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A NOTE ON THE SHIFT TO A SERVICE-BASED ECONOMY AND THE CONSEQUENCES FOR REGIONAL GROWTH*

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ABSTRACT. Using data for the 50 U.S. states we relate industry-specific employment growth rates over the period 1976-1989 to the industrial compositions of the states in 1976. We explore the idea that services and manufacturing are inextricably linked and that this interdependence may be beneficial to manufacturing (through knowledge spillovers, for example). Specifically, we test whether the manufacturing sector grew faster in service-based economies. Our evidence does not support the idea of cross-fertilization from services to manufacturing.

1. INTRODUCTION

The question of what causes regional economic growth and why different regions experience different fortunes has attracted the attention of many economists in recent years (see, for example, Krugman, 1991 and Blanchard and Katz, 1992). In the European Community the answer has great implications for economic development policies among the member countries. In the U.S., structural shifts in employment and geographic shifts in population have resulted in rising tides and sinking ships among the 50 state economies.

In previous work (Garcia-Milà and McGuire, 1993), we find evidence that the industrial composition of an economy may exert an influence on regional growth above and beyond the obvious effect of having a mix of fast- or slow-growing industries. We argue that through knowledge spillovers across

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specific industries or through industry-specific agglomeration economies, certain combinations of industries may be more beneficial for growth than others.

In this paper we combine the possibility of a link between industrial mix and regional economic growth with the observation that in recent years there has been a major restructuring of highly developed economies away from manufacturing towards services. The restructuring has also involved a change in the activities occurring within the manufacturing and services sectors. In the OECD (1992) report, it is argued that much of the value contained in manufacturing output in recent years is attributable to services. This is supported by the figure quoted in Quinn (1988) that 75 to 85 percent of manufacturing value added is due to services. Given the changing nature of the service sector and the dependence of manufacturing on services, it is conceivable that the service sector may have become a primary generator of knowledge and technology of use to manufacturing and other industries. This is the hypothesis we investigate in this paper—that in recent years, manufacturing has become dependent on services, and that this dependence has benefitted manufacturing because the service sector generates technology and knowledge of use to manufacturing. The idea is that the manufacturing sector may grow faster, and thus overall growth may be higher, in service-based economies.[1]

We do not provide a direct test of this hypothesis because we do not have direct measures of knowledge or technology imbedded in services used by manufacturing. Instead we present various descriptive statistics and regression results on the employment and input linkages between services and manufacturing. We seek evidence that the linkages are growing and positive.

The notion of knowledge spillovers from services to manufacturing is in the spirit of Jacobs' theory of cross-fertilization of ideas *between* industries rather than *within* industries (Jacobs, 1969). Glaeser et al. (1992) find empirical evidence supporting the idea that a diversified regional economy grows faster. Our contribution is to focus on specific industries, and, in particular, on the service sector as a possible new engine of growth for other industries.

The idea that services and manufacturing are inextricably linked and that this interdependence may be beneficial to manufacturing is explored in several chapters in Guile and Quinn (1988). In his introductory chapter, Guile argues that increased technology use by services is changing the structure of competition in the goods-producing sectors, and thus may have implications for the growth and productivity of manufacturing (Guile, 1988). He argues that the services surrounding manufacturing are as important as new capital in contributing to manufacturing productivity. In support of this conclusion, Duchin (1988) finds a strong dependence of manufacturing on services in that for several of the largest service sectors the primary market is manufacturing. Similarly,

[1]For 16 manufacturing sub-industries Gershuny (1978) plots output per worker against percentage of the sub-industry's work-force employed in administrative, technical or clerical occupations (services) and finds a provocative positive correlation. He concludes that "the more service occupations employed in the industry, the more productive it is." (p. 109)

Beyers (1989) documents trends in producer services in the U.S. as a whole and by metropolitan area from 1974 to 1985. Producer services are found to be a key component of regional economies and to be important inputs in manufacturing as well as other basic industries. Kutscher (1988) uses input-output techniques to investigate the amount of unbundling or outsourcing of producer-service activities from manufacturing to outside service firms and finds that unbundling has been a small factor in explaining the growth of the service sector. Indeed, he finds that relative employment in producer services within manufacturing has increased in recent years. From the available evidence it appears that manufacturing is increasingly dependent on services; manufacturers are producing more services internally and are also purchasing more services in the market.

