DISAGGREGATE TERTIARY EARNINGS PER CAPITA — A SPATIAL ANALYSIS

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Introduction

Economic growth in the United States has emphasized concomitantly the shifting of employment from agriculture to manufacturing and, finally, to services [7, 8, 17, 25, 29]. Tertiary employment has grown almost twice as rapid as manufacturing for the period 1950-1970. Likewise, total tertiary earnings are larger and have increased 126 percent while the manufacturing figure is 109 percent. The tertiary sectors experiencing the most rapid growth in earnings (1950-1970) are finance-insurance-real estate (165 percent) and services (195 percent); also, employment in these sectors nearly doubled [19]. See Table 1. Table 1 also illustrates striking differences between prosperous and lagging regions (as will be defined later). The regions are composed of a core (SMSA) and periphery. While periphery population has declined as a percentage of the total regional population, its proportion is much larger in the lagging region (51 percent, 1970) than the prosperous (32 percent, 1970). In the properous region periphery income per capita and total tertiary earnings per capita were 87 percent and 60 percent respectively, of the core region in 1970. For the lagging regions comparable percentages are 75 percent and 46 percent respectively. Results are similar for 1950 with some convergence noted.

Comparing prosperous with lagging SMSAs suggests several hypotheses for investigation. For example, in 1970 the prosperous SMSAs had a 41 percent larger population and a 16 percent advantage in per capita income, but only a 3 percent advantage in aggregate tertiary earnings per capita. There are more notable differences between the regions' peripheries. The aggregate prosperous periphery population is only 63 percent that of the lagging periphery. Although population is much larger for the lagging peripheries, income per capita and aggregate earnings per capita are much larger in the propserous peripheries, 35 and 37 percent respectively.

This paper addresses disaggregate tertiary activities at the SMSA level and attempts to provide some explanations of the spatial variations in the descriptive statistics given above. Specifically, (1) why are interregional aggregate tertiary earnings per capita extremely close yet population and income per capita are not?, and (2) can generative regional growth be induced via tertiary stimulation?

Significant technological changes that affect these sectors have taken place. Advances in transportation and communication have reduced the need for personal contact, thus allowing services to become somewhat footloose and therefore, perhaps, amenable to regional development policies.[1] [18] This, of course, is contrary to the traditional economic models and their evaluation of tertiary

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[1] The French have advocated investment in services for some time. [10, 16, 21, 24]. See also Blumenfeld [4].

Table 1: Per Capita Figures and Growth Rates For Lagging and Prosperous Regions, 1950 and 1970*

	Lagging SMSA			Lagging Periphery		
	1950	1970	Percent Increase	1950	1970	Percent Increase
Population	10082	15043	49	15408	15697	2
Income	18513	46959	154	17188	36811	114
TTE	7380	18619	152	4484	8850	97
YP	1836	3122	70	1116	2345	110
TTEP	0.732	1.238	69	0.291	0.564	94
TCUP	0.156	0.208	33	0.056	0.089	59
TP	0.324	0.490	51	0.145	0.244	68
FP	0.072	0.149	107	0.014	0.045	221
SP	0.181	0.391	116	0.076	0.186	145
MP	0.335	0.591	76	0.137	0.396	189

	Prosperous SMSA			Prosperous Periphery		
	1950	1970	Percent Increase	1950	1970	Percent Increase
Population	13872	21196	53	8667	9958	15
Income	33404	76744	130	16810	31351	87
TTE	11821	27159	130	4327	7647	77
YP	2408	3621	50	1940	3148	62
TTEP	0.852	1.281	50	0.499	0.768	54
TCUP	0.175	0.212	21	0.099	0.124	25
TP	0.390	0.499	28	0.251	0.366	34
FP	0.085	0.144	69	0.028	0.057	104
SP	0.203	0.426	110	0.122	0.252	107
MP	0.690	0.918	33	0.293	0.598	104

Source: Hoppes (19)

* Population is in thousands, income and TTE are in millions of dollars.

TTE = total tertiary earnings
YP = income per capita
TTEP = total tertiary earnings per capita
TCUP = transportation-communication-utilities earnings per capita
TP = wholesale-retail trade earnings per capita
FP = finance-insurance-real estate earnings per capita
SP = service earnings per capita
MP = manufacturing earnings per capita

activity. Export base and central place theory emphasize the local orientation (although exportable down the hierarchy) of services [5, 11, 14, 31]. This paper investigates the contrasting roles of tertiary sectors and their regional importance using a basic demand, market-oriented OLS multiple linear regression model. To the extent tertiary activity is explained by such models then tertiary activity would not be amenable to policy manipulation; the suggestion being that growth in these sectors is tied to local market growth — per capita income, employment, population, etc. — and is an ex post rather than ex ante phenomenon. Other questions are posited (besides the theoretical underpinnings) by such descriptive statistics as: at the 95 pecent level of significance only one sector, services, barely exhibits a significant difference in mean earnings per capita between prosperous

and lagging cores, yet, there is a large difference in the regional (core) per capita income.

