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Economic impact of Malmstrom Air Force Base on Great Falls Montana: A model

Walter Herman Harris

The University of Montana

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THE ECONOMIC IMPACT OF MALMSTROM AIR FORCE BASE
ON GREAT FALLS, MONTANA: A MODEL

By

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B.A., Guilford College, 1971

Presented in partial fulfillment of the requirements for
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Date 6-7-78
This paper is dedicated to my parents and my loving wife
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PREFACE

Malmstrom Air Force Base (MAFB) and its associated individuals compose a visible and easily identified segment of the Great Falls population. Not only does the Base provide the community with human capital and intangible social contributions, but from it the area derives a considerable amount of income. These dollars support individual families, local and national firms, and the community as a whole. The size of the Base relative to Great Falls, in terms of employment, makes it along with agriculture one of the basic industries of the city.

Physical size may be an imprecise measure of the overall economic impact of this institution or facility, however, a better measure is the percentage of total dollars spent by the Base (as a unit) in the Great Falls area which remain as local income. Accurate determination of these dollars is useful for arriving at the degree of dependence placed upon the Base by the surrounding locality. A multiplier specific to the Base can be computed from income and spending information and applied to decisions regarding future economic interactions between the city and the Base.

This study will explore the concept of economic base analysis and multipliers and their relation to a specific economy--Malmstrom AFB and Great Falls. The purpose of this work is to offer a description of this relationship and a means to quantify the significance of the Base to Great Falls. Similar studies have been conducted for other Air Force
Bases but as yet none have been undertaken for Malmstrom. This, therefore, represents a formative statement and will lay the groundwork for future investigations.

Throughout the months necessary to prepare this study several individuals freely and willingly offered their time and criticisms. Dr. J. Holton Wilson is thanked for his guidance, counseling, and assistance. Mrs. Grace Molen is gratefully thanked for the many long hours spent typing, rearranging, and preparing the manuscripts. Mrs. Virginia Gilmore is also thanked for her research assistance and editorial aid. Mr. John Caldwell of the Management Analysis Office is also thanked for kindly granting the necessary interviews. Last but not least, my wife, Gwendolyn, is to be remembered for her kindness and cooperation throughout these months.

Despite the aid rendered by these capable individuals the author is responsible for the contents of the study. Errors and omissions are his responsibility and his alone.
CHAPTER I

ECONOMIC BASE ANALYSIS

Introduction

Each of us, in the transaction of our daily endeavors, is aware of the important economic and financial ties we have with our community. Hardly a day goes by without some economic problem coming to our attention. Some problems are more remote than others in their impact upon individuals; but nevertheless, are of sufficient importance to warrant attention. Inflation is felt in an indirect and subtle manner by the majority of the population, while the closing of a mill or factory is locally oriented and tends to be more traumatic. Rarely does an entire national economy collapse due to inflation. More frequently though, entire communities quietly pass away when a single supporting industry moves or closes.

Local economic disturbances, like the death of a town, may have their roots in a variety of causes. Causes such as the depletion of a resource base, growth of competing transportation lines, and governmental regulations historically have caused local supporting or basic industries to move from a town. Movements of basic activities from areas have a varying impact upon cities, an impact which is related to the size of the region, the type of activity and its size, and the spending characteristics of local residents. When decision makers, be they local politicians,
regional planners, or national legislators convene to decide the economic fate of an area's basic activity, its overall local economic impact is a prime consideration.

Regional Growth and Economic Base Analysis

So, how does one measure the size and magnitude of an industry's economic impact? Throughout the late 19th and 20th centuries this question has plagued academicians, politicians, and the general public alike. Concepts of a single industry town, both in practice and in academic thought, have surfaced in numerous political decisions affecting the livelihood of cities and counties. The key determinants in these situations are the size and type of basic activity and the geographic area it serves. Thus, as cities and metropolitan areas grow in size the ability of the community to satisfy the economic demands of its residents increases to the extent that larger cities find themselves in the position of being a regional trade center. With growth and diversity often comes a decreasing reliance on the basic activity for economic survival.

City and regional growth, although originally tied to some unique raw material, gradually evolves into a self perpetuating system which attracts labor and capital. Theoretically this may be true but in many instances a few key basic industries continue to sustain the growth and economic vitality of a region. Detroit, for example, is still known for the production of automobiles, while Washington, D.C. is recognized as the seat of the Federal Government. In both cities economic activities other than the most prominent transpire but to a lesser extent. Thus, one could say that government is basic to Washington while automobiles are basic to Detroit and that sudden removal of these activities (from
economic growth and vitality. Nevertheless, the economic composition of each city, in terms of related and unrelated industries is such that each would probably survive, although at an economic level somewhat lower than that previously experienced. But, what about areas which are not so large and can be readily identified with one or two supporting industries? How are they described?

Cities like New York, which have many basic activities, can more readily absorb the loss of one, than can a small city like Fort Benton, Montana. Several years ago New York City lost the Brooklyn Navy Yard and has yet to crumble because of this. Fort Benton, on the other hand, was a thriving inland port serving a trade area south to Butte and Helena and north into Southern Alberta. When the railroad bypassed the city, directly supplying Great Falls, Fort Benton's area of economic impact gradually shrank. Countless examples also exist of similar readjustments having occurred to other cities, principally those tied to natural resources which were eventually depleted.

When describing the economic base of a city, the observer must examine not only the basic activity and the accompanying sphere of influence but the composition of its interrelationships with other industries and localities. However, this is often difficult due to problems encountered in identifying the appropriate relationships to measure and in selecting a methodology to employ. Because of the complexities involved in developing an analysis of a region's economic base, policy makers should familiarize themselves with the various descriptive methods, their probable outcomes, and the underlying concepts of each before making decisions regarding the spending of public funds, attracting industries, or terminating subsidies.
Economic base analysis, as a discipline, concentrates upon the relationship between a community or region and its basic activity. This activity is defined as the economic function which acts as the region's driving force. As an income earning action it serves as the source of money which is channeled into the local economy. It is not possible to say that basic activities are set and specific for they are determined on an area by area basis; however, we can say that generally such organizations as industry, education, and federal and local governments are defined as being basic.

The Federal Government is particularly concerned about the impact of its activities upon local economies because of the associated political repercussions. The impact of this entity in regions relying on the Federal Government can be analyzed in the same manner as those dependent upon petroleum or manufacturing. Thus, using economic base analysis it is possible to quantify this relationship and then consider the impact to be expected, should the level of federal monies be altered.

Should a significant portion of a city's livelihood be derived from such an external source, it is easy to see why such areas bemoan the termination of these capital infusions. Local citizens and politicians benefiting from such situations tend to magnify the importance of these funds to the local economy, sympathetically demonstrating that in the absence of federal dollars their community would unnecessarily be allowed to fall into decline and ruin. Arguing from a purely biased and selfish perspective this would be the most logical conclusion to be reached.

However, when arguing from a more informed position these conclusions may be totally erroneous. Each and every type of basic activity has a unique and specific economic impact, the magnitude and scope of
which is dependent upon several factors. One of these, the type and amount of production factors drawn from the local area, certainly affects the economic relationships between a city and its basic industry. Knowledge of these ties or linkages is necessary before one can predict the impact of policy changes, regardless of the origin, which affect a city and its basic industry.

**An Example**

An example of this, using two cities each with the same basic industry will clarify this concept. Cities A and B each has a population of 20,000, an abundance of petroleum, an adequate transportation system, and the same number of workers employed in the petroleum industry. City A is only ten miles from a major ocean port with a population of 1,000,000, five miles from a major producer of petroleum support products, is surrounded by a number of different types of industries, and is self supporting in terms of basic necessities. City B, on the other hand, is more remote and isolated, being 500 miles from the nearest major metropolitan area, and is over 1,000 miles from petroleum support and other spinoff activities. This city merely serves as a producer of crude oil. Although identical industries are involved one can well imagine that the importance of the petroleum industry to City A is less than to City B because of A's proximity to other industries. Similarly, the dollars generated or derived from petroleum are spent differently in A than in B.

In City A the tendency would be for the industry and its employees to spend the majority of their incomes on goods manufactured and distributed in the local area. City B, however, because of its remoteness, would as a whole, tend to import more goods from a major metropolitan area and thus very few of the petroleum related dollars would remain
within the region. Should the wells run dry in both cities, and assuming no other economic changes, then it is logical to assume that City B would be more affected than City A.

City A would escape traumatic repercussions because of its proximity to other sources of income. Those employees formally connected to petroleum can easily migrate to other parts of the region for employment while still residing in City A. The economic activity is maintained at almost the same level with only the source of the dollars having changed. City B would not be so fortunate because most of its petroleum workers would be forced to leave the city in search of continued employment.

The point of this example is to demonstrate that not only is it important to know the size and magnitude of a community's basic industry, but to know what types of second round spendings are to be expected as a result. These second round spendings or leakages take the form of spendings outside the economy for luxury items, industrial supplies, and raw resources and are a function of income levels and general spending habits. Accordingly, a region tied to any of several industries such as petroleum, timbering, mining, light and heavy manufacturing, and government can expect a different economic impact to result from each facility. In the case of manufacturing, demands for specific capital equipment, not supplied by the region, tend to drain capital from the region in exchange for imports of the equipment. The greater the external purchases by a firm the more reduced the amount of dollars available to the community. Government on the other hand, may increase the total dollars coming into an area which in turn is reflected by increased wages to locally employed workers.
Economic Base Analysis and Multipliers

Because each type of industry and each locality has its own capital requirements and spending characteristics, no two can be compared directly with counterparts in other areas. They can be examined, each on its own features, in terms of the probable effects of a reduction in its basic activity. Multiplier concepts, such as those developed by Keynes, are now routinely applied in an effort to quantify the regional impact of changes in basic activity. Accordingly, each economic activity, like regions, has associated with it a multiplier which can be used to predict income and employment changes as a result of changes in exogenous demand for its products. The multiplier which is associated with an activity is a prime determinant in evaluating the economic impact of the unit upon its region and with this knowledge planners and politicians can predict and plan for changes in capital inflows to a region. Economic base analysis can be used to derive an appropriate multiplier for a municipality and an industry.

This study originally began as an attempt to specify a multiplier for Malmstrom Air Force Base. For reasons to be explained later, the study evolved into a critique of a presently used economic base analysis and then proposes a more appropriate method. Supporting this end we first examine some of the literature dealing with economic base analysis. Following this we discuss models of similar economic activities and regions; then propose a model of Great Falls and Malmstrom Air Force Base. Next, a more appropriate method of determining the appropriate multiplier is examined. We conclude with some observations upon the significance of the results and speculate on future courses of investigation.
CHAPTER II

REVIEW OF THE RELATED LITERATURE

Throughout the literature dealing with economic impact or base analysis the same topics and themes continually emerge. Themes such as regional delimitation, base-service identification, and arguments over varying methodologies are notable among these works. In this Chapter we seek to review, albeit briefly, some of the more important works which pertain to economic impact analysis and their treatment of the above themes. Beginning with a regional perspective, we move into a more local and specialized application. For the sake of clarity and ease of presentation, these works will be discussed chronologically. Periods to be reviewed are arbitrarily divided into: Early (1930-1959), Intermediate (1960-1969), and Late (1970-present).

Early (1930-1959)

The Multiplier Defined

Although the work of American economists was not initially oriented toward economic impact analysis, it was during this period that the work of John M. Keynes was gradually adapted and combined with the work of others to develop a formative explanation for the growth of cities. One of the tools for explaining economic activity, as defined by Keynes, was the national income multiplier. In The General Theory of Employment, Interest, and Money, the Keynesian multiplier is based upon exogenous investment from outside an economy inducing multiple rounds of
spending within it; thereby, generating income for successive recipients.

The rate at which the net national income changes in response to changes in exogenous investment is related to consumer marginal propensity to consume and/or save. Keynes described the multiplier as the "ratio of a change in income $\Delta Y_{np}$, to a change in investment, $\Delta I$."\textsuperscript{1} Mathematically stated as

$$k = \frac{\Delta Y_{np}}{\Delta I}$$

where $k$ is the multiplier.

A simple alternative definition of this concept is found in Samuelson's \textit{Economics}.\textsuperscript{3}

$$\text{Change in income} = \frac{1}{MPS} \times \text{change in investment}$$

$$= \frac{1}{1-MPC} \times \text{change in investment}$$

Where $MPC$ is the marginal propensity to save.

Further examination of this multiplier concept demonstrates that the $MPS$ and its complement, the marginal propensity to consume ($MPC$), total to one. (This is true, within the context of the Keynesian methodology, only if other leakages such as taxes are not present.)\textsuperscript{4} Although Keynes postulated a national macroeconomic multiplier, this idea has been applied, with modifications, to regional and local economies.

One of the earliest applications of the multiplier to a regional economy was published in 1938 by the editors of \textit{Fortune} magazine. In an

\begin{itemize}
  \item \textsuperscript{2}Ibid.
  \item \textsuperscript{4}Peterson, \textit{Income, Employment, and Economic Growth}, p. 150.
\end{itemize}
Hoyt and Weimer published the *Principles of Urban Real Estate* in 1936 wherein they established a universal base-service ratio of 1:1. A 1939 revision recognized the ability of this ratio to change over time and that in many cities it is possible to have more service workers than basic employees. Continuing his work on base analysis, Hoyt was able to relate "...local employment and population proportions to national employment and population data..." and separate basic and service employees in a particular locality.

### Income and Employment Multipliers

In 1938, Colin Clark published "Determination of the Multiplier from National Income Statistics," wherein he concluded that multipliers for economic analysis are actually composed of two types. The first is an employment or, as he described it, "output" multiplier, and the second is the income portion. In addition to reporting that these multipliers change over time, i.e., they are not static, he said that a national multiplier can be derived from the marginal propensity to import. Later, this concept was applied to smaller regional economies.

