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POOLED REGRESSION AND COVARIANCE ANALYSIS OF SMSA SELECTED SERVICES: EARNINGS AND FIRM SIZE

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The United States has experienced, in the last few decades, a major structural change. This change is generally referred to as the transition to a service economy. Service employment as a share of total employment has risen from 57 percent in 1948 to 74 percent in 1983. The major impact of this change has been on metropolitan economies [26]. Confusion and misconceptions about services' "homogeneity, scale economies, output, and spacelessness" have produced clouded and erroneous indications and implications of service growth. Services are not only unique products because they cannot be inventoried, but also because they are less and less recognizable from published data since more and more services are being undertaken in-house and purchased complimentarily with goods (intermediate services) [23, 24].

Little has occurred to deny Stigler's and Fuch's suggestion of a dearth of service industry research, especially, at the regional level. While Stigler, Perloff, et. al., and others [6, 7, 8, 18, 27], have researched at national and state level, only relatively recent work by Stanback, especially, and others have been completed at the nodal level [15, 23, 24, 25].

Recent papers [14, 15] have explored the interregional relationship between tertiary earnings per capita and market size. Those results indicated structural differences in tertiary activities between "lagging and prosperous" SMSAs. Tertiary earnings included transportation, communication, utilities, wholesale and retail trade finance, insurance and real estate, and services. It appeared the primary reason for tertiary structural differences lay in the latter two groups of industries. This paper undertakes a more rigorous, micro view of one of the groups of industries, service, that is thought responsible for interregional structural differences in tertiary activity. For purposes of this paper service industries will include hotel, business, health, education, and social services. The spatial dichotomy, prosperous versus lagging will be maintained.

The particular interests of this paper are (1) the role of these industries in explaining the variation in aggregate service earnings per capita, (2) the role of firm size in determining these earnings, and (3) the extent of spatial variation in the relationship between earnings and structure. This paper seeks to illustrate the relative importance of certain types of services and the size of the service firm in explaining the variation in aggregate service earnings per capita. Also, the type and size of firm will be examined for interregional variation.

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The spatial dimension is the SMSA. The interregional analysis is between "prosperous" and "lagging" SMSAs in an effort to capture the interregional flavor and be consistent with previous results [14, 15]. The SMSA is used not only for reasons noted above but also because of its nodal role in the landscape, its use by the Bureau of Economic Analysis (BEA) as part of an economic region. BEAs are used as the basis for the SMSAs because of their conceptual importance and the availability of data. Functional economic areas (BEA areas) are comprised of the SMSA counties and Non-SMSA counties. Service structure as defined in this paper is not commonly used and has several limitations. Structure is often measured by labor market characteristics such as workers by industry, or occupational structure. These measures have been implemented to some degree in a typological framework for the U.S. [22]. Any attempt to capture a measure for both human and plant capital at the SMSA level is faced with selecting surrogates. Firm size and occupations by industry would not be ideal but would be acceptable, however, they are either not available or inconsistent for even a small sample of cities. The surrogate used in this paper to capture structure — capital and labor productivity — is number of firms by size for each particular service industry for SMSAs.

The sample used 85 SMSAs, is gathered from 31 properous and 31 lagging BEA areas based on income per capita relative to the U.S. in 1978. It may very well be that the SMSAs, even though from prosperous and lagging BEA areas, are not prosperous or lagging as are their BEA areas since it may be the periphery which determined the categorization. However, while service earnings and income per capita are significantly different, other characteristics such as SMSA population, employment ratio, and service employment relative to population are not statistically different between our regions. Therefore, the hypothesis that these SMSAs are not different in their service structure or performance will be examined.

This sample is not random since it was selected in order to adjust for the obvious bias of size (population) of the BEA areas. That is, the prosperous BEA was aligned with the lagging BEA area with approximately equal population. Indeed, an effort was made to avoid (minimize) the size bias and maximize the differences in per capita income.[1] It is felt this initial dichotomization will provide evidence to buttress/refute spatial variation in service structure. Other qualitative dichotomizing will follow.

[1]. The BEA area populations are between 259,000 and 2,563,000. Their relative incomes per capita (1978) were used to dichotomize the sample by a rule of thumb; if income per capita is greater than .95 of the U.S. the region is "prosperous"; if less than .90 it is "lagging". The lagging BEA area populations are between 263,000 and 2,547,000. The mean SMSA populations are 388,000 (lagging) and 416,000 (prosperous) but are not statistically different.

