DETERMINANTS OF EMPLOYMENT MULTIPLIERS AMONG MILITARY INSTALLATIONS

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EMPLOYMENT MULTIPLIERS OF MILITARY INSTALLATIONS: A CROSS SECTIONAL ANALYSIS OF U.S. AIR FORCE BASES

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INTRODUCTION

Since 1970 when Congress passed the National Environmental Protection Act (NEPA), all branches of the Federal Government are required to prepare environmental impact statements when proposed changes in employment and/or investment meet certain threshold levels.1 Included in the broad interpretation of the "environment" is the socioeconomic environment, and thus NEPA can be viewed as the "father" of socioeconomic impact analysis within the Federal sector.

Although the military falls under the purview of NEPA, there are other specific requirements which mandate economic impact statements for the military.2 Within the U.S. Air Force, one such requirement through Air Force Regulation 170-4 (AFR 170-3).3 This regulation, which requires the preparation of a report known as the Economic Resources Impact Statement (ERIS), requires in part that each installation within the Air Force prepare a statement of it's economic impact on the local area. Because of the need for methodological consistency among the many Air Force installations, the size of the economic impact region (EIR) is held constant. The area in which the major economic impact of installation is concentrated is defined as those whole counties which fall within a 50 mile radius of the population centroid of county in which the installation is located. The objective of this paper is to examine the sensitivity of the employment multipliers among U.S. Air Force installations to alternative

definitions (radiuses) of the economic impact region.

METHODOLOGY FOR ESTIMATING EMPLOYMENT MULTIPLIERS

Before examining the precise methodology used in estimating the employment multipliers, some discussion of the motivation of the exercise is warranted. The primary objective of AFR 170-4 is to provide the base commander with a report (the Economic Resources Impact Statement) which, as accurately as possible, documents the size, character, nature and impact of the installation on the local area. All CONUS installations are required to prepare the report annually, although the specific format and detail are somewhat discretionary. Although the specific methodology to be used in estimating the size of the employment multiplier is not mandated in the regulation, the need for a cost-efficient and consistent methodology constrains the choice considerably.

The need for a cost-efficient methodology highly recommends an economic-base methodology. Input-output analysis as well as econometric models, while becoming more efficient in recent years, are still more costly than economic base models. Moreover, for purposes of the ERIS, economic base models satisfy the dual requirements of efficiency and accuracy.

The specific economic base methodology employed is that which has been developed by the U.S. Army Corps of Engineers, Construction Engineering Research Laboratory (CERL) and is known as the EIFS (economic impact forecast system).4

The traditional economic base multiplier is founded upon an assumed dichotomy of total employment between that portion of

employment which produces goods and services for export (outside of the region) and that portion of total employment which serves the export sector as well as the local population. The while the latter is termed the non-basic or service sector. If it is assumed that basic employment causes non-basic employment, then the ratio of the two sectors determines an employment multiplier.

The allocation of employment between basic and non-basic is one of the critical elements in the estimation of the multiplier. The EIFS approach utilizes a location quotient methodology, where the location quotient is a measure of relative concentration within certain sectors. More specifically, the location quotient is defined as the percent of total employment in a specific sector in the study region divided by the percent of total employment in that same sector in the nation (or state or other region used for comparison).

There are three assumptions which are implicit in the use of location quotients for determining the allocation of total employment between basic and non-basic. They are (1) patterns of consumption do not vary between the study area and the area used for comparison, (2) labor productivity does not vary between the study area and the area used for comparisons, and (3) each industry examined produces only a single homogeneous good. Given these three assumptions, it follows that local demand can be satisfied when the ratio of employment in a specific sector within the region is equal to the ratio of employment in that sector for the nation (the location quotient is equal to 1). Export based employment can then be derived as that proportion of

local employment which exceeds the amount needed to satisfy local needs.

The **EIFS** system assumes that all Federal employment is basic (export oriented) since funds for this sector originate outside the local area. In addition, all hotel, tourist court, and motel employment is treated as basic by assumption. In all other instances, the four-digit SIC code industry employment levels are used in the allocation of basic and non-basic employment. When ounty level employment data is not reported because of disclosure problems, the **EIFS** system utilizes an estimation routine which is detailed in the **EIFS** Technical Manual.

Before the economic base multiplier can be estimated, the specific area in which the economic impact is thought to occur must be identified. The **EIFS** system allows the user to specify the region as a single county, or a combination of counties. An alternative approach is to specify the radius (in miles) around the population centroids of the county in which the installation is located. Thus the user could specify that the economic impact region is the area represented by those counties which fall within a 50 mile radius of the of the location of the installation. The system then aggregates the associated employment information for this "region", and following the methodology outlined above, estimates the employment multipliers. Using the economic base methodology as contained in the **EIFS** system, and assuming a 50 mile economic impact region, employment multipliers have been estimated for all U.S. Air Force installations located in the continental United States. A

summary of the resulting distribution of employment multipliers is distribution is contained in Table 1.

