DETERMINANTS OF OCCUPATIONAL SHIFTS IN URBAN LABOR MARKETS

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Introduction

Analysts of urban labor markets have used employment by industry as a basis for analysis due, in part, to the availability of the data on a current and relatively disaggregated basis. For example, to develop a typology of urban areas, Noyelle and Stanback have calculated location quotients for the 140 largest metropolitan areas using employment by industry [9]. Nine categories of metropolitan areas reflecting hierarchical order and functional specialization were identified. Thus, in the Noyelle/Stanback typology, New York, Los Angeles, Chicago, and San Francisco are national nodes. Tampa and Riverside are resort-retirement centers. Buffalo is a manufacturing center.

The use of employment by industry raises a concern. During the first half of the 1980s due to recession and appreciation of the dollar, firms were forced to reduce costs to compete. Adjustments took a variety of forms. Hierarchical organizational structures became less hierarchical as layers of middle management were eliminated. Through collective bargaining agreements, the number of job classifications was reduced. Therefore, not only were people laid off, but what people did who remained on the payroll was affected. If we are to understand more fully these impacts at the urban level, we need to analyze employment by occupation.

The objective of this paper is to identify the determinants of differentials in occupational shifts among large metropolitan areas. The time period of the analysis is 1980-1986. It is not possible to begin the analysis earlier because the classification of occupations changed substantially in the *1980 Census of Population* [16]. For 1986, the data on occupations are estimates based on the *Current Population Survey* which comprises about 59,500 housing units [17]. The Bureau of the Census requires a minimum labor force, a predetermined critical cell, before estimates are published. Because the estimates are based on a sample rather than a complete count, two types of error arise--sampling and nonsampling. The error of the sample estimate varies inversely with the size of the sample. For example, the relative sampling error for Indianapolis employment is 3.5 percent, while for Atlanta it is 2.4 percent. The error of the sample estimate varies directly with the size of the estimate. The estimate for an occupation that is a small proportion of the

total employment will have a smaller absolute (and larger relative) error than one that is a large proportion of total employment.

At the metropolitan level, the *Current Population Survey* provides estimates for the 50 largest metropolitan areas. Because the occupational data in this study are derived from the *Census of Population* and *Current Population Survey*, which are based on the residence of the respondent, the inclusion of metropolitan areas that are contiguous, such as Anaheim and Riverside, could create some problems. For example, some of the independent variables in the empirical analysis below involve employment which is based on the location of the establishment. For a variety of reasons, employees may live in one metropolitan area and work in a contiguous one. To minimize the residence-workplace problem, consolidated metropolitan areas are used for Los Angeles (Los Angeles, Anaheim, and Riverside metropolitan areas), Miami (Ft. Lauderdale and Miami metropolitan areas), New York City (Nassau-Suffolk, New York City, and Newark metropolitan areas), and San Francisco (San Francisco, Oakland, and San Jose metropolitan areas). The effect of this consolidation is to reduce the number of metropolitan areas to 38.

During the period, 1980-1986, at the national level occupational categories grew at different rates as illustrated in Table 1. Appendix A provides definitions of occupations.

Administrative and sales occupations increased two and three times respectively the all-occupations rate. Although in part the large percentage increase in sales was due to the recession in 1980--the initial year of the period--three of ten jobs over the period occurred in sales whereas one of ten would have been expected based on the 1980 proportion. Two of ten occurred in the administrative, managerial, and executive category whereas one of ten would have been expected.

Are typologies of metropolitan areas based on location quotients by industry the same as those using quotients by occupation? Measuring nodality of metropolitan areas by the location quotient for the administrative, managerial, and executive occupational category, Table 2 provides a listing of metropolitan areas with the largest location quotients in 1980.

In the Noyelle/Stanback typology, New York, Los Angeles, Chicago, and San Francisco are national nodal centers. Only San Francisco appears in the list above. In terms of the number of corporate headquarters, Chicago is certainly a national nodal center. However, the location quotient for Chicago is about the same as the median value of the 38 metropolitan areas in the sample.

