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FORECASTING REGIONAL MANPOWER REQUIREMENTS: INPUT-OUTPUT ANALYSIS
vs BLS REGRESSION TECHNIQUES

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Forecasting manpower requirements for use in general labor market analysis, vocational and technical education design, career education, etc. has received increased attention with the formation of regional councils of government. The motivation is, of course, to provide for the region's future employment needs within a planning framework, and thus avoid the recurrent shortages which impede regional growth. Accurate forecasts, however, require the development of reliable techniques which can be applied to the regional context. This paper is concerned with two such techniques -- input-output analysis and BLS multiple regression procedures.

The Office of Manpower Planning of the North Central Texas Council of Governments (NTCOG) recently projected regional manpower requirements to 1980 using a methodology adapted from the U. S. Bureau of Labor Statistics procedures. NTCOG used regression techniques to project employment by industry for the Dallas and Fort Worth SMSAs.¹ The authors of this paper have projected manpower requirements for the same region using a 71 sector sub-state model of the Texas Input-Output Model. The latter method linked the regional input-output model and independent projections of final demand by industrial sector to provide sectoral estimates of 1980 manpower requirements. There exists, then, two sets of independent manpower projections for the study region.

The first objective of this paper is to provide a more complete statement of the methodology underlying each of the two approaches. The second objective is to compare the resulting projections for 23 major industrial categories in the eight county study region. The set of projections presented for each method is just one of numerous sets of projections which could be obtained by making different assumptions about key variables used in the analyses. Thus, the major focus of the paper is an evaluation of the two methodologies rather than the empirical results. The third objective, therefore, is to critically analyze each method by pointing out both the most serious limitations and strong points of each, with special emphasis on the adaptability of each method to the regional council of governments planning function.

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¹The Dallas SMSA is composed of six counties -- Collin, Dallas, Denton, Ellis, Kaufman, and Rockwall. The Fort Worth SMSA is composed of Tarrant and Johnson counties. The combined population of the two SMSAs was 2.3 million in 1970.

Description of Methodologies

Input-Output Analysis. The input-output methodology used in projecting labor requirements by industrial sector is based on the assumptions that (1) the final demand for goods and services is the driving force in the economy and that (2) the economy has the production capability of meeting the future demand for finished goods and services.

The basic input-output model relationship is that output is a function of final demand. This relationship may be expressed as follows:

$$X = (I-A)^{-1} \cdot Z$$

where

X = the vector of sectoral dollar output values
(I-A)⁻¹ = the total requirements matrix
A = the direct requirements matrix
I = the identity matrix
Z = the vector of final demand by industrial sector

For the North Central Texas region, the X vector contains projected 1980 dollar value of output for 71 industrial sectors and represents the projected levels of output required to support the projected levels of final demand.² The (I-A)⁻¹ matrix is a square 71 by 71 matrix, where the coefficients in the A matrix are production coefficients minus import coefficients. The Z vector contains 71 dollar values, with each entry in the vector representing the sum of projected 1980 purchases by seven final demand components -- Households, Capital Formation, Federal Government Defense, Federal Government Non-Defense, State Government, Local Government, and Exports -- from a given industrial sector.

The following steps were used to project the regional labor force requirements using the regional input-output model.³

- (1) Project final demand for each industrial sector.⁴
- (2) Project the dollar output by industrial sector required to support the projected level of final demand, i.e., $X = (I-A)^{-1} \cdot Z$.

²For further discussion of this method of projecting sectoral dollar output values see Miernyk [5, p. 30-41]. For a discussion of the difficulty of measuring final demand and of deriving meaningful output projections see Round [10].

³The 1967 North Central Texas Input-Output Model is described in Mullendore, Ekholm, and Hayashi [7].

⁴Projections of 1980 sales to final demand components for each of the 71 input-output industrial sectors of the regional economy are presented in Mullendore and Ziegler [8]. See Appendix A of this paper for a brief summary of the methodology used in projecting final demand.

- (3) Project dollar output per employee values by industrial sector.⁵
- (4) Project required labor force by industrial sector -- calculated for a given industrial sector by dividing the projected sectoral dollar output value developed in step 2 by the corresponding projected sectoral dollar value of output per employee from step 3.