By 1953, Hoyt and Weimer had perfected their technique and advanced in *Working Denver* that if a firm exports 50 percent of its...

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output then 50 percent of its employees should be considered as basic while the remaining 50 percent are service oriented. The idea is that many firms produce for both local and export use and their impact should be considered accordingly. Although real estate and population oriented, these authors contributed to economic base analysis the idea that in order to determine the true economic impact of any basic group the researcher must take into consideration the group's level of wages and consumption patterns. Later, we will see the importance of this concept.

As the period under review progressed, economic base researchers gradually became aware of the role played by both the employment and income multipliers. Efforts were directed toward defining the use of each in the growth of cities vis-a-vis growth in basic industries. George Hildebrand and Arthur Mace published a lengthy study which used regression analysis to determine the appropriate multiplier for Los Angeles County. Using data from the war years of 1940 through 1947, they concluded that employment multipliers are a function of both local and non-local growth. As the demand for goods and products produced by a particular region increases, due to external autonomous demand, not only does the basic industry increase its employment but so do the supporting or servicing industries. The rate at which the city grows in terms of employment and income is a function of the leakages from the economy via the importing of items not locally provided. As a city grows it begins to produce more and more goods for local use, imports less and

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generally becomes more "self sufficient." Accordingly, in larger cities more monies are expected to remain locally than are exported. Reducing the second round leakages or exports of money reduces the MPS factor creating a larger multiplier value.

Perhaps one of the most influential authors and researchers of this era was Richard B. Andrews. He authored eight articles between February 1954 and November 1955 comprehensively explaining the current problems in urban economic base analysis. Because of the volume of material to be covered only the salient points of these works will be touched upon.

Andrews begins with a general discussion of the preliminary or elementary items a researcher must pay attention to prior to beginning an economic impact analysis. He must decide: 1) how the economic base will be measured, 2) what constitutes the appropriate base-service sectors, and 3) what geographic area is to be discussed. He contended that the first, base measurement, was of particular importance to the final outcome and that if improperly identified the study will be of little value. Thus, one must decide upon the merits of six commonly accepted units of measurement. "These units are 1) jobs, 2) payrolls, 3) value added, 4) value of production, 5) physical production, and 6) dollar income and expenditure accounts for the community." Of


these he states the best unit is the latter, community income, but that gathering the data tends to be prohibitively expensive. Consequently, the next best alternative is an employment-payroll mixture, principally because of the ease with which the statistics can be acquired.

Once the unit of measure has been decided upon, the various industries within a community should be classified as either basic or non-basic. Andrews advances five identification techniques available to the researcher including: 1) residual method, 2) macrocosmic method, 3) sales-employment conversion, 4) sampling, and 5) dollar-flow movement. The ultimate goal of any economic survey, according to Andrews, is to identify the proper base-service ratio. Accordingly, the researcher should carefully examine the advantages and disadvantages of each of these methods.

His third article, titled "Special Problems of Base Identification," is one of the most crucial to any study of economic base analysis. In it he points out "...that changes in the prosperity of the base will have important repercussions in local employment and consequently in population." However, problems of base identification can arise quite easily when one deals with communities which are not tied to a single industry such as a university, government, transportation, or tourists. Despite these close ties the economic life of a city reverberates throughout the area via a series of linkages. These linked activities consequently may be termed as a basic activity and should be considered as the supporting foundation of the local economy.

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After deciding upon the units of measure and the method to be used the next step is to delimit the area to be studied. Andrews states that possible limits are: 1) legal limits, 2) industrial market areas, 3) labor market areas, 4) county, and 5) metropolitan concepts (e.g., SMSAs). Of these he favored the metropolitan area because data has already been compiled for these units. Caution should be exercised when delimiting regions to insure that areas do not overlap and economic units are not doubly counted as a result.

Development of the base ratio concept was the subject of the remaining four articles by Andrews. He concluded that the Base-Service, Base-Total Population, Base-Total Employment, and Total Employment-Total Population ratios are not static but vary over time and are peculiar to each locality. For example, once one of the ratios, Base-Service, has been disturbed the ratios will return to original levels over time, he pointed out. Causes for temporary imbalances may include a change in exogenous demand, improvement in technology, or sudden changes in the price of a factor of production.

Andrew's articles make a significant contribution to economic base analysis. By postulating the dynamics of these four ratios he implies that a time lag exists between the introduction of an external stimulus and the result. Because each region has its own unique set of ratios, adjustment to changes in exogenous demand also varies from one area to the next. Andrews concludes that so important is this rate of adjustment, or time lag, that in a sense this is what ultimately dictates the success or failure of a community in response to a loss in the basic industry.  

Specialization and Surplus

Up to this point in time research efforts were concentrated on the development of elementary and somewhat crude methods aimed at determining the economic base of a city or region. What had been lacking, as identified by Mattila and Thompson, was a means to compare one city with another. In their article, "The Measurement of the Economic Base of the Metropolitan Area," they developed two comparison tools. One was termed the index of local specialization and the second they called the index of surplus workers. 16

An index of local specialization was designed to take into account the widely recognized fact that some industries might be more labor intensive than others and/or may be more important to a community's economic base. By ranking the area's basic activities via a standard procedure useful comparisons with other cities can be made. Their fundamental index, later revised, appears in the unadjusted form as: 17

\[
\frac{e_i}{E_i} \quad \text{or} \quad \frac{e_t}{E_t} = \frac{e_i}{E} = \frac{e_t}{E_t}
\]

where \( e_i \) = local industry employment

\( e_t \) = local total employment

\( E_i \) = national industry employment

\( E_t \) = national total employment

Mattila and Thompson continue by saying that this index is misleading

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for all it "...indicates...is the importance of the industry to the locality relative to the importance of the industry to the nation."¹⁸

The index of surplus workers is used to determine to what extent labor in an area or industry produces above and beyond the local needs. This index is computed according to the formula:¹⁹

\[
e_i = \frac{e_i}{E_i} \times \frac{E_i}{E_t}
\]

This formula "...produces identical rank orders of industries not only within cities but also between cities if the cities in question are equally self-sufficient, i.e., 'surplus' workers as a percent of total local employment is the same for all the cities compared."²⁰ The question of measuring "equally self-sufficient" was not addressed and so the usefulness of this formula is subject to this limitation.

These two indexes attempt to relate the importance of an industry to an area considering the importance of the industry to the nation as a whole, then relate the significance of an industry to an area in relation to other activities. The overall goal is to determine which industry is more important to a region in terms of basic and service activity. Armed with this information it is then possible for the researcher to predict changes to be felt in any region from changes to basic industries.

Charles M. Tiebout further advanced the concept of exports and basic industries by saying that the economic base of a city is not necessarily tied to its exports. He argued in "Exports and Regional Economic Growth," that it is possible for a city to become so large as

¹⁸Ibid.  ¹⁹Ibid., p. 221.  ²⁰Ibid.
to be almost entirely self-sufficient. When this occurs much of its economic vitality is the result of induced spending within its boundaries. As it grows the region will be able to finance much of its expansion and resource needs from internal sources such as governments, etc. Finally, when considering exports one must evaluate not only the source of income but the product being exported.

Tiebout points out that the specialization of any region in terms of exports, depends largely upon its available production factors and their unit costs. These costs, measured in terms of supply, are dependent upon the income of the region and are reflected in the price of the raw materials. The more abundant a raw material is the more likely a region will seek to use it to support a basic activity. Total income accruing to any region as a result of its exports depends upon the productive efficiency of its base and service components and upon the relative abundance of production factors.

As a region faces increased demand for its resources or products, its income rises in turn, creating growth and prosperity. As the basic industry grows it should increase its production efficiency, thereby, perpetuating its existence as the supporting activity. Increased efficiency by the basic sector is in turn passed to the service sector and results in continued investment and growth of the community as a whole. Tiebout concludes that regions grow because of changes in autonomous national demand which increases the volume and value of regional exports. Changes in national demand are brought about by changes in national incomes and spending patterns and are effective in instigating the rise and/or fall of economic activity in individual localities or regions.  

Location Quotients and a Mathematical Model

"An Investigation of the Local Employment Multiplier" by Gerald E. Thompson is an early attempt at applying base-service analysis to a specific economic unit to arrive at the employment multiplier. While not the first to do this, Thompson's work is significant in that he employed the Location Quotient (LQ) or an index of surplus workers. He used it to arrive at basic employment and then extended its application to arrive at a measure of dependency. His approach was to pose the question of what percentage of the employment in the industries under investigation is attributable to exogenous demand and to local demand, assuming the region to be self-sufficient. The resulting employment multiplier could be used to predict changes in basic employment resulting from exogenous changes in demand for each industry in a community. One word of caution about his technique. This method, using Location Quotients, may actually overstate the multiplier, requiring the user to be aware of this limitation.

The close of the period, 1930-1959, is marked by one of the first mathematical models of a regional economic base. This model developed by Gerald Sirkin is an attempt to prove what had already been theorized. Namely, that regional income depends upon exports as well as spending characteristics of local residents. Their income is more accurately referred to as "disposable income of an area." 


His model attempted to accomplish two important things. First, it sought to relate basic output to non-basic output. Using the formula shown below he concluded that the more developed a region is, the greater its tendency to trade with outside units.\(^{24}\)

\[
\frac{H}{X + F + T} = \frac{hY}{mY + bY} = \frac{h}{m + b}
\]

where:

- \(Y\) = the income of an area
- \(H\) = the part of the area's output (value added) which is absorbed by the area
- \(X\) = the part of the area's value added which is "exported"
- \(F\) = net factor payments from "abroad"
- \(T\) = net transfer payments to the area from "abroad"
- \(h = \frac{H}{Y}\) = average propensity to absorb home production
- \(m = \frac{M}{Y}\) = average propensity to import
- \(b = \frac{B}{Y}\) = average propensity to lend
- \(M\) = value of imports of the area
- \(B\) = external balance on concurrent account = \(X + F + T - M\)

The second contribution of the article was to analyze the impact of changes in the base activity on the non-basic segment. By introducing three more variables (the marginal propensity to: spend at home, spend abroad and lend abroad) into his analysis he concludes that if one knows the marginal propensity to absorb home products, it is possible to predict changes occurring in the other sectors as a result of changes in the spending for home products. We should note that these variables are actually marginal propensities and that this is the first time this concept has been applied to economic base analysis.

\(^{24}\) Ibid., pp. 426-427.
As we prepare to review the next period, otherwise known as the Tiebout Era, a brief recapitulation of the general knowledge is in order. Recall that in 1935 John M. Keynes published his powerful theory of economic activity. In that work Keynes outlined how changes in investment levels could be multiplied as each successive round of spending occurred. From this model of a closed economy with no leakages, workers such as Clark, Tiebout, Andrews, and Hoyt sought to adapt this and similar methodologies to regions and specific localities.

Early in the 1930's, Homer Hoyt developed a method for quantifying and classifying the various economic units of cities. Hildebrand and Mace applied regression analysis to Los Angeles County in an attempt to compute an appropriate employment multiplier. Richard B. Andrews and others concentrated on base identification, ratio analysis, and the importance of proper delimitation of the study area. A method, using Location Quotients, of comparing several cities in terms of base dependence was advanced by Mattila and Thompson. Tiebout classified, in a theoretical context, the role basic industries and natural factor endowments play in the growth of a region. It was not until Gerald Thompson integrated the Location Quotient and the index of specialization did it become apparent that cities do indeed consume part of their export products. Finally, we saw how Gerald Sirkin developed a model which explained the relationship between leakages within an economy and regional growth based upon total income.

Intermediate Period, (1960-1969, Tiebout Era)

This period is significant to our review because during these years several important contributions to economic base analysis were
made. Not only were the methods of base-service identification perfected and modified but a more complicated one, Input-Output analysis, began to emerge as a useful tool in economic base quantification. Efforts to apply some of the many methodologies to actual situations were begun in earnest. Large metropolitan areas and regions such as New Delhi, India; Washington, D.C.; Houston; Dallas; San Diego; Atlanta; Kansas City; and Milwaukee, were frequently studied. We begin this section with a discussion of Homer Hoyt's contributions and conclude with the work of Se-Hark Park.

The Value of Imports

In two articles Homer Hoyt applied the flow of money into and out of a region to determine the ratio of basic to service employment in two different cities--Washington, D.C. and Detroit, Michigan. Hoyt argued that because most local economies are dynamic, abrupt changes in the inflow of money take time to be felt. These time lags are important considerations for two reasons. First, they give an idea as to the rate at which money leaves an economy, and second the time lag concept adds the perspective of linkages to economic base analysis which heretofore had not been included.

Along the lines of Gerald Thompson, Hoyt (in "A Method for Measuring the Value of Imports into an Urban Community") argues that a city must pay for its imports with exports of equivalent amounts. As a city grows it imports less causing its service population to grow. Thompson

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26 Ibid.
offers studies of Detroit and Washington, D.C., to support his thesis that it is possible to determine the amount of exports and imports attributed to each sector. He concludes by stating that the nature of basic employment undoubtedly influences the base-service ratio. In other words, automobile production, as a basic industry of a town, has a different impact than local government merely because the spending patterns of each unit and its employees are different.  

Charles M. Tiebout

Out of this era came a work which has continued to have impact upon economic base studies. The Community Economic Base Study, by Charles M. Tiebout, discusses the planning and implementing of an economic impact study. Detailing the differences between the direct and indirect methods of data collection, Tiebout shows the reader how to select the appropriate method. His discussion continues by developing one of the original economic multiplier models. For many years his model served as the starting point for multiplier specification efforts and bears some consideration here.

