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Management of the community economic base as a strategy for economic development

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MANAGEMENT OF THE COMMUNITY ECONOMIC BASE AS A STRATEGY FOR ECONOMIC DEVELOPMENT

by

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ABSTRACT

Application of economic base analysis at a multi-level scale illustrates the usefulness of this approach to tracking and measuring the economic flows and linkages between three defined areas. A census survey of employers in six rural communities of the White Mountain Region of Arizona is used to collect employment and sales data at a high level of specificity. These data serve as the basis for bifurcation of basic and nonbasic components necessary for estimating the multiplier. Measurement of these data determine the extent of economic dependence and spatial interaction which exist between communities, and between the region and the outside world. In addition, the study refines established procedures and applies a full range of adjustments to primary and secondary data sources to produce highly refined multipliers for the region and each community.

INTRODUCTION

With accelerated growth in population, employment and income taking place in non-metropolitan areas, rural communities now face new and more complex problems than they did in the past. In the past decade or so, it has become increasingly evident that a greater understanding is necessary to cope with and direct economic growth in rural areas. Solutions to the problems require the best local information that can be developed. An important element in the process of economic development in non-metropolitan areas is the availability of accurate, up-to-date information. An economic base study can provide an important part of the needed information; the primary objective of an economic base study is to develop information which will help a community solve local problems, and allow policy makers and planners to make better decisions about matters that will enhance both the economic opportunities and the general welfare of a community's residents (Tiebout, 1962).

Economic base analysis serves as both a theoretical concept and a research tool. The conceptual basis for this technique is the assumption that growth in a region or

community depends on the rate at which the exports of the region or community expand. An increase in exports, i.e., income generated by sales of locally produced goods and services to nonresidents of the region, will in turn stimulate local economic activities through a reactive, multiplier process.

Historically, economic base analysis has been recognized as a useful tool to provide a better understanding of the economic structure of metropolitan areas. More recently, however, a number of researchers have recognized that economic base analysis is potentially more effective when applied to the study of small, non-metropolitan communities. This is especially true when data are collected by a census survey. This thesis applies economic base analysis to the study of several rural communities which make up the White Mountain Region of Arizona.

While following procedures established by previous base studies which measure the economic links between a defined base area and the outside world surrounding it, this thesis applies economic base analysis to measure the flows and linkages between three defined areas -- the community, the region, and the outside world. At a macro scale, this thesis is a regional economic base study; at the micro scale, it incorporates a set of community base studies "nested" within the larger region.

The thesis examines the methodological issues involved in conducting an economic base study. Whereas economic base analysis has been valued for its ability to estimate the economic impacts of growth or decline in local or regional economies, this study clearly demonstrates the usefulness of applying a full range of adjustments to the multiplier estimation to produce more highly refined community and regional multipliers. In addition, this thesis discusses the usefulness of applying these adjustments to identify and measure the links between communities, the region, and the outside world.

A census survey of employers in the White Mountain study communities is used to collect employment and sales data at a high level of specificity; these data serve as the basis for bifurcation into basic and nonbasic components necessary for estimating the multiplier. Data are measured to determine the extent of economic dependence and spatial interaction which exists between communities, and between the region and the outside world. This thesis makes a comprehensive and systematic description and analysis of the flows of employees and customers within a complex regional system and the communities which form its constituent parts.

One of the elements that is considered when calculating a community or region's employment multiplier, is where people live and work. The two-tier nature of this

study provides data which are useful in determining journey-to-work flows between communities, and between the region and the outside world. A detailed analysis of data on commuting within the region provides a greater understanding of the nature and scope of non-metropolitan labor markets than could have been captured in a traditional base study. Sectoral characteristics of commuters are examined to identify how well the skills of the labor force are matched with local labor markets.

Similarly, the role of sectoral wage differentials is addressed in this analysis and an economic value is assigned to the employment "flow" data. Average wage by sector is applied to commuting flows to measure the economic base at both the community and regional levels.

External sources of income which provide residents with additional spending power, such as retirement pensions and welfare programs, are discussed in this analysis and are assessed to determine the extent to which local business growth is dependent on these transfer payments as a source of basic income.

This multi-level, regional economic base study seeks to identify the basic activities for each community and the region as a whole. The final analysis presents the economic base multipliers which determine the impact that new "basic" jobs would have on the study region as well as each community within the region.

ECONOMIC BASE ANALYSIS IN REVIEW

In order to gain a full understanding of the nature and scope of the regional economic base study presented in this thesis, this chapter defines in detail the concept of economic base analysis and its application by scholars and professionals to the study of urban and rural economies. The evolution and refinement of both the concept and its use as a research tool are discussed. Improvements made to the methodology and the resulting set of adjustments which are made to the data base are assessed in terms of their contribution to generating a "best" estimate of the multiplier, as well as the value which the data provide to more fully understanding community and regional economies.

Economic Base Theory

In general terms economic base analysis is founded on the simple logic which assumes that all business transactions are carried out at two scales -- the intra-area, locally-oriented scale, and the inter-area, export-oriented scale. The local economy is therefore divided into two sectors according to whether firms have markets inside the local area -- the nonbasic sector, or exports to markets outside the area -- the basic sector. Nonbasic

transactions involve the recycling of money that is already in the local economy. Basic transactions, on the other hand, require the importation of money from some source outside the base area. Economic base theory asserts that it is this "new" money which enters the local economy from the outside that leads to the growth and expansion of nonbasic business activity within the base area (Alexander, 1954; Blumenfeld, 1955; Isard, 1960; Hoover and Giarratani, 1984; Tiebout, 1962; Yeates and Garner, 1980). North (1955) asserts that the fundamental cause of regional growth throughout North America is the growth of the basic sector derived from increasing export sales.

There are several ways of measuring the basic and nonbasic components of an economy in a region or community. A number of indices are available; employment, value added and business income are all commonly used (Tiebout, 1962), but economic base studies have traditionally used employment. Using employment as a measure of economic growth or decline, the economy of a community is made up of the following:

$$TE = BE + NE$$

where TE is total employment, BE is basic employment, and NE is nonbasic employment (Isard, 1960; Richardson, 1985).

The general relationship between the basic and nonbasic activity is described by the multiplier. Basic

employment is generated by income flowing into the community from export markets, and nonbasic employment describes the existing structure of the economy by showing how many nonbasic jobs are indirectly supported by basic economic activity. Since the basic sector moves the nonbasic category, a rise or fall in the basic category will cause an adjustment in the nonbasic sector. This "reactive" process is known as the multiplier effect.

The simplest method of estimating the employment multiplier involves taking the ratio of the total employment to basic employment as follows:

$$M = \frac{TE}{BE}$$

where M is the multiplier estimate. This simple multiplier concept, which was implicit in the earliest writings on economic base has been widely criticized. An improved multiplier estimate is possible if data for two time periods are available:

$$M = \frac{\Delta \text{ Total Employment}}{\Delta \text{ Basic Employment}}$$

where Δ denotes the changes in basic and total employment over a time period (Weiss and Gooding, 1972).

The "marginal" multiplier is the added total employment that is generated by an additional amount of

basic employment that can be stated as follows:

$$\triangle TE = M \cdot \triangle BE$$

which describes the change TE in the community's total employment that would be expected to follow the initial change BE in the community or region's basic employment. Thus, the multiplier is a generalized statement of indirect employment (or income) that will be generated within a community by new investment (Mulligan and Reeves, 1986), and used to forecast development impacts generated within a community by new investment, or lost because of reduction in basic employment.

Alternative Methods of Estimating the Multiplier

There are a number of alternative methods that can be used to estimate the base multiplier. Given a unit of measure, such as employment or income, the most frequently used means of estimating economic base ratios is by indirect techniques which use secondary sources of data. A number of scholars (Gibson,Barr, and O'Keefe, 1975; Gibson and Worden, 1981; Isard, 1960; Richardson, 1985; Tiebout, 1962; Yeates and Garner, 1980) have reviewed the advantages and disadvantages of the various methods, but fail to agree upon the best method of measuring the "multiplier" impacts associated with local economic growth.

One of the most widely used methods of measuring the economic base has been the location quotient (Richardson, 1985). Its validity, however, is undermined by Tiebout (1962) who questions the unrealistic assumptions that this method makes about the uniformity of regional tastes, patterns of consumption, and rates of productivity throughout the nation. In a study by Gibson and Worden (1981), which tested alternative methods of estimating base multipliers, the authors use empirical data to compare multipliers derived from the total census survey, sample survey, location quotient and minimum requirements methods. Their results demonstrate that the location quotient approach produces much larger multipliers than the other methods, and conclude that while the location quotient is the most widely used approach it has "absolutely no utility for estimating basic and nonbasic employment shares in relatively small regional economies unless disaggregated data are available" (Gibson and Worden, 1981, p. 156).

Research by Moore (1975) and Ullman and Dacey (1960) assert that the minimum requirements approach provides a useful and easily applied tool for producing estimates of the multiplier. Empirical testing (Gibson and Worden, 1981) demonstrates that the minimum requirements approach provides a relatively good measure of basic and nonbasic ratios in small, rural communities.

Both the location quotient and minimum requirements are simple, fast and use data that are readily available from the U.S. Census and other secondary sources. These methods, however, have limited utility in the analysis of small, rural communities because they generate gross aggregates and use regional norms as a benchmark (Blumenfeld, 1955).

While the census survey approach is both time consuming and relatively expensive to conduct, there is a general consensus among researchers that this approach is the most useful way of collecting employment and sales data. This is especially true in the case of smaller regional communities because it provides data which more closely represents the peculiarities of a community or regions's economic structure (Blumenfeld, 1955; Gibson and Worden, 1981; Tiebout, 1962).

Limitations of Economic Base Analysis

A number of limitations have been identified concerning the use of the multiplier to describe the general relationship between basic and nonbasic employment (Isard, 1960). Gibson, Barr and O'Keefe (1975) make four main points. First, there may be a time-lag before the multiplier effect materializes if employers wait to see if business will increase before expanding their employment.

Second, if the regional economy has excess capacity, the demand for new services or nonbasic workers may simply be absorbed by existing employees. This contention is supported by Garrison (1972) whose analysis suggests that labor and capital are under-utilized in the nonbasic sector of rural communities which result in the failure to produce a significant effect on employment and investment. This may be particularly true in communities where there is considerable part-time and/or seasonal employment. Third, the economic base multipliers describe aggregates and ignore how sectors internalize their transactions within the local economy. Lastly, some basic jobs produce more income than others, and will therefore contribute more strongly to increases in the local demand for goods and services.

Many economic base studies use employment as a surrogate for actual flows of revenue within the community or regional economies. The use of the employment definition of the multiplier has been criticized because it "offers a poor substitute" for the detail concerning the actual flows of money within the economy. It is argued that input-output analysis provides a better approach; it incorporates the "real world" patterns of money flows by recognizing that an increase in production in one industry results in the increase in production among other industries due to the linkages between all production

activities (Isard, 1960; Richardson, 1985; Yeates and Garner, 1980).

Isard (1960) presents some of the technical difficulties associated with basic/nonbasic ratios. He points out that employment does not express the significance of total expansion of different wage levels in different industries nor do employment data reflect expansion effects which result over a period of years from changes in physical productivity levels. Isard also notes that economic base analysis fails to account for unearned income.

Another notable limitation with an economic base study is that it does not measure any leakages of revenue to the outside world, i.e., purchases made by local residents outside the region (Blumenfeld, 1955). Therefore, it does not identify the extent to which the region depends on the outside world for certain goods and services.

Conceptual problems in the use of the multiplier to establish the impact of future changes in basic activities in a city or region are subject to error since they are based on past data which are unable to determine future quantitative changes in population size, increased specialization, improvements in transportation and delayed reaction.

Certain weaknesses in economic base analysis do exist, but these are minimized when the areal unit of analysis is small. For this reason Tiebout (1962) reasons that economic base analysis should be utilized only in the study of rural communities, counties and sub-state units, and aggregate multiplier estimates generated by an economic base approach should only be applied in impact studies of relatively underdeveloped and sparsely settled areas (Gibson and Worden, 1981).

Historical Evolution of the Economic Base Concept

The economic base concept was first formulated by Frederick L. Olmstead (Andrews, 1953). In a letter addressed to John Glenn, a member of the New York Planning Committee on February 21, 1921, Olmstead wrote that:

> ...productive occupations may be roughly divided into those which can be called primary...(i.e. not confined to use within the city itself), and those occupations which maybe called ancillary, such as are devoted directly or indirectly to the service and convenience of the people engaged in the primary occupation (Haig and McCrea, 1927, p. 43).

Just a few years later in The Regional Survey of New York and its Environs (1927), Haig and McCrea identified the need for a technique which would clearly distinguish between "primary" and "ancillary" activities, stressing that priority be given to primary export activities in city planning. The bias in favor of "basic" activities is

implicit in such terms as "primary" and "town building" versus terms such as "secondary," "ancillary," "town-filling," "service," "dependent" and "nonbasic."

Much of the development of the economic base concept has been attributed to the work of Homer Hoyt, an economist. In his work with the Federal Housing Authority (FHA) during the 1930s, Hoyt devised a quick survey technique which yielded information and relationships concerning the economy. This technique was utilized to predict local housing market demand. By 1936, Hoyt had developed the fundamentals of the concept as we know it today, formulating the basic and "service" elements of cities as having an employment ratio of 1:1. Hoyt soon realized, however, that this ratio varied from one city to another (Andrews, 1953).

In Principles of Urban Real Estate (1939) Hoyt and co-author Weimer presented the first complete statement of the theory on economic base. In this text they described the idea of a mathematical relationship between basic and nonbasic employment. Hoyt considered the economic base concept to be a tool that might be employed in analyzing the economic background of cities with the objective of forecasting the future population and business growth of the entire city.

Another major advance in methodology was made in 1938 by researchers of Fortune magazine. In the report

titled, "Oskaloosa versus the United States," they used the balance of payments principle to analyze a small Iowa county seat. In tracing the dollar volumes of imports and exports, they distinguished between the city's "growth" and "service" factors.

In the two decades that followed Olmstead's letter, the economic base concept received considerable attention; the concept was developed further, reviewed, evaluated and tested. During the 1940s numerous reports and articles concerning the specific aspects of economic base added significantly to the refinement of the concept as an applied research tool. At this time local planning agencies, including the Regional Plan Association, New York (1944), began to apply the concept directly to the planning process. The Federal Reserve Banks also adopted the technique as a part of their economic analysis and forecasting system, and the FHA continued to use economic base analysis in their market estimations (Andrews, 1953).

Contributions Made by Geographers

The development and refinement of economic base analysis has been attributed to the work of scholars and professionals from a variety of fields. In spite of the fact that economic base is founded on a geographical concept which involves spatial relationships between two sectors of the economy, only a few studies by geographers

used the economic base concept before the 1950s.

