1
Full Model

		SECTHL	CONTRIB	FDSHR
36	MISCELLANEOUS RETAIL (59)	0.014825	0.006711	0.013479
46	PERSONAL SERVICES (72)	0.017628	0.004148	0.005459
52	LEGAL SERVICES (81)	0.019233	0.003008	0.003952
49	MISC. REPAIR SERVICES (76)	0.019698	0.000476	0.000582
11	LUMBER & WOOD PROD. (24)	0.019752	0.029363	0.031573
50	AMUSEMENT & RECREATION (79)	0.019963	0.003399	0.003328
3	BITUM. COAL & LIGNITE (12)	0.020110	0.000127	0.000170
4	NONMETAL MIN.-EX. FUELS (14)	0.020469	0.009200	0.014067
31	FOOD STORES (54)	0.020682	0.003971	0.004172
13	PRINTING & PUBLISHING (27)	0.020698	0.015449	0.016363
17	PRIMARY METAL PROD. (33)	0.020728	0.000296	0.000400
5	GENERAL BLDG. CONTRACTORS (15)	0.021043	0.052258	0.091205
37	BANKING (60)	0.021058	0.009890	0.010667
10	APPAREL & OTHER PROD. (23)	0.021109	0.068039	0.064537
29	BLDG. MAT.-GARDEN SUPPLY (52)	0.021226	0.002152	0.002036
16	STONE, CLAY, & GLASS (32)	0.021603	0.049946	0.057026
9	TEXTILE MILL PROD. (22)	0.021606	0.003185	0.003045
32	AUTO. DEALERS-SERV. STAT. (55)	0.021618	0.020786	0.020493
47	BUSINESS SERVICES (73)	0.021672	0.001854	0.001774
51	HEALTH SERVICES (80)	0.021719	0.054240	0.049441
35	EATING & DRINKING PLACES (58)	0.021936	0.025306	0.027676
18	FABRICATED METAL PROD. (34)	0.022071	0.021325	0.021405
30	GENERAL MERCH. STORES (53)	0.022186	0.007960	0.007698
7	SPECIAL TRADE CONTRACTORS (17)	0.022200	0.019327	0.013136
19	MACHINERY, EXCEPT ELEC. (35)	0.022474	0.023065	0.021995
20	ELECTRIC & ELEC. EQUIP. (36)	0.022476	0.103777	0.093971
34	FURNITURE & HOME FURNISH. (57)	0.022611	0.004005	0.004125
14	RUBBER & MISC. PLASTICS (30)	0.022928	0.066376	0.059143
33	APPAREL & ACCESS. STORES (56)	0.022990	0.004412	0.004246
8	FOOD & KINDRED PROD. (20)	0.023076	0.113353	0.132306
6	HEAVY CONST. CONTRACTORS (16)	0.023304	0.005046	0.003795
28	WHLSALE-NONDURABLE GOODS (51)	0.023636	0.005308	0.004915
24	TRANSPORTATION BY AIR (45)	0.024280	0.000128	0.000124
48	AUTO REPAIR,SERV.,GARAGES (75)	0.024284	0.015069	0.017537
23	TRUCKING & WAREHOUSING (42)	0.024353	0.006683	0.007409
15	LEATHER & LEATHER PROD. (31)	0.024462	0.008747	0.007026
2	AGRI. SERVICES (07)	0.024858	0.000441	0.000304
21	TRANSPORTATION EQUIPMENT (37)	0.025374	0.022131	0.017982

22	LOCAL PASS. TRANSIT (41)	0.026460	0.001836	0.002304
38	CREDIT AGENCIES EX. BANKS (61)	0.026650	0.005638	0.003844
55	MUSEUMS,BOTAN-ZOO.GARDENS (84)	0.026808	0.000039	0.000034
1	AGRICULTURE	0.028927	0.018788	0.020143
26	COMMUNICATION (48)	0.029817	0.057680	0.046197
56	MEMBERSHIP ORGANIZATIONS (86)	0.033120	0.005353	0.003972
12	FURNITURE & FIXTURES (25)	0.033884	0.022437	0.013773
57	MISCELLANEOUS SERVICES (89)	0.034754	0.002152	0.001594
45	HOTELS & OTHER LODGING (70)	0.038802	0.007757	0.003889
39	SECURITY, COMM. BROKERS (62)	0.041097	0.001000	0.000508
42	REAL ESTATE (65)	0.041180	0.009789	0.022632
53	EDUCATIONAL SERVICES (82)	0.041801	0.008652	0.006184
43	COMB. REAL ESTATE, INS. (66)	0.044253	0.000599	0.001403
40	INSURANCE CARRIERS (63)	0.045630	0.005832	0.002509
25	TRANSPORTATION SERVICES (47)	0.045756	0.002863	0.001148
27	WHLSALE-DURABLE-GOODS (50)	0.049984	0.029984	0.017822
41	INS. AGENTS, BROKERS (64)	0.056347	0.007666	0.004642
44	HOLDING-OTH. INV.. OFF'S (67)	0.057880	0.001441	0.000700
54	SOCIAL SERVICES (83)	0.068084	0.019537	0.008140

County Group 8
Total Model

		SECTHL	CONTRIB	FDSHR
38	MISCELLANEOUS RETAIL (59)	0.012940	-.001830	0.008261
47	PERSONAL SERVICES (72)	0.018736	0.001844	0.004720
26	TRUCKING & WAREHOUSING (42)	0.023760	0.002203	0.005473
12	LUMBER & WOOD PROD. (24)	0.027335	0.000858	0.001299
52	AMUSEMENT & RECREATION (79)	0.028365	0.000576	0.000636
53	HEALTH SERVICES (80)	0.029278	0.027390	0.028127
1	AGRICULTURE	0.029310	0.003508	0.014035
25	LOCAL PASS. TRANSIT (41)	0.031593	0.000178	0.000300
48	BUSINESS SERVICES (73)	0.032028	0.001396	0.002670
18	PRIMARY METAL PROD. (33)	0.032257	0.016749	0.023502
19	FABRICATED METAL PROD. (34)	0.032271	0.005569	0.006208
23	INSTRUMENTS & REL. PROD. (38)	0.032272	0.003171	0.002968
9	SPECIAL TRADE CONTRACTORS (17)	0.032598	0.004341	0.002379
15	CHEMICALS & ALLIED PROD. (28)	0.033118	0.000065	0.000135
10	FOOD & KINDRED PROD. (20)	0.033237	0.001251	0.002255
11	APPAREL & OTHER PROD. (23)	0.033238	0.016390	0.022221
21	ELECTRIC & ELEC. EQUIP. (36)	0.033367	0.000726	0.000731
20	MACHINERY, EXCEPT ELEC. (35)	0.033468	0.045998	0.047458
50	MISC. REPAIR SERVICES (76)	0.033511	0.001620	0.001980
31	BLDG. MAT.-GARDEN SUPPLY (52)	0.033665	0.000436	0.000359
17	STONE, CLAY, & GLASS (32)	0.033986	0.011521	0.012217
45	HOLDING-OTH. INV.. OFF'S (67)	0.033988	0.000237	0.000206
14	PRINTING & PUBLISHING (27)	0.034114	0.000882	0.001070
4	BITUM. COAL & LIGNITE (12)	0.034366	0.638418	0.623566
3	METAL MINING (10)	0.034396	0.000162	0.000163
7	GENERAL BLDG. CONTRACTORS (15)	0.034664	0.025964	0.037724

5	OIL & GAS EXTRACTION (13)	0.035171	0.000372	0.000797
6	NONMETAL MIN.-EX. FUELS (14)	0.035313	0.002276	0.002673
8	HEAVY CONST. CONTRACTORS (16)	0.035359	0.008223	0.004975
24	MISC. MANUFACTURING IND'S (39)	0.035558	0.002947	0.003988
2	AGRI. SERVICES (07)	0.036214	0.000085	0.000096
33	FOOD STORES (54)	0.036311	0.007079	0.006288
34	AUTO. DEALERS-SERV. STAT. (55)	0.037201	0.013920	0.011173
54	LEGAL SERVICES (81)	0.037224	0.001924	0.002633
39	BANKING (60)	0.039100	0.008775	0.007587
16	PETROLEUM & COAL PROD. (29)	0.039513	0.000543	0.000640
37	EATING & DRINKING PLACES (58)	0.039932	0.008703	0.009323
32	GENERAL MERCH. STORES (53)	0.040539	0.005790	0.004271
51	MOTION PICTURES (78)	0.041175	0.000550	0.000480
27	COMMUNICATION (48)	0.041381	0.008884	0.012470
35	APPAREL & ACCESS. STORES (56)	0.041842	0.001641	0.001198
22	TRANSPORTATION EQUIPMENT (37)	0.042213	0.000035	0.000030
40	CREDIT AGENCIES EX. BANKS (61)	0.046476	0.002780	0.001788
36	FURNITURE & HOME FURNISH. (57)	0.049516	0.004376	0.003003
44	REAL ESTATE (65)	0.049950	0.004118	0.013415
57	MEMBERSHIP ORGANIZATIONS (86)	0.050299	0.003437	0.002531
49	AUTO REPAIR,SERV.,GARAGES (75)	0.050643	0.002479	0.004118
58	MISCELLANEOUS SERVICES (89)	0.051363	0.004983	0.003560
28	ELEC.,GAS,&SANITARY SERV. (49)	0.051474	0.003433	0.006227
30	WHLSALE-NONDURABLE GOODS (51)	0.051618	0.006522	0.004487
41	SECURITY, COMM. BROKERS (62)	0.055884	0.000536	0.000278
43	INS. AGENTS, BROKERS (64)	0.060923	0.004802	0.003551
29	WHLSALE-DURABLE-GOODS (50)	0.063781	0.042938	0.022558
42	INSURANCE CARRIERS (63)	0.069984	0.001849	0.000886
46	HOTELS & OTHER LODGING (70)	0.086855	0.002481	0.001017
55	EDUCATIONAL SERVICES (82)	0.091242	0.001936	0.001089
13	FURNITURE & FIXTURES (25)	0.113655	0.014416	0.006961
56	SOCIAL SERVICES (83)	0.129267	0.017541	0.005245

County Group 8
Direct Model

		SECTHL	CONTRIB	FDSHR
38	MISCELLANEOUS RETAIL (59)	0.012399	-.004214	0.008261
47	PERSONAL SERVICES (72)	0.016892	0.001319	0.004720
26	TRUCKING & WAREHOUSING (42)	0.023628	0.001625	0.005473
12	LUMBER & WOOD PROD. (24)	0.024412	0.000579	0.001299
52	AMUSEMENT & RECREATION (79)	0.027557	0.000617	0.000636
53	HEALTH SERVICES (80)	0.028414	0.028497	0.028127
48	BUSINESS SERVICES (73)	0.029045	0.000677	0.002670
1	AGRICULTURE	0.030113	0.001572	0.014035
18	PRIMARY METAL PROD. (33)	0.031223	0.012491	0.023502
19	FABRICATED METAL PROD. (34)	0.031363	0.004786	0.006208
25	LOCAL PASS. TRANSIT (41)	0.031533	0.000180	0.000300
23	INSTRUMENTS & REL. PROD. (38)	0.031622	0.003073	0.002968
9	SPECIAL TRADE CONTRACTORS (17)	0.032480	0.004886	0.002379

15	CHEMICALS & ALLIED PROD. (28)	0.032521	0.000059	0.000135
10	FOOD & KINDRED PROD. (20)	0.032708	0.000891	0.002255
21	ELECTRIC & ELEC. EQUIP. (36)	0.032783	0.000677	0.000731
20	MACHINERY, EXCEPT ELEC. (35)	0.032810	0.039913	0.047458
11	APPAREL & OTHER PROD. (23)	0.032998	0.017565	0.022221
31	BLDG. MAT.-GARDEN SUPPLY (52)	0.033340	0.000504	0.000359
17	STONE, CLAY, & GLASS (32)	0.034259	0.011057	0.012217
45	HOLDING-OTH. INV.. OFF'S (67)	0.034269	0.000247	0.000206
14	PRINTING & PUBLISHING (27)	0.034337	0.000840	0.001070
3	METAL MINING (10)	0.034483	0.000177	0.000163
4	BITUM. COAL & LIGNITE (12)	0.034483	0.632361	0.623566
50	MISC. REPAIR SERVICES (76)	0.034529	0.001585	0.001980
7	GENERAL BLDG. CONTRACTORS (15)	0.035075	0.021458	0.037724
8	HEAVY CONST. CONTRACTORS (16)	0.035442	0.009334	0.004975
6	NONMETAL MIN.-EX. FUELS (14)	0.035515	0.002370	0.002673
5	OIL & GAS EXTRACTION (13)	0.035519	0.000384	0.000797
24	MISC. MANUFACTURING IND'S (39)	0.035999	0.002723	0.003988
33	FOOD STORES (54)	0.036627	0.008270	0.006288
34	AUTO. DEALERS-SERV. STAT. (55)	0.037653	0.016577	0.011173
2	AGRI. SERVICES (07)	0.037742	0.000083	0.000096
54	LEGAL SERVICES (81)	0.038747	0.002025	0.002633
39	BANKING (60)	0.039763	0.010239	0.007587
32	GENERAL MERCH. STORES (53)	0.041432	0.006943	0.004271
51	MOTION PICTURES (78)	0.042851	0.000547	0.000480
35	APPAREL & ACCESS. STORES (56)	0.042883	0.001984	0.001198
16	PETROLEUM & COAL PROD. (29)	0.044524	0.000530	0.000640
22	TRANSPORTATION EQUIPMENT (37)	0.044740	0.000037	0.000030
37	EATING & DRINKING PLACES (58)	0.045309	0.007936	0.009323
27	COMMUNICATION (48)	0.046134	0.007507	0.012470
40	CREDIT AGENCIES EX. BANKS (61)	0.049028	0.003093	0.001788
36	FURNITURE & HOME FURNISH. (57)	0.051561	0.005280	0.003003
57	MEMBERSHIP ORGANIZATIONS (86)	0.053697	0.003892	0.002531
58	MISCELLANEOUS SERVICES (89)	0.053697	0.005833	0.003560
30	WHLSALE-NONDURABLE GOODS (51)	0.053783	0.007595	0.004487
28	ELEC.,GAS,&SANITARY SERV. (49)	0.055084	0.003475	0.006227
41	SECURITY, COMM. BROKERS (62)	0.058683	0.000644	0.000278
49	AUTO REPAIR,SERV.,GARAGES (75)	0.059850	0.002121	0.004118
44	REAL ESTATE (65)	0.063128	0.003993	0.013415
29	WHLSALE-DURABLE-GOODS (50)	0.066843	0.052922	0.022558
43	INS. AGENTS, BROKERS (64)	0.068418	0.005491	0.003551
42	INSURANCE CARRIERS (63)	0.079923	0.001844	0.000886
46	HOTELS & OTHER LODGING (70)	0.099423	0.002926	0.001017
55	EDUCATIONAL SERVICES (82)	0.102813	0.002242	0.001089
56	SOCIAL SERVICES (83)	0.142861	0.021211	0.005245
13	FURNITURE & FIXTURES (25)	0.166409	0.016532	0.006961

County Group 8
No-C Model

		SECTHL	CONTRIB	FDSHR

38	MISCELLANEOUS RETAIL (59)	0.012553	-.002818	0.008261
47	PERSONAL SERVICES (72)	0.017932	0.001552	0.004720
26	TRUCKING & WAREHOUSING (42)	0.023718	0.001937	0.005473
12	LUMBER & WOOD PROD. (24)	0.026928	0.000835	0.001299
52	AMUSEMENT & RECREATION (79)	0.027985	0.000560	0.000636
53	HEALTH SERVICES (80)	0.028939	0.026720	0.028127
1	AGRICULTURE	0.029336	0.003222	0.014035
25	LOCAL PASS. TRANSIT (41)	0.031572	0.000174	0.000300
48	BUSINESS SERVICES (73)	0.031813	0.001384	0.002670
18	PRIMARY METAL PROD. (33)	0.032111	0.016664	0.023502
19	FABRICATED METAL PROD. (34)	0.032112	0.005538	0.006208
23	INSTRUMENTS & REL. PROD. (38)	0.032130	0.003156	0.002968
9	SPECIAL TRADE CONTRACTORS (17)	0.032486	0.004323	0.002379
15	CHEMICALS & ALLIED PROD. (28)	0.033001	0.000065	0.000135
10	FOOD & KINDRED PROD. (20)	0.033113	0.001244	0.002255
11	APPAREL & OTHER PROD. (23)	0.033173	0.016356	0.022221
21	ELECTRIC & ELEC. EQUIP. (36)	0.033265	0.000724	0.000731
20	MACHINERY, EXCEPT ELEC. (35)	0.033382	0.045868	0.047458
31	BLDG. MAT.-GARDEN SUPPLY (52)	0.033561	0.000431	0.000359
50	MISC. REPAIR SERVICES (76)	0.033627	0.001607	0.001980
17	STONE, CLAY, & GLASS (32)	0.033964	0.011517	0.012217
45	HOLDING-OTH. INV.. OFF'S (67)	0.034090	0.000234	0.000206
14	PRINTING & PUBLISHING (27)	0.034186	0.000883	0.001070
4	BITUM. COAL & LIGNITE (12)	0.034461	0.639623	0.623566
3	METAL MINING (10)	0.034492	0.000163	0.000163
7	GENERAL BLDG. CONTRACTORS (15)	0.034633	0.025961	0.037724
5	OIL & GAS EXTRACTION (13)	0.035294	0.000373	0.000797
8	HEAVY CONST. CONTRACTORS (16)	0.035383	0.008227	0.004975
6	NONMETAL MIN.-EX. FUELS (14)	0.035444	0.002284	0.002673
24	MISC. MANUFACTURING IND'S (39)	0.035547	0.002944	0.003988
33	FOOD STORES (54)	0.036548	0.006960	0.006288
2	AGRI. SERVICES (07)	0.036771	0.000082	0.000096
34	AUTO. DEALERS-SERV. STAT. (55)	0.037531	0.013818	0.011173
54	LEGAL SERVICES (81)	0.038039	0.001850	0.002633
39	BANKING (60)	0.039418	0.008705	0.007587
16	PETROLEUM & COAL PROD. (29)	0.039853	0.000540	0.000640
37	EATING & DRINKING PLACES (58)	0.040254	0.008687	0.009323
32	GENERAL MERCH. STORES (53)	0.041062	0.005775	0.004271
51	MOTION PICTURES (78)	0.041603	0.000552	0.000480
27	COMMUNICATION (48)	0.041761	0.008938	0.012470
35	APPAREL & ACCESS. STORES (56)	0.042582	0.001640	0.001198
22	TRANSPORTATION EQUIPMENT (37)	0.042688	0.000036	0.000030
40	CREDIT AGENCIES EX. BANKS (61)	0.047236	0.002805	0.001788
36	FURNITURE & HOME FURNISH. (57)	0.050906	0.004365	0.003003
44	REAL ESTATE (65)	0.051293	0.004168	0.013415
57	MEMBERSHIP ORGANIZATIONS (86)	0.051470	0.003462	0.002531
49	AUTO REPAIR,SERV.,GARAGES (75)	0.051795	0.002493	0.004118
28	ELEC.,GAS,&SANITARY SERV. (49)	0.052612	0.003477	0.006227
58	MISCELLANEOUS SERVICES (89)	0.052636	0.005021	0.003560
30	WHLSALE-NONDURABLE GOODS (51)	0.052991	0.006527	0.004487
41	SECURITY, COMM. BROKERS (62)	0.057407	0.000543	0.000278