Earlier papers investigating the tertiary sectors have concentrated on aggregate services — transportation, communication, utilities, trade, finance, insurance, real estate, services — and functionally integrated economic (Bureau of Economic Analysis [23] areas [28], or aggregate tertiary services in smaller nodes — standard metropolitan statistical areas (SMSA) [20]. Aggregate tertiary activity allocation at the BEA area (interregional) level and the SMSA area (intra-BEA) level appears to be rather closely tied to the local market; hence, tertiary investment, a la' the growth pole (center) hypothesis, seems unwarranted and unlikely to succeed. The Hoppes-Riefler paper [20] was less pessimistic than Riefler's [28] about regional development via tertiary activity growth. The results of that paper warrant an analysis of the disaggregate tertiary economy as *sector* market orientation is obscured and undetectable using the aggregate models. Sector results may further buttress or refute tertiary policies (at the second level) for stimulating regional development.

Estimation Procedure

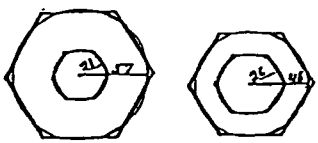
The models used to estimate the various tertiary sector earnings per capita are traditional demand, market oriented. How well do these models predict tertiary sector allocation? Which sectors (if any) are closely tied to the local market? Which (if any) appear to be footloose? Which (if any) help to explain the closeness of aggregate earnings per capita between the regions?

In order to analyze the sectors intraregionally, the BEA area is divided into the core (SMSA countries) and the periphery (non-SMSA counties) [23][2]. Also, the BEA areas were dichotomized into lagging and prosperous on the basis of relative (to U.S.) income per capita (1950-1970). The sampling of prosperous and lagging BEA areas was deliberate, that is, properous and lagging regions of nearly equal populations were aligned in order to avoid the obvious bias of population size. The sample yielded 53 and 56 SMSAs from the 39 lagging and 39 prosperous BEA regions respectively. While the lagging SMSAs are relatively concentrated in the southeast, the prosperous SMSAs are dispersed (see Appendix A). Also, the prosperous spatial configuration is different from the lagging. In the prosperous BEA area the core contains on the average 32 percent of the area, while for the lagging core it is only 14 percent. Also, the average prosperous region is 65 percent the size of the average lagging region, but the prosperous core is 153 percent the size of the lagging core.[3]

[2] The Bureau of Economic Analysis areas are based on functionally integrated economic areas and central place theory [23, volume 1].

[3] Forcing a simple circular or hexagonal configuration on the two regions illustrates a striking difference between the regions. Circular configuration: the average prosperous BEA dimensions are a 46 mile radius and a core radius of 26 miles; the average lagging BEA dimensions are a 57 mile radius for the BEA and a 21 mile radius for the core

Lagging BEA: core and periphery



Prosperous BEA: core and periphery

Two models are used to estimate core earnings per capita. Their general form is as follows:[4]

$$(1)\ TTEP_{ci} = f(P_c, YP_c, M_c, D_b, A_c)$$
$$(2)\ TTEP_{ci} = f(P_c, YP_c, M_c, A_c, P_p, YP_p, M_p, A_p)$$

where: TTEP = total core tertiary earnings per capita by sector, i, (i = 1 . . . 4)

P = population
YP = income per capita
M = manufacturing location quotient
A = armed forces location quotient
D = density
c = core p = periphery b = BEA

Models (1) and (2) are demand oriented models in the traditional sense. The basic theoretical underpinning is that the larger the market the higher will be earnings per capita, i.e., earnings are a function of market size.

Empirical Evidence

Model (1) estimates core earnings per capita on the basis of core variables. It attempts to illustrate the degree of local market orientation. To what extent does the demand-oriented model explain (predict) tertiary sector activity? The model results are provided in Appendix B.

Ideally one would like a hierarchical ranking of the cores (and even the nodes in the periphery). With such a ranking one would certainly feel more comfortable comparing/contrasting core sectors especially with respect to the "order" of service provided. It is felt the surrogate, population and the sample selection process adjusts somewhat for this data insufficiency, but certainly this caveat is proper.

As expected, disaggregation into sectors lowers the percent of explained variation compared to aggregate [28]. Indeed, the aggregation of tertiary activities obscures significant sector variation in market orientation. The amount of explained variation is similar for the prosperous and lagging sectors (wholesale-retail trade (T) and services (S)) and indicates relatively close market orientation (R^2 = .39 - .45). There are noticeable regional differences in the remaining sectors of transportation, communication, and utilities (TCU) and finance, insurance and real estate (F). For example, while TCU appears market oriented in the properous region (R^2 = .41), the model explains only a small amount of the variation and is not statistically significant for the financial sector (R^2 = .13). The evidence is opposite the above for the lagging region sectors, TCU, F.

In nearly all the cases the variables carry the expected sign, positive for population and income per capita and negative for the location quotients and

[4] Although population appears more than once in the equation multicolinearity does not appear to be a problem (12).

The location quotient is defined as follows: $LQ_i = \frac{E_i/P_i}{E_{us}/P_{us}}$

where: i= regions (core or periphery)
us = United States
E = manufacturing/armed forces earnings
P = population

density.[5] Population is significant statistically in only one prosperous sector (T) and two lagging sectors (T and F). Income per capita, however, is significant statistically in all prosperous and in 3 of the 4 lagging sectors. Perhaps this indicates the relative importance of extensive versus intensive factors. An interesting difference between the regions emerges with respect to the location quotients: While manufacturing is significant in 3 of the 4 prosperous sectors (T, F, S), armed forces is significant in only one (T); for the lagging sectors, armed forces is significant in 3 of the 4 sectors (T, F, S) while manufacturing is significant in only one (F). To the extent manufacturing has been used to ameliorate conditions in lagging regions disenchantment appears justified. Density is not significant in any lagging sectors but is in three prosperous sectors (TCU, T, S).