Descriptive Statistics

Cross-section data were obtained from the *1980 OBERS BEA Regional Projections, Volumes 1-3,* and *County Business Patterns, 1977.*[2] The descriptive statistics illustrated in Table 1 provide a glimpse of the regional (interregional) flavor of the service industries considered herein.

Service industries in this paper include five industries — (1) hotel and lodging places (SIC 70) which is one of the few growing consumer services, (2) business (SIC 73), (3) health (SIC 80), (4) education (SIC 82), and (5) social services (SIC 83). Business and social services are an important part of the fastest growing services — producer services. Non-profit services (here, health and education) are growing somewhat slower than producer services [23, 24, 26]. The surrogate for industrial structure in each of these industries is number of firms by size, that is, small firms 0-19 employees, medium 20-99, and large, one hundred or more employees (to minimize disclosure problems in the very large firms) per 1000 population. These are surrogates, albeit rough, for capital and labor inputs [21, 28].

Although prosperous and lagging BEA areas have nearly equal populations, the prosperous SMSAs have (1) 27 percent more service firms, (2) 22 percent more SMSAs, (3) 19 percent higher income per capita, and (4) only about 58 percent of the hinterland population available to the lagging region [14]. This results in about 3 percent fewer firms per SMSA for the lagging SMSAs and 13 percent fewer firms per one thousand population (2.6 vs 2.3). Certainly, we might expect more and/or larger (see Table 1) firms in the prosperous SMSAs with the somewhat larger SMSA population (410,000 vs 374,000 but not statistically different) and higher income per capita, but we might also expect them to serve a larger population; however, according to (4) above the population would be outside the BEA area.

In Table 1 we notice regional differences in the percentage distribution of type and size of firm. The widest differences (relatively and absolutely) exist in health services.[3] Perhaps regression coefficients for firm size will allow us to glean some evidence of regional similarities or differences in the various components of service industrial structure. Although in absolute number of firms the prosperous SMSA is about 23 percent larger, and firms per SMSA are only slightly more. But looking at the internal structure of prosperous vs lagging SMSAs the only service industry receiving relatively greater emphasis is health, whereas, hotel, education, and social service are relatively

[2]. *County Business Patterns* data prior to 1974 is of minimal value to regional economists because of their use of "reporting unit" and not "establishment." For example, branch offices employment was not separated out if in the same county — one reporting unit.

[3]. It is interesting to note the extent of interregional congruency of business services in all firm sizes. Recall the BEA area and SMSA populations are not significantly different statistically. These services appear more closely tied to population than other services. Others have suggested these services are selective and are becoming more and more in-house [25, 26].

more prevalent in the lagging structure by 18, 23, and 8 percent respectively. Although many apparently large differences exist, none of these differences are statistically significant.

Table 1. Percentage and Numerical Distributions of Firms Per SMSA by Type and Size

Type & Size of Firm	Percentage of Firms Per SMSA		Number of Firms Per SMSA		Firms per 1000 Population per SMSA	
	Prosperous	Lagging	Prosperous	Lagging	Prosperous	Lagging
HO 1+	5.0	5.7	55.7	49.4	.168	.143
HO 2+	1.1	1.6	11.7	13.8	.032**	.038
HO 3+	0.4	0.4	3.9	3.2	.007	.007
B 1	23.1	23.1	255.3	201.4	.551	.502
B 2	3.0	3.2	33.3	27.7	.070	.062
B 3	0.7	0.8	7.6	6.7	.013	.012
HE 1	49.7	45.8	542.2	399.0	1.249*	1.058
HE 2	2.6	2.6	28.7	22.4	.071	.065
HE 3	1.1	1.1	12.5	9.5	.030*	.026
E 1	3.2	3.8	35.1	33.0	.076**	.088
E 2	1.0	2.3	10.7	11.4	.022**	.029
E 3	0.2	0.3	2.1	2.4	.006	.005
SS 1	8.1	9.0	89.0	78.5	.227	.213
SS 2	1.3	1.2	13.9	10.8	.033**	.026
SS 3	0.2	0.2	2.3	1.8	.005	.005
Size 1	88.5	87.4	979.9	783.1	2.270*	2.004
2	9.0	9.9	99.2	88.8	.229	.221
3	2.6	2.7	28.5	24.5	.062	.055
ZHO+					.207	.188
ZB					.634	.577
ZHE					1.350*	1.148
ZE					.104**	.122
ZSS					.266	.244
All	100.0	100.0	1107.6	896.4	2.561	2.276
n	47	38	47	38	47	38

Source: *County Business Patterns, 1977.*

+ HO = hotels, etc.; B = Business; HE = Health; E = Education; SS = Social Services; 1 — small, 1-19 employees; 2 = medium, 20-99 employees; 3 = large, 100 or more employees; Z is the total number of firms by type.