We take a somewhat different approach to the question in that we look for evidence that manufacturing is made more productive through increased reliance on services inputs. We look for evidence at the macroeconomic level by examining broadly defined industries in broadly defined geographic regions (states). The question we ask is whether the overall (or regional) economy benefits from the shift to a service-based economy.

2. REGIONAL EMPLOYMENT GROWTH AND INDUSTRIAL MIX

Between 1959 and 1989 the share of employment in manufacturing in the private non-farm economy in the U.S. declined from 37 percent to 21 percent, while the share of employment in services doubled—increasing from 16 percent to over 30 percent. Over this same period productivity improvement (as measured by the growth of gross domestic output relative to the growth of employment) was high relative to other industries for both durable and nondurable manufacturing, especially during the years following the oil crisis of the mid-1970s. By 1989 earnings per worker were average or above average for the two manufacturing industries and for the service industries. Thus, there have been significant changes in the industrial structure of the U.S. economy in recent years; in particular, a dramatic shift in employment to a service-based economy has occurred, whereas the smaller manufacturing sector has become more productive relative to other sectors.[2]

The hypothesis we explore is whether differential employment growth rates of specific industries across states are related to states' industrial compositions. The idea is that industries may exhibit differential growth, in part, because the industrial composition in which they operate may affect growth, either through agglomeration economies or through knowledge spillovers across different industries. Glaeser et al. (1992) purport to find evidence that it is knowledge spillovers across industries rather than between firms of the same industry that benefit the growth of economies. They conclude that variety rather than

[2]The figures presented in this paragraph are based on calculations by the authors using data from the Bureau of Labor Statistics of the U.S. Department of Labor and the Bureau of Economic Analysis of the U.S. Department of Commerce.

specialization is beneficial for growth. The question left unexplored by Glaeser et al. is whether the type of industrial variety matters. This is the question we consider in our examination of the effect of different industrial mixes on industry-specific growth rates.

Our empirical model is an extension of the approach developed in Garcia-Milà and McGuire (1993), where we estimate a relationship between total employment growth and industrial composition as measured by the employment shares of major industries. Here, we investigate industry-specific growth and its relation to employment shares of services and other industries.[3]

Our method is to estimate regressions with industry employment growth as the dependent variable and shares of employment in the various industries as the independent variables. The form of the estimating equations for each of the nine industries is as follows:

$$GR_i = a + b_1SH_1 + b_2SH_2 + ... + b_8SH_8 + b_9SH_9 + e_i$$

with the identifying restriction,

$$b_1SHUS_1 + b_2SHUS_2 + ... + b_8SHUS_8 + b_9SHUS_9 = 0$$

where i denotes one of nine industries: construction, nondurable manufacturing, durable manufacturing, *TCPU* (transportation, communications and public utilities), wholesale trade, retail trade, *FIRE* (finance, insurance and real estate), services, and other, which primarily consists of mining, agricultural services, forestry and fisheries. *GR* denotes employment growth over a period, *SH* denotes employment share in the initial year of a period, and *SHUS* denotes the U.S. value of employment share in the initial year. To obtain estimates for the b_i coefficients we follow Kennedy (1986). For each regression, say industry i, the value of b_j indicates the effect on the growth rate of industry i of increasing the share of employment in industry j at the expense of decreasing the share of all other industries in proportion to their importance in the industrial composition of the U.S. in the initial year.

Each industry-specific regression is estimated with average annual growth from 1976 to 1989 as the dependent variable and with 1976 employment shares as the independent variables. This 13-year time period occurs after the mid-1970s oil crisis—a defining moment for structural change in the U.S. economy.[4]

[3]Our focus on employment growth rates rather than productivity growth rates, arguably a more natural measure of economic growth, is justified by assuming that labor is mobile across regions (states in our data), and thus wages across the regions will be equal. Under this assumption, the externalities derived from a particular industrial mix in a state will translate largely into employment growth, rather than productivity growth, and thus differences in industrial mix across the states will be reflected in differences in employment growth rates.

[4]In results not reported here we estimate similar regressions for a 13-year time period before the oil crisis, 1959-1972. The results for manufacturing and services differ between the two time periods lending support to the notion that structural change accelerated after the mid-1970s oil crisis.