As early as 1921, a paper in the Geographical Review discussed the morphology of towns in terms of the relation between the primary and secondary occupations of town residents (Aurousseau, 1921). The author explains that primary occupations are concerned with the functions of a community while the secondary occupations are those concerned with the maintenance of the people living in the community (Aurousseau 1921). In describing how rural and city populations are integrated with one another, Jefferson (1931) wrote:

> rural folk are only distinct from city folk in their sleep.... Awake and at work they are tied up to the city in every act of life. They raise crops for the city, buy clothes from the city and bank in cities (Jefferson, 1931 p. 453).

Probably one of the first geographers to apply the economic base concept to a study of a city was Richard Hartshorne. In the 1932 study of Minneapolis-St.Paul, Hartshorne determined that the city's economy consisted of two distinct components - the "internal" and the "external." Later he pioneered a methodology for applying the economic base concept to a single type of endeavor -- manufacturing, reasoning that manufacturing in every city produces part of its total output for local consumption in addition to the amount it produces for export. Hartshorne stressed the need to measure the amount that exceeded local

demand in order to determine the basic, export component (Hartshorne, 1936).

Victor Roterus was probably the first geographer to organize a case study around the concept in his economic analysis of Cincinnati in 1946. As research director for the Cincinnati City Planning Commission, Rotherus played a part in refining the base identification technique established in the New York (1944) report. Among several observations, Roterus estimated that the employment ratio was 100:170 between urban growth (basic) and urban serving (nonbasic) activity (Cincinnati City Planning Commission, 1946).

John W. Alexander made some major contributions to the economic base theory during the 1950s. In The Economic Life of Oshkosh, Alexander (1952) devised a new methodology for identifying the basic-nonbasic components. He used a firm-by-firm questionnaire approach in which he asked employers to report their total employment and the percentage of their sales made to local and non-local customers. He used the origins of sales to determine whether employment was export or local serving. This was the first use of a direct, field survey method for distinguishing basic from nonbasic data. Alexander (1954) summarized the utility of the concept to geography:

> By revealing components of the urban economy connecting the city with other areas, by providing a regional service

> criterion for classifying cities in terms of regional functions, by providing the B/N ratio as another criterion for distinguishing between cities, and by a new method of measuring individual business firms -- the basic-nonbasic concept contributes to the geographical understanding of cities (Alexander, 1954, p.255).

Wilson (1955) extended the methodology by recognizing weaknesses in the application of economic base studies and correcting for them. He observed that employment ratios failed to take into account differences in wage levels among industries, and adjusted for this by applying estimates of income payments to all industrial groups in his study. He also attempted to locate and assess sources of "unearned income" such as annuities, dividends, interest, and income from property which prior to this had not been included in economic base studies (Wilson, 1955).

Traditionally, economic base analysis has been applied to the study of large urban areas and only recently have a few economic base studies been conducted of small regional communities. In the past fifteen years, the Department of Geography and Regional Development at the University of Arizona, has conducted a number of base studies of rural communities throughout the State of Arizona. Data derived from over forty of these economic base studies covering more than thirty communities have

been compiled in the Arizona Community Data Set (ACDS). The ACDS has been utilized to test and refine components of economic base analysis as it relates to the understanding of the economic structure of small rural communities (Gibson and Worden, 1981; Mulligan, 1987; Mulligan and Gibson, 1984; Mulligan and Reeves, 1986).

Census Survey Method

Procedures for conducting an employment type economic base census survey have been refined over the past thirty years. All of the economic base studies in the ACDS were conducted in the field using the census survey approach to collect data on employment and sales. These procedures are outlined by Gibson and Worden (1981).

One of the initial problems with the census survey method is in defining the base area for each community being surveyed. A realistic base area would define the trade area of a community, including the entire extent of the community being studied and at least some of the outlying establishments which are physically separate from the community, but still functionally part of it. This is impossible to do since the trade area varies with each type of good or service offered. In the case of the Arizona studies, the study area was usually defined by a circle within a ten-mile radius from the center of the study community; the area surrounding the study community was

considered the outside world and the economic transactions between the two were measured. Transactions between parties located inside the base area are be considered nonbasic, whereas transactions with residents from outside the base area are considered basic. This approach works reasonably well in Arizona where most rural places are free-standing and located in sparsely settled areas.

Census survey procedures developed by Gibson require that a concerted effort be made to identify and interview all employers in the study area including private and governmental establishments. This approach uses a standard questionnaire to collect data on the principal function of each firm, record the number of employees in each category (full-time, part-time and seasonal), document the numbers of employees who commute in from outside the study area, and assign the proportion of each establishment's revenue that is generated from outside the community.

Selecting a measure of magnitude is relatively simple. The most frequently used measure is employment because firms are often reluctant to provide information on business income. There are, however, some problems associated with the use of the employment measure. Since there are wide variations in productivity and income per employee from sector to sector and within sectors, all employees are therefore not of equal economic value. As a

result a number of adjustments need to be made to the employment data.

Data Adjustments

Whereas a head count of employees in each business is useful for descriptive purposes, a thorough analysis requires the standardization of employment to a full-time equivalent (FTE) value. Part-time employment is converted to FTE employment using a 40-hour week, and seasonal employment is transformed to an FTE by using a 52-week year. One problem with adjusting data to an FTE is that the procedure may underestimate some full-time workers, like the owner of a small business who works more than a 40-hour week, or overstate the seasonal worker who perhaps does not work a full 40-hour week.

Besides the fine tuning of employment data just mentioned there are a number of adjustments which require data not typically collected as part of the field survey. Secondary sources of data provide the basis for adjustments to account for wage differentials, unearned income and outcommuters.

One of the most significant adjustments to the base survey data set accounts for the variability of wages among and within employment sectors (Gibson and Worden, 1981). Assumptions are made that high income employees are in a better position to contribute more to the local economic

base than low wage earners. Ideally wage data would be collected on a firm-by-firm basis, but this is generally not feasible in studies of this nature because employers are generally reluctant to provide payroll data. Instead, previous studies have used average wage by sector to weight FTE employment. This process serves to inflate employment in high wage sectors and deflate the significance of low wage sectors.

Because economic base theory is founded on the identification and measurement of external income to determine the extent to which it generates jobs in the local economy, it stands to reason that sources of unearned income such as pensions and social security benefits be included in the economic analysis of a region or community. By injecting income into the local economy from outside the region or community, transfers have the same effect upon the region as basic sector activity.

The inclusion of transfer payments in determining the basic and nonbasic components of the economy have been supported by a number of recent studies (Forward, 1982; Hoppe and Saupe, 1982; Saupe, Hoppe and Gruidl, 1982; Smith, 1986, 1987). A recent study which compared multipliers with adjustments for outcommuters, wage differentials and transfer payments, found that the inclusion of transfer payments produced the most dramatic results; the multiplier dropped in every community included

in the study (Gibson and Worden, 1981). The same study determined that the greatest decline in the multiplier was experienced in communities with large retirement populations.

Summers and Hirschl (1985) support the idea that retirees "with their pensions and investment incomes" represent a major source of dollars flowing into a community. They state that unearned income (pensions, investments, government transfers) in the Unites States, made up 33% of total personal income in 1982, which was an increase from 20% in 1960. This increase reflects an important demographic trend -- the aging of the American population. Social security and government pensions represent a substantial portion of transfer payments and "are among the leading sources of total personal income growth (Smith, 1987, p. 44).

Transfer payments are not uniformly allocated to different functional types of communities (Gibson and Worden, 1981; Mulligan, 1987; Mulligan and Reeves, 1985, 1986). A study using the ACDS, showed that mining towns received substantially lower levels of public transfer payments than trade and service centers, which received disproportionately high levels (Mulligan, 1987). Mulligan's use of OLS regression analysis indicates that transfer payments significantly affected "the levels of nonbasic employment (and thus the magnitude of the base

multiplier) in three out of four functional types of settlement" (Mulligan, 1987, p. 11) A recent study conducted by Hirschl and Summers (1982) found that the most efficient generation of nonbasic income growth from a cash transfer came from old age survivor insurance (OASI). They found that for every $3,600 of additional OASI payments made to the county, one additional nonbasic job was created, whereas it took $88,500 in salaries and wages paid to manufacturing to create one additional nonbasic job. In estimating employment impacts for five rural towns proximate to new manufacturing plants in Kentucky, Garrison (1972) concluded that the multiplier effect on nonbasic employment was small. In an extreme case it has been found that "it is possible for transfers to provide the entire economic base of a region and for people to live in a region without any basic activity" (Knapp and Huskey, 1988, p. 30).

Commuting and the Economic Base

The issue of commuting raises some interesting questions concerning the determination of the economic base of a community or region. In an economic base study which uses employment as its measure, it is necessary to determine whether employees are residents of the study area or not. Additionally, data on employee residence identify the extent of in- and out-commuting. A detailed analysis

of commuting patterns will show which communities are net losers, and which are net gainers of employees. There are two important adjustments concerning commuting which are made to an employment-type economic base study -- the inclusion of outcommuters and the exclusion of incommuters. The people who live in a study area but work elsewhere are treated as outcommuters. Employees who work in the base area but leave the area in the evening to return home to another community or region are considered incommuters.

Commuting is important to measuring the economic base because it represents an important factor in the spatial distribution of income. Erickson (1977) uses micro data on commuting to and from a major defense installation, to document the impact of an "income spread effect" on the surrounding geographic areas. A recent study which examined the relationship between long distance commuting and income change in small rural communities in upstate New York, noted that outcommuting had a significant impact on the spread of income growth to non-metropolitan peripheries (Mitchelson and Fisher, 1987). Since income transfers are realized in the "home" community through expenditures on land, housing, retail and service activities and tax payments, outcommuting may therefore be regarded as a "basic" or "export" industry in the sense that it effectively transfers income from the destination of the

commute (the place of employment) to the origin (the place of residence) (Lamb, 1975).

In an economic base study it is therefore important to include estimates of people who live in the study area but who outcommute for employment. Determining outcommuting data enhances the results of the economic base analysis and provides a better understanding of regional labor markets.

Krout's study (1983) of intercounty commuting in non-metropolitan areas raises an interesting question concerning which industrial sectors in non-metropolitan economies rely most heavily on resident workers and which rely on incommuters (Krout, 1983). Krout reports on observations from census data which document outcommuting by industry type at the county level; counties substantially involved in agriculture, forestry, fisheries, personal services and retail trade had little outcommuting (less than 10 percent). Counties involved more heavily than the average county in mining, wholesale trade, transportation and construction activity experienced more outcommuting than average (Krout, 1983).

Data on commuting patterns directly relate to the methodological issue of assigning employees an economic value, i.e., an average county wage according to industrial sector, as described above. Communities which offer employment but attract incommuting are expected to

experience a negative impact on the local economy; incommuters represent a source of lost income or leakage from the local economy and it is for this reason that the process which leads to the estimation of the multiplier, excludes incommuters.

Summary

Both the concept and the application of economic base analysis have come a long way since its inception more than sixty years ago. Its early use in forecasting population growth and real estate growth has since been surpassed. Today its value is seen in the application of measuring small area economic impacts in small, rural areas and providing community leaders with valuable information about their local economies.

Researchers concur that the application of economic base analysis to data collected in the field provides small rural communities and sparsely populated regions with detailed information about their economies that would otherwise not be available. Research has continued to search for solutions which overcome a number of limitations and problems associated with economic base analysis. These have largely been overcome by applying a number of adjustments to the data which produce a more refined multiplier estimate.

While a number of economic base studies have been conducted of communities and regions, none have integrated the two, applying the concept to the measurement of economic activity between the community, the region, and the outside world. Application of the theory at these levels is demonstrated in this thesis, and in conjunction with a range of adjustments, serves to generate highly detailed information concerning the economic and spatial flows and linkages at the inter- and intra-regional level, as well as the economic characteristics of the community and the region.

DATA SET AND METHODOLOGY

A primary data set generated by the White Mountain Regional Economic Impact Study (WMREIS), which was conducted by the Economic Development Program at the University of Arizona during the fall of 1987, forms the basis of this thesis. The WMREIS, a census survey of employers in the White Mountain Region of Arizona, measured the economic relationship of six "core" communities to the region, and determined the economic links existing between the communities and the region, and between the region and the "outside" world.

The WMREIS was initiated by community leaders in the White Mountain Region, seeking a better understanding of the workings of their local economies and how their economies function as part of a regional economic system. The WMREIS was established to provide information that would help decision makers formulate regional development planning strategies and more efficiently direct public and private investments.

Study Design

The WMREIS was designed to measure: the structural characteristics of the various communities which make up the region, flows of revenues between these communities,

and the flows of revenue between the region and the "outside" world, and to map the economic base of the region so that regional and community multipliers could be calculated.

Study Area

The White Mountain area is located in the eastern part of central Arizona (Figure 1). Figure 2 shows a detailed map of the area, which includes southern parts of Apache and Navajo counties, and a portion of the White Mountain Apache Reservation. The extent of the WMREIS study region and the study communities are illustrated in Figure 3. The study region extends from Snowflake and Taylor in the north to Whiteriver in the south, and reaches as far east as Springerville and Eagar.