* This firm is significantly different between the regions at the .05 level of significance.

** The level of significance is .10.

After adjusting for size of SMSA and firm, in 12 of the 15 cases there are fewer firms per 1000 population in the lagging SMSAs, Table 1. This may imply that lagging firms are more efficient since they serve more people; or,

are making up for their lower income by serving more people.[4] This research does not attempt to answer these and many related hypotheses except in the context of structural differences as measured here.

In most cases the prosperous mean firms per 1000 population statistic is larger than the lagging. Note, however, that significant statistical differences interregionally by number, size, and type of firm are few. For sectors, there is a significant regional difference between the mean of all health firms (ZHE) and all educational institutions (ZE). As expected, aggregate service earnings per capita and income per capita are significantly different between the regions and population is not.

As illustrated in the right hand columns of Table 1, on a firm per 1000 population per SMSA basis, the prosperous SMSAs have more hotels (10 percent), health services (17 percent), and social services (9 percent) but fewer educational service institutions (15 percent). We will want to compare the regression coefficients later to make some interregional comparisons which may either buttress or refute the differences noted above. That is, are the differences noted here couched in behavioral differences (significantly different regression coefficients) or merely scale differences (similar coefficients but differences in means) or both.

The descriptive statistics above indicate possible structural differences between these two groups of SMSAs. We shall now develop models by which additional evidence may be gleaned to either refute or buttress the structural differences hypothesis.

Models

The models developed in this paper to analyze more closely the relationship between service earnings and service industrial structure are simple models of the often used cross-section multiple log-linear regression technique [14, 15, 30].[5] The dependent variable is aggregate service earnings per capita, 1970, from *OBERS 1980* and the independent variables are firms per 1000 population by service industry from *County Business Patterns, 1977*.[6]

4. The primary assumption is that the BEA areas (which are based on central place theory) provide an accurate measure of market area. This, of course, is quite suspect in certain regions. See *1980 OBERS,* volume 1. These are intriguing hypotheses but beyond the scope of this paper for many reasons not the least of which is a measure of output by which to measure productivity. They also beg a much larger question of intensive and extensive factors. See Greytak [9] for an excellent discussion of these factors.

5. Linear models using industry percentages and number of firms by size were used also but did not perform as well in terms of $\bar{R}^2$. The one year lag in earnings occurs because of data limitations, but is not thought to be problematic.

6. *OBERS* defines earnings as wage and salary disbursements, other labor income, and proprietors' income.

Pooled regression analysis is used to analyze the spatial variation among various relationships [10, 11]. Five service industries are selected for investigation — hotels (SIC 70), health (SIC 80), education (SIC 82), and social services (SIC 83). The industrial structure surrogates for these industries are firms by size. For each industry data for three firm sizes were collected — small (1-19 employees), medium (20-99 employees), and large (100 or more employees). These models are used to analyze (1) the impact of various service industries on aggregate service earnings per capita, (2) the impact of service industrial structures (firm size) on earnings, and (3) the interregional variations in (1) and (2). Certainly there exist other variables (income, population, etc.) and models [14, 15] which may explain more of the variation in earnings per capita, however, the focus in this paper is the influence of and regional variation in firm size in these selected services on aggregate service earnings. Models I and II are illustrated below. While Model I is simply a log-linear regression model, Model II, a dummy variable model, allows us to examine both quantitative and qualitative variables by pooling the data. Model II is then essentially an analysis-of-variance and covariance model by using dummies for intercepts and slopes [30].

I. $LSP^r = f(LN_{ij})$

where SP = aggregate service earnings per capita
r = region
i = selected services
j = firm size, 1 = small, 2 = medium, 3 = large
N = number of firms per 1000 population
L = natural logarithm

II. $LSP = a_0 + a_1 D = a_2 LN_{ij} + a_3 LDN_{ij} + U_{ij}$

where D = 1 for lagging region
D = 0 for prosperous region

Results

Perfunctorily, while the model is specifically designed to capture market demand, it does well in explaining the variation in earnings per capita particularly for cross section data. A priori, regression coefficients will generally be positive and increase with firm size. That is, generally, more and/or larger firms will be associated with larger earnings.