43	INS. AGENTS, BROKERS (64)	0.063107	0.004879	0.003551
29	WHLSALE-DURABLE-GOODS (50)	0.065845	0.043733	0.022558
42	INSURANCE CARRIERS (63)	0.072577	0.001884	0.000886
46	HOTELS & OTHER LODGING (70)	0.090781	0.002532	0.001017
55	EDUCATIONAL SERVICES (82)	0.095821	0.001961	0.001089
13	FURNITURE & FIXTURES (25)	0.120409	0.014893	0.006961
56	SOCIAL SERVICES (83)	0.136581	0.017919	0.005245

County Group 8
No-I Model

		SECTHL	CONTRIB	FDSHR
38	MISCELLANEOUS RETAIL (59)	0.012600	-.003126	0.008261
47	PERSONAL SERVICES (72)	0.017579	0.001637	0.004720
26	TRUCKING & WAREHOUSING (42)	0.023515	0.001890	0.005473
12	LUMBER & WOOD PROD. (24)	0.024777	0.000602	0.001299
52	AMUSEMENT & RECREATION (79)	0.027882	0.000633	0.000636
53	HEALTH SERVICES (80)	0.028707	0.029231	0.028127
48	BUSINESS SERVICES (73)	0.029347	0.000692	0.002670
1	AGRICULTURE	0.029700	0.001865	0.014035
18	PRIMARY METAL PROD. (33)	0.031340	0.012559	0.023502
25	LOCAL PASS. TRANSIT (41)	0.031463	0.000185	0.000300
19	FABRICATED METAL PROD. (34)	0.031506	0.004817	0.006208
23	INSTRUMENTS & REL. PROD. (38)	0.031729	0.003086	0.002968
9	SPECIAL TRADE CONTRACTORS (17)	0.032539	0.004903	0.002379
15	CHEMICALS & ALLIED PROD. (28)	0.032601	0.000059	0.000135
10	FOOD & KINDRED PROD. (20)	0.032766	0.000893	0.002255
21	ELECTRIC & ELEC. EQUIP. (36)	0.032863	0.000679	0.000731
20	MACHINERY, EXCEPT ELEC. (35)	0.032875	0.040039	0.047458
11	APPAREL & OTHER PROD. (23)	0.033012	0.017586	0.022221
31	BLDG. MAT.-GARDEN SUPPLY (52)	0.033422	0.000509	0.000359
45	HOLDING-OTH. INV.. OFF'S (67)	0.034092	0.000250	0.000206
14	PRINTING & PUBLISHING (27)	0.034184	0.000839	0.001070
17	STONE, CLAY, & GLASS (32)	0.034219	0.011047	0.012217
50	MISC. REPAIR SERVICES (76)	0.034224	0.001597	0.001980
3	METAL MINING (10)	0.034341	0.000176	0.000163
4	BITUM. COAL & LIGNITE (12)	0.034341	0.630866	0.623566
7	GENERAL BLDG. CONTRACTORS (15)	0.034918	0.021389	0.037724
6	NONMETAL MIN.-EX. FUELS (14)	0.035335	0.002360	0.002673
5	OIL & GAS EXTRACTION (13)	0.035338	0.000382	0.000797
8	HEAVY CONST. CONTRACTORS (16)	0.035387	0.009329	0.004975
24	MISC. MANUFACTURING IND'S (39)	0.035961	0.002724	0.003988
33	FOOD STORES (54)	0.036411	0.008412	0.006288
2	AGRI. SERVICES (07)	0.037095	0.000087	0.000096
34	AUTO. DEALERS-SERV. STAT. (55)	0.037351	0.016703	0.011173
54	LEGAL SERVICES (81)	0.037905	0.002109	0.002633
39	BANKING (60)	0.039466	0.010329	0.007587
32	GENERAL MERCH. STORES (53)	0.040954	0.006966	0.004271
35	APPAREL & ACCESS. STORES (56)	0.042210	0.001987	0.001198
51	MOTION PICTURES (78)	0.042374	0.000546	0.000480

16	PETROLEUM & COAL PROD. (29)	0.043895	0.000533	0.000640
22	TRANSPORTATION EQUIPMENT (37)	0.044190	0.000037	0.000030
37	EATING & DRINKING PLACES (58)	0.044599	0.007946	0.009323
27	COMMUNICATION (48)	0.045527	0.007459	0.012470
40	CREDIT AGENCIES EX. BANKS (61)	0.048238	0.003069	0.001788
36	FURNITURE & HOME FURNISH. (57)	0.050311	0.005301	0.003003
57	MEMBERSHIP ORGANIZATIONS (86)	0.052499	0.003872	0.002531
58	MISCELLANEOUS SERVICES (89)	0.052499	0.005803	0.003560
30	WHLSALE-NONDURABLE GOODS (51)	0.052500	0.007612	0.004487
28	ELEC.,GAS,&SANITARY SERV. (49)	0.053924	0.003438	0.006227
41	SECURITY, COMM. BROKERS (62)	0.057252	0.000637	0.000278
49	AUTO REPAIR,SERV.,GARAGES (75)	0.058210	0.002116	0.004118
44	REAL ESTATE (65)	0.060932	0.003938	0.013415
29	WHLSALE-DURABLE-GOODS (50)	0.064991	0.052151	0.022558
43	INS. AGENTS, BROKERS (64)	0.066071	0.005413	0.003551
42	INSURANCE CARRIERS (63)	0.077155	0.001817	0.000886
46	HOTELS & OTHER LODGING (70)	0.095426	0.002877	0.001017
55	EDUCATIONAL SERVICES (82)	0.098337	0.002224	0.001089
56	SOCIAL SERVICES (83)	0.136039	0.020891	0.005245
13	FURNITURE & FIXTURES (25)	0.156788	0.016029	0.006961

County Group 8
Full Model

		SECTHL	CONTRIB	FDSHR
38	MISCELLANEOUS RETAIL (59)	0.015738	0.001159	0.008261
47	PERSONAL SERVICES (72)	0.022436	0.002669	0.004720
26	TRUCKING & WAREHOUSING (42)	0.025961	0.003484	0.005473
12	LUMBER & WOOD PROD. (24)	0.030131	0.001222	0.001299
52	AMUSEMENT & RECREATION (79)	0.030530	0.000637	0.000636
1	AGRICULTURE	0.030812	0.008719	0.014035
53	HEALTH SERVICES (80)	0.031308	0.028506	0.028127
25	LOCAL PASS. TRANSIT (41)	0.033052	0.000220	0.000300
10	FOOD & KINDRED PROD. (20)	0.033260	0.001744	0.002255
9	SPECIAL TRADE CONTRACTORS (17)	0.033556	0.003689	0.002379
23	INSTRUMENTS & REL. PROD. (38)	0.033650	0.003440	0.002968
19	FABRICATED METAL PROD. (34)	0.033704	0.006689	0.006208
18	PRIMARY METAL PROD. (33)	0.033977	0.025640	0.023502
50	MISC. REPAIR SERVICES (76)	0.034307	0.001821	0.001980
11	APPAREL & OTHER PROD. (23)	0.034371	0.015169	0.022221
20	MACHINERY, EXCEPT ELEC. (35)	0.034488	0.052774	0.047458
15	CHEMICALS & ALLIED PROD. (28)	0.034508	0.000112	0.000135
21	ELECTRIC & ELEC. EQUIP. (36)	0.034521	0.000853	0.000731
17	STONE, CLAY, & GLASS (32)	0.034759	0.012058	0.012217
48	BUSINESS SERVICES (73)	0.034840	0.002810	0.002670
2	AGRI. SERVICES (07)	0.034895	0.000108	0.000096
4	BITUM. COAL & LIGNITE (12)	0.034896	0.618410	0.623566
3	METAL MINING (10)	0.035013	0.000171	0.000163
31	BLDG. MAT.-GARDEN SUPPLY (52)	0.035029	0.000413	0.000359
45	HOLDING-OTH. INV.. OFF'S (67)	0.035229	0.000262	0.000206

14	PRINTING & PUBLISHING (27)	0.035339	0.001093	0.001070
5	OIL & GAS EXTRACTION (13)	0.035633	0.000457	0.000797
6	NONMETAL MIN.-EX. FUELS (14)	0.035729	0.002431	0.002673
7	GENERAL BLDG. CONTRACTORS (15)	0.035846	0.025383	0.037724
54	LEGAL SERVICES (81)	0.035902	0.002081	0.002633
24	MISC. MANUFACTURING IND'S (39)	0.036025	0.003442	0.003988
8	HEAVY CONST. CONTRACTORS (16)	0.036040	0.007023	0.004975
33	FOOD STORES (54)	0.036135	0.006515	0.006288
34	AUTO. DEALERS-SERV. STAT. (55)	0.036831	0.012696	0.011173
37	EATING & DRINKING PLACES (58)	0.037745	0.009274	0.009323
16	PETROLEUM & COAL PROD. (29)	0.038086	0.000791	0.000640
39	BANKING (60)	0.038456	0.008317	0.007587
27	COMMUNICATION (48)	0.038757	0.013004	0.012470
32	GENERAL MERCH. STORES (53)	0.039435	0.005125	0.004271
51	MOTION PICTURES (78)	0.040058	0.000626	0.000480
35	APPAREL & ACCESS. STORES (56)	0.040296	0.001440	0.001198
22	TRANSPORTATION EQUIPMENT (37)	0.040298	0.000041	0.000030
44	REAL ESTATE (65)	0.042651	0.004997	0.013415
49	AUTO REPAIR,SERV.,GARAGES (75)	0.042860	0.004004	0.004118
40	CREDIT AGENCIES EX. BANKS (61)	0.044262	0.002777	0.001788
28	ELEC.,GAS,&SANITARY SERV. (49)	0.044286	0.004103	0.006227
36	FURNITURE & HOME FURNISH. (57)	0.045928	0.003822	0.003003
57	MEMBERSHIP ORGANIZATIONS (86)	0.046333	0.003280	0.002531
30	WHLSALE-NONDURABLE GOODS (51)	0.048091	0.005992	0.004487
58	MISCELLANEOUS SERVICES (89)	0.048211	0.004533	0.003560
41	SECURITY, COMM. BROKERS (62)	0.051959	0.000474	0.000278
43	INS. AGENTS, BROKERS (64)	0.052037	0.004647	0.003551
29	WHLSALE-DURABLE-GOODS (50)	0.057952	0.035790	0.022558
42	INSURANCE CARRIERS (63)	0.061131	0.001733	0.000886
46	HOTELS & OTHER LODGING (70)	0.070856	0.002196	0.001017
55	EDUCATIONAL SERVICES (82)	0.073206	0.001762	0.001089
13	FURNITURE & FIXTURES (25)	0.078079	0.012676	0.006961
56	SOCIAL SERVICES (83)	0.104858	0.014697	0.005245

County Group 24
Total Model

		SECTHL	CONTRIB	FDSHR
38	AUTO. DEALERS-SERV. STAT. (55)	0.007743	0.010976	0.014506
36	GENERAL MERCH. STORES (53)	0.007919	0.008351	0.011273
39	APPAREL & ACCESS. STORES (56)	0.008197	0.003080	0.005539
11	LUMBER & WOOD PROD. (24)	0.008420	0.001647	0.004433
26	LOCAL PASS. TRANSIT (41)	0.008480	0.000090	0.000313
13	PAPER & ALLIED PROD. (26)	0.008491	0.006307	0.009680
41	EATING & DRINKING PLACES (58)	0.008716	0.016373	0.028681
7	SPECIAL TRADE CONTRACTORS (17)	0.008834	0.023923	0.021021
15	CHEMICALS & ALLIED PROD. (28)	0.008910	0.071083	0.136566
10	TEXTILE MILL PROD. (22)	0.009060	0.038371	0.052890
21	FABRICATED METAL PROD. (34)	0.009200	0.041581	0.055262
29	TRANSPORTATION BY AIR (45)	0.009208	0.000390	0.000761

8	FOOD & KINDRED PROD. (20)	0.009221	0.001479	0.003467
25	MISC. MANUFACTURING IND'S (39)	0.009561	0.023173	0.034212
20	PRIMARY METAL PROD. (33)	0.009914	0.085233	0.129872
6	HEAVY CONST. CONTRACTORS (16)	0.009993	0.046338	0.033365
23	ELECTRIC & ELEC. EQUIP. (36)	0.010008	0.001371	0.001774
22	MACHINERY, EXCEPT ELEC. (35)	0.010055	0.019411	0.022964
37	FOOD STORES (54)	0.010133	0.005737	0.006055
9	TOBACCO MANUFACTURES (21)	0.010495	0.010914	0.019878
43	BANKING (60)	0.010789	0.003743	0.003763
5	GENERAL BLDG. CONTRACTORS (15)	0.010877	0.030339	0.057551
19	STONE, CLAY, & GLASS (32)	0.011000	0.002943	0.003851
40	FURNITURE & HOME FURNISH. (57)	0.011026	0.003112	0.003713
53	BUSINESS SERVICES (73)	0.011550	0.015421	0.019106
24	TRANSPORTATION EQUIPMENT (37)	0.011577	0.000352	0.000375
17	RUBBER & MISC. PLASTICS (30)	0.012579	0.044201	0.035635
18	LEATHER & LEATHER PROD. (31)	0.012917	0.000487	0.000377
28	WATER TRANSPORTATION (44)	0.012993	0.000160	0.000196
35	BLDG. MAT.-GARDEN SUPPLY (52)	0.013908	0.000501	0.000342
14	PRINTING & PUBLISHING (27)	0.014111	0.006208	0.008369
52	PERSONAL SERVICES (72)	0.014197	0.003655	0.004273
4	NONMETAL MIN.-EX. FUELS (14)	0.014724	0.001072	0.001784
55	MISC. REPAIR SERVICES (76)	0.015541	0.003390	0.003396
31	COMMUNICATION (48)	0.015891	0.022374	0.025667
56	AMUSEMENT & RECREATION (79)	0.017856	0.004766	0.002838
33	WHLSALE-DURABLE-GOODS (50)	0.018592	0.012331	0.018041
61	MEMBERSHIP ORGANIZATIONS (86)	0.018949	0.003899	0.002583
27	TRUCKING & WAREHOUSING (42)	0.019405	0.022351	0.021939
48	REAL ESTATE (65)	0.020241	0.021550	0.039721
49	COMB. REAL ESTATE, INS. (66)	0.020534	0.000653	0.001230
44	CREDIT AGENCIES EX. BANKS (61)	0.020770	0.005542	0.003294
62	MISCELLANEOUS SERVICES (89)	0.021089	0.021441	0.013546
30	TRANSPORTATION SERVICES (47)	0.022783	0.000821	0.000409
34	WHLSALE-NONDURABLE GOODS (51)	0.022974	0.001545	0.000772
16	PETROLEUM & COAL PROD. (29)	0.023162	0.000785	0.001492
42	MISCELLANEOUS RETAIL (59)	0.023623	0.012974	0.016001
54	AUTO REPAIR,SERV.,GARAGES (75)	0.025459	0.011861	0.011029
3	FORESTRY (08)	0.025644	0.011016	0.012981
2	AGRI. SERVICES (07)	0.029752	0.005455	0.001874
32	ELEC.,GAS,&SANITARY SERV. (49)	0.030978	0.022614	0.021426
50	HOLDING-OTH. INV.. OFF'S (67)	0.031880	0.000560	0.000215
58	LEGAL SERVICES (81)	0.033312	0.004677	0.001941
47	INS. AGENTS, BROKERS (64)	0.035195	0.005283	0.002356
57	HEALTH SERVICES (80)	0.036694	0.092619	0.027056
12	FURNITURE & FIXTURES (25)	0.045070	0.061100	0.020127
59	EDUCATIONAL SERVICES (82)	0.047022	0.003703	0.001057
1	AGRICULTURE	0.047374	0.003902	0.002625
60	SOCIAL SERVICES (83)	0.052891	0.015052	0.003141
46	INSURANCE CARRIERS (63)	0.128958	0.064880	0.007821
51	HOTELS & OTHER LODGING (70)	0.144519	0.033092	0.003415
45	SECURITY, COMM. BROKERS (62)	0.167595	0.001741	0.000160

County Group 24
Direct Model

		SECTHL	CONTRIB	FDSHR
38	AUTO. DEALERS-SERV. STAT. (55)	0.006777	0.010825	0.014506
36	GENERAL MERCH. STORES (53)	0.007193	0.008584	0.011273
41	EATING & DRINKING PLACES (58)	0.007976	0.012390	0.028681
39	APPAREL & ACCESS. STORES (56)	0.008210	0.002717	0.005539
13	PAPER & ALLIED PROD. (26)	0.008238	0.004468	0.009680
26	LOCAL PASS. TRANSIT (41)	0.008804	0.000002	0.000313
15	CHEMICALS & ALLIED PROD. (28)	0.008886	0.031744	0.136566
10	TEXTILE MILL PROD. (22)	0.009093	0.030017	0.052890
8	FOOD & KINDRED PROD. (20)	0.009207	0.000942	0.003467
37	FOOD STORES (54)	0.009306	0.005881	0.006055
21	FABRICATED METAL PROD. (34)	0.009359	0.035233	0.055262
11	LUMBER & WOOD PROD. (24)	0.009413	0.000174	0.004433
7	SPECIAL TRADE CONTRACTORS (17)	0.009586	0.028212	0.021021
6	HEAVY CONST. CONTRACTORS (16)	0.009747	0.057201	0.033365
29	TRANSPORTATION BY AIR (45)	0.009837	0.000288	0.000761
43	BANKING (60)	0.010252	0.004388	0.003763
20	PRIMARY METAL PROD. (33)	0.010691	0.054942	0.129872
22	MACHINERY, EXCEPT ELEC. (35)	0.010706	0.018496	0.022964
40	FURNITURE & HOME FURNISH. (57)	0.010834	0.003249	0.003713
25	MISC. MANUFACTURING IND'S (39)	0.011217	0.014119	0.034212
9	TOBACCO MANUFACTURES (21)	0.011599	0.010392	0.019878
23	ELECTRIC & ELEC. EQUIP. (36)	0.011711	0.001153	0.001774
28	WATER TRANSPORTATION (44)	0.012103	0.000162	0.000196
24	TRANSPORTATION EQUIPMENT (37)	0.012744	0.000384	0.000375
35	BLDG. MAT.-GARDEN SUPPLY (52)	0.013370	0.000585	0.000342
19	STONE, CLAY, & GLASS (32)	0.013749	0.002639	0.003851
17	RUBBER & MISC. PLASTICS (30)	0.013809	0.048254	0.035635
18	LEATHER & LEATHER PROD. (31)	0.014127	0.000535	0.000377
53	BUSINESS SERVICES (73)	0.015082	0.008868	0.019106
52	PERSONAL SERVICES (72)	0.016349	0.003918	0.004273
56	AMUSEMENT & RECREATION (79)	0.018698	0.005310	0.002838
55	MISC. REPAIR SERVICES (76)	0.018708	0.003286	0.003396
5	GENERAL BLDG. CONTRACTORS (15)	0.019227	0.021650	0.057551
4	NONMETAL MIN.-EX. FUELS (14)	0.021468	0.001129	0.001784
33	WHLSALE-DURABLE-GOODS (50)	0.021734	0.008908	0.018041
61	MEMBERSHIP ORGANIZATIONS (86)	0.021894	0.004493	0.002583
62	MISCELLANEOUS SERVICES (89)	0.021894	0.025099	0.013546
27	TRUCKING & WAREHOUSING (42)	0.022914	0.020553	0.021939
44	CREDIT AGENCIES EX. BANKS (61)	0.023321	0.006151	0.003294
14	PRINTING & PUBLISHING (27)	0.023801	0.004235	0.008369
34	WHLSALE-NONDURABLE GOODS (51)	0.025385	0.002018	0.000772
31	COMMUNICATION (48)	0.025939	0.015216	0.025667
30	TRANSPORTATION SERVICES (47)	0.025940	0.000893	0.000409
42	MISCELLANEOUS RETAIL (59)	0.030153	0.013678	0.016001
2	AGRI. SERVICES (07)	0.036264	0.006945	0.001874