In this regional economic base study, three different types of "area" are identified -- the "community," the "region" and the "outside world." Since it was not feasible to survey the full geographic extent of each community's market area, the study applied procedures established by similar economic base studies of rural communities in Arizona (Gibson and Worden, 1981). In most cases the study community was defined to encompass the area within a circle having a ten-mile radius from the center of the community. The study region was determined by the communities that sponsored the study. If other communities

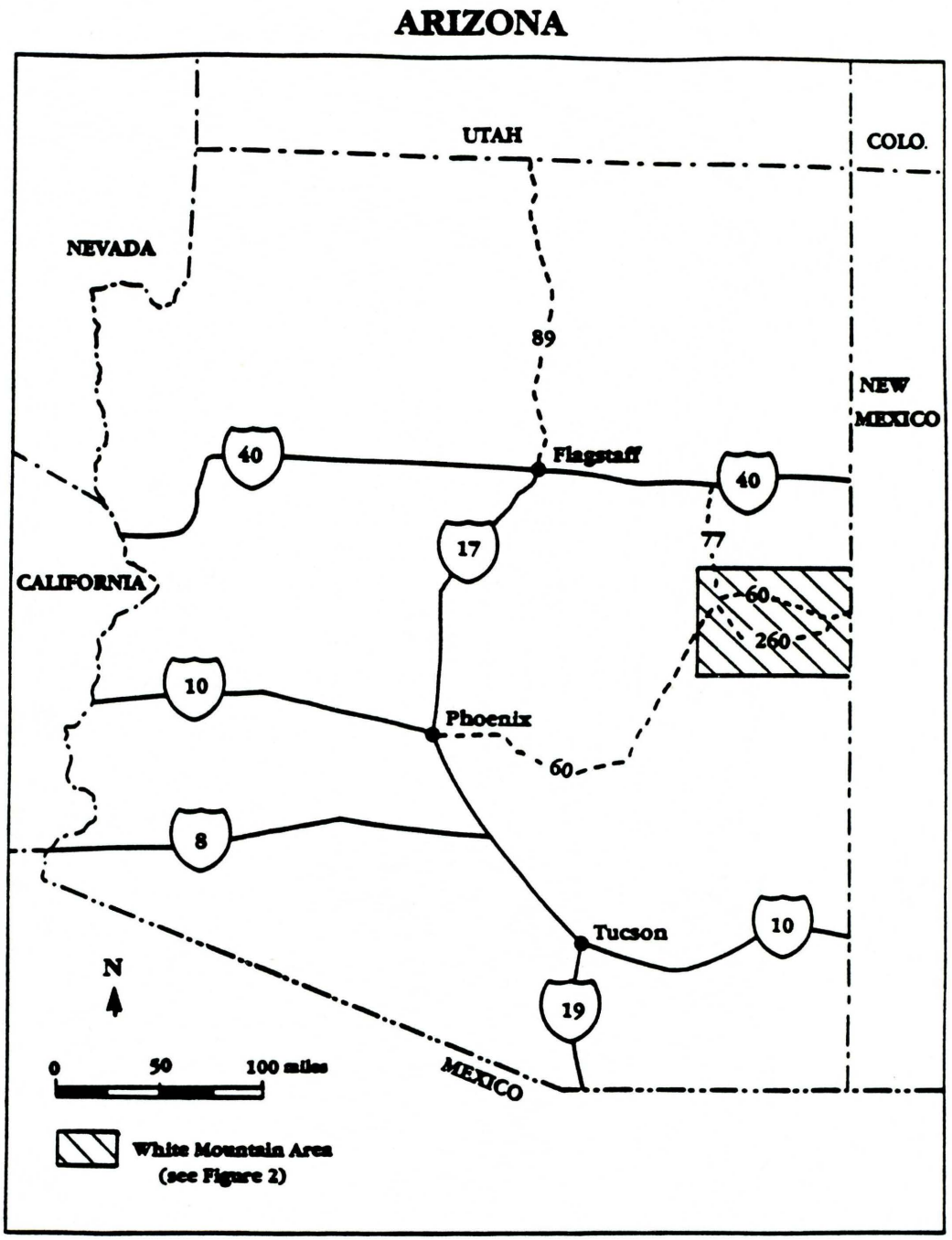

Figure 1. Major Cities and Highways in Arizona

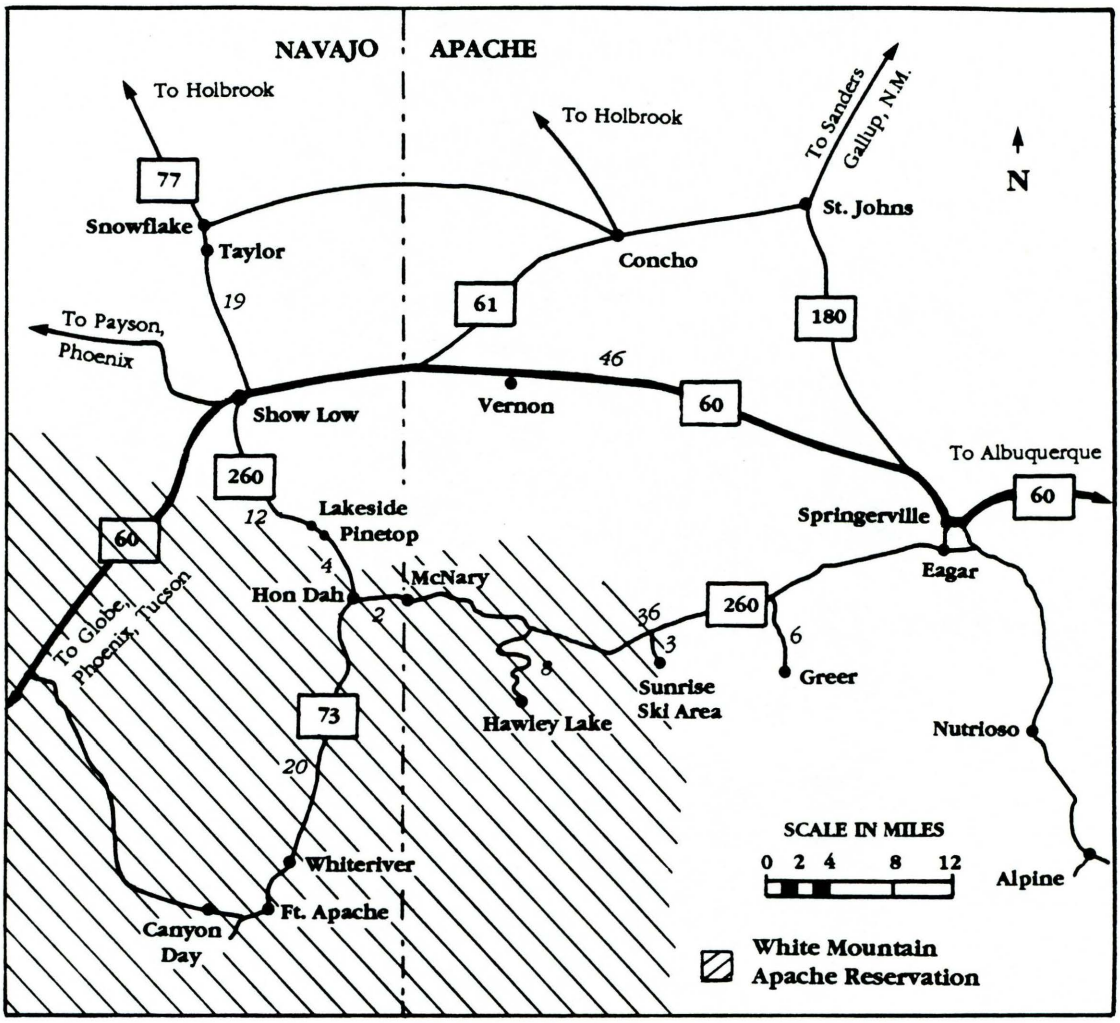

Figure 2. White Mountain Area of Arizona

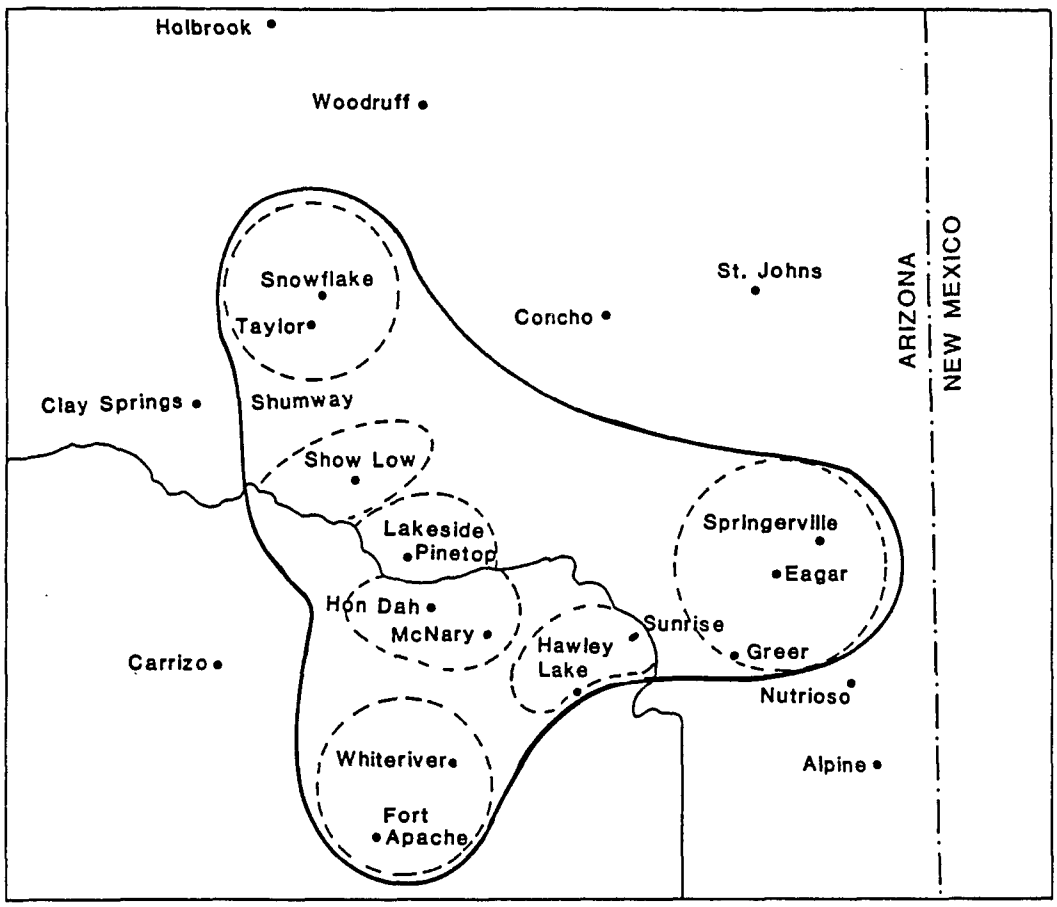

Figure 3. White Mountain Study Region and Communities

such as St. Johns, Alpine or Nutrioso had wished to participate in the study, then the study region would have been extended to include these communities as well. The individual communities surveyed in the study were Springerville, Eagar, Greer, Pinetop, Lakeside, Show Low, Snowflake, Taylor, Whiteriver, Hon Dah, McNary, Hawley Lake and Sunrise. Data were collected separately for these individual communities and later aggregated to create larger "functional" core communities. The larger units are Springerville, Eagar and Greer; Snowflake and Taylor; Pinetop-Lakeside, Hon Dah and McNary; Hawley Lake and Sunrise; Whiteriver (which includes East Fork, Fort Apache and Canyon Day); and Show Low. Show Low is the only community which was treated independently.

Study Communities

The study communities are described as follows:

Pinetop-Lakeside/Hon Dah/McNary

This functional community is located in the middle of the study area. Because of the ten-mile rule this community includes the smaller settlements of Hon Dah and McNary which lie within the White Mountain Apache Reservation. Pinetop-Lakeside, which became incorporated in 1984, offers tourist and recreation amenities to winter and summer visitors, and seasonal "cottagers." This community has an estimated resident population of

approximately 6,000, which more than doubles during the peak summer months (BRW, Inc., 1987). The ten-mile radius was applied to this community with one exception -- the northwest boundary between Lakeside and Show Low was modified. The boundary was determined by the median road distance between the Lakeside and Show Low city limits.

Show Low

It is centrally located in the White Mountain Region at the crossroads between Globe and St. Johns, Heber and Springerville. Show Low was originally settled over a century ago as a ranching community, but has since become the regional trade and recreation center serving the diversified needs of the area. This study community includes Linden and White Mountain Lakes, but excludes Pinedale and Clay Springs. The incorporated city of Show Low has an estimated resident population of 5,600 (Arizona Department of Economic Security estimates, July 1, 1988).

Snowflake/Taylor

They are neighboring towns situated at the northern part of the study region with a population of 5,935 (Arizona Department of Economic Security estimates for 1988). These towns were founded by Mormon ranchers in the 1870s and traditionally have functioned as agricultural villages and as foci for livestock ranching. In 1960 the

economy of Snowflake/ Taylor was transformed when the Southwest Forest Industries pulp and paper mill (now Stone Forest Industries) began operations at a site seventeen miles west of Snowflake on Highway 77. The paper mill was not included in the functional community of Snowflake/Taylor or the study region because of the ten-mile rule, mill employees who live within the study region were included as "outcommuters".

Springerville/Eagar/Greer

This functional community is centered on the city limits boundary line between the incorporated towns of Springerville and Eagar. The Springerville Generating Station, formerly the Tucson Electric Power plant, is included within this community. The two small communities of Nutrioso and Alpine, which to some extent appear to function as a part of the Springerville/Eagar system in terms of employment and shopping behavior, were excluded from the study community and study region because they fell outside of the ten-mile radius. At an elevation of 7000', Springerville and Eagar are located adjacent to each other and the Little Colorado River, about 15 miles from the border with New Mexico. Both towns were settled around 1878 and became the economic center of Round Valley. Fifteen road miles southwest of Springerville and Eagar is the small unincorporated community of Greer. The economic base

of this "rustic" community is tourism. Traditionally tourism, cattle grazing and lumbering have been the main economic activities in the Springerville, Eagar, Greer area. Population data published by the Population Statistics Unit of the Arizona Department of Economic Security indicate that Springerville/Eagar/Greer has an estimated resident population of 6,865 in 1988.

Whiteriver

Located on the White Mountain Apache Indian Reservation, Whiteriver is the administrative headquarters for the tribe and the Bureau of Indian Affairs. It is the home for approximately 7,000 members of the White Mountain Apache Tribe; Whiteriver and vicinity accounts for about 80 percent of the total population living on the reservation (Indian Health Service Household Survey, 1988). This functional community includes East Fork, Fort Apache and Canyon Day.

Hawley Lake/Sunrise

These places are located on the reservation between McNary and Springerville. Hawley Lake is a small, seasonal, "second home" community. Sunrise, on the other hand, provides recreational facilities for tourists, and seasonal jobs, but has virtually no residential base.

The six study communities described above make up the White Mountain study region. The area within the

boundary of the region which is not covered by the ten mile rule is described in the study as "other." "Other" is considered a place of residence but not as a place of work; this area has only a few employers and employees. Vernon is probably the most recognizable community in the "other" area. Persons living on ranches or in remote subdivisions also fall into this category.

Employment Census Survey

Data for the WMREIS were collected in the field from September 1987 to January 1988. As a census survey, it sought to identify and interview all public and private sector employers in the six core communities of the White Mountain Region. If two attempts to interview an establishment in the field were unsuccessful, then several attempts were made to contact the business by telephone. It is estimated that the survey identified virtually all of the "significant" employers in the White Mountain study region, and at least part of the questionnaire was completed by 95% of the establishments identified (Table 1). Ninety-percent of the employers identified completed the interview providing information on the economic base questions concerning the origins of sales and revenues. Furthermore, it is estimated that those firms providing information account for 99% of the region's total employment.

Table 1

ESTABLISHMENTS PROVIDING EMPLOYMENT AND ECONOMIC BASE DATA

Community	Total Identified	Employment Figures	% Total	Economic Base Figures	% Total
Pinetop	246	243	95	217	88
Lakeside	116	109	94	103	89
Show Low	378	369	98	340	90
Snowflake	111	106	95	103	93
Taylor	50	48	96	45	90
Springerville	146	134	92	130	89
Eagar	81	80	99	79	98
Greer	22	19	90	19	90
Whiteriver	55	50	91	49	89
Hon Dah/McNary	13	12	92	11	85
Hawley Lake/Sunrise	8	7	88	6	75
Total	I,226	1,168	95	1,102	90

Source: 1987-88 Survey by Economic Development Program, University of Arizona.

Study Limitations and Problems

The study surveyed all establishments within the ten-mile base area of each study community, with one exception -- farms and ranching establishments were usually not interviewed. Some agricultural enterprises, however, were included, namely the tribal farm at Canyon Day and a pig farm near Taylor.

