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## UTILIZATION OF SMM DATA AND RETAIL LOCATION THEORY

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### Introduction

Regional scientists are accustomed to confronting data problems in applied work. Short time series, small sample size, missing observations, and disclosure problems are just some impediments to progress in the field. The regional analyst views with envy the data sets available, for example, to the international or financial economist. Although problems exist in both the micro and macro realms of the discipline, perhaps no where is the constraint as binding as in location theory. As a corollary, recent evidence suggests a decrease in the amount of time devoted to this subject in introductory classes (Kirk, 1995).

Much of the early research in location theory, as best exemplified in the work of Hoover (1937, 1948), focuses on the congruency between theory and fact and, therefore, emphasizes real world relevancy. Recent theoretical prowess in areas such as central place theory and the new urban economics has outstripped our ability to conduct empirical validation. The result has been the development of challenging hypotheses awaiting empirical testing and increased reliance on case studies and analytical approaches that strain the credulity of the *ceteris paribus* assumption.<sup>1</sup> Such advances, while adding to the knowledge base, make synthesis and exposition a daunting experience when it comes to presenting the state of the art to students in introductory (and even advanced) courses. We advance the hypothesis that it is in classroom presentation of location theory (or regional microanalysis) that diversity of coverage and approach currently is maximized.

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<sup>1</sup> For example, choosing one journal at random, see articles by Yinger, Sivitanidou and Wheaton, and Mai and Hwang in the *Journal of Urban Economics*, 31, no. 2 (March 1992).

## The Sales and Marketing Management Data Bank

Discovery of a "new" data source in a discipline as data-sparse as regional science is an exciting event. This is especially the case when the source can bring to life a rather abstract corner of the discipline. We think this can be accomplished with statistics from the annual "Survey of Buying Power" published in *Sales and Marketing Management* (SMM) magazine.<sup>2</sup> While not filling the lacunae in our tool kit for applied regional microeconomic work, they do provide statistics of pedagogical value for bringing location theory into the real world for students.

The adjective new above is in quotation marks for two reasons. First, the data bank published in SMM is not a recent innovation; it has been published annually for over 30 years. Second, with one exception noted below, these statistics are not generated by the statisticians employed by the magazine. Rather, they combine data from other sources such as the *Census of Retail Trade* and *Census of Population*. It is the compilation of diverse statistics in one source that provides the pedagogic value of the database for applied location work.

Before turning to the contents of this data bank and giving some specific examples of classroom utilization, it is advantageous to summarize the objective SMM has in publishing the annual compendium. According to the "User's Guide" accompanying the survey, the survey is designed to facilitate evaluation in the sales, marketing, and advertising strategies of managers. The database, therefore, is pertinent to market-oriented firms, specifically firms in retail trade that sell directly to consumers. Especially relevant for regional scholars are the goals of the statistics in the sales and marketing areas. In the sales arena, the data presented are meant to assist in measuring sales performance, setting sales goals or quotas, and facilitating analysis of sales territory. In the marketing realm, published statistics allow measurement of market potential, assist in developing marketing strategies and distribution channels, and allow evaluation of new product potential.

Data are published at the MSA or CMSA level as well as at the county level for those areas (i.e., rural areas) not contained in MSAs. In addition, statistics are available for the urban and suburban areas of MSAs. The basic statistics published fall into three categories: population, total retail sales, and effective buying power or effective buying income (EBI). Population data include number of persons, percent of U.S. population, median age of population, and percent distribution of population by age group.<sup>3</sup> The number of households in each spatial component also is identified.

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<sup>2</sup> See also the annual "Survey of Media Markets" in the same magazine.

<sup>3</sup> The four age groupings are 18 to 24, 25 to 34, 35 to 49, and 50 and over.