3	FORESTRY (08)	0.036264	0.011493	0.012981
32	ELEC.,GAS,&SANITARY SERV. (49)	0.037944	0.025405	0.021426
58	LEGAL SERVICES (81)	0.038141	0.006167	0.001941
48	REAL ESTATE (65)	0.038551	0.021517	0.039721
49	COMB. REAL ESTATE, INS. (66)	0.039270	0.000637	0.001230
50	HOLDING-OTH. INV.. OFF'S (67)	0.039274	0.000715	0.000215
54	AUTO REPAIR,SERV.,GARAGES (75)	0.041483	0.014151	0.011029
57	HEALTH SERVICES (80)	0.043949	0.125684	0.027056
16	PETROLEUM & COAL PROD. (29)	0.044662	0.000369	0.001492
47	INS. AGENTS, BROKERS (64)	0.046734	0.006639	0.002356
59	EDUCATIONAL SERVICES (82)	0.061018	0.005169	0.001057
60	SOCIAL SERVICES (83)	0.061628	0.021726	0.003141
1	AGRICULTURE	0.081810	0.004558	0.002625
12	FURNITURE & FIXTURES (25)	0.085283	0.076721	0.020127
51	HOTELS & OTHER LODGING (70)	0.210018	0.047412	0.003415
46	INSURANCE CARRIERS (63)	0.210381	0.088767	0.007821
45	SECURITY, COMM. BROKERS (62)	0.218899	0.002544	0.000160

County Group 24
No-C Model

		SECTHL	CONTRIB	FDSHR
38	AUTO. DEALERS-SERV. STAT. (55)	0.007130	0.009979	0.014506
36	GENERAL MERCH. STORES (53)	0.007354	0.007512	0.011273
39	APPAREL & ACCESS. STORES (56)	0.008012	0.002585	0.005539
13	PAPER & ALLIED PROD. (26)	0.008063	0.006132	0.009680
11	LUMBER & WOOD PROD. (24)	0.008073	0.001258	0.004433
41	EATING & DRINKING PLACES (58)	0.008112	0.015473	0.028681
26	LOCAL PASS. TRANSIT (41)	0.008159	0.000064	0.000313
15	CHEMICALS & ALLIED PROD. (28)	0.008626	0.070869	0.136566
10	TEXTILE MILL PROD. (22)	0.008783	0.038205	0.052890
8	FOOD & KINDRED PROD. (20)	0.008933	0.001485	0.003467
29	TRANSPORTATION BY AIR (45)	0.009026	0.000341	0.000761
7	SPECIAL TRADE CONTRACTORS (17)	0.009032	0.023961	0.021021
21	FABRICATED METAL PROD. (34)	0.009040	0.041929	0.055262
37	FOOD STORES (54)	0.009538	0.005335	0.006055
25	MISC. MANUFACTURING IND'S (39)	0.009547	0.023479	0.034212
6	HEAVY CONST. CONTRACTORS (16)	0.009655	0.046751	0.033365
20	PRIMARY METAL PROD. (33)	0.009690	0.086264	0.129872
22	MACHINERY, EXCEPT ELEC. (35)	0.009859	0.019576	0.022964
23	ELECTRIC & ELEC. EQUIP. (36)	0.010257	0.001403	0.001774
43	BANKING (60)	0.010279	0.003625	0.003763
40	FURNITURE & HOME FURNISH. (57)	0.010778	0.002814	0.003713
9	TOBACCO MANUFACTURES (21)	0.010818	0.011343	0.019878
53	BUSINESS SERVICES (73)	0.011067	0.015691	0.019106
5	GENERAL BLDG. CONTRACTORS (15)	0.011227	0.031580	0.057551
19	STONE, CLAY, & GLASS (32)	0.011421	0.003068	0.003851
24	TRANSPORTATION EQUIPMENT (37)	0.011561	0.000365	0.000375
17	RUBBER & MISC. PLASTICS (30)	0.012198	0.045397	0.035635
28	WATER TRANSPORTATION (44)	0.012229	0.000154	0.000196

18	LEATHER & LEATHER PROD. (31)	0.012589	0.000500	0.000377
35	BLDG. MAT.-GARDEN SUPPLY (52)	0.013500	0.000494	0.000342
52	PERSONAL SERVICES (72)	0.014416	0.003355	0.004273
55	MISC. REPAIR SERVICES (76)	0.015224	0.003220	0.003396
14	PRINTING & PUBLISHING (27)	0.015232	0.006592	0.008369
31	COMMUNICATION (48)	0.015927	0.022521	0.025667
4	NONMETAL MIN.-EX. FUELS (14)	0.016459	0.001168	0.001784
56	AMUSEMENT & RECREATION (79)	0.017764	0.004748	0.002838
61	MEMBERSHIP ORGANIZATIONS (86)	0.019005	0.003937	0.002583
33	WHLSALE-DURABLE-GOODS (50)	0.020229	0.010875	0.018041
27	TRUCKING & WAREHOUSING (42)	0.020406	0.020885	0.021939
48	REAL ESTATE (65)	0.020869	0.022654	0.039721
44	CREDIT AGENCIES EX. BANKS (61)	0.021127	0.005485	0.003294
49	COMB. REAL ESTATE, INS. (66)	0.021163	0.000682	0.001230
62	MISCELLANEOUS SERVICES (89)	0.021354	0.021648	0.013546
30	TRANSPORTATION SERVICES (47)	0.023759	0.000817	0.000409
34	WHLSALE-NONDURABLE GOODS (51)	0.023811	0.001601	0.000772
54	AUTO REPAIR,SERV.,GARAGES (75)	0.025661	0.012146	0.011029
16	PETROLEUM & COAL PROD. (29)	0.025889	0.000755	0.001492
3	FORESTRY (08)	0.025935	0.011237	0.012981
42	MISCELLANEOUS RETAIL (59)	0.026127	0.011334	0.016001
2	AGRI. SERVICES (07)	0.030554	0.005582	0.001874
32	ELEC.,GAS,&SANITARY SERV. (49)	0.031713	0.022971	0.021426
50	HOLDING-OTH. INV.. OFF'S (67)	0.034090	0.000590	0.000215
58	LEGAL SERVICES (81)	0.035043	0.004930	0.001941
47	INS. AGENTS, BROKERS (64)	0.037728	0.005587	0.002356
57	HEALTH SERVICES (80)	0.038114	0.093261	0.027056
12	FURNITURE & FIXTURES (25)	0.047502	0.060331	0.020127
1	AGRICULTURE	0.050301	0.003826	0.002625
59	EDUCATIONAL SERVICES (82)	0.050571	0.003832	0.001057
60	SOCIAL SERVICES (83)	0.056545	0.015684	0.003141
46	INSURANCE CARRIERS (63)	0.145143	0.065198	0.007821
51	HOTELS & OTHER LODGING (70)	0.164225	0.033171	0.003415
45	SECURITY, COMM. BROKERS (62)	0.193754	0.001744	0.000160

County Group 24
No-I Model

		SECTHL	CONTRIB	FDSHR
38	AUTO. DEALERS-SERV. STAT. (55)	0.007201	0.011995	0.014506
36	GENERAL MERCH. STORES (53)	0.007596	0.009536	0.011273
39	APPAREL & ACCESS. STORES (56)	0.008220	0.003280	0.005539
13	PAPER & ALLIED PROD. (26)	0.008328	0.004569	0.009680
41	EATING & DRINKING PLACES (58)	0.008339	0.013423	0.028681
15	CHEMICALS & ALLIED PROD. (28)	0.008535	0.031983	0.136566
26	LOCAL PASS. TRANSIT (41)	0.008720	0.000034	0.000313
8	FOOD & KINDRED PROD. (20)	0.008931	0.000929	0.003467
10	TEXTILE MILL PROD. (22)	0.009103	0.029924	0.052890
7	SPECIAL TRADE CONTRACTORS (17)	0.009149	0.027696	0.021021
21	FABRICATED METAL PROD. (34)	0.009229	0.034580	0.055262

11	LUMBER & WOOD PROD. (24)	0.009399	0.000547	0.004433
29	TRANSPORTATION BY AIR (45)	0.009720	0.000345	0.000761
37	FOOD STORES (54)	0.009754	0.006375	0.006055
6	HEAVY CONST. CONTRACTORS (16)	0.009905	0.056248	0.033365
20	PRIMARY METAL PROD. (33)	0.010288	0.053488	0.129872
25	MISC. MANUFACTURING IND'S (39)	0.010425	0.013648	0.034212
43	BANKING (60)	0.010646	0.004518	0.003763
22	MACHINERY, EXCEPT ELEC. (35)	0.010674	0.018188	0.022964
23	ELECTRIC & ELEC. EQUIP. (36)	0.010898	0.001104	0.001774
40	FURNITURE & HOME FURNISH. (57)	0.010965	0.003603	0.003713
9	TOBACCO MANUFACTURES (21)	0.010992	0.009865	0.019878
24	TRANSPORTATION EQUIPMENT (37)	0.012469	0.000366	0.000375
19	STONE, CLAY, & GLASS (32)	0.012647	0.002464	0.003851
28	WATER TRANSPORTATION (44)	0.012799	0.000171	0.000196
35	BLDG. MAT.-GARDEN SUPPLY (52)	0.013677	0.000594	0.000342
17	RUBBER & MISC. PLASTICS (30)	0.014009	0.046698	0.035635
18	LEATHER & LEATHER PROD. (31)	0.014310	0.000520	0.000377
53	BUSINESS SERVICES (73)	0.015537	0.008877	0.019106
52	PERSONAL SERVICES (72)	0.015965	0.004259	0.004273
5	GENERAL BLDG. CONTRACTORS (15)	0.016900	0.019438	0.057551
56	AMUSEMENT & RECREATION (79)	0.018697	0.005339	0.002838
55	MISC. REPAIR SERVICES (76)	0.018699	0.003508	0.003396
4	NONMETAL MIN.-EX. FUELS (14)	0.018744	0.001001	0.001784
33	WHLSALE-DURABLE-GOODS (50)	0.019970	0.010799	0.018041
14	PRINTING & PUBLISHING (27)	0.020736	0.003749	0.008369
61	MEMBERSHIP ORGANIZATIONS (86)	0.021584	0.004455	0.002583
62	MISCELLANEOUS SERVICES (89)	0.021585	0.024883	0.013546
27	TRUCKING & WAREHOUSING (42)	0.021735	0.022219	0.021939
44	CREDIT AGENCIES EX. BANKS (61)	0.022804	0.006247	0.003294
34	WHLSALE-NONDURABLE GOODS (51)	0.024508	0.001949	0.000772
30	TRANSPORTATION SERVICES (47)	0.024752	0.000901	0.000409
31	COMMUNICATION (48)	0.024753	0.015344	0.025667
42	MISCELLANEOUS RETAIL (59)	0.027459	0.015519	0.016001
2	AGRI. SERVICES (07)	0.035280	0.006813	0.001874
3	FORESTRY (08)	0.035280	0.011276	0.012981
48	REAL ESTATE (65)	0.035954	0.020238	0.039721
58	LEGAL SERVICES (81)	0.036419	0.005853	0.001941
49	COMB. REAL ESTATE, INS. (66)	0.036806	0.000604	0.001230
50	HOLDING-OTH. INV.. OFF'S (67)	0.036808	0.000678	0.000215
32	ELEC.,GAS,&SANITARY SERV. (49)	0.037043	0.025129	0.021426
16	PETROLEUM & COAL PROD. (29)	0.039527	0.000408	0.001492
54	AUTO REPAIR,SERV.,GARAGES (75)	0.040163	0.013818	0.011029
57	HEALTH SERVICES (80)	0.042566	0.125338	0.027056
47	INS. AGENTS, BROKERS (64)	0.043568	0.006272	0.002356
59	EDUCATIONAL SERVICES (82)	0.057026	0.005029	0.001057
60	SOCIAL SERVICES (83)	0.058408	0.021004	0.003141
1	AGRICULTURE	0.076182	0.004700	0.002625
12	FURNITURE & FIXTURES (25)	0.079680	0.078166	0.020127
46	INSURANCE CARRIERS (63)	0.185369	0.089290	0.007821
51	HOTELS & OTHER LODGING (70)	0.185424	0.047655	0.003415
45	SECURITY, COMM. BROKERS (62)	0.191527	0.002558	0.000160

County Group 24
Full Model

		SECTHL	CONTRIB	FDSHR
39	APPAREL & ACCESS. STORES (56)	0.008690	0.003072	0.005539
38	AUTO. DEALERS-SERV. STAT. (55)	0.008825	0.010357	0.014506
36	GENERAL MERCH. STORES (53)	0.008867	0.007791	0.011273
11	LUMBER & WOOD PROD. (24)	0.009110	0.002927	0.004433
7	SPECIAL TRADE CONTRACTORS (17)	0.009203	0.020687	0.021021
13	PAPER & ALLIED PROD. (26)	0.009653	0.007825	0.009680
26	LOCAL PASS. TRANSIT (41)	0.009820	0.000151	0.000313
29	TRANSPORTATION BY AIR (45)	0.009848	0.000602	0.000761
21	FABRICATED METAL PROD. (34)	0.009878	0.045557	0.055262
15	CHEMICALS & ALLIED PROD. (28)	0.010138	0.101018	0.136566
10	TEXTILE MILL PROD. (22)	0.010179	0.049767	0.052890
23	ELECTRIC & ELEC. EQUIP. (36)	0.010214	0.001566	0.001774
20	PRIMARY METAL PROD. (33)	0.010492	0.092659	0.129872
22	MACHINERY, EXCEPT ELEC. (35)	0.010518	0.020991	0.022964
19	STONE, CLAY, & GLASS (32)	0.010632	0.002938	0.003851
25	MISC. MANUFACTURING IND'S (39)	0.010653	0.031510	0.034212
9	TOBACCO MANUFACTURES (21)	0.010811	0.012900	0.019878
6	HEAVY CONST. CONTRACTORS (16)	0.010855	0.038961	0.033365
37	FOOD STORES (54)	0.010928	0.005230	0.006055
41	EATING & DRINKING PLACES (58)	0.011079	0.025636	0.028681
5	GENERAL BLDG. CONTRACTORS (15)	0.011117	0.030146	0.057551
40	FURNITURE & HOME FURNISH. (57)	0.011390	0.002875	0.003713
24	TRANSPORTATION EQUIPMENT (37)	0.011614	0.000380	0.000375
4	NONMETAL MIN.-EX. FUELS (14)	0.011943	0.001098	0.001784
53	BUSINESS SERVICES (73)	0.011978	0.020294	0.019106
43	BANKING (60)	0.012162	0.003698	0.003763
14	PRINTING & PUBLISHING (27)	0.012377	0.007537	0.008369
17	RUBBER & MISC. PLASTICS (30)	0.012569	0.043560	0.035635
18	LEATHER & LEATHER PROD. (31)	0.012843	0.000473	0.000377
52	PERSONAL SERVICES (72)	0.013143	0.003390	0.004273
28	WATER TRANSPORTATION (44)	0.013171	0.000241	0.000196
8	FOOD & KINDRED PROD. (20)	0.013554	0.003639	0.003467
31	COMMUNICATION (48)	0.013891	0.025079	0.025667
35	BLDG. MAT.-GARDEN SUPPLY (52)	0.014459	0.000436	0.000342
55	MISC. REPAIR SERVICES (76)	0.014499	0.003430	0.003396
27	TRUCKING & WAREHOUSING (42)	0.015746	0.021323	0.021939
33	WHLSALE-DURABLE-GOODS (50)	0.016541	0.013021	0.018041
54	AUTO REPAIR,SERV.,GARAGES (75)	0.016793	0.012724	0.011029
56	AMUSEMENT & RECREATION (79)	0.017637	0.004335	0.002838
61	MEMBERSHIP ORGANIZATIONS (86)	0.017886	0.003317	0.002583
16	PETROLEUM & COAL PROD. (29)	0.018926	0.001377	0.001492
48	REAL ESTATE (65)	0.018948	0.018680	0.039721
49	COMB. REAL ESTATE, INS. (66)	0.019202	0.000574	0.001230
42	MISCELLANEOUS RETAIL (59)	0.019304	0.011571	0.016001
62	MISCELLANEOUS SERVICES (89)	0.019583	0.017716	0.013546