Although the study included all identifiable in-the-home businesses, it is expected that a number of such businesses were missed but it is unlikely that these businesses are economically significant. Because of the problems relating to the identification of informal transactions such as bartering of goods or services, and the shadow economy of drugs or stolen goods trade (Farness, 1987), these activities were not included in the survey.

In spite of detailed and exact employment data obtained by the field survey, the reliability of information provided by employers concerning the origins of customers, has been questioned in the past (Isard, 1960). This criticism directly applies to the estimates made by employers concerning the percent of their sales made to local residents and non-residents. This is a problem which may apply to larger retail stores where it is difficult to accurately determine whether on the spot sales are made to residents or non-residents of the community, or region. To

a great extent this problem does not seem to be the case in this study. Data derived from businesses with the same four-digit Standard Industrial Classification (SIC) code were examined to determine if discrepancies of this nature existed; little disparity was found. It was also found that the large firms, which account for a large share of employment in most communities, had a good knowledge of their sales.

Since the study conducted interviews at the place of employment, the survey fails to collect data on regional "outcommuters," i.e., those people who live in the region but who work outside the region. This limitation was in part offset by identifying and interviewing all major employers outside the region within a fifty-minute commute. These employers were asked to provide counts of their employees residing in each study community. Even though this procedure tends to underestimate the actual numbers of outcommuters, it does serve to improve the results of the economic base analysis and it is crucial to an understanding of commuting flows and the regional labor market.

Primary Data Set

Data were collected in the field by using a standard employment questionnaire. The questionnaire which was used (Appendix 1) was designed to collect various

types of data. Questions 1-4 describe the firms and organizations interviewed. Question 5 determines the principle function of the establishment so that a four-digit code could be assigned according to the Standard Industrial Classification Manual (1987). Questions 6-8 record the total number of full-time and part-time employees by sex. Questions 9-10 document the number of employees who in-commute from other named communities in the study region. The difference between the total number of employees and the number of employees living inside the region represents the number of intra-regional incommuters, i.e., people who work in the study area but live outside the region. Inter-regional incommuters to a specific community were identified in the same way. Questions 11-13 describe the number and amount of seasonal employment. Seasonal employees were identified according to whether they live permanently within the White Mountain Region or not.

Data, which are crucial for the economic base analysis, are covered by questions 14-16. These questions ask for estimates of the percent of sales/revenue that is supported by customers from other communities in the study region, and from the "outside" world. Just as the employment field survey identified incommuters but excluded outcommuters, the questionnaire section dealing with sales data identified the origins of customers but fails to

account for residents shopping out of the region.

In questions 14-16, the word "sales" used in the questionnaire was not always appropriate so substitutions were made. For example, interviews with banks used the word "customers," churches used "parishioners," and school districts were asked what percent of their funding came from local, county and state sources. Since not all establishments rely on sales to customers, it was necessary to establish sources of funding for government agencies, school districts, churches etc. In the case of the White Mountain Apache tribe, tribal administrative operations were treated as a single government agency. Businesses operating as a part of the Tribal Enterprises were interviewed separately and treated as independent business establishments. Besides these modifications all establishments were treated as a "firm."

Manipulation of Primary Data

Whereas the data collected in the field are useful in their "raw state" for descriptive purposes, a number of computations and adjustments to the data were necessary to provide useful analyses and an accurate estimation of the basic and nonbasic components which make up the community and regional economies.

Since the unit of measure in this data set was based on employment, it required standardization. Data

provided by the employer on the full-time, part-time and seasonal employees were used for conversion to a full-time equivalent (FTE). This procedure can be particularly significant in areas which rely heavily on part-time and seasonal employment.

Employment data were bifurcated in a two-step process. First, aggregates of FTE employment living and working in the region were calculated, and from that total the FTE employment of those living and working in the named study community were determined. These regional and community aggregates were then applied to the sales data derived from the economic base section of the questionnaire. For example, where the employer of 3.0 FTE regional, resident "employees" estimated 60% of his/her sales going to residents of the region, it was computed that 1.8 FTE jobs were supported by sales made to residents of the region. In this case, the bifurcation process estimated that 1.8 FTE was nonbasic (local serving) and the remaining 1.2 FTE was basic (serving an export or external market). Employment data bifurcated at the regional level are used to estimate the multiplier for the region as a whole.

The FTE "employees" living and working in a named study community were used in conjunction with the portion of sales made to residents of the same community, in order to determine what portion of employment was supported by

local sales and export sales. Bifurcated employment data, i.e., the ratio of basic to nonbasic employment at the community level, were applied to estimate the community multiplier.

Secondary Sources of Data

Besides the fine tuning of employment data just described, there are other adjustments which require data not typically collected as part of the economic base census survey. In this study, secondary sources of data provided the basis for adjustments to account for outcommuters, wage differentials and unearned income.

Annual average wages for each of the nine industrial sectors for the appropriate county during the period from October 1986 to September 1987 were used to make wage adjustments to the employment data. Table 2 shows the average wage by sector for Apache and Navajo counties. It is apparent that both county and sectoral wage differentials are substantial. At the extreme the "average" TCPU worker in Apache county earns more than three times as much as the "average" retail trade employee in the same county. Other differences are not as great but they are significant.

The final adjustment is designed to account for sources of unearned income which are made to individuals and firms in the study communities and region. Data

Table 2

AVERAGE ANNUAL WAGE BY SECTOR IN APACHE AND NAVAJO COUNTIES*

Sector	Apache	Navajo
Agriculture	$ 15,439	$ 17,183
Construction	21,669	18,729
Manufacturing	16,524	20,113
TCPU	29,610	28,719
Wholesale Trade	18,045	17,451
Retail Trade	9,273	9,499
FIRE	14,797	15,757
Services	15,758	16,274
Public Administration	19,334	19,304

* Average wage figures represent the weighted average of private, local, state, and federal employees.

Source: Data provided by the Arizona Department of Economic Security, UI Research and Reports Sections.

published in Local Area Personal Income: 1979-84 (1985) identify two main types of unearned income. Property income includes rents, royalties, interest, and dividends, whereas transfer payments include unemployment insurance, payments to old-age survivors, supplementary security, food stamps, aid to families with dependent children, and general assistance. Property income was not included in this study because it was not available at the community level, and it was assumed to be relatively insignificant. Transfer payment data, obtained from the Arizona Department of Economic Security, were assembled at the five-digit zip code level and then aggregated to correspond with the study communities.

The procedures for estimating unearned income in previous studies were refined in this study. Social security payments were estimated as a percentage of the total transfer income at the county level and this percentage was used to estimate total transfer income at the community and regional levels. Annual transfer income totals were divided by the average income for a community's workers and converted into "basic" employee equivalents and added into the data set. This process serves only as a "best estimate," yet it plays a significant role in increasing basic employment causing the multiplier to drop (Gibson and Worden, 1981). In the final multiplier analysis both outcommuters and transfer payments become

"phantom" sectors adding basic equivalent employees to the primary data set.

The thesis also makes use of the Arizona Community Data Set (ACDS), a body of survey information derived from economic base studies of rural communities in Arizona which summarize the employment and selling behavior of virtually all establishments within the base area. The ACDS includes studies of Springerville, Eagar, Show Low, Snowflake, Taylor and Pinetop-Lakeside which are used for comparative purposes in this thesis.

Summary

Employing a standard questionnaire to an employment census survey of the White Mountain Region served to establish the origins of employees and customers which provide the foundation needed to distinguish the basic components at the community and regional levels. The questionnaire approach is essential to the identification of incommuters as well as determining the status of employees, i.e., differentiating between full-time, part-time and seasonal employees, as well as identifying the level of employment in each industrial sector. Data from secondary sources provided criteria necessary for the implementation of a set of adjustments, namely outcommuters, sectoral wage differences and the level of transfer payments at the community and regional scales.

THE ECONOMIC STRUCTURE OF THE WHITE MOUNTAIN REGION AND ITS COMMUNITIES

An analysis of the primary and secondary data collected are presented including a detailed description of the employment structure, sectoral characteristics, wage structures, residential base of communities, patterns of commuting and sales activity, and the impact of transfer payments at the community and regional level. Data analysis are presented for each study community and aggregated to determine the characteristics of the region. This chapter concludes with a section detailing the estimation of the multipliers for each community and the region as a whole.

Employment

General Characteristics

Since the WMREIS was an employment-oriented census survey, it generated a highly detailed and comprehensive data set of employment for each community in the White Mountain study region. The study identified 13,442 employees working in 1,226 establishments in the region (Table 3), although this estimate may in fact overinflate the actual number of employees since it includes multiple job holders, i.e., people holding more than one job.

Table 3

NUMBER OF EMPLOYERS, EMPLOYEES AND AVERAGE EMPLOYEES PER FIRM
(Head Count)

Community	Total Employers Identified	% Total	Total Employees Identified	% Total	Average Employees Per Firm
Pinetop-Lakeside/ Hon Dah/McNary	375	30%	2,831	21%	8
Show Low	378	31	3,535	26	9
Snowflake/Taylor	161	13	1,544	12	10
Springerville/Eagar/ Greer	249	20	2,735	11	11
Whiteriver	55	5	2,408	44	44
Hawley Lake/Sunrise	8	1	389	3	49
Total	1,226	100%	13,442	100%	11

Source: 1987-88 Survey by EDP/U of A.

Show Low is the major employment center of the region, with both the largest number of identified employers and employees. Show Low accounts for almost one third (31%) of the region's total employers and more than one quarter (26%) of the region's total employees. If the business establishments in Show Low and Pinetop-Lakeside are considered together, they account for almost half (46%) of the region's jobs and 61% of the region's business establishments. Because Show Low and Pinetop-Lakeside provide a large share of regional employment opportunities, combined they serve as a dispersed but contiguous, nodal city for the region (Fox and Kumar, 1965).

Springerville/Eagar/Greer and Whiteriver also offer substantial employment whereas Snowflake/Taylor accounts for only 12% of the region's total employment. This figure would have been significantly higher if the Stone Forest Industries paper mill had been included in the Snowflake/Taylor study area.

The smaller reservation communities of Hawley Lake and Sunrise account for only a small percent (3%) of regional employment. Even though Whiteriver has almost a fifth of the region's employees, it is conspicuous because it has far fewer employers than the other communities; this community is dominated by a few large employers. The average size of a firm in Sunrise and Whiteriver is more than 44 employees per establishment. Pinetop-Lakeside, on

the other hand, is characterized by establishments with fewer employees; it has 30 percent of the total employers in the region and the average firm employs eight workers (Table 3). An average firm in the remaining communities has between nine and eleven employees.

Employment Status

The employment data set discerns between full-time, part-time and seasonal employment. Table 4 shows the percentages of the labor force engaged in full-time, part-time and seasonal employment. Springerville/Eagar/Greer has the highest percentage of employees working full-time (75.9%), and the least seasonal employment (7.7%). This table identifies a dramatic shift in Springerville/Eagar/Greer's employment structure since 1977 when Springerville was last surveyed. The structure of the labor force is similar in Snowflake/Taylor, having a little less full-time and marginally more seasonal employment. Snowflake/Taylor's employment, however, has remained stable over the past decade. Both Show Low and Pinetop-Lakeside have larger shares of part-time employment than the regional average.

Employment in Hawley Lake/Sunrise is almost entirely seasonal. Pinetop-Lakeside follows with a large share of its workforce engaged in seasonal employment (21%). Seasonal employment in the White Mountain Region

Table 4

LABOR FORCE BY EMPLOYMENT STATUS
(Percentages Based on Head Count)

Community	Full-time	Part-time	Seasonal
Pinetop-Lakeside/ Hon Dah/McNary	59.2%	19.8%	21.0%
Show Low	68.9	20.4	10.7
(1977 study*)	(72.0)	(17.5)	(10.5)
Snowflake/Taylor	72.9	16.2	10.9
(1977 study*)	(74.0)	(16.5)	(9.5)
Springerville/Eagar/ Greer	75.9	16.4	7.7
(1977 study*)	(59.5)	(15.6)	(24.9)
Whiteriver	70.3	14.1	15.6
Hawley Lake/Sunrise	16.5	8.7	74.8
Weighted Regional Average	67.5	17.5	15.0

* 1977 survey results reported by Gibson and Worden (1981).

Source: 1987-88 Survey by EDP/U of A.

includes workers associated with summer and winter recreation activities, tourism, construction and forestry. On average, full-time employment in the region accounts for 67.5% of total employment, with the remainder being split between part-time employment (17.5%) and seasonal employment (15.0%).

The consequences of standardizing employment to an FTE are demonstrated in Table 5, which compares head count and FTE; the differences are dramatic in some cases. An extreme example is Hawley Lake/Sunrise which shrinks by almost 50% from 389 employees to an FTE of 207.7. Overall this adjusting procedure "reduces" employment by almost one fifth.

Employment by Sector

All employment data were aggregated by industrial sector according to the SIC Manual. The two major employment sectors in the region are services and retail trade, which account for 31.4% and 25.0% of all employment (Table 6). Public administration employs 11.9% and manufacturing employs 9.7%. The remaining other five sectors are comparatively small employers. The small percentage of employment in agriculture is explained in part by the fact that few agricultural establishments were included in the survey, and in part because U.S. Census and other sources suggest that agriculture is in fact a minor

Table 5

HEAD COUNT AND FTE EMPLOYMENT IN THE WHITE MOUNTAIN REGION

Community	Head Count	FTE	Percentage*
Pinetop-Lakeside/ Hon Dah/McNary	2,831	2,140.1	76%
Show Low	3,535	2,898.7	82
Snowflake/Taylor	1,544	1,288.7	83
Springerville/Eagar/ Greer	2,735	2,325.8	85
Whiteriver	2,408	2,055.8	85
Hawley Lake/Sunrise	389	207.7	53
Total	13,442	10,916.8	81%

* FTE as a percentage of head count employment.

Source: 1987-88 Survey by EDP/U of A.

Table 6

RANK ORDER OF EMPLOYMENT SECTORS
FOR THE WHITE MOUNTAIN REGION
(Head Count)

Sector	Percent of Total Employment
Services	31.4%
Retail Trade	25.0
Public Administration	11.9
Manufacturing	9.7
Construction	6.8
TCPU	6.7
FIRE	5.1
Wholesale Trade	2.3
Agriculture	1.1
	100.0%

Source: 1987-88 Survey by EDP/U of A.

industry in the White Mountain area. Tables 7 to 12 present a detailed breakdown of the number of firms, and the number of employees identified by industrial sector for each study community.

In the past many rural economies have specialized in one or two sectors. In the decade following 1975 more than half of the non-metropolitan communities In the U.S. were dominated by a single economic sector with two-thirds of non-metropolitan counties specialized in agriculture and manufacturing. In light of this sectoral employment was at the community level to determine the extent to which each community relies on employment in one or two major sectors. The top ranking employment sectors which account for at least two-thirds of employment are summarized in Table 13.