SENSITIVITY OF MULTIPLIERS TO THE CHOICE OF EIR'S

The choice of a 50 mile radius for the area in which the economic impact occurs is essentially based upon distance-to-work travel patterns revealed in the 1981 Annual Housing Survey. As Table 2 indicates, over 98 percent of those who rent homes and over 97 percent of those who own their homes travel less than 50 miles to work each way. If we assume that most consumption occurs within the area defined by travel to work patterns, then a 50 radius appears to capture almost all of the consumption expenditures made in the local area. While the distance to work data supports the used of a 50 mile radius in general, a question arises as to how sensitive the employment multipliers are to this choice of EIR's? If the multipliers are distance sensitive, then it follows that a more careful approach to the selection of EIR's (even installation-specific), would be justified. If they are not sensitive, then the 50 mile radius is supported by the evidence.

In order to test the sensitivity of these employment multipliers to the size of the economic impact region, a null hypothesis is advanced that there is no difference in the means of the distributions of multipliers based upon three alternative economic impact regions. The alternative EIR's tested are: (1) a 20 mile region, (2) a 30 mile region, and (3) and a 40 mile region.

Using a test of the differences between the means of

Table 1

Estimates of Employment Multipliers, Alternative Definitions of the Economic Impact Region 1983

Description	Economic Impact Region			
	20 Mile	30 Mile	40 Mile	50 Mile
Mean of Distribution	2.7489	2.8965	3.0410	2.9797
Standard Deviation of Distribution	.6419	.6789	.7420	.7242
Number in Sample	101	103	104	98
Significantly Different from Previous Distribution	..	NO	NO	NO

Source: Estimated by the author

distributions, the data support the null hypothesis that there is no difference between the means of the distributions of employment multipliers for U.S. Air Force installations (Table 2). It can be argued therefore, that the choice of the 50 mile radius is an appropriate one, and that the alternatives would not significantly (statistically) alter the estimated size of the multipliers.

THE RELATIONSHIP BETWEEN POPULATION AND THE SIZE OF THE MULTIPLIER

It was noted above that the most recent year for which data is available for estimating the multipliers is 1982. When attempting to estimating an impact for a future year (1988 or beyond), there is some question as to the appropriateness of the 1982 based multiplier for a 1988 or beyond impact. To see if a simple forecasting equation could be estimated from the cross sectional data on U.S. Air Force multipliers, a regression equation was estimated for each of the four distributions (50 mile, 40 mile, 30 mile and 20 mile) using the total population of the economic impact region as an independent variable. Table 3 presents the results of these regressions.

While the population variable is statistically significant in each of the regression equations, none of the r2's are sufficiently high enough to provide an accurate methodology for updating the estimate of the size of the multiplier. The equation with the highest percent of explained variance is the 40 Mile radius equation. This suggests that there is a better degree of association between the size of the multipliers and

Table 2

Comparison of Owner and Renter Occupied Households
by Distance to Work, United States
1981

Distance From Home to Work	Renters	Owners
Less than 4 Miles	42.0%	31.4%
5 to 9 Miles	22.8%	23.0%
10 to 29 Miles	30.1%	36.7%
30 to 49 Miles	3.8%	6.8%
Over 50 Miles	1.3%	2.1%
	100.0%	100.0%

Source: U. S. Department of Commerce, Annual Housing Survey, 1981.

Table 3

Regression Analysis of Employment Multipliers and Total Population by Size of Economic Impact Region (EIR)

Size of EIR	Regression Equation
20 Mile Radius	EM = 2.4819 + .00000038POP (8.32) F = 69.2; r2 = .4055; DF = 99
30 Mile Radius	EM = 2.5671 + .00000036POP (9.39) F = 87.7; r2 = .4596; DF = 101
40 Mile Radius	EM = 2.6583 + .0000003224POP (9.99) F = 99.8; r2 = .4898; DF = 102
50 Mile Radius	EM = 2.7284 + .000000136POP (6.44) F = 41.55; r2 = .2948; DF = 96

Source: Estimated by the Author

population using the 40 mile radius EIR than the other EIR's. It does not suggest that the 40 mile radius is superior to the others in terms of estimating the size of the multipliers, however.

CONCLUSIONS

The primary objective of this was to examine the sensitivity of employment multipliers to alternative definitions of the economic impact region for U.S. Air Force installations. A secondary objective was to examine the relationship between the size of the multiplier and the total population of the economic impact region. The results of the research suggest that the choice between a 20, 30, 40 or 50 mile radius is not critical in determining the mean of the distribution of multipliers, and by implication, the multipliers for any of the individual installations. The relationship between the size of the multiplier and the total population of the EIR's proved to be statistically significant, but not sufficiently large enough to provide a useful tool.

Footnotes

1National Environmental Protection Act of 1969, 83 Stat 852, 42USC 4321 (January 1970)

2See, for example, the Military Construction Authorization Act, 1981, PL 96-418, October 10, 1980, Sec. 803b; 10USC 2687 and Executive Order 12049, March 27 1978 (Defense Economic Adjustment Programs).

3Air Force Regulation 170-3, Department of the Air Force, Headquarters Air Force, Washington D.C., 1 November 1984.

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