The statistical significance and impact of the core independent variables on their respective sectors is illustrated in Tables 2 and 3. While population in

Table 2. Variable Influence by Lagging Sector — 1950 and 1970: Model 2[1]

		TTEP	TCUP	TP	FP	SP
Pc	(1950)	.6	.6	-.4	1.8**	.5
	(1970)	.2	.2	.4	.3	-1.1
YPc		12.6*	19.0*	10.1*	12.0**	10.6*
		21.0*	14.4	20.5*	26.4*	23.0*
Mc		-.5	-.4	-.7	-1.6	-.3
		-1.2*	-.1	-1.1**	-3.4*	-1.2**
Ac		-.3	-.8	-.1	-.7	+.0
		-.5*	-.5	-.5*	-.9*	-.6*
Pp		1.3**	2.3	.3	1.3	.9
		.5	1.5	.3	1.3	-.0
YPp		-2.1	-3.3	.0	3.9	-4.2**
		-4.5**	-7.5	-3.2	3.8	-7.1**
Mp		-3.3	-.3	-.0	-.4	-.2
		.3	-.0	.1	1.6	.4
Ap		.2	.5	.0	.1	.0
		.1	.4	.1	.1	.1
R^2/F:[2]	1950	.50/5.80*	.36/3.63*	.42/4.42*	.16/1.89	.46/3.15*
R^2/F:	1970	.77/16.63*	.07/1.36	.55/6.82*	.40/4.12*	.51/6.01*

(1) The cell entries are obtained by increasing the independent variable mean by 10 percent and calculating that as a percent of the mean value of the dependent variable.

(2) The R^2s and F values are adjusted for degrees of freedom.

* Significant at the 0.05 level.

** Significant at the 0.10 level.

[5] Larger location quotients indicate increased concentration of either manufacturing or armed forces. The negative sign may be interpreted as the greater concentration brings with it a greater use of in-house services (manufacturing) or military privileges (PX, commissary, etc.) and thus, less reliance/use of the local service economy. Density is used as a surrogate for the friction of distance. The hypothesis is that as density increases the need for/use of delivery services by activities diminishes; Whereas, the low density regions (longer average delivery distances) such services may be indispensable, thus, the density coefficient is expected to be negative. See Hoppes and Riefler, [20].

Table 3. Variable Influence by Prosperous Sector — 1950 and 1970: Model 2[1]

		TTEP	TCUP	TP	FP	SP
Pc	(1950)	.3	.6	-.1	.0	-1.7
	(1970)	-.1	-.3	.3	-.8	-.5
YPc		22.3*	19.6*	11.9*	16.0*	44.7*
		25.3*	22.7*	8.2*	38.2*	42.2*
Mc		-3.0*	-1.5	-1.5*	-2.7	-7.0*
		-2.8*	-2.7*	-1.5*	-2.2	-4.5*
Ac		-.2	.7*	-.3*	-.5	-.5
		-.4**	.1	-.5*	-.7**	-.5
Pp		1.7*	2.3**	1.9	5.6*	-.4
		1.9*	3.1*	2.0*	7.1*	-.3
YPp		-6.7*	2.3	.5	-7.8	-26.9*
		-3.8	-3.1	3.3	-4.8	-12.0
Mp		.2	-.9	-.6	-1.1	2.9**
		-.6	-1.0	-1.0*	-2.7*	.5
Ap		-.1	.2	-.2	-.6	5.2
		-.7*	-.6	-.4*	-1.9*	-.7
R^2/F:[2]	1950	.62/8.59*	.33/3.36*	.68/11.32*	.49/4.88*	.42/4.41*
R^2/F:	1970	.56/7.07*	.44/4.71*	.57/7.25*	.58/7.68*	.30/3.08*

(1) The cell entries are obtained by increasing the independent variable mean by 10 percent and calculating that as percent of the mean value of the dependent variable.

(2) The R^2s and F values are adjusted for degrees of freedom.

* Significant at the 0.05 level.

** Significant at the 0.10 level.

absolute terms is, of course, much larger than per capita income, it does not have nearly as large an impact on sector earnings. Also, the impact of income per capita is larger in the prosperous sectors than in the lagging sectors in three of the four cases. The exception is trade where the lagging core provides relatively more income elastic goods.