The service sector dominates employment in four of the communities and ranks second in importance in two other communities. Retail trade ranks first in Pinetop-Lakeside, and second in Show Low, Snowflake/Taylor, and Springerville/Eagar/Greer. The retail trade sector is conspicuous by its absence in the communities on the Indian Reservation, namely Whiteriver and Hawley Lake/Sunrise. Public administration ranks top in only one community -- Whiteriver, where it accounts for more than a third of total employment. Manufacturing ranks third in Snowflake/Taylor and Whiteriver, and fourth in Springerville/Eagar/Greer. In all three of these

Table 7

Pinetop-Lakeside/Hon Dah/McNary

NUMBER OF FIRMS, EMPLOYMENT HEAD COUNTS, AND PERCENTAGE SECTORAL EMPLOYMENT

Sector	Number of Firms Identified	Number of Employees	Percent of Total Employment
Agriculture	8	13	0.4%
Construction	16	136	4.7
Manufacturing	12	82	2.7
TCPU	17	192	6.7
Wholesale Trade	4	9	0.3
Retail Trade	141	1,077	38.0
FIRE	45	249	8.7
Services	120	884	32.1
Public Administration	12	189	6.8
Total	375	2,831	100.0%

Source: 1987-88 Survey by EDP/U of A.

Table 8

Show Low

NUMBER OF FIRMS, EMPLOYMENT HEAD COUNTS, AND PERCENTAGE SECTORAL EMPLOYMENT

Sector	Number of Firms Identified	Number of Employees	Percent of Total Employment
Agriculture	5	12	0%
Construction	16	190	5.4
Manufacturing	4	62	1.8
TCPU	18	267	7.5
Wholesale Trade	18	141	4.0
Retail Trade	142	1,188	33.5
FIRE	38	301	8.5
Services	127	1,192	33.6
Public Administration	10	182	5.7
Total	378	3,535	100.0%

Source: 1987-88 Survey by EDP/U of A.

Table 9

Snowflake/Taylor

NUMBER OF FIRMS, EMPLOYMENT HEAD COUNTS, AND PERCENTAGE SECTORAL EMPLOYMENT

Sector	Number of Firms Identified	Number of Employees	Percent of Total Employment
Agriculture	3	15	0.9%
Construction	11	114	7.4
Manufacturing	11	304	19.7
TCPU	10	109	7.1
Wholesale Trade	11	88	5.7
Retail Trade	49	332	21.5
FIRE	9	45	2.9
Services	54	455	29.5
Public Administration	3	82	5.3
Total	161	1,544	100.0%

Source: 1987-88 Survey by EDP/U of A.

Table 10

Springerville/Eagar/Greer

NUMBER OF FIRMS, EMPLOYMENT HEAD COUNTS, AND PERCENTAGE SECTORAL EMPLOYMENT

Sector	Number of Firms Identified	Number of Employees	Percent of Total Employment
Agriculture	2	6	2.1%
Construction	6	455	16.6
Manufacturing	11	350	12.7
TCPU	14	278	10.1
Wholesale Trade	7	35	1.2
Retail Trade	88	575	21.0
FIRE	19	80	2.7
Services	92	706	24.6
Public Administration	10	250	9.0
Total	249	2,735	100.0%

Source: 1987-88 Survey by EDP/U of A.

Table 11

Whiteriver

NUMBER OF FIRMS, EMPLOYMENT HEAD COUNTS, AND PERCENTAGE SECTORAL EMPLOYMENT

Sector	Number of Firms Identified	Number of Employees	Percent of Total Employment
Agriculture	4	102	4.2%
Construction	1	D	D
Manufacturing	4	511	21.2
TCPU	8	47	2.0
Wholesale Trade	1	D	D
Retail Trade	18	186	7.7
FIRE	1	D	D
Services	15	611	25.4
Public Administration	3	890	37.0
Total	55	2,408	97.5%

D = no employment reported to avoid disclosure.

Source: 1987-88 Survey by EDP/U of A.

Table 12

Hawley Lake/Sunrise

NUMBER OF FIRMS, EMPLOYMENT HEAD COUNTS, AND PERCENTAGE SECTORAL EMPLOYMENT

Sector	Number of Firms Identified	Number of Employees	Percent of Total Employment
Agriculture	0	0	0.0%
Construction	1	N/A	N/A
Manufacturing	0	0	0
TCPU	1	D	D
Wholesale Trade	0	0	0
Retail Trade	1	D	D
FIRE	0	0	0
Services	5	385	99.0
Public Administration	0	0	0
Total	8	389	99.0%

D = no employment reported to avoid disclosure.

Source: 1987-88 Survey by EDP/U of A.

Table 13

TOP EMPLOYMENT SECTORS IN EACH COMMUNITY
(Head Count)

Community	Percent of all Community Employment in the Sector
Pinetop-Lakeside	
Retail Trade	38.0%
Services	31.2
	69.2
Show Low	
Services	33.7
Retail Trade	33.6
	67.3
Snowflake/Taylor	
Services	29.5
Retail Trade	21.5
Manufacturing	19.7
	70.7
Springerville/Eagar/Greer	
Services	25.8
Retail Trade	21.0
Construction	16.6
Manufacturing	12.8
	76.2
Whiteriver	
Public Administration	37.0
Services	25.4
Manufacturing	21.2
	83.6
Hawley Lake/Sunrise	
Services	99.0

Source: 1987-88 Survey by EDP/U of A.

"industrial" communities, lumber and related products predominate.

Major Employers

Recently the trend towards rural industrialization has led to an increasing dependence on a few large firms for employment opportunities. Employment data for each community in the White Mountain Region was analyzed to determine the extent of dependence on a few large employers. The five largest establishments in each functional community were examined; the results are shown in Table 14.

Major Employers in Each Community

Of all the communities in the region, Pinetop-Lakeside and Show Low are the least dependent on the five largest employers. Only 18.2% of all jobs in Pinetop-Lakeside are provided by the five largest employers. The largest employer in Pinetop-Lakeside is the school district; the remaining four firms are all private sector enterprises which include retail and service establishments, and a public utility.

Show Low is a relatively diversified community with 21.6 % of its employment accounted for in the five largest firms. Again, the school district is the largest employer, the community college ranks fourth, and the other establishments provide public utilities and health care.

Table 14

PERCENTAGE OF TOTAL EMPLOYMENT ACCOUNTED
FOR BY THE FIVE LARGEST EMPLOYERS IN EACH COMMUNITY
(Head Count)

Community	Percentage
Pinetop-Lakeside/Hon Dah/McNary	18.2%
Show Low	21.6
Snowflake/Taylor	34.2
Springerville/Eagar/Greer	42.6
Whiteriver	73.7
Hawley Lake/Sunrise	99.2

Source: 1987-88 Survey by EDP/U of A.

In this community, four out of the five largest employers are in the service sector.

All five of the largest employers in Snowflake/ Taylor are located in Snowflake. The two largest employers are in the service sector; the school district employs 15.3%, and the community college has 13.7% of all employees in the community. The other three largest employers are firms in lumber and related products industries classified in the manufacturing sector.

Almost one half (42.6%) of employment in Springerville/Eagar/Greer is accounted for by the five largest firms. Construction activity and the operation of the Springerville Generating Station contribute substantially to employment in this community. The Stone Forest Industries sawmill in Eagar is another major employer as well as the school district and hospital which are both in the service sector.

The small number of establishments in Whiteriver, which were noted earlier, explains the concentration of employment by a few large employers; the five largest employers account for 73.75% of Whiteriver's total employment. Employment in the public administration sector in the Tribal Administration and the Bureau of Indian Affairs accounts for a third of Whiteriver's jobs. Another 21.6% of total jobs are found at the hospital and the school district which are both classified in the service

sector. The Fort Apache Timber Company (FATCO) is also a major employer which is classified as manufacturing.

Employment in Hawley Lake/Sunrise is dominated by the ski area which accounts for 78.9% of total employment in the community. The five largest employers in this community provide 99.2% of all jobs.

Major Employers in the Region

A comparable analysis examined the ten largest employers in the region. Based on the 1987 survey data, employment in the ten largest establishments in the region, identified 3,180 employees, or 24% of the region's total employment (Table 15).

Firms in the service sector account for a large share of the employees in the ten largest establishments. The remaining five include two public administration employers, two manufacturing and one construction establishment(s). Five of the ten largest employers in the region are located on the White Mountain Fort Apache Indian reservation.

Wage Differentials

Another fine-tuning step in the multiplier generation process involves accounting for the variable wage structure of each sector at the community level. Table 16 shows the impact of assigning wage differentials by sector which not only alters the ranking of the sectors,

Table 15

EMPLOYMENT BY SECTOR FOR THE TEN LARGEST EMPLOYERS IN THE REGION

Sector	Employees by Head Count	Percent of Total Employment
Services	1,277	40.2
Public Administration	882	27.7
Manufacturing	584	18.4
Construction	437	13.7
Total	3,180	100.0%

Source: 1987-88 Survey by EDP/U of A.

but more significantly deflates low wage sectors such as retail, and inflates high wage sectors like TCPU and construction, and to a lesser extent manufacturing. Wage data are particularly meaningful in estimating the economic base multiplier because employment data are weighted according to the average wage for each sector.

Table 16 shows annual wage bill by sector for those who live in a community and who work somewhere in the study community, region or outside world. Incomes derived from the service sector account for a large portion of the total wage bill in all communities. Wages paid in the manufacturing sector in Snowflake/Taylor and Whiteriver are also considerable. In addition, total wages paid to TCPU in Pinetop-Lakeside, Show Low and Springerville/Eagar/Greer are high. The top-ranking sector in Whiteriver is public administration which accounts for more than a third of the community's total income derived from employment wages. Wholesale trade in general only constitutes a small percentage. A fuller discussion in Chapter 6 addresses the consequences of examining wage differentials in conjunction with commuting patterns and the dollar impact of wages on the economic base of each community and the region.

Where People Live and Work

In previous survey-based economic base studies, which involve one base area, employees either live in or

Table 16

ANNUAL WAGE BILL BY SECTOR BY COMMUNITY FOR EMPLOYEES
LIVING IN THE COMMUNITY AND WORKING SOMEWHERE IN OR OUTSIDE THE REGION

Sector	Pinetop-Lakeside/ Hon Dah/McNary	Show Low	Snowflake/ Taylor	Springerville/ Eagar/Greer	Whiteriver	Region
Agriculture	$ 211,351	$ 175,267	$ 238,843	$ 58,661	$ 828,221	$ 1,512,343
Construction	2,509,686	2,878,647	2,005,875	6,895,076	269,697	14,558,981
Manufacturing	2,831,910	2,872,137	11,844,545	2,349,713	9,579,822	29,478,127
TCPU	7,030,411	6,232,023	2,745,536	8,767,521	1,171,735	25,947,226
Wholesale Trade	750,393	1,656,100	1,221,570	622,522	656,157	4,906,772
Retail Trade	7,193,593	7,948,763	2,658,770	3,871,477	1,680,374	23,352,977
FIRE	3,381,452	2,970,195	802,031	1,164,524	53,574	8,371,776
Services	14,881,861	11,595,938	6,734,594	8,197,312	9,883,808	51,293,513
Public Administration	3,515,258	2,453,539	1,405,331	4,067,873	12,285,066	23,727,067
Total	$42,305,915	$38,782,609	$29,657,095	$35,994,709	$36,408,454	$183,148,782

Source: Estimated using Department of Economic Security wage bill data and employment data from the 1987-88 Survey by EDP/U of A.

outside of the study area. The complex nature of this study allows the analysis of employment, for the community base and the regional base areas. Because of this, data on employment are analyzed in two different ways. First, data were collected at the place of employment and later tabulated according to where employees lived. These patterns are described in Table 17. The columns describe the community as a place of employment. For example, a total of 2140.1 FTE employees work at establishments in the Pinetop-Lakeside study area. Of this total, 1674.5 FTE live in Pinetop-Lakeside, 259.5 FTE live in Show Low, etc. Of the Pinetop-Lakeside employees, a total of 2056.2 FTE live inside the region as a whole, and an additional 83.9 FTE live outside the region.

Table 17 also reveals information about incommuting at the community and regional levels. For example, Pinetop-Lakeside has 1674.5 FTE living and working in its community, and an additional 492.6 FTE who work there but live elsewhere in, or outside the region. The region has 1,0293.1 FTE who live and work inside the region and an additional 524.7 FTE who incommute from outside the region. Identification of incommuters is an important component in the economic base analysis. In this study incommuters were easily identified at both the community and regional level and later excluded from the base analysis.

Table 17

WHERE RESIDENTS OF THE WHITE MOUNTAIN REGION LIVE AND WORK
(FTE Employment)

WORK: / HOME:	Pinetop-Lakeside/ Hon Dah/ McNary	Show Low	Snowflake/ Taylor	Springer-ville/ Eagar/ Greer	White-river	Hawley Lake/ Sunrise	Total Living in Region	Work Outside/ Live in Region	Total
Pinetop-Lakeside/ Hon Dah/ McNary	1674.5	599.2	29.7	48.8	195.8	31.4	2579.4	64.0	2643.4
Show Low	259.5	1930.7	62.6	54.9	19.5	6.3	2333.5	150.0	2483.5
Snowflake/ Taylor	34.3	141.3	1115.9	12.6	2.8	0	1306.9	386.0	1692.8
Springerville/ Eagar/Greer	8.9	22.6	6.0	1871.9	2.0	22.7	1934.1	87.5	2021.6
Whiteriver	60.5	1.0	2.5	25.9	1802.6	136.3	2028.8	12.5	2041.3
Hawley Lake/ Sunrise	1.2	0	0	0.9	2.0	7.2	11.3	2.0	13.3
Other	17.3	53.7	5.3	13.4	7.0	2.4	99.1	0	99.1
Total Living in Region	2056.2	2748.5	1220.0	2028.4	2031.7	206.3	10293.1	702.0	10995.0
Work in Region/ Live Outside	83.9	150.2	66.7	297.4	24.1	1.4	524.7	0	0
Total	2140.1	2898.7	1288.7	2325.8	2055.8	207.7	10817.8	702.0	10995.0

Source: Survey by EDP/U of A.

The second advantage of organizing employment data by where employees work and live is found in its ability to identify where residents of a community work. Reading Table 17 horizontally shows where a named community's residents work. For example, Pinetop-Lakeside has a total of 2643.4 FTE "working residents," of which 1674.5 FTE work there, while 968.9 FTE employees outcommute to work in other communities either inside, or outside the region. By using this approach, the number of outcommuters can be calculated for each named community and the region. In this case, outcommuters are included in the base analysis and designated as basic employees. Reading the table according to where residents reside is crucial to estimating the economic base of a community or region.

Origins of Sales/Revenue

The first step in determining the basic and nonbasic components of the local and regional economies was to determine the number of employees working and living in the community or region. The second part of the bifurcation process required knowledge of the origin of customers to determine whether or not income was supported by sales to nonbasic (local) or basic (export) customers. Table 18 describes the overall pattern of flows of revenue between the named communities, and between the region and the outside world.