His model, as shown here in a rearranged form, is the short run version. The long run version differs only by the inclusion of more propensities.  


\[ T_{II} = \Delta (PE + LBI + LHI + LGC) \times \frac{1}{1-(PC \cdot IS)} \]

where: 
- \( T_{II} \) = Total Income Increase
- \( PE \) = Private Exports and Exports to the Federal Government
- \( LBI \) = Local Business Investment
- \( LHI \) = Local Housing Investment
- \( LGC \) = Local Government Current Operations
- \( PC \) = Propensity to consume locally
- \( IS \) = Income created per dollar of local consumption sales

In this formula the \( \frac{1}{1-(PC \cdot IS)} \) would be the same as \( \frac{1}{1-MPC} \) as found in the Keynesian methodology. Stated in an alternative manner the change in local income is equal to the change in investment (i.e., income going into an area) times the reciprocal of one minus the propensity to consume. Notice that Tiebout does not employ the marginal concepts but rather states his propensities in absolute or average terms.

Large Institutions

Once the basic methodology of economic base and impact analysis had been developed and refined, the remaining years of this period saw researchers adapt these methods to a host of specific problems. Frequently studied were other large metropolitan areas, universities, and military installations. Emphasis was placed on the calculation of general economic impact in terms of absolute dollar amounts of money being transferred from one economic unit to another and the formulation of a predictive model. These models, in general, were intended to be employed in predicting possible short term changes in income and/or the employment an area could reasonably anticipate should its basic component experience sudden growth or decline. The primary tool in these predictive
studies was either the income or employment multiplier or a combination of both.

Some of these investigations dealt with the total economic impact of large scale Federal and State government financed institutions. Charles Tiebout and Richard Peterson concentrated on military installations, for they are not only large in size but often reputed to be the life blood of many communities. Their report of one such study revealed that in a regional sense defense spending tends to be very diffuse and diversified in its general impact upon individual firms. From this they concluded that large scale defense-space related expenditures tend to be concentrated with prime contractors who subcontract, thus making the smaller subcontractor's output more closely tied to defense industries than that of the prime recipient.29

The extent of any particular region or area being supported by a basic industry is determined, in the long run, by how much readjustment is necessary to return the economy to previous levels of operation, should the base-service ratio be altered. In a 1965 study, Wassily Leontief, et al, reported that some regions are more clearly tied to military spending than others and that readjustments to reductions in defense spending must be offset by equal or greater increases in civilian demand.

Leontief derived his conclusion from a multi-regional input-output model in which he subjected all regions containing military

installations to an arbitrary 20 percent reduction in military spending. After presenting elaborate statistics supporting the regional nature of defense spending at that time (1965) he offers this comment.

The geographic picture confirms the well known fact that most of the resources serving directly or indirectly Final Military Demand come from the Western, South-Western and South-Eastern regions, while the Mid-West, the Great Lakes region and the North Atlantic and New England states depend to a large extent on civilian demand. A cut in military expenditures, accompanied by an expansion of the non-military bill of goods, thus will create more serious readjustment problems in the first than in the second group of regions.

The power of this model is best seen when we view one specific region--Idaho, Montana, and Wyoming. Based upon this analysis he concludes that a decrease in military earnings of 13.37 million dollars in these states accompanied by a comparable increase in non-military earnings would result in an increase of 35.9 million dollars in the earnings of the region. Compare this to Maryland, Virginia, West Virginia, Delaware, and D.C. where a reduction of 302.37 million dollars (also accompanied by an increase in non-military earnings) leads to a decrease of 256.7 million dollars in earnings to labor. One can easily see that the Western states of Montana, Idaho, and Wyoming are not as heavily tied to the defense dollars as the area surrounding Washington, D.C. Although Leontief, et al, did not specifically develop a multiplier, their conclusions and input-output coefficients lead to the conclusion that defense originating dollars are indeed multiplied on a

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31 Ibid., p. 224. 32 Ibid., p. 239.
regional basis and that some areas are more oriented to these funds than others. Questions still remain as to what extent specific cities and communities are tied to these exogenous sources.

Military Installations

Using the multiplier concept as the measure of dependence one community has on its basic economic activity, Ian D. Terner concluded that Ayer, Massachusetts was not supported by Fort Devens to the extent that many believed. Terner employed the standard Location Quotient technique to determine which industries within the small rural community were basic and which were service. Analysis of both the spending of the Fort (as a unit) and of a sample of the military population allowed him to compute marginal propensities to spend; in Ayer, on the Fort, in the surrounding trade area, and in Boston, Massachusetts. From this data he constructed a linear regression model arriving at an employment multiplier of 1.2. One of the principle reasons for this multiplier is, according to Terner, that

...employment generated by local spending is also very low, since in most cases it is probably limited to one round. Ayer has a very 'open' economy, i.e., there is a great deal of second round leakage, since almost all intermediate goods and many services are imported rather than produced locally. Thus, the increased local activity generated by a given increment of export activity does not set off a great chain of local employment. Rather, in many cases, it leads to an almost immediate import. 

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34 Ibid., p. 84.
A prime determinant or cause of these leakages is the proximity of Fort Devens to the larger metropolitan area of Boston and the direct supplying of goods for resale by the Federal Government. Additionally, the military members of the community tend to export many of their dollars either in the form of transfer payments or as purchases for imports thus contributing to these leakages. However, one must not overlook the major impact of military installations in terms of the increased demand for housing and collateral services such as schools, utilities, and water systems. To some extent, as in the case of schools, the affects are mitigated by federal impact funds but should the Fort suddenly be disbanded the local housing market would definitely suffer.

A similar study by Weiss and Gooding yielded roughly equivalent results as that of Terner. Theirs differed in that they considered a regional economy with three principle export industries, each differing in their type of impact. The authors evaluated the employment generated within the region of Portsmouth, New Hampshire by dividing basic employment into private export employment, civilian employment at Portsmouth Naval Shipyard, and the military-civilian employment at Pease Air Force Base. These authors criticized traditional economic base studies as being somewhat misleading by saying that multipliers from such studies, when applied to large regions, tend to suppress important consumer spending patterns. In addition, they argue that for small regional economies such as the Portsmouth area these differences are negligible.

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direct determination method and is generally the preferred one to use. But because of the expense of mail and personal interviews less costly methods were developed and employed throughout the decade of the 1960's. One of these, the Location Quotient, was refined during this period but the Minimum Requirements method was truly a product of the era.

**Minimum Requirements**

Recall that the Location Quotient method seeks to determine the amount of specialization existing in a given city in comparison to the nation. Thus, if a city is highly specialized, i.e., has a Location Quotient greater than one, in a certain sector, it is said to export this specialty. Exports of this product become a source of income. Location Quotient multipliers, or coefficients of localization, are derived by comparing the percentage of local employment in one industry with national employment levels in the same industry. Employees of a community are assigned to the basic-nonbasic categories, depending on whether or not they support the primary industry. The basic objection most researchers have to this procedure is its tendency to overstate the multiplier because the comparison of local industry employment to national norms does not adequately account for a very efficient industry or city.\(^\text{38}\) The Location Quotient method is a national averaging system in a sense and therefore compares all cities and industries of similar size with national standards.

On the other hand, the Minimum Requirements technique (MR) developed by Ullman, et al, in 1960, sought "...a short cut way of

\(^{38}\) Tiebout, *Community Economic Base Study*, pp. 47-49.
estimating nonbasic or service employment and is based on the actual minimum percent employed in the lowest city..." of a group of like cities.\footnote{Edward L. Ullman, Michael F. Dacey, and Harold Brodsky, The Economic Base of American Cities, (Seattle: The University of Washington Press, 1969): 3.} Basically, the approach is to compare employment in selected industries of one city to employment in the same industries in other identical cities. These cities must be identical in terms of size, population, and regional associations. The city with the lowest percentage of its population employed in a particular industry is taken as the benchmark city regarding that sector. This value becomes the minima and is applied to the same industry in all cities being studied. Export or basic employment is defined as the excess employed over the benchmark minima. As from Location Quotients, misleading results can occur from the MR method. Ullman attributes this to a tendency to overstate the exports of a city or region which results in an understated multiplier.\footnote{Ibid., p. 4.} Exports are overstated because of the arbitrary manner that benchmark economies are established.

Determination of export-service industries using this method is best demonstrated via a simple illustration. Suppose that a city the size of St. Louis employs two percent of its population in agriculture while a city the same size (population of one to 1.5 million) actually requires a minimum of only 1.1 percent of its population to be engaged in agriculture in order to satisfy basic needs. Based upon the difference between 2.0 and 1.1 percent it is determined that an excess
export employment of 0.9 percent or 2.1 percent of the total population exists. Therefore, agriculture is said to be a basic industry.\(^\text{41}\)

Since its original publication this technique has been criticized, perhaps more than any other indirect measurement technique. Several arguments have been advanced against it and a thoughtful attack was made by Richard T. Pratt in his 1965 article titled, "An Appraisal of the Minimum Requirements Technique."\(^\text{42}\) Pratt criticized the technique on several points and then offered his own alternative.

Pratt contends that the MR technique is minimum oriented while the LQ method is average oriented. He states that the MR approach makes the assumption that all cities of like size have like spending patterns and that none import. Pratt also theorizes that the degree of disaggregation, in terms of Standard Industrial Classification, (S.I.C.) codes, can affect the accuracy of the LQ or the MR methods making it possible to produce varying results. Pratt is of the opinion that fine disaggregation of an area's economic activity can only improve the results gained from Location Quotients while at the same time being only marginally beneficial to the Minimum Requirements procedure. In essence, he states that..."...disaggregation will increase basic workers; aggregation will decrease basic workers,"\(^\text{43}\) meaning that quantifying the dependency of a region on a basic economy is related to how the basic industry is defined.


\(^{43}\) Ibid., p. 123.
His alternative, the maximum requirements, is based on the assumption that the city producing the least amount of any good falls short of the leading city in that category; therefore, must import goods. Based upon this hypothesis he claims it is possible to compute the number of employees necessary to support these importers and express this as a base-service ratio.

Other objections to the MR technique have also been raised. Two noted objections are: is it possible to find a sufficient number of similar cities in terms of industries, population, location, etc., to establish realistic minimums; and where is the benchmark cut-off placed? Should it be at the lowest city, the fourth, or fifth city from the bottom? Certainly the benchmark level of economic activity can affect the outcome of the MR calculations.

Edward L. Ullman defends the Minimum Requirements technique on the grounds that the averages of the Location Quotient system are less accurate than the minimum because the latter fails to discern the more efficient cities from less productive ones. He further argues that the MR procedure does correct for city size and thereby only compares cities of like size because the differences between similar cities are probably minor. In comparison, Ullman states the results achieved with the MR method are remarkably similar to those done by other studies employing alternate methods.

Other Works

Se-Hark Park, in an analysis of St. Louis, emphasized the need for making accurate and correct identification of base, export and import factors and urged that an element of common sense be used when
method or the economic base method. This holds true providing both procedures are approached with similar assumptions. 45

Throughout the period, 1960-1969, the newly refined methods of economic base analysis and input-output studies were tested in many large cities; primarily to develop a method of predicting future levels of economic activity and to develop regional and local multipliers. Specific areas of concentration within this period were along the lines of base-service model development, Minimum Requirements technique, general multiplier theory, the role of exogenous stimulus to a region, and the development of specific multipliers on a city and regional basis.

The Late Period (1970 to the present)

Previous researchers, with the exception of Tiebout and Pfouts, had implicitly assumed that urban growth was directly related to basic employment. In 1970, Moody and Puffer presented an argument that this may not actually be the case, for they contend that all too frequently economic base analyses have been short run oriented. In actuality the analyst should consider both the short and long run effects of changes in basic employment for it is entirely possible that urban growth may be inhibited by changes in basic industries. To properly correct for this, their adjustment model sought to incorporate both a short run and long run multiplier component. Using data from San Diego, these values were computed to be 1.2 and 5.45, short and long run respectively. The implication was that over a decade the response of total employment

to changes in basic employment would be in an amount equal to the greater value while over a year or so it would be equal to the smaller one.  

The policy implications from this type of information are quite evident.

Regional Multipliers

Using Arizona as the region of study, Billings compares the employment and income multipliers derived from input-output and economic base studies. He writes that the input-output model consistently derived larger multipliers but when compared with economic base values they are not particularly far apart as seen below in Table 1.

<table>
<thead>
<tr>
<th>Category</th>
<th>Income</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total for State</td>
<td>$4,078,000,000</td>
<td>519,566</td>
</tr>
<tr>
<td>Defense related final demands</td>
<td>318,633,000</td>
<td>53,493</td>
</tr>
<tr>
<td>Total defense impact estimate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input-Output Model</td>
<td>780,265,000</td>
<td>120,111</td>
</tr>
<tr>
<td>Economic Base Model</td>
<td>729,669,570</td>
<td>114,639</td>
</tr>
<tr>
<td>Aggregate multipliers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input-Output</td>
<td>2.44</td>
<td>2.24</td>
</tr>
<tr>
<td>Economic Base</td>
<td>2.29</td>
<td>2.14</td>
</tr>
</tbody>
</table>


Billings' primary data came from a direct mail survey of firms which had received defense related contracts. Additional information was taken from published federal and state government statistics. From these he learned that military related spending is often difficult to measure because of subcontracting and the long delay time between the awarding date and the actual starting date of a project. Further, he states that the majority of defense impact falls in the form of induced spending. Communities supply schools and services while utilities provide power to subcontractors of military projects. Transportation firms also benefit from military shipping. Long range policy implications for communities located adjacent to military installations are clearly enhanced by this type of information.

