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Timber Stumpage Supply and Economic Dependency

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John Mark DeVilbiss

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Ph.D. degree in Forestry

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TIMBER STUMPAGE SUPPLY AND ECONOMIC DEPENDENCY

by

John Mark DeVilbiss

A DISSERTATION

Submitted to
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ABSTRACT

TIMBER STUMPAGE SUPPLY AND ECONOMIC DEPENDENCY

By

John Mark DeVilbiss

During the past forty years considerable attention has been given to the issues of community stability, timber-dependent communities, stabilization of employment and the role played by a continuous flow of National Forest timber stumpage supply toward meeting these objectives.

This research proposes a theoretical framework and analytical methodology for analyzing and evaluating the economic dependency of a region on its local export base, wood-processing sectors, and timber stumpage supplied from National Forest lands. Eight case study areas (six counties and two multiple-county areas) within the Rocky Mountain Region of the U.S. Forest Service were chosen for detailed analysis and evaluation. Economic profiles and economic input-output models were developed for each case study area. Using these data and models each area was analyzed to determine its economic dependency on the total export base, logging and sawmilling sector export base, and the National Forest timber stumpage export base. National Forest timber stumpage market shares were calculated and analyzed for each area.

The results of the analysis and evaluation for each area, are presented in the Summary. In brief, all counties and areas tested showed a positive economic dependency on their respective total export bases, four of the eight case study areas tested showed a positive economic dependency on their respective logging and milling sector export bases, and two of the eight case study areas tested showed a positive economic dependency on their respective National Forest timber stumpage export bases. The Conclusions section includes a discussion of the policy implications regarding the application of this methodology for measuring economic dependency.

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CHAPTER I

INTRODUCTION

Background

Numerous small rural communities are scattered throughout the Rocky Mountains. These small communities and their respective economies characteristically are tied to Agricultural, Forestry, Mining and Tourism related activities for a significant portion of their local economic activity. In numerous cases, these activities are either directly or indirectly affected by management decisions made on National Forest lands which adjoin these communities and, often times, dominate landownership patterns of the local area. Due to this close relationship between National Forest management and the economic activity of local rural communities, Forest Service activities, particularly timber harvesting, historically has been considered to significantly effect local employment and income in these communities. In view of this perception, the Forest Service has considered the

effects its decisions have on local economic activity (i.e. Income and Employment). Statutory and policy language regarding the stability of local economies that may be dependent on Forest Service decisions has been stated in general terms over time, and with one exception, adjacent (timber) dependent communities (See page 3), guidelines regarding its consideration in analysis and decisionmaking have been vague or entirely missing.

The literature, as well as popular discussion on this subject often refers to ideas such as "community stability" (Beuter, 1978; Schallau, 1983), stabilization of employment, timber-dependent communities (USFS, 1984), sustained flow of timber (Josephson, 1976; Waggener, 1978), and so on. These issues are seldom defined or placed in an analytical context. Numerous questions must be answered to deal with these issues in a policy framework. These questions include: What is "community stability", "stabilization", "dependency"? What is the nature and extent of "dependent relationships", i.e. when is a relationship "dependent" and not merely "functionally linked"? Is stability desirable, and if so, how much stability? How can "dependency" and "stability" be measured? What is the relationship between sustained yield, economic dependency and community stability?

As well as being historically significant, these issues are particularly relevant and timely in the land management planning and decisionmaking currently underway on National Forests throughout the Nation.

The subject of community stability and economic dependency surfaced indirectly in the US Forest Service's Organic Act of 1897 which stated, "...furnish a continuous supply of timber for the use and necessities of citizens of the United States." (Waggener, 1977). Two notions were set forth here; first, that a continuous supply of timber was needed, and second, that a relationship exists between the supply of timber and the needs of the citizenry (community) of the United States.

By the time the Sustained Yield-Forest Management Act of 1944 was passed the discussion had become somewhat more focused, though specific definitions and direction still were not included in the statutory language. This Act stated, "In order to promote the stability of forest industries, of employment, of communities, and of taxable forest wealth, through continuous supplies of timber..." (Waggener, 1977). The notion of a linkage between timber supplies and community continues to be expressed in this Act.

The Sustained Yield-Forest Management Act specifically directed the creation of Sustained Yield Units. A number of these Cooperative and Federal Sustained Yield Units were established, of which six are in existence today. Although a general policy of economic support for communities was set forth through this legislation and the creation of the selected sustained yield units, it proceeded cautiously with respect to "where" and "how" such a policy was to be conducted. No detailed direction regarding the implementation of such an economic policy was forthcoming.

Meanwhile, Congress passed the Employment Act of 1946 officially sanctioned the goal of economic stability (U.S. Congress, 1946). In 1960, the Multiple Use-Sustained Yield Act was passed by the Congress reaffirming its policy of promoting sustained yield, and clarifying the multiple use responsibilities of the Forest Service. No mention was made of community stability in this Act (U.S. Congress, 1960).

More recently, Congress passed the National Forest Management Act of 1976 (NFMA). This legislation makes no mention of "community stability", "timber-dependent communities" or "stabilization of employment". The Implementing Regulations, 36 CFR 219, National Forest System Land and Resource Management Planning, established by direction of NFMA in 1979, and revised in 1982, also do

not refer to stability or dependency. The only remotely related reference, Section 219.7, states "...consideration of the objectives of other Federal, State and local governments, and Indian tribes, as expressed in their plans and policies;..." (36 CFR 219.7 (c)(1)), and "a program of monitoring and evaluation shall be conducted that includes consideration of the effects of National Forest management on...communities adjacent to or near the National Forest..." (36 CFR 219.7 (f)).

NFMA Implementing Regulation, 36 CFR 223 - Sale and Disposal of Timber, became effective June 2, 1977. This Regulation states, in part,

"223.6 Bidding Methods, (a) Definitions, (1) 'Adjacent dependent communities' means an area with common social and economic interests bounded by established daily marketing and workforce connecting patterns, and encompassing one or more primary wood product manufacturing facilities located within or adjacent to a specific area of National Forest timber upon which it is dependent for its timber supply and where 10 percent or more of the community workforce is employed in the primary manufacture of wood products, including logging and log transportation, and National Forest timber accounted for at least 30 percent of the timber used in the primary wood product manufacturing facilities in the last 5 calendar years.

"223.6 (b) (3) In areas tributary to adjacent dependent communities, a mix of bidding methods...may be used".

The general policy of providing support to timber-dependent communities was affirmed, while at the same time, carefully specifying the terms of its application. In this case, its focus was on the particular bidding methods that may be used in conjunction with adjacent dependent communties. In

1984, these Regulations (36 CFR 223) were revised and reissued as "Sale and Disposal of National Forest System Timber" (USFS, 1984). In the revised version, language regarding Bidding Methods (36 CFR 223.89) was changed to "...consider the economic stability of communities whose economies are dependent upon National Forest timber". Neither "economic stability" nor "dependent" were defined in the Act. The "continuous flow of timber" as mentioned in the earlier legislation (U.S Congress, 1905, 1946) was not included in the revision. It is included in the revised 36 CFR 221 - Timber Management Planning, effective July 1, 1984, which states in section 221.3(3), "...provide, so far as feasible, an even flow of National Forest timber in order to facilitate the stabilization of communities, and of opportunities for employment" (USFS, 1984).

The Forest Service Manual, Chapter 2410 - Timber Resource Management Planning (FSM 8/85, Amend 139) provides no further policy direction on this subject and makes no reference to community stability or timber-dependent communities. However, Chapter 2411 of the Forest Service Manual, Cooperative and Federal Sustained Yield Units (FSM 8/85 Amend 139) states: "... provide to the extent possible, a supply of timber to maintain a stable community or communities designated by existing Cooperative or Federal Sustained Yield Unit's agreement or policy

statements". None of the existing Cooperative (one) (FSM 2411.2) and Federal (five) Units (FSM 2411.3) are located in the Rocky Mountain Region.

Collectively, Regulations, 36 CFR 221 and 223 appear to require the Forest Service to consider the economic stability of communities and provide, so far as feasible, an even flow of National Forest timber to facilitate the stabilization of employment for those communities whose economy's are dependent upon National Forest timber. To implement such a policy interpretation, an analytical method is needed to identify those economies that are dependent upon National Forest timber. To be effective, such a method must be both founded on economic principles and address the policy issue under study.

A number of studies in the area of dependency and stability have been conducted during the past years. Refer to Bell, 1977; Darr and Fight, 1974; Maki,et al., 1968; Maki, et al., 1973; Dickerman, et. al., 1975; Haynes, 1983; Pfister, 1963; Schallau, 1980; Schallau, et al., 1969; Schallau, et al., 1983; Shuster, 1975; Youmans, et al., 1973. Most of this work has concentrated on areas in the Pacific Northwest. Very little information is available regarding these issues in the Rocky Mountain Region. Furthermore, there is no generally accepted method or procedure for measuring the level of dependency which local rural

economies exhibit for National Forest timber stumpage supplies. The purpose of this research is to develop a method by which such economic dependency may be determined for small rural economies in the Rocky Mountain West.

Problem Statement

This research concentrates on the following five tasks:

First, develop a testable hypothesis for evaluating economic dependency,

Second, identify an appropriate theoretical framework for determining economic dependency of regions,

Third, develop an analytical model for measuring regional economic dependency,

Fourth, conduct a series of case studies of selected areas within the Rocky Mountain Region to test the hypothesis, and

Fifth, prepare a summary of analysis results, conclusions, and outline the policy considerations and recommendations resulting from this research.

Although the testing of the analytical method in this research is limited to the public policy question: "Are local rural economies in the Rocky Mountain Region economically dependent upon National Forest timber stumpage supplies, and if so, to what extent are they dependent?",

the method may be used to analyze the dependency effects of private sector expenditures as well.

In this research, economic dependency refers to a functional relationship between the activities of one or more segments of an economy and its economic output or income. This research investigates economic dependency in terms of the relation of its output to its exporting activities in small rural economies. Specifically, this research addresses the questions "Does an economy depend on its export base, and if so, does the economy depend on the export activity of its logging and sawmilling (LOG-MILL) sector[1]?" If the economy depends on the LOG-MILL sector, "Is that sector dependent on National Forest timber stumpage supplies?". These questions may be rephrased, "Is the local economy economically dependent on timber stumpage supplied by National Forest lands"?

Given this export base approach, a testable hypothesis is formulated which identifies a unique set of normative criteria for measuring economic dependency. These criteria are based on the 1977 Regulation, 36 CFR 223.6, (a) Definitions: (1) "Adjacent dependent communities". Thus,

1 Logging and sawmilling sectors are maintained as separate entities, however, when this data is aggregated it is labelled "LOG-MILL" sector.

this research tests the following hypothesis:

> For local rural economies within the Rocky Mountain Region, economic output as measured by income and employment, is dependent on the local export base associated with the timber stumpage supplied by National Forest lands. Specifically, for the hypothesis to be verified correct, the following conditions must be met:
> local export base activity attributable to National Forest stumpage supplies must account for at least ten percent of the economy's income and employment, and local wood-processing facilities must rely on National Forest lands for at least thirty percent of their timber stumpage supply.

Although the Regulation, 36 CFR 223.6, is not explicit on this point, for purposes of this research the ten percent criterion includes direct, indirect and induced (total) outputs.

Where all conditions of the hypothesis are met those local economies may be considered to be economically dependent on National Forest stumpage. In those areas, reductions in National Forest timber harvest levels could have significant effects on adjacent timber-dependent economies. Conversely, if these conditions are not met, local economies would not be considered economically dependent on National Forest timber stumpage supplies. In

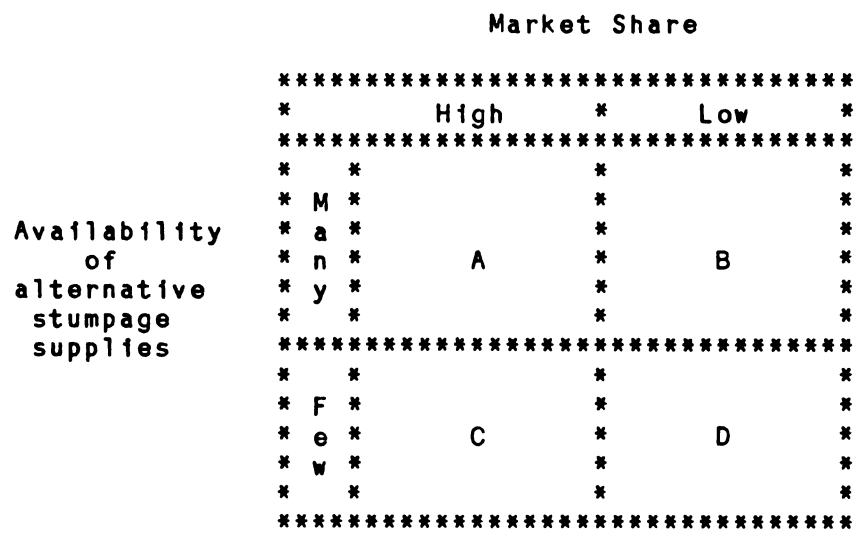
these cases, fluctations of timber stumpage supplies from National Forest lands would have limited or no effect on adjacent economies as discussed in this research.

Although the second specification of the hypothesis is indirectly included within the first specification (through the method used in this research to calculate the timber supply export base), it is included as part of the hypothesis for two reasons. First, it is a specific dependency criterion identified in the Implementing Regulation (36 CFR 223.6), and second, the market share of timber supplied by National Forest lands, both current and future, are critical to the determination of economic dependency.

The market share requirement of economic dependency relates to alternative timber stumpage supply sources available to the LOG-MILL sector. Availability of alternative timber stumpage supplies from other public or private sources is a key consideration in evaluating economic dependency. If potential reductions in National Forest timber supplies cannot be compensated from alternative supply sources, then any economic dependency of local economies on National Forest supplies will be critical. However, if numerous alternative timber stumpage suppliers are available, reductions in current National Forest timber stumpage market shares would be much less critical to

timber-dependent economies. In such cases, although an economy may be currently dependent on high market share National Forest timber stumpage supplies, alternative supply sources could reduce or possibly remove such economic dependency in the future. In evaluating economic dependency of an economy on particular supply sources, current and future alternative supply sources need to be considered.

In this research, observed current market shares are assumed to reflect the availability of future alternative supplies. That is, if the current National Forest timber market share is 75%, it is assumed that reductions below 75% would not be compensated by corresponding future increases in alternative supply sources. In actuality, this may or may not be the case depending on local conditions. In either case, the relation of a particular supplier's market share to the availability of alternative stumpage supplies is shown as follows:



A - Supplier provides a high proportion (market share) of current stumpage supplies to the LOG-MILL sector; many alternative sources of supply are available or may become available

B - Supplier provides a small proportion (market share) of current stumpage supplies to the LOG-MILL sector; many alternative sources of supply are available or may become available

C - Supplier provides a high proportion (market share) of current stumpage supplies to the LOG-MILL sector; few alternative sources of supply are available or may become available

D - Supplier provides a small proportion (market share) of current stumpage supplies to the

LOG-MILL sector; few alternative sources of supply are available or may become available

Obviously, quadrant C presents the setting in which an economy would be most critically dependent on a particular supplier. In quadrant B, a supplier would be of little consequence to the economy, while in quadrants A and D, a supplier may be important, but probably would not be critical to its economy.

In summary, if no alternative supply sources are available, the supplier is a monopolistic seller of stumpage and becomes crucial to the LOG-MILL sector's operation. Conversely, if numerous alternative sources of supply are available, then the LOG-MILL sector is correspondingly less dependent on any particular supplier. In this case, although a local economy may be dependent on the LOG-MILL sector, the LOG-MILL sector would not be dependent on a particular supply source.

Research Objectives

The objectives of this research are as follows:

1. Identify an appropriate theoretical framework on which the economic dependency relationships of rural economies may be based;

2. Develop an analytical methodology that may be used to apply the theoretical framework to specific locations and measure regional economic dependency relationships;

3. Select an appropriate set of study areas within the Rocky Mountain Region for detailed analysis of possible economic dependencies on National Forest timber stumpage supplies;

4. Describe the economic structure of the selected case study area economies;

5. Determine whether each local economy is economically dependent on National Forest timber stumpage supplies, and if so, the extent to which they are economically dependent; and

6. Summarize the case study analysis results and hypothesis test for economic dependency, and outline appropriate conclusions for using this method in a policy framework.

Outline of Remaining Chapters

The remainder of this dissertation is divided into five sections. They are as follows:

1. Study Methods and Analysis Procedures - Basic methods and procedures used in the research are presented. (Chapter II)

2. Application-Case Studies - The methods and procedures described in Chapter II are applied to eight selected case study areas. (Chapter III)

3. Summary and Conclusions (Chapter IV)

4. Bibliography

5. Appendices

CHAPTER II

STUDY METHODS AND ANALYSIS PROCESS

Theoretical Framework

This section describes the theoretical basis underlying the analysis of economic dependency effects. The following topics are discussed:

National Income and Product Accounts

Keynesian Macroeconomic Model

Regional Growth Theory

A statistical accounting framework for describing and measuring economic activity within an economy is presented followed by a description of how National Income and Product Accounts relate to one another within a simple macroeconomic model. Following this is a brief summary of selected regional growth theories which explain several important forces causing economic activity to expand or contract in rural economies.

National Income and Product Accounts - A means for describing economic activities and their relationship to one another is needed for studying macroeconomic activity. National social accounting systems have been developed for this purpose. One of these social accounting approaches is a statistical framework known as National Income and Product Accounts.

In the National Income and Product Accounting system, economic activity is considered from two different perspectives: Income created, and Production of Goods and Services by the economy. Economic activity is divided into Consumption, Business, Government, and Foreign Trade components.

On the Income side, the dollar value of an economy's output is comprised of wages and salaries, proprietor's income, rental income of persons, corporate profits and net interest. From the production (Product) side, economic output is comprised of consumption spending by households, investment spending by households and businesses, government purchases of goods and services, and net foreign demand. These components are termed aggregate demand for goods and services.

Each set of Accounts, Income or Product, measure the total dollar value of an economy's output for a given accounting

period, usually one year. The output value represents the productive capacity of the economy and is referred to as Gross National Product (GNP). In the case of sub-national, regional economies, this value is termed Gross Regional Product (GRP).

A convention used in National Income and Product Accounting is to subtract capital consumption allowance (depreciation) from GNP to define Net National Product (NNP). NNP is the net production of goods and services resulting from economic activity within the economy during the accounting period. Also, to avoid confusing changes in price levels from changes in production, the value of these accounting terms are measured in "real" dollars, that is, output valued at fixed price levels in which effects of inflation are not a factor.

National Income and Product Accounts may be expressed mathematically as follows:

On the Income side

$$Y \equiv Yd + R - T \qquad (1)$$

where:

Y = Output (Income)

Yd = Disposable Income

R = Transfers

T = Taxes

and on the Product side

$$Y \equiv C + I + G + [X - M] \qquad (2)$$

where:

Y = Output (Product)

C = Consumption spending by households

I = Investment spending by households and businesses

G = Government purchases of goods and services

[X-M] = Net Foreign Demand, (Exports minus Imports)

Additionally,

$$GNP \equiv NNP + \text{Capital Consumption Allowances} \qquad (3)$$

and

$$\text{National Income} \equiv NNP - \text{Indirect taxes} \qquad (4)$$

$$\equiv \text{Employee Compensation} + \text{Property-type income} \qquad (5)$$

Keynesian Macroeconomic Model - As shown in the previous section, National Income and Product Accounts provide a means by which National Income and Output may be measured. In this section, relationships among the various income and product accounts which determine the level of economic output are outlined through the development of a Keynesian macroeconomic model. All prices are assumed given and constant. Emphasis is placed on aggregate demand and the conditions which determine the level of GNP in equilibrium. This theoretical framework provides the basis

for selecting the analytical model used to analyze and evaluate economic dependency.

Economic production is described by expression (2) above. Ignoring Government (G) and Foreign Trade [X-M] for the moment,

$$Y \equiv C + I \tag{6}$$

that is, Output (Y) produced is consumed (C) or invested (I). Without Government or Foreign Trade considered, the identity for the disposition of Income (Y) is:

$$Y \equiv S + C \tag{7}$$

that is, Income (Y) is either saved or consumed. By combining (6) and (7),

$$C + I \equiv Y \equiv C + S \tag{8}$$

or

$$I \equiv Y - C \equiv S \tag{9}$$

Thus, Investment is identically equal to savings.

With regard to disposable income (Yd), since disposable income is either consumed (C) or saved (S)

$$Yd \equiv C + S \tag{10}$$

From identities (1), (2) and (10), a basic macroeconomic identity is derived. Given

$$Y \equiv C + I + G + [X - M] \tag{2}$$

and

$$Yd \equiv Y + R - T \tag{3}$$

which is

$$Y \equiv Yd + (T - R) \tag{11}$$

and

$$Yd \equiv C + S \tag{10}$$

then, combining

$$C + I + G + [X - M] \equiv Y \equiv Yd + (T - R) \equiv (T - R) + S + C \tag{12}$$

Restated,

$$C + I + G + [X - M] \equiv Y \equiv S + (T - R) + C \tag{13}$$

that is, Output/Demand equals Income/Supply.