Total retail sales are split into six major subcategories: food (SIC 54), eating and drinking places (SIC 58), general merchandise stores (SIC 53), furniture, home furnishing, and appliance outlets (SIC 57), auto dealers (SIC 55, excluding 554), and drug stores (SIC 591). EBI is area personal income minus personal taxes, non-tax payments, and contributions to social insurance. EBI is similar to the familiar concept of disposable or after tax income. In addition to total EBI, data are published for both area median household EBI and per capita EBI. Finally, the percent of area households with EBIs in four ranges is presented.<sup>4</sup>

The final statistic published by SMM for each potential market area is the exception to the rule of published statistics derived from other sources. What SMM defines as an area's buying power index (BPI) combines population, income, and retail sales data into an overall index of market size. In computing this index, the assigned weights to each component are population (0.2), effective buying income (0.5), and total retail sales (0.3). These weights, while not determined in a quantitative or scientific manner, represent a consensus of professionals in the marketing field. Given SMM's emphasis on receiving professional feedback over the years, one could rationalize the choice of weights as the outcome of a Delphi selection process. The formula used to calculate an overall BPI for a specific region (i) relative to that of the U.S. is:

$$(1) BPI_i = 0.2(P_i/P_{us}) + 0.5(EBI_i/EBI_{us}) + 0.3(RS_i/R_{us})$$

where:

- P = Population;
- EBI = Effective buying power;
- RS = Retail sales;
- i = The region; and
- us = The United States.

This index could be customized by changing the base of comparison (i.e., the Midwest or Missouri versus the U.S.) or substituting specific components of population, EBI, and/or retail sales. Thus, if one were analyzing the market potential of an area for an upscale restaurant appealing to the elderly population, one could use the following formula:

$$(2) CBPI_i = 0.2(P_i^{50+}/P_{us}^{50+}) + 0.5(EBI_i^{\$50,000+}/EBI_{us}^{\$50,000+}) \\ + 0.3(RS_i^{sic58}/RS_{us}^{sic58})$$

<sup>4</sup> The EBI ranges are \$10,000 to \$19,999, \$20,000 to \$34,999, \$35,000 to \$49,999, and over \$50,000.

### Classroom Utilization of SMM Data

Utilization of the SMM database is most appropriate in the location theory/application part of a regional economics syllabus. The statistics are most appropriate for analysis of the location pattern for market-oriented activities. Further, the data are useful in investigating:

- \* The location of such firms in isolation
- \* The location pattern of similar firms (i.e., firms in competition); and
- \* The hierarchy of market areas (i.e., central place theory).

SMM's buying power index indicates the market access potential or market size for a firm locating in isolation. Therefore, it can be used in the application of the principle of median location or Reilly's law of retail gravitation (Hoover and Giarratani, 1984, pp. 38-41; O'Sullivan, 1993, pp. 48-55). BPIs also can be used for market-oriented firms as a proxy for ideal weight in a Varignon frame analysis (or computer model) (Heilbrun, 1987, p. 67; Hoover and Giarratani, 1984, p. 30; Blair, 1991, pp. 22-32).

In order to investigate the location of similar firms in competition, SMM's concept of a performance index (PI) is useful. The PI is calculated as:

$$(3) \text{ PI} = \text{Actual Sales in Market } i / (\text{Total U.S. Sales} \times \text{BPI}_i)$$

The denominator of PI is a measure of potential sales in the market area; the numerator measures actual performance. U.S. sales in the denominator could be replaced by a different base (i.e., state or regional sales). In such a case, the BPI also would have to be adjusted to a congruent measure.

The performance index is similar to a location quotient or coefficient. If the PI is equal or greater than one, the market is well served by current facilities. A PI significantly lower than unity would indicate that current facilities are not meeting market needs. The existence of such a deficit would indicate that the market is a prime location for either expansion of existing facilities or location of new establishments.

