# Factors Influencing Trade Area Capture In The Great Basin Area

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Abstract

Tobit estimation procedures were used for pull factors of eight retail sectors to determine factors which influence the capture of local and non-local retail demands. These significant factors were derived and discussed as elements to be implemented into future retail extension/outreach programs.

## Introduction

Undertaking goals of economic development, there are numerous strategies from which a rural community can use. Industrial recruitment and downtown revitalization continue to be the two most common economic development strategies employed by communities (Daniels). A community employing only industrial recruitment may however be restricting its economic development options. One such strategy is for a community to improve its ability to capture local retail expenditures. This strategy has focused on estimating rural retail sector activity and performance. Recently, economists and planners have conducted applied local retail development research extension, and outreach programs across the nation. The intention of these programs is to help local economic development practitioners adequately address problems in their local retail sector. In addition, the extension service of the USDA has targeted programs to increase the viability of rural retail sector as a national program priority.

A potentially successful extension program which encompasses the strategy of capturing local retail dollars is rural retail sales potential and retention. Sales retention is an indirect measure of locally available goods and services assuming local people buy locally if possible (Goldstucker et al.). An approach to measure potential retail sales is trade area analysis. Trade area analysis estimates the number of persons buying locally and yields information as to retail sales capture or leakage for a community.

However, trade area analysis does not yield information as to the impacts of exogenous variables on rural retail activity. An understanding of the influences of exogenous factors on trade area would provide additional behavioral information in the formulation and development of extension or outreach rural retail sector programs. The intention of such extension or outreach programs would be to strengthen the local retail sector.

Therefore, the primary objective of this paper is to develop analytical procedures to explain variations in rural retail trade capture in the Great Basin Region. The Great Basin Region is defined as the states of Nevada and Utah. The Great Basin Region depicts a water basin as designated by the Water Resurces Council.

## Trade Area Analysis

Trade area analysis is rooted in central place theory. The varieties of retail goods offered by a community depend upon demand and supply conditions locally as well as the distance a consumer would normally travel to obtain a particular good.

The adoption of central place theory to estimate rural commercial sector activity requires application of trade area analysis. A trade area as defined by Hustedde, Pulver, and Shaffer is a geographical area for which a commodity captures the majority of its customers. The trade area analysis procedures used in this study are the trade area capture and the pull factor. Trade area capture has been used widely to estimate sales potential for local economies (Chase and Pulver; Stone and McConnon; Hustedde et al.; Shaffer; Harris). Trade area capture is based on the assumption that, after accounting for income differences, local tastes or preferences are similar to that of the state or reference area.

The trade area capture measure is a surrogate estimate for the number of customers or customer equivalents who purchase a specific type of merchandise (merchandise type i) in a given locality. With application to a county, the standard approach used to derive trade area capture is presented by the following equation:

(1) $$TAC_{ij} = \frac{RS_{ij}}{\frac{RS_{is}}{POP_s} * \frac{PCI_j}{PCI_s}}$$

Where $TAC_{ij}$ is the trade area capture estimate for merchandise type i in county j; $RS_i$ is total sales of merchandise type i in county j; $RS_{is}$ is total sales of merchandise type i in state s; $POP_s$ is population in state s; $PCI_j$ is per capita income in county j; and $PCI_s$ is per capita income in state s. However, Stone and Yanagida et al. excluded the relative per capita income calculation, $\frac{PCI_j}{PCI_s}$ from their estimate of $TAC_{ij}$. Thus $TAC_{ij}$ is derived as:

(2) $$TAC_{ij} = \frac{RS_{ij}}{\frac{RS_{is}}{POP_s}}$$

Where $TAC_{ij}$, $RS_{ij}$, $RS_{is}$ and $POP_s$ have been defined. The relative per capita income calculation will be used later as an explanatory variable in the analysis.

If trade area capture exceeds county population, the county is capturing outside trade. However, if the trade area capture is less than county population, the county is losing local retail trade. Comparison of the trade area capture estimates for specific retail sectors to total local retail trade provides insights as to which local retail sector is attracting customers from outside local boundaries. Also, it is important to compare trade area capture estimates over time to identify trends.

The trade area capture estimate is an absolute rather than a relative measure of performance. That is, it measures purchases of both residents and nonresidents. It is therefore difficult to use this measure for making comparisons with regions of different sizes and for assessing trends over time. For these purposes, the pull factor is used. The pull factor explicitly calculates the proportion of the consumers that a county draws from outside its boundaries (i.e., tourists, residents from outside the county, etc.). The pull factor removes the influence of local population changes over time when determining changes in drawing power for a particular county. The pull factor is calculated by dividing the trade area capture estimate by the county population, or:

(3) $$PF_{ij} = \frac{TAC_{ij}}{POP_j}$$

Where $PF_{ij}$ is the pull factor for merchandise type i in county j; $TAC_{ij}$ is the Trade Area Capture estimate of merchandise type i in county j; and $POP_j$ is population in county j.

A pull factor greater than one may be interpreted as the county attracting a larger number of customer equivalents than would normally be drawn from the local population assuming their level of purchases were similar to the statewide average. Conversely, a pull factor less than one implies that the retail purchases of local residents are not being captured by the local commercial sector.

If a community's or county's retail sector pull factor is less than one, then the question becomes can the community or county do anything to increase capture by the local retail sector. The results from trade area capture and pull factors do not yield information as to the determinants of trade and therefore may yield little information as to causes of retail sector leakages. With little or no knowledge of potential socio-economic factors contributing to local

retail sector leakages, formulating and presenting extension or outreach programs to strengthen local retail sector activity may be inappropriate or fall short of anticipated goals.