Two additional steps were required to make the manpower projections derived by this method comparable to those developed by the NTCOG using regression techniques. These additional steps were required because of differences in sectoring and in geographic area. The NTCOG projections were for only 23 industrial sectors, while the input-output projections were for 71 industrial sectors. Thus, it was necessary to aggregate the manpower projections for the 71 industrial sectors, developed in step 4 above, to match the 23 sectors used by NTCOG. This presented no difficulty since sectors for both studies were defined by SIC components.

A final procedural step was required because of the difference in geographic area considered by the two manpower studies. The North Central Texas 1-0 model was developed for a 31-county region surrounding Dallas and Fort Worth. Since the NTCOG projections are for the 8-county combined Dallas-Fort Worth SMSAs, it was necessary to scale down the aggregated manpower projections. This was done by calculating for each of the 23 industrial sectors the ratio of employment in the 8-county area to employment in the same sector for the 31-county region. Employment data for 1970 were used to calculate these percentages, the assumption being that, for a given sector, the 8-county region would account for the same proportion of total employment for the 31-county region in 1980 as it did in 1970.⁶ The proportion of 31-county employment accounted for by the 8-county region in 1970 ranged from approximately 69 percent for the Agricultural Services sector to nearly 100 percent for Chemicals. In 1970 total employment in the sub-region was approximately 85 percent of that in the larger region.

BLS Regression Technique.⁷ The NTCOG developed regional employment projections using the methodology suggested by the BLS [14]. This methodology uses demographic projections and assumes that important determinants of the area's economic structure will continue largely as in the past.

⁵The procedure used in projecting the dollar value of output per employee to 1980 for each of the 71 industrial sectors is described in Hayashi, Mullendore, and Ziegler [3]. See Appendix B of this paper for a brief description of the methods used in projecting dollar output per employee values and a summary of results.

⁶Although the 31-county region contains the Waco and Sherman-Denison SMSAs in addition to the Dallas and Fort Worth SMSAs, it is reasonable to expect that growth in employment for most industrial sectors will be greater for the 8-county region than for the larger 31-county region as a whole. Thus, the forecasts derived by this method will likely be biased toward lower end projections.

⁷The following discussion is based upon Bureau of Labor Statistics procedures [14] and materials prepared by the Office of Manpower Planning for the North Central Texas Council of Governments [9] which discuss the procedures used in forecasting manpower requirements for the Dallas SMSA and the Fort Worth SMSA.

The BLS regression technique relates the trends of national and local nonagricultural wage and salary employment in an industry. Using 1980 national wage and salary employment projections, a first approximation of future employment in a given industry was projected by extrapolating the appropriate national trend to 1980. Obviously, results based upon national trends are reasonable only if a close relationship exists between the local and national markets. As a test of their first approximation the NTCOG study compared trends in non-agricultural wage and salary employment in the Dallas SMSA, the Fort Worth SMSA, the State of Texas, and the nation. For some industries, a strong relationship existed between Texas employment and one or both SMSAs considered. For such industries, the BLS regression technique was used to project Texas employment and Texas estimates were then used to project industrial employment for the relevant SMSA.

Thus, the purpose of the regression is to determine the relationship between employment in the Dallas-Fort Worth SMSA, employment in the state, and employment in the nation. This method required time series data for establishment wage and salary employment in both the Dallas and Fort Worth SMSAs.

The following describes the form of multiple regression utilized by NTCOG [9] in deriving their forecasts:

The multiple regression took the form $Y_s = A + bX_t + dX_s$, where Y_s represented SMSA employment, X_n represented national employment, X_t represented time, and X_s represented Texas employment. With the simple and multiple least squares regressions, the time series for industry was tested for the Dallas SMSA and the Fort Worth SMSA with four combinations of the relationships:

- (1) $Y_s = a + bX_t$ [SMSA/Nation = $a + b$ (Time)]
- (2) $Y_s = a + bX_n$ [SMSA = $a + b$ (Nation)]
- (3) $Y_s = a + bX_n + cX_t$ [SMSA = $a + b$ (Nation) + c (Time)]
- (4) $Y_s = a + bX_n + cX_t + dX_s$ [SMSA = $a + b$ (Nation) + c (Time) + d (State)]

The equation that provided the best R^2 , standard error of the estimate, and tested significant at the 95 percent confidence limits was selected to project wage and salary employment for that industry. In industries for which no regression equation was determined from the four combinations, an alternative method was used. The trend in the SMSA's employment was extrapolated with time; the equation took the form $Y_s = a + bX_t$, where Y_s represented SMSA employment and X_t represented time. The results were acceptable only if the projected estimates were within the range of the other estimates to maintain internal consistency and if the estimates agreed with the qualitative industry judgments.

