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MANUFACTURING AND THE EXTERNALIZATION OF SERVICES: A THEORETICAL MODEL

*Andrew Krmenec and Adrian Esparza**

Introduction

The growth of the U.S. service sector over the past several decades is both unprecedented and puzzling. Regional scientists are accustomed to thinking of services as nonbasic activity subservient to manufacturing and the extractive industries. Yet between 1976 and 1986, the U.S. service sector grew at an average annual rate of 5.39 percent, nearly double the growth rate of total employment in the economy. Is our understanding of the role of services in the economy faulty, or has the role of the service sector changed?

Several explanations have been offered for the recent rapid growth in service employment. Rising personal incomes, increased female labor force participation, slower rates of productivity growth, and lower relative service wages have been proposed by a variety of authors [3, 5, 9, 15, 18]. Regional scientists such as Beyers and Alvine [2], Kirk [7], and O hUallachain [10] offer two alternative explanations: the export and externalization hypotheses. The export hypothesis suggests that much of this growth has been fueled by nonlocal demand for services and the consequent development of service exports [14]. The externalization hypothesis, on the other hand, suggests that at least part of the growth in service employment can be traced to the spin-off of service activities from within the manufacturing sector. Although neither of these hypotheses has been tested extensively, Beyers and Alvine [2], Harrington and Lombard [4], Keil and Mack [6], and Smith [13] report evidence of service exportation in regional economies.

This paper presents a theoretical model of service externalization that may be used for empirical tests of the externalization hypothesis.

Services as Industry and Activity: Some Definitions

Services refer to intangible functions that enter the production process or that are consumed by the population at large. At the industry level, services traditionally cover such activities as transportation, communication, and public utilities; wholesale and retail

*Department of Geography and Center for Governmental Studies, Northern Illinois University. This paper was presented at the Mid-Continent Regional Science meetings, June 1989, Minneapolis, Minnesota.

trade; finance, insurance, and real estate; and business and personal services. This set of industries spans two digit SIC categories 40-89. This paper considers these industries as services or the nonbasic sector.

The key notion of the definition of services is based upon function or activity, not on industry. For example, the services provided by an accountant in an accountancy agency or in the front office of a manufacturer are essentially the same. Service functions are not exclusive to the service sector, but often are self-provided within an industry. Technically, therefore, service activities may be present in all sectors of the economy.

Table 1 illustrates the variety of service activity occupations found within the manufacturing sector. This table is based upon a coding system developed by the Bureau of Labor Statistics for the Occupational Employment Survey (OES). In addition to production workers (OES codes 50-61 and 64-89), several forms of service activity can be distinguished. Production services represent services that directly or indirectly assist the production process. These include such occupations as engineer, scientist, janitor, mechanic, and fork lift operator. Management services such as accounting, secretarial support, and legal assistance provide administrative support. These types of activities are susceptible to externalization.

Service Externalization: A Conceptual Review

The recent growth in U.S. services is particularly vexing because its causes are not transparent. Under the traditional economic base viewpoint, services serve manufacturing and final demand. Thus, it is expected that the service sector will grow only as the demand for its products--by either manufacturers or consumers--grows. Recent patterns of service growth, however, do not follow this dictum. Table 2 reports employment growth statistics for services and nonservices across U.S. census regions. Although the general pattern of increasing service sector employment is evident, these increases do not always accompany growth in nonservices. For example, the East and West North Central regions experienced net declines in nonservice industry employment between 1980 and 1985, yet positive growth in services.

As recent service growth is considered, it is important to bear in mind that other significant changes have occurred simultaneously in the economy. Among these are what Agnew [1] and Schoenberger [12] refer to as the *globalization of manufacturing.* The U.S. has lost its competitive advantage in manufacturing through stiff international competition made possible by the expansion of international markets, the standardization of technology, and the proliferation of multinational

corporations [16]. This process of restructuring has an effect on growth of the service sector.

From a demand perspective, services can be distinguished by the point at which they are consumed in the economy. Business services are consumed as intermediate demand by manufacturing and other businesses. Personal services are consumed in final demand. That is:

(1)Total Service Demand	=	Demand by Manufacturing	+	Demand by Consumers
(2)Total Service Demand	=	Demand for Business Services	+	Demand for Personal Services

Growth in the service sector thereby can be attributed to increased demand for service products as business services or personal services. Normally, the demand for personal services is expected to grow as local population grows, and the demand for business services is expected to grow as the local manufacturing base of the economy grows. It is this latter relation that has been modified in the process of the globalization of the U.S. economy.

In order to remain competitive and profitable in the face of the globalization of product markets, U.S. manufacturers first had to cut costs. This had to be done, however, in a fashion that would not sacrifice production. Over the long run, costs could be cut by modernizing the technology of production and eliminating excessive (U.S.) labor costs. Over the short run, labor cost savings could be realized in one of two ways. First, firms could consolidate labor functions and eliminate the redundant workforce; some of the large auto makers, for example, drastically reduced their management staffs by this means. Alternatively, firms could substitute cheaper external labor for the more expensive (unionized) in-house labor. Clearly, this type of cost savings could not be realized through substitution for production labor, but only through substitution for nonproduction--i.e., service--labor.