30	TRANSPORTATION SERVICES (47)	0.020739	0.000728	0.000409
3	FORESTRY (08)	0.020834	0.012847	0.012981
34	WHLSALE-NONDURABLE GOODS (51)	0.021048	0.001267	0.000772
44	CREDIT AGENCIES EX. BANKS (61)	0.022067	0.006447	0.003294
2	AGRI. SERVICES (07)	0.024881	0.004709	0.001874
50	HOLDING-OTH. INV.. OFF'S (67)	0.028099	0.000558	0.000215
47	INS. AGENTS, BROKERS (64)	0.028404	0.004380	0.002356
32	ELEC.,GAS,&SANITARY SERV. (49)	0.028605	0.017253	0.021426
58	LEGAL SERVICES (81)	0.029097	0.003680	0.001941
12	FURNITURE & FIXTURES (25)	0.030922	0.051334	0.020127
57	HEALTH SERVICES (80)	0.031426	0.070378	0.027056
1	AGRICULTURE	0.032026	0.004836	0.002625
59	EDUCATIONAL SERVICES (82)	0.038759	0.002835	0.001057
60	SOCIAL SERVICES (83)	0.047204	0.011808	0.003141
46	INSURANCE CARRIERS (63)	0.088580	0.048947	0.007821
51	HOTELS & OTHER LODGING (70)	0.107216	0.023664	0.003415
45	SECURITY, COMM. BROKERS (62)	0.131092	0.001267	0.000160

County Group 26
Total Model

		SECTHL	CONTRIB	FDSHR
41	MISCELLANEOUS RETAIL (59)	0.015985	0.002606	0.009943
50	PERSONAL SERVICES (72)	0.019917	0.002495	0.003230
38	APPAREL & ACCESS. STORES (56)	0.020390	0.001495	0.002061
37	AUTO. DEALERS-SERV. STAT. (55)	0.020668	0.009907	0.011254
35	GENERAL MERCH. STORES (53)	0.020943	0.003599	0.004074
40	EATING & DRINKING PLACES (58)	0.021992	0.013702	0.018972
42	BANKING (60)	0.022130	0.011765	0.012968
53	MISC. REPAIR SERVICES (76)	0.022149	0.000354	0.000453
39	FURNITURE & HOME FURNISH. (57)	0.022891	0.002785	0.002941
36	FOOD STORES (54)	0.023402	0.009940	0.009265
55	AMUSEMENT & RECREATION (79)	0.023533	0.000732	0.000647
13	PAPER & ALLIED PROD. (26)	0.023675	0.046474	0.059360
56	HEALTH SERVICES (80)	0.025174	0.031916	0.026912
54	MOTION PICTURES (78)	0.025687	0.000205	0.000209
8	SPECIAL TRADE CONTRACTORS (17)	0.026341	0.018656	0.010031
34	BLDG. MAT.-GARDEN SUPPLY (52)	0.026620	0.001350	0.001012
6	GENERAL BLDG. CONTRACTORS (15)	0.026775	0.021717	0.033460
10	TEXTILE MILL PROD. (22)	0.027042	0.016036	0.017347
18	PRIMARY METAL PROD. (33)	0.027118	0.000228	0.000376
25	TRUCKING & WAREHOUSING (42)	0.027266	0.002345	0.002635
9	FOOD & KINDRED PROD. (20)	0.027420	0.287667	0.366933
57	LEGAL SERVICES (81)	0.027434	0.005056	0.004980
24	LOCAL PASS. TRANSIT (41)	0.027520	0.000339	0.000444
5	NONMETAL MIN.-EX. FUELS (14)	0.027643	0.000167	0.000227
12	LUMBER & WOOD PROD. (24)	0.027739	0.033594	0.037601
14	PRINTING & PUBLISHING (27)	0.027908	0.012612	0.013565
20	MACHINERY, EXCEPT ELEC. (35)	0.028056	0.000690	0.000758
11	APPAREL & OTHER PROD. (23)	0.028257	0.023606	0.021629

23	INSTRUMENTS & REL. PROD. (38)	0.028408	0.003385	0.002954
7	HEAVY CONST. CONTRACTORS (16)	0.028542	0.009329	0.005339
19	FABRICATED METAL PROD. (34)	0.028703	0.011597	0.013118
15	CHEMICALS & ALLIED PROD. (28)	0.029080	0.003056	0.004861
17	STONE, CLAY, & GLASS (32)	0.029644	0.010512	0.010472
3	FORESTRY (08)	0.030070	0.000867	0.001577
4	FISHING,HUNTING,&TRAPPING (09)	0.030072	0.015160	0.027600
51	BUSINESS SERVICES (73)	0.030135	0.005777	0.007048
1	AGRICULTURE	0.030812	0.056736	0.072956
2	AGRI. SERVICES (07)	0.031020	0.001020	0.000680
21	ELECTRIC & ELEC. EQUIP. (36)	0.031699	0.002901	0.002508
33	WHLSALE-NONDURABLE GOODS (51)	0.031986	0.039574	0.025884
16	RUBBER & MISC. PLASTICS (30)	0.034044	0.001598	0.001249
28	PIPE LINES-EX. NAT. GAS (46)	0.036295	0.000292	0.000424
52	AUTO REPAIR,SERV.,GARAGES (75)	0.036479	0.006320	0.007320
43	CREDIT AGENCIES EX. BANKS (61)	0.037058	0.002713	0.001511
31	ELEC.,GAS,&SANITARY SERV. (49)	0.038279	0.004415	0.006977
47	COMB. REAL ESTATE, INS. (66)	0.040999	0.001046	0.002283
48	HOLDING-OTH. INV.. OFF'S (67)	0.050910	0.005495	0.002594
58	EDUCATIONAL SERVICES (82)	0.051049	0.003370	0.001655
22	TRANSPORTATION EQUIPMENT (37)	0.052806	0.089169	0.052035
27	TRANSPORTATION BY AIR (45)	0.056307	0.000455	0.000218
46	REAL ESTATE (65)	0.058665	0.010860	0.017690
60	MEMBERSHIP ORGANIZATIONS (86)	0.060680	0.002510	0.001364
61	MISCELLANEOUS SERVICES (89)	0.064347	0.006671	0.003523
26	WATER TRANSPORTATION (44)	0.066642	0.002060	0.004278
49	HOTELS & OTHER LODGING (70)	0.066890	0.012415	0.004460
32	WHLSALE-DURABLE-GOODS (50)	0.067586	0.024320	0.009548
45	INS. AGENTS, BROKERS (64)	0.072692	0.013469	0.006276
44	INSURANCE CARRIERS (63)	0.094966	0.018507	0.005004
30	COMMUNICATION (48)	0.098538	0.032390	0.015445
59	SOCIAL SERVICES (83)	0.137629	0.020400	0.004830
29	TRANSPORTATION SERVICES (47)	0.137856	0.019572	0.003036

County Group 26
Direct Model

		SECTHL	CONTRIB	FDSHR
41	MISCELLANEOUS RETAIL (59)	0.015686	0.000304	0.009943
50	PERSONAL SERVICES (72)	0.018441	0.002794	0.003230
40	EATING & DRINKING PLACES (58)	0.019431	0.009692	0.018972
51	BUSINESS SERVICES (73)	0.019574	0.001927	0.007048
53	MISC. REPAIR SERVICES (76)	0.019603	0.000355	0.000453
37	AUTO. DEALERS-SERV. STAT. (55)	0.019796	0.011836	0.011254
35	GENERAL MERCH. STORES (53)	0.020212	0.004378	0.004074
38	APPAREL & ACCESS. STORES (56)	0.020358	0.001694	0.002061
42	BANKING (60)	0.020926	0.014820	0.012968
55	AMUSEMENT & RECREATION (79)	0.021919	0.000875	0.000647
13	PAPER & ALLIED PROD. (26)	0.022000	0.041594	0.059360
39	FURNITURE & HOME FURNISH. (57)	0.022125	0.003576	0.002941

36	FOOD STORES (54)	0.022397	0.012825	0.009265
54	MOTION PICTURES (78)	0.024406	0.000238	0.000209
56	HEALTH SERVICES (80)	0.024560	0.038762	0.026912
34	BLDG. MAT.-GARDEN SUPPLY (52)	0.025623	0.001849	0.001012
8	SPECIAL TRADE CONTRACTORS (17)	0.026217	0.025575	0.010031
9	FOOD & KINDRED PROD. (20)	0.026455	0.182300	0.366933
10	TEXTILE MILL PROD. (22)	0.026885	0.015222	0.017347
18	PRIMARY METAL PROD. (33)	0.026895	0.000247	0.000376
57	LEGAL SERVICES (81)	0.026986	0.006221	0.004980
20	MACHINERY, EXCEPT ELEC. (35)	0.027541	0.000810	0.000758
14	PRINTING & PUBLISHING (27)	0.027837	0.010897	0.013565
6	GENERAL BLDG. CONTRACTORS (15)	0.027867	0.020079	0.033460
24	LOCAL PASS. TRANSIT (41)	0.027882	0.000399	0.000444
5	NONMETAL MIN.-EX. FUELS (14)	0.028041	0.000209	0.000227
12	LUMBER & WOOD PROD. (24)	0.028192	0.028538	0.037601
7	HEAVY CONST. CONTRACTORS (16)	0.028282	0.013065	0.005339
23	INSTRUMENTS & REL. PROD. (38)	0.028302	0.003998	0.002954
19	FABRICATED METAL PROD. (34)	0.028363	0.014375	0.013118
11	APPAREL & OTHER PROD. (23)	0.028630	0.022773	0.021629
25	TRUCKING & WAREHOUSING (42)	0.028904	0.002484	0.002635
15	CHEMICALS & ALLIED PROD. (28)	0.030004	0.002945	0.004861
17	STONE, CLAY, & GLASS (32)	0.030828	0.012488	0.010472
33	WHLSALE-NONDURABLE GOODS (51)	0.031462	0.055715	0.025884
21	ELECTRIC & ELEC. EQUIP. (36)	0.032819	0.003447	0.002508
3	FORESTRY (08)	0.033434	0.000658	0.001577
4	FISHING,HUNTING,&TRAPPING (09)	0.033434	0.011528	0.027600
2	AGRI. SERVICES (07)	0.033435	0.001189	0.000680
52	AUTO REPAIR,SERV.,GARAGES (75)	0.036132	0.004672	0.007320
1	AGRICULTURE	0.036418	0.037804	0.072956
16	RUBBER & MISC. PLASTICS (30)	0.036643	0.002007	0.001249
43	CREDIT AGENCIES EX. BANKS (61)	0.039853	0.003742	0.001511
31	ELEC.,GAS,&SANITARY SERV. (49)	0.040955	0.005603	0.006977
28	PIPE LINES-EX. NAT. GAS (46)	0.044676	0.000327	0.000424
58	EDUCATIONAL SERVICES (82)	0.057435	0.004997	0.001655
48	HOLDING-OTH. INV.. OFF'S (67)	0.059146	0.007839	0.002594
47	COMB. REAL ESTATE, INS. (66)	0.059147	0.001075	0.002283
27	TRANSPORTATION BY AIR (45)	0.059886	0.000614	0.000218
22	TRANSPORTATION EQUIPMENT (37)	0.062657	0.117976	0.052035
32	WHLSALE-DURABLE-GOODS (50)	0.075270	0.037989	0.009548
60	MEMBERSHIP ORGANIZATIONS (86)	0.076178	0.003446	0.001364
61	MISCELLANEOUS SERVICES (89)	0.076179	0.009484	0.003523
49	HOTELS & OTHER LODGING (70)	0.079493	0.018078	0.004460
45	INS. AGENTS, BROKERS (64)	0.089444	0.019410	0.006276
26	WATER TRANSPORTATION (44)	0.095799	-.000005	0.004278
46	REAL ESTATE (65)	0.103473	0.013042	0.017690
44	INSURANCE CARRIERS (63)	0.125126	0.022609	0.005004
59	SOCIAL SERVICES (83)	0.161002	0.031788	0.004830
30	COMMUNICATION (48)	0.171812	0.043415	0.015445
29	TRANSPORTATION SERVICES (47)	0.171816	0.031407	0.003036

County Group 26
No-C Model

		SECTHL	CONTRIB	FDSHR
41	MISCELLANEOUS RETAIL (59)	0.015767	0.001146	0.009943
50	PERSONAL SERVICES (72)	0.019145	0.002270	0.003230
37	AUTO. DEALERS-SERV. STAT. (55)	0.020114	0.009131	0.011254
38	APPAREL & ACCESS. STORES (56)	0.020322	0.001326	0.002061
35	GENERAL MERCH. STORES (53)	0.020434	0.003314	0.004074
40	EATING & DRINKING PLACES (58)	0.021301	0.012947	0.018972
53	MISC. REPAIR SERVICES (76)	0.021334	0.000337	0.000453
42	BANKING (60)	0.021376	0.011023	0.012968
39	FURNITURE & HOME FURNISH. (57)	0.022395	0.002554	0.002941
55	AMUSEMENT & RECREATION (79)	0.022769	0.000703	0.000647
36	FOOD STORES (54)	0.022781	0.009442	0.009265
13	PAPER & ALLIED PROD. (26)	0.023170	0.045259	0.059360
56	HEALTH SERVICES (80)	0.024790	0.030911	0.026912
54	MOTION PICTURES (78)	0.025151	0.000202	0.000209
8	SPECIAL TRADE CONTRACTORS (17)	0.026076	0.018497	0.010031
34	BLDG. MAT.-GARDEN SUPPLY (52)	0.026151	0.001330	0.001012
6	GENERAL BLDG. CONTRACTORS (15)	0.026605	0.021533	0.033460
10	TEXTILE MILL PROD. (22)	0.026955	0.015912	0.017347
18	PRIMARY METAL PROD. (33)	0.027001	0.000227	0.000376
9	FOOD & KINDRED PROD. (20)	0.027185	0.286785	0.366933
57	LEGAL SERVICES (81)	0.027418	0.004881	0.004980
24	LOCAL PASS. TRANSIT (41)	0.027620	0.000335	0.000444
25	TRUCKING & WAREHOUSING (42)	0.027784	0.002249	0.002635
5	NONMETAL MIN.-EX. FUELS (14)	0.027800	0.000166	0.000227
14	PRINTING & PUBLISHING (27)	0.027911	0.012559	0.013565
12	LUMBER & WOOD PROD. (24)	0.027992	0.033404	0.037601
20	MACHINERY, EXCEPT ELEC. (35)	0.028024	0.000689	0.000758
11	APPAREL & OTHER PROD. (23)	0.028092	0.023566	0.021629
7	HEAVY CONST. CONTRACTORS (16)	0.028269	0.009311	0.005339
23	INSTRUMENTS & REL. PROD. (38)	0.028405	0.003382	0.002954
19	FABRICATED METAL PROD. (34)	0.028609	0.011604	0.013118
15	CHEMICALS & ALLIED PROD. (28)	0.028987	0.003064	0.004861
17	STONE, CLAY, & GLASS (32)	0.029711	0.010549	0.010472
51	BUSINESS SERVICES (73)	0.030055	0.005755	0.007048
3	FORESTRY (08)	0.030308	0.000864	0.001577
4	FISHING,HUNTING,&TRAPPING (09)	0.030309	0.015107	0.027600
1	AGRICULTURE	0.031380	0.057090	0.072956
2	AGRI. SERVICES (07)	0.031612	0.001011	0.000680
33	WHLSALE-NONDURABLE GOODS (51)	0.031910	0.039672	0.025884
21	ELECTRIC & ELEC. EQUIP. (36)	0.032009	0.002928	0.002508
16	RUBBER & MISC. PLASTICS (30)	0.034399	0.001621	0.001249
28	PIPE LINES-EX. NAT. GAS (46)	0.036726	0.000294	0.000424
52	AUTO REPAIR,SERV.,GARAGES (75)	0.036892	0.006392	0.007320
43	CREDIT AGENCIES EX. BANKS (61)	0.037656	0.002744	0.001511
31	ELEC.,GAS,&SANITARY SERV. (49)	0.038834	0.004473	0.006977
47	COMB. REAL ESTATE, INS. (66)	0.041995	0.001060	0.002283
48	HOLDING-OTH. INV.. OFF'S (67)	0.053135	0.005595	0.002594

58	EDUCATIONAL SERVICES (82)	0.053310	0.003498	0.001655
22	TRANSPORTATION EQUIPMENT (37)	0.055762	0.092488	0.052035
27	TRANSPORTATION BY AIR (45)	0.059498	0.000467	0.000218
46	REAL ESTATE (65)	0.061700	0.011217	0.017690
60	MEMBERSHIP ORGANIZATIONS (86)	0.065664	0.002597	0.001364
61	MISCELLANEOUS SERVICES (89)	0.069913	0.006913	0.003523
49	HOTELS & OTHER LODGING (70)	0.071005	0.012564	0.004460
32	WHLSALE-DURABLE-GOODS (50)	0.072438	0.025422	0.009548
26	WATER TRANSPORTATION (44)	0.075062	0.001784	0.004278
45	INS. AGENTS, BROKERS (64)	0.077296	0.013889	0.006276
44	INSURANCE CARRIERS (63)	0.102622	0.019034	0.005004
30	COMMUNICATION (48)	0.108096	0.033703	0.015445
59	SOCIAL SERVICES (83)	0.151021	0.020741	0.004830
29	TRANSPORTATION SERVICES (47)	0.154749	0.020471	0.003036

County Group 26
No-I Model

		SECTHL	CONTRIB	FDSHR
41	MISCELLANEOUS RETAIL (59)	0.015627	0.002065	0.009943
50	PERSONAL SERVICES (72)	0.018995	0.003064	0.003230
40	EATING & DRINKING PLACES (58)	0.019874	0.010620	0.018972
37	AUTO. DEALERS-SERV. STAT. (55)	0.020091	0.012848	0.011254
38	APPAREL & ACCESS. STORES (56)	0.020176	0.001911	0.002061
51	BUSINESS SERVICES (73)	0.020252	0.002035	0.007048
53	MISC. REPAIR SERVICES (76)	0.020270	0.000376	0.000453
35	GENERAL MERCH. STORES (53)	0.020491	0.004743	0.004074
42	BANKING (60)	0.021499	0.015747	0.012968
13	PAPER & ALLIED PROD. (26)	0.022347	0.042869	0.059360
39	FURNITURE & HOME FURNISH. (57)	0.022473	0.003862	0.002941
55	AMUSEMENT & RECREATION (79)	0.022540	0.000910	0.000647
36	FOOD STORES (54)	0.022852	0.013459	0.009265
56	HEALTH SERVICES (80)	0.024774	0.039982	0.026912
54	MOTION PICTURES (78)	0.024819	0.000242	0.000209
34	BLDG. MAT.-GARDEN SUPPLY (52)	0.025980	0.001876	0.001012
8	SPECIAL TRADE CONTRACTORS (17)	0.026326	0.025734	0.010031
9	FOOD & KINDRED PROD. (20)	0.026584	0.183234	0.366933
18	PRIMARY METAL PROD. (33)	0.026775	0.000249	0.000376
10	TEXTILE MILL PROD. (22)	0.026787	0.015362	0.017347
57	LEGAL SERVICES (81)	0.026893	0.006449	0.004980
14	PRINTING & PUBLISHING (27)	0.027366	0.010994	0.013565
20	MACHINERY, EXCEPT ELEC. (35)	0.027465	0.000812	0.000758
6	GENERAL BLDG. CONTRACTORS (15)	0.027552	0.020201	0.033460
24	LOCAL PASS. TRANSIT (41)	0.027570	0.000404	0.000444
12	LUMBER & WOOD PROD. (24)	0.027652	0.028910	0.037601
5	NONMETAL MIN.-EX. FUELS (14)	0.027693	0.000210	0.000227
25	TRUCKING & WAREHOUSING (42)	0.028037	0.002611	0.002635
23	INSTRUMENTS & REL. PROD. (38)	0.028174	0.004005	0.002954
19	FABRICATED METAL PROD. (34)	0.028367	0.014378	0.013118
7	HEAVY CONST. CONTRACTORS (16)	0.028451	0.013071	0.005339