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Determinants of Differentials

A multiple regression model is specified to identify determinants of differentials in shifts in occupational categories by metropolitan area. The general form of the model is:

$$OCCUP_{ij} = b_0 + b_{aj}ATTRIBUTE_{aj} + e_j$$

where

$OCCUP_{ij}$ = the competitive effect coefficient where the coefficient is the percentage change in employment for the ith occupational category in the jth metropolitan area minus the percentage change in employment for the ith occupational category in the United States;

$ATTRIBUTE_{aj}$ = the ath attribute for the jth metropolitan area where $a = 1$, ... n; and

e_j = the error term for the jth metropolitan area.

The empirical work below is based on three occupational categories: (1) administrative, managerial, and executive; (2) professional; and (3) goods-producing which is defined as precision, machine, transportation, and materials-handling occupations. The hypotheses to be tested are discussed below.

Metropolitan Area Performance

It is assumed that the change in employment by occupation is affected directly by metropolitan area performance. Differences in metropolitan area performance are based on the way the area's industrial mix is impacted by national economic change and the competitive performance of the area's industries. Because measures of industry output by metropolitan area are unavailable, a proxy--the competitive effect coefficient for employment by industry--is used. Two industry groupings are used: manufacturing and services. In an export base context, manufacturing is primarily export-oriented. Services, as a sector, has elements of both export base and local serving activities.

Exports in the form of services are becoming increasingly important to metropolitan area economies. The work of Beyers and Alvine suggests that the growth of services is explained not so much by greater input requirements by export sectors in the region, but more so by

"complex intraservices sector demands, and final demands for services by consumers and government" [3, p. 43]. Services employment includes hotels and motels, personal, business, legal, engineering and accounting, and health services. The hypothesis is that a direct relationship exists between the competitive effect coefficient for manufacturing and/or services employment and the competitive effect coefficient of the relevant occupation.

Initial Advantage

Change in employment by occupation may be influenced by the extent to which a metropolitan area already had a comparative advantage in a particular occupation at the beginning of the period. Initial advantage is measured by the location quotient for the occupational category in 1980. Given both diffusion processes as well as cumulative causation processes, the author will not hypothesize a relationship between the existence of a comparative advantage at a point in time (the location quotient in 1980) and whether the comparative advantage is enhanced or diminished over time (the competitive effect coefficient, 1980-1986). The data will be used to reveal the nature of the relationship.

Global Economy

Weinstein and Gross find conventional explanations of regional growth and decline lacking [19]. These explanations include the business climate studies of The Fantus Company and Grant Thornton, regional taxonomies such as those of Rostow and Friedmann, and the Schumpeterian view of creative destruction applied to the decline of traditional manufacturing in the Northeast and Midwest and the rise of new industrial centers in the South and Southwest. Weinstein and Gross call for a reexamination that is characterized by " ... the confluence of three externally-driven and overwhelming economic and political trends: the evolving structure of the global economy, the international business cycle, and a changing federal environment" [19, p. 14].

What did the increasing internationalization of the U.S. economy mean for U.S. metropolitan area labor markets? As the dollar appreciated and exports fell during the 1980-1985 period, regions and industries were differentially impacted. The Bureau of Economic Analysis of the U.S. Department of Commerce reports that regional differences in per capita personal income diverged from 1979 to 1986 compared to convergence from 1929 to 1979 [15]. The Mideast and New England regions were more above the U.S. average in percentage terms in 1986 than in 1979. Per capita personal income changes, relative to the U.S.

average, because the region's total personal income and/or population change at rates different from the U.S. In the case of the Mideast and New England, both regions experienced higher average annual rates of growth in total personal income than the U.S. but lower rates of growth in population.