If the pattern of PIs is such that a few markets (for instance, the largest) record an index significantly greater than one, while most exhibit a ratio close to zero, the evidence suggests that agglomeration economies are important for the product line being analyzed. Care must be taken; the PI is useful for firms locating in competition only if either it is unlikely that firms are subject to such economies or if the PIs are calculated for several markets with similar BPIs to insure that there is little similarity. If a dozen markets with similar BPIs all report PIs of 0.010 to 0.020, for instance, this may indicate that such markets do not offer agglomeration economies (either localization or urbanization

economies) conducive to location of the type facility under investigation. If the PIs cluster in two groups (one above unity, the other below), however, *prima facie* evidence of market potential for additional location/expansion exists in the latter. Calculation of PIs, therefore, allows the instructor and students to examine both market potential and look for empirical evidence of one of the more illusive concepts in applied location theory, agglomeration economies (Heilbrun, 1987, pp. 13-18; Mills and Hamilton, 1994, pp. 20-21; Blair, 1991, pp. 107-119; O'Sullivan, 1993, pp. 33-35).

The SMM database is not the perfect source for all location analysis. It is restricted to analyzing the location of market-oriented firms. Even when restricted to these firms, it is not the perfect data source. Application of the SMM statistics is as likely to raise issues and questions as to illustrate the concepts at work. But, like the utilization of BLS employment data or BEA earnings statistics to illustrate the workings of the export base model, caveats and questions raised can be used to illustrate the shortcomings of implicit *ceteris paribus* assumptions as well as to suggest more sophisticated approaches. Students seem to enjoy this type of hands-on exercise illustrating textbook concepts. A simple research project often opens the door to more comprehension and questioning of the world around the student.

The objective of the foregoing outline is to acquaint the reader with the potential utility of the SMM data and to suggest where in a typical introductory course in regional economics the material can be placed. We now turn to some actual examples of applying the SMM data to the problems detailed above. These examples indicate the uses to which we've put these statistics. We welcome your input and challenge readers to suggest additional exercises. We have only scratched the surface of potential application.

### **SMM Data and Central Place Theory**

SMM data, as indicated above, may be used to investigate the distribution of retail establishments as predicted by central place theory. Here we present two levels of comparison. The first is simple, but the second may require students to brush up on some of their statistical techniques (and therefore is to be recommended).

We use the state of Missouri for our central place analysis. We rank counties according to their BPI and record the number of retail establishments, automotive dealers and service stations, and eating and drinking places for each.<sup>5</sup> The latter data are obtained from *County Business Patterns* (CBP). When comparing counties with BPIs of

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<sup>5</sup> Although for certain purposes one might use total employment as a proxy for the quantity of a retail service available in a community, disclosure problems necessitate the use of number of establishments.

0.0010 with those of 0.0020 we would expect the number of stores, as a proxy for service availability, to double. This roughly is the pattern found. The average number of retail establishments of all types increases from 58 to 124. The number of auto dealers and service stations increases from 12 to 26; for eating and drinking establishments the figure rises from 14 to 28.

Focusing on those counties with a BPI of 0.0040 versus 0.0020, we again find an approximate doubling of establishments. If we compare Joplin (BPI = 0.0196) to Springfield, MO (BPI = 0.0389) the number of stores in each category nearly doubles, as predicted. St. Louis's BPI is approximately 50 percent higher than Kansas City's, as is the number of retail establishments. If we compare BPI/establishment relationships for Springfield and Kansas City, however, we see a lack of stability. The Kansas City BPI is roughly seven times that for Springfield, but the number of stores only increases fivefold. If we compare Springfield and Kansas City in terms of retail employment rather than the number of stores, however, we find a 6.2-fold increase; this is closer to the sevenfold expected increase.<sup>6</sup> cursory investigation suggests a fairly consistent and nearly linear relationship between BPIs and number of stores, therefore, as predicted by central place theory. Little evidence for agglomeration economies is found.<sup>7</sup>

A slightly more sophisticated test of the implications of central place theory can be illustrated. Again, we use Missouri as our test bed and continue to use the three retail categories above. A percentage distribution based on each area's (county or MSA) number of establishments is calculated. CBP data for the Kansas City and St. Louis areas are adjusted to reflect their interstate nature. We then compare the percent distribution (and rankings) of the number of stores variables with those based on the BPI.