Table 18

ESTIMATED TOTAL EMPLOYMENT IN EACH COMMUNITY SUPPORTED BY SALES TO ITS OWN RESIDENTS, RESIDENTS OF OTHER COMMUNITIES IN THE REGION AND TO THE OUTSIDE WORLD

	Pinetop-Lakeside/ Hon Dah/ McNary	Show Low	Snowflake/ Taylor	Springer-ville/ Eagar/ Greer	White-river	Hawley Lake/ Sunrise	Total
Pinetop-Lakeside/ Hon Dah/McNary	817.4 38%	419.7 14%	48.7 4%	32.9 1%	41.3 2%	9.1 4%	1369.1 13%
Show Low	167.2 8%	1012.6 35%	71.9 6%	28.1 1%	13.9 1%	2.7 1%	1296.4 12%
Snowflake/ Taylor	43.1 2%	174.5 6%	452.0 35%	44.8 2%	0.2 0%	0 0%	714.6 7%
Springerville/ Eagar/Greer	45.6 2%	78.1 3%	29.9 2%	990.1 43%	0.4 0%	2.7 1%	1146.8 10%
Whiteriver	134.1 6%	160.2 5%	16.4 1%	19.6 1%	465.2 22%	1.4 1%	769.9 7%
Hawley Lake/ Sunrise	14.9 1%	28.2 1%	1.3 0%	5.0 0%	1.4 0%	0.5 0%	51.3 0%
Other	9.2 0%	18.3 1%	16.0 1%	17.3 1%	0.3 0%	1.4 1%	62.5 1%
Total Sales in Region	1231.5 57%	1891.6 65%	636.2 49%	1137.8 49%	522.7 25%	17.8 8%	5437.6 50%
Out of Region Sales	908.6 43%	1007.1 35%	652.5 51%	1188.0 51%	1533.1 75%	189.9 92%	5479.2 50%
Total	2140.1 100%	2898.7 100%	1288.7 100%	2325.8 100%	2055.8 100%	207.7 100%	10916.8 100%

Source: 1987-88 Survey by EDP/U of A.

Show Low

This community is the regional employment and service center for the White Mountain Region. Over one-third of the region's nonbasic (local serving) employees work in Show Low. Only 35% of Show Low's workers depend on the outside world for support. The remaining 65% (1891.6 FTE) serve the region. In both absolute and relative terms Show Low is the White Mountain Region's shopping center. Show Low has a greater diversified market geography with no more than one-third of its revenue dependent on any one area, i.e., the local community or the outside world (Table 18). The remaining 20% of Show Low's customers come from Snowflake/Taylor, Whiteriver and Springerville/Eagar/Greer.

Pinetop-Lakeside/Hon Dah/McNary

This community ranks second after Show Low in terms of the mix of geographic markets and service to the region. Three-fifths (57%) of its employees are supported by sales to customers within the region and 43% comes from the "outside world." This community is less effective at drawing customers from Show Low than it is in sending customers to that community.

Snowflake/Taylor

Over half of this community's workers are supported by revenues from the "outside world." An estimated 35% of its workers are supported by local sales and the remainder

are supported by sales to other communities in the region, especially Show Low and to a lesser extent Pinetop-Lakeside.

Springerville/Eagar/Greer

This community is the most freestanding and self-contained community in the region. Most of its employees are supported by sales either to local residents (43%), or to the outside world (51%). No other community in the region has such a high local sales percentage.

Whiteriver

In some ways Whiteriver is the opposite of Show Low. Show Low depends relatively little on the outside world, whereas Whiteriver depends heavily on the outside world. Show Low serves the region; Whiteriver barely serves itself.

Hawley Lake/Sunrise

This "community" is almost totally dependent on the outside world. Over 90% of its employees are supported by sales to customers from outside the region.

The Region

The last column in Table 18 shows that sales to "customers" who reside outside the White mountain region totals 50%. In other words, revenue generated from outside

the region, whether it be from tourist receipts, export sales, or governmental agencies supported by state or federal funds, supports an estimated 5479.2 FTE employment inside the region.

Transfer Payments

As previously discussed, transfer payments can be substantial, and in some communities enormous. Whereas the White Mountain Region is only a small part of the State of Arizona, it is interesting to note that Arizonans collected over six billion dollars worth of transfer income in 1986, including $2.6 billion from Social Security. Estimates for the White Mountain Region total $54 million per year, including $21.6 worth of payments from RSDI (Social Security), $1.7 million from unemployment insurance, $1 million from Aid for Dependent Children, and $1.6 million from Food Stamps. Based on ratios, it is assumed that the remainder comes into the region from a variety of other sources.

Because transfer income spends just like wages, it can have a tremendous impact on local economies. Table 19 shows estimated total transfers and the amount coming from one major source -- Social Security. Both figures are high in all communities, but Pinetop-Lakeside and Show Low stand out because the totals are large and their Social Security figures suggest that retirees (the largest group of Social

Table 19

ESTIMATED TRANSFER PAYMENTS TO THE
WHITE MOUNTAIN REGION AND ITS COMMUNITIES

Community	Estimated Transfer Payments. All Sources	Estimated Transfer Payments. Social Security only	Social Security as % of Total Transfer Payments
Pinetop-Lakeside/ Hon Dah/McNary	$17,606,112	$ 7,801,239	44.3%
Show Low	13,734,135	5,676,041	41.3
Snowflake/Taylor	8,325,509	3,423,777	41.1
Springerville/ Eagar/Greer	7,126,901	2,856,871	40.1
Whiteriver	7,385,809	1,792,875	24.3
White Mountain Region Total	$54,178,466	$21,550,803	39.8%

Source: Estimated from data from Social Security Administration, Arizona Department of Economic Security, and Bureau of Economic Analysis.

Security beneficiaries) are a major group and source of basic income to these local economies.

Transfer payments, in fact, represent such a substantial source of income that if they were included as a tenth "industrial" sector, would rank first in Pinetop-Lakeside and Show Low, second in Snowflake/Taylor after manufacturing, third in Springerville/Eagar/Greer, and fourth in Whiteriver.

Economic Base Multipliers

Economic base multipliers can be a powerful tool in forecasting the impacts of regional growth and decline. The multipliers presented in this study are estimates after the following adjustments have been made:

- Head count employment is converted to FTE employment
- Incommuters are excluded from employment data set
- Outcommuters are added into data set
- FTE figures in each sector are weighted for wage differentials
- FTE figures are adjusted to include transfer payment employment equivalents

These procedures are outlined by Gibson and Worden (1981) who demonstrate the impact of using a baseline-survey adjusted multiplier (k_1) which uses employment data converted to an FTE which excludes incommuters. Table 20

Table 20

MULTIPLIER ESTIMATES FOR THE WHITE MOUNTAIN REGION AND ITS COMMUNITIES

Community	k_1	k_2	k_3	k_{4a}	k_{4b}	k_{5a}	k_{5b}
Pinetop-Lakeside/ Hon Dah/McNary	1.65	1.33	1.74	1.42	1.31	1.27	1.22
Show Low	1.62 (1.86)	1.42 (1.68)	1.66 (1.80)	1.45 (1.58)	1.35	1.34 (1.46)	1.28
Snowflake/ Taylor	1.60 (1.72)	1.33 (1.36)	1.51 (1.62)	1.45 (1.59)	1.35	1.23 (1.29)	1.20
Springerville/ Eagar/Greer	1.82 (1.80)	1.72 (1.63)	1.60 (1.74)	1.69 (1.63)	1.59	1.45 (1.48)	1.40
Whiteriver	1.31	1.27	1.30	1.28	1.24	1.23	1.20
Region	1.97	1.85	1.86	1.74	1.59	1.61	1.44

( ) Multipliers published by Gibson and Worden (1981).

k_1 = Baseline survey multiplier; this multiplier has been adjusted for incommuters. FTE employment values are used for employees living and working in the community.
k_2 = k_1, adjusted for outcommuters.
k_3 = k_1, adjusted for sectoral wage differences.
k_4 = k_1, adjusted for uninflated transfer payments.
k_{4b} = k_1, adjusted for inflated transfer payments.
k_{5a} = k_2, adjusted for uninflated transfer payments.
k_{5b} = k_2, adjusted for inflated transfer payments and wage differentials.

Source: 1987-88 Survey by EDP/U of A.

demonstrates the impact of using the various multiplier adjustment criteria.

This table highlights the impact of adjusting for sectoral wage differences (K_3) which dramatically inflates the multipliers in Pinetop-Lakeside, Show Low and Snowflake/Taylor while generating a smaller multiplier in Springerville/Eagar/ Greer.

Adjustments for transfer incomes are included in the multipliers k_4 and k_5. Multipliers k_{4a} and k_{5a} used selective public transfer data including UI, OASDI, SSI, AFDCA, food stamp subsidy value and general assistance payments. Multipliers k_{4b} and k_{5b} are produced by estimating the proportion of selected public transfer payments representing of total transfer payments.

Column k_{5b} represents the fully adjusted multiplier estimates for each community and the region as a whole. As expected, the larger the community or region, the greater its ability to internalize demand for locally supplied goods and services, consequently the region's multiplier is the largest. The multiplier for Springerville/Eagar/Greer ranks second in magnitude. Commuting and shopping patterns clearly support the idea that this community is relatively self-contained and to a certain extent separate from the rest of the White Mountain Regional economic system. Its physical location serves to isolate Springerville/Eagar/ Greer from the other communities in the region which form a

more integrated and interrelated regional economic system.

The multiplier for Show Low, which has been identified as the leading service sector of the region, follows. In fact the multiplier may have been larger if the community had not lost so many of its employees as incommuters to other communities, especially to Pinetop-Lakeside. If Show Low and Pinetop-Lakeside had been treated as one functional community, it is expected that the multiplier would have approximated the regional multiplier. The multipliers for Pinetop-Lakeside, Snowflake/Taylor and Whiteriver are all little over 1.2. These communities are not in fact very efficient at converting basic employment into non-basic, local jobs.

Summary

The usefulness of the economic base concept in analyzing the economies of small, rural communities is demonstrated by its sensitivity to the structural characteristics of each community. Disaggregated data at the community level are combined to form a regional aggregate which can be used as a benchmark for economic performance at the community level. The economic base approach clearly illustrates and measures the economic relationship between each of the communities, between the communities and the region, and between the region and the outside world.

Whereas each community in the region is distinctively unique, each relies to some extent on support from other communities in the region as well as support form outside the region. The larger regional multiplier clearly supports earlier work that quantitatively proves that the larger the "city," the more self-contained it becomes because more jobs are dependent on basic employment, which leads to a larger multiplier effect (Ullman, Dacey and Brodsky, 1971).

Applying a full range of adjustments to the data analysis demonstrates the extent to which the magnitude of the multiplier is altered, especially in the case of wage differentials and transfer payments. In addition to this, data gathered in the adjustment process generate a wealth of local information which form a substantial data base useful to community leaders in the economic development planning process.

COMMUTING: ITS IMPACT ON THE MEASUREMENT OF THE ECONOMIC BASE

Focus is placed on commuting because as a methodological issue it is crucial to the measurement of the economic base. In addition, analysis of commuting at the community and regional levels contribute much to the understanding of the structure and function of non-metropolitan labor markets and the impacts of income spread effects within a regional context.

Journey-to-Work Matrix

As noted earlier, a carefully prepared economic base study accounts for both incommuters and outcommuters. Because the White Mountain study deals with several base areas "nested" within a larger regional base area, it offers a unique opportunity to accurately measure in detail the flows and linkages between the communities in the region, and between the region and the "outside" world through an examination of journey-to-work patterns.

The commuting patterns of working people who live in the region (the rows), and work in the region (the columns) are described in Table 21. The numbers, which are based on head count data, include accurate accounts of full-time and part-time employees, and estimates of the

Table 21

CROSS-COMMUTING: INTRA- AND INTER-REGIONAL COMMUTING PATTERNS
(Head Count)

Work: / Residence:	Pinetop-Lakeside/ Hon Dah/ McNary	Show Low	Snowflake/ Taylor	Springer-ville/ Eagar/ Greer	White-river	Hawley Lake/ Sunrise	Work Outside/ Live in Region	Total
Pinetop-Lakeside/ Hon Dah/McNary	2,147	694	34	54	225	51	64	3,269
Show Low	318	2,347	70	56	22	12	152	2,977
Snowflake/Taylor	44	170	1,343	13	3	0	388	1,961
Springerville/ Eagar/Greer	13	25	8	2,220	2	43	88	2,399
Whiteriver	68	1	3	27	2,109	263	13	2,484
Hawley Lake/ Sunrise	1	0	0	1	2	12	2	18
Other	23	67	10	14	8	4	0	126
Total Living in Region	2,614	3,304	1,468	2,385	2,371	385	707	13,234
Work in Region/ Live Outside	217	231	76	350	37	4	0	915
Total	2,831	3,535	1,544	2,735	2,408	389	707	14,149

Source: 1987-88 Survey by EDP/U of A.

residential location of seasonal workers. In this analysis "other," the space between the core communities, is considered a place of residence, but not as place of employment.

In all cases, the majority of a community's working population are employed within their own community. The community of Springerville/Eagar/Greer employs virtually all of its working residents (93%), whereas Whiteriver employs 85% of its residents, Show Low 79%, Hawley Lake/Sunrise 66%, and Pinetop-Lakeside/Hon Dah/McNary 65%.

Actual and Predicted Journey-to-Work Patterns

An examination of Tables 22 and 23 shows the impact that distance has on commuting patterns; most of the working residents of the White Mountain Region work in their own community or in neighboring communities. While proximity has a strong pulling effect, a distance-decay effect can be observed: the further from the "home" community one goes, the fewer commutes are made. For example, only 2% of residents from Pinetop-Lakeside/Hon Dah/McNary make the 42-mile commute to Springerville/Eagar/ Greer whereas 21% of its residents make the 12-miles journey to Show Low for work.

The use of a gravity model to predict the extent of flows between places based on variables, such as distance and population size, are useful for planning purposes and

Table 22

ROAD DISTANCES BETWEEN COMMUNITIES IN MILES*

TO: FROM:	Pinetop-Lakeside/ Hon Dah/McNary	Show Low	Snowflake/ Taylor	Springerville/ Eagar/Greer	Whiteriver	Hawley Lake/ Sunrise
Pinetop-Lakeside/ Hon Dah/ McNary	3	12	32	42	24	20
Show Low	12	3	21	46	36	32
Snowflake/ Taylor	32	21	3	67	58	51
Springerville/ Eagar/Greer	42	46	67	3	58	20
Whiteriver	24	36	57	58	3	34

* Estimated average distance between study communities.

Source: Author.