Interregional differences in rates of population growth affected the rate of growth in population-related occupational categories. Table 3 provides by region the competitive effect coefficient for two occupational categories--the service occupations (closely tied to population change) and the administrative, managerial, and executive occupational category.

Although New England experienced slow population growth which was a factor in the negative service share, it increased its share of the administrative, managerial, executive occupation.

Industries experiencing the greatest percentage of decline in employment attributable to foreign trade were motor vehicles and equipment, apparel, primary nonferrous metals, and footwear [12]. Metropolitan areas whose industrial structure is specialized in trade-impacted industries would be more affected than others. Firms in these industries would need to make changes in production methods to reduce costs to remain competitive internationally.

In this study, foreign-trade orientation is measured by the proportion of total metropolitan area employment in 1980 that was in the trade-impacted industries--motor vehicles, apparel, primary metals, and footwear. The hypothesis is that an inverse relationship exists between a high proportion of total employment in 1980 in foreign trade-impacted industries and the goods-processing occupational categories.

The negative foreign trade impact of dollar appreciation is in reduced demand for goods produced by the respective industries. Reducing labor costs is one way to remain competitive. An incentive to make changes in the method of production is measured by the production worker wage in 1980 in the metropolitan area relative to the U.S. production worker wage. Acknowledging that productivity differentials among metropolitan areas might contribute to relatively high manufacturing wages in some areas, it is hypothesized that an inverse relationship exists between the relative manufacturing wage rate and the competitive effect coefficient in goods-processing occupations.

Changing Federal Environment

Another trend with regional implications that Weinstein and Gross mention is the deregulation of several industries including financial services, transportation, broadcasting, and telecommunications. The Airline Deregulation Act of 1978 permitted new airlines to enter, and all

airlines to determine markets they would serve. Access to good airline connections becomes increasingly important for information-intensive occupations such as the administrative, managerial, and executive occupation. Bauer says that "the development of hub-and-spoke networks is one of the most important innovations in the industry since deregulation" [2]. Optimal hub-and-spoke networks would involve high levels of local traffic at the hub with a hub being centrally located to minimize circuitous travel between the airline's hub and spoke cities. Benefits to the consumer are more frequent flights at lower cost. Airport activity levels are measured by the number of airplane departures per 1,000 population in 1980 [18]. It is hypothesized that a direct relationship exists between the number of airplane departures and the competitive effect coefficient of the administrative and professional occupations--two occupational categories which place value on spatial access.

Technical Change

Weinstein and Gross argue that the Schumpeterian view of creative destruction is not a useful framework to analyze recent regional change. They write, "simply put, the Frostbelt evidently retains a supportive environment for competitive capitalism, while the elements thought to comprise the Sunbelt's business climate--below average taxes and social services and strong right-to-work laws--are of dubious value" [19, p. 13].

Let's examine the supportive environment for competitive capitalism. At the metropolitan level, it is important to differentiate between the industrial composition of the area and the capacity of the area to generate new industries. Traditionally, labor and capital have been the primary factors of production analyzed. However, new product technology has become an increasingly important third factor of production. The product cycle theory took on an metropolitan-nonmetropolitan theme in the work of Vernon [14] and Thompson [13]. In the early product cycle phase, critical human inputs are scientific and engineering skills, and the technology is characterized by short production runs, rapidly changing techniques, and dependence on external economies. These characteristics are typically found in urban areas.

As the product cycle enters the growth phase, management becomes the critical labor skill, and the technology is characterized by mass production methods. Finally, in the mature product phase, in the face of price competition unskilled and semi-skilled labor becomes critical. Because the production runs have become routinized, access to

scientific and engineering skills is less important. The location of production may be shifted away from metropolitan areas.