Using the accounting identities presented above, a Keynesian model showing the relation between aggregate demand and level of output is established. To begin with, economic variables (C, I, G, X, M) which define aggregate demand are considered.

Consumption spending (C), that is, an individual's level of consumption, is assumed to be a function of his or her income level. In this model, consumption spending is assumed to be a linear function of Income (Y).

$$C \equiv \bar{C} + cY \tag{14}$$

where:

$\bar{C}$ = autonomous consumption

c = marginal propensity to consume, and

$\bar{C} > 0$ and $0 < c < 1$

This function indicates that with an increase in Income (Y), Consumption (C) will also increase. The coefficient "c" is the individual's marginal propensity to consume, that is, the amount of increase in Consumption resulting from a per unit increase in Income.

Planned investment spending is assumed to be a constant level $\bar{I}$. Under this assumption, aggregate demand (A) is represented in the identity

$$A \equiv \bar{C} + cY + \bar{I} \tag{15}$$

Again ignoring Government spending and Foreign Trade for the moment, equilibrium condition in the goods market is defined as follows. Since in equilibrium, output supplied, or income (Y) equals output demanded, or planned aggregate demand (A),

$$Y \equiv A \tag{16}$$

or

$$Y \equiv \bar{C} + cY + \bar{I} \tag{17}$$

Solving for equilibrium level of income and output (Yo),

$$Y - cY = \bar{C} + \bar{I} \tag{18}$$

or

$$Y(1 - c) = \bar{C} + \bar{I} \tag{19}$$

The equilibrium level of income, at which aggregate demand equals output is

$$Yo = \frac{1}{1 - c} [\bar{C} + \bar{I}] \tag{20}$$

This expression indicates that changes in autonomous

spending affect the equilibrium level of output through a multiple, 1 / 1 - c, of the initial change in aggregate spending. The amount of change in the equilibrium level of income and aggregate demand produced by a one dollar change in autonomous spending ($\bar{A}$) is termed the "multiplier". Note, the greater the marginal propensity to consume (c), the greater will be the multiplier effect. To summarize, an increase (decrease) in autonomous spending raises (lowers) equilibrium level of income, and the increase (decrease) in income is a multiple of the change in autonomous spending. Government (G) and Foreign Trade [X-M] are now reintroduced to the macroeconomic model.

Government (G) affects equilibrium income through government spending on goods and services as a component of aggregate demand, and through the effect of taxes and transfer payments on disposable income (Yd) available for consumption and saving. Recalling identity (8) on page 21,

$$C + I \equiv Y \equiv C + S \qquad (8)$$

rewritten as

$$C + I + G \equiv Y = C + \bar{I} + G \qquad (22)$$

Consumption is now a function of disposable income (Yd) rather than income (Y). Referring to identity (1), disposable income is the income available after taxes are paid and transfers are received. The consumption function

now is

$$C \equiv \bar{C} + cYd \equiv \bar{C} + c(Y + R - T) \tag{23}$$

Given a fiscal policy where $G = \bar{G}$, $R = \bar{R}$, $T = tY$ and t = fractional income tax rates, expression (14) may be rewritten as

$$C \equiv \bar{C} + c(Y + \bar{R} - tY) \tag{24}$$

or

$$C \equiv (\bar{C} + c\bar{R}) + c(1 - t)Y \tag{25}$$

Given equilibrium condition in the goods market, $Y = A$, and substituting expressions (22) and (25), the equilibrium condition becomes

$$Y \equiv (\bar{C} + c\bar{R}) + c(1 - t)Y + \bar{I} + \bar{G} \tag{26}$$

$$\equiv (\bar{C} + c\bar{R} + \bar{I} + \bar{G}) + c(1 - t)Y \tag{27}$$

$$\equiv \bar{A} + c(1 - t)Y \tag{28}$$

Solving for Yo, the equilibrium level of income

$$Y[1 - c(1 - t)] = \bar{C} + c\bar{R} + \bar{I} + \bar{G} \tag{29}$$

$$Yo = \frac{1}{1 - c(1 - t)} (\bar{C} + c\bar{R} + \bar{I} + \bar{G}) \tag{30}$$

$$= \frac{1}{1 - c(1 - t)} \bar{A} \tag{31}$$

The multiplier, a, in the presence of income taxes becomes

$$a \equiv \frac{1}{1 - c(1 - t)} \tag{32}$$

The effect of a change in government spending is

$$\text{change } Yo = \frac{1}{1 - c(1 - t)} (\text{change } \bar{G}) \tag{33}$$

For a change in transfer payments, equilibrium level of

income will change as a result of the change in autonomous spending, (c change $\bar{R}$), plus induced spending, (c(1 - t) change Y), therefore

$$\text{change } Yo = (c \text{ change } \bar{R}) + (c(1 - t)) \text{ change } Yo \quad (34)$$

or

$$\text{change } Yo = \frac{1}{1 - c(1 - t)} (c \text{ change } \bar{R}) \quad (35)$$

Bringing Foreign Trade (international or interregional trade at the subnational level) into the National Income and Product Accounting framework, the Income equilibrium condition is extended to include all components of aggregate demand as shown in expression (2). Equilibrium level of income includes not only spending by domestic residents

$$A \equiv C + I + G \quad (22)$$

but also foreign spending on domestic goods

$$Y \equiv A + [X - M] \quad (36)$$

$$\equiv (C + I + G) + [X - M] \quad (2)$$

where:

X = exports

M = imports

[X - M] = trade balance surplus or deficit (net exports)

An increase (decrease) in the trade balance increases (decreases) income in the same fashion that a change in Investment is an addition to income.

Referring to identity (13), page 22, the equilibrium condition becomes

$$C + I + G + [X - M] \equiv Y \equiv S + (T - R) + C \qquad (13)$$

or

$$C + I + G + X \equiv S \equiv (T - R) + M + C \qquad (37)$$

or

$$I + G + X \equiv S + (T - R) + M \qquad (38)$$

Exports, like investment and government purchases, represent injections into the domestic income stream, while imports, like savings and taxes, represent leakages.

As before, domestic spending is assumed to be a function of income. Foreign demand for goods and services (exports) is assumed to be autonomous ($\bar{X}$), however, domestic demand for foreign goods and services (imports) is assumed to be a function of income.

$$[X - M] \equiv X - M \equiv \bar{X} - (\bar{M} + mY) \qquad (39)$$

where:

$\bar{X}$ = Exports

$\bar{M}$ = Imports

m = marginal propensity to import

Again, both domestic and foreign price levels are assumed

fixed and output demanded will be supplied at the given price level.

Given equilibrium conditions in the goods market, Y = A, and substituting expressions (2) and (25), the equilibrium condition becomes

$$Y \equiv (\bar{C} + c\bar{R}) + c(1 - t)Y + \bar{I} + \bar{G} + [\bar{X} - M] \qquad (40)$$

and substituting expression (39)

$$Y \equiv (\bar{C} + c\bar{R} + \bar{I} + \bar{G} + \bar{X} - \bar{M}) + c(1 - t)Y - mY \qquad (41)$$

$$\equiv \bar{A} + c(1 - t)Y - mY \qquad (42)$$

Solving for Yo, the equilibrium level of income becomes

$$Y - c(1 - t)Y - mY = \bar{C} + c\bar{R} + \bar{I} + \bar{G} + \bar{X} - \bar{M} \qquad (43)$$

$$Y[1 - c(1 - t) - M] = \bar{C} + c\bar{R} + \bar{I} + \bar{G} + \bar{X} - \bar{M} \qquad (44)$$

$$Yo = \frac{1}{1 - c(1 - t) - m} (\bar{C} + c\bar{R} + \bar{I} + \bar{G} + \bar{X} - \bar{M}) \qquad (45)$$

$$= \frac{1}{1 - c(1 - t) - m} \bar{A} \qquad (46)$$

The effect of domestic autonomous spending ($\bar{C}$, $\bar{R}$, $\bar{I}$, $\bar{G}$) increases is to raise income (Yo) levels, and at the same time worsen the trade balance resulting from increased imports with fixed exports. Note, the larger the marginal propensity to import, the smaller the domestic multiplier effect (Dernburg and McDougall, 1968; Dornbusch and Fischer, 1978).

In highly abbreviated fashion, expressions (40) and (46) describe the macroeconomic model and multiplier effect of a local rural economy which trades with other domestic

regions and foreign countries. The analytical input-output model described in a later section is a highly detailed, empirical description of an economy in terms of this macroeconomic model. It is this macroeconomic model applied at the regional (subnational) level which provides the theoretical basis for this research. Although the model describes the regional economy, it does not explain the economic forces which cause change to occur within the economy or between trading economies over time.

In the following section, regional growth theory is discussed as it relates to explaining these autonomous changes in economic activity.

Regional Growth Theories A number of general and regional growth theories have been formulated to explain the forces which influence movement of economic activity within national and regional economies. In this section, general growth models are discussed briefly followed by several regional growth theories. This discussion focuses attention specifically on the general export-led growth hypothesis and regional export-base theory. Given the heavy export orientation of the case study area economies, it is felt that export-base theory reasonably explains a significant portion of the changes in aggregate demand levels, and thereby explain a significant portion of the

growth and maintenance of economic income and employment in such small, rural economies.

Two general approaches have been taken in the development of general growth theories, Classical theory and Modern theory. Classical theory attempts to develop general explanations of the process which drives long-term economic growth in all locations for all time periods. This school is identified with the works of Adam Smith and David Ricardo and others. Modern theory is characterized by less expansive theories that use "a relatively small number of precisely defined economic variables in the construction of a formal model of an aspect of the process of economic growth" (Choi, 1983). Modern growth theory derives from the work of John Maynard Keynes. This school includes the Harrod and Domar models, neoclassical and neo-Keynesian theories of economic growth, and the sources-of-growth methodology. Also included are the investment-led and export-led growth hypotheses (Choi, 1983). It is this export-led growth hypothesis applied in the subnational, interregional trade context of export-base theory that is employed in this research.

The export-led growth hypothesis argues that exported primary products induce higher domestic saving rates, attracts an inflow of factor inputs into expanding export sectors, and establishes linkages with other sectors in the

economy. Increased exports induced by greater foreign and interregional demand cause supply responses within the economy that increase the productivity of the exporting economy. In a number of studies, export growth has been identified as the key variable in promoting economic growth among countries through the growth of foreign markets (Marshall, 1959; Nurkse, 1961). Kindleberger argues that increased foreign demand stimulates domestic growth (Kindleberger, 1962), while Lamfalussy explains post-war growth in the United Kingdom relative to other Common Market countries in terms of differences in their respective exports (Lamfalussy, 1963). Regional economic growth theory, as contrasted to general growth theories which are more often applied at the National level, concentrates on economic forces operating within subnational regional economies.

A number of problems are encountered in moving from general to regional growth theory and analysis. A critical difference is the need to give particular attention to space and distance in the regional setting. Although spatial distribution of economic activity is seldom considered at the National level, it significantly affects overall efficiency of regional economies (Richardson, 1973). Regional economies are very much "open" systems and cannot be analyzed as the "closed" systems so often assumed at the National level. A much higher proportion of total

commodity and factor flows are exported and imported across boundaries of open regional economies than in national economies with trade barriers. Given this open character of regional economies, it is particularly important to specify the exogenous variables which influence regional economic activity. Regional economic analysis must also account for higher levels of uncertainity and more limited data at the regional level. Given the need for developing useable, operational models for policy purposes and the difficulties in empirically testing complex regional models, analysis of economic growth and development at the regional level must be fairly simple and straightforward (Hoover, 1975).

A number of regional growth models have been developed for regional economic impact analysis and forecasting. They include the export-base, cumulative-causation (Myrdal-Kaldor) and input-output models (Richardson, 1973). Other theories such as stages of economic growth or sector theory have also attempted to explain regional economic growth (Isard, 1960; Perloff, et al., 1960; Rostow, 1956, 1971).

The export-base model as developed by Douglass North attempts to explain long-run economic growth (North, 1955). Charles Tiebout used export-base theory in his Community Economic Base Study as a means to short-run

income determination (Tiebout, 1962). Export-base theory stresses the openness of regions and the role of changes in subnational demand patterns in regional growth. Autonomous investment, technical progress, captial accumulation and in-migration are not generally emphasized. This theory holds that the primary factor determining the overall level of activity in the economy, or sectors within the economy is demand from outside the region (North 1955, 1959; Richardson, 1969). This theory claimed (1) the concept of region should be defined in terms of its development around a common export base; (2) the success of the export base has been the determining factor in the rate of growth of regions; and (3) the export base of a region has a primary role in determining the level of absolute and per capita income of a region, and therefore in determining the amount of residentiary, secondary and tertiary activity that will develop (Holland, 1976). Richardson (1969) states that export-base analysis is most appropriate to smaller regions where investment levels generally are not determined internally. He further states the stage of development of a region may be a critical factor in determining the usefulness of export base theory. Development must be such that growth of trade makes possible regional growth by specializing in lines of production for which the region is particularly suited (Holland, 1976).

Objections to the export-base model include its exclusive concern with demand without concern for growth in capacity, its assumption that demand creates its own supply, and its emphasis on single regions rather than interregional relationships of the region with the "rest of the world". Also, objectionable are the difficulties in defining and measuring the exogenous export base, the inverse relation between output and exports to region size, and the direction of regional capital flows (high regional growth and net export of capital require unrealistically high marginal propensities to save) (Richardson, 1973).

Although the export-base approach is certainly limited in comparison to interregional models, its application in the context of this research is considered to be appropriate and reasonable given the very strong exporting characteristics of the small rural economies in the Rocky Mountains.

In the analytical model section, this theoretical framework is developed into an operational and mathematical model used to analyze and evaluate effects of changes in the aggregate spending.

Analytical Model

The export-base approach to regional analysis has used a number of techniques to separate exporting from non-exporting activity and estimate export multiplier effects. Community (economic) base studies (Tiebout, 1962), Intersectoral Flows analysis (Hansen and Tiebout, 1963), and Input-Output analysis (Leontief, 1936) are examples. In the past, many regional studies used community (economic) base analysis to estimate export activity due to the large time and budget requirements involved in constructing direct survey Leontief input-output models. This resulted in rather crude and non-specific two-sector (base and residentary) community base multipliers. Given the recent availability of the IMPLAN system for constructing relatively inexpensive and workable Leontief input-output models, this I-O approach was chosen for this research. As a result, a much more sophisticated and detailed sector-by-sector export-base analysis is possible. Refer to Appendix 2 for a description of the U.S. Forest Service IMPLAN system used for constructing and using the case study I-O models.

The Leontief I-O model used in this research formulates the macroeconomic theory of general equilibrium outlined above and was developed into an operational framework by Wassily

Leontief in the 1930s and 1940s. It has become a widely used economic modelling technique in regional economic forecasting and impact analysis. The I-O model is used to trace out interindustry (multiplier) effects on economic growth initiated by autonomous spending changes in final markets.

In this research, I-O models are employed in combination with export-base theory to mathematically construct Keynesian macroeconomic models, including National Income and Product Accounts for each case study area. Using these I-O models, regional economic output effects caused by shifts in the regions's export component of aggregate demand ($\bar{A}$) are estimated.

The basic components and relations of the I-O model consist of a system of "n" linear equations with "n" unknowns, where "n" equals the number of intermediate sectors being modelled. In matrix notation it is described as

$$[I - A] X_{tgo} = Y_{fd}$$

where:

A = technical input-output, or direct coefficients matrix

I = an identity matrix

X_{tgo} = total gross output vector

Y_{fd} = final demand vector

To avoid confusion note the symbols X_{tgo} and Y_{fd} are used to indicate the I-O notation for total gross outputs and final demand, respectively. This is in contrast to the notation employed in National Income and Product Accounts where X and Y represent exports and output, respectively.

Basically, the model is solved by finding a unique solution for

$$X_{tgo} = [I - A]^{-1} Y_{fd}$$

where:

$[I - A]^{-1}$ = the Leontief inverse, and

$[I - A] \neq 0$

The major data elements of the I-O model are:

Intermediate Sectors - These sectors provide the basic information of product flows from producers to consumers in the production process in the form of a transactions table. The technical input-output, or direct coefficients table, or "A" matrix, is developed from this transactions table. In each table, rows represent the distribution of producers' output, while columns represent the composition of inputs required to produce the output. Both the production functions and consumption functions are of a linear functional form.

Final Demand Sectors - This set represents sectoral sales to final markets (demand) in which no further intermediate processing occurs. Final Demand is represented in I-O convention by "Y" and is equivalent to Output or Product in National Income and Product Accounting. In this regard the I-O model is a demand-driven model and the results of the I-O analysis are particularly dependent on the sources and validity of the final demand estimates. The components of aggregate demand (C, I, G, X) are given for each intermediate sector.

Final Payments Sectors - These sectors represent inputs to the production process, that is, the payments to factors. In I-O notation, they are collectively termed "Value Added", while in national income and product accounting they are called Income. Final payment sectors include employee compensation, government services (taxes), capital (interest payments), rents and profits and purchases for imported inputs. Due to the manner in which the model is formulated, that is, imports included in final payments, Value Added may not precisely equal Income as described in the above macroeconomic formulation.

Total Gross Outputs - This is the column vector of sectoral interindustry transactions plus sectoral final demand components. The sum of all sector gross output is Total Gross Output (TGO) for the entire economy.

Total Gross Outlays - This is the row vector of all sector transactions plus sector final payments (value added). The sum of this row vector equals Total Gross Outlay for the economy. Given the double-entry accounting framework of the I-O model formulation, Total Gross Output summed for all sectors equals Total Gross Outlay summed for all sectors.

The mathematical structure of the Leontief I-O model and its tie to national income accounts and the macroeconomic model is summarized as follows. For an economy with two intermediate sectors (X_1 and X_2), final demand (Y_{fd}) components for each intermediate sector are

$$Y_{fd1} = C_1 + I_1 + G_1 + X_1$$

and

$$Y_{fd2} = C_2 + I_2 + G_2 + X_2$$

Final payment components are

$$W_1 = L_1 + N_1$$

and

$$W_2 = L_2 + N_2$$

where:

W = final payments

L = employee compensation

N = taxes, interest, rent and profit

Including payments to Imports, total expenditures in the payment components are

$$W_1 = W_1 + M_1$$

and

$$W_2 = W_2 + M_2$$

where:

M = imported inputs

Total Gross Output and Total Gross Outlays, then, equal

$$X_{tgo} = X_1 + X_2 + C + I + G + X$$

and

$X_{tgo} = X_1 + X_2 + L + N + M$, respectively.

Equating the two expressions for X_{tgo} and subtracting X_1 and X_2 from each side leaves

$$C + I + G + X = L + N + M$$

or

$$C + I + G + [X - M] = L + N$$

that is, gross national product equals gross national income (total factor payments). This corresponds to expression (13), page 21,

$$C + I + G + [X - M] \equiv S + (T - R) + C$$

where national income is saved or consumed, after taxes and transfers. (Blair, 1985)

Advantages of using the Leontief I-O model include:

1. It provides an operational and implementable framework
2. It provides a highly detailed examination of output composition and growth impacts, sector-by-sector
3. It may be formulated in many different forms allowing a high degree of flexibility in the types of economic problems that may be analyzed.

Disadvantages or weaknesses characteristic of the Leontief I-O model include:

1. Assumption of linear production and consumption functions
2. Relatively large exogenous final demand sectors
3. Difficulty of incorporating factor and commodity substitutions
4. Lack of comparative advantage components which make prediction of changes in interregional trade flows difficult
5. I-O models do not account for agglomeration economies and external scale economies
6. Average rather than marginal propensities to consume, tax and import are reflected in the observed data which comprise the I-O model.

In selecting a theoretical framework and analytical model it must be recognized that economic growth occurs as a result of a complex set of interrelated social and economic forces, occurring both within the regional economy, and the "rest of the world". Because the macroeconomic model, export-base theory and input-output analysis are limited to a partial set of variables from this complex set of forces, they provide a partial, though significant, explanation of the economic growth process for an area. Given the dominance of the export component in the aggregate demand schedule of these rural economies, and the limited application of the demand-driven I-O model, use of National Income and Product Accounts, export-base theory and the Leontief I-O model are appropriate to the objectives of this research.

Case Study Areas

In conducting regional economic analyses, geographical boundaries must be defined to provide the spatial dimension by which the regional economy may be described, data collected, and analysis conducted. This is a particularly important activity in this type of study since defining regional boundaries also determine internal and external trade flows, that is, the export component (X) of aggregate demand.

In practice, defining geographical boundaries depends on the objectives of the study (Castle, 1968; Nourse, 1968). In this research, the objective of defining case study areas is to identify functional regional economies that may be impacted by changes in the LOG-MILL sector and National Forest Timber stumpage export bases (Fox and Kumar, 1965).