Comparison of Projections

Projected 1980 nonagricultural employment for the 8-county region developed using the two alternative methods of forecasting is presented in Table 1.

TABLE 1: Nonagricultural Wage and Salary Employment, Dallas-Fort Worth SMSA, 1971 and Projected 1980

Sec. No.	Sector Identification	1971 ^a (Thousands)	BLS		Percent Change (1971-1980)	Input-Output Method (Thousands)	Percent Change (1971-1980)
			Regression Method 1980 ^a (Thousands)	Method			
MANUFACTURING							
<u>Durables</u>							
1	Lumber & Wood	2.7	3.4	25.9	4.4	63.0	
2	Furniture & Fixtures	6.1	8.7	42.6	7.7	26.2	
3	Stone, Clay & Glass	6.6	7.9	19.7	8.2	24.2	
4	Primary Metal	3.9	5.3	35.9	4.7	20.5	
5	Fabricated Metal	14.9	21.6	45.0	15.9	6.7	
6	Machinery excl. Elec.	31.0	33.9	61.4	24.2	15.2	
7	Electrical Machinery	25.2	66.6	89.2	57.4	63.1	
8	Transportation Equip.	49.7	58.6	17.9	37.0	-25.6	
<u>Nondurables</u>							
9	Food & Kindred	20.5	22.3	8.0	18.0	-12.2	
10	Apparel	15.5	19.3	24.5	22.0	41.9	
11	Paper & Allied	6.9	11.6	68.1	7.2	4.3	
12	Printing	14.4	18.7	29.9	15.5	7.6	
13	Chemicals	5.9	7.7	30.5	6.6	11.9	
NONMANUFACTURING							
14	Agri. Serv., For. & Fish	1.5	2.2	46.7	0.9	-40.0	
15	Mining	9.8	9.0	-8.2	6.7	-31.6	
16	Contract Construction	50.4	67.7	34.3	47.3	-6.2	
17	Transportation	42.5	54.2	27.5	41.9	-1.4	
18	Communication	14.3	14.1	-1.4	16.7	16.8	
19	Utilities	9.5	9.8	3.2	12.5	31.6	
20	Wholesale	81.2	102.3	26.0	84.6	4.2	
21	Retail	159.5	191.6	20.1	208.4	30.7	
22	F.I.R.E.	68.9	80.8	17.3	81.9	18.9	
23	Services	144.2	229.1	58.9	176.2	22.2	
Total for 23 Sectors ^b		785.1	1046.4	33.3	905.9	15.4	

^aSource: Office of Manpower Planning, North Central Texas Council of Governments.

^bTotal for the 23 industrial sectors considered does not represent total nonagricultural employment in the region since such important employment sectors as the government are not considered.

Employment projections for 23 major industrial categories are considered. Employment in these 23 economic sectors accounts for approximately 85 percent of total employment in the 8-county study region, with government accounting for the major portion of remaining employment.

The region is highly industrialized with relatively large employment in the manufacture of electrical machinery and transportation equipment (including the aerospace industry). The region also serves as a wholesale distribution and financial center for the Southwest. Thus, the Wholesale and F.I.R.E. sectors are quite important as employers in the regional economy.

In comparing the two sets of projections, it is immediately apparent that the I-0 projections of employment tend to be smaller (for 16 of the 23 sectors) than those developed using trend analysis. The BLS regression method results in a projection of total employment in the 23 sectors in 1980 which is 142.1 thousand greater than the total projected by I-0 analysis. However, one should not conclude that the I-0 methodology will necessarily tend to yield lower employment forecasts for this region or any other region. The employment forecasts depend largely upon the final demand projections. For the North Central Texas region, final demand categories were projected by industrial sector in terms of annual rates of change over the period 1967 to 1980. The projected rates of change in final demand will vary depending upon assumptions about economic and demographic variables. For example, larger employment forecasts would have resulted from the I-0 method if the projections of Household demand had been based upon higher birth rates and a larger annual rate of increase in per capita income.⁸

Both sets of projections indicate that employment in most of the 23 industrial sectors will increase from 1971 to 1980. Both projections, for example, indicate that a rapid expansion of employment in the Electrical Machinery sector is expected. In the 1980 forecasts, as in 1971, the two largest employing sectors are the Services and Retail Trade sectors. The two sets of employment projections are very close for most sectors. Where major differences occur, the I-0 projections are always lower.