**Differential Multipliers and Institutions**

Heretofore many of the works pertaining to economic base studies have concentrated on determining either a single composite multiplier or one capable of being applied to a region as a whole. Wilson and Raymond challenge this concept on the grounds that such an approach tends to average out applicable multipliers. A more accurate approach would be to specify multipliers peculiar to each specific industry or large institution. Modifying the sales to employees ratio, originally discussed in Andrews, they were able to demonstrate that a large university actually has an employment multiplier of 1.09.\(^{48}\) The particular method employed was to derive, based upon spending surveys of the university population,

how various income groups and the university as a whole spent their dollars in the local area. These expenditure patterns were then converted into employee equivalents to arrive at the total number of employees outside the university who were in fact supported by the spending of the school's population.

Such a low multiplier is accounted for by the nature of the leakages. Since most retail purchases by the students are for finished goods, the community actually adds very little and is in a sense an importer. In addition, a great deal of the income of the students is spent within the university for tuition, expenses, and room and board. Note the similarity between this situation and that of the Air Base addressed by Weiss and Gooding. Both are defined as high leakage economies, self supporting in some goods and services, importing others from the local economy, and relying upon external sources (state and federal governments) to supply dollars and other goods.

The University of Tulsa was the subject of "Impact Analysis and Multiplier Specification," also by Wilson. In this article he refines the three multiplier model of Weiss and Gooding to stress that institutions may actually have three multipliers. The three are: 1) related to the spending of the institution, 2) the portion of consumption dollars which remain locally, and 3) an integration of the two. The latter, he contends, may be the most appropriate because it incorporates a means to account for successive rounds of community spending. Accordingly, a

community should be cautious when deciding upon a multiplier because
erroneous conclusions may be reached unless a more moderate value is
used.\textsuperscript{50}

Floyd and Robertson in "The Impact of Federal Government Expendi­
tures on the Coastal Plains Economy," presented the thesis that a vigorous
regional economy can offset employment declines at defense installations
primarily because a strong civilian employment rate largely negates the
dependence of the community upon military related employment. Measuring
this hypothesis against reductions at military installations in North and
South Carolina and Georgia, they concluded that the decline in civilian
employment resulting from reductions at a region's primary defense estab­
ishment vary from 2.0 to 19 percent. While not actually specifying a
particular model for multiplier development or a specific multiplier,
the authors present evidence which supports earlier economic base studies.
Specifically, that the total impact of a military unit is a function of
the size of the unit, the size of the local economy, and to a certain
extent, the type of establishment. (Air bases may have a different
impact than do supply facilities or Army bases.)\textsuperscript{51}

Military Related Multipliers

An economic impact study which is directly pertinent to this
study of Malmstrom Air Force Base was published in the Spring of 1974
by J. Whitney Hanks. It deals with the impact of Hill Air Force Base

\textsuperscript{50} J. Holton Wilson, "Impact Analysis and Multiplier Specifica­

\textsuperscript{51} Charles F. Floyd and Terry D. Robertson, "The Impact of Military
Force Reductions on the Coastal Plains Region," \textit{Growth and Change} 6 (April
on Utah's economy. In it he applied the technical coefficients from the Utah State Input-Output model to Hill Air Force Base and the State to arrive at his multiplier values.\(^{52}\) Using data obtained from the Federal Government, state units, and the Air Base Comptroller, Hanks compared three factors. These were the total base derived income, base related expenditures, and base related employment changes relative to total population changes. Income expenditure multipliers derived from this method are seen below.\(^{53}\)

<table>
<thead>
<tr>
<th>Year</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>1.33</td>
</tr>
<tr>
<td>1970</td>
<td>1.36</td>
</tr>
<tr>
<td>1971</td>
<td>1.38</td>
</tr>
<tr>
<td>1972</td>
<td>1.36</td>
</tr>
<tr>
<td>1973</td>
<td>1.34</td>
</tr>
<tr>
<td>1974</td>
<td>1.32 (estimated)</td>
</tr>
</tbody>
</table>

Information presented in earlier works brings the question to mind of whether or not the State of Utah is not too large an area in which to measure the impact of such an installation. Contrast this to Weiss and Gooding's work in Portsmouth; or Tiebout, Hildebrand and Mace, and Terner who delimited their regions to areas the size of Los Angeles, St. Louis and Ayers, Massachusetts. Perhaps, had Mr. Hanks confined his study area to the Standard Metropolitan Statistical Area surrounding Hill Air Force Base, a different income-expenditure multiplier would have been derived.

One student of the economics and the economic impact of defense related spending within a region is Roger Bolton. Throughout his work


\(^{53}\)Ibid., p. 23.
the theme of the usefulness that defense spending can play in the development of a region's overall economic health and well being prevails. Bolton's main thesis is that defense spending, in the form of limited contracts, can be used as the nucleus for further industrial development in an area where labor is underemployed or not employed at all. Thus, subsidized employment may be a workable alternative for regional planners because it would lower unemployment, raise income and tax revenues, and lower welfare costs. He adds a few precautions, however, to this approach.\textsuperscript{54}

As other analysts have concluded, Bolton cautions that military contracts and personal spending have a somewhat diffuse impact due to subcontracting, time lags, and spending patterns which vastly differ from their civilian counterparts. Caution must be exercised by the regional planner when considering the overall dependence of an area upon defense spending. Despite the different spending habits, the multiplier of the particular institution is perhaps the most important economic factor to consider (because it indicates the amount of leakages) in these situations, but no doubt political considerations also play an important role in all decisions pertaining to military spending.\textsuperscript{55}

To summarize the knowledge pertaining to the institutional economic impact of this era, we might begin by saying that economic


\textsuperscript{55}Ibid.
base analysis has grown from a method of quantifying the resources of a region to a tool capable of predicting the result of changes in the local economy caused by exogenous activities outside the area under discussion. We know that the size of the city and the type of basic or supporting activity largely influence the nature of the multiplier or the driving force behind the growth of an area. The multipliers for any two areas will differ depending upon the ability of the community to provide for itself, the spending habits of the residents, and its economic relationship with the surrounding communities. Research has demonstrated that specific types of activities have unique multipliers which tend to vary over the long term and are composed of two components: employment and the income functions. Throughout the years these have often been used interchangeably; however, a more correct multiplier would be the aggregate or community base type. It is understandable why these have been interchanged so frequently. The more exports the city has the more its gross income increases resulting in more employment in the basic activity. Alternatively, if the city, in response to increases in external demand for its products, increases production and employment in its basic activity, then increases in income would logically be expected.

A community's size and growth rate are directly dependent upon its ability to export some product. In the case of manufacturing endeavors the amount of goods and the raw materials used in production are easily counted and from this the total basic activity can be computed. Problems arise when one considers such enterprises like universities and military installations. Questions of measuring the amount of "production"
from these institutions to allocate to the supporting element of local employment are difficult to address and answer.

We are also aware that the multiplier concept is defined in many different manners but all versions concentrate on the leakages from the income within the city. Community multipliers can loosely be described, for a small regional economy, as the "...reciprocal of the rate at which income leaks out of the internal circular flow of income and expenditures." 56 Otherwise stated as 1/marginal propensity to save. The economic base multiplier and the national income multiplier, which is also stated as one over the marginal propensity to save, are in concept essentially equivalent. Thus, one of the most important factors for the economic base analyst to concentrate upon is the leakages from the local economy and the degree to which the economy is "open" or subject to successive rounds of spending and leakages.

Leakages from an economy are instrumental in defining the area's ability to sustain growth. For as the city becomes larger it becomes more and more self-sufficient, resulting from fewer leakages, which in turn yields a larger multiplier. Empirical research has shown that depending upon the type of specification method used, large cities generally tend to have large multipliers. Conversely, a small rural economy located near a larger city will tend to have a smaller multiplier because so many of the resident's dollars flow to the larger city to buy goods and services. Importation of these goods serve to drive the economy of the larger city while the smaller one either maintains its

present economic level or dies. A similar analogy applies to cities and their base-service industrial relationship.

The theoretical framework presented in these pages covers a period of some forty years of regional economics and multiplier derivation. It is by no means exhaustive but is adequate to meet the needs of our investigation. This background material will be drawn upon in the development of an economic impact model. Our attention will now be directed toward that end.
CHAPTER III

MODEL DEVELOPMENT

Frameworks

We have now seen the development of impact analysis from its infancy as a theoretical tool to its use in actual situations. Recurring throughout the years has been the acknowledgement that cities grow partially as a result of natural resource endowments and partially because of external autonomous demand for products or services. Internal growth of communities is a natural by-product of exogenous forces and has been the subject of many different models and approaches. Some of these analytical frameworks have been mentioned previously but to provide a summary of important ones we refer to Werner Hirsch's *Urban Economic Analysis*.

Hirsch provides a thorough appraisal of the advantages and disadvantages to the researcher of each of these. Of those in his schematic (reproduced here) we are most concerned with the export-base presentation.  

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Theoretical Base</th>
<th>Statistical-Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>External</td>
<td>Export-Base</td>
<td>Allocation</td>
</tr>
<tr>
<td>Internal</td>
<td>Resource-Base</td>
<td>Extrapolation</td>
</tr>
<tr>
<td>Mixed</td>
<td>Input-Output</td>
<td>Shift and Shares</td>
</tr>
<tr>
<td></td>
<td>Income-Expenditure</td>
<td></td>
</tr>
</tbody>
</table>

Suffice it to say that each of the remaining methods rest on firm theoretical foundations and seek to analyze the urban or regional economy from a unique perspective. Because little has been published to indicate clear superiority of one method over others, analysts are free to use the method they feel to be most appropriate. For our study of Malmstrom Air Force Base, the export base approach is best because of the clear dependence of the community on the Base for economic survival.

What, then, is the exact perspective of the export base theory? Hirsch describes it in this manner:

In the export-base framework, the city is seen as if it were a firm responding to a variety of market forces, in competition with other cities. Thus, the export-base framework perceives local growth, decline, and short-term instability as being fueled primarily by what happens to the city's export markets. As these markets change, they influence levels of activity and industry mix in the city, bringing about changes in local markets, labor supply, investment, public services and so forth; all of which, in turn, affect the city's comparative advantage and therefore its ability to sell in export markets.²

Within export-base methodology the researcher can use any one of three methods to determine export and base employment and industry or community multipliers. These are the Location Quotient, Minimum Requirements, and Linking. The industrial multiplier is generally referred to as the employment multiplier and reflects the amount total employment will change based upon changes in basic employment. The latter, the community or economic base multiplier, is a measure of the ability of incomes in an area to change in response to changes in external or exogenous factors. This figure is a function of "...the propensity to

²Ibid., p. 184.
consume and the complement of the propensity to import. In this sense the income multiplier is a Keynesian multiplier which substitutes the income earned from exports for the dollars realized as a result of external investments.

The economic or income multiplier associated with a basic unit has been the subject of many investigations. Two of the most common types of activities examined have been military installations and universities. Before we develop a model of Malmstrom Air Force Base (MAFB) an examination of how other universities and military facilities have been described would be useful. Four different expressions or models of community economic impact will be discussed. They are the products of Messer, Terner, Weiss and Gooding, and Wilson and Raymond.

A Single Industry Town

Stephen D. Messer, in a Market Analysis for the Single-Industry Community, observes that in examining a single industry town the sole export industry must first be described. In his description of the University of Connecticut, he divides the overall economic impact of the University into direct and indirect impact. Direct impact would be the increased need for books, rooms, faculty, and staff, etc., as a result of growing enrollments. Indirect impact would be the long run demand for buildings, local housing, and local services due to the influx of students. Referring to the University population he writes:

...students, the largest segment of this population, generally do not rely upon the university for their income; rather, they represent a segment of the 'export' demand for local goods and

\[3\] Ibid., p. 190.
services to the extent that the money they spend locally for education, subsistence and entertainment comes from outside the market area.4

The impact of a university must not be viewed solely from the perspective of drawing from the community. Often human capital in the form of part-time labor or charitable contributions is transferred to the city. By the same token were the university to act completely independent of the town by supplying its own housing and service needs its impact would be altogether different than if it were totally dependent upon the town. Additionally, the university employs professors and administrators who may have spending characteristics vastly different from the local community. Coupling this with generally low incomes typically associated with students one can theorize that the income multiplier associated with a university is low.5 Empirical investigation of this issue supports this hypothesis in most cases. Combining all separate activities, be they purchasing or spending, into a comprehensive model was done graphically by Messer. Figure 1 is his description of the relationship between the University and Storrs, Connecticut.

Despite the apparent simplicity of this model it does convey the feeling that this particular university community, as a whole, is involved in the city's economic life through direct private, public, and university purchases. A point where this particular schematic is deficient is that

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Fig. 1. The University of Connecticut and Storrs, Connecticut

it gives no perspective of the tendency or the rate at which purchases are made. In other words, it neither provides the sources of income to the university as a whole nor gives any indication of whether on campus student purchases exceed off campus student expenditures. A final fault is that income accruing to the city via direct payments in lieu of taxes is not shown.

Fort Devens

More complex and mathematical models exist and have been applied to both universities and military installations alike. Ian D. Terner developed a mathematical description of the interaction between Fort Devens and Ayers, Massachusetts. Briefly, he began by dividing the economy into the two segments of Local and Export as follows:

$$Y = L + X$$

where:  
Y = the total economy  
L = local or service sector  
X = export or basic sector.