Delineation of the case study areas is based on the central place theory which places emphasis on communities (cities) as hubs around and within which integrated economic activity occurs. These areas are often referred to as nodal regions (Hoover, 1975). This method of defining economic impact areas is based on the functional integration principle (Nourse, 1968). Demographic data used in establishing case study area boundaries include:

Distance between population centers

Travel times for workers in each area

Persons working outside area of residence

Since the county is the smallest unit of spatial data available in the IMPLAN System, it is the smallest unit for delineating case study areas. A map of counties with wood-processing facilities (over one million board-feet production annually) is shown in Figure 1. Also, this map shows the single county and multiple county case study areas chosen for detailed analysis. The four counties not included in either multiple county case study area were found to be functional economic areas. The remaining two

Figure 1 - LOCATION MAP

counties were determined not to be individual functional economic areas, but were aggregated with surrounding counties to form integrated multiple county functional economic areas.

Given the focus on wood-processing and timber stumpage supply activities, the identification of specific areas for detailed case study analysis proceeded as follows: First, all wood-processing facilities in the Rocky Mountain Region with annual production levels in excess of one million board feet were located by community and county. Data on timber stumpage volumes processed for each of these counties, by supply source, were collected from U.S. Forest Service Forest Mill Capacities and Sales Information Reports (R2-2430-22). The source of supply was identified as either National Forest or Other. In this fashion, the National Forest market share of total volume supplied was computed for each county. See Table 1.

Second, direct employment and income data were retrieved from the IMPLAN data base for each of the identified counties. These data are expressed as a percent of each county's total economic base. See Table 2.

Third, counties listed in Table 2 were listed in order of increasing percentage of direct LOG-MILL sector employment

TABLE 1

TIMBER STUMPAGE PROCESSED BY LOCAL MILLS
Average Annual Volume, Three-year period
ending September 30, 1982

STATE/County (1)	Volume Used (MMBF) N.F.	Other	Total	NF, % of Total
COLORADO				
Delta	3.0	1.0	4.0	75
Eagle	1.0	- (2)	1.0	100
Garfield	4.9	-	4.9	100
Grand	8.3	-	8.3	100
Gunnison	1.4	0	1.4	100
Jackson	12.2	.1	12.3	99
LaPlata	6.0	1.0	7.0	86
Larimer	3.0	0	3.0	100
Moffat	4.4	1.0	5.4	82
Montezuma	18.1	7.2	25.3	72
Montrose	14.7	4.3	18.0	82
Rio Grande	17.5	.5	18.0	97
Saguache	1.0	0	1.0	100
San Miguel	1.0	0	1.0	100
Teller	1.2	0	1.2	100
SOUTH DAKOTA				
Custer	12.8	7.5	20.3	63
Lawrence	20.3	20.0	40.3	50
Meade	6.2	1.5	7.7	80
Pennington	19.7	2.3	22.0	90
WYOMING				
Albany	23.2	-	23.2	100
Carbon	14.9	2.4	17.3	86
Crook	8.1	1.5	9.6	84
Fremont	16.0	.5	16.5	97
Sheridan	13.6	-	13.6	100
Park	3.0	1.2	4.2	71
Weston	15.0	4.0	19.0	79
AREAS				
Alamosa	17.6	1.3	18.9	93
Black Hills	82.1	36.8	118.9	69

(1) Counties with 1 MMBF or greater total volume used
(2) - indicates Not Reported

Source: Forest Mill Capacities and Sales Information Report (R2-2430-22), FY 1982, by Forest

TABLE 2

EMPLOYMENT AND INCOME and VOLUME PROCESSED
Logging and Milling Sectors, 1977

STATE/County	Direct Employment (as a % of Economic Base)	Direct Income (as a % of Economic Base)	NF Volume Processed (1) (% of Total)
COLORADO			
Delta	.9	.9	75
Eagle	2.1	3.6	100
Garfield	.3	.3	100
Grand	4.4	6.8	100
Gunnison	.7	1.0	100
Jackson	15.1	15.9	99
LaPlata	2.2	3.0	86
Larimer	.2	.2	100
Moffat	.9	.9	82
Montezuma	1.7	3.1	72
Montrose	1.8	2.5	82
Rio Grande	4.6	5.9	97
Saguache	1.6	1.4	100
San Miguel	.2	.5	100
Teller	1.4	1.4	100
SOUTH DAKOTA			
Custer	12.8	19.6	63
Lawrence	10.2	12.1	50
Meade	.8	2.1	80
Pennington	.3	.5	90
WYOMING			
Albany	2.2	2.5	100
Carbon	1.4	1.0	86
Crook	5.7	6.1	84
Fremont	1.5	1.8	97
Sheridan	.9	1.3	100
Park	.5	.4	71
Weston	4.4	3.7	79
AREAS			
Alamosa	2.3	3.2	93
Black Hills	1.6	3.1	69

(1) Data from Table 1

Source: IMPLAN Data Base, SCALE Reports, 1977, USDA-Forest Service, Lakewood, CO

and income. The data formed three distinct clusters: 0 - 3.9%, 4.0 - 9.9%, and 10.0% and above. See Table 3. Counties in the second and third clusters were chosen for detailed analysis and testing of the hypothesis. Individual economic input-output models were constructed for each of the counties in the second and third clusters.

As stated in the hypothesis, economic dependency is determined to exist if the National Forest timber stumpage export activity accounts for at least ten percent of economic base outputs and National Forest timber supplies provide at least 30% of the wood-processing facilities supply market. As an initial screen, the third cluster counties are economically dependent based on direct employment and income of their LOG-MILL sectors. Given the multiplier effect within the second cluster county economies, one or more of these counties could meet the test for economic dependency when total output effects are considered. With the large spread between first cluster direct employment and income levels and the ten percent criterion for economic dependency, it is highly improbable that any county in the first cluster would exceed 10% when total output is calculated. Therefore, these first cluster counties were dropped from further study. If as a result of the analysis conducted on the second cluster counties, it appeared one or more counties in the first cluster may

TABLE 3

DIRECT EMPLOYMENT AND INCOME, By Cluster
Logging and Milling Sectors, 1977
(As a percent of Economic Base)

EMPLOYMENT		INCOME	
First Cluster 0 - 3.9%		0 - 3.9%	
0.2	San Miguel-CO	0.3	Garfield-CO
0.3	Garfield-CO	0.5	Pennington-SD
0.3	Pennington-SD	0.5	San Miguel-CO
0.7	Gunnison-CO	0.9	Delta-CO
0.8	Meade-SD	0.9	Moffat-CO
0.9	Delta-CO	1.0	Carbon-WY
0.9	Moffat-CO	1.0	Gunnison-CO
0.9	Sheridan-WY	1.3	Sheridan-WY
1.4	Carbon-WY	1.4	Saguache-CO
1.4	Teller-CO	1.4	Teller-CO
1.5	Fremont-WY	1.8	Fremont-WY
1.6	Saguache-CO	2.1	Meade-SD
1.7	Montezuma-CO	2.5	Albany-WY
1.8	Montrose-CO	2.5	Montrose-CO
2.1	Eagle-CO	3.0	LaPlata-CO
2.2	Albany-WY	3.1	Montezuma-CO
2.2	LaPlata-CO	3.6	Eagle-CO
		3.7	Weston-CO
Second Cluster 4.0 - 9.9%		4.0 - 9.9%	
4.4	Grand-CO	5.9	Rio Grande-CO
4.4	Weston-WY	6.1	Crook-WY
4.6	Rio Grande-CO	6.8	Grand-CO
5.7	Crook-WY		
Third Cluster 10.0% and Above		10.0% and Above	
10.2	Lawrence-SD	12.1	Lawrence-SD
12.8	Custer-SD	15.9	Jackson-CO
15.1	Jackson-CO	19.6	Custer-SD

Source: IMPLAN DATA BASE, SCALE REPORTS, 1977, USDA-Forest Service, Lakewood, CO

meet the economic dependency test, additional analysis would be conducted for those counties. When the testing was completed on second and third cluster counties, no additional first cluster counties were considered to need further detailed study. In addition to the six single-county case study areas, detailed analysis was also conducted on two multiple-county areas, the Black Hills and the Alamosa areas. These two areas were studied because it appeared the single-county study areas included within them had significant interactions (trade) with the sourrounding counties. By analyzing the larger multiple-county economies, impacts of changes in economic activity (exports and stumpage supply changes) were determined both for the larger multiple-county and the single-county areas.

Development of the Economic Profile

An economic profile developed for each case study area describes the general structure of each area's economy, including a detailed description of each area's local export base. Each economic profile includes the following data:

- Final Demand Sectors and Total Gross Output
- Final Payments and Total Gross Outlay
- Employment
- Selected Export Base Values

The base year for these profiles is 1977. These economic data provide a fairly detailed one-year "snapshot" of each case study area's economy. Also, these data provide the basis for constructing the economic input-output models used to analyze the respective LOG-MILL sector export and National Forest timber stumpage export base and supply levels.

The local export base was developed including both foreign and domestic export components for each case study area. Each sector with an export value of one percent or greater of the areas's total export base is categorized as "exporting" and is shown individually. The remaining sectors are aggregated and shown as "Other". Total export activity from all sectors, whether the sector was mostly exporting or predominately non-exporting residentary are included in the analysis of the export bases. In this fashion, each sector was analyzed to include its full export value, thereby overcoming a serious criticism of the economic base study approach that all activity within a given sector is identified and analyzed as basic or non-basic, depending on its overall performance as measured by its location quotient (Nourse, 1968; Tiebout, 1962).

Location quotients for both total gross output (TGO) and employment were calculated for each sector in each case study area. See Appendix 1 for an explanation of how these

indices were calculated. A comparison was made of the listing of sectors identified as exporting using both the location quotients and the detailed export sector data. After review of the results of each method for determining export vs non-export sectors, the more detailed export sector data shown were chosen for use in the export base analyses. Location quotients were not used for any subsequent analysis in this research.

Export Base Analysis

In export-base theory, exports are taken as the "engine of growth" for regional economies (North, 1955, 1959). The importance of these exports in the economy's of each case study area may be seen in the large proportion of total final demand provided by the export component. Refer to Appendices Tables 2, 7, 12, 17, 22, 27, 32 and 37. To determine the effect of these export bases on economic growth several key questions arise: "To what extent is an economy dependent upon its export base for continued economic growth and development?" and "To what extent is the local economy dependent upon particular segments of the export base, i.e. LOG-MILL sector and National Forest timber stumpage supplies?" Economic dependency of an economy on its export base is indicated by the occurence of a significant change in economic output (Income and

Employment) caused by changes in the export base. Export base analysis is accomplished by first calculating the total dollar value of all goods and services exported from the case study area, then deleting this total export value from the area's total final demand and determining the net loss in economic activity to the local area. This net loss is compared to base economic activity levels for the area to determine the relative effects of such a change in export base activity.

Next, economic dependency of the local economy on its LOG-MILL sector exports is estimated by assuming there is no export final demand for these products. This is accomplished by calculating the dollar value of LOG-MILL sector exports and deleting this export value from final demand, then reanalyzing the level of economic output from the economy. Net losses caused by deleting the LOG-MILL sector export base are expressed as a percent of the economy's base level of economic activity.

The economic effects resulting from the loss of National Forest timber stumpage exports are determined by proportioning the LOG-MILL sector economic output effects by the National Forests's market share of total timber stumpage supplied to wood-processing facilities in each area. For example, if loss of an area's LOG-MILL sector exports results in a 18% drop in an area's income or

employment, then loss of National Forest timber stumpage export base, with a 50% market share, results in a 9% drop in area income or employment. An additional analysis of each area's National Forest timber stumpage supply was completed. This analysis determined the economic effects to be expected if National Forest timber stumpage volumes supplied to wood-processing facilities in each case study area annually during 1980-82 were eliminated. This analysis was conducted to corroborate the economic effects determined for National Forest timber stumpage exports using the proportioning method. Results of this analysis are shown in the Appendices Tables 5, 10, 15, 20, 25, 30, 35 and 40.

If exports of the LOG-MILL sector are important to the local area's economic activity, it would be expected that a significant change in economic output would result from a loss of LOG-MILL sector export activity. Conversely, a relatively small change of economic activity resulting from a similar loss of LOG-MILL export base activity would suggest that LOG-MILL sector is not a significant force in the economy. An economy may be highly dependent on its export base, but little dependent on its LOG-MILL exporting sector. In this case, other sectors with a higher proportion of the area's export base value would be more significant in providing for the maintenance and growth of local economic activity.

Although an economy may be highly dependent on both its export base and LOG-MILL sector, it does not automatically follow that the economy is similarly dependent on timber stumpage suppliers. Dependency is established by the market share of stumpage supplied by a particular supplier and the availability of alternative timber stumpage supply sources. In much of the Rocky Mountain Region, National Forest lands supply most of the timber stumpage processed by local mills with relatively few alternative supply sources available. In these situations, a relatively strong linkage exists between an economy's dependence on its LOG-MILL export base and on its supply of National Forest timber stumpage. However, if alternative supply sources were available, the linkage would be correspondingly weakened. See Market Shares and Alternative Supply Sources, page 13. In cases where National Forests supply a much smaller market share of stumpage for local processing and alternative stumpage sources are widely available, economic output is little dependent on National Forest timber stumpage even though it may be highly dependent on its LOG-MILL sector.

In addition to the issue of an economy's dependence on its local export activity, another very important consideration is the distributional impacts of such changes within the economy. Obviously, the LOG-MILL sector will be directly

impacted by reductions in the LOG-MILL export activity. Other sectors of the economy closely linked to the LOG-MILL sector may also experience shifts in their levels of economic output. These distributional effects are displayed for each case study area in Appendices Tables 4, 9, 14, 19, 24, 29, 34 and 39.

CHAPTER III

APPLICATION - CASE STUDIES

In this chapter, the theoretical framework and analytical method outlined in Chapter II are applied to eight case study areas located in the Rocky Mountain states of Colorado, Wyoming and South Dakota. In each of these case studies, a description of the area is followed by a summary discussion of the economic effects resulting from changes in each area's export base and timber stumpage supplies.

Demographic data used in delineating case study area boundaries are presented in Table 4. These data assist in identifying the study area boundaries based on labor supply areas and trading patterns. Economic profile data which provide a summary description of the area's economy and economic analysis results for each case study area are included in this Chapter. More detailed data for each area are presented in Appendices 3 through 10. Complete

TABLE 4

DEMOGRAPHIC DATA
By County

STATE/County	Popul. (1980)	Workers 16 yrs & over	Workers % worked outside area of residence	Mean travel time to work (mins)	Travel Time to Work (minutes) (% travelers)				
					<10	10-19	20-29	30-44	>45
COLORADO									
Grand	7,475	3979	6.7	10.8	44	21	9	11	15
Jackson	1,863	940	1.7	9.2	66	17	13	3	2
Rio Grande	10,511	3933	14.1	15.7	43	28	13	9	7
SOUTH DAKOTA									
Custer	6,000	2457	15.4	17.6	37	32	11	9	11
Lawrence	18,339	7592	11.3	13.8	42	38	6	9	5
WYOMING									
Crook	5,308	2229	17.8	18.6	53	15	6	10	15

Source: U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, General Social and Economic Characteristics, Vol.1, Chapter C, Parts 7, 43, 52. Washington, D.C.

sector-level detail for each area is available upon request.

Economic Profiles - By Area

The case study areas studied are rural with relatively small economies. These economies are characterized by one or several basic-type industries such as agriculture, forestry and mining, that process primarily for export. These economies also include a set of service or residentiary sectors supporting the primary processing sectors. Often these service-related sectors also include a strong export component of their own generated by recreation and tourist activities and other economic services provided to surrounding areas. Occasionally, these economies serve as regional hubs for surrounding counties. In these cases, their economies may be more developed and differentiated. Examples include Rapid City, SD, Grand Junction, CO and Alamosa, CO. See Table 5 for a summary of selected economic profile data by case study area.

In most cases, secondary wood-product manufacturing activity beyond sawmilling does not occur locally. Such forward linkages are most often located outside the local area. While the forward linkages are weak or entirely

TABLE 5

ECONOMIC PROFILE - ALL AREAS
(1977 Dollars and Base Data)

	CASE STUDY AREAS							
	Grand-CO	Jackson-CO	Rio Grande-CO	Custer-SD	Lawrence-SD	Crook-WY	Alamosa Area	Black Hills Area
Total Income (MM$)	35.58	7.71	62.53	17.57	79.51	22.17	116.84	614.25
Employment (# of Jobs)	2594	328	3451	855	4978	990	6903	33504
Value Added (MM$)	42.45	8.21	69.00	19.16	89.80	24.49	129.27	684.97
Final Demand (MM$)	60.19	14.93	103.49	32.75	133.45	41.67	182.98	948.60
Total Export Base (MM$)	36.19	10.57	71.17	21.55	78.73	29.20	104.19	348.79
LOG-MILL Export Base (MM$)	5.43	3.02	7.42	6.86	21.65	2.36	7.30	33.11
% of Total Export Base	15.0	28.5	10.4	31.8	27.5	8.1	7.0	9.5
% of Final Demand	60.1	70.8	68.8	65.8	59.0	70.1	56.9	36.8

Source: Appendices 3 - 10

missing locally, backward linkages are usually very strong. If timber stumpage supplies are reduced the effect is similar to a reduction in export demand for the wood-products and timber stumpage processed locally.

Case Study Area A
Grand County - Colorado

Grand County is located in central Colorado, immediately south of Jackson County (Case Study Area B). It is an area known as Middle Park surrounded by high mountains. Grand county has a population of 7475. Kremmling, its major community, has a population of 1,296. Other communities located in the county include Granby, 963, Hot Sulphur Springs, 405 (county seat), and Fraser, 470. The work force, 16 years and older, is 3,979.

Travel distances from Kremmling, the wood-processing center, to Granby is 27 miles, and to Dillon, located in Summit county, is 38 miles. Mean travel time to work for Grand county residents is approximately 11 minutes with nearly seven percent of the workers employed outside their area of residence. Approximately 75% of the workers travel less than thirty minutes to work. Given the distances to adjacent population centers and limited travel times, it appears most of the labor force resides within the county.

To a limited extent, trading patterns for selected low expense items may be described by these boundaries.

The county's major economic activity is real estate, winter sports (skiing), construction, logging and sawmilling, and recreation-related activities. Unlike most rural western counties, there is only a minor amount of agricultural activity occurring in Grand county. This is due to many ranch properties being sold and subdivided for summer home and winter sports condominiums and townhome sites, as well as the purchase of water rights by front range communities for transmountain diversion purposes.

Wood-processing facilities used approximately 8.3 million board feet of timber stumpage annually during the 1980-82 period. This volume was supplied entirely by National Forest lands. Approximately four percent of the county's employment is within the LOG-MILL sector. Following 1982, sawmilling operations ceased production and a wafer-board facility was put into operation. Because of these changes, the results of this analysis are meaningful in terms of the 1980-82 period only. At that time, approximately 4% of the county's employment and 7% of its income was directly tied to logging and sawmill sector activity.

As with most rural economies, Grand county is heavily oriented toward export activity. Sixty percent of the

county's $60.2 million in sales to final demand is to its export market. The county's local export base, $36.2 million, is oriented toward logging and sawmilling, real estate and summer and winter sports activities. See Appendix 3, Tables 1 and 2, pages 118-119.

Case Study Area B

Jackson County, Colorado

Jackson County is located in north-central Colorado along the Wyoming border, including an area known as North Park. Its county seat and only population center is the town of Walden. Population for the county is 1863, with Walden having 947 persons. The county work force is 940. The closest population centers to Jackson County are Laramie, Wyoming 72 miles to the northeast, Fort Collins, Colorado 104 miles to the east over Cameron Pass (10,276 feet), and Steamboat Springs, 58 miles to the west over Rabbit Ears Pass (9,426 feet). All three communities are connected to Walden with all-weather roads. Most of Jackson County's trade is with Laramie, Wyoming. The mean travel time to work for Jackson County residents is nine minutes with only 1.7% of the workers employed outside their area of residence. Almost the entire work force is employed within the local area.

Jackson County is heavily involved in logging and sawmilling activity. A total of 12.3 million board feet of timber stumpage was processed annually from 1980 to 1982. Approximately 99% of this volume was supplied by National Forest lands. Over 15% of Jackson county's direct employment and direct income is provided by the LOG-MILL sector. Agriculture, predominately livestock, is the second most important sector in Jackson county's economy.

The $10.6 million local export base for Jackson county is predominately within the livestock, mining, logging and sawmilling sectors. Approximately 71% of the county's sales to final demand are exported. Refer to Appendix 4, Tables 6 and 7, pages 124-125.

Case Study Area C
Rio Grande County, Colorado

This county is located in the San Luis Valley of southcentral Colorado. It adjoins Alamosa county, the regional center for most economic activity in the Valley, to its east. This county and Alamosa county are studied as a two-county study area in Case Study G. Rio Grande county has a total population of 10,511 with 3933 workers, 16 years old and over. Larger communities and their populations are Monte Vista, its county seat, 3902;

Del Norte, 1709; and South Fork, 250, the location of the county's primary wood-processing facility.

Road distances from Monte Vista are 28 miles to South Fork, 11 miles to Del Norte, 17 miles to Alamosa, and 81 miles to Salida, the next closest population center outside Rio Grande or Alamosa counties. Mean travel time to work is 15.7 minutes with 71% of workers travelling less than 20 minutes to work. 14.1% of the work force was employed outside their area of residence. Given the travel times and distances involved, it appears the majority of workers are employed in Rio Grande or Alamosa counties.