In several cases, where there are differences between projections, the I-0 method had projected an actual decline in employment. Both methods project a decline in Mining employment. The I-0 method, however, forecasts a decline in employment in five additional sectors. In four of these (Food and Kindred Products, Agricultural Services, Contract Construction, and Transportation), the projected absolute decline in employment is slight as was the case for Mining. It is important to note however that the final demand for output in these sectors was not forecast to decline. Thus the projected dollar value of output for each sector in the economy, $[X = (I-A)^{-1} \cdot Z]$, is expected to increase. Utilization

⁸Modification of the I-0 procedure used in this paper will also yield different projections. For example, Households could be included as an interindustry sector.

of the projected dollar value of sectoral output to obtain employment estimates, however, requires independent projection of labor productivity, i.e., projections of the rate of change in dollar output per employee values by industrial sector. Thus, sectors in which employment is projected to decline slightly or to remain stable are those which are expected to experience relatively slow growth in dollar volume of output while experiencing increases in dollar output per employee. These sectors are growing sectors in the economy, but in which increases in labor productivity permit a larger dollar output with fewer workers.

The projected decline in employment in the Transportation Equipment industry is substantial. The I-0 method projects a decline in employment of 12.7 thousand workers from 1971 to 1980. This seems reasonable since the aerospace industry accounts for approximately three-fourths of the total dollar output of the Transportation Equipment sector in the regional economy, and the regional aerospace industry has experienced a substantial reduction in sales to the Federal Government (i.e., sales to final demand) in recent years. (Employment in the regional aerospace industry declined by approximately 39 percent from the peak year of 1961 to 1971.⁹) On a small scale, the production processes of the aircraft industry in the region are being converted to processes which develop and produce equipment for mass transit systems. This should serve to stabilize employment in this sector of the regional economy but it is highly unlikely that employment in this sector will reach the Vietnam build-up levels in a peace time economy.

Finally, it should be emphasized that the real value of such regional manpower projections by industrial sector, such as those presented in Table 1, is to develop occupational projections, since the industrial structure of the regional economy determines the occupational structure. The total projected employment in a given industrial sector can be disaggregated by occupational groups through use of national occupational ratios developed by the BLS [15]. The application of a national occupational ratio to a projection of regional employment in a given industrial sector assumes that the regional sector requires the same occupational mix as required for that sector in the national economy.

Evaluation of Methods

For some sectors there are substantial differences in projections provided by the alternative methods. Only time will tell which set of projections will more closely approximate the 1980 situation. Indeed both methods are only intended to approximate anticipated conditions in 1980. The evaluation of the methods will, therefore, concentrate on the strengths and weaknesses of assumptions underlying each methodology and the ease of utilizing each method at the regional level by a Council of Governments.

⁹See Ekholm, Hayashi, and Mullendore [2].

Simplicity and Cost. Trend analysis is a simple projection technique which requires fewer assumptions than the more involved I-0 approach. The appeal of trend analysis for projecting regional manpower needs is indicated by NTCOG [9]:

The BLS method was selected to project nonagricultural employment for the Dallas SMSA and the Fort Worth SMSA because (1) the technique is relatively simple and can be adapted to the particular expertise and resources of the user; (2) the technique permits the local analyst to make local projections within the framework of anticipated national developments; (3) the technique can be easily repeated so that errors and problems can be identified and dealt with to provide more accurate projected estimates.

Due to the relative simplicity of trend analysis, one would expect the cost of deriving projections through trend analysis to be lower. This is especially true if the I-0 model is developed largely from primary data. This is certainly the case for the North Central Texas Input-Output Model which was developed over a two year period at a cost in excess of \$200,000. This is not to criticize the development of regional I-0 models. Projecting manpower requirements is only one of the ways in which regional planners and others can profitably use I-0 models.

The derivation of manpower projections through input-output analysis, however, requires substantial work beyond development of the I-0 model. One must also develop (1) independent projections of final demand by industrial sector and (2) projections of dollar output per employee values by industrial sector.