The period begins and ends relatively near a peak in the business cycle, it contains two recessionary periods, and it includes a sustained period of strong economic growth. The sample for each regression is a cross-section of the 50 states. The data are from the Bureau of Economic Analysis of the U.S. Department of Commerce.[5] Because of the possibility for interdependence between neighboring states (spatial correlation), we test for the presence of spatial dependence in the error terms of the regression model (see Cliff and Ord, 1981 and Anselin, 1988).

The results are presented in Table 1. Each row presents a set of estimated marginal effects based on a regression for a given industry, and the column headings indicate the industry shares or independent variables. Except for the final three columns, the figures in the table are the b_i coefficients with absolute values of t-statistics in parentheses below the coefficients. If a variable is significant at the 10 percent level of confidence, this is indicated by the coefficient and t-statistic in bold italics. As an example of how to interpret the coefficients, the 0.12 coefficient on services share in the *FIRE* regression indicates that a 10 percent increase in services share would result in an increase in the growth rate of *FIRE* of 1.2 percentage points. The second-to-last column of Table 1 presents the statistic, z_I, to test for spatial autocorrelation, and the last column presents the spatial autoregressive coefficient, λ, for the regressions where the null hypothesis of absence of spatial autocorrelation can be rejected.

The results in Table 1 seem to indicate that industrial mix matters. Several of the industrial share variables are significant for several of the industry growth equations, and the R^2s or $R_W{}^2$s are quite large for cross-sectional results.[6] For many of these significant variables, we pose possible explanations that stem from the recent literature on economic geography and growth. Other explanations are, of course, possible, and these we address in turn. The diagonal cells can be seen as a test of own-industry agglomeration economies in general, or of within-industry knowledge spillovers (a form of own-industry agglomeration economies). If own-industry agglomeration economies are important we would expect to see a positive coefficient on a given industry's own employment share, since a higher concentration of the industry should cause the industry to grow faster. Instead, except for the *FIRE* industry, we find either no effect or a negative effect of own share on a given industry's growth. This is consistent with the findings of Glaeser et al. (1992) that regional specialization is not conducive to growth.

If there is cross-fertilization across industries, in other words, knowledge spillovers of the Jacobs type, we would expect to see positive coefficients on the shares of the industries generating the knowledge spillovers in the equations of the recipient industries. The idea is that the number of employees in the

[5]Contact the authors for a detailed description of the data.

[6]$R_W{}^2$ is a measure of fit based on weighted predicted values and residuals as proposed in Buse (1973, 1979) and used by Anselin (1988, p. 244).

TABLE 1: Regression Results for Industry-Specific Employment Growth and Industrial Mix

	1976 Employment Share In:											
1976–1989 Growth Rates of:	Construc-tion	Non-Durable	Durable	TCPU	Wholesale Trade	Retail Trade	Fire	Services	Other	R^2 or $R_w^{\ 2}$	z_I	λ
Construction	***–0.53***	***0.15***	-0.03	***–0.88***	***–0.55***	–0.03	***0.45***	***0.28***	0.07	0.81	0.58	
	(4.50)	***(3.90)***	(0.96)	***(3.18)***	***(2.69)***	(0.34)	***(3.33)***	***(5.66)***	(0.69)			
Nondurable Manufacturing*	***0.33***	***–0.09***	0.03	–0.19	–0.18	–0.06	0.02	***0.08***	***–0.18***	0.47	4.99	0.150
	(3.12)	***(1.98)***	(0.75)	(0.72)	(1.01)	(0.59)	(0.12)	***(1.81)***	***(1.99)***			
Durable Manufacturing*	***0.27***	0.05	***–0.10***	***–0.95***	–0.17	0.06	0.20	***0.12***	0.04	0.42	2.65	0.124
	(2.11)	(0.91)	***(2.32)***	***(3.05)***	(0.77)	(0.60)	(1.35)	***(2.21)***	(0.34)			
TCPU*	***0.17***	0.02	–0.04	***–0.56***	–0.16	0.04	***0.19***	0.05	–0.06	0.40	2.55	0.097
	(2.28)	(0.71)	(1.51)	***(3.06)***	(1.21)	(0.69)	***(2.16)***	(1.49)	(0.91)			
Wholesale Trade	0.02	***0.06***	–0.03	***–0.61***	***–0.44***	0.03	***0.26***	***0.14***	0.00	0.60	–0.01	
	(0.22)	***(2.13)***	(1.36)	***(2.95)***	***(2.93)***	(0.48)	***(2.57)***	***(3.77)***	(0.06)			
Retail Trade*	0.09	0.03	–0.01	***–0.40***	***–0.25***	–0.03	***0.21***	***0.08***	0.01	0.45	2.25	0.143
	(1.26)	(0.94)	(0.46)	***(2.22)***	***(2.04)***	(0.48)	***(2.43)***	***(2.45)***	(0.18)			
Fire	0.03	***0.10***	***–0.07***	***–0.78***	***–0.36***	***0.12***	***0.16***	***0.12***	0.03	0.65	0.15	
	(0.36)	***(3.92)***	***(3.11)***	***(4.15)***	***(2.59)***	***(1.89)***	***(1.75)***	***(3.42)***	(0.46)			
Services	0.04	0.02	***–0.05***	***–0.58***	–0.19	0.03	***0.36***	0.04	0.04	0.53	1.18	
	(0.60)	(1.15)	***(2.38)***	***(3.68)***	(1.67)	(0.54)	***(4.70)***	(1.24)	(0.70)			
Other	0.40	–0.03	–0.00	–0.32	–0.14	***–0.23***	0.26	***0.16***	***–0.54***	0.55	1.70	
	(2.55)	(0.61)	(0.10)	(0.87)	(0.53)	***(1.91)***	(1.46)	***(2.42)***	***(3.99)***			