The area is characterized by a predominant agricultural industry, with additional emphasis on the food and kindred products manufacturing sector. Logging and Sawmilling activities are present, but they are not as significant as agriculture. During 1980-82, a total of 18.0 million board feet of timber stumpage was processed in Rio Grande County wood-processing facilities, primarily in South Fork. Of that total, 17.5 million board feet or 97% was supplied by National Forest lands. Logging and sawmilling activity accounted for 4.6% and 5.9% of the county's direct employment and income, respectively.

The local export base is heavily concentrated in the agricultural industry and the grain milling sectors. The

LOG-MILL sector accounts for 10.4% of the $71.17 million of local export base. Ninety-five percent of the Rio Grande county's agricultual and manufacturing sales to final markets is exported. See Appendix 5, Tables 11 and 12, pages 130-131.

Case Study Area D
Custer County, South Dakota

Custer County is located in the southwest corner of South Dakota, bordering Wyoming on its western boundary. This county is part of the Black Hills Area which is studied as a separate multiple-county case study area H. Custer County has a population of 6000 with a work force, 16 years old and over, of 2457. The town of Custer, population 1830, is the county seat and the county's major population center. The nearest major populations centers to Custer County include Rapid City, 46,492 persons, 40 miles, Hot Springs, 4742, 32 miles, and Newcastle, Wyoming, 3596, 37 miles. Much of Custer County and the entire Black Hills area's population, with the exception of Rapid City, is located outside major incorporated communities.

Mean travel time to work for Custer county employees is approximately 18 minutes, with 15% of the workers employed outside their area of residence. Sixty nine percent of the work force, 16 years old and over, live within 20 minutes

of their place of work, and 80% live within 30 minutes of their work. Refer to Table 4, page 58. It appears that Custer County may be functionally integrated within the larger Black Hills Area, rather than being a separate and essentially independent economy. Case Study H considers the entire Black Hills area as a single economy.

The economic base of Custer County is predominately logging and sawmilling with agriculture contributing fairly significantly to the base. The LOG-MILL sector provides approximately 25% of the Total Gross Output, and 22% of its Final Demand. Custer county and the Black Hills area is a very important wood-processing center in the Rocky Mountain Region. Custer County processed over 20 million board feet of timber stumpage per year during the three-year period ending September 30, 1982. Approximately 63% of this volume was supplied by National Forest lands. Nearly 13% of Custer County's employment and 20% of its income is directly tied to the LOG-MILL sector.

Approximately 32% of the county's $21.6 million local export base is included in its wood-processing sectors, with another 21% in agriculture, 9% in minerals processing and 8% in the eating and drinking sector. The local export base represents 66% of the county's total sales to final demand. See Appendix 6, Tables 16 and 17, pages 136-137.

Case Study Area E

Lawrence County, South Dakota

This case study area is located in west-central South Dakota on the Wyoming border, adjoining Crook County, Wyoming. Its major communities and their populations include: Spearfish, 5251 and Lead, 4330. Total county population is 18,339, with a work force, 16 years old and over, of 7592. Rapid City, population 46,492, is located in Pennington County, 30 miles to the east. Other nearby communities with populations outside Lawrence County include Sturgis (Meade County), 5184 at 14 miles to the east; and Belle Fourche (Butte County), 4692 at 10 miles to the north. Travel distances from Spearfish to Lead is 10 miles.

Mean travel time to work for county workers is 14 minutes, with approximately 11% of the workers living outside their area of residence. Approximately 80% of the workers spend less than 20 minutes travelling to work. As with Custer County, it appears Lawrence County is functionally integrated within the larger Black Hills Area.

Lawrence County is a very important wood-processing center in the Black Hills Area. Ten percent of the county's employment and 12% of its income are tied directly to the

logging and sawmilling sectors. The LOG-MILL sector provides 17% of total Final Demand for the Lawrence County economy. Approximately 40.3 million board feet of timber stumpage was used annually by wood-processing facilities during the 1980-82 period. Fifty percent of this volume was supplied from National Forest lands. In addition to logging and sawmilling, a major portion of the county's economic activity is associated with nonferrous metal ore (gold) mining.

The County's local export base is valued at $78.7 million and is predominately in gold mining (46%) and wood-processing (28%) activities. Approximately 59% of the county's $133.5 million sales to final demand is exported, with over 90% of its agricultural, mining and manufacturing sales to final demand being exported. See Appendix 7, Tables 21 and 22, pages 142-143.

Case Study Area F
Crook County, Wyoming

Crook county is located in the far northeast corner of Wyoming. It borders on South Dakota to the east, and Montana to the north. County population is 5308, with the major communities of Sundance and Moorcroft having populations of 1087 and 1014, respectively. Hulett is the location of its primary wood-processing facility and has a

population of 291. There are 2229 workers, 16 years old and over, in Crook County.

Distances from Sundance to nearby communities are: Hulett, 29 miles; Spearfish, South Dakota, 29 miles; Moorcroft, 33 miles; Newcastle, 45 miles; and Gillette, 59 miles. The mean travel time to work for Crook County residents is approximately 19 minutes, with 18% of workers employed outside their area of residence. Approximately 68% of the workers travel less than 20 minutes to work, with an additional 25% travelling 30 minutes or more. Crook county appears to be sufficiently independent of the Black Hills Area to be considered a functionally integrated economy. As with Custer and Lawrence (South Dakota) counties these analysis results should be evaluated together with the analysis results from the Black Hills Area case study to determine the alternative effects of considering Crook county both an independent economy and part of the larger Black Hills economy.

Major sectors in the Crook County economy include: livestock, stone and clay mining and electric utilities, together with lesser amounts of activity from the construction and LOG-MILL sectors. Approximately 6% of the county's employment and income and 7% of its final demand were tied directly to the LOG-MILL sector. Wood-processing facilities in Crook County processed approximately 9.6

million board feet of timber stumpage annually during the 1980-82 period. Eighty-four percent of this amount was supplied by National Forest lands.

Crook County's export base of $29.2 million is largely supported by agriculture (37%), mining (23%), and electric services (24%). LOG-MILL secotor export activity amounts to $2.4 million of the total export base. Approximately 70% of the county's $41.7 million sales to final demand is exported. See Appendix 8, Tables 26 and 27, pages 148-149.

Case Study Area G

Alamosa Area

The Alamosa Area is comprised of two counties, Rio Grande (See Case Study C, page 62) and Alamosa. Alamosa county includes the towns of Alamosa and East Alamosa, with populations of 6830 and 1040, respectively.

The economic base for this area is much the same as for Rio Grande County. Relative emphasis is on agriculture and food and kindred products with a similar distribution of economic activity in the remaining sectors. The LOG-MILL sector is the exception. No major wood-processing facilities are located in Alamosa County, therefore total economic activity and the annual 18.0 million board feet volume of timber stumpage processed for this two-county

area during 1980-82 occurred in Rio Grande County. No additional LOG-MILL sector employment or income is generated in Alamosa County. Because of this lack of additional LOG-MILL sector activity, direct employment in the LOG-MILL sector for the Area is one-half that of Rio Grande County, 2.3% versus 4.6%. Other measures of economic base activity are proportionally less for the area as compared to Rio Grande County, though the drop is not as pronounced as for employment.

The local export base for the Alamosa Area remains heavily concentrated in the agricultural industry, and food and feed processing sectors. Total export base values is $104.2 million. LOG-MILL sector export contributions drop from 10.4% in Rio Grande county to 7.0% in the Alamosa Area. It is interesting to note the reversal that occurs in the Wholesale and Retail Trade sectors. When wholesale trade activities of Alamosa county are included in the larger area analysis, its proportion of the export base drops from 6.7% to 3.6%, while retail trade exports increases from 3.0% to 7.0%. These changes are a reflection of the regional hub role served by Alamosa County. Compared to the 69% of total final demand in exports for Rio Grande county, 57% of final demand is exported from the Alamosa Area. None the less, agriculture, manufacturing and electric service exports remain very high at approximately 95%, 86%, and 72%,

respectively. See Appendix 9, Tables 31 and 32, pages 154-155.

Case Study Area H
Black Hills Area

The Black Hills Area includes Custer, Lawrence, Meade and Pennington Counties in South Dakota and Crook and Weston Counties in Wyoming. This Area includes all the major wood-processing facilities in the Black Hills. The Black Hills Area is comprised of a much larger economy than the three counties considered in detail (Custer, Lawrence and Crook). Because of this, the importance of the LOG-MILL sector's economic activity, though still sizeable, is proportionally less than any of the counties taken individually. Timber stumpage volumes processed in Meade, Pennington, and Weston Counties are 7.7, 22.0 and 19.0 million board feet annually, respectively. Custer, Lawrence, and Crook counties processed another 70.2 million board feet annually during the 1980-82 period. Approximately 69% of the total volume was supplied came from National Forest lands. Although a significant volume of stumpage is processed in Pennington and Weston Counties, they are not studied in detail because their LOG-MILL sector employment and income levels are less than one percent and 4.4% of the county's respective total economic activity. In Pennington County this is due to the

relatively large and dominating influence of Rapid City within this county. Although Weston county's 4.4% employment was in the second cluster range, its 3.7% income level was in the first cluster.

The Black Hills Area total export base of $348.79 million is 37% of its final demand, a drop from 66% for Custer county, 59% for Lawrence county and 70% for Crook county. The LOG-MILL sector export base provides 9.5% of the Black Hills total export base and 4% of its total final demand. This is compared to LOG-MILL sector and total export base levels for Custer, Lawrence and Crook Counties of 32% and 22%, 28% and 17%, and 8% and 7%, respectively. See Appendix 10, Tables 36 and 37. page 160-161.

Economic Analysis Results - Summary

The results of the economic analyses conducted on the total export base, LOG-MILL sector export base and National Forest stumpage supplied showed a number of fairly uniform effects across the case study areas. See Table 6. The economy of each of the areas is highly dependent on its local export base for income and employment. In each case study area, except the Black Hills, the total export base supported approximately 85% of income. Black Hills exports supported 66% of the area's income and employment.

TABLE 6

ECONOMIC EFFECTS SUMMARY - ALL AREAS
(1977 Dollars and Base Data)

	CASE STUDY AREAS							
	Grand-CO	Jackson-CO	Rio Grande-CO	Custer-SD	Lawrence-SD	Crook-WY	Alamosa Area	Black Hills Area
TOTAL INCOME (1)								
Economic Base (MM$)	35.58	7.71	62.53	17.57	79.51	22.17	116.8	614.2
Delete Total Export Base (%)	84.3	84.2	85.9	86.4	85.6	85.2	83.0	66.1
Delete LOG-MILL Export Base (%)	9.7	21.8	7.5	29.7	17.1	9.4	4.6	5.2
Delete NF Stumpage Supply (%)(2)	9.7	21.6	7.4	18.7	8.6	7.9	4.3	3.6
EMPLOYMENT (1)								
Economic Base (# of Jobs)	2594	328	3451	855	4978	990	6903	33504
Delete Total Export Base (%)	86.9	79.0	84.4	85.2	85.7	78.5	81.3	66.7
Delete LOG-MILL Export Base (%)	7.4	26.8	7.6	30.8	15.9	11.2	4.5	5.2
Delete NF Stumpage Supply (%)(2)	7.4	26.5	7.4	19.4	8.0	9.4	4.2	3.6
VALUE ADDED								
Economic Base (MM$)	42.45	8.21	69.00	19.16	89.80	24.49	129.3	686.0
Delete Total Export Base (%)	85.2	84.3	86.0	86.5	85.7	85.5	83.2	66.1
Delete LOG-MILL Export Base (%)	8.6	21.4	7.2	28.9	16.5	9.1	4.4	5.1
Delete NF Stumpage Supply (%)(2)	8.6	21.2	7.0	18.2	8.2	7.6	4.1	3.5

(1) Changes as a percent of Economic Base
(2) Annual Average Volume Used, FY 1980-82

Source: Appendices 3 - 10

Comparable data for employment were 78% to 87% for all study areas.

There was much more variability among study areas when considering income ties to the LOG-MILL sector exports only. Counties varied from 7% to 30% (Rio Grande, 7%; Crook, 9%; Grand, 10%; Lawrence, 17%; Jackson, 22%; Custer, 30%), with both multiple-county areas at 5%. Results for employment for the case study areas was basically the same as for income.

Contributions of National Forest timber stumpage exports to income and employment were nearly identical to the LOG-MILL sector results in areas with high National Forest timber stumpage market shares. These are Grand, Jackson, Rio Grande, and Crook counties and the Alamosa Area. With the lower National forest market shares for Custer and Lawrence counties and the Black Hills Area, these economies are proportionally less dependent on National Forest timber stumpage exports than the LOG-MILL sector export base. As an example, although Custer county's LOG-MILL sector exports support 30% of the economy's income, National Forest timber stumpage (market share of 63%) supports only 19% of its income. In all case study areas except Jackson (22%) and Custer (19%) counties, less than 10% of total income was provided by the National Forest timber stumpage export base. Similar results were found for employment

except in Jackson county where 27% of its employment was tied to National Forest timber stumpage exports.

The results found in the National Forest timber stumpage export base analysis were corroborated by National Forest timber stumpage supply analysis. See Table 6 and Appendices Tables 5, 10, 15, 20, 25, 30, 35 and 40. All counties except two differed by less than two percent, while the remaining two counties differed by less than four percent. The hypothesis test results for each case study area were the same for both analyses.

In terms of the distributional effects on income and employment within Industry groups, similar patterns were found across all case study areas. As would be expected, most economic effects occurred in the LOG-MILL sector of all county economies. Employment losses in excess of 92% occurred in all areas except Lawrence county with an 81% loss rate. Most significant indirect effects on employment are found in wholesale and retail trade, followed by lesser impacts in the Service, Finance, Insurance and Real Estate (FIRE), and Transportation, Utilities and Communications industries. With the exception of those economies heavily oriented to the LOG-MILL sector (Custer, Jackson, and to a less extent, Lawrence and Crook), indirect impacts were less than 8%. Where the economy was more heavily oriented

to its LOG-MILL sector, indirect effects were significantly higher.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Summary

The hypothesis for this research, initially outlined in Chapter I, is restated:

> For local rural economies within the Rocky Mountain Region, regional economic output, as measured by income and employment, is dependent on the local export base associated with timber stumpage supplied by National Forest lands. Specifically, for the hypothesis to be verified correct in a particular economy, the following conditions must be met,
>
> - local export base activity attributable to National Forest Stumpage supplies must account for at least ten percent of the economy's income and employment, and

- local wood-processing facilities must rely on National Forest lands for at least thirty percent of their timber stumpage supply.

The results of testing the hypothesis for the six counties and two multiple-county areas are summarized in Table 7.

Based on this hypothesis, both Jackson County, Colorado and Custer County, South Dakota test positively for economic dependency. All other counties and both multiple-county areas test negatively. This hypothesis test is sensitive to the market share of total timber stumpage supply held by the National Forests. Market shares vary from year to year depending on a number of factors, including stumpage volumes offered by National Forests and alternative suppliers, and stumpage volume purchased, cut and processed by local wood-processing facilities. These factors should be considered in evaluating the policy implications of such results. Referring to Table 8, note that if economic dependency is defined by LOG-MILL sector export activity rather than the market share sensitive National Forest timber stumpage supply base, Lawrence County, South Dakota meets the criteria for economic dependence for both Employment and Income, and Crook County, Wyoming becomes economically dependent for Employment only.

As discussed earlier, the location of study area boundaries is significant in determining whether or not an area is

Table 7

TIMBER STUMPAGE SUPPLIES AND ECONOMIC DEPENDENCY
Hypothesis Test - By Case Study Area
(1977 dollars)

	CASE STUDY AREAS							
	Grand-CO	Jackson-CO	Rio Grande-CO	Custer-SD	Lawrence-SD	Crook-WY	Alamosa Area	Black Hills Area
VOLUME PROCESSED BY LOCAL MILLS								
National Forest (MMBF)	8.3	12.2	17.5	12.2	20.3	8.1	17.4	82.1
Market Share (NF as a % of Total)	100	99	97	63	50	84	93	69
ECONOMIC DEPENDENCY ON NF STUMPAGE								
Income (MM$)	3.4	1.7	4.6	3.3	6.8	1.8	5.0	22.1
(% of Economic Base)	9.7	21.6	4.3	18.7	8.6	7.9	4.3	3.6
Employment (# of Jobs)	191	87	257	166	396	93	290	1192
(% of Economic Base)	7.4	26.5	7.4	19.4	8.0	9.4	4.2	3.6
HYPOTHESIS TEST	NO	YES	NO	YES	NO	NO	NO	NO

Source: Table 1, page 46; Table 6, page 75

economically dependent. Taken individually, Custer County, South Dakota is strongly dependent on both its LOG-MILL sector export activity and its National Forest timber attributable export activity. When considered as part of the larger Black Hills Area, with its much greater volume of economic activity, Custer County is not economically dependent on either the LOG-MILL sector export base or the National Forest timber attributable export base.

In chapter II, page 48, it is stated that additional detailed analysis would be conducted on Cluster One counties if needed. Referring to Table 8, note that only Cluster Three counties tested positively, and all Cluster Two counties tested negative. Two counties, Crook County, Wyoming and Lawrence County, South Dakota were borderline if allowances are made for variation in their market shares of timber stumpage supply. Based on the detailed case study analysis conducted on the counties in second and third clusters (See Table 3, page 49), it appears reasonable to conclude that all counties in the first cluster would test negative on the hypothesis. Therefore, no further analysis was conducted on first cluster counties.

TABLE 8

IMPLICATIONS FOR COUNTIES IN CLUSTER ONE
(As a percent of Economic Base)

STATE/County	EMPLOYMENT			INCOME		
	Direct Only	NF Exports	LOG-MILL Exports	Direct Only	NF Exports	LOG-MILL Exports
COLORADO						
Grand	4.4	7.4	7.4	6.8	9.7	9.7
Jackson	15.1	26.5	26.8	15.9	21.6	21.8
Rio Grande	4.6	7.4	7.6	5.9	4.3	7.5
SOUTH DAKOTA						
Custer	12.8	19.4	30.8	19.6	18.7	29.7
Lawrence	10.2	8.0	15.9	12.1	8.6	17.1
WYOMING						
Crook	5.7	9.4	11.2	6.1	7.9	9.4

Source: Table 3, page 49; Table 6, page 75.

Conclusions

This research has explored a theoretical framework and analytical method with which economic dependency of rural economies on National Forest timber supplies may be analyzed and evaluated. A number of case studies are tested using a hypothesis of economic dependency. In analyzing the case studies, some areas are found to be economically dependent while others are not dependent.

This research concludes that a Keynesian macroeconomic model using export base as a major determinant of aggregate demand changes for small rural economies is appropriate for evaluating changes in National Forest timber stumpage exports and supplies. Although this research recognizes the important effects produced by other economic and non-economic forces within an economy, export base theory represents a significant economic force which describes the basis for much of the economic output in these small rural economies. This dominant role of exports is clearly apparent in the very high proportion of export activity in total final demand levels for each economy studied. Furthermore, Leontief input-output models provide an appropriate and reasonable analytical tool for conducting operational tests and applications of this method.

It is emphasized that, both in a technical and policy sense, economic dependency as considered in this research is only part of a much wider complex of social, economic, political and other factors that must be considered when applying these methods in public policy making. Many factors are beyond the realm of quantification, and often outside the sphere of influence of National Forest decisions. The application of this method to policy formulation, analysis and evaluation process requires an understanding of, and appreciation for, this larger economic, social and political environment. In this regard, it is appropriate to finish with a section on the policy considerations that need to be recognized to successfully employ economic dependency analysis in effective public policy formulation. The remainder of this chapter presents several policy considerations for developing regional economic policies regarding economic dependency. The chapter closes with several suggestions for further research in this subject area.

Policy Considerations - It was stated above that for effective policymaking, this economic dependency analysis method must be used in full consideration of other social, economic, and political forces as they exist in the local policy environment. For this to happen the application of the economic dependency method to specific situations must occur through the use of a practical policy analysis

process. Without such a process for relating the method to a specific situation and problem, there is little chance of sensible and meaningful policy formulation and analysis, particularly as the problems and situations become more complex. The following are several considerations which will facilitate the use of this method in the public policy process.

The first policy consideration is to insure the particular situation and policy problem is clearly defined. It should be described in sufficient detail to allow an understanding of the problem within the larger social, economic and political system within which it occurs.

The second consideration is to insure the theoretical framework and analytical model is appropriate to the problem and situation under study. Are the assumptions of the model consistent with the application intended and can the necessary information be collected to allow for acceptably accurate estimates of effects and consequences?

A third consideration is the determination of policy objectives for the analysis. These objectives, although set by policymakers, are a reflection of the values existing within society and as such must be based on a sufficiently broad consensus of publics to gain acceptance and general support. This consensus-building must rely on

an active public involvement process, including close coordination with local, county, state and other federal governmental entities. Once these policy objectives are defined, appropriate criteria and economic measures (such as those developed in the hypothesis) can be identified.