Assumptions. The major shortcoming of trend analysis in projecting manpower needs by industrial sector is that it does not account for the interrelationships or linkages which exist among the industrial sectors of the regional economy. "Thus, the rapid growth of employment in a particular industry may be the result of a particular configuration of growth in the demand for the exports of the region. The final processing and sales of these exports may be carried out by one industry group of establishments who purchase intermediate goods within the region from another industry group of establishments."¹⁰

The major limitations of input-output analysis result from the underlying assumptions of such a model. The major assumption is that resources are combined in fixed proportions in the production process. Over time, it is likely that changes in the prices of resources and changes in technology will alter the proportions of resources used in the production process, and this will alter the

¹⁰Stern [11, p. 1-2].

input coefficients.¹¹ To the extent that this occurs the model is rendered less accurate by the passage of time. Though it can be argued that these changes are not substantial for most firms within a given industry over a period of a few years, an input-output model obviously must be updated from time to time if it is to accurately depict current interdependencies.¹²

Using input-output analysis to provide manpower projections requires assumptions other than those which underlie the I-O model. Independent forecasts of final demand and dollar output per employee values by industrial sector require further assumptions. The projections of final demand for the input-output sectors of the regional economy relied heavily upon Department of Labor [13] projections of final demand to 1980 for the nation. The national forecasts were based upon (1) an assumed continuation of the observed long term shift away from goods, and toward services, (2) the assumption of a four percent unemployment rate as estimated by currently used procedures, and (3) the assumption that the Vietnam conflict would be resolved and defense expenditures will have been reduced somewhat but will be higher than just before the Vietnam build-up. These and more specific assumptions of the BLS about the national economy were also used by NTCOG in applying BLS regression procedures. With the BLS method, the local analyst links regional data to the BLS projections for the national economy. As a result manpower projections developed from both methods are constrained by the assumptions about the national economy which have been incorporated into the analyses.

The fact that alternative final demands by industrial sector can be developed by making different assumptions with regard to expected changes in the economy points out a major advantage of I-O analysis. For example, different levels of Household purchases can be projected by assuming different rates of growth in the population and/or growth in per capita income. Once the I-O model is developed, numerous alternative projections of output by industrial sector (and alternative projections of employment required to support sectoral output) can be derived by making alternative assumptions about growth in final demand. With the assumptions explicitly stated, the policy maker can choose the projections associated with the set of assumptions considered most appropriate.

The projection of output per employee values incorporated in the I-O method

¹¹ Import substitution will also influence the input-output coefficients in a regional model where the coefficients in the direct requirements matrix are production coefficients minus import coefficients.

¹² The direct requirements matrix for a regional economy may be adjusted by methods other than current survey. Miernyk and Shellhammer [6, p. 19-30] have used the "best practice" firm approach to adjust technical coefficients. This approach requires (1) the determination of certain firms in an industry which are considered more advanced than others at the time of the survey and (2) using the input patterns of these "best practice" firms to project the average input patterns of the industry. In an attempt to project the direct coefficients matrix of the Washington state input-output model, Tiebout [12, p. 337-339] developed procedures, requiring substantial judgment in their application, to adjust for technological change and import substitution.

required an analysis of trends in output per employee by industrial sector. Lack of data will usually preclude direct calculation of regional trends in productivity. Therefore, trends in output per employee at the regional level must usually be estimated from state and national data (see Appendix B). As in projecting final demand, alternative projections of output per employee can be developed by making alternative assumptions about trends in labor productivity.

Thus, numerous alternative projections of manpower requirements for a regional economy can be developed by making alternative assumptions about growth in final demand and labor productivity for each sector of the economy. Such flexibility requires a larger number of assumptions and a larger amount of information than a simpler model, such as the BLS regression method.

Geographic and Sectoral Detail. The NTCOG projections by industrial sector were provided for each of the eight counties in the study region, and maintaining such detail has merit. However, development of an I-0 model for each county is not likely to be feasible because of the cost and difficulty of developing a functional model for the extremely "open" economies of such small areas. Of course, projections developed for larger regions could be disaggregated to the county level by using ratios of county employment to total regional employment which existed at some point in the past.

As noted earlier, regional projections of manpower requirements were developed for 71 industrial sectors using the I-0 model approach. These sectors were aggregated to match the 23 sectors used by NTCOG. For many of the smaller counties in the region, time series data required for the BLS regression approach are not available in sufficient detail to permit projections for a large number of sectors.