Table 23

ACTUAL AND PREDICTED JOURNEY-TO-WORK PATTERNS

	WORK PLACE - DESTINATION						
	Pinetop-Lakeside/ Hon Dah/ McNary	Show Low	Snowflake/ Taylor	Springerville/ Eagar/ Greer	White-river	Hawley Lake/ Sunrise	Total
RESIDENCE - ORIGIN							
Pinetop-Lakeside/ Hon Dah/McNary	2147 2187	694 549	34 73	54 104	225 143	51 149	3205 3205
Show Low	318 209	2347 2371	70 84	56 59	22 22	12 50	2825 2825
Snowflake/Taylor	44 56	170 168	1343 1258	13 36	3 28	0 27	1573 1573
Springerville/ Eagar/Greer	13 31	25 47	8 14	2220 2115	2 23	43 81	2311 2311
Whiteriver	68 107	1 103	3 28	27 57	2109 2115	263 61	2471 2471
Total Employees Working in Community	2590 2590	3237 3238	1458 1457	2370 2371	2361 2361	369 368	12385 12385

Actual Trips (Head Count)
Predicted Trips (Head Count)

Source: 1987-88 Survey by EDP/U of A.

have often been used by geographers to study commuting, migration, and shopping patterns (Erickson, 1977; Lonsdale, 1966; Plane, 1984; Taaffe, Garner and Yeates, 1963). A gravity model of this kind was applied to the employment data collected in the White Mountain study.

Variables such as the distribution of place of employment and place of residence, and the distance between them, were applied to a double-constrained gravity model to predict the number of trips from each origin (place of residence) to each destination (place of work). The equation for this gravity model is:

$$T_{ij} = k_i l_j O_i D_j f(d_{ij})$$

where T_{ij} is the number of trips from origin i to destination j; O_i is the number of trips with origins at i; D_j is the number of trips with destinations at j; d_{ij} is the distance from i to j; $f(d_{ij})$ is an inverse function of distance; and k_i and l_j are empirically determined "accessibility" parameters associated with the origins and destinations (Thomas and Huggett, 1980).

Actual journey-to-work trips were applied to the model. Several different inverse power function values were applied to the model before an inverse power function of 1.375 achieved the least mean squared error of 4509.33. Table 23 shows both the actual and the predicted number of trips made between the place of residence (the rows) and

the place of employment (the columns). The number of actual trips is based on figures from Table 21. Hawley Lake/Sunrise was included only as an destination for two reasons. First, Hawley Lake is predominantly a second home community for seasonal residents, and second Sunrise serves only as an employment center.

Since the model makes gross assumptions about aggregate human behavior, the model's predictions were compared with reality. If all predictions had been perfect, then all values T_{ij} would have equalled the actual trips made. Where the model over- or under-predicted reality, i.e., the number of actual trips made, then the resultant residuals highlight particularly significant interactions between origins and destinations, i.e., functional linkages going on beyond the general influences of distance.

Results of the double-constrained gravity model (Table 23) show that 145 more journey-to work-trips were made between Pinetop-Lakeside and Show Low than predicted by the model (Table 24). This disparity can be explained in two ways. Show Low is a major employment center which offers diverse and numerous employment opportunities. Second, Show Low may be a less residentially desirable location than Pinetop-Lakeside. Examining the commuting patterns from Pinetop-Lakeside to Whiteriver shows that 82 more trips occurred in reality. This is probably explained

Table 24

RESIDUALS - WHERE THE GRAVITY MODEL OVER- OR UNDER-PREDICTS REALITY

	Pinetop-Lakeside/ Hon Dah/ McNary	Show Low	Snowflake/ Taylor	Springerville/ Eagar/ Greer	White-river	Hawley Lake/ Sunrise	Total
Pinetop-Lakeside/ Dah/McNary	+40	-145	+39	+50	-82	+98	3205
Show Low	-109	+24	+14	+3	+30	+38	2825
Snowflake/Taylor	+12	-2	-85	+23	+25	+27	1573
Springerville/ Eagar/Greer	+18	+22	+6	-105	+21	+38	2311
Whiteriver	+39	+102	+25	+30	+6	-202	2471

\+ The number of trips over-predicted by the model
\- The number of trips under-predicted by the model

Source: Based on differences between actual and predicted trips in Table 23.

by a number of non-Indians who commute to the reservation to work preferring to reside in an Anglo community. The commuting patterns between Pinetop-Lakeside and Hawley Lake/Sunrise were vastly over-predicted by the model. This is explained by the fact that most of the employees at Sunrise commute in from the reservation.

In reality, Snowflake/Taylor retains 85 more of its resident workers than predicted. This could be explained by the community's cultural isolation from the other communities in the study region. The community of Springerville/Eagar/Greer is similar to Snowflake/Taylor; it employs 105 more of its residents than the model predicts. It appears the most isolated from the rest of the region and is probably more self-contained than Snowflake/Taylor.

The predicted journey-to-work flows between Whiteriver and the other communities in the region are higher than the actual numbers; in reality little commuting out of Whiteriver takes place. The one exception is Hawley Lake/Sunrise; more than two hundred people commute from Whiteriver to Sunrise than the model predicts. This is not surprising since employees are transported daily to work at the Sunrise resort, which is also located on the reservation.

An unusual and perhaps unexplainable observation is that more than 100 Show Low residents work in Pinetop-

Lakeside than are predicted by the model. In light of this and because of evidence presented earlier which show that combined Pinetop-Lakeside and Show Low appear to function as one economic entity, the gravity model was re-run combining commuting data for Pinetop-Lakeside and Show Low. It was also concluded that since Hawley Lake/Sunrise serves only as a destination primarily for employees from Whiteriver, it contributed little to the understanding of journey-to-work patterns of the region. Data for Hawley Lake/Sunrise therefore were excluded from the model. The average distance between an origin and itself as a destination, remained constant at three miles but a distance of twelve miles was introduced between Pinetop-Lakeside/Show Low and itself.

Results of the re-run are described in Table 25. Both an inverse power function of distance and a negative exponential function of distance were utilized to determine the least error. An inverse power function of distance of 1.91 yielded the least mean-squared error of 224.44. Both in absolute and relative terms the performance of this model is far superior to that of the initial gravity model. In fact the model's predictions do not deviate more than 31 trips or 18% from reality.

Outcommuting

Outcommuters are significant to any employment-type

Table 25

ACTUAL AND PREDICTED JOURNEY-TO-WORK PATTERNS USING A MODIFIED DATA SET

	Pinetop-Lakeside/ Hon Dah/McNary/ Show Low	Snowflake/ Taylor	Springerville/ Eagar/Greer	Whiteriver	Total
Pinetop-Lakeside/ Hon Dah/McNary/ Show Low	5506 5510	104 88	110 123	247 246	5967 5967
Snowflake/Taylor	214 182	1343 1365	13 12	3 13	1572 1572
Springerville/ Eagar/Greer	38 35	8 2	2220 2225	2 6	2268 2268
Whiteriver	69 100	3 3	27 9	2109 2096	2208 2208
Total Employees Working in Community	5827	1458	2370	2361	12016

Actual Trips (Head Count)
Predicted Trips (Head Count)

Source: 1987-88 Survey by EDP/U of A.

economic base study because they represent an important source of basic income. Economic base analysis assumes that these workers will spend most of their earnings in the community where they live.

Outcommuting and the Region

Table 26 represents the number of residents (by head count) from each community working outside of the White Mountain base region. In all, 707 residents of the White Mountain communities who work outside of the region were identified. This figure understates the actual numbers because only the major employers proximate to the region were contacted. Out-of-region employers contacted include the Navajo and Apache County governments in Holbrook and St. Johns, Stone Forest Industries paper mill outside Snowflake/Taylor, and the Salt River Project Coronado Generating Station at St. Johns. Almost all of the outcommuters from Snowflake/Taylor work at the neighboring paper mill.

Outcommuting and the Community

The people who live in the region but who work outside the region are only a small part of the whole situation. From the standpoint of each individual community, a person who lives in the community but who works outside is an outcommuter whether or not he or she leaves the region to work. The consequences of

Table 26

REGIONAL OUTCOMMUTERS*
(Head Count)

Community	Outcommuters
Pinetop-Lakeside/Hon Dah/McNary	64
Show Low	152
Snowflake/Taylor	388
Springerville/Eagar/Greer	88
Whiteriver	13
Hawley Lake/Sunrise	2
Total	707

* Estimates of residents living in the White Mountain communities who work outside of the region.

Source: Table 21.

outcommuting are described in Table 27, which show the percent of a community's working residents who commute out of their "home" community to work. Pinetop-Lakeside has more than a third of its residents, a total of 1,122 outcommuters, who literally import outside income into the base system. Approximately one-third of the working residents of Snowflake/Taylor outcommute to work whereas one-fifth of Show Low's workers outcommute, and only a small percentage leave Whiteriver (15%). Springerville/ Eagar/Greer derives the least benefit from outcommuting; it has only 7% of its total working residents employed outside of its community.

Outcommuting by Sector

The numbers and percentage of outcommuters are useful for descriptive purposes but an understanding of the economic interaction between communities, and between the region and the outside world, is more useful for regional planning purposes. Determining the economic significance of commuting is achieved by measuring trip flows by sector and then by average wage. Table 28 describes regional outcommuters by sector of employment. These numbers represent FTE "employees" who live in a named community but who work outside of the region. For example, Show Low is the home of 73 manufacturing and 30 TCPU workers, both relatively high-paid wage sectors, who work outside the

Table 27

COMMUNITY OUTCOMMUTERS*
(Head Count)

Community	Outcommuters	Percentage of Total Regional Employment
Pineop-Lakeside/ Hon Dah/McNary	1,122	34.3%
Show Low	630	21.2
Snowflake/Taylor	618	31.5
Springerville/ Eagar/Greer	179	7.5
Whiteriver	375	15.1
Hawley Lake/ Sunrise	6	33.3

* Community outcommuters represent persons living in a named community who work elsewhere in the region.

Source: Table 23.

Table 28

OUTCOMMUTING BY SECTOR FROM THE WHITE MOUNTAIN REGION*

Sector	Pinetop-Lakeside/ Hon Dah/ McNary	Show Low	Snowflake/ Taylor	Springerville/ Eagar/ Greer	White-river	Hawley Lake/ Sunrise	Total
Agriculture	0	0	0	0	0	0	0
Construction	7	8	0	4	0	0	19
Manufacturing	18	73	340	0	3	0	434
TCPU	21	30	16	65	0	0	132
Wholesale Trade	0	0	0	0	0	0	0
Retail Trade	0	0	0	0	0	0	0
FIRE	0	0	0	0	0	0	0
Services	18	38	20	9	10	2	97
Public Administration	0	3	12	10	0	0	25
Total	64	152	388	88	13	2	707

* White Mountain residents (head count) who work outside the region.

Source: 1987-88 Survey by EDA/U of A.

community and outside of the region. These figures are particularly significant when average county wages by sector are applied to the outcommuting data flow (average wage data by sector are described in Table 2, Chapter 2).

Table 29 shows the extent of outcommuting by industrial sector for each community. In relative terms it appears that a large amount of outcommuting in agriculture takes from Pinetop-Lakeside and Show Low whereas virtually none takes place from Springerville/ Eagar/Greer and Whiteriver. These results, however, should be treated with caution because the survey of agricultural enterprises was limited in coverage.

More than 40% of both Pinetop-Lakeside and Show Low's working residents leave the community to work in construction whereas only one-fifth leave Snowflake/Taylor and very few employees leave Springerville/Eagar/Greer or Whiteriver.

More outcommuting takes place in the manufacturing sector than in the other sectors, except in Springerville/Eagar/Greer and Whiteriver. The highest percentage of outcommuting in manufacturing takes place from Show Low (85%), followed by Pinetop-Lakeside (71%). A high percentage (59%) of outcommuting from Snowflake/Taylor is almost entirely made up by employees who commute out to the paper mill. All communities experience fairly high

Table 29

OUTCOMMUTING BY SECTOR FOR EACH COMMUNITY*
(Head Count)

Sector	Pinetop-Lakeside/ Hon Dah/ McNary	Show Low	Snowflake/ Taylor	Springerville/ Eagar/ Greer	White-river	Total
Agriculture	37%	31%	9%	0%	2%	15%
Construction	44	42	20	2	3	22
Manufacturing	71	85	59	1	11	45
TCPU	40	33	31	23	5	26
Wholesale Trade	91	9	15	10	8	26
Retail Trade	23	14	16	1	9	12
FIRE	19	17	33	22	29	24
Services	41	15	20	6	27	21
Public Administration	43	26	32	9	0	22
Total	35%	21%	31%	7%	15%	22%

* Number of outcommuters as a percentage of total employemnt who do not reside in a named community.

Source: 1987-88 Survey by EDP/U of A.

community and outside of the region. These figures are particularly significant when average county wages by sector are applied to the outcommuting data flow (average wage data by sector are described in Table 2, Chapter 2).

Table 29 shows the extent of outcommuting by industrial sector for each community. In relative terms it appears that a large amount of outcommuting in agriculture takes from Pinetop-Lakeside and Show Low whereas virtually none takes place from Springerville/ Eagar/Greer and Whiteriver. These results, however, should be treated with caution because the survey of agricultural enterprises was limited in coverage.

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amounts of outcommuting by TCPU workers with the exception of Whitervier.

Generally little outcommuting takes place in wholesale trade, however, the high percentage for Pinetop-Lakeside (91%) identifies employees commuting to Show Low for employment in this sector. The retail trade sector is notable for its overall low percentage of outcommuting in spite of its large absolute numbers which reflect high employment in this sector. On average only 12% retail trade employees outcommute compared to the high percentage (45%) noted for manufacturing.

Throughout the region there is a moderate amount of outcommuting in FIRE with outcommuting accounting for about 30% of total employment in Snowflake/Taylor and Whiteriver. The service sector experiences much the same amount with the exception of Pinetop-Lakeside/Hon Dah/McNary which has almost twice (41%) the regional average.

Outcommuting in the public administration sector is especially high in Pinetop-Lakeside but accounts for little commuting activity in Springerville/Eagar/Greer, and virtually none in Whiteriver.

Overall, there is relatively little outcommuting in the retail trade or agriculture sectors but considerable outcommuting in the manufacturing sector.

The Spearman Rank Correlation Coefficient was used to test the hypothesis that outcommuting and wages are

related, i.e., that high wage sectors experience more outcommuting than lower wage sectors. In almost all communities as well as the region, the ranking of wages and the percentage of outcommuting were found not to be correlated at significance levels of .05 and .01 (Table 30) One exception does exist; there is a relationship between wages and commuting in Show Low, but this is at best only moderate, i.e., the relationship is statistically significant but it does not point to an especially strong correlation. In the other White Mountain communities there is virtually no relationship between wage levels and the amount of outcommuting.

Before determining which communities in the White Mountain Region are net exporters or importers of workers, it is first necessary to examine the number of incommuters, i.e., the people who are employed in the region but who live outside the region.

Incommuting

As far as the economic base study is concerned incommuters are excluded from the computation of the multiplier because it is assumed that these workers contribute little or nothing to the local demand for goods and services and therefore do not contribute to the economic base of a community or region.

Table 30

SPEARMAN RANK CORRELATION BETWEEN OUTCOMMUTING AND WAGE*

Community	r_s**
Pinetop-Lakeside/ Hon Dah/McNary	0.592
Show Low	0.684
Snowflake/Taylor	0.392
Springerville/ Eagar/Greer	0.446
Whiteriver	0.450
Region	0.500

* Outcommuting is defined as the percentage of FTE employees who live in a named community but work else where in or out of the region. Wage is defined as the annual average wage for Apache and Navajo counties for the nine industrial sectors.