A fourth consideration involves the construction and use of the analytical model to predict effects and consequences resulting from one or more policy alternatives. Based on a reasonable array of these alternative policy solutions , an estimate of effects and comparison of trade-offs among alternatives should be determined. In most situations where these policy analyses are conducted, competing demands for resources and advantage are such that seldom can all demands be satisfied all the time. An analysis of trade-offs involved in meeting these competing demands is extremely helpful in making informed and reasoned judgments under such conditions of complexity and uncertainty. In the more complex situations where effects and consequences are not easily or intuitively identified, it may be impossible to meaningfully evaluate policies without such a policy analysis process. The trade-off analysis is particularly important in balancing the "gains" and "losses" inherent in opting for varying combinations of efficiency and equity objectives.

The final consideration is to insure that the "best" possible policy decisions are reached based on all available information. In this final policymaking step, all social, economic, and political information needs to be brought to bear in order to provide the best possible balance among all policy objectives. With continued public involvement, a dynamic process may be established whereby the chosen policy may be implemented in a manner consistent with the values it is to reflect.

Also, several policy considerations specific to the economic dependency analysis method should be mentioned. Many factors affect economic dependency of communities and their economies. Provision of an even flow of timber stumpage is just one of those factors. A continuous flow of timber stumpage is neither a necessary nor sufficient cause to guarantee the maintence of employment and/or income for an economy in all cases. In conducting the dependency analysis using this export base method, a clear distinction needs to be made between the total export base and the wood-processing facilities portion of the export base with regard to dependency relationships. In the Rocky Mountain Region, where local mills generally have few alternative sources of timber stumpage other than National Forest lands, their dependency on National Forest timber may be very real, direct, and immediate. However, this dependency relation between the mill and National Forest

timber supply does not automatically translate to an economic dependency of the local community's economy on those National Forest timber supplies. It may be dependent and then again it may not be dependent! Economic dependency of the local economy is a function of its economic structure, alternative production possibilities, sectoral trade-patterns, and the National Forests' share of local wood-processing supplies. If the wood-processing sector is strong enough and its export base is of sufficient size, the economy will be dependent on National Forest timber stumpage supply. If a significant economic dependency relationship exists between the local economy and National Forest timber stumpage supplies, then there may be opportunities to consider the use of an even flow timber policy to pursue certain policy objectives as they relate to economic dependency and economic development.

The question of "whose" or "what" policy objectives are to be given consideration is relevent to the issue of economic dependency. In developing policy objectives particular attention must be given where several governmental entities are involved in an area, particularly where the public agency controlling the growth and development resources is different that the entity directly responsible to the community being affected. In the NFMA Implementing Regulations, the requirement for this coordination is

specifically addressed in 36 CFR 219.7, Coordination with other public planning efforts.

Also, are the policy objectives national, regional, or local in scope? If the objectives are National in scope, the loss of local economic activity in order to further greater economic outputs elsewhere within the national economy may be necessary and appropriate. Conversely, if the local objective takes precedent, then overall national objectives may be secondary to providing economic growth or the maintenance of "status quo" employment and income at the local level. The consequence of such an objective would be a redistribution of income and economic resources within the national economy. This is an appropriate, though non-technical, policy decision.

Development of public policy using this economic dependency method should not occur without the explicit recognition of the interplay between the efficiency and equity objectives. Economically, the two policy objectives focus on two separate, but related areas. The efficiency objective refers to benefits received and costs incurred in the allocation of economic resources with a given region, or among all regions being considered. Equity, on the other hand, refers to the distribution of these benefits and costs among various regions and/or segments of the economy. Within a Nation or region, efficiency dictates

emphasis be given to those economic activities that produce the greatest discounted net benefits possible given available resources. When more than a single region is dealt with, each region's comparative advantage, that is, the economic activities for which it is best adapted (most efficient in a relative sense) need be favored such that economic output for all regions is maximized collectively. Encouraging economic growth in one region may well be at the expense of growth in another region, and perhaps, at the expense of overall National growth. Relating regional needs to one another, and to the Nation, requires clearly stated regional economic objectives.

Although economic efficiency is an important objective, it must be considered in relation to the other economic (equity) and non-economic objectives. The Federal government has a responsibility to all citizens of the Nation, as well as to citizens of particular regions within the Nation. In this regard, the Federal government must balance its overall responsibilities for Nation-wide efficiency and economic development with its concomitant responsibility for providing equitable regional assistance. In other words, National efficiency must take into consideration regional and interregional equity objectives. W. Arthur Lewis, in referring to the two policy objectives of economic efficiency and equity stated, "The advantage of economic growth is not that wealth

increases happiness, but that it increases the range of human choice" (Lewis, 1955). Clearly, economic efficiency in this reference becomes a means to an end, rather than an end in itself. In this context, income redistribution (equity) between regions is a particularly important objective in public policy.

What is the relationship, then, between the regional objectives and the objective for economic efficiency? Castle and Youmens refer to the Flood Control Act of 1936 which states, " The benefits to whomsoever they may occur should exceed the costs" (Castle and Youmens, 1968). In this respect, the efficiency objective in public policy choice is not simply that of maximizing economic efficiency, but of insuring that, at least, benefits exceed costs". A benefit-cost ratio of unity or greater then is a necessary, but not the exclusive condition for public investment.

Of course, forest policy is not directed by the Flood Control Act of 1936. The language of this Act, however, does present a reasonable statement of how these two objectives may be related in the public policy process. More specific to forest policy, the NFMA Implementing Regulations, 36 CFR 219., also require a balancing of these objectives. It states "Each alternative shall represent to the extent practicable the most cost efficient combination

of management prescriptions examined that can meet the objectives established in the alternative" (36 CFR 219.12(f)(8)). It is clear that although economic efficiency is stressed throughout the Regulations, a requirement remains that efficiency be balanced with other objectives including equity in formulating regional economic growth and development policies.

In the course of finding this "balance" between efficiency and equity objectives, the regional economy should be analyzed to determine which of its sectors have the highest potential for producing the greatest increase in economic growth while at the same time meeting regional economic development objectives. In this respect, although an economy may be dependent on a number of economic activities for its current output and future growth, particular activities and therefore sectors may be more effective in promoting regional economic growth or otherwise achieving the stated growth and development objectives. Through the support and development of these activities and sectors, equity objectives should be pursued with the least possible adverse impacts on the overall wealth-producing potential of the regional and National economies. That is to say, equity objectives must be pursued as efficiently as practicable. If as a result, policy decisions are reached which in pursuing a particular set of long-range objectives have potential to cause significant short-term disruptions

and adverse impacts within local economies, consideration needs to be given to the period over which the policy objectives will be put in place. This transitional period would provide for an orderly and stable reallocating of economic resources within the economy.

In the context of economic dependency, this discussion argues that resources should be allocated in such a manner as to increase the economic output of a regional economy as much as possible with several provisions. If current public policies or investments on which a significant portion of the economy's output depends are not efficient, or not as efficient as alternative uses of those economic resources, then within the scope of the overall policy objectives, those resources should be moved to more efficient economic activities or sectors with greater potential for economic growth (more efficient). Most often, these shifts do not occur overnight. Some may take substantial amounts of time to complete fully. It is important that sectors and activities on which the economy depends be identified and maintained, if needed, during the transitional period. In this manner, critical losses in the regional income and employment base may be avoided during the transitional period. However, as with the arguments for supporting inefficient infant industries in the short-run so they may establish themselves for efficient operations in the long-run, this protection would

be warranted only during the transistional short-run period.

Summarized, public policy decisions should seek to insure that proposed benefits at least exceed costs, that is, the wealth of the Nation should not be reduced. Although the political process should increase the efficiency of its policies as much as possible and may choose to allow efficiency to unilaterally direct the choice of public policies, of course, it is not required to do so. Society through the political process may exercise its "range of human choice" through selection of equity objectives involving the distribution of benefits and costs created by the economy. However, it is in society's interest to increase efficiency as much as possible given its objectives, both at levels above and below a benefit-cost ratio of unity. By maintaining the most efficient allocation of economic resources possible, given the equity objectives being pursued, an economy will produce the highest possible (constrained) level of wealth to society. As efficiency increases, economic wealth increases and the range of choice available to society also increases.

Policy Recommendations - Given the considerations outlined above, the following recommendations are suggested for consideration in formulating regional economic growth policies.

1. Develop coordinated overall economic policy objectives to be considered when formulating and evaluating alternative regional (area) economic development and planning policies. Such economic policy objectives should indicate the role of both efficiency and equity in the planning and management of resources available to the policymaker for use in each area.

2. When developing economic growth and development policies, consider all economic sectors of each economy under study, and all relevant economic activities that may influence the policy objectives. In other words, economic growth and development policies must not be limited to simply the logging and milling sectors or timber harvesting activities. All sectors of the economy need be considered in terms of its economic structure and condition (health) to determine the segments with the greatest potential for meeting regional economic policy objectives. Other economic activities such as grazing and recreation should also be considered, as appropriate. Emphasis should be given to the segments of the economy that are particularly suited to maximizing the growth potential of the economy while meeting its regional economic objectives.

3. Close coordination with local, county, state and other Federal agencies must be encouraged as required by 36 CFR

219.6. Economic growth and development policies of these agencies must be balanced with both local and national objectives of the Forest Service.

4. Regional economic development alternatives should balance the needs and limitations of an area in both the short-run and long-run. When utilizing the economic dependency analysis detailed herein, its assumptions regarding the short-run, economic structure, availability of supplies, and other factors must be observed. If conditions are contrary to the assumptions of this model, the analysis method must be modified accordingly.

The reason for investigating a theoretical framework and analytical method for measuring economic dependency is not to provide definitive answers to all the economic growth and development issues. More reasonably, it is intended as a means by which a measure of understanding may be brought to the economic dependency issue. Hopefully, the method provides a more explicit process by which this policy issue may be reasonably examined and related to its policy environment. Although its application in these case studies is oriented to policy analysis and management decisionmaking in the public sector, it may be useful in private sector considerations as well. In either case, hopefully it may provide more relevant and useful information to policy formulation and analysis, and in

doing so, contribute to a more informed and reasoned decisionmaking process.

Suggestions for Further Research

1. Develop interindustry trade coefficients and associated IMPLAN modules to allow for the construction of interregional input-output models.

2. Replace the current Supply-Demand pooling technique to improve the identification of inter-regional and intra-regional trade flows.

3. Investigate alternative regional growth theories and expand the theoretical framework to include additional economic variables (such as Import demand shifts and Investment-led growth hypotheses) to better explain regional economic activity.

4. Investigate alternative timber stumpage supply sources and incorporate into economic dependency analyses.

5. Develop improved means for identifying labor supply areas and trading patterns in rural areas to better delineate economic impact areas.

6. Expand the application of economic dependency to the areas of economic development and economic and community stability.

BIBLIOGRAPHY

BIBLIOGRAPHY

Alward, Gregory S., H. Craig Davis, Kostas A. Despotakis, Everand M. Lofting. 1985. Regional Non-Survey Input-Output Analysis with IMPLAN. Paper presented at Southern Regional Science Association Conference, Washington, D.C. May 9-10, 1985.

Alward, Gregory S. and Charles J. Palmer. 1981. IMPLAN: An Input-Output Analysis System for Forest Service Planning. Preceedings of the First North American Conference on Forest Sector Models, Williamsburg, Virginia. A B Academic Publishing, Oxford, pp. 131-140.

Bell, Enoch. 1977. Estimating Effect of Timber Harvesting Levels on Employment in Western United States. USDA For. Serv. Res. Note. INT-237, 11 p.

Bendavid, Avrom. 1974. Regional Economic Analysis for Practictioners. Praeger, N.Y. 195 p.

Beuter, John H. and Con Schallau. 1978. Forests in Transition: Relationship to Economic and Community Stability. Paper presented at the Eighth World Forestry Congress, Jakarta, Indonesia. 18 p.

Brazzel, John M. and W. Whitney Hicks. 1968. Exports and Regional Economic Growth: An Evaluation of the Economic Base and Staple Models. Land Economics. 44(4):503-509.

Castle, Emery N. and Russell C. Youmans. 1968. Economics in Regional Water Research and Policy. Amer. J. Agr. Econ. 50(5):1655-1666.

Choi, Kwang. 1983. Theories of Comparative Economic Growth. The Iowa State University Press, Ames, Ia. 298 p.

Connaughton, Kent P. and William McKillop. 1979. Estimation of "Small Area" Multipliers for the Wood Processing Sector-an Econometric Approach. Forest Science. 25(1):7-20.

Czamanski, Stan. 1973. Regional and Interregional Social Accounting. D.C. Heath and Co., Lexington, Mass.

Darr, David R. and Roger D. Fight. 1974. Douglas County, Oregon: Potential Economic Impacts of a Changing Timber Resource Base. U.S. For. Serv. Res. paper, PNW-179. 41 p.

Dernberg, Thomas F, and Duncan M. McDougall. 1968. Macroeconomics. McGraw-Hill, N.Y. 438 p.

Dickerman, Alan R. and Stanley Butzer. 1975. The Potential of Timber Management to affect Regional Growth and Stability. J.For. 73:268-269.

Dornbusch, Rudiger and Stanley Fischer. 1978. Macroeconomics. McGraw-Hill, N.Y. 664 p.

Fox, Karl A. and T. Krishna Kumar. 1965. The Functional Economic Area: Delineation and Implications for Economic Analysis and Policy. The Regional Science Association Papers, Vol. 15. pp. 57-85.

Hansen, W. Lee and Charles M. Tiebout. 1963. An Intersectoral Flows Analysis of the California Economy. Review of Economics and Statistics, Vol 45. pp. 412-413.

Haynes, Richard W., ed. 1983. Competition for National Forest Timber: Effects on Timber-Dependent Communities. U.S. For. Serv. General Tech Rpt, PNW-148. 40 p.

Hill, F.G., 1962. Regional Aspects of Economic Development. Land Economics. Vol. 38. pp. 85-98.

Holland, Stuart. 1976. Capital versus the Regions. St Martin's Press, N.Y. 328 p.

Hoover, Edgar M. 1975. An Introduction to Regional Economics. Alfred A. Knopf, N.Y. 395 p.

Isard, Walter. 1960. Methods of Regional Analysis: An Introduction to Regional Science. The M.I.T. Press, Cambridge, Mass. 784 p.

Josephson, H.R. 1976. Economics and National Forest Timber Harvests. J.For. 74:605-608.

Kindleberger, C.P. 1962. Foreign Trade and the National Economy. Yale University Press, New Haven, Conn.

Kromm, David E. 1972. Limitations on the Role of Forestry in Regional Economic Development. J. For. 70:630-633.

Lamfalussy, A. 1963. The United Kingdom and the Six: An Essay on Economic Growth in Western Europe. R. Irwin, Homewood, Ill.

Leontief, Wassily. 1936. Quantitative Input-Output Relations in the Economic System of the United States. Review of Economics and Statistics. XVIII.

Leven, Charles L. 1966. The economic base and regional growth. In Research and Education for Regional and Area Development, p. 79-94. W.R. Maki and B.J.L. Berry, eds. Iowa State Univ. Press, Ames, Iowa.

Lewis, W. Arthur. 1955. Is Economic Growth Desirable? In The Theory of Economic Growth. Richard D. Irwin, Inc., Homewood, Ill., pp. 478-491.

Lofting, Evard. No date. Procedures used to develop State and County Data for preparing Regional Input-Output Models. USDA For. Serv. Northern Reg., Missoula, MT. 11 p.

Maki, Wilbur R., Con H. Schallau and John H. Beuter. 1968. Importance of Timber-Based Employment to the Economic Base of the Douglas-fir Region of Oregon, Washington and Northern California. USDA For. Serv. Res. Note PNW-76. 6 p.

Maki, W. R. and D. L. Schweitzer. 1973. Importance of Timber-Based Employment to the Douglas-fir Region, 1959-1971. USDA For. Serv. Res. Note PNW-196. 16 p.

Mandelbaum, Thomas B. and Bruce A. Weber. 1984. "Absentee Ownership, Regional Income Growth and Employment Instability in Oregon Counties, 1969 - 1979". Paper presented at Thirty-First North American Meeting of the Regional Science Association. 27 p.

Marshall, A. 1959. Principles of Economics, 5th Ed., Macmillan, London.

Miernyk, William H. 1967. The Elements of Input-Output Analysis. Random House, NY. 156 p.

Morgan, Thomas D. 1964. "The Export Base and Development Stages Theories of Regional Economic Growth: An Appraisal". Land Economics. 40:421-432.

North, Douglass C. 1955. Location Theory and Regional Economic Growth. The Journal of Political Economy, June 1955. pp. 243-257.

North, Douglass C. 1956. A Reply. The Journal of Political Economy. April 1956. 167 p.

North, Douglass C. 1959. Agriculture in Regional Economic Growth. Journal of Farm Economics. 41:943-951.

Nourse, Hugh O. 1968. Regional Economics. McGraw-Hill, NY. 247 p.

Nurkse, R. 1961. Patterns of Trade and Development. Blackwell, Oxford.

Perloff, Harvey S., et al. 1960. Regions, Resources and Economic Growth. University of Nebraska Press, Lincoln, Nebr. 716 p.

Perloff, Harvey S. 1963. How a Region Grows - Area Development in the U. S. Economy. Suppl. Paper No. 17, Committee for Economic Development. 147 p.

Pfister, Richard L. 1963. External Trade and Regional Growth: A Case Study of the Pacific Northwest, Economic Development and Cultural Change, Vol. 11, pp. 285-302.

Polzin, Paul E. and Con H. Schallau. 1983. Characterizing Economic Trends in Small, Resource-Dependent Communities. The Southwestern Review. 3(2):85-95.

Reiling, Stephen D. and Mark W. Anderson. 1985. Equity and Efficiency in Public Provision of Forest-based Recreation Opportunities. Journal of Environmental Mgmt. 20:149-161.

Richardson, Harry W. 1969. Regional Economics, Location Theory, Urban Structure and Regional Change. Praeger Publishers, N.Y. 457 p.

Richardson, H. W. 1972. Input-Output and Regional Economics. John Wiley and Sons, N.Y. 294 p.

Richardson, Harry W. 1973. Regional Growth Theory. John Wiley & Sons., N.Y. 264 p.

Ritz, Philip M. 1980. Definitions and Conventions of the 1972 Input-Output Study. USDC Bureau of Economic Analysis. BEA staff paper. Washington, D.C. 77 p.

Round, Jeffery I. 1983. Nonsurvey Techniques: A Critical Review of the Theory and the Evidence. International Regional Science Review 8(3):189-212.

Rostow, W. W. 1971. The Stages of Economic Growth. Cambridge University Press. 253 p.

Rostow, W. W. 1956. "The Take-off into Self-Sustained Growth". Economic Journal. pp. 25-48.

Samuelson, Paul A. 1976. Economics of Forestry in an Evolving Society. Econ. Inq. 16:466-491.

Schallau, Con H. 1974. Forest Regulation II: Can Regulation Contribute to Economic Stability? J. For. 72:214-216.

Schallau, C. H., W. R. Maki and J. H. Beuter. 1969. Economic Impact Projections for Alternative Levels of Timber Production in the Douglas-fir Region. Annuals of Regional Science 3(1):96-106.

Schallau, C. H. 1980. Stages of Growth Theory and Money Flows from Commercial Banks in Timber-Dependent Communities. USDA For. Serv. Res. paper PNW-279. Portland, Ore. 16 p.

Schallau, C. H. and P. E. Polzin. 1983. Considering Departures from Current Timber Harvesting Policies. Case studies of four economies in the Pacific Northwest. USDA For. Serv. Res. paper PNW-306. Portland, Ore. 29 p.

Schallau, Con. 1983. Departures from What? How National Forest Policy has been fashioned to achieve Community Stability. Western Wildlands. p. 8-13.

Schuster, Ervin G., Charles R. Hatch and William D. Koss. 1975. Location Quotients, Excess Employment and Short Run Economic Base Multipliers for Idaho's forest products industry. Univ. Idaho Forest, Wildlife and Range Exp. Stn., Inform. Ser. No. 10. 25 p.

Sirkin, Gerald, 1959. The Theory of the Regional Economic Base. The Review of Economics and Statistics. pp. 426-429.

Stokey, Edith and Richard Zeckhauser. 1978. A Primer for Policy Analysis. W.W. Norton & Co., N.Y. 356 p.

Tiebout, Charles M. 1956. Exports and Regional Economic Growth, The Journal of Political Economy, Vol. 64. pp. 256-265.

Tiebout, Charles M. 1962. The Community Economic Base Study. Committee for Economic Development, Supplemental Paper Number 16. New York, N.Y. 84 p.

United States Congress. 1946. Employment Act of 1946. 60 Stat. 23:15 U.S.C. 1021-1024.

United States Congress. 1960. Multiple Use-Sustained Yield Act of 1960. 74 Stat. 215:16 U.S.C. 528-531.

United States Congress. 1974. Forest and Rangeland Renewable Resources Planning Act. Act of August 17, 1974. 88 Stat. 476, as amended; 16 U.S.C. 1600-1614.

United States Congress. 1976. National Forest Management Act of 1976. Act of October 22, 1976. 90 Stat. 2949; 16 U.S.C. 1600 (note).

United States Department of Commerce, Bureau of the Census. 1980. Census of Population, General Social and Economic Characteristics. Vol. 1, Chapter C, Parts 7, 43, 52. U.S. Government Printing Office, Washington, D.C.