11	APPAREL & OTHER PROD. (23)	0.028647	0.022762	0.021629
15	CHEMICALS & ALLIED PROD. (28)	0.029849	0.002933	0.004861
17	STONE, CLAY, & GLASS (32)	0.030558	0.012423	0.010472
33	WHLSALE-NONDURABLE GOODS (51)	0.031525	0.055613	0.025884
21	ELECTRIC & ELEC. EQUIP. (36)	0.032371	0.003414	0.002508
3	FORESTRY (08)	0.032582	0.000667	0.001577
4	FISHING,HUNTING,&TRAPPING (09)	0.032582	0.011669	0.027600
2	AGRI. SERVICES (07)	0.032584	0.001203	0.000680
1	AGRICULTURE	0.034887	0.037584	0.072956
52	AUTO REPAIR,SERV.,GARAGES (75)	0.035718	0.004692	0.007320
16	RUBBER & MISC. PLASTICS (30)	0.036114	0.001979	0.001249
43	CREDIT AGENCIES EX. BANKS (61)	0.039158	0.003696	0.001511
31	ELEC.,GAS,&SANITARY SERV. (49)	0.040330	0.005529	0.006977
28	PIPE LINES-EX. NAT. GAS (46)	0.043581	0.000324	0.000424
58	EDUCATIONAL SERVICES (82)	0.055179	0.004839	0.001655
48	HOLDING-OTH. INV.. OFF'S (67)	0.056791	0.007690	0.002594
47	COMB. REAL ESTATE, INS. (66)	0.056792	0.001055	0.002283
27	TRANSPORTATION BY AIR (45)	0.057238	0.000601	0.000218
22	TRANSPORTATION EQUIPMENT (37)	0.059562	0.113997	0.052035
60	MEMBERSHIP ORGANIZATIONS (86)	0.070773	0.003351	0.001364
61	MISCELLANEOUS SERVICES (89)	0.070774	0.009222	0.003523
32	WHLSALE-DURABLE-GOODS (50)	0.071018	0.036626	0.009548
49	HOTELS & OTHER LODGING (70)	0.075455	0.017862	0.004460
45	INS. AGENTS, BROKERS (64)	0.084651	0.018869	0.006276
26	WATER TRANSPORTATION (44)	0.085566	0.000316	0.004278
46	REAL ESTATE (65)	0.097228	0.012566	0.017690
44	INSURANCE CARRIERS (63)	0.116570	0.022079	0.005004
59	SOCIAL SERVICES (83)	0.149307	0.031313	0.004830
30	COMMUNICATION (48)	0.155185	0.041716	0.015445
29	TRANSPORTATION SERVICES (47)	0.155188	0.030178	0.003036

County Group 26
Full Model

		SECTHL	CONTRIB	FDSHR
41	MISCELLANEOUS RETAIL (59)	0.017890	0.004148	0.009943
38	APPAREL & ACCESS. STORES (56)	0.021631	0.001406	0.002061
50	PERSONAL SERVICES (72)	0.022366	0.002420	0.003230
37	AUTO. DEALERS-SERV. STAT. (55)	0.022596	0.008955	0.011254
35	GENERAL MERCH. STORES (53)	0.022625	0.003212	0.004074
42	BANKING (60)	0.024245	0.010654	0.012968
39	FURNITURE & HOME FURNISH. (57)	0.024462	0.002445	0.002941
40	EATING & DRINKING PLACES (58)	0.024832	0.015342	0.018972
36	FOOD STORES (54)	0.025220	0.008548	0.009265
53	MISC. REPAIR SERVICES (76)	0.025469	0.000382	0.000453
55	AMUSEMENT & RECREATION (79)	0.025949	0.000678	0.000647
13	PAPER & ALLIED PROD. (26)	0.026275	0.052590	0.059360
56	HEALTH SERVICES (80)	0.026926	0.028677	0.026912
8	SPECIAL TRADE CONTRACTORS (17)	0.027506	0.014405	0.010031
25	TRUCKING & WAREHOUSING (42)	0.027566	0.002184	0.002635

54	MOTION PICTURES (78)	0.028024	0.000231	0.000209
34	BLDG. MAT.-GARDEN SUPPLY (52)	0.028508	0.001124	0.001012
10	TEXTILE MILL PROD. (22)	0.028679	0.018772	0.017347
24	LOCAL PASS. TRANSIT (41)	0.028708	0.000300	0.000444
5	NONMETAL MIN.-EX. FUELS (14)	0.028713	0.000163	0.000227
57	LEGAL SERVICES (81)	0.028742	0.004511	0.004980
18	PRIMARY METAL PROD. (33)	0.028806	0.000303	0.000376
12	LUMBER & WOOD PROD. (24)	0.028986	0.039468	0.037601
9	FOOD & KINDRED PROD. (20)	0.029112	0.321481	0.366933
6	GENERAL BLDG. CONTRACTORS (15)	0.029194	0.020877	0.033460
11	APPAREL & OTHER PROD. (23)	0.029415	0.024827	0.021629
20	MACHINERY, EXCEPT ELEC. (35)	0.029571	0.000818	0.000758
23	INSTRUMENTS & REL. PROD. (38)	0.029726	0.003512	0.002954
19	FABRICATED METAL PROD. (34)	0.029818	0.013884	0.013118
7	HEAVY CONST. CONTRACTORS (16)	0.029821	0.007296	0.005339
14	PRINTING & PUBLISHING (27)	0.030302	0.015223	0.013565
17	STONE, CLAY, & GLASS (32)	0.030348	0.010001	0.010472
15	CHEMICALS & ALLIED PROD. (28)	0.030510	0.004352	0.004861
4	FISHING,HUNTING,&TRAPPING (09)	0.030535	0.016284	0.027600
3	FORESTRY (08)	0.030536	0.000931	0.001577
2	AGRI. SERVICES (07)	0.030734	0.000928	0.000680
1	AGRICULTURE	0.030786	0.058331	0.072956
21	ELECTRIC & ELEC. EQUIP. (36)	0.031750	0.003082	0.002508
33	WHLSALE-NONDURABLE GOODS (51)	0.033031	0.032466	0.025884
16	RUBBER & MISC. PLASTICS (30)	0.033261	0.001614	0.001249
51	BUSINESS SERVICES (73)	0.034032	0.009050	0.007048
28	PIPE LINES-EX. NAT. GAS (46)	0.035955	0.000253	0.000424
43	CREDIT AGENCIES EX. BANKS (61)	0.036649	0.002278	0.001511
52	AUTO REPAIR,SERV.,GARAGES (75)	0.036889	0.007436	0.007320
31	ELEC.,GAS,&SANITARY SERV. (49)	0.038184	0.003610	0.006977
47	COMB. REAL ESTATE, INS. (66)	0.040319	0.000908	0.002283
22	TRANSPORTATION EQUIPMENT (37)	0.044534	0.081811	0.052035
48	HOLDING-OTH. INV.. OFF'S (67)	0.046523	0.004474	0.002594
58	EDUCATIONAL SERVICES (82)	0.047563	0.002572	0.001655
26	WATER TRANSPORTATION (44)	0.050770	0.002464	0.004278
27	TRANSPORTATION BY AIR (45)	0.051183	0.000370	0.000218
60	MEMBERSHIP ORGANIZATIONS (86)	0.052136	0.001972	0.001364
46	REAL ESTATE (65)	0.052918	0.008848	0.017690
61	MISCELLANEOUS SERVICES (89)	0.055689	0.005151	0.003523
49	HOTELS & OTHER LODGING (70)	0.058586	0.009702	0.004460
32	WHLSALE-DURABLE-GOODS (50)	0.060596	0.017804	0.009548
45	INS. AGENTS, BROKERS (64)	0.060757	0.010962	0.006276
30	COMMUNICATION (48)	0.064482	0.030608	0.015445
44	INSURANCE CARRIERS (63)	0.081202	0.013895	0.005004
29	TRANSPORTATION SERVICES (47)	0.113827	0.014253	0.003036
59	SOCIAL SERVICES (83)	0.115521	0.014750	0.004830

APPENDIX C

This appendix was derived from the sectoral inequality impacts found in Appendix B. Each column is the ratio of the corresponding inequality impact from Appendix B divided by the Direct inquality impact.

County Group 1

SECTOR	TOTAL	N-CONS	N-I/I	FULL
43 COMB. REAL ESTATE, INS. (66)	0.524896	0.562988	0.930219	0.453384
42 REAL ESTATE (65)	0.550129	0.586347	0.932772	0.486290
26 COMMUNICATION (48)	0.600503	0.627850	0.941618	0.492998
12 FURNITURE & FIXTURES (25)	0.612818	0.650232	0.931784	0.495590
1 AGRICULTURE	0.713131	0.737589	0.952396	0.655109
41 INS. AGENTS, BROKERS (64)	0.746108	0.808685	0.933553	0.594302
44 HOLDING-OTH. INV.. OFF'S (67)	0.758677	0.826712	0.930173	0.592960
53 EDUCATIONAL SERVICES (82)	0.827709	0.882003	0.945896	0.724178
45 HOTELS & OTHER LODGING (70)	0.832753	0.882354	0.949104	0.738537
54 SOCIAL SERVICES (83)	0.840972	0.922035	0.927985	0.696063
56 MEMBERSHIP ORGANIZATIONS (86)	0.852883	0.892482	0.957885	0.786269
25 TRANSPORTATION SERVICES (47)	0.855660	0.918637	0.941602	0.756523
40 INSURANCE CARRIERS (63)	0.859588	0.915613	0.943856	0.781055
27 WHLSALE-DURABLE-GOODS (50)	0.860782	0.937438	0.932110	0.743843
39 SECURITY, COMM. BROKERS (62)	0.893385	0.948741	0.951085	0.809602
57 MISCELLANEOUS SERVICES (89)	0.895591	0.941172	0.957861	0.825060
23 TRUCKING & WAREHOUSING (42)	0.900778	0.935262	0.958526	0.872961
15 LEATHER & LEATHER PROD. (31)	0.907834	0.921159	0.981538	0.878632
14 RUBBER & MISC. PLASTICS (30)	0.915325	0.923396	0.984562	0.898397
22 LOCAL PASS. TRANSIT (41)	0.918038	0.936596	0.978281	0.909310
55 MUSEUMS,BOTAN-ZOO.GARDENS (84)	0.921718	0.942573	0.977029	0.900292
21 TRANSPORTATION EQUIPMENT (37)	0.924358	0.935833	0.985165	0.907057
38 CREDIT AGENCIES EX. BANKS (61)	0.931988	0.949633	0.980172	0.923808
20 ELECTRIC & ELEC. EQUIP. (36)	0.947658	0.951924	0.987032	0.958792
2 AGRI. SERVICES (07)	0.950609	0.961727	0.987066	0.940095
35 EATING & DRINKING PLACES (58)	0.961806	0.957350	0.995635	0.997408
34 FURNITURE & HOME FURNISH. (57)	0.970419	0.988406	0.983547	0.963770
18 FABRICATED METAL PROD. (34)	0.974134	0.971692	0.997603	0.998056
5 GENERAL BLDG. CONTRACTORS (15)	0.975909	0.964289	0.992587	1.053942
19 MACHINERY, EXCEPT ELEC. (35)	0.985542	0.984914	0.997216	1.009070
33 APPAREL & ACCESS. STORES (56)	0.985719	0.995543	0.990999	0.994894
3 BITUM. COAL & LIGNITE (12)	0.987159	0.984397	0.992940	1.028802
16 STONE, CLAY, & GLASS (32)	0.988119	0.985243	0.998633	1.018481
6 HEAVY CONST. CONTRACTORS (16)	0.988540	0.989150	0.997778	1.015469
28 WHLSALE-NONDURABLE GOODS (51)	0.989208	0.997992	0.991969	0.988664
7 SPECIAL TRADE CONTRACTORS (17)	0.990129	0.987925	0.999587	1.019284
36 MISCELLANEOUS RETAIL (59)	0.991211	0.991919	0.988021	1.050822
48 AUTO REPAIR,SERV.,GARAGES (75)	0.991306	0.994708	0.991306	1.019950

13 PRINTING & PUBLISHING (27)	0.992499	0.984843	0.987823	1.063454
30 GENERAL MERCH. STORES (53)	0.994977	0.997214	0.997352	1.013106
9 TEXTILE MILL PROD. (22)	0.996158	0.989003	1.001345	1.037553
4 NONMETAL MIN.-EX. FUELS (14)	0.997705	0.994034	0.995615	1.043751
24 TRANSPORTATION BY AIR (45)	0.999288	1.007662	0.990538	1.016538
31 FOOD STORES (54)	1.003349	0.999350	1.001749	1.033687
51 HEALTH SERVICES (80)	1.003780	1.000861	1.000191	1.039286
37 BANKING (60)	1.004487	1.000838	1.001824	1.038414
32 AUTO. DEALERS-SERV. STAT. (55)	1.007977	1.005574	1.001345	1.038777
8 FOOD & KINDRED PROD. (20)	1.011492	1.007600	0.999817	1.056545
52 LEGAL SERVICES (81)	1.020390	1.013315	1.001114	1.071476
49 MISC. REPAIR SERVICES (76)	1.026326	1.011732	1.004266	1.105698
29 BLDG. MAT.-GARDEN SUPPLY (52)	1.030787	1.016602	1.011976	1.090975
17 PRIMARY METAL PROD. (33)	1.031396	1.021457	1.003734	1.090087
10 APPAREL & OTHER PROD. (23)	1.034408	1.022646	1.008873	1.088935
46 PERSONAL SERVICES (72)	1.037762	1.019449	1.009283	1.113160
50 AMUSEMENT & RECREATION (79)	1.042922	1.026044	1.012239	1.115688
11 LUMBER & WOOD PROD. (24)	1.043898	1.027722	1.003544	1.129008
47 BUSINESS SERVICES (73)	1.174990	1.164357	1.010011	1.225722

County Group 8

SECTOR	TOTAL	N-CONS	N-I/I	FULL
13 FURNITURE & FIXTURES (25)	0.682986	0.723573	0.942185	0.469199
44 REAL ESTATE (65)	0.791250	0.812524	0.965213	0.675627
49 AUTO REPAIR,SERV.,GARAGES (75)	0.846165	0.865413	0.972598	0.716124
46 HOTELS & OTHER LODGING (70)	0.873591	0.913078	0.959798	0.712672
42 INSURANCE CARRIERS (63)	0.875643	0.908087	0.965367	0.764874
37 EATING & DRINKING PLACES (58)	0.881326	0.888433	0.984330	0.833057
16 PETROLEUM & COAL PROD. (29)	0.887454	0.895090	0.985873	0.855404
55 EDUCATIONAL SERVICES (82)	0.887456	0.931993	0.956465	0.712031
43 INS. AGENTS, BROKERS (64)	0.890453	0.922374	0.965696	0.760575
27 COMMUNICATION (48)	0.896974	0.905211	0.986843	0.840096
56 SOCIAL SERVICES (83)	0.904845	0.956041	0.952247	0.733986
28 ELEC.,GAS,&SANITARY SERV. (49)	0.934464	0.955123	0.978941	0.803972
57 MEMBERSHIP ORGANIZATIONS (86)	0.936719	0.958527	0.977690	0.862860
22 TRANSPORTATION EQUIPMENT (37)	0.943518	0.954135	0.987707	0.900715
40 CREDIT AGENCIES EX. BANKS (61)	0.947948	0.963449	0.983887	0.902790
41 SECURITY, COMM. BROKERS (62)	0.952303	0.978256	0.975615	0.885418
29 WHLSALE-DURABLE-GOODS (50)	0.954191	0.985069	0.972293	0.866987
58 MISCELLANEOUS SERVICES (89)	0.956534	0.980241	0.977690	0.897834
2 AGRI. SERVICES (07)	0.959515	0.974273	0.982857	0.924567
30 WHLSALE-NONDURABLE GOODS (51)	0.959746	0.985274	0.976145	0.894167
36 FURNITURE & HOME FURNISH. (57)	0.960338	0.987297	0.975757	0.890751
54 LEGAL SERVICES (81)	0.960694	0.981728	0.978269	0.926575
51 MOTION PICTURES (78)	0.960888	0.970876	0.988868	0.934821
50 MISC. REPAIR SERVICES (76)	0.970518	0.973877	0.991167	0.993571
1 AGRICULTURE	0.973334	0.974197	0.986285	1.023213
35 APPAREL & ACCESS. STORES (56)	0.975725	0.992981	0.984306	0.939673
32 GENERAL MERCH. STORES (53)	0.978447	0.991070	0.988463	0.951801

39 BANKING (60)	0.983326	0.991324	0.992531	0.967130
24 MISC. MANUFACTURING IND'S (39)	0.987750	0.987444	0.998944	1.000722
34 AUTO. DEALERS-SERV. STAT. (55)	0.987996	0.996760	0.991979	0.978169
7 GENERAL BLDG. CONTRACTORS (15)	0.988282	0.987398	0.995524	1.021981
5 OIL & GAS EXTRACTION (13)	0.990202	0.993665	0.994904	1.003210
33 FOOD STORES (54)	0.991373	0.997843	0.994103	0.986567
45 HOLDING-OTH. INV.. OFF'S (67)	0.991800	0.994777	0.994835	1.028014
17 STONE, CLAY, & GLASS (32)	0.992031	0.991389	0.998832	1.014595
14 PRINTING & PUBLISHING (27)	0.993506	0.995602	0.995544	1.029181
6 NONMETAL MIN.-EX. FUELS (14)	0.994312	0.998001	0.994932	1.006026
4 BITUM. COAL & LIGNITE (12)	0.996607	0.999362	0.995882	1.011977
3 METAL MINING (10)	0.997477	1.000261	0.995882	1.015370
8 HEAVY CONST. CONTRACTORS (16)	0.997658	0.998335	0.998448	1.016873
25 LOCAL PASS. TRANSIT (41)	1.001903	1.001237	0.997780	1.048172
9 SPECIAL TRADE CONTRACTORS (17)	1.003633	1.000185	1.001816	1.033128
26 TRUCKING & WAREHOUSING (42)	1.005587	1.003809	0.995218	1.098739
11 APPAREL & OTHER PROD. (23)	1.007273	1.005303	1.000424	1.041609
31 BLDG. MAT.-GARDEN SUPPLY (52)	1.009748	1.006629	1.002460	1.050660
10 FOOD & KINDRED PROD. (20)	1.016173	1.012382	1.001773	1.016877
21 ELECTRIC & ELEC. EQUIP. (36)	1.017814	1.014703	1.002440	1.053015
15 CHEMICALS & ALLIED PROD. (28)	1.018357	1.014760	1.002460	1.061099
20 MACHINERY, EXCEPT ELEC. (35)	1.020055	1.017434	1.001981	1.051143
23 INSTRUMENTS & REL. PROD. (38)	1.020555	1.016065	1.003384	1.064133
19 FABRICATED METAL PROD. (34)	1.028951	1.023882	1.004560	1.074642
52 AMUSEMENT & RECREATION (79)	1.029321	1.015531	1.011794	1.107885
53 HEALTH SERVICES (80)	1.030408	1.018477	1.010312	1.101851
18 PRIMARY METAL PROD. (33)	1.033117	1.028441	1.003747	1.088204
38 MISCELLANEOUS RETAIL (59)	1.043633	1.012420	1.016211	1.269296
48 BUSINESS SERVICES (73)	1.102703	1.095300	1.010398	1.199518
47 PERSONAL SERVICES (72)	1.109164	1.061568	1.040670	1.328203
12 LUMBER & WOOD PROD. (24)	1.119736	1.103064	1.014952	1.234270