This research and central place theory suffers from at least two locational problems. Firstly, because market areas have become so large, market-oriented firms may select a small city location without losing its market [13, 29]. Secondly, the type of industry may not be the best or even good indicator of locational preferences, it may very well be that plant size is more important [17, 20].

When prosperous and lagging SMSAs are pooled in Model I for size only, the results indicate that all three sizes of firms are significant. In column 4 of

Table 2 notice that size one (small) is the most elastic with respect to service earnings with a one percent change (increase) in the number of small firms per 1000 population causing a .47 percent change (increase) in service earnings. The elasticity coefficients decline with firm size. All types of services are statistically significant in explaining aggregate service earnings per capita except education as shown in column 8. Education and hotels have negative effects on earnings. More technically, if two SMSAs differ in the number of education (or hotels, etc.) firms per 1000 population, the city with more of these firms will have lower service earnings. The elasticity of earnings with respect to business firms is more than twice as large as health and social service firms.

Table 2. Regression Results Using Model I For Size of Firm and Type of Service Sector

Size of Firm				Type of Service Sector			
Variable	Prosperous	Lagging	All SMSAs	Variable	Prosperous	Lagging	All SMSAs
K	.1917	−.0498	.4015	K	−.5739	−.1996	−.4378
LONE+	.3930*	.4665*	.4337*	LZHO‡	−.2179*	−.1176	−.1791*
	(2.42)§	(2.77)	(4.26)		(4.16)	(1.42)	(3.93)
LTWO	.1604	.4196*	.2364*	LZB	.5652*	.4655*	.4649*
	(1.41)	(2.86)	(3.89)		(6.06)	(2.16)	(6.42)
LTHREE	.2622*	.0745	.1852*	LZHE	−.0560	.2262**	.2132*
	(4.37)	(1.14)	(2.67)		(.32)	(1.69)	(2.15)
$\bar{R}^2$	.46	.50	.49	LZE	−.1527	.1356**	−.0387
					(2.55)*	(1.69)	(.81)
F	13.96*	13.32*	27.89*	LZSS	.2386*	.0444	.2052*
					(2.38)	(.28)	(2.41)
n	47	38	85	$\bar{R}^2$	.57	.53	.54
				F	13.15*	9.35*	21.05

* The level of statistical significance is .05.
\+ LONE = natural log of size one (small) firms per 1000 population, similarly for other variables.
§ The numbers in parenthesis are t values.
‡ LZHO . . . LZSS = natural log of the total number of firms per 1000 population by type of service.
** The level of statistical significance is .10.

When the sample is dichotomized into prosperous and lagging based on relative (to the U.S.) income per capita, but adjusted for population, interregional service industry behavior does not appear congruent. While the size model of Table 2, explains nearly the same amount of variation in service earnings in both regions, the influence by firmsize is quite different interregionally. A 19 percent difference exists interregionally for small firms, but medium sized firms have more than twice as much positive influence in the lagging region and large firms have about 3.5 times as much positive effect in

the prosperous SMSAs. Yet, the elasticity of earnings with respect to firm size is much larger for the small firms in both regions.

Looking at the service industry structure also shown in Table 2, we can see some striking differences. For all SMSAs, only education is not a significant variable in explaining a city's service earnings. While differences in coefficients do exist between regions, the most notable differences occur with respect to health and education services where the coefficients switch signs. Social Service types of firms are much more (5 times) beneficial to the prosperous SMSAs than their lagging counterpart. For both regions the business service firms provide the largest elasticity with respect to earnings. A 1 percent increase in business firms per 1000 population cause a .56 percent and .46 percent increase in service earnings per capita in prosperous and lagging cities respectively. There are hints of structural differences between our regions in coefficient size and/or sign. We will investigate further this possibility later with Model II.