The externalization of service functions from manufacturing allows firms to realize certain costs savings. Kirk [7] also argues that firms are motivated to externalize service functions because this increases internal economies of scale and reduces risk. Instead of a maintenance staff performing a myriad of repair and production functions, repairs could be contracted and paid only when needed. Externalization may be practiced through production services (e.g., equipment repair and general maintenance, custodial service) or through management services (data processing, bookkeeping, financial and engineering services).

The externalization of services from manufacturing does not necessarily imply a loss of jobs in the economy. On the contrary, externalization may be a principal cause of service growth in the economy. Figure 1 illustrates this mechanism. At the incipient stage of externalization, firms contracting outside for service support create new service enterprises. There is a strong correlation at this point between job gain in services and job loss in manufacturing. The net employment effect may be slightly negative. The newly spun-off service firms, however, create their own secondary demand for services (especially management services), thereby further increasing local service employment. The total employment effect at the end of this first stage may be positive or slightly negative.

Regional differences in service growth, such as those seen in Table 1, may develop through this process in two ways. First, firms in different regions may vary in their tendencies to externalize service functions. Malecki [8] argues that recent patterns of manufacturing development led to the (regional) separation of corporate functions and the development of functionally specialized regions. The dispersion of production to branch plants in peripheral locations is one critical aspect of this development [11]. The core of the economy retained corporate administration and development functions, while the periphery assumed the production function. If Malecki's thesis is correct, greater management service growth should be expected in core regions and greater production service growth should be expected in the periphery.

Regional variation in service growth also can develop through competitive advantage and specialization. A region strong in one industry, e.g., iron production, initially may develop a strong service industry oriented to its specific needs. As other iron-producing firms in other regions begin to cut costs through externalization of service functions, they may contract with the first region's already developed service industry. An initial competitive advantage in iron production services may lead to regional specialization in that service industry, exportation of the service, and therefore regional variation in the growth of the service.

An Economic Base Model of Externalization

The economic base model simplifies the economy into two sectors--the basic sector that produces goods for export and the nonbasic sector that produces commodities that are consumed locally. The fundamental accounting equation of this model defines total employment as the sum of employment in the basic sector and employment in nonbasic activities.

(3) $E_T = E_B + E_N$.

By simple reorganization, equation (3) can be written as:

(4) $E_T = (1 + r)\, E_B$;

where $r = (E_N / E_B)$ is the economic base ratio. This ratio represents the number of nonbasic (service) employees supported by one employee in the export-oriented basic sector of the economy.

Now consider the process of service externalization. At the start of this process (t=0), labor in the basic sector is distinguished as employed in either business services or production. Let E_{BS} denote the number of business service employees internal to the basic sector and E_P the number of production employees. Accounting equation (3) now can be rewritten as:

(5) $E_T = (E_P + E_{BS}) + E_N$.

Following the usual definition of the economic base ratio, then

(6) $r_0 = E_N / E_B = E_N / (E_{BS} + E_P)$.

As service externalization occurs, business service labor in the basic sector is shifted to the nonbasic sector. Assuming E_T in equation (5) is constant, the economic base ratio after externalization (t=1) is calculated as:

(7) $r_1 = (E_{BS} + E_N) / E_P$.

Comparing equations (6) and (7) shows that the numerator of equation (6) is smaller than the numerator of equation (7) and that the denominator of equation (6) is larger. It therefore follows that:

(8) $r_0 = E_N / (E_{BS} + E_P) << r_1 = (E_{BS} + E_N) / E_P$.

The implication of this exercise is clear. As long as $E_{BS} \neq 0$, the externalization of service functions from basic activity will increase unambiguously the observed economic base ratio. Unfortunately, service externalization is only a sufficient, not a necessary, condition for an increasing economic base ratio. Thus, equation (8) only should be read as a rudimentary test for evidence of externalization.

Equation (8) shows a simple ordering relationship between the prior and posterior economic base ratios. Solving equation (6) for E_N,

(9) $E_N = r_0 (E_{BS} + E_p)$

and substituting into equation (7):

(10) $r_1 = (E_{BS} + r_0 E_{BS} + r_0 E_p) / E_p$.

Equation (10) now specifies r_1 directly as a function of the prior economic base ratio (r_0), production labor, and the quantity of business service labor externalized. This relation can be simplified further as:

(11) $r_1 = (1 + r_0) [E_{BS} / E_p] + r_0$

$= r_0 + [E_{BS}/E_p] + r_0 [E_{BS}/E_p]$.

The new economic base ratio, after service externalization, is the prior ratio (r_0) plus the contribution of the employment shift (the middle term) plus the multiplier effect of the employment shift (the last term). Equation (11) is a straightforward and particularly appealing result, as it formally recognizes the multiplier component of the shift of business service labor from the basic sector.