County Group 24

SECTOR	TOTAL	N-CONS	N-I/I	FULL
16 PETROLEUM & COAL PROD. (29)	0.518606	0.579665	0.885025	0.423761
49 COMB. REAL ESTATE, INS. (66)	0.522893	0.538910	0.937255	0.488974
48 REAL ESTATE (65)	0.525045	0.541335	0.932635	0.491505
12 FURNITURE & FIXTURES (25)	0.528476	0.556993	0.934301	0.362581
5 GENERAL BLDG. CONTRACTORS (15)	0.565715	0.583918	0.878972	0.578197
1 AGRICULTURE	0.579073	0.614852	0.931206	0.391468
14 PRINTING & PUBLISHING (27)	0.592874	0.639973	0.871224	0.520020
31 COMMUNICATION (48)	0.612630	0.614017	0.954277	0.535526
46 INSURANCE CARRIERS (63)	0.612974	0.689905	0.881111	0.421046
54 AUTO REPAIR, SERV., GARAGES (75)	0.613721	0.618591	0.968180	0.404816
4 NONMETAL MIN.-EX. FUELS (14)	0.685858	0.766676	0.873113	0.556316
51 HOTELS & OTHER LODGING (70)	0.688127	0.781957	0.882896	0.510509
3 FORESTRY (08)	0.707148	0.715172	0.972866	0.574509
47 INS. AGENTS, BROKERS (64)	0.753092	0.807292	0.932255	0.607780
45 SECURITY, COMM. BROKERS (62)	0.765627	0.885130	0.874956	0.598870

53 BUSINESS SERVICES (73)	0.765814	0.733789	1.030168	0.794192
59 EDUCATIONAL SERVICES (82)	0.770625	0.828788	0.934577	0.635206
42 MISCELLANEOUS RETAIL (59)	0.783438	0.866481	0.910656	0.640202
19 STONE, CLAY, & GLASS (32)	0.800058	0.830679	0.919849	0.773293
50 HOLDING-OTH. INV.. OFF'S (67)	0.811733	0.868004	0.937210	0.715461
32 ELEC.,GAS,&SANITARY SERV. (49)	0.816414	0.835784	0.976255	0.753874
2 AGRI. SERVICES (07)	0.820428	0.842544	0.972866	0.686107
55 MISC. REPAIR SERVICES (76)	0.830714	0.813770	0.999519	0.775016
57 HEALTH SERVICES (80)	0.834922	0.867232	0.968532	0.715056
27 TRUCKING & WAREHOUSING (42)	0.846862	0.890547	0.948547	0.687178
25 MISC. MANUFACTURING IND'S (39)	0.852367	0.851119	0.929393	0.949719
23 ELECTRIC & ELEC. EQUIP. (36)	0.854581	0.875843	0.930578	0.872171
33 WHLSALE-DURABLE-GOODS (50)	0.855434	0.930754	0.918837	0.761066
60 SOCIAL SERVICES (83)	0.858230	0.917521	0.947751	0.765951
61 MEMBERSHIP ORGANIZATIONS (86)	0.865488	0.868046	0.985841	0.816936
52 PERSONAL SERVICES (72)	0.868371	0.881766	0.976512	0.803902
58 LEGAL SERVICES (81)	0.873391	0.918775	0.954852	0.762880
30 TRANSPORTATION SERVICES (47)	0.878296	0.915921	0.954202	0.799499
44 CREDIT AGENCIES EX. BANKS (61)	0.890614	0.905922	0.977831	0.946229
11 LUMBER & WOOD PROD. (24)	0.894508	0.857644	0.998513	0.967810
9 TOBACCO MANUFACTURES (21)	0.904819	0.932667	0.947668	0.932063
34 WHLSALE-NONDURABLE GOODS (51)	0.905023	0.937995	0.965452	0.829151
24 TRANSPORTATION EQUIPMENT (37)	0.908427	0.907172	0.978421	0.911331
17 RUBBER & MISC. PLASTICS (30)	0.910928	0.883337	1.014483	0.910203
18 LEATHER & LEATHER PROD. (31)	0.914348	0.891130	1.012954	0.909110
7 SPECIAL TRADE CONTRACTORS (17)	0.921552	0.942207	0.954413	0.960046
20 PRIMARY METAL PROD. (33)	0.927322	0.906370	0.962305	0.981386
29 TRANSPORTATION BY AIR (45)	0.936058	0.917556	0.988106	1.001118
22 MACHINERY, EXCEPT ELEC. (35)	0.939193	0.920886	0.997011	0.982440
56 AMUSEMENT & RECREATION (79)	0.954968	0.950048	0.999947	0.943256
26 LOCAL PASS. TRANSIT (41)	0.963199	0.926738	0.990459	1.115402
62 MISCELLANEOUS SERVICES (89)	0.963232	0.975336	0.985887	0.894446
21 FABRICATED METAL PROD. (34)	0.983011	0.965915	0.986110	1.055455
10 TEXTILE MILL PROD. (22)	0.996371	0.965908	1.001100	1.119433
39 APPAREL & ACCESS. STORES (56)	0.998417	0.975883	1.001218	1.058465
8 FOOD & KINDRED PROD. (20)	1.001521	0.970240	0.970023	1.472141
15 CHEMICALS & ALLIED PROD. (28)	1.002701	0.970740	0.960500	1.140896
40 FURNITURE & HOME FURNISH. (57)	1.017722	0.994831	1.012092	1.051320
6 HEAVY CONST. CONTRACTORS (16)	1.025239	0.990561	1.016210	1.113676
13 PAPER & ALLIED PROD. (26)	1.030711	0.978757	1.010925	1.171765
35 BLDG. MAT.-GARDEN SUPPLY (52)	1.040239	1.009723	1.022962	1.081451
43 BANKING (60)	1.052380	1.002634	1.038432	1.186305
28 WATER TRANSPORTATION (44)	1.073536	1.010411	1.057506	1.088243
37 FOOD STORES (54)	1.088867	1.024930	1.048141	1.174296
41 EATING & DRINKING PLACES (58)	1.092778	1.017051	1.045511	1.389042
36 GENERAL MERCH. STORES (53)	1.100932	1.022383	1.056027	1.232726
38 AUTO. DEALERS-SERV. STAT. (55)	1.142541	1.052088	1.062564	1.302199

County Group 26

SECTOR	TOTAL	N-CONS	N-I/I	FULL
46 REAL ESTATE (65)	0.566960	0.596291	0.939646	0.511418
30 COMMUNICATION (48)	0.573522	0.629153	0.903226	0.375306
47 COMB. REAL ESTATE, INS. (66)	0.693171	0.710011	0.960184	0.681674
26 WATER TRANSPORTATION (44)	0.695644	0.783536	0.893183	0.529964
44 INSURANCE CARRIERS (63)	0.758963	0.820149	0.931621	0.648962
60 MEMBERSHIP ORGANIZATIONS (86)	0.796555	0.861981	0.929048	0.684397
29 TRANSPORTATION SERVICES (47)	0.802347	0.900667	0.903222	0.662494
28 PIPE LINES-EX. NAT. GAS (46)	0.812405	0.822052	0.975490	0.804795
45 INS. AGENTS, BROKERS (64)	0.812710	0.864183	0.946413	0.679274
49 HOTELS & OTHER LODGING (70)	0.841458	0.893223	0.949203	0.736996
22 TRANSPORTATION EQUIPMENT (37)	0.842779	0.889956	0.950604	0.710759
61 MISCELLANEOUS SERVICES (89)	0.844682	0.917746	0.929049	0.731028
1 AGRICULTURE	0.846065	0.861662	0.957960	0.845351
59 SOCIAL SERVICES (83)	0.854828	0.938007	0.927361	0.717513
48 HOLDING-OTH. INV.. OFF'S (67)	0.860751	0.898370	0.960183	0.786579
58 EDUCATIONAL SERVICES (82)	0.888813	0.928180	0.960721	0.828119
32 WHLSALE-DURABLE-GOODS (50)	0.897914	0.962376	0.943510	0.805049
3 FORESTRY (08)	0.899384	0.906502	0.974517	0.913322
4 FISHING,HUNTING,&TRAPPING (09)	0.899444	0.906532	0.974517	0.913292
2 AGRI. SERVICES (07)	0.927770	0.945476	0.974548	0.919216
16 RUBBER & MISC. PLASTICS (30)	0.929072	0.938760	0.985563	0.907704
43 CREDIT AGENCIES EX. BANKS (61)	0.929867	0.944872	0.982561	0.919605
31 ELEC.,GAS,&SANITARY SERV. (49)	0.934660	0.948211	0.984739	0.932340
27 TRANSPORTATION BY AIR (45)	0.940236	0.993521	0.955783	0.854674
25 TRUCKING & WAREHOUSING (42)	0.943330	0.961251	0.970004	0.953709
6 GENERAL BLDG. CONTRACTORS (15)	0.960814	0.954713	0.988696	1.047619
17 STONE, CLAY, & GLASS (32)	0.961593	0.963767	0.991242	0.984430
21 ELECTRIC & ELEC. EQUIP. (36)	0.965873	0.975319	0.986349	0.967427
15 CHEMICALS & ALLIED PROD. (28)	0.969204	0.966105	0.994834	1.016864
12 LUMBER & WOOD PROD. (24)	0.983932	0.992906	0.980846	1.028164
5 NONMETAL MIN.-EX. FUELS (14)	0.985807	0.991405	0.987590	1.023965
11 APPAREL & OTHER PROD. (23)	0.986972	0.981209	1.000594	1.027419
24 LOCAL PASS. TRANSIT (41)	0.987017	0.990603	0.988810	1.029625
38 APPAREL & ACCESS. STORES (56)	1.001572	0.998232	0.991060	1.062531
14 PRINTING & PUBLISHING (27)	1.002550	1.002658	0.983080	1.088551
23 INSTRUMENTS & REL. PROD. (38)	1.003745	1.003639	0.995477	1.050314
8 SPECIAL TRADE CONTRACTORS (17)	1.004730	0.994622	1.004158	1.049167
10 TEXTILE MILL PROD. (22)	1.005840	1.002604	0.996355	1.066729
18 PRIMARY METAL PROD. (33)	1.008291	1.003941	0.995538	1.071054
7 HEAVY CONST. CONTRACTORS (16)	1.009193	0.999540	1.005975	1.054416
52 AUTO REPAIR,SERV.,GARAGES (75)	1.009604	1.021034	0.988542	1.020951
19 FABRICATED METAL PROD. (34)	1.011987	1.008673	1.000141	1.051299
57 LEGAL SERVICES (81)	1.016601	1.016008	0.996554	1.065071
33 WHLSALE-NONDURABLE GOODS (51)	1.016655	1.014239	1.002002	1.049870
20 MACHINERY, EXCEPT ELEC. (35)	1.018699	1.017537	0.997240	1.073708
41 MISCELLANEOUS RETAIL (59)	1.019062	1.005164	0.996239	1.140508
56 HEALTH SERVICES (80)	1.025000	1.009365	1.008713	1.096335
39 FURNITURE & HOME FURNISH. (57)	1.034621	1.012203	1.015729	1.105627
35 GENERAL MERCH. STORES (53)	1.036167	1.010984	1.013804	1.119385
9 FOOD & KINDRED PROD. (20)	1.036477	1.027594	1.004876	1.100435

34 BLDG. MAT.-GARDEN SUPPLY (52)	1.038910	1.020607	1.013933	1.112594
37 AUTO. DEALERS-SERV. STAT. (55)	1.044049	1.016064	1.014902	1.141443
36 FOOD STORES (54)	1.044872	1.017145	1.020315	1.126044
54 MOTION PICTURES (78)	1.052487	1.030525	1.016922	1.148242
42 BANKING (60)	1.057536	1.021504	1.027382	1.158606
55 AMUSEMENT & RECREATION (79)	1.073635	1.038779	1.028332	1.183859
13 PAPER & ALLIED PROD. (26)	1.076136	1.053182	1.015773	1.194318
50 PERSONAL SERVICES (72)	1.080039	1.038176	1.030042	1.212841
53 MISC. REPAIR SERVICES (76)	1.129878	1.088303	1.034025	1.299240
40 EATING & DRINKING PLACES (58)	1.131800	1.096238	1.022799	1.277958
51 BUSINESS SERVICES (73)	1.539542	1.535455	1.034638	1.738633

APPENDIX D

This appendix presents the results of changing household income for each household group by $1,000,000 for each version of each regional model. THIEL is the household inequality impact. CHNG IQ is the change in overall inequality including the $1,000,000 change. CHNG Y is the ratio of total household income after the transfer to household income before the transfer, e.g., it is the standard I-O income multiplier. TOTAL Y is total household income.

County Group 1

Full Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.023125	0.869583	1.028411	42846820
INCOME GROUP 4	0.023145	0.958664	1.026533	42768580
INCOME GROUP 2	0.023190	0.926487	1.027047	42789970
INCOME GROUP 5	0.023294	0.971237	1.026594	42771120
INCOME GROUP 3	0.023321	0.942373	1.026654	42773620
INCOME GROUP 6	0.023447	0.982910	1.026421	42763890
INCOME GROUP 8	0.023619	1.012203	1.026148	42752520
INCOME GROUP 7	0.023636	0.992513	1.026231	42756000
INCOME GROUP 9	0.023669	1.028030	1.025987	42745810
INCOME GROUP 10	0.023723	1.049963	1.025870	42740960
INCOME GROUP 12	0.023923	1.112903	1.025198	42712950
INCOME GROUP 11	0.023993	1.084508	1.025718	42734630

Direct Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 4	0.023076	0.958919	1.025822	42738930
INCOME GROUP 1	0.023102	0.869975	1.027152	42794350
INCOME GROUP 2	0.023176	0.926803	1.026176	42753690
INCOME GROUP 5	0.023280	0.971518	1.025864	42740710
INCOME GROUP 3	0.023328	0.942650	1.025898	42742100
INCOME GROUP 6	0.023490	0.983182	1.025745	42735720
INCOME GROUP 8	0.023695	1.012458	1.025549	42727560
INCOME GROUP 7	0.023729	0.992764	1.025608	42730020
INCOME GROUP 9	0.023740	1.028271	1.025438	42722930
INCOME GROUP 10	0.023817	1.050209	1.025352	42719390
INCOME GROUP 12	0.024104	1.113094	1.024870	42699290
INCOME GROUP 11	0.024187	1.084752	1.025244	42714880

No Consumption Linkage Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.000000	0.870989	1.024002	42663120
INCOME GROUP 2	0.000000	0.927612	1.024002	42663120
INCOME GROUP 3	0.000000	0.943359	1.024002	42663120
INCOME GROUP 4	0.000000	0.959599	1.024002	42663120
INCOME GROUP 5	0.000000	0.972260	1.024002	42663120
INCOME GROUP 6	0.000000	0.983885	1.024002	42663120
INCOME GROUP 7	0.000000	0.993390	1.024002	42663120
INCOME GROUP 8	0.000000	1.013109	1.024002	42663120
INCOME GROUP 9	0.000000	1.028889	1.024002	42663120
INCOME GROUP 10	0.000000	1.050837	1.024002	42663120
INCOME GROUP 11	0.000000	1.085360	1.024002	42663120
INCOME GROUP 12	0.000000	1.113572	1.024002	42663120

No Interindustry Linkage Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 4	0.023107	0.958871	1.025955	42744480
INCOME GROUP 1	0.023133	0.869905	1.027382	42803960
INCOME GROUP 2	0.023201	0.926746	1.026335	42760320
INCOME GROUP 5	0.023299	0.971466	1.026000	42746380
INCOME GROUP 3	0.023344	0.942599	1.026037	42747880
INCOME GROUP 6	0.023494	0.983131	1.025872	42741030
INCOME GROUP 8	0.023685	1.012410	1.025662	42732260
INCOME GROUP 7	0.023715	0.992717	1.025725	42734900
INCOME GROUP 9	0.023729	1.028225	1.025542	42727300
INCOME GROUP 10	0.023796	1.050161	1.025451	42723500
INCOME GROUP 12	0.024059	1.113057	1.024934	42701930
INCOME GROUP 11	0.024138	1.084704	1.025335	42718640

Total Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.025736	0.868818	1.033077	43041210
INCOME GROUP 2	0.025992	0.925801	1.030386	42929110
INCOME GROUP 4	0.026251	0.958136	1.029344	42885680
INCOME GROUP 3	0.026292	0.941782	1.029603	42896470
INCOME GROUP 5	0.026399	0.970644	1.029477	42891210
INCOME GROUP 6	0.026527	0.982320	1.029144	42877360
INCOME GROUP 7	0.026909	0.991969	1.028838	42864600
INCOME GROUP 8	0.026941	1.011612	1.028659	42857150
INCOME GROUP 9	0.027189	1.027498	1.028340	42843850

INCOME GROUP 10	0.027311	1.049391	1.028116	42834500
INCOME GROUP 12	0.027489	1.112366	1.026636	42772840
INCOME GROUP 11	0.027540	1.083933	1.027794	42821110

County Group 8

Full Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.035486	0.853731	1.034223	34391680
INCOME GROUP 2	0.035895	0.929500	1.032951	34349390
INCOME GROUP 4	0.036058	0.963285	1.032440	34332410
INCOME GROUP 3	0.036063	0.944886	1.032522	34335130
INCOME GROUP 5	0.036101	0.984879	1.032437	34332280
INCOME GROUP 6	0.036771	0.992700	1.032269	34326720
INCOME GROUP 12	0.036802	1.146345	1.031065	34286680
INCOME GROUP 7	0.036948	1.002562	1.032084	34320560
INCOME GROUP 8	0.036969	1.025796	1.031975	34316940
INCOME GROUP 11	0.037000	1.114966	1.031511	34301520
INCOME GROUP 10	0.037003	1.075869	1.031682	34307200
INCOME GROUP 9	0.037058	1.046159	1.031827	34312010