In a discussion of recent manufacturing changes, Kumpe and Bolwijn divide production into three stages--components, sub-assembly, and assembly. Examining the audio/video products industry, Kumpe and Bolwijn note that commercial life cycles have fallen to a year or less. As the product life cycle is collapsed, assemblers find that economies of scale is a luxury of time that is not worth pursuing. More important economies can be gained " ... from reductions in work-in-progress inventories, stock inventories, throughput time, and transportation costs" [8, p. 77]. Because the most important advances in quality come not from assembly but rather sub-assemblies and components, the goal is to design sub-assemblies that fit together in a highly predictable way.

Jaikumar, in comparing flexible manufacturing systems in the U.S. and Japan, notes that a much higher percent of the workforce in Japan consists of college-trained engineers than in the U.S. [6]. For example, the operators on the shop floor were engineers with multifunctional responsibilities. Engineering is the critical line function, while manufacturing has become, by comparison, a support function.

To test for the role of this type of technical change, industries that are particularly sensitive to the changing manufacturing processes discussed above are classified on the basis of a definition of high tech [10]. The industries are drugs, electronic computing, communications equipment, aircraft and guided missiles, and instruments. It is hypothesized that a direct relationship exists between the proportion of metropolitan employment in 1980 in high tech industries and the competitive effect coefficients for the administrative and professional occupations.

Quality of Life

Quality of life has become an area of study in regional economics because quality has become a recruitment tool of firms, for example, "the Piedmont area of the Carolinas proved to be a tremendous asset in recruiting" [11]. It is assumed that firms, in terms of their location decision, would be most responsive to the tastes for quality of life of their administrative and professional personnel. For example, Ecker and Syron examined "relative tax burdens on highly paid workers living in different states" [5, p. 26]. Work by Bloomquist, Berger, and Hoehn provide quality of life measures at the county level for metropolitan areas [4]. They find substantial intra and intermetropolitan variation. Their quality of life is measured by climatic, environmental, and urban conditions. The assumption of Bloomquist, Berger, and Hoehn is that

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interregional differences in amenities are reflected in interregional differences in wages and land rents which, in turn, result in implicit amenity prices. These prices become weights for a quality of life index. The hypothesis is that a direct relationship exists between the quality of life index and the competitive effect coefficient for the occupations under study.

Occupational Linkages

The product cycle theory suggests that some occupations may be linked. Johansson states that "a fundamental feature of knowledge oriented activities is the high frequency of contacts between persons" [7, p. 56]. As a consequence, Johansson distributes occupational categories over space according to their spatial interdependencies with knowledge occupations in metropolitan areas, service occupations in regional centers, and goods-handling occupations in peripheral regions. Administrative and professional occupations are knowledge-oriented and are spatially linked in metropolitan areas. Therefore, it is hypothesized that the competitive effect coefficient for professional occupations will be directly related to the competitive effect coefficient for administrative occupations and vice versa.

The hypotheses and their measure, hypothesized relationship, and mnemonic form are respectively:

1. metropolitan performance, competitive effect coefficient for service or manufacturing employment, (+), and PERFORM;

2. initial advantage, location quotient for 1980 for occupation, (+) or (-), and INITADV;

3 global economy
   a) proportion of 1980 total employment in foreign-trade impacted industries, (-), FORTRD, and
   b) 1980 production worker wage in metropolitan area relative to U.S. production worker wage, (-), EARNINGS;

4. changing federal environment, airplane departures per 1,000 population in 1980, (+), and DEPART;

5. technical change, proportion of 1980 total employment in high tech industries, (+), HITECH;

6. quality of life, Bloomquist-Berger-Hoehn quality-of-life index, (+), QL; and

7. occupational linkage, competitive effect coefficient of linked occupation, (+), LINKAGE.

Empirical Results

Results are presented for the administrative, professional, and goods-processing occupations.

Administrative, Managerial, and Executive Occupation

The results for the administrative occupation are presented in Table 4.