Table 1 contains the results from two tests of correlation: the coefficient of determination and the Spearman rank-order correlation coefficient. The first coefficient measures the correlation between the number of establishments and the BPI. The Spearman coefficient measures the correlation between the ranks of each data set.

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<sup>6</sup> This indicates a discontinuity in the nature of retail establishments. For towns and cities with a BPI equal to or less than that of Springfield, a larger market means more (similar) stores. In going from Springfield to Kansas City the number and type of retail establishment apparently changes (i.e., full-line department stores exhibiting economies of scale).

<sup>7</sup> Localization economies would appear as a geographic clustering of retail establishments. Urbanization economies would be reflected in higher establishment/BPI ratios for larger urban areas.

**Table 1—Market Buying Power Indices and Retail Store Distributions, 1989 Correlations**

Variables* (n = 104)	Coefficient of Determination (R <sup>2</sup> )	Spearman Rank Correlation (Rho)
% BPI, % Total Retail	0.9307	0.9647
% BPI, % Auto Dealers, Service Stations	0.9130	0.9555
% BPI, % Eating & Drinking Establishments	0.8730	0.9343

\* % = percentage of the variable in each of the regions in Missouri

In Table 1 the fact that the coefficient of determination is high supports the finding of a high degree of linearity between the distribution of BPIs and retail establishments. The Spearman rank correlation coefficient is more in keeping with the spirit of testing central place theory. The latter does not necessarily require a linear relationship, but a monotonic one reflecting a hierarchy of places. In addition, the assumption of a normal distribution in our variables is unrealistic, further questioning the first two tests. Utilization of the Spearman measure does not change our conclusion of a high degree of association between a county's (or city's) BPI and the number of retail establishments. The pattern of significant differences in rank (both geographically and by size of area) often is more interesting than the finding of a high level of rank correlation.<sup>8</sup>

### **SMM Data and Other Measures of Retail Activity**

Obtaining data that allow students to implement models that have been discussed in class can be (and perhaps as a training exercise should be) an onerous task. In some cases just gathering data becomes a discouraging job, however, and the excitement and learning experience from a project is diluted. Pedagogic considerations entail balancing data gathering with analysis and interpretation. The various surveys contained in SMM provide the student easy access to current

<sup>8</sup> The congruency of this analysis to that pertaining to empirical work on the size distribution of urban areas is obvious. Further utilizing that literature it would be instructive to test for the existence of a rank-size relationship between BPIs and number of retail establishments.



data about goods and services and locations with which they are familiar. This introduces a degree of relevance into the project, and students feel that they learn something even from the simplest models. Students, therefore, can be asked to choose a region for analysis early in a course and then build a database for that area including SMM statistics. The database can be used during the course for several small projects including retail analysis, market boundary, shift/share, localization coefficients, and economic base studies.

Husteede, Pulver, and Shaffer (1993) have written an excellent how-to manual illustrating many techniques that can be used as decision-making aids when undertaking local economic analysis. Many of their techniques can be implemented using SMM data. Several of these complement and/or extend the SMM indices presented above. Among these are the trade capture area population (TAC), pull factors (PF), and potential sales (PS).

The TAC is a population estimate of a firm's market area rather than an index number such as BPI. An area's TAC is computed by:

$$(4) \text{ TAC} = A_r / (B_b \times C_{rb})$$

where:

- $A_r$  = Sales of  $i$  in a community  $r$ ;
- $B_b$  = Per capita sales of  $i$  in the base region (i.e., state); and
- $C_{rb}$  = Community  $r$ 's per capita income divided by base region per capita income.