Testing for significant differences between lagging and prosperous mean earnings per capita yields only one statistically significant difference — the service center (1970) (all sectors, 1950). Independent variable means that show statistically significant differences are income per capita, manufacturing location quotient, and density, 1970. Therefore, let us see how well the core market structure, as illustrated by the model, explains the lack of significant differences between regions. In other words, how well does the prosperous equation predict (using mean values of the lagging region) lagging sector earnings. For all sectors it "under-predicts" earnings per capita — TTEP are under-predicted by 18 percent, TCUP by 27 percent, TP by 6 percent, FP by 24 percent, and SP by 32 percent.[6] This evidence buttresses the hypothesis that the lagging core sectors are doing better than they "should be" because they either (1) export relatively more to their hinterland than their prosperous counterparts and/or, (2) export

[6] Similar "predictions" for 1950 are TTEP (-9 percent), TCU (+14 percent), T (+13 percent), F (-23 percent), s (-37 percent).

relatively more beyond their BEA area boundaries and/or, (3) provide relatively more higher order services to their market area than do prosperous sectors. The hypotheses garner support from the lagging regions locations, that is, these regions may receive relatively greater protection from the friction of distance than prosperous regions because of their greater isolation and larger periphery (see footnote 2). The first hypothesis, (1), is incorporated in the model discussed below. Certainly, the evidence so far suggests lagging tertiary sectors already "over-service" their regions and policies aimed at their stimulation seem ill-conceived and unwarranted.

The model described by equation (1) is enlarged to consider suggestion (1) of the above paragraph. This new model, (2), attempts to capture the impact of the periphery (within the BEA area) on the core sectors' earnings. As central place theory suggests, the core sector's market area extends beyond the core which enables it to provide higher order services to the core and periphery. Economies of scale (and/or additional threshold levels) may be reached with the servicing of the periphery. The size of the periphery market is measured analagous to the core. Thus, periphery population, income per capita, and location quotients for manufacturing and armed forces are included.[7]

There is wide variation in the impact/influence of the periphery on core earnings. The periphery has little impact on properous TTEP and TCUP. While the explained variation in the trade sector increases by 30 percent, it increases by 346 percent for the finance sector. Interestingly, the incorporation of the periphery lowers (by 23 percent) the R^2 for the service sector, perhaps indicating its more local orientation or periphery import substitution. As for the lagging sectors, TCU and F experience declines in R^2, with periphery variables added. The sectors, trade and service, (and TTEP) experience rather sizeable (18-28 percent) increases in the percent of explained variation.[8]

The influence and statistical significance of the periphery variables (coefficients) in equation (2) are given in Tables 2 and 3. Three of the four periphery variables are significant in the prosperous sectors, trade and finance, which have the largest increases in explained variation. Both the peripheral extensive levels (population) and intensive levels (income per capita) have positive impacts on core trade earnings indicating the cores' periphery penetration in the form of higher order and income elastic goods (trade equation). This implies a symbiotic relationship between the core and periphery, i.e., high levels (income per capita) in the periphery are associated with high levels in the core (earnings per capita). A notable difference between the trade and finance sector is the behavior of periphery per capita income. For the finance sector the coefficient (impact) is larger and *negative* (although not statistically significant) suggesting periphery

[7] With the incorporation of the periphery variables, density is no longer significant statistically in any sector.

[8] In 1950, all the prosperous sectors experienced large increases in the adjusted R^2 with the addition of periphery variables: TTEP (+51 percent), TCU (+65 percent), T (+66 percent), F (+717 percent), S (+62 percent). The only lagging sectors that appear to be affected by the periphery are TCU (+29 percent), S (+142 percent), T (-12 percent), F (-48 percent). The evidence suggests that between 1950-1970 the prosperous periphery has undergone significant import substitution, while the lagging periphery is now being incorporated in the economic mainstream of the core as it increasingly penetrates the periphery — spread versus backwash effects.

dependence which has decreased since 1950.[9] Periphery import substitution, "polarization reversal," seems to be apparent in the service center (note the decrease in the negative impact created by periphery income per capita) [22, 26, 27, 30]. The periphery location quotients are all negative, as expected, but significant statistically only in the prosperous trade and finance sectors. Larger (increased) concentrations have negative influences on earnings (see footnote 5).

As stated above, the lagging periphery appears to be an important factor in core earnings for the lagging sectors, trade and services, as indicated by R^2 increases. It is interesting and surprising to note that only one periphery coefficient (per capita income—service sector) is significant statistically. Therefore, the improvement in the R^2s noted above is likely due to the aggregate effect of adding the periphery market variables. Periphery per capita income shows a larger negative impact in 1970 than in 1950 for the trade and service sectors. This implies greater core penetration (periphery dependence) in the periphery in these sectors (especially services).[10]

As illustrated using model (1), let us see how well the prosperous core/periphery structure, model (2), predicts lagging sector earnings per capita. The results of estimated (predicted) versus actual earnings are similar but the magnitude is reduced greatly. Overall tertiary earnings (TTEP) are under-predicted (6 percent) which implies the lagging region is over-serviced, as are trade sector earnings (6 percent) and service sector earnings (17 percent). Including the periphery suggests that the remaining sectors, TCU and F, are under-servicing the region. It seems the lagging core sectors, T and S, must either be (1) exporting beyond the BEA area, (2) undertaking import substitution in the core and/or (3) developing "latent" goods and services. The evidence from model (2) suggests (2) and/or (3).

Further results

Before suggesting overall policy implications and conclusions, two additional elements are analyzed briefly — (1) 1950 versus 1970 results and (2) residuals of models (1) and (2).