United States Forest Service. 1977. Sale and Disposal of National Forest Timber. 36 CFR 223. Washington, D.C.

United States Forest Service. 1982. Guidelines for Economic and Social Analysis of Programs, Resource Plans and Projects: Final Rule. Federal Register 47(80):17940-17954.

United States Forest Service. 1982. National Forest System Land and Resource Management Planning: Final Rule. Federal Register 47(190):43026-43052.

United States Forest Service. 1983. IMPLAN User's Guide. Systems Application Unit, Land Management Planning, Fort Collins, Colorado.

United States Forest Service. 1984. Sale and Disposal of National Forest System Timber. 36 CFR 223. Washington, D.C.

United States Forest Service. 1984. Timber Management Planning. 36 CFR 221. Washington, D.C.

Waggener, T. R. 1977. Community Stability as a Forest Management Objective. J. For. 75(11):710-714.

Waggener, Thomas R. 1978. Sustained Yield Policies and Community Stability. Paper presented at the Eighth World Forestry Congress, Jakarta, Indonesia. 10 p.

Wildavsky, Aaron. 1979. Speaking Truth To Power: The Art and Craft of Policy Analysis. Little, Brown & Co., Boston, Mass. 431 p.

Youmans, Russell C., David R. Darr, Roger Fight and Dennis Schweitzer. 1973. Douglas County, Oregon: Structure of a Timber-Dependent Economy. Oregon St. Univ. Ag. Exp. Sta. Circ. Inform. 645. 25 p.

Zivnuska, John A. 1949. Commercial Forestry in an Unstable Economy. J. For. 47:4-13.

APPENDICES

APPENDICES

APPENDIX 1

CALCULATION OF OUTPUT AND EMPLOYMENT SPECIALIZATION INDICES (Location quotients)

The SCALE (or SMASH, as appropriate) program calculates the total gross output (employment) specialization index by dividing the output (employment) of a given sector by the total regional output (employment). The product of this calculation is then divided by the total gross output (employment) of that sector nationally, divided by the total gross output (employment) nationally.

These indices or location quotients, measure the specialization of a region relative to the national economy in the production of its respective sectors. The measure is defined in terms of total gross output or employment. An index greater than unity for a given sector indicates a relatively high concentration of that sector's activity in the region relative to the Nation. Conversely, an index less than unity indicates a lower concentration of that activity in the region as compared to the Nation.

APPENDIX 2

DESCRIPTION OF THE IMPLAN SYSTEM

The IMPLAN System was developed by the late Charles J. Palmer and Dr. Greg Alward of the U.S. Forest Service. It is a system for constructing and using regional input-output models based on secondary data sources.

This system is comprised of five modules, four of which are used for constructing the economic I-O model and one for conducting the forecasting or impact analysis. A number of supporting modules are also available for facilitating the operation of the system. The five primary modules include: REGION, SCALE, SMASH, INVERT and IMPACT.

REGION - This module contains the empirical data base used in specifying national income accounts for the economic area under study. 1977 base year data is available for each county and state within the United States. IMPLAN data components for each Income and Product Account and subsidary data follow.

Seven Final Demand (Product) accounts

1. Personal Consumption Expenditures
2. Capital Formation
3. Inventory Change
4. State and Local Government Expenditures
5. Federal Government Expenditures
6. Foreign Exports
7. Total Final Demand

Four Final Payment (Income) accounts

1. Employee Compensation
2. Indirect Business Taxes
3. Property-type Income
4. Total Value Added

Two associated components

1. Total Gross Output
2. Employment

The above data is developed for only those counties included in the economic area.

The key activity performed by the analyst with the REGION module is specifying the geographical area to be included in the study. This area, or region, is referred to as the economic impact area. It specifies the boundaries of the economy that will be studied, and therefore, also defines the trade component, that is, the portion of economic activity that occurs as exports (leakages from the economy)

and imports (leakages into the economy). This process, termed regionalization, is a critically important activity for insuring the subsequent I-O model will be appropriate to the study objectives. This is particularly the case given the focus on the export base in this research. The process by which these economic impact areas were defined is described in Chapter 2, Determination of Case Study Areas.

SCALE - This module performs several tasks. Using output from the REGION program and a set of national average production functions, the SCALE module constructs a detailed set of input-output accounts for the economic impact area. Reports from SCALE output files are generated using the supporting LISTER program module. A complete set of detailed Income and Product Accounts are developed by SCALE. In addition to REGION data shown above, the following data is provided by SCALE output files.

Two Final Demand (Product) accounts

7. Domestic Exports
8. Domestic Final Demand

Seven Final Payment (Income) accounts

5. Competitive Imports
6. Non-Competitive Imports
7. Total Domestic Imports
8. Foreign Imports
9. Total Imports

10. Total Domestic Final Payments

11. Total Final Payments

An Interindustry transactions table is developed for a total of 466 intermediate producing and consuming sectors within the IMPLAN data base. Only those sectors which actually occur within the designated area are included in the transactions matrix. This sectorization process establishes the detailed sector plan, although it may be changed through an aggregation routine in the SMASH program module. The LISTER program generates both interindustry transactions tables and input-output direct coefficients tables from SCALE output files. It can also report both Intermediate Output and Intermediate Outlay for the economic impact area. This part of the I-O model, the transactions matrix, is developed using secondary, non-survey data, specifically the 1972 Bureau of Economic Analysis (BEA) National I-O model. The 1972 industry-by-industry input-output table was updated to 1977 with relative price changes and separate estimates of final demand, value added, and gross output. Coefficient changes for the intermediate sectors were estimated using the RAS technique.

A debate has occurred over the past years regarding the merits of nonsurvey versus survey data collection techniques in I-O model construction. A critical review of

this discussion has been presented by Round (1983). Although a detailed appraisal of the accuracy of the nonsurvey technique used by the IMPLAN system is outside the scope of this research, several comparative evaluations of IMPLAN models with primary survey data models for the same areas has been completed. The results of these comparisons indicate output estimates for the IMPLAN models are not significantly different from the survey-based I-O models (Alward, 1985).

SMASH - This program module allows an analyst to aggregate two or more sectors identified by the SCALE program into a single aggregated sector. This is an optional step which may be bypassed at the discretion of the analyst. If aggregation is desired, the analyst must provide the aggregation scheme as program data input. In this case, SMASH prepares an aggregated interindustry transactions table and direct coefficients table. These tables may be retrieved from SMASH output files using the LISTER program.

INVERT - The INVERT program module has two primary functions. One, it inverts the direct coefficients table developed in SCALE or SMASH to form the Leontief Inverse matrix. Two, INVERT calculates a set of multipliers for both the open and closed models. Included are multipliers for Output, Personal Income, Total Income, Value Added, and Employment. In the open model the household sector

(personal consumption expenditures) is left outside the transactions matrix, whereas, with the closed model the household sector is included within the transactions matrix. Open model multipliers are used in calculating economic impacts in the IMPACT module.

IMPACT - Using output from INVERT and a set of exogenous changes to final demand determined by the analyst, IMPACT solves the matrix equation

$$[I - A]^{-1} Y_{fd} = X_{tgo}$$

IMPACT solves for changes in economic output expressed in terms of Value Added, Income and Employment. Since depreciation is not a variable in the IMPLAN system, Net Regional Product cannot be computed directly, therefore, Gross Regional Product (Value Added) is used to indicate economic output (Y). Value Added is the value of goods and services bought from households, that is, total income and indirect business taxes. Total income is comprised of employee compensation (wages and salaries) and property-type income (dividends, rent and interest). Employment is derived from the REGION data base, by sector.

This program produces a number of reports displaying economic effects caused by the changes in final demand. These effects are measured for Final Demand, Total Gross Output, Emloyee Compensation Income, Property-type Income,

Total Income, Value Added and Employment. A report for 1977 base year data is provided for the same measures.

For input data, IMPACT requires the changes in direct expenditures that will be injected into, or withheld from, the economy. These expenditure changes must be identified by sector. Final demand changes may be entered directly, or in the form of a matrix of expenditures per unit activity. In the latter case, the amount of each activity considered is specified for each alternative under study. The following types of input data were collected and used in the export base and timber stumpage supply impact analyses. This data are available on request.

Timber stumpage volumes processed by local wood-processing facilities
Final demand expenditures for timber stumpage
Price deflators for sector 137, Sawmilling
Export base values, by sector.

In developing input data for IMPACT, that is, alternative sets of changes in final demand, the analyst must decide the appropriate time period over which the changes to final demand are occurring. Identification of this time period, or periodization, involves two aspects. First, the determination of the time interval for the base period over which the dollar flows within each income and product account is measured. In the IMPLAN system this is a

one-year period (1977). Second, the analyst must decide the time period over which the changes to final demand take place. Given the nature of I-O models, and in the case of this research, the theory of Income and Trade, this time interval is the short-run period. The actual length of the short-run time period is not fixed, but is a function of the time during which the basic assumnptions of the I-O model (fixed industrial composition, trade flows, etc.) and of the theory governing the exogenous variables is valid.

The strength of using the IMPLAN system to construct the I-O models is in its flexibility in design and application, its relatively low cost to build and use models, its consistency of method in model construction and application, and its current availability for operational applications. It is particularly useful in permitting comparative analyses of alternative situations (theories, impact areas, etc.), in which a number of different models are needed.

Given the approriateness of using the Leontief I-O model formulation to address the macroeconomic and regional economic questions being addressed in this research, the strengths of the IMPLAN system in providing useable and meaningful I-O models far out-weigh its weaknesses and provide reasonable analytical models for this type of application.

APPENDIX 3

CASE STUDY AREA A

GRAND COUNTY - COLORADO

Table 1

FINAL DEMAND, FINAL PAYMENT AND EMPLOYMENT
(1977 Dollars and Base Data)

Economic area: Grand County, Colorado

	TOTAL (All) ($MM)	LOG-MILL (136-137)	LOG-MILL (% of Total)
A. Final Demand and Total Gross Output			
Personal Consumption	16.9038	.0002	< 1.0
Capital Formation	4.7471	.0004	< 1.0
Inventory Change	.5223	.3308	63.3
State-Local Govt Expenditures	1.1392	.0004	< 1.0
Federal Govt Expenditures	.6821	.0001	< 1.0
Exports	36.1851	5.4322	15.0
Total Final Demand	60.1896	5.7477	9.6
Intermediate Output	15.1883	.5239	3.4
Total Gross Output	75.3779	6.2716	8.3
B. Final Payments and Total Gross Outlay ($MM)			
Employee Compensation	19.2498	1.5391	8.0
Indirect Business Taxes	6.8651	.0612	< 1.0
Property-type Income	16.3344	.8839	5.4
Total Value Added	42.4492	2.4842	5.8
Imports	17.7404	2.7871	15.7
Total Final Payments	60.1896	5.2713	8.8
Intermediate Outlay	15.1883	1.7317	11.4
Total Gross Outlay	75.3779	7.0030	9.3
C. Employment (# Jobs)	2594	140	4.4

Source: Lister Report #3.230; IMPLAN*C033803211282. file dated 7/30/85

Table 2

LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Grand County, Colorado

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
AGRICULTURE (1-12)				
Meat Animals, Misc.	(3)	1.8292	2.0	95.6
Forestry & Fishery	(11)	1.1530	1.2	96.7
Other		.0890	< 1.0	89.0
Total, Industry		3.0717	3.3	98.5
MINING (13-50)				
Total, Industry		.0491	< 1.0	105.6
CONSTRUCTION (51-52)				
New Construction	(51)	.0002	< 1.0	< 1.0
Mtc & Repair Constr.	(52)	.0002	< 1.0	< 1.0
Total, Industry		.0004	< 1.0	< 1.0
MANUFACTURING (53-419)				
Logging	(136)	.0158	< 1.0	96.9
Sawmills, General	(137)	5.4164	15.0	94.2
Other		1.7822	1.9	69.3
Total, Industry		7.2144	7.7	86.6
TRANSPORTATION, COMMUNICATION AND UTILITIES (420-431)				
Electric Services	(429)	2.3724	2.5	77.9
Other		.8505	< 1.0	44.1
Total, Industry		3.2229	3.4	64.8
WHOLESALE TRADE	(432)	.0085	< 1.0	1.6
RETAIL TRADE	(433)	.4865	< 1.0	9.8
FINANCE, INSURANCE AND REAL ESTATE (434-440)				
Real Estate	(440)	5.5277	5.9	74.0
Other		1.0533	1.1	10.1
Total, Industry		6.5810	7.0	36.8

Table 2 (cont'd)

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
SERVICES (441-457)				
Hotels & Lodging	(441)	3.8550	4.1	93.8
Eating & Drinking	(447)	3.4501	3.7	67.8
Amusement & Recreat.	(450)	7.5529	8.0	96.4
Other		.7051	< 1.0	22.0
Total, Industry		15.5631	16.6	76.9
GOVERNMENT ENTERPRISES (458-464)		.4826	< 1.0	122.5
TOTAL		36.1851	100.0	60.1

(1) Sectors with percent of total exports equal to, or over, 1% are shown individually; Sectors with less than 1% are grouped as Other.

(2) Some Sectors may exceed 100% due to negative Inventory changes within that sector's final demand component.

Source: Lister Report #3.210; IMPLAN*C03380321282. file dated 7/30/85

TABLE 3

ECONOMIC EFFECTS - CHANGES IN LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Grand County, Colorado

	Value Added (MM$)		Income (MM$)		Employment (# of jobs)	
	Direct	Total	Direct	Total	Direct	Total
A. ECONOMIC BASE (1)		42.449		35.584		2594
B. DELETE EXPORT BASE	-18.91	-36.15	-15.39	-30.00	-1416	-2255
% of Economic Base	44.6%	85.2%	43.2%	84.3%	54.6%	86.9%
C. DELETE LOG-MILL EXPORTS	-1.974	-3.666	-1.928	-3.441	-102	-191
% of Economic Base	4.6%	8.6%	5.4%	9.7%	3.9%	7.4%

(1) Base Year Data for the Total Economy

Source: Impact Report #6.224; IMPLAN*C03372659252. file dated 7/22/85

TABLE 4

DISTRIBUTIONAL EFFECTS (1)
Change as a percent of Industry Base
(1977 Dollars and Base Data)

Economic Area: Grand County, Colorado

Major Industry Group	Value Added MM$ (%)	Income MM$ (%)	Employment # of Jobs(%)
Agriculture	-.1892(8.9)	-.1820(9.1)	-2 (5.1)
Mining	-.0001(<1)	-.0001(<1)	0 (-)
Construction	-.0324(1.1)	-.0322(1.1)	-2 (< 1)
Manufacturing			
Log-Mill	-2.2993(92.)	-2.2426(92.)	-130 (92.)
Other	-.0217(2.0)	-.0206(1.9)	-1 (2.1)
Transportation, Communication, Utilities	-.1552(4.0)	-.1378(4.1)	-4 (4.7)
Wholesale and Retail Trade	-.3043(6.3)	-.2402(6.3)	-23 (6.2)
Finance, Insurance, Real Est	-.4121(3.4)	-.3501(4.0)	-4 (2.9)
Services	-.2300(1.8)	-.2138(2.0)	-23 (1.5)
TOTAL (less sectors 458-466)	-3.6446(8.7)	-3.4197(9.7)	-189 (7.4)

(1) Deletion of LOG-MILL Export Base

Source: Impact Report #6.224; IMPLAN*C03REDUCE252. file dated 7/22/85

TABLE 5

ECONOMIC EFFECTS - NATIONAL FOREST TIMBER VOLUME SUPPLIED (1)
(1977 dollars)

Economic Area: Grand County, Colorado

	Economic Base Level	NF Volume Supplied	Volume Supplied, as a % of Base
Value Added (MM$)			
Direct		.8510	2.0
Total	42.4492	1.5728	3.7
Income (MM$)			
Direct		.6309	2.3
Total	35.5841	1.4768	4.2
Employment (# of Jobs)			
Direct		44	1.7
Total	2594	82	3.2

(1) Annual Average Volume, FY80-FY82

Source: Impact Reports #6.111, #6.221, #6.224; IMPLAN*C03380323162. file dated 7/30/85

APPENDIX 4

CASE STUDY AREA B

JACKSON COUNTY - COLORADO

Table 6

FINAL DEMAND, FINAL PAYMENT AND EMPLOYMENT
(1977 Dollars and Base Data)

Economic area: Jackson County, Colorado

	TOTAL (All)	LOG-MILL (136-137)	LOG-MILL (% of Total)
A. Final Demand and Total Gross Output ($MM)			
Personal Consumption	2.5983	.0000	-
Capital Formation	.8092	.0000	-
Inventory Change	.4762	.1822	38.3
State-Local Govt Expenditures	.3473	.0001	< 1.0
Federal Govt Expenditures	.1216	.0000	-
Exports	10.5726	3.0161	28.5
Total Final Demand	14.9252	3.1985	21.4
Intermediate Output	4.7734	.2601	5.4
Total Gross Output	19.6986	3.4586	17.6
B. Final Payments and Total Gross Outlay ($MM)			
Employee Compensation	3.5185	.7989	22.7
Indirect Business Taxes	.4986	.0297	6.0
Property-type Income	4.1936	.4292	10.2
Total Value Added	8.2106	1.2579	15.3
Imports	6.7145	1.8605	27.7
Total Final Payments	14.9252	3.1184	20.9
Intermediate Outlay	4.7734	.3402	7.1
Total Gross Outlay	19.6986	3.4586	17.6
C. Employment (# Jobs)	328	64	15.1

Source: Lister Report #3.230; IMPLAN*CO2125421302. file dated 2/25/85

Table 7

LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Jackson County, Colorado

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
AGRICULTURE (1-12)				
Meat Animals, Misc.	(3)	4.2576	40.3	97.0
Food Feed grains,etc	(5)	.2846	2.7	73.8
Forestry & Fishery	(11)	.5097	4.8	97.8
Other		.0000	0.0	0.0
Total, Industry		5.0519	47.8	95.4
MINING (13-50)				
Bitum & Lignite Mine	(25)	1.0007	9.5	97.5
Other		.0231	< 1.0	100.0
Total, Industry		1.0238	9.7	97.6
CONSTRUCTION (51-52)				
New Construction	(51)	.1870	1.8	14.4
Mtc & Repair Constr	(52)	.0991	< 1.0	47.9
Total, Industry		.2861	2.7	19.0
MANUFACTURING (53-419)				
Sawmills, General	(137)	3.0161	28.5	94.3
Other		.0093	< 1.0	27.3
Total, Industry		3.0254	28.6	93.6
TRANSPORTATION, COMMUNICATION AND UTILITIES (420-431)				
Railroads, rel serv	(420)	.2827	2.7	86.4
Other		.0558	3.2	36.1
Total, Industry		.3385	3.2	70.3
WHOLESALE TRADE	(432)	.0034	< 1.0	< 1.0
RETAIL TRADE	(433)	.0004	< 1.0	< 1.0
FINANCE, INSURANCE AND REAL ESTATE (434-440)				
Banking	(434)	.1582	1.5	48.2
Other		.3736	3.5	29.5
Total, Industry		.5318	5.0	33.3

Table 7 (cont'd)

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
SERVICES (441-457)				
Eating & Drinking	(447)	.2689	2.5	39.6
Other		.0232	< 1.0	7.2
Total, Industry		.2921	2.8	29.1
GOVERNMENT ENTERPRISES (458-464)		.0005	< 1.0	1.4
TOTAL		10.5726	100.0	70.8

(1) Sectors with percent of total exports equal to, or over, 1% are shown individually; Sectors with less than 1% are grouped as Other.

(2) Some Sectors may exceed 100% due to negative Inventory changes within that sector's final demand component.

Source: Lister Report #3.210; IMPLAN*C02125421302. file dated 2/25/85

TABLE 8

ECONOMIC EFFECTS - CHANGES IN LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Jackson County, Colorado

	Value Added (MM$)		Income (MM$)		Employment (# of jobs)	
	Direct	Total	Direct	Total	Direct	Total
A. ECONOMIC BASE (1)		8.2106		7.7120		328
B. DELETE EXPORT BASE	-3.753	-6.921	-3.568	-6.494	-133	-259
% of Economic Base	45.7%	84.3%	46.3%	84.2%	40.6%	79.0%
C. DELETE LOG-MILL EXPORTS	-1.097	-1.762	-1.071	-1.682	-56	-88
% of Economic Base	13.4%	21.4%	13.9%	21.8%	17.1%	26.8%

(1) Base Year Data for the Total Economy

Source: Impact Report #6.224; IMPLAN*CO2160673712. file dated 3/10/85

TABLE 9

DISTRIBUTIONAL EFFECTS (1)
Change as a percent of Industry Base
(1977 Dollars and Base Data)

Economic Area: Jackson County, Colorado

Major Industry Group	Value Added MM$ (%)	Income MM$ (%)	Employment # of Jobs(%)
Agriculture	-.0031(< 1)	-.0031(< 1)	- (-)
Mining	-.0062(< 1)	-.0060(< 1)	- (-)
Construction	-.0208(2.6)	-.0207(2.6)	-1 (2.2)
Manufacturing			
Log-Mill	-1.1756(93.)	-1.1478(94.)	-60 (94.)
Other	-.0050(20.)	-.0049(20.)	- (-)
Transportation, Communication, Utilities	-.0447(11.)	-.0416(11.)	-2 (12.)
Wholesale and Retail Trade	-.1601(23.)	-.1265(23.)	-12 (23.)
Finance, Insurance, Real Est	-.2363(17.)	-.2341(18.)	-2 (14.)
Services	-.1012(19.)	-.0895(19.)	-11 (20.)
TOTAL (less sectors 458-466)	-1.7550(22.)	-1.6740(22.)	-88 (27.)