Table 3 disaggregates Model I in order to consider both the size and type of service industry interregionally. Small firms, size 1 are statistically significant in 9 of 10 cases, for medium firms, it is 4 of 10, and for large firms it is 7 of 10. Each region has about the same number negative coefficients, 8 (pros-

Table 3. Regression Results Using Model I and Disaggregating for Size and Type of Firm

Service Industry	K	Size 1	Size 2	Size 3	$\bar{R}^2$	F
Hotels/ Lodging:						
Prosperous	−.3914	−.0994**	.1308*	−.0477*	.25	6.18*
Lagging	−.4238	−.0351	.1092	−.0332**	.06	1.86
Business:						
Prosperous	−.0471	.2491*	.1512*	−.0440*	.51	17.07*
Lagging	−.5460	.6695*	−.1060*	−.0371	.52	14.31*
Health:						
Prosperous	−.8052	.4996*	−.0823	.0033	.07	2.19
Lagging	−.3044	.3347*	.0756	.0250	.07	1.99
Education:						
Prosperous	−.4375	.1394*	−.0728*	−.0151	.11	2.93*
Lagging	−.3958	.1634**	.0006	−.0572*	.37	8.17*
Social Services:						
Prosperous	−.2473	.2834*	−.0287	−.0279*	.10	2.80*
Lagging	−.0070	.4265*	.0253	−.0448*	.34	7.32*

* The level of statistical significance is .05.

** The level of statistical significance is .10.

perous) and 6 (lagging) and they occur mostly on the large firm variable. Four of the five industries (excluding health) have negative regression coefficients for the size 3 variable and are quite different in size in the education and social services equations. In both equations these have a much larger depressing effect on earnings in the lagging SMSAs. Of the five industries considered here only hotels, lodging, etc., firms tend to "hold down" service earnings in both regions.

Aiding in the cross-section interpretation of these variables with respect to city size is Appendix Table A-1. For example, large hotel firms have a negative regression coefficient in both regions. The coefficient is .0477 in the prosperous equation. The implication is that if two cities differ in the number of large hotel firms (per 1000 population) by, say, 10 percent, ceteris paribus, on the average, then the city with the larger number of firms will have service earnings per capita 4.77 percent smaller. In this case, the city will be larger because of the firms correlation with population as shown in Table A-1. More small business firms are associated with larger cities and higher service earnings per capita. Large education establishments are somewhat different in that while the E3 coefficient is negative in both equations, it is positively correlated to population in the lagging sample but negatively correlated in the prosperous sample. Thus, E3 tends to be associated with lower earnings in larger SMSAs in the lagging sample, but with lower earnings in small SMSAs in the prosperous sample. Small firms, in all cases except hotels, lodging, etc., have the largest positive effects on service earnings, while large firms have negative but small effects on service earnings. Service earnings are most elastic with respect to business and health establishments.

Suggested in the evidence above, that is, different size, sign of coefficients, is the possibility of different service industrial structures even though population has been neutralized. For now, let us use a dummy variable model, Model II, to see if our dichotomy, which attempts to maximize BEA income per capita differences and minimize population differences, elucidates particular structural differences. Covariance analysis provides a method to combine regression analysis and analysis of variance, i.e., a way to analyze the effects of interdependent variables. For example, initially we will look at firm size and type (quantitative variables) by region (qualitative variables). Other qualitative variables follow in a later section. The analysis of variance and covariance can be accomplished in regression analysis using dummy variables as in Model II [30].

Before indulging in any of the rather copious variations of our dummy variable model, the impetous for such indulgence may be thwarted or blessed by the more cogent Chow Test [3, 10, 11, 12]. Basically, the Chow Test tests for significant differences in structure between samples by testing for significant differences between the set of regression coefficients. This test suggests no structural differences between our regions based on size of firm or type of firm. However, when the type of firm is disaggregated to firm size the business and education equations are significantly different between our regions at the .01 level of significance. Also, when all firms by size and type are included the

regions are significantly different at the .05 level. A limitation of this test is that it tests the independent variables as a set, therefore, the existence of regional differences in individual regression coefficients and/or intercepts is not shown. In order to glean further evidence we now turn to the dummy variable model.

Table 4 summarizes the pooled regression results using Model II for size of firm by type of service sector. The dummy variable in this model is used to divide our sample based on BEA area (the whole region) income per capita levels and to test the income effects on levels of service earning. That is, is there a threshold effect on earnings types between cities whose relative income per capita is below our designation (median) and those where it is above? The underlying rationale is that service earnings may be quite different based on a city's BEA area relative income per capita (see footnote 4). If D is significant and less than zero it implies the lagging cities service earnings are lower than prosperous, *i.e.*, that the two regressions do not have the same intercept.