Tables 2 and 3 also contain data for 1950 which allow comparisons/contrasts with the evidence presented above for 1970. As illustrated by means (1950 and 1970) there have been dramatic increases in earnings per capita. Increases have been relatively greater in the lagging sectors, that is, respective sector earnings per capita have converged between regions both in the core and periphery. While mean core total tertiary earnings per capita converged about 15 percent (.75 percent per year), the core service sector showed the least convergence 3 percent (.15 percent per year). It is also in this sector where the prosperous regions had the largest advantage in 1970 (based on mean service earnings per capita it was

[9] The simple correlations between FP and periphery income per capita are 1950 (-.27), 1970 (-.04). The periphery income per capita impacts are somewhat puzzling and would be easier to interpret with time series data. One explanation may be that the positive correlations imply periphery dependence for higher order goods (higher income levels in the periphery with higher levels of core earnings); while negative correlations imply periphery dependence for even lower order goods (high core earnings and low periphery income per capita). The positive sign also appears consistent with the peripheries import substitution ability (on "polarization reversal.")

[10] In this case note that periphery income per capita is not statistically significant in the trade equation.

Model 1: SMSA Results — 1950

Prosperous n = 50	TTEP	TCUP	TP	FP	SP
Mean	.811	.167	.367	.076	.201
Constant	.057	.029	.188	.081	-.240
Pc	.00026	.00006	.00011	.00004	.00004
	(2.49)	(1.48)	(3.07)	(1.52)	(.83)
YPc	.00038	.00036	.00007	.00010	.00001
	(3.84)	(5.22)	(1.72)	(2.87)	(.30)
Mc	-.12314	.02166	-.03073	-.01714	-.05361
	(2.91)	(1.30)	(2.09)	(1.47)	(2.53)
Ac	-.00501	-.00750	-.00741	-.00336	-.00175
	(.48)	(1.82)	(2.03)	(.90)	(.33)
Dc	-.00070	-.00022	-.00043	-.00012	.00008
	(1.44)	(1.15)	(2.56)	(1.16)	(.31)
$\bar{R}^2$	.41	.20	.41	.06	.26
F	8.59	3.76	8.72	1.64	4.94
Lagging n = 47					
Mean	.642	.128	.291	.056	.166
Constant	.013	-.054	.014	.000	.053
Pc	.00040	.00012	.00013	.00009	.00006
	(3.49)	(2.38)	(2.76)	(3.76)	(1.67)
YPc	.00036	.00009	.00017	.00003	.00007
	(5.22)	(3.05)	(5.89)	(2.34)	(3.00)
Mc	-.05984	.00020	-.03125	-.01052	-.01827
	(1.09)	(.01)	(1.39)	(.94)	(1.00)
Ac	-.01576	-.00598	-.00596	-.00215	-.00167
	(2.07)	(1.78)	(1.92)	(1.39)	(.66)
Dc	-.00030	.00007	-.00016	-.00013	.00009
	(.62)	(.35)	(.81)	(1.28)	(.56)
$\bar{R}^2$	.50	.28	.51	.31	.19
F	11.35	5.08	11.72	5.75	3.36

18 percent whereas in 1950 it was 21 percent). The fastest convergence has taken place in the finance sector where the prosperous advantage decreased by 31 percent. Intuitively, there seems a paradox: the lagging and prosperous regions have converged significantly with respect to higher order services (financial sector), however, convergence in terms of the lower order services (the service sector, of course, is a mix of both high and low order services) has been markedly slower. Also, it is the service and trade sectors that "over-service" the region while the region is "under-serviced" by the financial sector. Part of the reason for the puzzling rates of change is that the lagging core was closest to the prosperous core in service sector earnings in 1950 and quite distant (and much smaller, absolutely) in financial earnings per capita. Also the role of the periphery provides some insight into why the lagging service and trade sectors over-service the region and the financial sector under-services the region. It appears that the lagging core sectors, trade and services, have significantly penetrated the periphery whereas the financial sector has not.

As illustrated in Tables 2 and 3, many core per capita income coefficients increased substantially from 1950 to 1970 which buttresses the hypothesis of providing higher-order goods ("income elastic") and import substitution in the cores. This appears especially true for the prosperous sectors, finance and service, and lagging sectors, trade, finance, and service.

Lagging sectors, it appears, have not reached the threshold levels necessary to provide as high an order of goods as its prosperous counterpart. That is, the *core* income per capita coefficients are larger and have increased faster in the prosperous sectors than in the lagging. An exception is the trade sector where (1) core per capita income has the largest impact in the lagging region in 1970 (more than

twice as large as in the prosperous region), (2) the coefficient has more than doubled in the lagging region but has declined in the prosperous region and (3) the periphery income per capita impact is postive in the prosperous periphery (and larger in 1970 than 1950) but is negative in the lagging periphery. It appears from the coefficients that the core trade sector in the lagging region provides high order (and higher than prosperous cores) services indicating import substitution and/or the development of latent services in the core and/or relative greater exports to the periphery than the prosperous trade sector. Hence, as indicated earlier, the lagging core trade sector over-services its region. Core and periphery impacts are congruent among the other sectors with the noticeable difference that the core income per capita impact is much larger in the prosperous sectors in both 1950 and 1970: for 1970: TCU (58 percent), F (45 percent), S (83 percent). Also, it is notable that the core income impact on the prosperous service sector appears to have reached a maximum near 1950 with significant help from periphery dependence (-26.9 percent). Perhaps the decline in the income impact is due to relatively heavy import substitution in the periphery as evidenced by the much smaller negative impact in 1970. It appears, then, that the lagging region is over-serviced (17 percent) by the service sector because of relatively less import substitution in the periphery even though it has not (cannot) provide as high an order selection of goods as that found in the prosperous region. Both lagging sectors, trade and services, may be capitalizing on the much larger (absolutely and relatively) periphery (see footnote 3). As for the under-servicing sectors, TCU and finance, this may be the result of high order services in the prosperous region and the prosperous cores' impetus from periphery population. The models simply do not capture the lagging sector's TCU market area while they do quite well for the prosperous cores' TCU. It appears that the main reason for core aggregate tertiary earnings per capita to be so close is the activity in the lagging trade and especially, service sectors.