Location quotients were employed to divide the town's population of some 2,000 workers into basic and service sectors. A 69 industry, 3 digit SIC division classification was used. This information used in a regression analysis yielded an employment multiplier of 1.2. Integrating this into his complete and expanded equation resulted in the following model:

$$Y = (a+bY) + (M_x) + (mMW+pMP+T_r+c_1CW_1+c_2CW_2) + (Em+Er) + (Gm+Gr)$$

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6 Terner, Economic Impact of Military Installation on Surrounding Area, p. 73.

7 Ibid., p. 72.
where: \( Y \) = total economy

\( a \) = autonomous local economic activity

\( b \) = product of the marginal propensity of local residents to consume locally multiplied by the induced economic activity generated per dollar of local spending.

\( M_X \) = manufacturing for export

\( m \) = average propensity of the military to spend locally

\( MW \) = total military wages

\( p \) = average propensity of the Post to procure locally

\( MP \) = total military procurement

\( T \) = trade exported to the region and beyond

\( c_1 \) = average propensity of civilian workers of the Fort who live within 15 miles to spend locally

\( c_2 \) = average propensity of civilian workers of the Fort who live beyond 15 miles to spend locally

\( CW_1 \) = total civilian wages of Post employees who live within 15 miles

\( CW_2 \) = total civilian wages of Post employees who live beyond 15 miles

\( E_m \) = out-commuter employment to the military

\( E_r \) = out-commuter employment to the region and beyond

\( G_m \) = governmental services exported to the military

\( G_r \) = governmental services exported to the region and beyond

Clearly we can see that this model not only identifies the leakages from the economy but leads to a description of the multiplier. Terner states:

...the reciprocal of \( 1-b \) equals the value of the multiplier, which, when multiplied by a change in exports, will yield the total change in the economy. This total change is composed of the original change in exports plus induced local activity.\(^8\)

\(^8\) Ibid., p. 74.
Based upon his computed employment multiplier of 1.2 and the inclusion of the leakages in his model it should be obvious that this particular military installation may not be a significant economic unit in the life of Ayers. Terner postulates that this is due to the proximity of the town to Boston, Massachusetts; the tendency for military personnel to spend on the base; and the degree which the Department of Defense supports the post with supplies and equipment. Similarly, a significant impact of the Fort upon the community of Ayers, Terner concludes, lies in the housing and education sectors; housing because the post may expand beyond the existing capabilities of the base, and schools because Federal Impact funds largely support the school system.

Perhaps the most significant aspect of his study rests upon the determination of the leakages. Relying upon a direct mail questionnaire, a comprehensive survey of 1,000 soldiers was conducted. Of this sample, 401 were actually used to calculate spending traits. The population surveyed consisted of 10,470 military members and another 1,900 civilians. Civilian consumption propensities were based upon the spending traits of all civilian workers in Massachusetts. (This may prove to be a weakness of his method.) The results of his survey led him to draw a preliminary conclusion, "...that a typical military installation will capture approximately 35-40 percent of the spending of its personnel, but that neighboring communities will capture varying amounts according to their size and range of commercial facilities."

We will not elaborate further upon his results because they substantiate the phenomenon that the spending of military installations,
under certain conditions, tends to be diffuse and generates a low multiplier. Low multiplier values in and of themselves are deceptive. Terner goes on to say that 437 jobs are export related, i.e., dependent upon the post, with another 88 being induced type positions associated with the 437. Thus, should the post close then 525 jobs would be lost. An additional 111 would be lost due to "shrinkage" in both local and regional impact, and some 22 more would be lost because of the 1.2 multiplier. In other words, fully one quarter (658) of Ayer's working population would lose their jobs due to the closing of the post. Offsetting this would be the tendency of this export population to seek employment in jobs outside Ayers while still residing within the community.

One last comment on Terner's model before going on to the Weiss and Gooding model. It is significant to note that in the final model Terner included factors relating to the exports of the community of Ayers in various sectors such as manufacturing and regional export. This is significant because it is an attempt to disaggregate the export base of the community into portions directly dependent upon the Fort and those relying upon other basic activities.

Differential Employment Multipliers: A Case

A different approach to employment multiplier specification was developed by Weiss and Gooding and yielded results surprisingly similar to Terner's. The basic method employed was the same but where Terner disaggregated the exports of the community of Ayers, Weiss and Gooding elected to build their model about three different economic systems. Other differences exist between their studies but the most notable is

10 Ibid., p. 107.
that Terner examined a small rural town with a large military installation and Weiss studied an area with three relatively large installations which were also in proximity to a major metropolitan area. 11

The model found in their report is composed of three parts. They are: 12

Total export employment = x_1 + x_2 + x_3

where: x_1 = private export employment
x_2 = civilian employment at Portsmouth Naval Shipyard
x_3 = total employment (military and civilian) at Pease Air Force Base

Location quotients and a priori determinations were used to allocate base and service industries. Benchmark economies employed were the United States, New England, and New Hampshire in an effort to accurately classify the importance of various activities to the region under study.

The authors estimated the three differential employment multipliers from linear regression of this equation. 13

S = Q + b_1 x_1 + b_2 x_2 + b_3 x_3

where: S = service employment
b_1, b_2, b_3,..., b_r = multiplier coefficient estimated for each sector
Q = a constant
1+b_i = total employment multiplier

Actual multiplier values were found to be: 14

Export Employment Category | Multiplier
---|---
$x_1$: Private Export Employment | $k_1 = 1.8$
$x_2$: Civilian Employment at Portsmouth Naval Shipyard | $k_2 = 1.6$
$x_3$: Employment at Pease Air Force Base | $k_3 = 1.4$

(All data used in these computations came from secondary sources such as state and federal government employment statistics.)

Several conclusions were drawn from these computations. Namely that private export employment has a higher employment multiplier because of the tendency of the private citizens to purchase goods and services from the retail outlets of the community. As for employment at the shipyard, the high wages relative to area wages draw employees from distances greater than they would travel to shop. Finally, the employment multiplier of only 1.4 for the Air Base is not theoretically low. Rather, it would be expected because of the propensity for military members and authorized individuals to spend their incomes at Base facilities. In their words, "...personnel stationed or employed at a large defense base have relatively few economic ties to the surrounding community."\(^{15}\)

From these two military related studies several general conclusions can again be drawn. First, that the magnitude of the impact of these installations is a function of its size, the size of the area, and the type of installation. Second, for the most part, these facilities are basic to the community but generally tend to be self-sufficient. This causes such regions to experience a relatively high sales rate but with little substantial prosperity.\(^{16}\) Second round leakages from an

\(^{15}\) Ibid., p. 5.

\(^{16}\) Terner, Economic Impact of Military Installation on Surrounding Area, p. 111.
open economy explain this. Third, the magnitude and size of calculated employment multipliers is related to the degree of aggregation employed throughout the analysis. And finally, of all possible data sources used to determine multipliers, income-expenditures is best, but because of the greater availability of raw information, employment is frequently used.

University Impact

The final model to be reviewed is one developed by Wilson and Raymond. Using the system of payroll to sales ratios, the authors offer a more refined multiplier specification technique. Their work demonstrates that previous studies have resulted in overstated and exaggerated employment multipliers. The main reason for overstatement lies in the tendency for improper classification of basic and service activities which result in an over allocation of employees to the basic sector. This fault directly contributed to an overstated multiplier of 1.82 being calculated for Kent State University. A brief discussion of their technique follows.

Wilson and Raymond divided the spending of the university community into fourteen categories. Survey results of a sample of residents yielded an estimate of their propensity to spend locally in each of these categories. These propensities are designated as the term $a_i$. A term, $b_i$, is used to denote the payroll to sales ratio for each category as a proxy measure of value added. In their words, "...if total university

\footnotesize{17} Wilson and Raymond, "Economic Impact of University on Local Community," p. 244.

\footnotesize{18} Ibid., p. 135.
spending was \( x \) dollars, then \( a_i x \) dollars would be spent in category \( i \) within the local community and \( b_i x \) dollars of local value added would be generated in category \( i \). Continuing, their mathematical expression of a model is:

\[
Z = b_1a_1x + b_2a_2x + b_3a_3x + \ldots + b_n a_n x
\]

and redefined as: \( z = x\Sigma b_i a_i \), where \( \Sigma b_i a_i \) can be reexpressed as \( m \).

Accordingly, the total impact of the university is:

\[
T = x + mx + m^2x + m^3x + \ldots + m^n x
\]

or \( T = x/(1-m) \) where \( 0 \leq m < 1 \)

Thus, the local community multiplier becomes \( 1/(1-m) \) or \( M = \frac{1}{1-m} = \frac{1}{1-0.083} = 1.09 \). The figure .083 is an expression of \( a_i b_i \) summed for each of the fourteen types of expenditures surveyed.

Wilson and Raymond conclude their study by computing the employee equivalents (EE) within the Kent community as a result of student spending within the economic area. The usefulness of this can readily be seen in this context. To determine the impact of Kent State upon the Kent community they add the employee equivalents to total school employment of 3,082 yielding total basic employment of 3,979. When expanded by the employment multiplier of 1.09 then a total impact of 4,337 is realized. Subtracting the basic figure from this results in a service component of 358.

What is significant about this method as opposed to alternate procedures? The authors compare their system of EE to the Albuquerque-Cook system which developed EE "by dividing student spending by

\[\text{\cite{ibid.}} \quad \text{\cite{ibid., p. 136.}} \quad \text{\cite{ibid., p. 142.}}\]
average wage income in the Albuquerque area.\textsuperscript{22} Had this method been applied to Kent State, Wilson demonstrates that a multiplier of 1.82 and total employment impact of 9,511 would have been estimated, markedly larger than those reached by the alternate method.

A second important point to remember about this study is that the $a_i$, the propensity to spend locally, was calculated from survey data. This underscores the need to acquire primary data about a population's income and spending habits. From this data the leakages which are crucial to the correct specification of local multipliers can be identified.

One final note. This article and a similar one, also by Wilson,\textsuperscript{23} clearly points out that community wide multipliers tend to be average in nature. That is, when applied to specific activities they may be too large or too small. For example, a military plant may have a multiplier of 1.2 while the local brewery has one of 2.8. The average, 2.0, when applied to the brewery would understate its impact and when applied to the military would overstate its influence. Care and attention on the part of the analyst are, therefore, in order when considering the multiplied impact of an activity upon a city or region.

Malmstrom Air Force Base

Up to this point our primary focus has been to develop a firm theoretical background in economic base analysis, to briefly discuss the work of other researchers, and then to examine a few models pertinent to

\textsuperscript{22}Ibid., p. 139.

our topic. Since we are considering the economic impact of Malmstrom Air Force Base upon the Great Falls Standard Metropolitan Statistical Area (G.F.SMSA), let us begin with a simple schematic presentation of this economy as in Figure 2.

The Malmstrom Air Force Base Office of Management and Budget publishes an annual Economic Impact Statement which describes the magnitude of the Base's impact. Table 2 indicates, for 1976, the magnitude of this impact on the North Central Montana economy. North Central Montana is defined as the delimited area of concern because the Air Force accounting system prevents concise measurement within the SMSA. Therefore, when interpreting these amounts with respect to the SMSA the observer must be aware that many of these dollars flow through the Base from national sources to remote sites without being spent within the community. Nevertheless, the information does give the casual viewer a perspective and a frame of reference about the number of dollars spent by the Base in the local economy.

The total economic impact of the Base upon the SMSA could be described as a function of the total dollars flowing within each subgroup and then their subsequent spending within the economic unit. We can define the amounts remaining locally in each of the above categories using the following formula:

\[
\text{Total impact} = \text{local SMSA spending of: Base + Military Members + Civilian Employees + Contractors}
\]

Legend:

W + S = Total wages and salaries: Military and Civilian
DOD-S + E = Department of Defense purchased supplies and equipment
Ex-Region Spending = Purchases by MAFB and its personnel (Military and Civilian) beyond SMSA
L.P. = Base local purchases for utilities, services, fuel, commissary, clubs, etc.
C.C. = Charitable Contributions
Housing = Mortgages and rents: Military and Civilian (incomes from Base jobs)
Savings = Investments and payments to local institutions
Contractors = Wages, salaries, purchases by contractors
P.S. = Personal spending in SMSA derived from Base jobs and incomes

Fig. 2. Economic Impact of Malmstrom AFB on the Great Falls SMSA: A Model
TABLE 2

PAYROLL DISTRIBUTIONS OF MALMSTROM AIR FORCE BASE

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Military and Civilian Salaries</td>
<td>$43,851,000</td>
</tr>
<tr>
<td>Military Personnel Travel &amp; Property Shipments</td>
<td>885,600</td>
</tr>
<tr>
<td>Utilities and Rents</td>
<td>1,816,000</td>
</tr>
<tr>
<td>Communications</td>
<td>495,200</td>
</tr>
<tr>
<td>Purchased Equipment Maintenance</td>
<td>367,000</td>
</tr>
<tr>
<td>Facilities Maintenance &amp; Construction</td>
<td>7,576,900</td>
</tr>
<tr>
<td>Contractual Service</td>
<td>4,885,800</td>
</tr>
<tr>
<td>Aircraft Fuels</td>
<td>2,786,300</td>
</tr>
<tr>
<td>Supplies &amp; Equipment</td>
<td>6,630,500</td>
</tr>
<tr>
<td>Local Commissary Purchases</td>
<td>2,900,000</td>
</tr>
<tr>
<td>Local Purchases for Clubs &amp; Exchange</td>
<td>1,639,000</td>
</tr>
<tr>
<td>Federal Impact Funds</td>
<td>1,188,700</td>
</tr>
<tr>
<td>CHAMPUS</td>
<td>2,477,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$77,499,600</strong></td>
</tr>
</tbody>
</table>


Let us put this into a more simple mathematical relationship of:

\[ T = G + M + CP + C \]

where: \( T \) = Total impact in G.F. SMSA  
\( G \) = Base related spending  
\( M \) = Military member wages  
\( CP \) = Civilian employee wages  
\( C \) = Contractor payments

Which may be further expended to yield local spending within each of these subgroups or components via:

\[ TG = \lambda_p(T + U + C + Co + F + Su + Bx + H) \]  
\[ TM = \lambda_p(T + Ho + U + C + Co + F + G + H + In) \]  
\[ TCP = \lambda_p(T + Ho + U + C + Co + F + G + H + In) \]  
\[ TC = \lambda_p(T + U + C + Co + Su + F + W + Ca) \]

where: \( TG \) = Total impact of the Base component  
\( TM \) = Total impact of the military Members component
TCP = Total impact of the civilian Employees component
TC = Total impact of the Contractors component
sp = Propensity to spend locally
T = Transportation of goods and people
U = Utilities
C = Communications
Co = Construction
F = Fuel, heating, etc.
Su = Miscellaneous supplies
Bx = Commissary and exchange purchases
H = Local hospital and CHAMPUS spending
G = Local retail and grocery spending
Ho = Housing expenses (mortgage and operation)
In = Insurance, investments
W = Wages and capital spendings of contractors

Terner described Fort Devens by this equation, modified here, as:

\[ T = (a + bT) + G + M + e^p + r^C \]

where:
- \( T \) = total impact
- \( a \) = autonomous local economic activity
- \( b \) = product of the marginal propensity of local residents to consume locally, multiplied by the induced economic activity generated per dollar of local spending
- \( p \) = average propensity of the Base to spend within the SMSA
- \( G \) = Base spending
- \( m \) = average propensity of military members to spend locally
- \( M \) = military member wages
- \( c \) = average propensity of civilian employees to spend locally
- \( P \) = civilian employee wages
- \( r \) = average propensity of contractors to spend locally
- \( C \) = payments to contractors.