(1) Deletion of LOG-MILL Export Base

Source: Impact Report #6.224; IMPLAN*CO2REDUCE712. file dated 4/29/85

TABLE 10

ECONOMIC EFFECTS - NATIONAL FOREST TIMBER VOLUME SUPPLIED (1)
(1977 dollars)

Economic Area: Jackson County, Colorado

	Economic Base Level	NF Volume Supplied	Volume Supplied, as a % of Base
Value Added (MM$)			
Direct		1.2509	15.2
Total	8.2106	1.9186	23.4
Income (MM$)			
Direct		1.2213	15.8
Total	7.7120	2.0088	26.0
Employment (# of Jobs)			
Direct		64	19.5
Total	328	101	30.8

(1) Annual Average Volume, FY80-FY82

Source: Impact Reports #6.111, #6.221, #6.224; IMPLAN*CO2368514072. file dated 7/18/85

APPENDIX 5

CASE STUDY AREA C

RIO GRANDE COUNTY - COLORADO

Table 11

FINAL DEMAND, FINAL PAYMENT AND EMPLOYMENT
(1977 Dollars and Base Data)

Economic area: Rio Grande County, Colorado

	TOTAL (All)	LOG-MILL (136-137)	LOG-MILL (% of Total)
A. Final Demand and Total Gross Output ($MM)			
Personal Consumption	22.2298	.0004	< 1.0
Capital Formation	3.8620	.0002	< 1.0
Inventory Change	2.2900	.3393	14.8
State-Local Govt Expenditures	3.1045	.0008	< 1.0
Federal Govt Expenditures	.8327	.0001	< 1.0
Exports	71.1720	7.4191	10.4
Total Final Demand	103.4910	7.7599	7.5
Intermediate Output	33.8622	3.9806	11.8
Total Gross Output	137.3532	11.7405	8.6
B. Final Payments and Total Gross Outlay ($MM)			
Employee Compensation	35.5469	2.1151	6.5
Indirect Business Taxes	6.4734	.1088	1.7
Property-type Income	29.9819	1.5694	5.2
Total Value Added	69.0021	3.7933	5.5
Imports	34.4888	4.0482	11.7
Total Final Payments	103.4910	7.8414	7.6
Intermediate Outlay	33.8622	3.8991	11.5
Total Gross Outlay	137.3532	11.7405	8.6
C. Employment (# Jobs)	3451	186	4.6

Source: Lister Report #3.230; IMPLAN*CO1125420062. file dated 2/25/85

Table 12

LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Rio Grande County, Colorado

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
AGRICULTURE (1-12)				
Meat Animals, Misc.	(3)	1.9783	2.8	94.2
Vegetables, Misc.	(8)	22.4911	29.9	97.4
Other		1.2076	1.7	72.6
Total, Industry		25.6770	36.1	95.6
MINING (13-50)				
None		0	0	0
CONSTRUCTION (51-52)				
Total, Industry		.0006	< 1.0	< 1.0
MANUFACTURING (53-419)				
Creamery Butter	(63)	.8918	1.3	97.1
Dehydrated Food Prod	(71)	1.1921	1.7	101.2
Prepared Feeds, NEC	(79)	4.0084	5.6	96.4
Wet Corn Milling	(81)	14.2079	20.0	97.8
Logging	(136)	2.7638	3.9	99.5
Sawmills, General	(137)	4.6553	6.5	93.4
Millwork	(140)	2.1195	3.0	92.7
Ready-mixed Concrete	(243)	1.0968	1.5	99.8
Other		1.9826	2.8	65.8
Total, Industry		32.9184	46.2	94.2
TRANSPORTATION, COMMUNICATION AND UTILITIES (420-431)				
Electric Services	(429)	1.9766	2.8	67.9
Other		.1567	< 1.0	15.0
Total, Industry		2.1333	3.0	54.0
WHOLESALE TRADE	(432)	4.7990	6.7	63.9
RETAIL TRADE	(433)	2.1121	3.0	26.7

Table 12 (cont'd)

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
FINANCE, INSURANCE AND REAL ESTATE (434-440)				
Total, Industry		.5647	< 1.0	8.1
SERVICES (441-457)				
Hospitals	(452)	2.3391	3.3	81.0
Other		.5471	< 1.0	10.1
Total, Industry		2.8862	4.1	30.7
GOVERNMENT ENTERPRISES (458-464)		.0032	< 1.0	1.4
TOTAL		71.1720	100.0	68.8

(1) Sectors with percent of total exports equal to, or over, 1% are shown individually; Sectors with less than 1% are grouped as Other.

(2) Some Sectors may exceed 100% due to negative Inventory changes within that sector's final demand component.

Source: Lister Report #3.210; IMPLAN*C01125420062. file dated 2/25/85

TABLE 13

ECONOMIC EFFECTS - CHANGES IN LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Rio Grande County, Colorado

	Value Added (MM$)		Income (MM$)		Employment (# of jobs)	
	Direct	Total	Direct	Total	Direct	Total
A. ECONOMIC BASE (1)		69.002		62.529		3451
B. DELETE EXPORT BASE	-32.218	-59.366	-29.643	-53.737	-1493	-2911
% of Economic Base	46.7%	86.0%	47.4%	85.9%	43.3%	84.4%
C. DELETE LOG-MILL EXPORTS	-2.461	-4.998	-2.394	-4.684	-121	-264
% of Economic Base	3.6%	7.2%	3.8%	7.5%	3.5%	7.6%

(1) Base Year Data for the Total Economy

Source: Impact Reports #6.111, #6.224; IMPLAN*C01160672912. file dated 3/10/85

TABLE 14

DISTRIBUTIONAL EFFECTS (1)
Change as a percent of Industry Base
(1977 Dollars and Base Data)

Economic Area: Rio Grande County, Colorado

Major Industry Group	Value Added MM$ (%)	Income MM$ (%)	Employment # of Jobs(%)
Agriculture	-.0537(< 1)	-.0497(< 1)	-2 (< 1)
Mining	- (-)	- (-)	- (-)
Construction	-.0386(1.2)	-.0384(1.2)	-2 (< 1)
Manufacturing			
Log-Mill	-3.1976(84.)	-3.1049(84.)	-156 (84.)
Other	-.0327(< 1)	-.0316(< 1)	-2 (< 1)
Transportation, Communication, Utilities	-.1367(4.0)	-.1189(4.0)	-4 (4.4)
Wholesale and Retail Trade	-.7245(4.7)	-.5742(4.7)	-58 (4.7)
Finance, Insurance, Real Est	-.4252(6.4)	-.3941(6.6)	-4 (4.6)
Services	-.3715(5.2)	-.3549(5.2)	-35 (4.9)
TOTAL (less sectors 458-466)	-4.9806(7.2)	-4.6666(7.5)	-262 (7.6)

(1) Deletion of LOG-MILL Export Base

Source: Impact Report #6.224; IMPLAN*COlREDUCE912. file dated 4/29/85

TABLE 15

ECONOMIC EFFECTS - NATIONAL FOREST TIMBER VOLUME SUPPLIED (1)
(1977 dollars)

Economic Area: Rio Grande County, Colorado

	Economic Base Level	NF Volume Supplied	Volume Supplied, as a % of Base
Value Added (MM$)			
Direct		1.7913	2.6
Total	69.0021	3.9373	5.7
Income (MM$)			
Direct		1.7490	2.8
Total	62.5287	3.7000	5.9
Employment (# of Jobs)			
Direct		90	2.6
Total	3451	209	6.1

(1) Annual Average Volume, FY80-FY82

Source: Impact Reports #6.111, #6.221, #6.224; IMPLAN*CO1368524062. file dated 7/18/85

APPENDIX 6

CASE STUDY AREA D

CUSTER COUNTY - SOUTH DAKOTA

Table 16

FINAL DEMAND, FINAL PAYMENT AND EMPLOYMENT
(1977 Dollars and Base Data)

Economic area: Custer County, South Dakota

	TOTAL (All)	LOG-MILL (136-137)	LOG-MILL (% of Total)
A. Final Demand and Total Gross Output ($MM)			
Personal Consumption	8.2445	.0002	< 1.0
Capital Formation	.3980	.0000	-
Inventory Change	.5949	.3578	60.1
State-Local Govt Expenditures	1.2475	.0004	< 1.0
Federal Govt Expenditures	.7202	.0001	< 1.0
Exports	21.5466	6.8502	31.8
Total Final Demand	32.7517	7.2087	22.0
Intermediate Output	9.2410	3.5237	38.1
Total Gross Output	41.9927	10.7324	25.6
B. Final Payments and Total Gross Outlay ($MM)			
Employee Compensation	9.6501	2.0354	21.1
Indirect Business Taxes	1.5920	.0981	6.2
Property-type Income	7.9166	1.4154	17.9
Total Value Added	19.1588	3.5488	18.5
Imports	13.5928	3.2298	23.8
Total Final Payments	32.7517	6.7787	20.7
Intermediate Outlay	9.2410	3.9537	42.8
Total Gross Outlay	41.9927	10.7324	25.6
C. Employment (# Jobs)	855	182	12.8

Source: Lister Report #3.230; IMPLAN*D02125411122. file dated 2/25/85

Table 17

LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Custer County, South Dakota

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
AGRICULTURE (1-12)				
Dairy Farm Products	(1)	.5165	2.4	91.1
Meat Animals, Misc.	(3)	3.7152	17.2	96.8
Other		.2559	1.2	86.0
Total, Industry		4.4876	20.8	95.4
MINING (13-50)				
Total, Industry		.7739	3.6	93.9
CONSTRUCTION (51-52)				
Total, Industry		.0001	< 1.0	< 1.0
MANUFACTURING (53-419)				
Logging	(136)	1.1470	5.3	99.1
Sawmills, General	(137)	5.7032	26.5	94.2
Wood Preserving	(145)	.3602	1.7	97.9
Minerals, Grd or trt	(250)	2.0157	9.4	98.8
Other		.1034	< 1.0	40.6
Total, Industry		9.3295	43.3	94.5
TRANSPORTATION, COMMUNICATION AND UTILITIES (420-431)				
Electric Services	(429)	2.7079	12.6	82.4
Other		.0724	< 1.0	9.3
Total, Industry		2.7803	12.9	68.4
WHOLESALE TRADE	(432)	.0058	< 1.0	1.8
RETAIL TRADE	(433)	.0011	< 1.0	< 1.0
FINANCE, INSURANCE AND REAL ESTATE (434-440)				
Total, Industry		.1004	< 1.0	3.8

Table 17 (cont'd)

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
SERVICES (441-457)				
Hotels & Lodging	(441)	.9279	4.3	85.2
Eating & Drinking	(447)	1.6467	7.6	58.7
Other Medical Serv	(453)	1.2058	5.6	79.9
Other		.0004	< 1.0	< 1.0
Total, Industry		3.7808	17.6	57.2
GOVERNMENT ENTERPRISES (458-464)		.2704	1.2	64.4
TOTAL		21.5466	100.0	65.8

(1) Sectors with percent of total exports equal to, or over, 1% are shown individually; Sectors with less than 1% are grouped as Other.

(2) Some Sectors may exceed 100% due to negative Inventory changes within that sector's final demand component.

Source: Lister Report #3.210; IMPLAN*D02125411122. file dated 2/25/85

TABLE 18

ECONOMIC EFFECTS - CHANGES IN LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Custer County, South Dakota

	Value Added (MM$)		Income (MM$)		Employment (# of jobs)	
	Direct	Total	Direct	Total	Direct	Total
A. ECONOMIC BASE (1)		19.159		17.567		855
B. DELETE EXPORT BASE	-8.438	-16.575	-7.847	-15.185	-384	-728
% of Economic Base	44.0%	86.5%	44.7%	86.4%	44.9%	85.2%
C. DELETE LOG-MILL EXPORTS	-2.393	-5.532	-2.332	-5.210	-124	-263
% of Economic Base	12.5%	28.9%	13.3%	29.7%	14.5%	30.8%

(1) Base Year Data for the Total Economy

Source: Impact Report #6.224; IMPLAN*DO2REDUCE452. file dated 6/12/85

TABLE 19

DISTRIBUTIONAL EFFECTS (1)
Change as a percent of Industry Base
(1977 Dollars and Base Data)

Economic Area: Custer County, South Dakota

Major Industry Group	Value Added MM$ (%)	Income MM$ (%)	Employment # of Jobs(%)
Agriculture	-.1986(10.)	-.1912(10.)	-6 (7.4)
Mining	.0000(-)	.0000(-)	0 (-)
Construction	-.0235(3.1)	-.0234(3.1)	-1 (2.4)
Manufacturing			
Log-Mill	-3.2844(93.)	-3.1936(93.)	-169 (93.)
Other	-.0198(1.8)	-.0192(1.8)	-2 (4.8)
Transportation, Communication, Utilities	-.3016(10.)	-.2623(11.)	-7 (12.)
Wholesale and Retail Trade	-.5349(29.)	-.4225(29.)	-39 (30.)
Finance, Insurance, Real Est	-.6622(28.)	-.6250(28.)	-4 (20.)
Services	-.4727(12.)	-.4380(12.)	-35 (14.)
TOTAL (less sectors 458-466)	-5.4974(29.)	-5.1753(30.)	-261 (31.)

(1) Deletion of LOG-MILL Export Base

Source: Impact Report #6.224; IMPLAN*DO2REDUCE452. file dated 4/29/85

TABLE 20

ECONOMIC EFFECTS - NATIONAL FOREST TIMBER VOLUME SUPPLIED (1)
(1977 dollars)

Economic Area: Custer County, South Dakota

	Economic Base Level	NF Volume Supplied	Volume Supplied, as a % of Base
Value Added (MM$)			
Direct		1.3115	6.8
Total	19.1588	3.1236	16.3
Income (MM$)			
Direct		1.2805	7.3
Total	17.5668	2.9432	16.8
Employment (# of Jobs)			
Direct		69	8.1
Total	855	150	17.5

(1) Annual Average Volume, FY80-FY82

Source: Impact Reports #6.111, #6.221, #6.224; IMPLAN*D02370402392. file dated 7/20/85

APPENDIX 7

CASE STUDY AREA E

LAWRENCE COUNTY - SOUTH DAKOTA

Table 21

FINAL DEMAND, FINAL PAYMENT AND EMPLOYMENT
(1977 Dollars and Base Data)

Economic area: Lawrence County, South Dakota

A. Final Demand and Total Gross Output	TOTAL (All) ($MM)	LOG-MILL (136-137)	LOG-MILL (% of Total)
Personal Consumption	42.2310	.0008	< 1.0
Capital Formation	4.7447	.0003	< 1.0
Inventory Change	1.4591	.6255	42.9
State-Local Govt Expenditures	4.4744	.0008	< 1.0
Federal Govt Expenditures	1.8181	.0001	< 1.0
Exports	78.7259	21.6548	27.5
Total Final Demand	133.4532	22.2825	16.7
Intermediate Output	33.5277	10.1505	30.3
Total Gross Output	166.9809	32.4330	19.4
B. Final Payments and Total Gross Outlay ($MM)			
Employee Compensation	45.6083	5.1763	11.4
Indirect Business Taxes	10.2888	.3091	3.0
Property-type Income	33.9005	4.4508	13.1
Total Value Added	89.7976	9.9463	11.1
Imports	43.6549	14.2056	32.5
Total Final Payments	133.4532	24.1519	18.1
Intermediate Outlay	33.5277	8.2811	24.7
Total Gross Outlay	166.9809	32.4330	19.4
C. Employment (# Jobs)	4978	508	8.7

Source: Lister Report #3.230; IMPLAN*LAW355306462. file dated 7/5/85

Table 22

LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Lawrence County, South Dakota

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
AGRICULTURE (1-12)				
Dairy Farm Products	(1)	1.3077	1.7	87.6
Meat Animals, Misc.	(3)	2.6501	3.4	94.9
Other		.1101	< 1.0	27.9
Total, Industry		4.0679	5.2	90.6
MINING (13-50)				
Gold Ores	(17)	36.4244	46.3	99.7
Crude Petroleum	(27)	1.0123	1.3	93.9
Other		.7002	< 1.0	100.0
Total, Industry		38.1369	48.4	99.6
CONSTRUCTION (51-52)				
New Construction	(51)	.0004	< 1.0	< 1.0
Mtc & Repair Const	(52)	.0002	< 1.0	< 1.0
Total, Industry		.0006	< 1.0	< 1.0
MANUFACTURING (53-419)				
Logging	(136)	13.3426	17.0	99.6
Sawmills, General	(137)	8.3122	10.6	93.5
Wood Preserving	(145)	3.6599	4.6	97.9
Wood Products, NEC	(148)	1.6259	2.1	54.3
Jewelry, Precious	(400)	1.7823	2.3	80.6
Other		.9622	1.2	2.6
Total, Industry		29.6851	37.7	93.4
TRANSPORTATION, COMMUNICATION AND UTILITIES (420-431)				
Total, Industry		.8682	1.1	13.3
WHOLESALE TRADE (432)		.1470	< 1.0	4.1
RETAIL TRADE (433)		.0103	< 1.0	< 1.0

Table 22 (cont'd)

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
FINANCE, INSURANCE AND REAL ESTATE (434-440)				
Insurance Agts, Brkr	(438)	.8787	1.1	1.0
Other		.1302	< 1.0	1.1
Total, Industry		1.0089	1.3	7.6
SERVICES (441-457)				
Hotels & Lodging	(441)	1.1572	1.5	68.6
Eating & Drinking	(447)	1.7997	2.3	29.2
Amusements & Recreat	(450)	.9991	1.3	63.6
Other		.7030	< 1.0	8.6
Total, Industry		4.6590	5.9	26.4
GOVERNMENT ENTERPRISES (458-464)		.1522	< 1.0	55.0
TOTAL		78.7259	100.0	59.0

(1) Sectors with percent of total exports equal to, or over, 1% are shown individually; Sectors with less than 1% are grouped as Other.

(2) Some Sectors may exceed 100% due to negative Inventory changes within that sector's final demand component.

Source: Lister Report #3.210; IMPLAN*LAW355306462. file dated 7/5/85

TABLE 23

ECONOMIC EFFECTS - CHANGES IN LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Lawrence County, South Dakota

	Value Added (MM$)		Income (MM$)		Employment (# of jobs)	
	Direct	Total	Direct	Total	Direct	Total
A. ECONOMIC BASE (1)		89.798		79.509		4978
B. DELETE EXPORT BASE	-38.425	-76.943	-34.957	-68.099	-2124	-4268
% of Economic Base	42.8%	85.7%	44.0%	85.6%	42.7%	85.7%
C. DELETE LOG-MILL EXPORTS	-6.731	-14.809	-6.526	-13.629	-344	-792
% of Economic Base	7.5%	16.5%	8.2%	17.1%	6.9%	15.9%

(1) Base Year Data for the Total Economy

Source: Impact Report #6.224; IMPLAN*LAW361305452. file dated 7/11/85

TABLE 24

DISTRIBUTIONAL EFFECTS (1)
Change as a percent of Industry Base
(1977 Dollars and Base Data)

Economic Area: Lawrence County, South Dakota

Major Industry Group	Value Added MM$ (%)	Income MM$ (%)	Employment # of Jobs(%)
Agriculture	-.3005(13.)	-.2860(13.)	-10 (12.)
Mining	-.0357(< 1)	-.0325(< 1)	0 (-)
Construction	-.1117(2.9)	-.1110(2.9)	-4 (2.1)
Manufacturing			
Log-Mill	-8.0865(82.)	-7.8385(81.)	-413 (81.)
Other	-.1119(3.0)	-.1077(3.0)	-9 (3.5)
Transportation, Communication, Utilities	-.8561(13.)	-.7546(13.)	-34 (14.)
Wholesale and Retail Trade	-2.0129(16.)	-1.5925(16.)	-137 (16.)
Finance, Insurance, Real Est	-1.8356(13.)	-1.5414(14.)	-25 (11.)
Services	-1.3763(12.)	-1.2860(12.)	-155 (11.)
TOTAL (less sectors 458-466)	-14.7268(16.)	-13.5470(17.)	-787 (15.)