Secondly, from the analysis of core behavior it is implied that structural differences (vis-a-vis differences in levels) may exist between lagging and prosperous core sectors. This is investigated briefly via the Chow test [6, 13], dummy variables, and analyzing residuals. The Chow test indicates structural differences using equation (1) for the following — TCU, trade and the aggregate of the sectors; model (2) suggests structural differences for the trade and finance sectors. Although structural differences are not indicated in all cases recall that this test analyzes the whole model, the set of independent variables. Hence, significant differences may yet exist between regional regression coefficients. For example, the Chow test indicates no structural differences in the finance and service sectors (equation (1)), yet a pairwise test indicates significant statistical differences between prosperous and lagging coefficients for population and the armed forces location quotient, similarly, for the finance sector.[11] [12]

A possible explanation of the structural differences may be the existence of or degrees of differences in agglomeration economies between the lagging and prosperous cores. An indication of agglomeration economies may be gleaned from positive serial correlation. Serial correlation in cross section data may be investigated through various rankings of the observations. While no serial correlation appears when ranking the observations by population and income per capita (indicating the model adequately captures their significance), other rankings do exhibit serial correlation. For example, if each dependent variable is ranked from low earnings per capita to high, then, using model (1) positive serial correlation appears in each sector when ranked by its own earnings. It implies that as earnings per capita increase the size of the error increases. Interestingly,

following the same procedure with model (2) (in an attempt to eliminate some specification bias) the serial correlation is either not indicated or questionable (that is, between d_l and d_u) in the following sectors: lagging-trade (none), lagging-service (questionable); prosperous-TCU and trade (questionably). Positive serial correlation remains in the lagging sectors, TCUP and finance, and the prosperous sectors, finance and services.

While further investigation is needed preliminary results indicate that the lagging sector, trade (and perhaps service), may be doing better than "expected" due to structural differences and their large(r) (than prosperous) periphery market. The above results should be interpreted in light of the following caveats: there may exist a variable(s) that explains the correlation in the residuals, as yet, it remains undiscovered; also, the effects of agglomeration economies since they affect location and the size of the market area should be reflected in earnings.

Summary, Conclusions and Policy Implications

As suggested by earlier research [20], the aggregation of tertiary activities certainly obscures sector behavior. By and large, the models' results are consistent with and bulwark the traditional demand orientation of tertiary activity. The incorporation of the periphery, model (2), increases the explained variation in the lagging sectors trade (22 percent) and services (28 percent), but the finance sector R^2 is reduced (5 percent). The periphery increases the explained variation in the prosperous sectors trade (30 percent), finance (346 percent), and TCU (7 percent) but the R^2 is reduced by 23 percent in the service sector.[13]

It appears that one reason aggregate tertiary earnings per capita are nearly equal in 1970 ($1185 per 1000 population — prosperous and $1074 per 1000 population — lagging) is the behavior of two sectors — trade and services. Using the prosperous equations to predict lagging sector earnings per capita implies that the lagging sectors of trade and services are doing better than expected; indeed, they "over-service" the region and this is why the aggregate tertiary earnings per capita are nearly equal between regions. The over-servicing may be due to (1) relatively less import substitution taking place in the lagging periphery, and/or (2) the lagging core's ability to provide relatively more (and/or) higher order goods because of their larger tributaries, and/or (3) the lagging core's ability to export relatively more beyond the BEA area because of their location. Policies aimed at stimulating the trade and service sectors will not, it appears, be

[11] As discussed in Hoppes and Riefler [20], it appears that the prosperous region is relatively more depressed by manufacturing and the lagging region is relatively more depressed by the armed forces. Briefly they indicate (1) that the prosperous regions attract relatively more manufacturing that carry on their own services (headquarters, etc.) and (2) that the lagging regions have relatively more military establishments that are larger, thus supplanting more of the local service economy than would smaller military depots that do not have PXs or commissaries.

[12] A core dummy variable model indicates that for the sectors, trade and services statistically significant differences exist not only in the "slope" (income per capita coefficients) but also in the "intercept." This buttresses the hypothesis of the regions providing different types of goods or levels of services.

[13] This raises intriguing questions for investigation of "polarization reversal" [Richardson 26, 27] at the regional level and the type of urban heirarchy in each type of region. Is the lagging region more of the primate type whereas the prosperous region has more of a continuum?