The TAC provides an estimate of the number of customers drawn to a community. It assumes local persons buy goods and services at the same rate as the base region's per capita average. The only force causing variation in spending patterns is income.

Suppose the student wishes to compute the TAC for total retail sales, eating and drinking places, and furniture, fixture, and appliance outlets for Norfolk, Virginia. Taking total retail sales as our exemplar, the student first must calculate sales per capita in the base region. Suppose that region is the entire state of Virginia. SMM data indicate that total retail sales in the state are \$44.8 billion. Dividing that by the state's population of 6.1 million results in an average per capita consumption of \$7,346.

Because per capita retail consumption may be expected to vary with income per capita, the student then compares the EBI per capita of Norfolk with that of Virginia (again using SMM statistics). The EBI per capita for Norfolk is \$12,644 (EBI = \$17.5 billion; population = 1.38 million) compared to Virginia's \$14,330. Substituting in equation (4), we find Norfolk's trade area capture:

$$\text{TAC} = \$9.9 \text{ billion} / (7,346 \times 12,644 / 14330)$$

$$= 1.524 \text{ million}$$

Similar calculations for the specific retail lines yield a TAC of 1.647 million for eating and drinking establishments and 1.711 million for furniture, fixture, and appliance outlets. These computations assume that Norfolk's overall consumption patterns match those of Virginia, but that the level must be adjusted downward to account for Norfolk's lower effective buying power. Results indicate Norfolk either is attracting customers from outside the urban area or local persons are spending more than the population of the state as a whole.

Following Hustedde, Shaffer, and Pulver, it is simple to calculate what they term Norfolk's pull factor (PF) for each retail line:

$$(5) \text{ PF} = \text{TAC} / \text{Local Population}$$

For total retail trade, eating and drinking establishments, and furniture, fixtures, and appliance outlets, respectively, the PFs are 1.10, 1.19, and 1.24. Under the assumption of congruent consumption patterns, these figures indicate exports from the urban area of 10 percent, 19 percent, and 24 percent.

SMM's performance indices (PIs) for Norfolk are 1.04640, 1.05677, and 1.15784, respectively, for total retail, eating and drinking, and furniture, fixture, and appliance establishments. These PIs indicate exports of 4.6 percent, 5.7 percent, and 15.8 percent, respectively. The fact that these statistics are 46 percent, 30 percent, and 66 percent of those reported for the PF calculation indicates that the local populace in Norfolk, possibly due to a young demographic profile associated with a high percentage military, are spending more than the statewide average.

It is simple to translate the percentage export (import) data resulting from the calculation of either PI or PF into a measure of dollar flows using either equation (6a) or (6b):

$$(6a) \text{ EM} = S - (S/\text{PF})$$

$$(6b) \text{ EM} = S - (S/\text{PI})$$

where:

- EM = A measure of export/import sales in dollars; and
- S = Total sales.