** Significance Level: 0.05 0.600
0.01 0.783

Critical values of r_s, the Spearman Rank Correlation Coefficient in Allen L. Bernstein. 1966. "A Handbook of Statistics Solutions for the Behavioral Sciences," p. 133. New York: Holt, Rinehart and Winston, Inc.

Source: Tables 2 and 29.

From an economic development standpoint, incommuters are a source of lost income to the region or community, which accommodates them. At the end of the day incommuters leave the base area with their paychecks to return home to another community. Tracking incommuters shows to what extent the region and the individual communities draw employees from outside the base area, and a measurement of incommuters illustrates the dollar amount of "lost" income.

Incommuting and the Region

Table 31 shows the number of employees that commute in from outside the region to work in the study communities. Springerville/Eagar/Greer stands out as a major importer of employees. Hawley Lake/Sunrise, on the other hand, has very few incommuters from outside the region. On average, incommuting accounts for only 7.7% of the region's total employment.

Incommuting and the Community

Incommuting to each community is treated in much the same way as outcommuting. Table 32 documents the number of incommuters to each community. Data show that 1,188 workers incommuted into Show Low, making up over a third (33.6%) of total employment in this community.

The numbers above show that Hawley Lake/Sunrise is clearly a place of work and not a permanent place of

Table 31

REGIONAL INCOMMUTERS*
(Head Count)

Community	Outcommuters
Pinetop-Lakeside/Hon Dah/McNary	217
Show Low	231
Snowflake/Taylor	76
Springerville/Eagar/Greer	350
Whiteriver	37
Hawley Lake/Sunrise	4
Total	915

* Total number of employees working in the White Mountain communities but who live outside of the region.

Source: Table 21.

Table 32

COMMUNITY INCOMMUTERS*
(Head Count)

Community	Incommuters	Percentage of Total Regional Employment
Pineop-Lakeside/ Hon Dah/McNary	684	24%
Show Low	1,188	34
Snowflake/Taylor	201	13
Springerville/ Eagar/Greer	515	19
Whiteriver	299	12
Hawley Lake/ Sunrise	377	97

* Community incommuters work in named communities but live elsewhere in or out of the region.

Source: 1987-88 Survey by EDP/U of A.

residence. On the other hand, relatively little incommuting to Whiteriver, Snowflake/Taylor or Springerville/Eagar/Greer takes place.

Incommuting by Sector

In relative and absolute terms little incommuting takes place from outside the region in agriculture, TCPU, FIRE, retail trade and public administration, whereas construction and manufacturing attract workers from outside the region particularly to work at the Springerville Generating Plant and the sawmill in Eagar (Table 33). Data suggests that these manufacturing establishments act as employment magnets for workers from the region.

Not surprisingly, far more incommuting activity takes place within the region. The sectors which experience the highest percentage of incommuting are manufacturing and wholesale trade. The high absolute and relative values in Table 34 indicate a labor supply deficit in these sectors which tend to draw on workers from outside the community to perform certain jobs.

Agriculture and construction in Pinetop-Lakeside and Show Low depend on workers from other communities inside the region. Incommuting in TCPU is especially high in Show Low and Snowflake/Taylor experiences a large degree of incommuting. Show low, Pinetop-Lakeside, and Sunrise all depend on people from other communities to fill jobs in

Table 33

INCOMMUTING BY SECTOR TO THE WHITE MOUNTAIN REGION*

Sector	Pinetop-Lakeside/ Hon Dah/ McNary	Show Low	Snowflake/ Taylor	Springerville/ Eagar/ Greer	White-river	Hawley Lake/ Sunrise
Agriculture	0	0	0	1	1	0
Construction	1	29	0	99	2	0
Manufacturing	2	5	35	121	6	0
TCPU	1	9	11	34	0	0
Wholesale Trade	1	7	2	3	0	0
Retail Trade	60	51	14	26	4	0
FIRE	22	23	3	5	0	0
Services	111	85	10	43	7	4
Public Administration	19	22	1	18	17	0
Total	217	231	76	350	37	4

* Incommuting numbers are based on a head count of employees who work inside the region but reside elsewhere.

Source: 1987-88 Survey by EDA/U of A.

Table 34

INCOMMUTING BY SECTOR FOR EACH COMMUNITY*

Sector	Pinetop-Lakeside/ Hon Dah/ McNary	Show Low	Snowflake/ Taylor	Springerville/ Eagar/ Greer	White-river	Hawley Lake/ Sunrise	Total
Agriculture	6	2	0	0	5	0	13
Construction	30	38	10	42	1	0	121
Manufacturing	38	32	13	78	30	0	191
TCPU	33	101	23	6	4	1	168
Wholesale Trade	4	41	22	0	2	0	69
Retail Trade	152	233	23	3	7	2	420
FIRE	38	81	1	2	1	0	123
Services	105	287	14	25	116	92	639
Public Administration	36	49	4	0	56	0	145
Total	442	864	110	156	222	95	1,889

* Incommutings numbers are based on a head count of full-time and part-time employees who work in a named community but reside elsewhere in the region.

Source: 1987-88 Survey by EDA/U of A.

the retail trade and service sectors. There is also a good deal of incommuting to Pinetop-Lakeside and Show Low in the public administration sector. From a planning point of view, incommuters represent a negative cash flow. The incomes of incommuters do not contribute much to the community or regional economy since most of their earnings are spent in the "home" community of residence. This assumption may in fact be mitigated to some extent by cross-shopping within the region.

Significance of Cross-Commuting

The impact of cross-commuting, i.e., intra- and inter-regional commuting is examined to identify the extent to which some communities in the White Mountain Region export their residents to work elsewhere, and determine which communities draw on workers from other communities inside and outside of the region.

Cross-commuting data were computed to show the net flow of FTE "workers" in the study region and the study communities (Table 35). Pinetop-Lakeside; Snowflake, Taylor; and the region are clearly net gainers. They "export" more of their residents to jobs in other communities than they "import;" all three of these places have more workers than jobs. This is particularly crucial when a dollar impact is placed on commuting activity.

Table 35

NET FLOW OF FTE WORKERS IN THE WHITE MOUNTAIN REGION

Community	Net Exporter of Workers	Net Importer of Workers
Pinetop-Lakeside/ Hon Dah/McNary	+ 503.3	
Show Low		- 415.2
Snowflake/Taylor	+ 404.1	
Springerville/ Eagar/Greer		- 304.2
Whiteriver		- 14.5
Hawley Lake/Sunrise		- 194.4
Balance for the Region	+ 177.2	

Source: 1987-88 Survey by EDP/U of A.

Show Low is the largest net loser; it "imports" 1,188 workers who leave the community each evening with their paychecks in hand to return home to another community. Because Show Low "exports" only 630 of its own employees, the net loss to the community amounts to 508 jobs or 415.2 FTE. Springerville/Eagar/Greer is also another conspicuous loser; it provides more jobs for more people than it accommodates residentially. Hawley Lake/Sunrise is another major loser, but this is negated because it has virtually no residential economic base. Whiteriver is the only community which is more-or-less in balance.

Impact of Wage Differentials on Cross Commuting

Another fine-tuning step in the multiplier generation process involves accounting for the variable wage structure of each sector. Ideally, the wage bill would be collected on a firm-by-firm basis, but since this is not feasible, each community's employment is adjusted using the average wage bill for each sector for the appropriate county. The impacts are substantial because wages vary widely from sector to sector, and from county to county.

To explain the impact of wage differentials, a note on wages and commuting is necessary. Table 36 compares total annual community wage bills. These data describe the

Table 36

ANNUAL WAGE BILL BY SECTOR BY COMMUNITY
USING THREE DIFFERENT DEFINITIONS

Community	Wages of Those Who Live and Work in the Community	Wages of all Working People Living in the Community (Regardles of of where they work)	Wages of all Those Working in the Community (Regardless of of where they live)
Pinetop-Lakeside	$25,679,670	$42,305,915	$33,259,253
Show Low	28,918,507	38,782,609	44,851,499
Snowflake/Taylor	18,750,962	29,657,095	21,980,767
Springerville/ Eagar/Greer	32,634,415	35,994,709	40,875,437
Whiteriver	32,398,180	36,408,454	36,825,570

Source: 1987-88 Survey by EDP/U of A.

dollar cost of having more incommuters than outcommuters, which are measured in millions of dollars. Pinetop-Lakeside benefits the most; it nets over nine million dollars as a result of the commuting patterns. To a certain extent, Pinetop-Lakeside gains at the expense of Show Low because it is a preferable residential location.

Table 36 demonstrates the differences between the annual wage bill for people who live in a named community and work somewhere else, and those who work in the community. The dollar impact of commuting patterns amounts to millions of dollars. This table clearly shows the importance of determining not only where people work, but also where they live.

Summary

Journey-to-work patterns illustrate the interaction that exists between specific places of residence and specific places of employment. Analysis of commuting patterns highlight in- and outcommuting in and outside of the White Mountain Region to show that far more cross-commuting takes place inside the region than between the region and the outside world.

The journey-to-work matrix identifies the unique interactions between communities. Since little commuting takes place from Springerville/Eagar/Greer and Whiteriver, data suggest that residents of these communities rely

little on jobs in other communities. This observation may in fact reflect a cultural rather than a physical isolation from the other communities in the region. Pinetop-Lakeside and Show Low, on the other hand, experience far more cross-commuting within the region.

The identification of commuting patterns is fundamental to the measurement of the economic base for the individual communities and the larger region. The importance of determining both where people live and work is highlighted when compared to an economic base measured according to where people work, or according to where people live.

SUMMARY AND CONCLUSION

This economic base study not only demonstrates the importance and usefulness of applying a full range of adjustments to the multiplier estimation to produce more highly refined community and regional multipliers, but the multi-scale nature of the study provides the opportunity to measure the flows and links within the White Mountain Region.

This study is unique by virtue of the fact that the base analysis was conducted at three separate, but integrated scales. This process identified the spatial interaction and the measurement of economic links between communities, between the community and the region, and between the region and the outside world. Specifically, the employment census survey approach used in this study enables the researcher a high level of specificity in tracking the flows of employees and customers.

Crucial to an accurate measurement of the community and regional economic base is the identification and adjustment of in- and outcommuters at the community and regional scale. Modelling commuting flows served to highlight the interactive links between places of employment and residential locations. In addition, the

commuting data yielded information that was essential to determining whether communities were net losers or net gainers of employees.

The dollar impact of commuting patterns is highlighted by the wage-weighting procedure which gives greater value to high wage sectors and less to low wage sectors thereby illustrating the benefits to be gained from developing high-wage, export-oriented sectors.

In a study of employment, it is easy to overlook the economic significance of unearned income to a community. This study identified transfer payments, a major source of unearned income to some communities, where if incorporated as a tenth industrial sector, ranked highly among employment sectors in most communities of the study region. The economic impact of including this external source of income is demonstrated in the case of communities that have large numbers of retirees.

The bifurcation process of employment data into basic and nonbasic components required each employer to identify his or her market area; this study utilized the market data to tabulate intra- and inter-regional shopping patterns identifying the place of origin for each firm's "customers."

In conclusion, this study applies and extends methodological procedures developed by Gibson in earlier economic base studies of rural communities in Arizona. The

procedures followed in this analysis have generated a highly detailed and comprehensive community and regional data base which is more sensitive to the unique structural characteristics of the study area than the traditional sources of economic data collected by the U.S. Census or state Departments of Economic Security.

Appendix 1.

WHITE MOUNTAIN EMPLOYER QUESTIONNAIRE

Community _____ Subarea _____

DATE_____ INTERVIEWER_____

WHITE MOUNTAIN EMPLOYER QUESTIONNAIRE

Hello! I'm _____ and I'm at the University of Arizona. We're working on a study here in the White Mountain Region that we hope will tell us something about the area's economic structure. May I have a few minutes to ask you some questions?

A. **General**

1. What is the formal name of this establishment?_____

   _____

2. What is the street address?_____

   Community:_____

3. P.O. Box:_____Community:_____Zip:_____Phone:_____

4. Who is the principal local official and what is his or her title?

   Name:_____Title:_____

5. What is the principal function of this establishment?_____

   _____SIC Code:_____

B. **WORK FORCE DESCRIPTION**

6. Including yourself, members of your family, hourly workers, and those on salary, how many employees do you have? _____ (Sept. 1986-Sept. 1987 average)

7. How many were:

   a. Year-round full-time male employees? ____

   b. Year-round full-time female employees? ____

   c. Year-round part-time male employees? ____

   d. Year-round part-time female employees? ____

8. On the average, how many hours per week did these part-time employees work? (Note if total or per employee): ____

9. How many of these year-round full-time employees live in the White Mountain Region (see map). _____

Where do they live:

Pinetop/Lakeside _____

Show Low _____

Snowflake/Taylor/Shumway _____

Springerville/Eagar/Greer _____

Whiteriver _____

Hon Dah/McNary _____

Hawley Lake/Sunrise _____

Other _____

Total (should add to # above) _____

10. How many of these year-round, part-time employees live in the White Mountain Region (see map). _____

Where do they live:

Pinetop/Lakeside _____

Show Low _____

Snowflake/Taylor/Shumway _____

Springerville/Eagar/Greer _____

Whiteriver _____

Hon Dah/McNary _____

Hawley Lake/Sunrise _____

Other _____

Total (should add to # above) _____

11. How many seasonal employees did you hire during the last year?_____

12. How many weeks (annually) did you employ seasonal workers?_____

13. How many of your seasonal workers live in the White Mountain Region?

_____

C. **ECONOMIC BASE**

14. What percent of your total sales are made to people who reside within the White Mountain Region? _____ (Sept. 1986 - Sept 1987 average)

15. What percent of your total sales are made to people who reside outside of the White Mountain Region? _____ (Sept. 1986 - Sept 1987 average)

Note: be sure that the two numbers add to 100 percent. And, be sure that the respondent is comfortable with the two numbers.

16. Now, let's focus on the White Mountain Region only. Let me ask you to break-out the percent of your total sales that are made to residents of the White Mountain Region. (Again, Sept. 1986 - Sept. 1987 average)

How are these sales distributed between the following communities?

Pinetop/Lakeside	_____
Show Low	_____
Snowflake/Taylor/Shumway	_____
Springerville/Eagar/Greer	_____
Whiteriver	_____
Hon Dah/McNary	_____
Hawley Lake/Sunrise	_____
Other	_____
Total (should add to * above)	100%

17. Now let me ask a final question about seasonal patterns of business activity.

What percent of your annual sales are made during:

"Winter" (December, January, February, March)	_____
"Spring" (April, May)	_____
"Summer" (June, July, August)	_____
"Fall" (September, October, November)	_____
Total (should add to 100%)	_____

Thank you. Just in case we need to call back to check a fact, please give me your name!

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