NOTES

Each row is a regression, with the dependent variable being average annual growth of an industry over the period, and the independent variables being employment shares (the columns) in the first year of the period, with the restriction that the coefficients, weighted by the initial-year U.S. shares, sum to zero for each regression.

Not reported are results for the constants, which were included in each regression.

The figures in parentheses are *t*-statistics. Figures in bold italics indicate significance at the 10 percent level.

The four equations marked with * are estimated by maximum likelihood controlling for spatial autocorrelation. All other equations are estimated by OLS.

knowledge-generating industry as measured by the employment share is a proxy for the amount of activity in the area and thus the potential for interaction between industries. We recognize that share of employment in an industry is an imperfect measure of extent of influence of one industry on another, but without direct measures of spatial interaction and level of activity between industries we feel that our measure is a reasonable proxy.

We find that a relatively large presence of four industries—construction, nondurable manufacturing, FIRE, and services—appears to have had a positive effect on the growth of many other industries. The positive coefficients for the construction and FIRE variables are likely to reflect demand effects, rather than spillovers, as relatively fast-growing states require real estate development and new construction of factories, offices, and housing to employ and house the large increase in workers. The positive coefficients for FIRE could also indicate that other industries benefit from a large financial sector.

It is possible that the positive coefficients for nondurable manufacturing and for services also reflect demand. However, these two industries are likely candidates to be generators of knowledge spillovers. Services, in particular, consist in part of knowledge-intensive business and professional services. These services are, arguably, of increasing importance in the production processes of other industries, and of manufacturing in particular. The positive effect of nondurable manufacturing may also be due to a services effect, given the blurring of the line between manufacturing and services that many claim has occurred in recent years (see OECD, 1993).

There are, of course, other possible explanations for the finding of a positive effect of services on manufacturing in the post-oil-crisis period. The most obvious is that the relatively fast-growing states generate a large demand for all types of services, from personal to business services, and that the positive coefficient simply reflects this reverse demand relationship. Another possible explanation is that the service sector has become an export industry, and thus the demand for the goods of other industries is higher in service-based economies (see Heilbrun, 1987). To argue convincingly for knowledge spillovers as the explanation for the positive coefficient of services, we need corroborating evidence.