Table 2—1989 Buying Power Index and Performance Index\*

Measure	Norfolk, VA	Charlotte, NC	Orlando, FL	Tacoma, WA	Springfield, MO	Lincoln, NE
<b>Base: State</b>						
BPI - TRS	.54822	.45618	.46637	.20618	.09661	.09082
- E/Drkg	.55072	.51504	.58032	.44429	.41022	.40221
- FFA	.57630	.54114	.53301	.43734	.39818	.39421
PI - TRS	1.04640	1.07379	1.21888	1.05228	1.22611	.97792
- E/Drkg	1.05677	.89908	1.17291	.51145	.27708	.21619
- FFA	1.15784	1.01647	.98113	.46661	.18465	.15295
TAC - TRS	1523.95	1132.83	1292.17	663.13	333.10	201.41
- E/Drkg	1646.79	1152.11	1521.71	617.39	329.43	196.60
- FFA	1710.55	1135.21	1136.50	623.30	285.62	149.91
PF - TRS	1.10	1.00	1.24	1.18	1.40	0.95
- E/Drkg	1.19	1.02	1.46	1.10	1.39	0.93
- FFA	1.24	1.01	1.09	1.11	1.20	0.71
<b>Exports/Imports</b>						
TRS	\$927,313	\$36,740	\$1,878,555	\$568,097	\$583,630	(\$81,159)
E/Drkg	\$163,223	\$16,904	\$371,013	\$35,221	\$54,918	(\$11,911)
FFA	\$114,895	\$3,163	\$37,948	\$17,845	\$10,998	(\$22,350)
<b>Base: United States</b>						
TAC - TRS	1491.39	1261.76	1398.33	634.87	335.03	199.56
- E/Drkg	1513.03	1192.76	1674.38	664.94	321.46	195.37
- FFA	1734.75	1416.83	1286.41	597.15	207.94	135.48
PF - TRS	1.08	1.12	1.34	1.13	1.41	0.94
- E/Drkg	1.10	1.06	1.60	1.18	1.35	0.92
- FFA	1.26	1.26	1.23	1.06	0.87	0.64

Source: Sales and Marketing Management. BPI = Buying power index; PI = Performance index; TAC = Trade area capture (in \$000s); PF = Pull factor; TRS = Total retail sales; E/Drkg = Eating and drinking places; FFA = Furniture, fixtures, and appliances

Equation (6a), for instance, would indicate Norfolk exported \$927,313, \$163,223, and \$114,895 in total retail, eating and drinking, and furniture, fixture, and appliance sales in 1989.

A student's understanding of the working of market forces on retail location can be enhanced by examining trends in SMM and SMM-derived statistics over time and by comparing the performance of retail trade at a point in time among cities in different regions. Table 2 also contains similar statistics for Charlotte, North Carolina, Orlando, Florida, Tacoma, Washington, Springfield, Missouri, and Lincoln, Nebraska. The upper part of Table 2 uses the state in which the city is located as the base region for comparison. The data in the lower portion of the table utilize the U.S. as a base.

The PF results in Table 2 indicate that all cities, except Charlotte and Lincoln, are exporters of retail goods. This result is not surprising, given the size of these cities. The high PFs for Orlando and Springfield, indicating 24 percent and 40 percent export of total retail sales, are consistent with both cities serving as recreational centers pulling customers from outside their local boundaries. For both cities the lower PF for furniture, fixture, and appliance stores reflects the fact that such purchases are likely to be a minor part of tourist spending.<sup>9</sup>

The fact that almost 28 percent of Lincoln's imports are accounted for by outside purchases of furniture, fixtures, and appliances undoubtedly reflects the existence of a local sales tax on non-food and clothing items. It is likely that the bulk of the remaining imports consist of relative big ticket discretionary consumption items (and purchases of complimentary goods such as meals consumed on shopping trips).

## Conclusions

The SMM data bank can serve many purposes in the classroom. In introductory regional science courses it is our contention that these statistics can be used to illuminate one of the darker corners of our discipline and enhance student understanding of (and motivation to study) location theory. The fact that the data enable the students to answer some questions concerning the location of market-oriented activities and formulate additional (unanswered, but answerable) questions make them a strong pedagogic tool in the classroom.

Although outside the purview of this article, this statistical compilation can be combined with other data sources on nonretail sectors,

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<sup>9</sup> Note that Orlando and especially Springfield record PIs lower than one. In the case of Springfield the PI measure indicates significant imports of furniture, etc., while the PF measure indicates exports. This would be consistent with local purchasing patterns differing with state average consumption patterns. Also interesting are the differences in export/import performance of Tacoma when comparing PI and PF measures.

thereby improving the information content of models such as export base theory and shift/share analysis. This capability, when combined with the utility of the data bank for initiating microanalysis, makes the SMM statistics an interesting vehicle for graduate level work in regional analysis. But that is best a story to leave for another paper.

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