If the dummy variables are not statistically significant then the group regressions do not differ from one another and there exists a common

Table 4. Pooled Regression Results Using Dummy Variable Model II for Type and Size of Firm

Hotels/Lodging		Business		Health		Education		Social Services	
K	−.3914	K	−.4711	K	−.8052	K	−.3818	K	−.2473
LH01+	−.0994	LB1	.2491*	LHE1	.4996*	LEL	.1510*	LSS1	.2834*
	(2.39)§		(6.80)		(5.25)		(7.46)		(5.36)
LH02	.1308*	LB2	.1512*	LHE2	−.0823	LE2	−.0548*	LSS2	−.0287
	(3.82)		(6.93)		(1.16)		(4.85)		(.71)
LH03	−.0477*	LB3	−.0440*	LHE3	.0033	LE3	−.0259*	LSS3	−.0279*
	(9.00)		(9.84)		(.00)		(5.78)		(4.00)
D	−.0324	D	−.4989*	D	.5008	D	−.2240	D	.2403
	(.01)		(6.43)		(1.27)		(1.51)		(.27)
DLH01	.0643	DLB1	.4203*	DLHE1	−.1649	DLE	−.0543	DLSS1	.1431
	(.36)		(7.66)		(.37)		(.41)		(.65)
DLH02	−.0216	DLB2	−.2573*	DLHE2	.1578	DLE2	.1104	DLSS2	.0540
	(.04)		(11.14)		(2.18)		(2.66)		(.31)
DLH03	.0146	DLB3	.0069	DLHE3	.0216	DLE3	.0713	DLSS3	−.0169
	(.38)		(.11)		(.05)		(1.07)		(.66)
$\overline{R}^2$	.20		.54		.11		.30		.25
F	4.01*		14.84*		2.52*		6.14*		4.93*

* The level of significance is .05.

\+ Variables are as defined above where L = natural logarithm, D = 1 if the observation is from a lagging SMSA, D = 0 if a prosperous observation.

§ t values are in parentheses.

regression for all observations of that service sector. If the intercept is significantly different this difference may refer to differences in scale, amenities, agglomeration economies, or as indicated above [21, 25, 28]. Different slopes suggest differences in regional behavior in those firms. This model, Model II, and later extentions use dummy variables to remove explicitly, as regression analysis requires, the effects of "nuisance" variables; to ignore them invites bias in estimators and variance [30].

Size only results indicate a single regression equation will suffice when using small and medium sized firms. There is, however, a significant statistical difference between our regions concerning the behavior of large firms. Recall there is no scale difference (the regional means for large firms are not statistically different) but there is a behavioral difference indicated by the statistical difference in the coefficient. As for the interregional behavior type of service sector, one equation per service type is acceptable in all cases except education.

Table 4 is comparable to Table 3 except the observations are pooled and a dummy is used for prosperous and lagging. In this model, Model II, which considers both type and size of firm by region, only the business services sector appears structurally different between the regions as suggested by the Chow Test. Not only do the regions appear to be operating at different levels or perhaps orders of business services, i.e., the dummy intercept is statistically significant, but also small and medium sized business firms have significantly different relationships to service earnings between our regions. We do not find evidence to buttress the earlier suggestion of regional differences in the large firms.

Further Results

Additional categorical (qualitative) variables, besides the "prosperous" and "lagging" used above, are included below to garner further evidence of interregional congruence or non-congruency. The model used is merely an extention of Model II with several dummy variables by which we divide the 85 SMSAs. The intercept results are shown in Table 5 while the intercepts and slopes will be discussed but not shown due to space. The six dummies chosen for investigation are (1) relative BEA area income per capita, D, (the same as before), (2) median SMSA population (F), "large versus small" cities (median = 269,000), (3) media SMSA income per capita (G), "rich versus poor" cities (median = $5,101), (4) median total number of service firms per 1000 population (T) (median = 2.43), (5) median number of business firms per 1000 population (U) (median = .58), and (6) median number of health firms per 1000 population (V) (median = 1.25).

Although results are somewhat mixed, to summarize briefly, three dummy categories are generally significant, there appear to be thresholds consistent with the level of SMSA income per capita (G), the level of SMSA population (F), and the total number of business service firms (U). Recall mean SMSA population and mean total number of business service firms are not statistically different between our regions (Table 1). Thus, if the means (scales of

Table 5. Pooled Regression Results: Significance of Dummy Intercepts Using the median statistic does the intercept differ significantly between our regions?