It is our supposition that the business and professional services sub-industry is most likely to generate knowledge of benefit to the manufacturing industry. Thus we examine the effect of the share of business-services employment on the growth of manufacturing to test more directly whether knowledge spillovers exist from services to manufacturing. In Table 2, we present industry-specific regressions for the same set of one-digit industries examined in Table 1, with employment growth from 1976 to 1989 as the dependent variable and industry shares in 1976 as the independent variables. However, in Table 2, we split the services share variable into four separate share variables: business and professional services (including business, engineering and management, and legal

TABLE 2: Regression Results for Industry-Specific Employment Growth and Services

	1976 Employment Share In:													
								Services						
1976–1989 Growth Rates of:	Construction	Non-Durable	Durable	TCPU	Wholesale Trade	Retail Trade	Fire	Business	Education	Health	Other	Other	R^2 or R_w^2	z_I
Construction	***–0.55***	***0.17***	–0.03	***–0.98***	***–0.40***	0.02	0.28	***0.54***	0.33	0.25	***0.45***	0.10	0.81	1.03
	(4.40)	***(4.18)***	(0.79)	***(3.58)***	***(1.69)***	(0.15)	(1.36)	***(2.45)***	(1.12)	(1.02)	***(3.11)***	(1.23)		
Nondurable Manufacturing	***0.36***	***–0.08***	0.04	***–0.63***	0.27	0.01	0.20	0.03	***–0.55***	–0.06	***0.35***	–0.06	0.57	1.04
	(3.65)	***(2.38)***	(1.35)	***(2.90)***	(1.45)	(0.08)	(1.26)	(0.19)	***(2.33)***	(0.29)	***(3.02)***	(0.86)		
Durable Manufacturing	***0.41***	0.01	***–0.11***	***–1.52***	0.29	0.14	***0.40***	–0.14	0.34	–0.31	0.22	0.14	0.63	0.96
	(3.29)	(0.23)	***(2.73)***	***(5.53)***	(1.24)	(1.26)	***(1.95)***	(0.60)	(1.12)	(1.24)	(1.54)	(1.62)		
TCPU	***0.24***	***0.05***	–0.01	***–0.86***	0.16	0.06	***0.31***	–0.01	–0.19	–0.21	***0.25***	–0.01	0.66	0.24
	(3.40)	***(2.20)***	(0.37)	***(5.63)***	(1.20)	(1.00)	***(2.73)***	(0.08)	(1.14)	(1.48)	***(3.13)***	(0.23)		
Wholesale Trade	0.03	***0.08***	–0.01	***–0.71***	–0.27	0.05	0.17	***0.29***	–0.01	0.07	***0.31***	0.02	0.62	–0.05
	(0.32)	***(2.62)***	(0.47)	***(3.53)***	(1.55)	(0.56)	(1.12)	***(1.79)***	(0.06)	(0.41)	***(2.92)***	(0.25)		
Retail Trade	***0.18***	***0.07***	–0.01	***–0.71***	–0.12	–0.05	***0.36***	0.00	0.06	–0.02	***0.20***	0.07	0.65	1.44
	(2.59)	***(3.20)***	(0.39)	***(4.64)***	(0.91)	(0.83)	***(3.16)***	(0.00)	(0.36)	(0.16)	***(2.44)***	(1.47)		
Fire	0.01	***0.12***	***–0.08***	***–0.81***	***–0.36***	***0.13***	0.06	***0.29***	0.10	0.20	0.13	0.05	0.66	–0.29
	(0.09)	***(4.16)***	***(3.06)***	***(4.35)***	***(2.27)***	***(1.72)***	(0.46)	***(1.94)***	(0.48)	(1.21)	(1.36)	(0.93)		
Services	0.04	0.03	***–0.04***	***–0.60***	–0.14	0.07	***0.21***	***0.27***	–0.10	–0.03	0.06	0.00	0.58	0.66
	(0.56)	(1.16)	***(1.67)***	***(4.03)***	(1.06)	(1.13)	***(1.84)***	***(2.20)***	(0.59)	(0.21)	(0.71)	(0.05)		
Other*	***0.39***	0.05	0.09	***–0.88***	0.43	–0.05	0.13	***0.53***	–0.55	–0.16	***0.84***	***–0.32***	0.54	2.35
	(2.51)	(0.81)	(1.67)	***(2.46)***	(1.43)	(0.34)	(0.56)	***(2.02)***	(1.38)	(0.50)	***(4.74)***	***(2.99)***		

NOTES

Each row is a regression, with the dependent variable being average annual growth of an industry over the period, and the independent variables being employment shares (the columns) in the first year of the period, with the restriction that the coefficients, weighted by the initial-year U.S. shares, sum to zero for each regression. Not reported are results for the constants, which were included in each regression. The figures in parentheses are t-statistics. Figures in bold italics indicate significance at the 10 percent level.