(1) Deletion of LOG-MILL Export Base

Source: Impact Report #6.224; IMPLAN*LAWREDUCE452. file dated 7/17/85

TABLE 25

ECONOMIC EFFECTS - NATIONAL FOREST TIMBER VOLUME USED (1)
(1977 dollars)

Economic Area: Lawrence County, South Dakota

	Economic Base Level	NF Volume Used	Volume Used, as a % of Base
Value Added (MM$)			
Direct		1.8737	2.1
Total	89.7976	4.7382	5.3
Income (MM$)			
Direct		1.8293	2.3
Total	79.5088	4.3786	5.5
Employment (# of Jobs)			
Direct		98	2.0
Total	4978	256	5.1

(1) Annual Average Volume, FY80-FY82

Source: Impact Reports #6.111, #6.221, #6.224; IMPLAN*LAW370408652. file dated 7/20/85

APPENDIX 8

CASE STUDY AREA F

CROOK COUNTY - WYOMING

Table 26

FINAL DEMAND, FINAL PAYMENT AND EMPLOYMENT
(1977 Dollars and Base Data)

Economic area: Crook County, Wyoming

	TOTAL (All)	LOG-MILL (136-137)	LOG-MILL (% of Total)
A. Final Demand and Total Gross Output ($MM)			
Personal Consumption	8.2470	.0003	< 1.0
Capital Formation	1.7002	.0000	-
Inventory Change	.4697	.1413	30.1
State-Local Govt Expenditures	1.5483	.0004	< 1.0
Federal Govt Expenditures	.5085	.0000	-
Exports	29.1988	2.3580	8.1
Total Final Demand	41.6724	2.8121	6.8
Intermediate Output	13.6740	1.3836	10.1
Total Gross Output	55.3464	4.1957	7.6
B. Final Payments and Total Gross Outlay ($MM)			
Employee Compensation	10.3893	.7987	7.7
Indirect Business Taxes	2.3201	.0383	1.6
Property-type Income	11.7821	.5527	4.7
Total Value Added	24.4915	1.3898	5.7
Imports	17.1795	1.0651	6.2
Total Final Payments	41.6724	2.4550	5.9
Intermediate Outlay	13.6740	1.7407	12.7
Total Gross Outlay	55.3464	4.1957	7.6
C. Employment (# Jobs)	990	75	5.7

Source: Lister Report #3.230; IMPLAN*W01125413922. file dated 2/25/85

Table 27

LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Crook County, Wyoming

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
AGRICULTURE (1-12)				
Meat Animals, Misc.	(3)	9.7309	33.3	97.0
Ag, Forestry, Fish	(12)	.5260	1.8	99.5
Other		.4665	1.6	70.0
Total, Industry		10.7234	36.7	95.5
MINING (13-50)				
Uranium, other ores	(22)	.3048	1.0	96.5
Bentonite	(35)	6.3115	21.6	101.8
Total, Industry		6.6163	22.7	101.5
CONSTRUCTION (51-52)				
Total, Industry		.0003	< 1.0	< 1.0
MANUFACTURING (53-419)				
Logging	(136)	.4408	1.5	99.1
Sawmills, General	(137)	2.2292	7.6	94.2
Other		.1645	< 1.0	63.9
Total, Industry		2.8345	3.4	92.3
TRANSPORTATION, COMMUNICATION AND UTILITIES (420-431)				
Electric Services	(429)	7.1135	24.4	92.8
Other		.0649	< 1.0	11.8
Total, Industry		7.1784	24.6	87.4
WHOLESALE TRADE	(432)	.0031	< 1.0	1.2
RETAIL TRADE	(433)	.0007	< 1.0	< 1.0
FINANCE, INSURANCE AND REAL ESTATE (434-440)				
Total, Industry		.0718	< 1.0	2.4

Table 27 (cont'd)

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
SERVICES (441-457)				
Other Medical Serv.	(453)	1.7198	5.9	80.9
Other		.0018	< 1.0	< 1.0
Total, Industry		1.7216	5.9	40.5
GOVERNMENT ENTERPRISES (458-464)		.0122	< 1.0	5.9
TOTAL		29.1988	100.0	70.1

(1) Sectors with percent of total exports equal to, or over, 1% are shown individually; Sectors with less than 1% are grouped as Other.

(2) Some Sectors may exceed 100% due to negative Inventory changes within that sector's final demand component.

Source: Lister Report #3.210; IMPLAN*W01125413922. file dated 2/25/85

TABLE 28

ECONOMIC EFFECTS - CHANGES IN LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Crook County, Wyoming

	Value Added (MM$)		Income (MM$)		Employment (# of jobs)	
	Direct	Total	Direct	Total	Direct	Total
A. ECONOMIC BASE (1)		24.492		22.171		990
B. DELETE EXPORT BASE	-11.516	-20.946	-10.514	-18.888	-383	-777
% of Economic Base	47.0%	85.5%	47.4%	85.2%	38.7%	78.5%
C. DELETE LOG-MILL EXPORTS	- .933	-2.219	- .910	-2.088	-53	-111
% of Economic Base	3.8%	9.1%	4.1%	9.4%	5.4%	11.2%

(1) Base Year Data for the Total Economy

Source: Impact Reports #6.111, #6.224; IMPLAN*W01160676942. file dated 3/10/85

TABLE 29

DISTRIBUTIONAL EFFECTS (1)
Change as a percent of Industry Base
(1977 Dollars and Base Data)

Economic Area: Crook County, Wyoming

Major Industry Group	Value Added MM$ (%)	Income MM$ (%)	Employment # of Jobs(%)
Agriculture	-.1683(3.6)	-.1628(3.8)	-4 (2.3)
Mining	.0000(-)	.0000(-)	0 (-)
Construction	-.0251(1.4)	-.0249(1.4)	-1 (< 1)
Manufacturing			
Log-Mill	-1.2817(92.)	-1.2462(92.)	-69 (92.)
Other	-.0078(4.6)	-.0077(4.6)	-1 (8.3)
Transportation, Communication, Utilities	-.1013(2.0)	-.0896(2.0)	-3 (3.3)
Wholesale and Retail Trade	-.1698(10.)	-.1340(10.)	-13 (10.)
Finance, Insurance, Real Est	-.2882(9.2)	-.2594(9.6)	-2 (6.9)
Services	-.1597(5.8)	-.1456(5.5)	-16 (5.8)
TOTAL (less sectors 458-466)	-2.2020(9.1)	-2.0702(9.4)	-110 (11.)

(1) Deletion of LOG-MILL Export Base

Source: Impact Report #6.224; IMPLAN*W01REDUCE942. file dated 4/29/85

TABLE 30

ECONOMIC EFFECTS - NATIONAL FOREST TIMBER VOLUME SUPPLIED (1)
(1977 dollars)

Economic Area: Crook County, Wyoming

	Economic Base Level	NF Volume Supplied	Volume Supplied, as a % of Base
Value Added (MM$)			
Direct		.8299	3.4
Total	24.4915	2.0157	8.2
Income (MM$)			
Direct		.8103	3.6
Total	22.1714	1.8963	8.6
Employment (# of Jobs)			
Direct		49	5.0
Total	990	103	10.4

(1) Annual Average Volume, FY80-FY82

Source: Impact Reports #6.111, #6.221, #6.224; IMPLAN*W01370405652. file dated 7/20/85

APPENDIX 9

CASE STUDY AREA G

ALAMOSA AREA

Table 31

FINAL DEMAND, FINAL PAYMENT AND EMPLOYMENT
(1977 Dollars and Base Data)

Economic area: Alamosa Area

	TOTAL (All)	LOG-MILL (136-137)	LOG-MILL (% of Total)
A. Final Demand and Total Gross Output ($MM)			
Personal Consumption	58.5048	.0009	< 1.0
Capital Formation	7.9352	.0004	< 1.0
Inventory Change	3.4874	.3393	9.7
State-Local Govt Expenditures	7.0555	.0019	< 1.0
Federal Govt Expenditures	1.8057	.0002	< 1.0
Exports	104.1920	7.3010	7.0
Total Final Demand	182.9805	7.6436	4.2
Intermediate Output	57.4069	4.0969	7.1
Total Gross Output	240.3874	11.7405	4.9
B. Final Payments and Total Gross Outlay ($MM)			
Employee Compensation	62.1684	2.1151	3.4
Indirect Business Taxes	12.4262	.1088	< 1.0
Property-type Income	54.6741	1.5694	2.9
Total Value Added	129.2687	3.7933	2.9
Imports	53.7117	3.8788	7.2
Total Final Payments	182.9805	7.6721	4.2
Intermediate Outlay	57.4069	4.0684	7.1
Total Gross Outlay	240.3874	11.7405	4.9
C. Employment (# Jobs)	6903	186	2.3

Source: Lister Report #3.230; IMPLAN*SLV311648882. file dated 6/11/85

Table 32

LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Alamosa Area

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
AGRICULTURE (1-12)				
Meat Animals, Misc.	(3)	3.8340	3.7	94.8
Food, Feed Grains	(5)	4.1053	3.9	83.6
Vegetables, Sugar	(8)	31.0367	29.8	97.2
Other		.5320	< 1.0	72.7
Total, Industry		39.5080	37.9	94.9
MINING (13-50)				
None		0	0	0
CONSTRUCTION (51-52)				
Total, Industry		.0010	< 1.0	< 1.0
MANUFACTURING (53-419)				
Dehydrated Food Prod	(71)	1.1583	1.1	98.8
Prepared Feeds, NEC	(79)	3.6217	3.5	95.6
Wet Corn Milling	(81)	14.1915	13.6	97.8
Apparel	(127)	2.0562	2.0	47.4
Logging	(136)	2.7585	2.6	99.5
Sawmills, General	(137)	4.5425	4.4	93.3
Millwork	(140)	2.0263	1.9	92.3
Ready-mix Concrete	(243)	1.3123	1.3	99.8
Other		3.1147	3.0	55.2
Total, Industry		34.7820	33.4	85.7
TRANSPORTATION, COMMUNICATION AND UTILITIES (420-431)				
Railroads, rel serv	(420)	1.1797	1.1	71.7
Electric Services	(429)	7.9290	7.6	79.3
Other		.8908	< 1.0	18.3
Total, Industry		9.9995	9.6	60.6
WHOLESALE TRADE	(432)	3.7335	3.6	39.0
RETAIL TRADE (433)	(433)	7.3355	7.0	36.4

Table 32 (cont'd)

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
FINANCE, INSURANCE AND REAL ESTATE (434-440)				
Total, Industry		1.6731	1.6	10.1
SERVICES (441-457)				
Hotels & Lodging	(441)	1.8241	1.8	72.0
Hospitals	(452)	3.1396	3.0	46.6
Other Medical, Health	(453)	1.4106	1.4	48.4
Other		.7852	< 1.0	5.8
Total, Industry		7.1595	6.9	27.8
GOVERNMENT ENTERPRISES (458-464)		.2304	< 1.0	87.3
TOTAL		104.1920	100.0	56.9

(1) Sectors with percent of total exports equal to, or over, 1% are shown individually; Sectors with less than 1% are grouped as Other.

(2) Some Sectors may exceed 100% due to negative Inventory changes within that sector's final demand component.

Source: Lister Report #3.210; IMPLAN*SLV311648882. file dated 6/11/85

TABLE 33

ECONOMIC EFFECTS - CHANGES IN LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Alamosa Area

	Value Added (MM$)		Income (MM$)		Employment (# of jobs)	
	Direct	Total	Direct	Total	Direct	Total
A. ECONOMIC BASE (1)		129.27		116.84		6903
B. DELETE EXPORT BASE	-51.71	-107.54	-47.28	-96.99	-2505	-5610
% of Economic Base	40.0%	83.2%	40.5%	83.0%	36.3%	81.3%
C. DELETE LOG-MILL EXPORTS	-2.42	-5.75	-2.35	-5.36	-119	-312
% of Economic Base	1.9%	4.4%	2.0%	4.6%	1.7%	4.5%

(1) Base Year Data for the Total Economy

Source: Impact Report #6.111, #6.224; IMPLAN*SLVREDUCE952. file dated 6/12/85

TABLE 34

DISTRIBUTIONAL EFFECTS (1)
Change as a percent of Industry Base
(1977 Dollars and Base Data)

Economic Area: Alamosa Area

Major Industry Group	Value Added MM$ (%)	Income MM$ (%)	Employment # of Jobs(%)
Agriculture	-.0760(< 1)	-.0712(< 1)	-2 (< 1)
Mining	- (-)	- (-)	- (-)
Construction	-.0464(< 1)	-.0461(< 1)	-2 (< 1)
Manufacturing			
Log-Mill	-3.0465(80.)	-3.1375(85.)	-153 (82.)
Other	-.0929(< 1)	-.0898(< 1)	-9 (< 1)
Transportation, Communication, Utilities	-.3170(2.2)	-.2814(2.3)	-10 (2.8)
Wholesale and Retail Trade	-.8842(3.1)	-.7005(3.1)	-70 (3.1)
Finance, Insurance, Real Est	-.5849(3.8)	-.5436(3.9)	-8 (3.2)
Services	-.5854(3.2)	-.5547(3.2)	-58 (3.1)
TOTAL (less sectors 458-466)	-5.7247(4.5)	-5.3339(4.6)	-311 (4.5)

(1) Deletion of LOG-MILL Export Base

Source: Impact Report #6.224; IMPLAN*SLVREDUCE952. file dated 5/10/85

TABLE 35

ECONOMIC EFFECTS - NATIONAL FOREST TIMBER VOLUME SUPPLIED (1)
(1977 dollars)

Economic Area: Alamosa Area

	Economic Base Level	NF Volume Supplied	Volume Supplied, as a % of Base
Value Added (MM$)			
Direct		1.8017	1.4
Total	129.2687	4.6419	3.6
Income (MM$)			
Direct		1.7591	1.5
Total	116.8425	4.3370	3.7
Employment (# of Jobs)			
Direct		91	1.3
Total	6903	253	3.7

(1) Annual Average Volume, FY80-FY82

Source: Impact Report #6.224; IMPLAN*SLV377401392. file dated 7/27/85

APPENDIX 10

CASE STUDY AREA H

BLACK HILLS AREA

Table 36

FINAL DEMAND, FINAL PAYMENT AND EMPLOYMENT
(1977 Dollars and Base Data)

Economic area: Black Hills Area

	TOTAL (All)	LOG-MILL (136-137)	LOG-MILL (% of Total)
A. Final Demand and Total Gross Output ($MM)			
Personal Consumption	394.4373	.0063	< 1.0
Capital Formation	61.2586	.0025	< 1.0
Inventory Change	9.8381	1.6676	17.0
State-Local Govt Expenditures	41.5915	.0060	< 1.0
Federal Govt Expenditures	92.6822	.0041	< 1.0
Exports	348.7920	33.1112	9.5
Total Final Demand	948.5996	34.7978	3.7
Intermediate Output	394.3881	25.7406	6.5
Total Gross Output	1342.9877	60.5384	4.5
B. Final Payments and Total Gross Outlay ($MM)			
Employee Compensation	378.6713	10.7314	2.8
Indirect Business Taxes	70.7186	.5631	< 1.0
Property-type Income	235.5829	8.1250	3.4
Total Value Added	684.9729	19.4195	2.8
Imports	263.6222	15.5780	5.9
Total Final Payments	948.5993	34.9976	3.7
Intermediate Outlay	394.3881	25.5408	6.5
Total Gross Outlay	1342.9874	60.5384	4.5
C. Employment (# Jobs)	33504	1019	1.6

Source: Lister Report #3.230; IMPLAN*BKH311647592. file dated 6/11/85

Table 37

LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Black Hills Area

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
AGRICULTURE (1-12)				
Meat Animals, Misc.	(3)	22.7456	6.5	92.3
Other		5.7380	1.6	67.4
Total, Industry		28.4836	8.2	85.9
MINING (13-50)				
Gold Ores	(17)	36.4244	10.4	99.7
Crushed, brkn Limest	(30)	5.6310	1.6	99.9
Bentonite	(35)	12.7075	3.6	101.8
Other		2.5638	< 1.0	78.1
Total, Industry		57.3267	16.4	99.0
CONSTRUCTION (51-52)				
New Construction	(51)	13.0943	3.8	39.1
Mtc & Repair Constr	(52)	15.3919	4.4	53.0
Total, Industry		28.4862	< 1.0	45.6
MANUFACTURING (53-419)				
Meat Packing Plants	(59)	25.5147	7.3	71.1
Fluid Milk	(67)	6.6922	1.9	56.5
Flour, Other Product	(75)	4.1625	1.2	82.5
Logging	(136)	13.2081	3.8	99.4
Sawmills, General	(137)	19.9031	5.7	92.5
Prefab Wood Bldg	(144)	6.2451	1.8	90.0
Wood Preserving	(145)	3.8380	1.1	96.2
Cement, Hydraulic	(231)	15.2420	4.4	96.6
Blast Furnaces, Steel	(254)	3.8291	1.1	91.7
Electronic Comput Eq	(336)	22.2621	6.4	88.7
Jewelry, Prec Metals	(400)	5.9654	1.7	75.3
Other		13.5803	3.9	26.9
Total, Industry		140.4426	40.3	69.7

Table 37 (cont'd)

SECTORS (1), by Industry	Sector Number	Value of Exports ($MM)	Percent of Total Exports (%)	Percent of Sector Final Demand(2) (%)
TRANSPORTATION, COMMUNICATION AND UTILITIES (420-431)				
Motor Freight Transp	(422)	4.5891	1.3	38.1
Pipelines, ex nat gas	(425)	4.6575	1.3	94.9
Radio, TV Broadcast	(428)	3.7441	1.1	96.5
Electric Services	(429)	13.6769	3.7	49.3
Other		3.8277	1.1	13.4
Total, Industry		30.4953	8.7	39.6
WHOLESALE TRADE	(432)	2.2577	< 1.0	5.6
RETAIL TRADE	(433)	11.4044	3.3	11.4
FINANCE, INSURANCE AND REAL ESTATE (434-440)				
Insurance Agts, Brkr	(438)	4.3628	1.2	100.0
Real Estate	(440)	4.0141	1.2	42.6
Other		.4495	< 1.0	< 1.0
Total, Industry		8.8264	2.5	8.4
SERVICES (441-457)				
Eating & Drinking	(447)	13.9860	4.0	29.6
Other Medical Serv	(453)	5.8248	1.7	44.3
Other		.0158	< 1.0	< 1.0
Total, Industry		19.8267	5.7	13.7
GOVERNMENT ENTERPRISES (458-464)		20.0904	5.8	78.7
TOTAL		348.7920	100.0	36.8

(1) Sectors with percent of total exports equal to, or over, 1% are shown individually; Sectors with less than 1% are grouped as Other.

(2) Some Sectors may exceed 100% due to negative Inventory changes within that sector's final demand component.

Source: Lister Report #3.21; IMPLAN*BKH311647592. file dated 6/11/85

TABLE 38

ECONOMIC EFFECTS - CHANGES IN LOCAL EXPORT BASE
(1977 Dollars and Base Data)

Economic Area: Black Hills Area

	Value Added (MM$)		Income (MM$)		Employment (# of jobs)	
	Direct	Total	Direct	Total	Direct	Total
A. ECONOMIC BASE (1)		684.97		614.25		33504
B. DELETE EXPORT BASE	-163.76	-452.85	-152.66	-405.78	-8494	-22345
% of Economic Base	23.9%	66.1%	24.8%	66.1%	25.4%	66.7%
C. DELETE LOG-MILL EXPORTS	-10.91	-35.06	-10.61	-32.03	-576	-1726
% of Economic Base	1.6%	5.1%	1.7%	5.2%	1.7%	5.2%

(1) Base Year Data for the Total Economy

Source: Impact Report #6.224; IMPLAN*BKH*BKHREDUCE602. file dated 6/12/85

TABLE 39

DISTRIBUTIONAL EFFECTS (1)
Change as a percent of Industry Base
(1977 Dollars and Base Data)

Economic Area: Black Hills Area

Major Industry Group	Value Added MM$ (%)	Income MM$ (%)	Employment # of Jobs(%)
Agriculture	-1.4433(4.3)	-1.3753(4.5)	-41 (3.2)
Mining	-.9233(1.9)	-.8409(1.9)	-3 (< 1)
Construction	-.4631(< 1)	-.4602(< 1)	-15 (< 1)
Manufacturing			
Log-Mill	-14.0748(72.)	-13.6641(72.)	-737 (72.)
Other	-1.2695(1.9)	-1.0453(1.7)	-48 (1.6)
Transportation, Communication, Utilities	-2.3818(3.2)	-2.1033(3.2)	-70 (3.2)
Wholesale and Retail Trade	-5.6038(4.2)	-4.4341(4.2)	-331 (4.2)
Finance, Insurance, Real Est	-4.2767(4.5)	-3.7236(4.6)	-63 (4.0)
Services	-4.3360(4.0)	-4.0902(4.0)	-393 (3.9)
TOTAL (less sectors 458-466)	-31.7365(4.8)	-34.7527(5.9)	-1707 (5.3)

(1) Deletion of LOG-MILL Export Base

Source: Impact Report #6.224; IMPLAN*BKHPR$084321. file dated 5/14/85

TABLE 40

ECONOMIC EFFECTS - NATIONAL FOREST TIMBER VOLUME SUPPLIED (1)
(1977 dollars)

Economic Area: Black Hills Area

	Economic Base Level	NF Volume Supplied	Volume Supplied, as a % of Base
Value Added (MM$)			
Direct		8.1392	1.2
Total	684.9729	27.5688	4.0
Income (MM$)			
Direct		438	1.3
Total	614.2542	1384	4.1
Employment (# of Jobs)			
Direct		438	1.3
Total	33504	1384	4.1

(1) Annual Average Volume, FY80-FY82

Source: Impact Report #6.111, #6.224; IMPLAN*BKH379400642. file dated 7/29/85