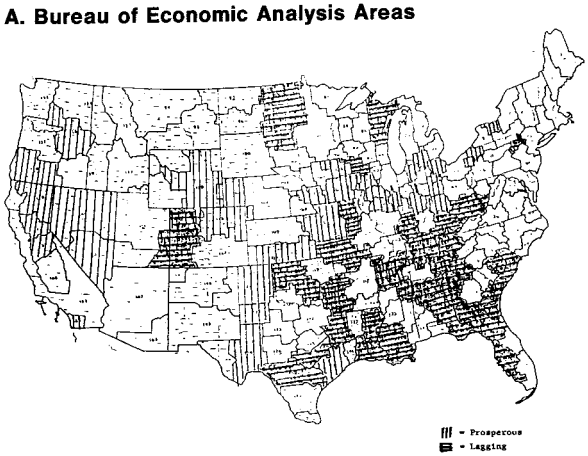
particularly successful as they are already over-servicing the region. However, the locational advantage of these lagging regions, that is, the southeast, may reap long term benefits for the trade and service sectors. Also, the existence of only one large regional capital, Atlanta, should be beneficial. Over time, one would expect greater import substitution in the periphery. Thus, while extensive (population) and intensive (income per capita) growth in the periphery may increase the earnings (efficiency) of the core in the short run, such growth in the long run may stimulate peripheral growth ("polarization reversal") and self-sufficiency (equity). To the extent the lagging cores have depended relatively more on their peripheries their future growth will be dampened as these peripheries undertake import substitution.

The under-servicing that appears to be taking place in the lagging financial sector seems to be due to (1) the lack of periphery penetration and (2) the lack of higher order services (the lagging income per capita coefficient is 45 percent smaller than the prosperous). As for the lagging sector, TCU, the models simply do not perform well. This under-servicing may reflect a basic deficiency in infra-structure development or economic overhead capital.

While disaggregating the tertiary economy had shed some light on the intra- and interregional market orientation of various sectors, it also exudes other questions and hypotheses. Regional growth via tertiary stimulation in lagging regions receives a poor prognosis. This is especially true for the trade and service sectors as they are performing better than "expected." Policies directed toward stimulating the financial sector have little intuitive appeal because of their "higher-order" nature. The efficacy of policies related to the TCU sector may be less pessimistic. The apparent under-servicing in this sector may be relieved somewhat through infra-structure investment and economic overhead capital which are of permanent importance in the long run.

While it may be quite obvious that tertiary development has stimulated regional growth in specific locations, such an observation is not apparent from this macro-study. Thus, determining the feasibility and efficacy of tertiary stimulation must be site specific. This research also exhorts questions related to interregional tertiary industrial structure, periphery markets/urbanization, efficiency (labor/productivity) differences and many other hypotheses concerning this area of regional economic growth and development. Such analyses are needed to gain further insight into interregional tertiary structure and behavior.

APPENDIX A. Bureau of Economic Analysis Areas



APPENDIX B. Model 1: SMSA Results — 1970

Prosperous n = 50	TTEP	TCUP	TP	FP	SP
Mean	1.185	.196	.453	.128	.408
Constant	-1.014	-.232	.156	-.17	-.85
Pc	.00010	.00002	.00009	.00002	-.00002
	(1.37)	(.80)	(3.65)	(.75)	(.46)
YPc	.00072	.00013	.00010	.00010	.00038
	(6.56)	(4.48)	(2.85)	(2.68)	(5.04)
Mc	-.20065	-.02614	-.05030	-.03547	-.08870
	(3.12)	(1.50)	(2.34)	(1.68)	(1.96)
Ac	-.03402	.00920	-.02049	-.01016	-.01257
	(1.18)	(1.18)	(2.13)	(1.08)	(.63)
Db	-.00104	-.00022	-.00030	-.00003	-.00051
	(2.62)	(1.99)	(2.24)	(.22)	(1.81)
$\bar{R}^2$	.59	.41	.44	.13	.39
F	17.14	8.71	9.66	2.70	8.12
Lagging n = 47					
Mean	1.074	.186	.418	.123	.347
Constant	-.71	-.029	-.270	-.153	-.260
Pc	.00026	.00007	.00011	.00005	.00003
	(2.75)	(1.59)	(2.09)	(2.19)	(.63)
1/Pc	.00062	.00006	.00024	.00010	.00022
	(6.52)	(1.33)	(4.48)	(4.05)	(4.80)
Mc	-.10017	.02915	-.05955	-.03251	-.03725
	(1.48)	(.98)	(1.55)	(1.87)	(1.12)
Ac	-.02989	-.00085	-.01316	-.00599	-.01159
	(2.52)	(.16)	(1.97)	(1.97)	(1.99)
Db	-.00031	.00010	-.00005	-.00004	-.00032
	(.66)	(.48)	(.20)	(.31)	(1.37)
$\bar{R}^2$	.63	.12	.45	.42	.40
F	18.80	2.36	9.37	8.45	8.06