*The "other" equation is estimated by maximum likelihood controlling for spatial autocorrelation with an optimal λ of 0.110. All other equations are estimated by OLS.

services); education services; health services; and all other services (including recreation, repair, household and personal services).[7]

The results confirm our previous finding of no own-industry agglomeration economies, or even possibly own-industry agglomeration diseconomies, except for the services industry.[8] Generally, the results confirm the positive impact of construction, nondurable manufacturing, and FIRE on the growth of other industries. We attribute the minor differences in results between Tables 1 and 2 to the different set of regressors with the services industry being split into four sub-industries in Table 2.

We now focus our attention on the four columns describing the services industry, where we attempt to untangle the meaning of the six significantly positive coefficients for services share that we uncovered in Table 1. Of most interest is the effect of business-services share on the growth of the two manufacturing industries. In Table 2 we find that the share of business services is not significant for either manufacturing industry, thus refuting the idea that business services generates knowledge spillovers of benefit to manufacturing. Nevertheless, business services has a positive effect on four other industries—construction, wholesale trade, FIRE and services—and for FIRE and services no other type of service matters.

An important part of the positive impact of services seems to be due to the sub-industry "other services." Given the composition of other services (primarily repair services, recreation services, hotels, and personal services), this indicates that the link between services and the growth of other industries may be due to demand effects rather than to supply effects such as knowledge spillovers.

3. CONCLUSION

Drawing from our own previous work (Garcia-Milà and McGuire, 1993), from Glaeser et al. (1992), and from recent studies of the services sector (Guile and Quinn, 1988 and Beyers, 1991, for example), we pose the hypothesis that the recent shift towards services and away from manufacturing in the U.S. economy may have benefitted regional employment growth. In particular, the growth of manufacturing itself may have benefitted from this structural shift because of knowledge spillovers from services to manufacturing.

We found evidence suggestive of this hypothesis in Table 1 which shows that manufacturing employment growth was greater in states with greater shares of initial employment in services. However, when we explored the effects of employment shares of different types of services on the growth rates of nondur-

[7]We test for spatial autocorrelation for the nine regressions reported in Table 2 and we reject the null hypothesis of absence of spatial autocorrelation for only one equation, the equation corresponding to the "other" industry.

[8]One of the coefficients that changes from Table 1 to Table 2 is the coefficient for FIRE in its own equation. It is positive and significant at the 10 percent level in Table 1 but insignificant in Table 2.

able and durable manufacturing, we found that business services, the type of services most likely to generate knowledge spillovers, had no effect on regional manufacturing growth (Table 2). We therefore refute this one form of cross-fertilization between industries.

Thus, contrary to our expectations, we found no relationship between the share of employment in business services and the growth rate of either durable or nondurable manufacturing. An obvious explanation for this unexpected result might be the quality of and level of aggregation of the data. Obtaining finely detailed data on services is very difficult, and business services, although a subset of all services, is still a very large and amorphous category (in 1989 business services comprised nearly ten percent of total employment). It is also possible that although a positive, microeconomic linkage between services and manufacturing exists, it may not be reflected at the macroeconomic level because of the way the industries are defined for data-gathering purposes (for example, all employees of a manufacturing enterprise are counted as manufacturing employment whether they produce services or goods).

It is clear that data at less-aggregated levels along both the industrial and regional dimensions would be useful for future empirical research into the hypothesis that service-based economies grow faster than those based on goods production. It would also be helpful to have detailed data by occupation to address, to some extent, the issue of people employed by a firm in one industry but engaged in activity associated with another industry.

We have focused on a small subset of the findings and results displayed herein: those pertaining to the possibility of an effect of an increase in the importance of services on the growth of manufacturing. In Table 2, several other results of potential interest are displayed. The positive effect of the FIRE industry on growth of four of the nine industries may indicate that industries benefit from being in regions with relatively large financial sectors. Business services, while having no impact on manufacturing, displayed a positive effect on the growth of five other industries.[9] Nondurable manufacturing exhibited a positive effect on five other industries, perhaps supporting the notion described in Rauch (1993) that manufacturing produces localized externalities of benefit to other industries. In summary, while we found little evidence to support the idea of knowledge spillovers from services to manufacturing, our inquiry has confirmed the impact of industrial mix and services (broadly defined) on regional employment growth. Additional research is needed to understand the implications of these findings for regional economic growth and for regional economic development policy.