Solving for \( T \) we have:

\[ \]

\[ ^{25} \text{Terner, Economic Impact of Military Installation on Surrounding Area, p. 72.} \]
Because the above model for Malmstrom Air Force Base draws heavily upon that of Terner's it is logical to assume that the solution for $T$ is applicable to both models. Here the factor $\frac{1}{1-b}$ becomes the marginal propensity to consume locally in each of the components of Base expenditures, Military wages, Civilian wages, and Contractor payments. Therefore, by merely substituting the values of the local spending in each of the components into the above formula, an income multiplier can be computed. However, this is easier stated than performed because identification of the dollars flowing into the economy from the Base is difficult to measure and isolate. Because of this, a simplified method of determining the multiplier of the Base will be presented in the next chapter. This is not to say that the above mathematical expression is incorrect, but that an equally accurate but simpler method to arrive at the multiplier exists. Payroll to sales ratios, as developed by Wilson and Raymond, are preferred because of the ease with which one can calculate the expenditure or income multiplier.

Throughout this and the preceding chapter we have demonstrated that for any given locality a variety of multipliers can be computed. Not only variety in terms of type but the value for any location or activity may have a range of several points. These variations are dependent upon the relationship between the delimited area, the size of the installation, and the method of economic base analysis used. Comparing one multiplier with another is unfair without properly annotating the size of the area and/or the method employed. Comparisons, on the
other hand, are useful because they do tend to support the theories which contend that multipliers are locality and institution peculiar. On the review of Table 3 which lists the range of values assigned to multipliers, bear these thoughts in mind.

In this chapter we have examined four models used to describe the economic impact of universities and military installations on their local communities. Of those discussed, two models described military facilities while two discussed large metropolitan universities. Based on information gained from these and many other studies, a mathematical expression of the Malmstrom Air Force Base-Great Falls relationship was advanced. In the following chapter a procedure for quantifying this relationship will be presented.
TABLE 3
COMPARISON OF MULTIPLIERS

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Installation</th>
<th>Approximate Area</th>
<th>Method</th>
<th>Multipliers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Facility/Region</td>
<td>Population</td>
<td></td>
<td>Employment</td>
</tr>
<tr>
<td>Terner$^a$</td>
<td>Fort Devens</td>
<td>12,000/2,000</td>
<td>L.Q., Regression</td>
<td>1.2</td>
</tr>
<tr>
<td>Hildebrand &amp; Mace$^b$</td>
<td>Los Angeles County</td>
<td>unspecified</td>
<td>Regression</td>
<td>1.24</td>
</tr>
<tr>
<td>Bellinger$^c$</td>
<td>Univ. of Alabama</td>
<td>unspecified</td>
<td>unspecified</td>
<td>4.35</td>
</tr>
<tr>
<td>Weiss &amp; Gooding$^d$</td>
<td>Pease AFB &amp; Portsmouth Shipyard</td>
<td>15,233/59,156</td>
<td>L.Q.</td>
<td>1.8, 1.6, 1.4</td>
</tr>
<tr>
<td>Harvard Univ.$^a$</td>
<td>New York, N.Y., N.S., Conn.</td>
<td>unspecified</td>
<td>unspecified</td>
<td>3.36</td>
</tr>
<tr>
<td>Woodcock$^e$</td>
<td>Anaconda Co.</td>
<td>1,000/80,000</td>
<td>L.Q.</td>
<td>3.5</td>
</tr>
<tr>
<td>MAFB$^f$</td>
<td>North Central Mont. &amp; MAFB</td>
<td>6,000/80,000+</td>
<td>unspecified</td>
<td>2.5</td>
</tr>
<tr>
<td>Tiebout$^a$</td>
<td>Winnetka, Ill.</td>
<td>unspecified/15,000</td>
<td>Export Base</td>
<td>1.05</td>
</tr>
<tr>
<td>Federal Reserve Bank of Chicago$^a$</td>
<td>Fort Wayne, Ind.</td>
<td>unspecified/205,000</td>
<td>unspecified</td>
<td>1.74</td>
</tr>
<tr>
<td>Hanks$^g$</td>
<td>Hill AFB</td>
<td>20,100/234,000</td>
<td>Input-Output</td>
<td>1.34</td>
</tr>
</tbody>
</table>

$^a$Terner, The Economic Impact of a Military Installation upon the Surrounding Community, pp. 83-84.
TABLE 3 Continued


gJ. Whitney Hanks, Hill Air Force Base Impact on Utah's Economy, Bureau of Economic and Business Research, University of Utah, Spring, 1974: p.
CHAPTER IV

THE PROCEDURE

We have introduced the general framework of economic base analysis, reviewed the work of other researchers, and set the stage for an examination of Malmstrom Air Force Base (MAFB) and its economic impact. Such an analysis must be theoretical in nature because much of the requisite data for empirical verification is not available. It is disguised, unintentionally, by the Air Force system of accounting, disbursement, and overall funds management. However, once the exact data requirements are identified procedures of collection may be developed. The emphasis in this chapter will be to develop a critique of the economic impact statement currently used by MAFB and to offer a more refined technique for determining the multiplier for the Base.

Malmstrom AFB Economic Impact Statement

Following prescribed Air Force directives, officials of the Management Analysis Office annually compile a statement of the economic impact of Malmstrom AFB upon "the economy of Central Montana." Information about the civilian and military population trends, wages, and

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1 Malmstrom Air Force Base, Office of Management Analysis. Economic Impact: Jan. - Dec. 1976, 20 April 1976, mimeographed, Malmstrom Air Force Base, Montana. p. i. At the outset, in all fairness to the Malmstrom officials, we should recognize the public relations intent of this document. As a definitive statement upon which to plan, within the sphere of economic base analysis, it is somewhat general and could lead to incorrect conclusions.
spending, as well as expenditures of the Base as a unit are included in this statement. The total economic impact is computed by multiplying the total of all wages and non-pay related spending by a 2.5 multiplier. In 1976 this yielded a total impact of $193,749,000.2

Implicit throughout the analysis is that the Base is indeed a basic unit in the local economy. This is clearly evident and can be taken without dispute. However, three serious deficiencies exist with their statement: area delimitation, data adjustment, and surveys. We will address these issues in depth below. These items comprise the basic elements necessary to produce a useful impact statement and without any one or all of them being adequately addressed in such a study, the results must be questioned and used with extreme caution when making future economic decisions.

Because Malmstrom AFB acts as a disbursing point for dollars and supplies going to the remote stations of Kalispell, Opheim, Havre, and Glasgow the authors of the MAFB impact statement assume that the span of the Base's impact is bordered by these communities. If this is assumed to be the area of economic impact then transactions from the Base to such isolated facilities should be included. However, such an assumption is misleading. Merely because the Base supports these sites does not necessarily mean that its economic influence falls into the intermediate communities. A better way to approach this issue would be to state that each of these facilities has an impact upon its own local area. The money and supplies channeled to them from MAFB are simply an expression of their exogenous income. Measuring dollar flows to any other region

2Ibid., p. 17.
may tend to overstate the overall importance of the Base. Malmstrom AFB's impact is best measured in the area immediately surrounding the Base. The Standard Metropolitan Statistical Area (SMSA) is the best geographic area to use because of the abundance of spending, population, and income data already gathered. The remainder of this discussion will therefore, center upon the relationship between the Base and the Great Falls SMSA.

Once the region to be studied has been identified data must be gathered. The data necessary for this economic impact analysis must be obtained for each of the four components of our model: Government (Base), Military, Civilian, and Contractor. For the Base, and portions of the Contractor unit, it may be practical to review local purchase requisitions to determine the amount of dollars going to local SMSA suppliers. Of the three ways available to gather this information--sampling, arbitrary percentage adjustment, and counting each requisition--sampling is preferred. Properly conducted sampling of Base expenditures to SMSA units will ease the task of examining all requisitions and purchase orders. This would certainly be preferred to individual examination of all spending and would produce statistically acceptable results. Unfortunately the authors of the statement employ the arbitrary adjustment technique. Although it is understandable why this is done (the sheer volume of daily transactions precludes individual review)\(^3\) nevertheless, this practice could yield erroneous results.

An incorrect statement of the impact of the Base can result from improper or imprecise counting of spending within the SMSA. For example, 

suppose that the total off-base commissary purchases in the "central Montana economy" is arbitrarily reduced by 20 percent to determine local SMSA spendings. Without precise knowledge of this rate it is only speculation that this is the correct amount. Additional study of this issue, supported by sampling of off-base expenditures, would ultimately determine the accuracy of arbitrary adjustments.

Further compounding this is the problem of counting supply and equipment transfers made by the Base to its remote sites. The central question which one must consider is whether or not such transfers are properly considered to be spending by the Base. Often these transfers are merely items which flowed through the installation and were counted as Base expenditures merely to accommodate the Air Force accounting system. Adopting the SMSA approach would exclude these dollar amounts while using the "Central Montana" perspective would certainly include them. We have indicated why it is not proper to include them in Base spending, and the only way to correctly account for their potential impact is via sampling to determine SMSA spending patterns.

The spending habits of the remaining components, Military and Civilian, may also be determined through sampling. If properly conducted, direct sampling of these groups can be useful for determining their spending habits in the SMSA. Correctly constructed surveys contribute to this end by yielding information about local on-base and off-base spending patterns useful for estimating an expenditure multiplier.

The information necessary to do this is best obtained from a personal income and spending survey which asks the amount of a family's total gross income and then how it is spent both on-base and within the SMSA. A copy of the most recent Base survey is found in Appendix 1.
It violates two of the requirements necessary to determine a correct multiplier and to produce a useful impact statement. First, it does not attempt to compute a family's total gross income and; therefore, computing local spending propensities from it is impossible. Second, the area is defined as "Central Montana" which we have already indicated is conceptually too large for use in determining the economic impact of the Base. Local spending propensities by the Military and Civilian components of our model may be obtained from the author's revised survey as found in Appendix 2. This form defines the impact area and then inquires about income and spending both on-Base and within the SMSA. This approach is advantageous because it seeks to separate spending from the income stream into on-Base, within the SMSA, and beyond the boundaries of the SMSA. Of these three the only ones significant to our study are on-Base and within the SMSA.

Because this type of information, personal income and spending, is best gained by sampling using mail questionnaires, a word about the sample size and procedure is in order. If we assume that the range of incomes associated with the Base is normally distributed and roughly equivalent to that of the nation as a whole, then the requisite sample size may be computed from the formula found in Clover and Balsley's Business Research Methods.  

\[
n = \left( \frac{\sigma}{\overline{X}_s - \overline{X}_p} \right)^2 \frac{z}{\overline{X}}
\]

where \( n \) = sample size

\[
\sigma = \text{known or estimated standard deviation of the population}
\]

\[
\bar{X}_s - \bar{X}_p = \text{estimated deviation of sample mean from the population mean}
\]

(or the amount of tolerable deviation from the population mean)

\[
z = \text{standard normal deviate (1.96 for a 95% confidence interval}).
\]

Further, assuming that the \( \sigma \) is estimated to be 1,500 dollars, \( \bar{X}_s - \bar{X}_p \) is 100 dollars and a 95 percent confidence interval is used, a sample size of 859 results. This equates to about 14 percent of the estimated Base population of 6,000 employees. The Base does not follow this or a similar procedure. They seek to have 20 percent of all eligible members polled.\(^5\) Drawing a sample size greater than 14 percent is not improper but without sound statistical controls being applied to the sampling procedure one could argue that the spending characteristics derived from this procedure are suspect.

Let us place the above critique in perspective before continuing with a discussion of the multiplier specification procedure. We know that three of the elements necessary to yield a reasonable state of a basic industry's economic impact are: 1) a good institutional spending data base, 2) well delimited and easily managed geographic area, (from a data perspective), and 3) surveying for personal expenditure patterns. On all three points the Base's economic impact analysis is deficient. A logical outgrowth of their results would be the conclusion that the Base is basic to all of "Central Montana" and Great Falls as well. Accordingly one could conclude that much of the income and expenditure dollars derived from the Base fall into this area in a somewhat uniform manner because their analysis does not indicate the differential impact of these dollars.