The initial advantage (INITADV) variable was excluded because of multicollinearity. The metropolitan performance (PERFORM), occupational linkage with the professional occupation (LINKAGE), and high tech (HITECH) coefficients are statistically significant, have the hypothesized sign, and are the primary explanations of variation based on the size of the standardized beta coefficient. The airplane departures (DEPART) and quality-of-life (QL) coefficients were not significant. The model explains 74 percent of the variation in the dependent variable.

Professional Occupation

The same model was run for the professional occupation with the occupational linkage being with the administrative, managerial, and executive occupation. Again, the initial advantage variable was excluded due to multicollinearity. The results are given in Table 5.

The occupational linkage with the administrative occupation (LINKAGE) coefficient is significant with the hypothesized sign. This result is consistent with the occupational linkage variable in Table 4. The coefficients for all of the other variables were not significant. In terms of adjusted R-squared, the professional occupation model explains a smaller proportion of the variation than the administrative occupation model.

Goods-Processing Occupations

Goods-processing occupations consist of precision production, machine operators and assemblers, transportation and material moving

occupations, and handlers. The metropolitan performance variable (PERFORM) is defined in terms of the competitive effect for manufacturing employment and is hypothesized to have a positive sign. In lieu of the initial advantage variable (INITADV), the foreign trade orientation variable (FORTRD) and the wage rate of production workers relative to the U.S. rate (EARNINGS) are used and hypothesized to have positive and negative signs respectively. Because good spatial access measured by the number of airplane departures is not considered to be an important factor for these types of occupations, the DEPART variable is not included. The quality of life, QL, is expected to have a positive sign--as was the expectation for administrative and professional occupations. Because the dependent variable is an aggregation of four related goods-handling occupations, no occupational linkage (LINKAGE) variable is included. Table 6 provides the estimation results.

The metropolitan performance (PERFORM) and relative wage rate (EARNINGS) coefficients are significant and have the hypothesized signs. The foreign trade (FORTRD) and quality of life (QL) coefficients are not significant. The model explains 55 percent of the variation in the dependent variable.

Conclusions

Determinants of intermetropolitan differentials in the competitive effect coefficient of employment by occupation have been identified. The results indicate that the demand-oriented variables, such as metropolitan performance and occupational linkage, are important explanatory variables. Supply-oriented variables, such as the relative wage rate and high tech representing new product technology as a factor of production, were important, while quality of life and airplane departures were not.

What are the policy implications? The first implication relates to economic development strategy. As state and local government economic development agencies have competed against each other during the 1980s, there has been a tendency to target industries. The message of this paper is to encourage the economic development specialist to think in terms of occupations and linkages between occupations as part of the development strategy. The process of technological change is expressed not only through industrial change but also occupational change. The industrial dimension of economic development strategy is more developed than the occupational dimension. This paper is an initial step to deal with this imbalance.

The second implication relates to the monitoring of the economy. At the metropolitan level our economic monitoring system is based primarily

on employment by industry. We need to monitor economic change by occupation as well. More resources should be directed at the metropolitan level to surveys like the *Current Population Survey* to gather more detailed and frequent occupational information. This information may be used in several ways. It may guide planning for our educational and training programs. It may be used to forecast demand for office space because the space requirements are frequently defined in terms of occupations, for example 64, 150, and 250-300 square feet for a secretary, manager, and executive respectively.

Limitations of this analysis are the high degree of aggregation of the occupational categories, and the problem of sampling error due to the limited size of the *Current Population Survey.* Until more resources are made available for surveys, research on more narrowly defined occupational categories must wait until the *1990 Census of Population* is available. The data base of this analysis was limited to the 50 largest metropolitan areas. The *1990 Census of Population* will allow a sample with a greater range of metropolitan population size to be drawn which should strengthen the analysis. As firms respond occupationally to changing market conditions, metropolitan area analysis of employment by occupation will complement the more common analysis of employment by industry.