[9]Daniels (1991) and Beyers (1991) both discuss models of and the evidence for the way in which producer services may positively benefit the regional economy even though the linkage to manufacturing may be weak.

REFERENCES

Anselin, Luc. 1988. *Spatial Econometrics: Methods and Models*, Kluwer Academic Publishers.

Beyers, William B. 1989. "The Producer Services and Economic Development in the United States: The Last Decade," Final Report to the U.S. Department of Commerce, Economic Development Administration, Technical Assistance and Research Division.

———. 1991. "Trends in the Producer Services in the USA: The Last Decade", in P.W. Daniels (ed.), *Services and Metropolitan Development: International Perspectives*, London: Routledge.

Blanchard, Olivier Jean and Lawrence F. Katz. 1992. "Regional Evolutions," *Brookings Papers on Economic Activity*, 1, 1–61.

Buse, A. 1973. "Goodness-of-fit in Generalized Least Squares Estimation," *The American Statistician*, 27, 106–8.

———. 1979. "Goodness-of-fit in the Seemingly Unrelated Regressions Model, A Generalization," *Journal of Econometrics*, 10, 109–13.

Cliff, A.D., and J.K. Ord. 1981. *Spatial Processes: Models and Applications*, London: Pion Limited.

Daniels, Peter W. 1991. "Producer Services and the Development of the Space Economy", in Peter W. Daniels and Frank Moulaert (eds.), *The Changing Geography of Advanced Producer Services: Theoretical and Empirical Perspectives.* London: Belhaven Press.

Duchin, Faye. 1988. "Role of Services in the U.S. Economy," in Bruce R. Guile and James Brian Quinn (eds.), *Technology in Services: Policies for Growth, Trade, and Employment.* Washington, DC: National Academy Press.

Garcia-Milà, Teresa and Therese J. McGuire. 1993. "Industrial Mix as a Factor in the Growth and Variability of States' Economies," *Regional Science and Urban Economics,* 23, 731–748.

Gershuny, Jonathan. 1978. *After Industrial Society? The Emerging Self-service Economy*. Atlantic Highlands, N.J.:Humanities Press, Inc.

Glaeser, Edward L., Hedi D. Kallal, José A. Scheinkman and Andrei Shleifer. 1992. "Growth in Cities," *Journal of Political Economy,* 100, 1126–1152.

Guile, Bruce R. 1988. "Introduction to Services Industries Policy Issues," in Bruce R. Guile and James Brian Quinn (eds.), *Technology in Services: Policies for Growth, Trade, and Employment,* Washington, DC: National Academy Press.

Guile, Bruce R. and James Brian Quinn. 1988. *Technology in Services: Policies for Growth, Trade, and Employment,* Washington, DC: National Academy Press.

Heilbrun, James. 1987. *Urban Economics and Public Policy, Third Edition*. New York: St. Martin's Press.

Jacobs, Jane. 1969. *The Economy of Cities*. New York: Random House.

Kennedy, Peter. 1986. "Interpreting Dummy Variables," *The Review of Economics and Statistics,* 2, 174–175.

Krugman, Paul. 1991. *Geography and Trade*. Cambridge, Massachusetts, MIT Press.

Kutscher, Ronald E. 1988. "Growth of Services Employment in the United States," in Bruce R. Guile and James Brian Quinn (eds.), *Technology in Services: Policies for Growth, Trade, and Employment.* Washington, DC: National Academy Press.

OECD. 1992. "Industrial Policy in OECD Countries Annual Review 1992," Organization for Economic Cooperation and Development.

———. 1993. "Industrial Policy in OECD Countries Annual Review 1993," Organization for Economic Cooperation and Development.

Quinn, James Brian. 1988. "Technology in Services: Past Myths and Future Challenges," in Bruce R. Guile and James Brian Quinn (eds.), *Technology in Services: Policies for Growth, Trade, and Employment.* Washington, DC: National Academy Press.

Rauch, James E. 1993. "Does History Matter Only When it Matters Little? The Case of City-industry Location," *The Quarterly Journal of Economics*, 3, 843–867.