\(^5\) Personal interview with J. Caldwell.
The most likely impact with respect to this area is for the largest share to fall within the SMSA and gradually be funneled to the neighboring communities at a diminishing rate and in varying amounts.

Terner addresses this point by saying that the principle impact of Fort Devens, in terms of retail sales in the community, falls within 15 miles of Ayers (the location of Fort Devens). This amounted to 3.2 million dollars while only .7 million dollars were spent beyond this distance.  

Procurement of military and exchange supplies show a vastly different characteristic in that 1.7 million dollars were spent within 15 miles while 14.1 million dollars originated beyond this distance.

Similarly Weiss and Gooding have concluded that:

Defense installations, whether oriented to manufacturing or non-manufacturing functions, purchase only a minor portion of their total materials and operating supplies from the community in which they are located. This is particularly true when they are situated in a small area such as Portsmouth. The vast majority of purchases for defense installations are supplied through nation-wide government supply channels. Thus, even though the Portsmouth Naval Shipyard is a large manufacturing plant employing mostly civilians, its impact on the Portsmouth economy is less than the impact of the typical private export-oriented firm. Private firms have less specialized input requirements and they are able to obtain a greater proportion of their materials and supplies from local industries. Also, of course, they rarely provide their personnel with services that are competitive with local businesses.

This is not to say that what Terner and Weiss deduced is true for Malmstrom. It may well not be the case. What they have established, however, is that

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7 Ibid., p. 63.

the economic impact of military facilities is subject to a variety of leakages and is dependent upon local spending propensities. Leakages from the economy vary for each sector and are a function of the type of products purchased and local value added in each sector. We can reasonably conclude that Malmstrom is subject to the same types of leakages and that much of its potential impact is mitigated by these drains. Accordingly, it may have a lower total economic impact and multiplier value than is generally claimed by the Base.

Multiplier Specification

Recall that in Chapter II we defined the multiplier as the reciprocal of the marginal propensity to save with savings defined as leakages from the economy. Applying this to the 1976 Economic Impact Statement for MAFB, which states that three-fifths of personal income is spent while two-fifths is saved within the Central Montana economy, we see that fully 40 percent of the dollars derived from the Base leak out of this income stream.

Using the Wilson-Raymond multiplier specification process we can gain an approximation of how the remaining 60 percent of these expenditures are distributed within the SMSA. A more meaningful multiplier value will result because this method considers spending in as many different categories as the analyst desires to examine and can be tailored to meet the spending characteristics of the Base as a whole or any one of the individual components (Base, Military, Civilians, and Contractors).

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9Economic Impact Statement, Malmstrom AFB, p. 15.
Much of the following discussion describing the Wilson-Raymond multiplier specification method draws heavily upon their article, "The Economic Impact of the University on the Local Community."\textsuperscript{10} Their approach is from the perspective of local value added. Value added is defined in this context as the contribution to the final value of a good or service provided by a local firm. This value is the difference between the sale price of a good and the retailer's total cost of the imported resources and is a reasonable measure of the dollars which remain in the local SMSA.\textsuperscript{11} From this a key assumption of the Wilson-Raymond method arises and it is that these remaining dollars are again respent within the area at a stable rate. The authors postulate that assuming stability in consumption spending throughout successive spending rounds the multiplier may be applied to each round in a uniform manner regardless of the spending sector—basic or service.

With the concepts of the procedure in mind we can now describe its precise methodology. A hypothetical application is found in Figure 3. Column 1 lists the various categories to be examined while Columns 2 - 5 are the spending components to be studied. Values in these latter columns are the proportion of total spending by that component in the specific category. Data for these columns is gained from income and spending surveys of each of the four components. By looking at the Durables Category (#12) we see, for example, that Contractors spent no money for

\textsuperscript{10}Wilson and Raymond, "Economic Impact of University on Local Community."

\textsuperscript{11}A useful measure of this local value added is the payroll to sales ratio because it is premised on the assumption that the majority of the local contribution is in the form of payrolls. Additionally, this type of data is readily acquired from published statistics.
<table>
<thead>
<tr>
<th>Spending Category</th>
<th>Spending Component</th>
<th>Proportion of Total Base Spending in SMSA X</th>
<th>Payroll To Sales Ratio</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Food/Sundries</td>
<td>.067f</td>
<td>.019f</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Insurance</td>
<td>.036g</td>
<td>.348h</td>
<td>.012</td>
<td></td>
</tr>
<tr>
<td>Car/RV Payments</td>
<td>.018h</td>
<td>.200h</td>
<td>.003</td>
<td></td>
</tr>
<tr>
<td>Savings</td>
<td>.007f</td>
<td>.250h</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Transportation           b</td>
<td>.098g</td>
<td>.340j</td>
<td>.033</td>
<td></td>
</tr>
<tr>
<td>Medical/Dental</td>
<td>.014g</td>
<td>.118h</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Donations</td>
<td>.012g</td>
<td>.103h</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Clothing</td>
<td>.048g</td>
<td>.142h</td>
<td>.006</td>
<td></td>
</tr>
<tr>
<td>Housing</td>
<td>.113g</td>
<td>.219h</td>
<td>.024</td>
<td></td>
</tr>
<tr>
<td>Household Operation</td>
<td>.076g</td>
<td>.397h</td>
<td>.030</td>
<td></td>
</tr>
<tr>
<td>Durable                  c</td>
<td>.01f</td>
<td>.07f</td>
<td>.04f</td>
<td></td>
</tr>
<tr>
<td>Hardware</td>
<td>.012i</td>
<td>.010f</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Fuel                     d</td>
<td>.006i</td>
<td>.020f</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>CHAMPUS</td>
<td>.054i</td>
<td>.118f</td>
<td>.006</td>
<td></td>
</tr>
<tr>
<td>Impact Funds             e</td>
<td>.026i</td>
<td>.400f</td>
<td>.010</td>
<td></td>
</tr>
<tr>
<td>Construction             e</td>
<td>.108i</td>
<td>.388f</td>
<td>.041</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>.729</strong></td>
<td><strong>.173</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 3. Hypothetical Multiplier Computation Procedure

a Includes local commissary purchases.

b Includes in and out bound shipping of goods.

c Includes expenditures by the Base for lumber, asphalt, cement, BX purchases, etc., for use on the Base.
Fig. 3. Continued

\(d\) Includes military related purchases of jet fuel and gasoline.

\(e\) Includes spending by a contractor for use on the Base.

\(f\) Arbitrarily determined.

\(g\) Malmstrom AFB, Economic Impact: Jan. – Dec. 1976, p. 3. Found by dividing the amount listed on this page by total Base expenditures of $77,499,600.

\(h\) Wilson and Raymond, "The Economic Impact of the University on the Local Community," p. 137.

\(i\) Malmstrom AFB, Economic Impact: Jan. – Dec. 1976, p. 17. Same divisor was used.


NOTE: Columns 6 and 7 may be gathered from Census of Business 1972, and Retail Trade: Area Statistics for Montana.

SOURCE: Adapted from Table 1 of Wilson and Raymond, "The Economic Impact of the University on the Local Community," p. 137.
these goods as a result of Base contracts. Summing these values horizontally for each category yields the proportion of total Base spending in the SMSA by the Base as a whole within that category. This is listed in Column 6. The payroll to sales ratio for each category is listed in Column 7. Multiplying Columns 6 and 7 and totaling produces the figure of .173 or the proportion of total Base spending which accrues as local value added. Column 6 totaled represents the proportion of total Base spending which has occurred within SMSA and equates to 72.9 percent.

Mathematically the above procedure is expressed as:

$$Z = b_1a_1x + b_2a_2x + b_3a_3x + \ldots + b_na_nx$$

$$Z = x \sum b_ia_i$$

where $Z =$ total dollar amount of first round spending which remains in the local SMSA

$a_1, a_2, a_3, \ldots, a_n =$ the Column 6 values for each category 1, 2, 3, \ldots, n.

$b_1, b_2, b_3, \ldots, b_n =$ the Column 7 values for each category 1, 2, 3, \ldots, n.

$x =$ Total Base Spending (Military + Base + Civilian + Contractor). Let us denote $\sum b_ia_i$ as $m$ and define $T$ as the total local impact of the Base dollars. Then:

$$T = x + mx + m^2x + m^3x + \ldots + m^n x$$

$$T = \frac{1}{1-m} x$$

$$T = \frac{x}{1-m}$$

where $m$ is between 0 and 1. The local multiplier formula becomes $\frac{1}{1-m}$.

\[12\]Wilson and Raymond footnote this discussion which is quoted in part. "This multiplier is based on the assumption that the propensity to spend locally and the distribution of expenditures are the same for both the service sector of the local population and the university sector. If this is true, $m$ is constant through successive rounds of spending. If, however, $m$ is different for the service sector, the size of the
Therefore, the multiplier for the Base, using our hypothetical sum of .173, computes to 1.209. If we were to multiply this by the total off-base expenditures of $77,499,600, would yield a local impact of $93,697,016. Two reasons account for this lower dollar impact when compared to that derived by the Base. First, in the hypothetical example, 72.9 percent of the Base related expenditures was spent within the SMSA. Second, relatively little value was added by local merchants indicating that many of the dollars used to pay for products were exported beyond the SMSA. This high leakage rate, as we have seen, serves to mitigate the potential economic impact of the Base upon the SMSA. This conclusion is in line with those reached by Terner and Weiss.

General Remarks

In this chapter we have identified several deficiencies in the Economic Impact Statement published by Malmstrom AFB. The Wilson-Raymond method was adopted to determine the multiplier resulting from spending

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13 Economic Impact Statement, Malmstrom AFB, p. 17. The $77,499,600 are the total dollars spent locally.
within the SMSA by the four components which compose the Base's spending units. Additionally, a more relevant and useful survey form was proposed. Although empirical testing of this method was not possible, we can speculate upon the probable multiplier for the Base. 14

The author would suggest that the value probably lies between 1.2 and 1.8. The principle supporting reason for postulating this range is the relative dependence of military members upon the town for certain goods and services. This, however, is tempered by the relative remoteness of the community and its need to import goods and services. Importing is always defined as a leakage and the greater the tendency for Great Falls to import, either because of the Base or internal growth, the less impact each successive round of spending has within the economy. Despite the large injection of Base derived dollars they are of little value if many of them are exported beyond the SMSA to pay for imported goods and services.

14 The author's revised survey, found in Appendix 2, was not used because the Base had previously surveyed in February 1978. Regulations governing surveys preclude two surveys covering the same topic from being conducted within the same calendar year.
Economic Base Analysis and Malmstrom AFB

As was clearly demonstrated by almost every author and work discussed in this study, knowledge of the economic base of a community is extremely important to local decision makers and planners. Frequently cities, through no fault of their own, have become inexorably tied to a particular industry or government supported activity. Reliance upon a single source of community income bears with it many pitfalls and problems. Principle among them is readjustment when the source of exogenous income is reduced or suddenly terminated. For this reason it is in the best interest of every locality to analyze its economic base and have knowledge of the possible impact should its base be changed.

Economic base analysis is one tool which can yield information about the relationship between a city and its supporting or basic activity. Properly conducted studies provide information about personal and corporate spending patterns, differential leakages, multipliers peculiar to specific industries, and potential gains or losses should any industry or group change its spending patterns, ceterus paribus. Because the total of the information to be gained from competently performed studies far exceeds the small monetary outlay for the project such endeavors are within the means of most communities and worth the expenditure.
These studies are useful to more than local planning boards. Depending upon the locality being studied, state and federal government leaders may be quite interested in the impact of governmental spending in specific localities. Federal Government spending whether as grants, subsidies, or wages is generally viewed by communities as a desirable source of income. Those regions tied to such exogenous income activity seek to have these monetary levels sustained because the accompanying opportunities to maintain full employment and economic growth are always present.

Within the sphere of economic base analysis, methods exist which allow localities to evaluate the degree of their dependence upon federal funds or any other exogenous source of income. The local multiplier is particularly useful for this purpose and may be derived from either the base-service employee ratio, local value added method, Input-Output, and/or other methods. Irrespective of the method selected, the need for accurate information is overwhelming.

Criteria for Useful Economic Impact Studies

Richard Andrews clearly demonstrated that the very first step in economic base analysis is to delimit the region of study. Depending upon the method used, the impact of a factory or a city, expressed via its multiplier, can vary with the size of the unit studied. Accordingly, one would expect a large city which supports most of its own needs to have a larger multiplier than a small rural farming community which must import products and services. Therefore, when measuring the economic

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impact of a particular institution upon a city or region, care must be taken to ensure that the area of probable impact is clearly and correctly defined.

Regions of probable economic impact must be delimited for practical as well as conceptual reasons. On the practical side the impact analysis should cover a region for which a reasonable amount of data either exists or can be easily acquired. Depending upon the installation being studied, regions the size of Portsmouth, N. H., or the Great Falls SMSA are adequate. In most cases individual activities do not impact upon an entire state. Therefore, from a conceptual viewpoint efforts to attribute the economic impact of a facility to a region as large as a state must be viewed with caution. Numerous examples exist where particular manufacturing plants have a large and significant impact upon a town but when viewed from the perspective of a state its influence begins to diminish. Accordingly, it would be safe to assume that the economic impact upon a specific locality by a military base, manufacturing plant, and local wholesale distributors differs in both the amount and radius of the area surrounding the activity. Thus, an economic base study should recognize this and attempt to focus on the sphere of probable influence.