Because there is now a formal direct link between the prior and posterior ratios, the model can be solved for expected change. Subtracting the last term on the right side of equation (11) from both sides,

(12) $r_1 - r_0 = (1 + r_0) [E_{BS} / E_p]$;

i.e., $\Delta r = (1 + r_0) [E_{BS} / E_p]$.

A small change of notation will simplify this result. Let E_B denote basic sector employment at time t=0 and $E_{B->S}$ denote an observed shift of service labor from the basic sector to nonbasic. Rewriting equation (12) in the new notation,

(13) $\Delta r = (1 + r_0) [E_{B->S} / (E_B - E_{B->S})]$.

Given complete information from time t=0 and an observed externalization shift, equation (13) allows prediction of the change in the observed economic base ratio. Alternatively, equation (11) can be solved for an estimate of the quantity of business service labor externalized given both the prior and posterior ratios.

(14) $E_{B->S} = E_B / [1 + ((1 + r_0) / \Delta r)]$;

where $\Delta r = r_1 - r_0$.

The implications of this model contrast sharply with prior empirical analyses of service externalization. Urquhart [18] explores national industry employment data with a simple descriptive methodology and without a theoretical foundation. Tschetter [15], in contrast, estimates the likely impact of externalization on service growth for the entire U.S. economy using a shift-share methodology. Unfortunately, Tschetter's estimate of the externalization impact arises as a residual of the empirical model, and this precludes any possibility of an externalization multiplier. Equations (12) and (14) offer testable hypotheses of externalization within the foundations of the economic base model. Assuming E_T constant in equation (5) is potentially restrictive, insofar as the economic base ratio is expected to grow as a consequence of growth of the economy.

Concluding Remarks

The purpose of this paper was to begin an investigation of service externalization as an explanation for the recent rapid growth of the U.S. service sector. Externalization itself is a short-run phenomenon, resulting in little net change in an economy's total employment. Yet through indirect multiplication, longer-run, net employment growth is expected. The strongest appeal of this explanation, however, is that it provides some basis for understanding how a region can begin to specialize in service activities and therefore develop a service export function. The externalization hypothesis is complementary to, not exclusive of, the service-export explanation of service sector growth.

Regional science is far from understanding the multitude of factors affecting recent service sector growth. This paper has focused on one hypothesis by building a formal model of externalization. There is little empirical evidence on how significant externalization has been and to what extent it contributes to regional service specialization or the development of service export functions.

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Table 1
Occupation Aggregation from OES Two-digit Codes*

Code+	Occupation Title	Aggregate Employment
00/01	Engineer Engineering Technician	Production Services → Business Services
02 04 05	Scientist Science Technician Other Professional	Production Services → Business Services
	Other Technicians	Production Services → Business Services
37/38	Protection Service Cleaning: Building Service Supervisor Other Service	Production Services → Business Services
62-63	Mechanic & Repairer	Production Services → Business Services
90	Truck Driver	Production Services → Business Services
92	Packager/Handler	Production Services → Business Services
07	Health/Medical	Management Services → Business Services
09	Education/Instructor	Management Services → Business Services
10	Librarian	Management Services → Business Services
11	Lawyer	Management Services → Business Services
13/14	Writer/Editor Reporter	Management Services → Business Services
16	Accountant/Financier/ Purchasing Agent/Buyer	Management Services → Business Services
18	Manager/CEO	Management Services → Business Services
20-24	Secretary/Clerk: Office Clerical: Production Office Machine Operator	Management Services → Business Services
25-27 29	Sales	Management Services → Business Services
31	Food Service	Management Services → Business Services
50-61 64-89	Production	Production

*Aggregation compiled by the authors
+Code source: U.S. Department of Labor [17]

Table 2

Percentage Change in Service and Nonservice* Employment: 1975-1980 and 1980-1985

Census Division	Nonservice Employment 1975-1980	Nonservice Employment 1980-1985	Service Employment 1975-1980	Service Employment 1980-1985
New England	0.1875	0.0753	0.3773	0.2950
Mid-Atlantic	0.0679	0.0078	0.2485	0.2455
South Atlantic	0.2687	0.1263	0.2281	0.3542
E. North Central	0.1185	-0.0519	0.3046	0.1687
E. South Central	0.1992	0.0171	0.3504	0.2152
W. North Central	0.2073	-0.0158	0.3372	0.1733
W. South Central	0.3493	0.0564	0.4280	0.2934
Mountain	0.4214	0.0978	0.5161	0.2703
Pacific	0.3385	0.0668	0.4969	0.2444
U.S. (total)	0.2091	0.0355	0.3395	0.2485

*Nonservice activities include construction, mining, manufacturing, and wholesale trade. Nonservice employment is calculated as total employment minus service employment. Data source: *County Business Patterns*, various dates

Figure 1
Externalization in Service Sector Growth