However, using a detailed manpower projection model, such as the I-0 model, requires a greater number of assumptions and a greater amount of information than do the simpler models. Stern [11, p. 2] has observed that:

When a larger number of detailed assumptions have to be made there is a possibility that a larger number of errors will be made in the same direction. This can result in large errors in the final projections. It has the advantage, however, of providing a means of examining the detailed source of projection errors.

Summary

The BLS regression technique has two major advantages -- simplicity and low cost. The BLS regression technique also has three major weaknesses: (1) trend analysis does not take into account interdependencies among industrial sectors of the regional economy, (2) it does not have the flexibility of providing alternative projections associated with alternative assumptions regarding trends in final demand and labor productivity, and (3) it lacks the sectoral detail possible with an I-0 model. The greater detail and flexibility of an input-output model requires more information and more assumptions than does simple trend analysis. While this raises the possibility of making a large number of errors in the same direction, it also permits the forecaster to examine in detail the

source of projection errors. Both methods are characterized by the assumption that past conditions will continue to exist in the future. The BLS regression technique extrapolates past trends, while the static I-O model approach assumes that the proportions of resources used in a given industrial production process will remain stable for several years.

It should not be surprising that the projections for many of the sectors in a regional economy will be very similar. The reason is that both methods must often incorporate national and state trends into the analyses since local data are often not available. However, it is worth emphasizing that planners and policy makers in a region would be fortunate to have access to the alternative sets of manpower projections resulting from the two methods. It gives users of such projections an opportunity to choose among projections which are based upon alternative assumptions.

APPENDIX A

Projections of Final Demand to 1980

Sales by each of the 71 sectors of the North Central Texas Input-Output Model to the final demand components of the model were projected to 1980 by the following methods:

- (1) Households -- Projections of sales to regional households were based on estimates of sectoral income elasticities for the region and Department of Labor [13] projections of personal income for the nation, and assumes regional income will grow at the same rate for the nation.
- (2) Federal Government Defense -- Projections for this final demand category were based on trends in defense spending as developed by the U. S. Department of Labor [13]. The basic assumption is that defense spending in the region will follow national patterns and projected trends in total defense spending will be spread evenly across the sectors whose outputs are purchased by the Federal Government for defense purposes.
- (3) Federal Government Non-Defense -- These expenditures were projected using growth rates developed from Department of Labor [13] projections to 1980.
- (4) Capital Formation -- Sales to the capital formation sector of the model were separated into two categories. Sales of producers durables were projected on the basis of national trends developed by the Department of Labor [13]. Regional construction activity was projected on the basis of growth rates developed at the state level using time series regression analysis, and assumes the growth rate in regional construction activity will approximate that for the state.
- (5) State Government -- Regression analysis was used to project total state government expenditures as a function of lagged personal income. It was assumed that state government expenditures within the region will grow at the same rate as total state government expenditures.
- (6) Local Government -- Local government expenditures were assumed to grow at their annualized average rate for the period 1957-1967.
- (7) Exports -- The method used to project sectoral exports was based on an indirect relationship between regional exports and changes in final demand at the national level which were projected by the Department of Labor [13]. Growth in sectoral final demands at the national level was assumed a proxy for growth in the demand for regional exports.

APPENDIX B

Trends in Productivity

The procedures used to project dollar output per employee values to 1980 for the industrial sectors of the North Central Texas economy may be described as follows. First, sectoral productivity estimates were developed using regional employment and output data developed for the 1967 North Central Texas Input-Output Model. These base year values were then projected to 1980 on the basis of estimated average annual rates of change in output per employee for broad categories of industrial sectors. The productivity growth rates were based largely on state and national trends. This information is available in publications such as the U. S. Census of Manufactures, U. S. Census of Mineral Industries, etc. More detailed productivity studies dealing with specific sectors are available also. Examples are the work of Cassimatis [1] in studying productivity in the construction industry, Klarman's [4] work on health services, etc.

The most notable conclusions of the productivity analysis are:

- (1) In general, agriculture, mining, construction, manufacturing, transportation, and utility and communication sectors (a) had relatively high output per employee ratios in 1967, (b) are projected to experience relatively high percentage increases in output per employee, and, therefore, (c) are projected to have relatively high output per employee values in 1980.
- (2) In general, trade and service sectors (a) had relatively low output per employee ratios in 1967, (b) are expected to experience relatively small average annual rates of change in output per employee, and, therefore, (c) are projected to have relatively low output per employee ratios in 1980.

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