Next, a model for the specific enterprise must be developed and/or adopted to fit the needs of the study. Countless models and techniques exist but the most widely employed are Location Quotients, multiple regression, and Input-Output. Despite the various approaches commonly employed, evidence indicated that the results of one method,
under similar conditions, will be roughly equivalent to those of another.2 The particular method to be used depends partly upon the preference of the analyst and partly upon the available data base. Input-Output studies, for example, require considerably more data than does the Location Quotient method. Nevertheless, the common denominator is the conceptual model which describes the installation being studied and without such an analytical framework the resulting analysis is of little value.

The final step in this process is the building of a usable and reliable data base. Data requirements are easily met by first referencing the particular model for the necessary data and then developing appropriate collection methods: The degree of precision with which the data are collected is a prime determinant in the overall validity of a study. Personal surveys and samples of institutional records provide information about spending habits and income sources and must be conducted with the utmost care and diligence. The analyst must not rely solely upon institutional records but should also draw upon published statistics to provide payroll to sales ratios and population and employment data. In the absence of spending and income data a specific multiplier cannot be computed. Thus, the only type of economic impact statement possible would be a general one. Failure to determine a specific multiplier, for all practical purposes, eliminates detailed impact analysis and prediction of future impact.

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Because of its importance to the economy of the community, Malmstrom AFB has been the subject of a number of economic impact investigations. One of these is published by the Base and is designed to demonstrate to the general public the magnitude of the impact. We have demonstrated that this document is deficient when evaluated against the three criteria of area delimitation, data reliability, and personal spending and leakage information. It may be useful for public relations but using its conclusions for future planning would be inappropriate and negligent, unless the conclusions are clearly substantiated. While not attempting to determine a multiplier, the statement infers that a multiplier of 2.5 is appropriate for this situation. As we have shown, this may possibly lead to an overstatement of the economic importance of the Base (although the contribution of the Base to the local economy is of considerable importance to local merchants and planners.)

The degree to which dollars derived from Base related employment and wages remain within the SMSA is critical to determining the extent of economic dependence placed upon the Base by the community. Varying spending patterns by each component of our model (on-Base, and within and beyond the SMSA) contribute to differential rates of leakage. Identifying these leakages yields an estimation of the propensity for dollars to remain locally. Thus, when determining the multiplier applicable to Malmstrom and the Base's local impact, one must quantify

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3For example, in 1976 the Base employed 5,100 Federal Military workers or about 40 percent of Cascade County's 12,500 workers. Of the total 107.4 million dollars in earnings within the county, 43.5 million dollars went to the Federal Military. Source: Polzin, Paul, "Montana's Economic Outlook: For Business, Labor and Government," Mimeographed. February 2, 1978.
spending leakages by each component in the two localities: on-Base and within the SMSA.

The multiplier of 2.5 used by the Base may possibly be appropriate for the region of Central Montana but it certainly is not correct for the SMSA. Following the procedure given in this study one should be able to compute a more accurate multiplier for the Base as it impacts on Great Falls. However, before this can be accomplished the data base, surveys, and samples must be revised to satisfy the requirements of reliability as discussed.

At this point we can only speculate on the probable impact of reductions in employment at Malmstrom on the economy of the SMSA. Without definitive data about local spending and leakages it is impossible to specify a multiplier which would be a useful prediction tool. The fact that a close tie exists between the basic employment of the Base and the service sector of Great Falls cannot be disputed. Given this relationship and our hypothetical multiplier we can theorize that if the Base employment were to be reduced by 60 employees then an additional 13 SMSA service workers would also be unemployed. However, this is purely speculative because the multiplier appropriate to the Base is, as yet, largely unknown. Until such time that it is defined, accurate prediction and economic impact analysis is difficult to perform.

Future courses of investigation regarding the economic impact of the Base should follow the lines of area delimitation, perfecting the institutional data base, and identifying differential leakages. In doing

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4 Found by multiplying 60 x 1.209 = 73.14 total jobs lost. Subtracting the 60 Base workers yields 13 service jobs to be eliminated.
so the resulting data will easily fit the Wilson-Raymond model producing a reasonably valid and accurate multiplier. Predictions of the probable impact of force reductions or expansion could be readily made from this data base and approach.
APPENDIX 1
**ECONOMIC IMPACT SURVEY QUESTIONNAIRE**

**INSTRUCTIONS:** This is a feeder form for a statistical study. The results will be used for planning and information. Your name or identity will not be used in any way. If you wish you may remove the address label before returning. Please cooperate and complete all requested information. Return completed questionnaire to 41SMW/ACM.

a. If BOTH husband and wife are working on base, ONLY ONE member should complete a questionnaire.

b. Use the blank space provided in each applicable question to enter your answer or circle the appropriate number to indicate your choice of answers. Provide response to every item.

c. Local area means central Montana.

<table>
<thead>
<tr>
<th>EMPLOYMENT STATUS</th>
<th>PAY GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Circle Appropriate Number)</td>
<td>(Indicate Respective Grade)</td>
</tr>
<tr>
<td>Officer ..................1</td>
<td>Officer 0-</td>
</tr>
<tr>
<td>Enlisted ..................2</td>
<td>Enlisted 3-</td>
</tr>
<tr>
<td>Civil Service, GS ...........3</td>
<td>Civil Service</td>
</tr>
<tr>
<td>Civil Service, WB, WS, WL, WG .........4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NUMBER OF YEARS FEDERAL SERVICE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>MARITAL STATUS (Circle Appropriate Number)</th>
<th>Single.....1</th>
<th>Married.....2</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>NUMBER OF DEPENDENTS RESIDING WITH YOU.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(If none, enter 0. Do not count yourself.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WHERE DOES YOUR SPOUSE WORK OUTSIDE THE HOME?</th>
<th>IF YOUR SPOUSE WORKS OFF-BASE, WHAT IS HIS/HER WORK?</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Circle Appropriate Number)</td>
<td>(Circle Appropriate Number)</td>
</tr>
<tr>
<td>Not Applicable ..................1</td>
<td>Not Applicable ..................1</td>
</tr>
<tr>
<td>On-Base - Active Military ........2</td>
<td>Teacher ..................2</td>
</tr>
<tr>
<td>On-Base - Civil Service ........3</td>
<td>RN, LPN, or Nurses Aide ........3</td>
</tr>
<tr>
<td>On-Base - Other ................4</td>
<td>Med, Dent, Lab, or X-Ray</td>
</tr>
<tr>
<td>Off-Base .......................5</td>
<td>Technician ..................4</td>
</tr>
<tr>
<td>Other .........................5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OTHER THAN YOU OR YOUR SPOUSE, IS ANY MEMBER OF YOUR HOUSEHOLD EMPLOYED OFF-BASE?</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Circle Appropriate Number)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IF THE RESPONSE TO &quot;H&quot; IS YES, INDICATE HOW MANY</th>
</tr>
</thead>
<tbody>
<tr>
<td>(If the response to &quot;H&quot; is NO, enter 0.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ARE YOU ENGAGED IN OFF-DUTY EMPLOYMENT?</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Circle Appropriate Number):</td>
</tr>
</tbody>
</table>
NUMBER OF CHILDREN IN LOCAL SCHOOLS:
(Indicate Number)
- Parochial School
- Grade School
- College
- Other

High School _______
Jr. High School _______

TYPE OF DWELLING:
(Circle Appropriate Number)

<table>
<thead>
<tr>
<th>ON-BASE</th>
<th>OFF-BASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Housing (Includes Off-Base Wherry)</td>
<td>Mobile' Home</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Dormitory/BNCOQ</td>
<td>Single Family Dwelling</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>BOQ</td>
<td>Apartment/Duplex</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Private/Gov’t Mobile Home</td>
<td>Motel/Hotel/Boarding</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

EXPENDITURES OFF-BASE - ALL PERSONNEL:
(Enter average monthly amounts spent in local area in WHOLE DOLLARS. DO NOT include money spent on base.)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>AMT</th>
<th>ITEM</th>
<th>AMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRANSPORTATION (Include vehicle payments, maintenance &amp; parts, gas &amp; oil, insurance, fares, etc.) (OFF-BASE ONLY)</td>
<td>HOUSEHOLD MAINTENANCE (carpets, drapes, painting, lawn maint. etc) (OFF-BASE ONLY)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOOD AND BEVERAGES (For home use) (OFF-BASE ONLY)</td>
<td>HARDWARE &amp; APPLIANCIE (OFF-BASE ONLY)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLOTHING AND INCIDENTALS (OFF-BASE ONLY)</td>
<td>MEDICAL/DENTAL (OFF-BASE ONLY)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RECREATION (Travel, food, entertainment, etc.) (OFF-BASE ONLY)</td>
<td>UTILITIES (gas, water, electricity, phone, etc.) (OFF-BASE ONLY)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOUSING (Rent or Mortgage pymt. Any type quarters or trailer site) (OFF-BASE ONLY)</td>
<td>CONTRIBUTIONS (church, charities, etc.) (OFF-BASE ONLY)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OTHER EXPENDITURES (OFF-BASE ONLY)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NUMBER OF AUTOMOBILES, TRUCKS, AND RVs IN YOUR LOCAL FAMILY: _______

NUMBER OF VEHICLES PURCHASED WITHIN THE LOCAL AREA IN THE LAST 12 MONTHS:
(If none, enter 0)
- New automobiles/trucks/recreational vehicles _______
- Used automobiles/trucks/recreational vehicles _______
- Motor bikes _______
MILITARY

To each of the following nine questions please circle the number next to the correct response.

1. What is your age?
   (1) 17 - 20    (3) 25 - 28    (5) 33 - 36    (7) 40 & above
   (2) 21 - 24    (4) 29 - 32    (6) 37 - 40

2. What is your sex?
   (1) Male   (2) Female

3. What is the size of your family? (Include only those living with you in Cascade County.)
   (1) Married - no children  (4) Divorced/widowed - no children
   (2) Married - 1 or 2 children  (5) Divorced/widowed - with children
   (3) Married - 3 or more children  (6) Single

4. What is your rank?
   (1) E1 - E3  (3) E8 - E9  (5) 04 & above
   (2) E4 - E7  (4) 01 - 03

5. What is your time in service?
   (1) Less than 1 year  (3) 6 - 10 years  (5) 16 - 20 years
   (2) 1 - 5 years  (4) 11 - 15 years  (6) 21 & above years

6. Do you live in base housing or the barracks?  (1) Yes  (2) No

7. Do you presently pay mortgage on one or more homes, mobile homes, or apartment houses in Cascade County?
   (1) Yes  (2) No

8. Do you rent a home, mobile home and lot, or apartment (other than on base) which is located in Cascade County?
   (1) Yes  (2) No

9. In 1977 my family's total gross income before taxes was: (Be sure to include money from any second job or a working spouse as well as allotments and other allowances.)
   (1) Below $6,000  (4) $18,001 - $24,000  (7) $36,001 - $42,000
   (2) $6,001 - $12,000  (5) $24,001 - $30,000  (8) $42,001 - $49,999
   (3) $12,001 - $18,000  (6) $30,001 - $36,000  (9) $50,000 & above
To each part of Question 10 please indicate the amount of money your family spends during a typical month for each of the categories. Mark your answers in two columns, one for spending on Base and the other for spending in Cascade County. Be sure to include all money spent for each item, even if paid by an allotment. You may use your best guess if uncertain about the exact amount.

<table>
<thead>
<tr>
<th></th>
<th>On Base</th>
<th>Within Cascade County</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. (1) Food/Sundries</td>
<td></td>
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<tr>
<td>(2) Entertainment (movies, skiing, etc.)</td>
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<tr>
<td>(3) Insurance (except amount in mortgage)</td>
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<td></td>
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<tr>
<td>(4) Car/Recreational vehicle payments</td>
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<td></td>
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<tr>
<td>(5) Savings/addition to savings each month (Credit Unions, Savings Accts., etc., MFCU and Base Bank are &quot;On Base&quot;)</td>
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<tr>
<td>(6) Transportation (gas, tires, repairs, etc.)</td>
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<tr>
<td>(7) Medical/Dental (not what CHAMPUS pays)</td>
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<tr>
<td>(8) Donations/Charities</td>
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<tr>
<td>(9) Investments (stocks, bonds, retirement, etc.)</td>
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<td></td>
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<tr>
<td>(10) Clothing/yard goods</td>
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<tr>
<td>(11) Housing:</td>
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<tr>
<td>(1) Monthly mortgage (include taxes, insurance)</td>
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<tr>
<td>(2) Monthly rent (if in base housing mark N/A)</td>
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<tr>
<td>(12) Household operation:</td>
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<td></td>
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<tr>
<td>(1) Gas/electricity</td>
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<tr>
<td>(2) Water/sewer/garbage</td>
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<td></td>
</tr>
<tr>
<td>(3) House repairs/improvements</td>
<td></td>
<td></td>
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<tr>
<td>(4) Telephone</td>
<td></td>
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</tr>
</tbody>
</table>
11. Did you purchase any of the following, during 1977, from a store, or dealer within Cascade County? If so, please indicate the approximate amount paid.

| (1) Car/motorcycle/snowmobile (new or used) | Within Cascade County |
| (2) Recreational vehicle, etc. | |
| (3) Television/stereo | |
| (4) House/condominium (purchase price) | |
| (5) Airplane/glider | |
| (6) Horse/boat | |
| (7) Washer/dryer | |
| (8) Refrigerator/freezer | |

12. What is your current savings account balance in local institutions?

___________
BIBLIOGRAPHY

BOOKS


ARTICLES


REPORTS AND PAMPHLETS


GOVERNMENT PUBLICATIONS


PERSONAL INTERVIEW