Median Characteristic	Size & Type of Firm					Size of Firm	Type of Firm
	Hotel	Bus.	Health	Educ.	Social Services		
1. Relative income per capita of BEA areas (D as in earlier Model)	No	Yes+	No	Yes	No	No	No
2. Population of the BEA areas (M)	No	No	No	No	No	No	No
3. Income per capita of the SMSAs (G)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4. Population of the SMSAs (F)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5. Total number of service firms per 1000 population (T) per SMSA	No	No	No	No	No	No	No
6. Total number of Business firms per 1000 population (U) per SMSA	Yes	Yes	Yes	Yes	Yes	Yes	No
7. Total number of health firms per 1000 population (V) per SMSA	No	No	No	No	No	No	Yes

+ "yes" implies a statistically significant difference at the .05 level for the given dummy variable intercept.

activity) are not different, the dummies may indeed be surrogates for localization economies, amenities, etc., as Stanback and Knight suggest [25].

On the other hand, while BEA area relative income per capita is significant for business and education earnings, it is not for other services nor for size only or type only regressions. BEA area population (M), total number of service firms (T), and total number of health service firms (V) generally do not discriminate our regions one from another. The dummies U, T, and V, may be picking up implicitly city agglomeration economies. One dummy, total number of business firms (U), has a significant influence on other service industries.

Now, let us implement an aggregate dummy variable model with dummies for intercept and slope for each service sector. Two service sectors stand out as basically different based on several of our dummy variables. A key

difference is that while the business equation differs significantly over intercepts, the health equation exhibits various coefficient differences. Business services seem to differ interregionally by our "prosperous versus lagging" (D), SMSA income per capita (G), and number of total service firms (T). Education services still differ between regions based on D.

Summary and Conclusions

This research has investigated the relationship between service earnings per capita and service structure including the regional variation in service structure using a selected group of service sectors. While the percentage and per SMSA distribution of firms appear similar (Table 1) there are several significant differences in mean number of firms per 1000 population between our prosperous and lagging SMSAs (Table 2). These are differences in the scale of activity.

Service earnings are most elastic with respect to large firms in the prosperous SMSAs and small firms in the lagging SMSAs. Analyzing by type we note that business services are the most elastic in both regions. Differences in variable influences and signs suggest differences in SMSA service structure which are buttressed in the cases of business and education services by the Chow Test and dummy variable test. Large firms, size 3, are significantly different between our prosperous and lagging SMSAs. Perhaps some agglomerating economies take place among large firms since the separation of large firms by service sectors (Table 4) suggests no interregional differences in large firm behavior.

Further results implementing several dummy variables indicate that, across all SMSAs, SMSA income per capita, SMSA population, and the number of business firms per capita appear to be significant qualitative variables dividing our SMSAs. For specific services, business and education, BEA area income per capita is also significant, indicating perhaps the larger market orientation, for business services at least. Expanding this dummy variable model to include possible slope differences (behavior) as well as intercept differences (level) suggests business firms differ interregionally generally with respect to the level of activity (intercepts) while health services differ basically in behavior (coefficients). The other services appear basically congruent between our various types of regions.

[7]. This is consistent with the literature which suggests even though services are the fastest growing economic activities, to the extent they can be "industrialized" (large firms), they may not be a jobs panacea. (Levitt, T., "The Industrialization of Service," *Harvard Business Review*, September 1976).

Table A-I. City Size Signs of Coefficients and Correlations Between Earnings by Firms

Coefficient	Correlation+ with Population	Implication	Type and Size of Firm	
			Prosperous	Lagging
+	+	Higher earnings are associated with the larger SMSA	HE1, E1, B1 HE3, B2	B1, E1 E2, SS2
–	+	Lower earnings are associated with the larger SMSA	H03, B3 SS2, E2 SS3	H03, E3 B2, B3
+	–	Higher earnings are associated with the smaller SMSA	H02, SS1	H02, HE1, HE2, HE3, SS1
–	–	Lower earnings are associated with the smaller SMSA	H01, HE2 E3	H01, SS3

+ This column is from the correlation matrix and allows us to generalize the effects of the variables on city size which, of course, cross-section does not allow. Certainly these variables are not perfectly correlated (± 1) with population.

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