Direct Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.035280	0.853667	1.033425	34365160
INCOME GROUP 2	0.035796	0.929500	1.032397	34330980
INCOME GROUP 4	0.035978	0.963286	1.031998	34317710
INCOME GROUP 3	0.035986	0.944884	1.032056	34319630
INCOME GROUP 5	0.036027	0.984885	1.031996	34317620
INCOME GROUP 12	0.036842	1.146384	1.030886	34280720
INCOME GROUP 6	0.036846	0.992705	1.031868	34313380
INCOME GROUP 7	0.037048	1.002576	1.031714	34308250
INCOME GROUP 11	0.037071	1.115003	1.031250	34292830
INCOME GROUP 8	0.037074	1.025821	1.031629	34305420
INCOME GROUP 10	0.037096	1.075889	1.031390	34297480
INCOME GROUP 9	0.037158	1.046182	1.031510	34301460

No Consumption Linkage Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.000000	0.853607	1.030072	34253650
INCOME GROUP 2	0.000000	0.929609	1.030072	34253650
INCOME GROUP 3	0.000000	0.944965	1.030072	34253650
INCOME GROUP 4	0.000000	0.963414	1.030072	34253650
INCOME GROUP 5	0.000000	0.985010	1.030072	34253650

INCOME GROUP 6	0.000000	0.992800	1.030072	34253650
INCOME GROUP 7	0.000000	1.002707	1.030072	34253650
INCOME GROUP 8	0.000000	1.025989	1.030072	34253650
INCOME GROUP 9	0.000000	1.046337	1.030072	34253650
INCOME GROUP 10	0.000000	1.075999	1.030072	34253650
INCOME GROUP 11	0.000000	1.115211	1.030072	34253650
INCOME GROUP 12	0.000000	1.146585	1.030072	34253650

No Interindustry Linkage Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.035356	0.853675	1.033617	34371540
INCOME GROUP 2	0.035841	0.929497	1.032530	34335390
INCOME GROUP 4	0.036012	0.963279	1.032109	34321380
INCOME GROUP 3	0.036022	0.944881	1.032169	34323400
INCOME GROUP 5	0.036062	0.984879	1.032105	34321280
INCOME GROUP 12	0.036823	1.146372	1.030932	34282260
INCOME GROUP 6	0.036834	0.992699	1.031971	34316780
INCOME GROUP 7	0.037027	1.002569	1.031807	34311360
INCOME GROUP 8	0.037049	1.025811	1.031717	34308370
INCOME GROUP 11	0.037056	1.114989	1.031317	34295060
INCOME GROUP 10	0.037067	1.075881	1.031465	34299980
INCOME GROUP 9	0.037133	1.046173	1.031591	34304180

Total Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.038411	0.854856	1.041723	34641100
INCOME GROUP 2	0.038841	0.929930	1.038174	34523060
INCOME GROUP 3	0.039351	0.945378	1.037221	34491380
INCOME GROUP 4	0.039492	0.963738	1.036896	34480590
INCOME GROUP 5	0.039708	0.985375	1.037060	34486020
INCOME GROUP 6	0.040068	0.993144	1.036611	34471090
INCOME GROUP 7	0.040428	1.002912	1.036232	34458500
INCOME GROUP 8	0.040625	1.026052	1.036008	34451060
INCOME GROUP 9	0.040996	1.046450	1.035598	34437420
INCOME GROUP 10	0.041229	1.076215	1.035305	34427670
INCOME GROUP 11	0.041677	1.115117	1.034862	34412950
INCOME GROUP 12	0.041750	1.146284	1.033370	34363320

County Group 24

Full Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.018968	0.860326	1.020821	58982260
INCOME GROUP 2	0.020268	0.915326	1.019810	58923880
INCOME GROUP 3	0.021931	0.929107	1.019496	58905750
INCOME GROUP 4	0.022428	0.942684	1.019435	58902210
INCOME GROUP 5	0.023148	0.947570	1.019466	58903980
INCOME GROUP 6	0.023254	0.957890	1.019328	58896000
INCOME GROUP 7	0.024546	0.962520	1.019212	58889330
INCOME GROUP 8	0.025275	0.982196	1.019124	58884200
INCOME GROUP 9	0.026724	1.000559	1.019027	58878630
INCOME GROUP 10	0.027884	1.024755	1.018933	58873160
INCOME GROUP 11	0.029968	1.055419	1.018807	58865910
INCOME GROUP 12	0.030195	1.092455	1.018356	58839860

Direct Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.019954	0.860863	1.019884	58928130
INCOME GROUP 2	0.021825	0.915765	1.019143	58885330
INCOME GROUP 3	0.024181	0.929530	1.018917	58872260
INCOME GROUP 4	0.024833	0.943088	1.018878	58870000
INCOME GROUP 5	0.025879	0.947927	1.018902	58871380
INCOME GROUP 6	0.026043	0.958251	1.018800	58865540
INCOME GROUP 7	0.027910	0.962859	1.018716	58860620
INCOME GROUP 8	0.028926	0.982539	1.018653	58857000
INCOME GROUP 9	0.031046	1.000841	1.018584	58853000
INCOME GROUP 10	0.032774	1.025071	1.018513	58848950
INCOME GROUP 11	0.035883	1.055707	1.018421	58843630
INCOME GROUP 12	0.036218	1.092674	1.018088	58824340

No Consumption Linkage Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.000000	0.862419	1.017307	58779260
INCOME GROUP 2	0.000000	0.917049	1.017307	58779260
INCOME GROUP 3	0.000000	0.930827	1.017307	58779260
INCOME GROUP 4	0.000000	0.944380	1.017307	58779260
INCOME GROUP 5	0.000000	0.949130	1.017307	58779260

INCOME GROUP 6	0.000000	0.959429	1.017307	58779260
INCOME GROUP 7	0.000000	0.963961	1.017307	58779260
INCOME GROUP 8	0.000000	0.983655	1.017307	58779260
INCOME GROUP 9	0.000000	1.001711	1.017307	58779260
INCOME GROUP 10	0.000000	1.026137	1.017307	58779260
INCOME GROUP 11	0.000000	1.056692	1.017307	58779260
INCOME GROUP 12	0.000000	1.093421	1.017307	58779260

No Interindustry Linkage Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.020574	0.860737	1.020097	58940450
INCOME GROUP 2	0.022345	0.915660	1.019295	58894110
INCOME GROUP 3	0.024564	0.929424	1.019050	58879950
INCOME GROUP 4	0.025173	0.942985	1.019008	58877500
INCOME GROUP 5	0.026145	0.947830	1.019033	58879000
INCOME GROUP 6	0.026296	0.958155	1.018924	58872670
INCOME GROUP 7	0.028034	0.962768	1.018832	58867340
INCOME GROUP 8	0.028977	0.982447	1.018764	58863420
INCOME GROUP 9	0.030928	1.000769	1.018689	58859080
INCOME GROUP 10	0.032523	1.024982	1.018613	58854700
INCOME GROUP 11	0.035379	1.055624	1.018513	58848940
INCOME GROUP 12	0.035685	1.092612	1.018152	58828060

Total Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.019546	0.858165	1.025286	59240250
INCOME GROUP 2	0.020456	0.913522	1.022928	59104050
INCOME GROUP 3	0.021344	0.927315	1.022277	59066380
INCOME GROUP 4	0.021815	0.941008	1.022037	59052560
INCOME GROUP 6	0.022047	0.956271	1.021855	59042000
INCOME GROUP 5	0.022115	0.946056	1.022146	59058820
INCOME GROUP 7	0.023092	0.961033	1.021607	59027690
INCOME GROUP 8	0.023303	0.980605	1.021443	59018190
INCOME GROUP 9	0.024369	0.999330	1.021184	59003250
INCOME GROUP 10	0.025054	1.023273	1.020980	58991460
INCOME GROUP 11	0.026382	1.054064	1.020687	58974530
INCOME GROUP 12	0.026757	1.091451	1.019635	58913760

County Group 26

Full Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.031503	0.881846	1.032196	38136050
INCOME GROUP 2	0.032012	0.937408	1.030651	38078970
INCOME GROUP 4	0.032237	0.966709	1.030056	38057000
INCOME GROUP 3	0.032632	0.953267	1.030210	38062670
INCOME GROUP 5	0.032686	0.981512	1.030126	38059590
INCOME GROUP 6	0.033204	0.989770	1.029907	38051510
INCOME GROUP 7	0.033656	0.998203	1.029716	38044430
INCOME GROUP 8	0.033893	1.014809	1.029608	38040440
INCOME GROUP 9	0.034275	1.029736	1.029437	38034140
INCOME GROUP 10	0.034582	1.050577	1.029296	38028920
INCOME GROUP 12	0.035250	1.102029	1.028473	37998510
INCOME GROUP 11	0.035383	1.077202	1.029115	38022220

Direct Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.031224	0.882107	1.030758	38082940
INCOME GROUP 2	0.031809	0.937630	1.029645	38041820
INCOME GROUP 4	0.031882	0.966889	1.029227	38026360
INCOME GROUP 5	0.032426	0.981725	1.029280	38028320
INCOME GROUP 3	0.032505	0.953453	1.029330	38030190
INCOME GROUP 6	0.033038	0.989955	1.029133	38022910
INCOME GROUP 7	0.033592	0.998367	1.028990	38017600
INCOME GROUP 8	0.033812	1.014979	1.028913	38014770
INCOME GROUP 9	0.034217	1.029892	1.028791	38010260
INCOME GROUP 10	0.034577	1.050739	1.028687	38006430
INCOME GROUP 12	0.035402	1.102154	1.028093	37984460
INCOME GROUP 11	0.035617	1.077379	1.028557	38001600

No Consumption Linkage Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.000000	0.882835	1.027066	37946530
INCOME GROUP 2	0.000000	0.938260	1.027066	37946530
INCOME GROUP 3	0.000000	0.953982	1.027066	37946530
INCOME GROUP 4	0.000000	0.967446	1.027066	37946530
INCOME GROUP 5	0.000000	0.982369	1.027066	37946530

INCOME GROUP 6	0.000000	0.990508	1.027066	37946530
INCOME GROUP 7	0.000000	0.998828	1.027066	37946530
INCOME GROUP 8	0.000000	1.015474	1.027066	37946530
INCOME GROUP 9	0.000000	1.030333	1.027066	37946530
INCOME GROUP 10	0.000000	1.051214	1.027066	37946530
INCOME GROUP 11	0.000000	1.077842	1.027066	37946530
INCOME GROUP 12	0.000000	1.102489	1.027066	37946530

No Interindustry Linkage Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.031361	0.882065	1.031048	38093630
INCOME GROUP 2	0.031906	0.937588	1.029847	38049270
INCOME GROUP 4	0.031973	0.966851	1.029396	38032600
INCOME GROUP 5	0.032484	0.981679	1.029453	38034700
INCOME GROUP 3	0.032556	0.953415	1.029507	38036720
INCOME GROUP 6	0.033051	0.989913	1.029294	38028860
INCOME GROUP 7	0.033566	0.998330	1.029139	38023120
INCOME GROUP 8	0.033769	1.014938	1.029057	38020070
INCOME GROUP 9	0.034140	1.029854	1.028925	38015210
INCOME GROUP 10	0.034473	1.050697	1.028813	38011070
INCOME GROUP 12	0.035234	1.102123	1.028172	37987400
INCOME GROUP 11	0.035436	1.077336	1.028672	38005850

Total Model

INCOME GROUP	THIEL	CHNG IQ	CHNG Y	TOTAL Y
INCOME GROUP 1	0.034492	0.881556	1.037588	38335270
INCOME GROUP 2	0.035077	0.937060	1.034447	38219250
INCOME GROUP 4	0.035643	0.966430	1.033242	38174700
INCOME GROUP 3	0.035758	0.952979	1.033553	38186200
INCOME GROUP 5	0.036056	0.981133	1.033407	38180800
INCOME GROUP 6	0.036442	0.989453	1.032993	38165520
INCOME GROUP 7	0.036901	0.997958	1.032634	38152250
INCOME GROUP 8	0.037225	1.014498	1.032434	38144850
INCOME GROUP 9	0.037772	1.029521	1.032079	38131740
INCOME GROUP 10	0.038043	1.050251	1.031811	38121830
INCOME GROUP 12	0.038567	1.101741	1.030097	38058500
INCOME GROUP 11	0.038622	1.076807	1.031441	38108170

11.0 BIBLIOGRAPHY

Aaron, Henry and Martin McGuire. "Public Goods and Income Distribution." Econometrica 30(1970):907-920.

Adelman, Irma. "Development Economics: A Reassessment of Goals." American Economic Review 65(1975):302-309.

Allen, Michael Patrick. "The Perpetuation of Wealth: A Simulation Model" in Smith, James D., ed. Modeling the Distribution and Intergenerational Transmission of Wealth. Chicago: University of Chicago Press, 1980, pp. 139-158.

Appalachian Land Ownership Task Force. Land Ownership Patterns and Their Impacts on Appalachian Communities: A Survey of 80 Counties. Report submitted to the Appalachian Regional Commission, February, 1981.

Arrow, Kenneth J. "Higher Education as a Filter." Journal of Public Economics 2(1973):193-216.

Atkinson, A.B. The Economics of Inequality. Oxford: Clarendon Press, 1975.

______. "On the Measurement of Inequality." Journal of Economic Theory 2(1970):244-263.

Bartels, C.P.A. Economic Aspects of Regional Welfare: Income Distribution and Unemployment. Leiden: Martinus Nijhoff, 1977.

Batey, Peter W.J. "Input-Output Models for Regional Demographic Analysis: Some Structural Comparisons." Department of Civic Design, University of Liverpool, 1983.

Batey, Peter W.J. and Moss Madden. "Demographic-Economic Forecasting within an Activity-Commodity Framework." Environment and Planning A 13(1981):1067-1083.

Battalio, Raymond C., John H. Kagel and Morgan O. Reynolds. "Income Distributions in Two Experimental Economies." Journal of Political Economy 85(1977):1259-1271.

Batten, David F. "The Interregional Linkages between National and Regional Input-Output Models." International Regional Science Review 7(1982):53-67.

______. Spatial Analysis of Interacting Economies. Boston: Kluwer-Nighoff Publishing, 1983.

Beach, Charles M. "Cyclical Impacts on the Personal Distributions of Income." Annals of Economic and Social Measurement 5(1976):29-52.

Becker, Gary S. A Treatise on the Family. Cambridge: Harvard University Press, 1981.

______. Human Capital and the Personal Distributions of Income: An Analytical Approach. Ann Arbor: University of Michigan, 1967.

Becker, Gary S. and Barry R. Chiswick. "Education and the Distribution of Earnings." American Economic Review 56(1966):358-69.

Benus, Jacob and James N. Morgan. "Time Period, Unit of Analysis and Income Concept in the Analysis of Income Distribution" in Smith, James D., ed. The Personal Distribution of Income and Wealth. New York: Columbia University Press, 1975, pp. 209-224.

Bernat, G. Andrew, Jr. "A Comparison of Five Inequality Indices." Paper presented at the Rural Sociological Society Annual Meeting, August, 1985.

______. "Water and Regional Output: A Discussion of How Interregional Water Transfers Can Be Expected to Affect Regional Output in Virginia." Unpublished Manuscript, 1984.

Blackorby, Charles and David Donaldson. "A Theoretical Treatment of Indices of Absolute Inequality." International Economic Review 21(1980):107-136.

______. "Measures of Relative Equality and Their Measurement in Terms of Social Welfare." Journal of Economic Theory 18(1978):59-80.

Blaug, Mark. "The Empirical Status of Human Capital Theory: A Slightly Jaundiced Survey." Journal of Economic Literature 14(1976):827-855.

Blinder, Alan S. Toward an Economic Theory of Income Distribution. Cambridge: M.I.T. Press, 1974.

Boucher, Michael. "Some Further Results on the Linkage Hypothesis." Quarterly Journal of Economics 90(1976):313-318.

Brennan, Geoffrey. "The Distributional Implications of Public Goods." Econometrica 44(1976):391-399.

Bronfenbrenner, Martin. "Neo-Classical Macro-Distribution Models" in Marchal and Ducros, eds. The Distribution of National Income. New York: St. Martin's Press, 1968.

Brown, J.A.C. "The Mathematical and Statistical Theory of Income Distribution" in Atkinson, A.B., ed. The Personal Distributions of Incomes. Boulder: Westview Press, Inc., 1976.

Bureau of Labor Statistics (BLS, 1977a). Consumer Expenditure Survey: Diary Survey, July 1972-June 1974. Bulletin 1959, U.S. Department of Labor, Washington, D.C., 1977.

Bureau of Labor Statistics (BLS, 1977b). Consumer Expenditure Survey: Interview Survey, 1972-1973. Bulletin 1997, U.S. Department of Labor, Washington, D.C., 1977.

Cain, Glen G. "The Challenge of Segmented Labor Market Theories to Orthodox Labor Market Theory: A Survey." Journal of Economic Literature 14(1976):1215-1257.

Catalano, Ralph and David Dooley. "The Health Effects of Economic Instability: A Test of the Economic Stress Hypothesis." Journal of Health and Social Behavior. In press.

Cella, Guido. "The Input-Output Measurement of Interindustry Linkages." Oxford Bulletin of Economics and Statistics 46(1984):73-84.

Chenery, Hollis, Montek S. Ahluwalia, C.L.G. Bell, John H. Duloy, and Richard Jolly. Redistribution with Growth. London: Oxford University Press, 1974.

Chenery, H.B. and T. Watanabe. "International Comparisons of the Structure of Production." Econometrica 4(1958): 487-521.

Chiswick, Barry R. Income Inequality Regional Analysis within a Human Capital Framework. New York: Columbia University Press, 1974.

CONSAD Corporation. Regional Federal Procurement Study. U.S. Department of Commerce Contract 7-35211 October, 1967.

Creamer, Daniel. Personal Income During Business Cycles. Princeton: Princeton University Press, 1956.

Curtin, Richard T. Income Equity Among U.S. Workers: The Bases and Consequences of Deprivation. New York: Praeger Publishers, 1977.

Czamanski, Stanislaw and Emil E. Malizia. "Applicability and Limitations in the Use of National Input-Output Tables for Regional Studies." Papers of the Regional Science Association 23(1969):65-77.

Dalton, H. "The Measurement of the Inequality of Incomes." Economic Journal 30(1920):348-361.

Danziger, Sheldon, Robert Haveman, and Robert Plotnick. "How Income Transfer Programs Affect Work, Savings, and the Distribution of Income." Journal of Economic Literature 19(1981):975-1028.