Endnote

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Table 1
Rates of Change in Employment by Occupation,
1980-1986, in percent

Occupational category	Percent change	Percent of change	Proportion of 1980 total
All occupations	12.2	100.0	100.0
Administrative	24.9	22.2	10.7
Professional	15.7	16.6	12.7
Technical	12.7	3.4	3.1
Sales	35.8	30.8	10.3
Administrative support	5.3	7.8	17.8
Service	16.2	18.1	13.3
Precision production	6.5	7.2	13.3
Machine operators	-12.8	-10.3	9.6
Transportation and material moving	4.0	1.5	4.6
Handlers	7.0	2.7	4.6

Sources: *1980 Census of Population* and *Geographic Profile of Employment and Unemployment, 1986.*

Table 2
Nodality of Metropolitan Areas
as Measured by 1980 Location Quotients
for the Executive, Administrative, Managerial
Occupational Category

Location quotient	Metropolitan area
1.73	Washington, D.C.
1.44	San Francisco
1.42	Denver
1.33	Atlanta
1.31	Phoenix
1.30	Salt Lake City
1.30	Miami
1.30	Minneapolis-St. Paul
1.30	Seattle

Source: Same as Table 1 and computations by author

Table 3
The Competitive Effect Coefficient for Selected
Occupations by Region, 1980-1986

Region	Administration	Service
New England	9.6	-9.2
Mideast	-4.0	-4.0
Midwest	-10.1	-6.0
Plains	-11.6	-1.0
Southeast	-0.7	5.1
Southwest	18.2	12.7
Rocky Mountain	0.5	12.2
Far West	4.5	-0.9

Sources: Same as Table 1, calculations by author.

Table 4
Administrative, Managerial, and Executive Occupation

Variable	Parameter estimate	t-statistic	Standardized estimate	Adj. R²
INTERCEPT	-.129	-2.52	0	.74
PERFORM	.669	3.39*	.43	
LINKAGE	.736	3.71*	.42	
HITECH	.0007	3.00*	.41	
QL	-.00005	-1.12	-.14	
DEPART	.000008	0.70	.08	

*significant at 5 percent

Table 5
Professional Occupation

Variable	Parameter estimate	t-statistic	Standardized estimate	Adj. R^2
INTERCEPT	.075	1.50	0	.36
PERFORM	-.263	-1.21	-.30	
LINKAGE	.588	3.71*	1.03	
HITECH	-.0003	-1.28	-.33	
QL	.00002	0.57	.12	
DEPART	-.000004	-.34	-.06	

*significant at 5 percent

Table 6
Goods-Processing Occupations

Variable	Parameter estimate	t-statistic	Standardized estimate	Adj. R^2
INTERCEPT	.403	2.05	0	.55
PERFORM	.699	4.38*	.69	
FORTRD	.0001	0.60	.10	
EARNINGS	-.0004	-1.96*	-.31	
QL	-.00002	-0.39	-.06	

*significant at 5 percent
**significant at 10 percent

Appendix A

Administrative, Managerial, and Executive Occupations
    public administrators
    management related occupations
        accountants, auditors, personnel specialists, purchasing agents
Professional Speciality Occupations
    engineers and natural scientists
    health diagnosing occupations
        physicians, dentists
    health assessment and treating occupations
        nurses, pharmacists
    teachers, lawyers, social workers, religious workers
Technicians
    health technologists
    computer programmers, engineering technicians
Sales Occupations
    sales representatives, retail sales workers, cashiers
Administrative Support Occupations
    secretaries, bookkeepers, postal clerks, child care worker
Service Occupations
    police and firefighters
    correctional institution officers and guards
    food service--cooks and waiters, janitors, dental assists.
Precision Production, Craft, and Repair Occupations
    mechanics and repairers
    construction trades
    precision production occupations
    extractive occupations
Machine Operators, Assemblers, and Inspectors
    machine operators, fabricators
Transportation and Material Moving Occupations
    truck drivers, excavating machine operators
Handlers, Equipment Cleaners
    freight, stock, and material handlers
    service station workers