Model 2: SMSA Results — 1950

Prosperous n = 30	TTEP	TCUP	TP	FP	SP
Mean	.851	.174	.389	.076	.212
Constant	-.326	-.214	-.077	-.002	-.033
Pc	.00008	.00003	-.00001	.00000	-.00010
	(.67)	(.60)	(.19)	(.00)	(1.46)
YPc	.00078	.00014	.00019	.00005	.00039
	(5.82)	(2.50)	(4.87)	(2.11)	(4.93)
Mc	-.21282	-.02242	-.05006	-.01725	-.12309
	(3.16)	(.80)	(2.50)	(1.37)	(3.07)
Ac	-.01291	.00848	-.01039	-.00287	-.00813
	(1.25)	(1.97)	(3.39)	(1.48)	(1.33)
Pp	.00065	.00018	.00033	.00019	-.00004
	(2.67)	(1.76)	(4.58)	(4.08)	(.31)
YPp	-.00029	.00002	.00001	-.00003	-.00029
	(2.04)	(.29)	(3.31)	(1.04)	(3.47)
Mp	.02427	-.02684	-.03605	-.01425	.10141
	(.25)	(.66)	(1.25)	(.75)	(1.75)
Ap	-.01226	-.01049	-.01942	-.01220	.29841
	(.24)	(.50)	(1.29)	(1.29)	(.99)
$\bar{R}^2$	.62	.33	.68	.49	.42
F	8.59	3.36	11.32	4.88	4.41

Lagging n = 30					
Mean	.664	.140	.298	.059	.167
Constant	-.085	-.099	-.033	-.002	-.050
Pc	.00015	.00003	.00004	.00004	.00003
	(1.29)	(0.62)	(.85)	(1.76)	(.94)
YPc	.00047	.00015	.00017	.00004	.00010
	(4.29)	(3.16)	(3.72)	(1.82)	(3.26)
Mc	-.06844	-.00945	-.02372	-.01933	-.01595
	(.98)	(.31)	(.79)	(1.26)	(.80)
Ac	-.01316	-.00688	-.00370	-.00226	-.00031
	(1.44)	(1.73)	(.95)	(1.13)	(.12)
Pp	.00022	.00008	.00007	.00002	.00004
	(1.76)	(1.54)	(1.43)	(.67)	(1.18)
YPp	-.00012	-.00004	.00000	-.00002	-.00006
	(1.03)	(.82)	(.06)	(.72)	(1.91)
Mp	-.04950	-.02287	-.00459	-.00882	-.01322
	(.37)	(.39)	(.07)	(.30)	(.34)
Ap	.02239	.01119	.00185	.00677	.00257
	(1.10)	(1.27)	(.21)	(1.52)	(.44)
$\bar{R}^2$	.50	.36	.42	.16	.46
F	5.80	3.63	4.42	1.89	3.15

Model 2: SMSA Results — 1970

Prosperous n=30 Coefficient	TTEP	TCUP	TP	FP	SP
Mean	1.230	.203	.477	.130	.420
Constant	-1.083	-.172	-.047	-.270	-.593
Pc	-.00003	-.00001	.00003	-.00002	-.00004
	(.32)	(.25)	(1.10)	(.86)	(.49)
YPc	.00088	.00013	.00011	.00014	.00050
	(5.88)	(3.79)	(3.04)	(5.01)	(4.18)
Mc	-.33147	-.05302	-.06746	-.02826	-.18273
	(3.11)	(2.11)	(2.53)	(1.45)	(2.16)
Ac	-.06169	.00275	-.02713	-.01162	-.02569
	(1.72)	(.33)	(3.03)	(1.78)	(.91)
Pp	.00094	.00025	.00038	.00036	-.00005
	(2.68)	(2.98)	(4.36)	(5.63)	(.17)
YPp	-.00015	-.00002	.00005	-.00002	-.00016
	(.93)	(.60)	(1.26)	(.74)	(1.23)
Mp	-.11189	-.03009	-.06488	-.04949	.03258
	(1.01)	(1.15)	(2.34)	(2.44)	(.37)
Ap	-.14370	-.02173	-.03359	-.04484	-.04354
	(2.22)	(1.42)	(2.07)	(3.79)	(.85)
$\bar{R}^2$	.56	.44	.57	.58	.30
F	7.07	4.71	7.25	7.68	3.08

Lagging n = 30					
Mean	1.115	.188	.439	.125	.365
Constant	-.667	.023	-.278	-.244	-.168
Pc	.00005	.00001	.00004	.00001	-.00001
	(.63)	(.31)	(.84)	(.41)	(.39)
YPc	.00078	.00009	.00030	.00011	.00028
	(8.02)	(1.63)	(5.09)	(3.30)	(5.49)
Mc	-.20404	-.00273	-.07419	-.06187	-.06560
	(3.06)	(.07)	(1.84)	(2.65)	(1.89)
Ac	-.03593	-.00055	-.01363	-.00748	-.01380
	(3.53)	(.09)	(2.22)	(2.10)	(2.61)
Pp	.00014	.00007	.00003	.00004	-.00000
	(1.06)	(.93)	(.34)	(.98)	(.00)
YPp	-.00021	-.00006	-.00006	-.00002	-.00011
	(1.86)	(.91)	(.91)	(.43)	(1.81)
Mp	.07913	-.00028	.01155	.04007	.02965
	(.90)	(.00)	(.22)	(1.31)	(.65)
Ap	.00927	.00065	.00244	.00167	.00434
	(.87)	(.10)	(.38)	(.45)	(.78)
$\bar{R}^2$	.77	.07	.55	.40	.62
F	16.63	1.36	6.82	4.12	6.01

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