Deaton, Angus. "Inequality and Needs: Some Experimental Results for Sri Lanka" in Ben-Porath, Yoram, ed. Income Distribution and the Family, Supplement to Population and Development Review Volume 8, Population Council, Inc., 1982, pp. 35-52.

Deaton, Angus and John Meullbauer. Economics and Consumer Behavior. New York: Cambridge University Press, 1980.

Deaton, Brady J., Larry C. Morgan, and Kurt R. Anschel. "The Influence of Psychic Costs on Rural-Urban Migration." American Journal of Agricultural Economics 64(1982): 177-187.

Dervis, Kemal, Jaime De Melo, and Sherman Robinson. General Equilibrium Models for Development. New York: Cambridge University Press, 1982.

Domazlicky, Bruce. "Regional Business Cycles: A Survey." Regional Science Perspectives 10(1980):15-34.

Duncan, Bill and Mil Duncan. "Coal, Poverty, and Public Policy in Eastern Kentucky." Paper presented at the Resources for the Future Workshop on Rural Development, Poverty, and Natural Resources, July, 1983.

Fields, Gary S. Poverty, Inequality, and Development. New York: Cambridge University Press, 1980.

Friedman, Milton. "Choice, Chance, and the Personal Distribution of Income." Journal of Political Economy 61(1953):277-290.

Friesen, Peter H. and Danny Miller. "Annual Inequality and Lifetime Inequality." Quarterly Journal of Economics (1983):139-155.

Gilder, George. Wealth and Poverty. New York: Basic Books, 1981.

Greenwood, Daphne. "An Estimation of U.S. Family Wealth and Its Distribution from Microdata, 1973." The Review of Income and Wealth 29(1983):23-44.

Griliches, Zvi. "Estimating the Returns to Schooling: Some Econometric Problems." Econometrica 45(1977):1-22.

Gronau, Reuben. "Inequality of Family Income: Do Wives' Families Matter?" in Ben-Porath, Yoram, ed. Income Distribution and the Family, Supplement to Population and Development Review Volume 8, Population Council, Inc., 1982, pp. 119-136.

Hahn, F.H. The Share of Wages in the National Income: An Enquiry into the Theory of Distribution. London: London School of Economics and Political Science, 1972.

Hahnel, Robin and Howard J. Sherman. "Income Distribution and the Business Cycle: Three Conflicting Hypotheses." Journal of Economic Issues 16(1982):49-73.

Hargrave, Carolyn H. and Roger L. Buford. An Input-Output Study of the Louisiana Economy. Occasional Paper No. 16, College of Business Administration, Louisiana State University, 1973.

Harrigan, F., J.W. McGilvary, and I.H. McNicoll. "The Estimation of Interregional Trade Flows." Journal of Regional Science 21(1981):65-78.

Hedlund, Jeffrey D. "Distribution Theory Revisited: An Empirical Examination of the Weintraub Synthesis." J. Post Keynesian Economics 6(1983):73-81.

Hey, John D. Uncertainty in Microeconomics. Oxford: Martin Robertson, 1979.

Hirschman, A.O. The Strategy of Development. New Haven: Yale University Press, 1958.

Howard, Michael C. Modern Theories of Income Distribution New York: St. Martin's Press, 1979.

Inter-University Consortium for Political and Social Research (ICPSR). 1980 Census of Population and Housing Public Use Microdata Sampl e: Five Percent (A) Sample. Ann Arbor, Michigan. 1984.

Isard, Walter. "Regional Commodity Balances and Interregional Commodity Flows." American Economic Review 43(1953):167-180.

______. Methods of Regional Analysis. Cambridge: M.I.T. Press, 1960.

Isserman, A.M. "The Location Quotient Approach to Measuring Regional Economic Impacts." Journal of American Institute of Planning 43(1977):33-41.

Johnson, Harry G. On Economics and Society. Chicago: University of Chicago Press, 1975.

______. The Theory of Income Distribution. London: Gray-Mills Publishing Ltd., 1973.

Johnson, William R. "Uncertainty and the Distribution of Earnings." in Juster, ed. The Distribution of Economic Well-Being. Cambridge: Ballinger Publishing Co., 1977.

Jones, Leroy P. "The Measurement of Hirschmanian Linkages." Quarterly Journal of Economics 90(1976):323-333.

Jones, Ronald W. "The Structure of Simple General Equilibrium Models." Journal of Political Economy 73(1965):557-572.

Kaldor, Nicholas. Further Essays on Economic Theory. New York: Holmes and Meier Publishers, Inc., 1978.

Kanbur, S.M. "Of Risk Taking and the Personal Distribution of Income." Journal of Political Economy 87(1979): 769-797.

Kelley, Allen C., Warren C. Sanderson, and Jeffrey G. Williamson, eds. Modeling Growing Economies in Equilibrium and Disequilibrium. Durham: Duke Press Policy Studies, 1983.

Kokat, R.G. The Economic Component of a Regional Socioeconomic Model. IBM Technical Report 17-210. IBM, Inc., 1966.

Kolm, Serge-Chistophe (1976a). "Unequal Inequalities I." Journal of Economic Theory 12(1976):416-442.

______ (1976b). "Unequal Inequalities II." Journal of Economic Theory 13(1976):82-111.

Kristol, Irving and Peter T. Bauer. "Two Essays on Income Distribution and the Open Society." Los Angeles: International Instiiute for Economic Research, Reprint Paper 4, 1977.

Kusnic, Michael W. and Julie DaVanzo. "Who are the Poor in Malaysia? The Sensitivity of Poverty Profiles to Definition of Income" in Ben-Porath, Yoram, ed. Income Distribution and the Family, Supplement to Population and Development Review Volume 8, Population Council, Inc., 1982, pp. 17-34.

Kuttner, Robert. The Economic Illusion: False Choices Between Prosperity and Social Justice. Boston: Houghton Mifflin Co., 1984.

Laumas, Prem S. "The Weighting Problem in Testing the Linkage Hypothesis." Quarterly Journal of Economics 90(1976): 308-312.

Layard, Richard and Antoni Zabalza. "Family Income Distribution: Explanation and Policy Evaluation." Journal of Political Economy Supplement 87(1979):s133-s161.

Leontief, W. "Interregional Theory" in Leontief et al. Studies in the Structure of the American Economy, Chapter 4. New York: Oxford University Press, 1953.

Leontief, W. and A. Strout. "Multiregional Input-Output Analysis" in T. Barna, ed. Structual Interdependence and Economic Development. London: Macmillan, 1963, pp. 114-119.

Liem, Ramsay and Paula Rayman. "Health and Social Costs of Unemployment: Research and Policy Considerations." American Psychologist 37(1982):1116-1123.

Lillard, Lee A. "Inequality: Earnings vs. Human Wealth." American Economic Review 67(1977):42-53.

Lillydahl, Jane H. and Larry D. Singell. "The Scope of the Grants Economy and Income Distribution." American Journal of Economics and Sociology 41(1982):125-139.

Lindley, James T. Restructuring Virginia's Unemployment Compensation System: A Program for Solvency. Virginia Employment Commission, Richmond, Virginia, 1981.

Lucas, Robert E.B. "Is There a Human Capital Approach to Income Inequality?" Journal of Human Resources 12(1977): 387-395.

Lydall, H.F. "Theories of the Distribution of Earnings" in Atkinson, A.B., ed. The Personal Distributions of Incomes. Boulder: Westview Press, Inc., 1976.

______. The Structure of Earnings. Oxford; Clarendon Press, 1968.

McMenamin, David G. and Joseph E. Haring. "An Appraisal of Nonsurvey Techniques for Estimating Regional Input-Output Models." Journal of Regional Science 14(1974): 191-205.

Madden, M. and P.W.J. Batey. "Linked Population and Economic Models: Some Methodological Issues in Forecasting, Analysis, and Policy Optimization." Journal of Regional Science 23(1983):141-164.

Malizia, Emil and Daniel L. Bond. "Empirical Tests of the RAS Method of Interindustry Coefficient Adjustment." Journal of Regional Science 14(1974):355-365.

Martin, Thomas L. and Mark S. Henry. "Rural Area Consumer Demand and Regional Input-Output Analysis." American Journal of Agricultural Economics 64(1982):752-755.

Meade, James E. The Just Economy. Albany: State University of New York Press, 1976.

______. and Charles J. Hitch. "How Should Income Be Distributed?" in Budd, ed. Inequality and Poverty. New York: W.W. Norton, 1967.

Metcalf, Charles E. An Econometric Model of the Income Distribution. Chicago: Markham Publishing Co., 1972.

Miernyk, William H. "Long Range Forecasting with a Regional Input-Output Model." Western Economic Journal 6(1968): 165-176.

Minarik, Joseph J. "The Measurement and Trend of Inequality: Comment." American Economic Review 67(1977):513-516.

Mincer, Jacob. "Progress in Human Capital Analyses of the Distribution of Earnings" in Atkinson, A.B., ed. The Personal Distributions of Incomes. Boulder: Westview Press, Inc., 1976.

______. "The Distribution of Labor Incomes: A Survey." Journal of Economic Literature 8(1970):1-26.

Mincer, Jacob and Haim Ofek. "Interrupted Work Careers: Depreciation and Restoration of Human Capital." Journal of Human Resources 17(1982):3-24.

Mirer, Thad W. "Aspects of the Variability of Family Income," in Marilyn Moon and Eugene Smolensky, eds. Improving Measures of Economic Well-Being. New York: Academic Press, 1977.

______. "The Distributional Impact of the 1970 Recession." Review of Economics and Statistics (1973):214-22.

Mishkin, Frederic. "Illiquidity, Consumer Durable Expenditure, and Monetary Policy." American Economic Review 66(1976):642-653.

Miyazawa, K. Input-Output Analysis and the Structure of Income Distribution. New York: Springer-Verlag, 1976.

Mogridge, M.J.H. Systems Theory of Personal Income Distribution. Patrington Emmasglen, Ltd., 1973.

Moore, Frederick T. and James W. Petersen. "Regional Analysis: An Interindustry Model of Utah." Review of Economics and Statistics 37(1955):368-383.

Moore, Geoffrey H. Business Cycles, Inflation, and Forecasting. National Bureau of Economic Research Studies in Business Cycles No. 24. Cambridge: Ballinger Publishing Co., 1983.

Morrison, W.I. and P. Smith. "Nonsurvey Input-Output Techniques at the Small Area Level: An Evaluation." Journal of Regional Science 14(1974):1-14.

Musgrave, Richard A. and Peggy B. Musgrave. Public Finance in Theory and Practice. New York: McGraw-Hill Book Company, 1976.

Nelson, Joel I. Economic Inequality: Conflict Without Change. New York: Columbia University Press, 1982.

Norcliffe, G.B. "Using Location Quotients to Estimate the Economic Base and Trade Flows." Regional Studies 17(1983):161-168.

Okner, Benjamin A. "Individual Taxes and the Distribution of Income" in Smith, James D., ed. The Personal Distribution of Income and Wealth. New York: Columbia University Press, 1975, pp. 45-74.

Osberg, Lars. Economic Inequality in the United States. Armonk: M.E. Sharpe, Inc., 1984.

Osmani, Siddiqur Rahman. Economic Inequality and Group Welfare: A Theory of Comparison with Application to Bangladesh. Oxford: Clarendon Press, 1982.

Park, Se-Hark, Malek Mohtadi, and Atif Kubursi. "Errors in Regional Nonsurvey Input-Output Models: Analytical and Simulation Results." Journal of Regional Science 21(1981):321-339.

Pollack, Robert A. and Terence J. Wales. "Estimation of Complete Demand Systems from Household Budget Data: The Linear and Quadratic Expenditure Systems." American Economic Review 68(1978):348-359.

Ralston, Scott N., Steven E. Hastings, and Sharon M. Buckner. "Survey-Based Regional Purchase Coefficients: Their Effect on Delaware's Non-Survey Input-Output Model." Paper presented at the Southern Regional Science Association annual meeting. Orlando, Florida, 1984.

Ranadive, K.R. Income Distributions: The Unsolved Puzzle. Bombay: Oxford University Press, 1978.

Rasmussen, P.N. Studies in Intersectoral Relations. Amsterdam: North-Holland, 1958.

Richardson, Harry W. Input-Output and Regional Economics. London: Weidenfeld and Nicolson, 1972.

Riedel, James. "A Balanced-Growth Version of the Linkage Hypothesis: A Comment." Quarterly Journal of Economics 90(1976):319-322.

Round, Jeffery I. "Nonsurvey Techniques: A Critical Review of the Theory and Evidence." International Regional Science Review 8(1983):189-212.

______. "An Interregional Input-Output Approach to the Evaluation of Nonsurvey Methods." Journal of Regional Science 18(1978):179-194.

Sahota, Gian Singh. "Theories of Personal Income Distribution: A Survey." Journal of Economic Literature 14(1978):1-55.

Sandmo, A. "Competitive Firm Under Price Uncertainty." American Economic Review 61(1971):65-73.

Sattinger, Michael. Capital and the Distribution of Labor Earnings. Amsterdam: North-Holland Publishing Co., 1980.

Schaffer, William H. and Kong Chu. "Nonsurvey Techniques for Constructing Regional Interindusty Models." Papers of the Regional Science Association 23(1969):83-100.

Schultz, Siegfried. "Approaches to Identifying Key Sectors Empirically by Means of Input-Output Analysis." Journal of Development Studies 14(1977):75-96.

Schultz, T. Paul. "Secular Trends and Cyclical Behavior of Income Distribution in the United States 1944-1965" in Soltow, ed. Six Papers on the Size Distribution of Wealth and Income. New York: Columbia University Press, 1969.

______. "Family Composition and Income Inequality" in Ben-Porath, Yoram, ed. Income Distribution and the Family, Supplement to Population and Development Review Volume 8, Population Council, Inc., 1982, pp. 137-150.

Schultze, Charles L. "Short-run Movements of Income Shares" in Schultze and Weiner, eds. The Behavior of Income Shares: Selected Theoretical and Empirical Issues. Princeton: Princeton University Press, 1964.

Schur, Edwin M. "Poverty, Violence, and Crime in America." in Huber and Chalfant, eds. The Sociology of American Poverty. Cambridge: Schenkman Publishing Co., 1974.

Shorrocks, A. F. "The Class of Additively Decomposable Inequality Measures." Econometrica 48(1980):613-625.

Shorrocks, A. F. "The Mathematical and Statistical Theory of Distribution: Discussion" in Atkinson, A.B., ed. The Personal Distributions of Incomes. Boulder: Westview Press, Inc., 1976.

______. "On Stochatic Models of Size Distributions." Review of Economic Studies 42(1975):631-641.

Simon, Herbert A. "The Compensation of Executives." Sociometry 20(1957):32-35.

Smith, James D. and Guy H. Orcutt. "The Intergenerational Transmission of Wealth: Does Family Size Matter?" in Smith, James D., ed. Modeling the Distribution and Intergenerational Transmission of Wealth. Chicago: University of Chicago Press, 1980, pp. 273-288.

Smith, James P. "The Distribution of Family Earnings." Journal of Political Economy, Supplement 87(1979): s163-s192.

Stevens, Benjamin H. Unpublished manuscript. 1984.

Stevens, Benjamin H. and Glynnis A. Trainer. "Error Generation in Regional Input-Output Analysis and Its Implications for Non-Survey Models." Discussion Paper 108, Regional Science Research Institute, Amherst, MA, 1978.

Stevens, Benjamin H., George I. Treyz, David J. Ehrlich, and James R. Bower. "A New Technique for the Construction of Non-Survey Input-Output Models." International Regional Science Review 8(1983):271-286.

Stillwell, F.J.B. and B.D. Boatwright. "A Method of Estimating Interregional Trade Flows." Regional and Urban Economics 1(1971):77-87.

Stone, Richard. Mathematics in the Social Sciences and Other Essays. Cambridge: M.I.T. Press, 1966.

Taubman, Paul. J. Sources of Inequality in Earnings: Personal Skills, Random Events, Preferences Toward Risk, and Other Occupational Characteristics. New York: North-Holland Publishing Co., 1975.

Tawney, R.H. "Equality" in Budd, ed. Inequality and Poverty. New York: W.W. Norton, 1967.

Thurow, Lester C. The Zero-Sum Society: Distribution and the Possibilities for Economic Change. New York: Penguin Books, 1980.

______. Generating Inequality: Mechanisms of Distribution in the U.S. Economy. New York: Basic Books, 1975.

______. "The Income Distribution As a Pure Public Good." Quarterly Journal of Economics 85(1971):327-336.

Tinbergen, Jan. Income Distribution: Analysis and Policies. New York: North-Holland Publishing Co., 1975.

Tobin, James. Asset Accumulation and Economic Activity. Oxford: Basil Blackwell, 1980.

U.S. Department of Commerce (USDCa). Bureau of the Census. 1977 Census of Transportation. Vol 3, Commodity Transportation Survey Summary, 1981.

______ (USDCb). Bureau of the Census. County Business Patterns 1979: Virginia. 1981.

Virginia Employment Commission (VEC). Occupational Employment Statistics: Selected Transportation, Public Utilities, and Trade Industries. Richmond, Virginia, 1981.

Virginia Employment Commission (VEC). Occupational Employment Statistics: Selected Nonmanufacturing Industries. Richmond, Virginia, 1983.

Vanwynsberghe, D. "An Operational Nonsurvey Technique for Estimating a Coherent Set of Interregional Input-Output Tables" in Polenske, Karen R. and Jiri V. Skolka, eds. Advances in Input-Output Analysis. Cambridge: Ballinger Publishing Co., 1976.

Weiss, Yoram. "The Risk Element in Occupational and Educational Choice." Journal of Political Economy 80(1972):1203-1213.

Weisskoff, Richard and Edward N. Wolff. "The Structure of Income Inequality in Puerto Rico." Journal of Development Economics (1981):206-228.

von Weizsacker, C.C. "Annual Income, Lifetime Income, and Other Concepts in Measuring Income Distribution" in Krelle and Shorrocks, eds. Personal Income Distribution. Amsterdam: North-Holland Publishing Co., 1978.

Williamson, Jeffrey G. and Peter H. Lindert. American Inequality: A Macroeconomic History. New York: Academic Press, 1980.

Wolff, Edward N. "The Size Distribution of Household Disposable Wealth in the United States." The Review of Income and Wealth 29(1983):125-146.

______. "Estimates of the 1969 Size Distribution of Household Wealth in the U.S. from a Synthetic Data Base" in Smith, J.D., ed. Modeling the Distribution and Intergenerational Transmission of Wealth. Chicago: University of Chicago Press, 1980, pp.223-270.

Yotopoulos, Pan A. and Jeffrey B. Nugent. "A Balanced-Growth Version of the Linkage Hypothesis." Quarterly Journal of Economics 87(1973):157-171.

The vita has been removed from
the scanned document