## Factors Influencing Rural Retail Trade Activity

As stated earlier, the lack of knowledge pertaining to socio-economic factors that may cause variation in local commercial sector activity is a deficiency in trade area analysis. However, pull factors calculated over time and compared to other communities of similar socio-economic characteristics may help local decision makers evaluate the competitiveness of their local commercial sector. Unfortunately this may yield conclusions that may well be incorrect or unclear if statistical procedures are not followed.

Stone used cross-sectional data to investigate the impacts of shopping malls on rural Iowa retail sales. Stone found that if a mall is present in a county, total retail sales for the county increased by $75 per additional square foot of mall space. However, when a mall is located outside the county and is within 25 miles of the county seat, total county retail sales decreased by $4.86 for each additional square foot of mall space. When a mall is located outside the county and is within 26 to 50 miles of the county seat, county retail sales realized a loss of $0.61 for each additional square foot of mall space.

Hamilton investigated the influence of population size and change on retail sales patterns in Queensland, Australia. Hamilton found that more populated communities achieved higher levels of per capita retail sales than less populated communities. However, close proximity to larger trade centers decreased per capita sales significantly. Hamilton's results also showed that declining or slow growing communities are more tenacious in holding onto local retail outlets, while faster growing communities are engaged in replacing small shops with large retail outlets.

Henderson estimated the elasticity of retail sales with respect to rural income. Henderson found that elasticities varied by type of retail business, source of income, and size of community. Henderson concluded that alternative rural development strategies which change the various sources of income to rural communities will yield different retail sales distributions.

Yanagida et al. developed an analytical framework for explaining both cross-sectional and intertemporal variations in pull factors for county retail sales in Nebraska. They found that lower retail sales leakages may be attributed to counties which are situated farther from trade centers, have larger federally adjusted gross incomes and experienced relatively lower population

decreases. Specifically, for agricultural dependent Nebraska counties, the smaller the population of the largest town, the more significant the sales leakage.

Darling and Tubene investigated retail sector activity for 87 rural Kansas cities. Regression analysis indicated that city population alone explained significant variation in taxable retail sales. Kansas cities with population of 5,000 or greater consistently showed a net inflow of retail trade as measured by city pull factors.

Yanagida et al. and Darling and Tubene employed ordinary least square procedures to investigate how changes in exogenous variables influence pull factor values. However, when rural retail extension or outreach programs are developed or when local economic development practitioners target retail sector development, the pull factor threshold value of one is of importance. Retail sectors with pull factors greater than one means the local retail sector is not only meeting local consumer demands, but is also capturing consumer demand outside its borders. Therefore, statistical procedures which could yield information pertaining to exogenous factors which enhance capture not only of local consumers but of consumers outside a county's boundaries would be of interest to local economic development practitioners as well as rural retail extension and outreach personnel. Statistical results of the following would enhance on-going and future rural retail extension and outreach programs and program development.

In order to estimate impacts of exogenous factors on the ability of a given community's retail sector category in meeting local demands and capturing outside customers, censored regression procedures are employed. If a censored analysis is used, Amemiya among others have noted that the use of an ordinary least squares regression for censored data results in estimates that are inconsistent.

The statistical procedure used to correct for censored data estimation problem is the Tobit model. According to Peddle, the Tobit procedure recognizes the special nature of threshold values of independent variables and makes use of the information contained in counties and retail sector categories which are less than one. The Tobit procedure recognizes all pull factors less than one as zero and those equal to or greater than one as their calculated value. The Tobit model analyzes first the difference between zero and non-zero values then differentiating on the basis of explanatory variables, between varying pull factor values greater than one.

## Model Specifications

From the 1992 Census of Retail Trade (1994), county and state sales for eight retail sectors were derived for estimation of county trade area capture and pull factors. The pull factor for each of these eight retail sectors in a given county is a relative measure of trade activity for these retail sectors. The extent of retail sales for each of the eight retail sectors is a function of both market demand and supply for the eight retail sectors. Tobit regression procedures were employed to derive the influence of exogenous factors on retail pull factor values of one or higher. This threshold value signifies that the local retail sector is meeting demands not only of local consumers but also of those outside the county boundaries. This study differs from most market threshold or trade activity studies because the unit of observation is the county as opposed to town or city. Therefore, it is anticipated that the trade area activity calculations will not be directly comparable to estimates at the town or city level.

The Tobit equation combining both supply and demand for the eight retail sectors is given as:

(4) PF = f (PCI, AGE (18-64), AGE (65+), LARGTOWN, DMA, RETOUT, DUMMY)

Where PF is the pull factor value for a given retail sector of nonmetropolitan Great Basin county; PCI is county per capita income; AGE (18-64) is percent of each county's population between the ages of 18 and 64 relative to the state; AGE (65+) is percent of each county's population 65 years and older relative to the state's value; LARGTOWN is population of largest town in the county; DMA is distance to the nearest SMSA from the county seat of the non-metropolitan county; RETOUT is the number of retail outlets in a given non-metropolitan county; and DUMMY is a dummy variable where one is for counties adjacent to metropolitan counties and zero otherwise.

Per capita income, population of largest town in a county, distance to nearest SMSA and number of retailers in the county were transformed into log values. The dummy variable was employed to capture the impact of nearness to a metropolitan county. Maximum likelihood estimations through the LIMDEP software program (Greene) were employed in order to derive the most consistent and efficient estimators.

In addition, Tobit coefficients can provide economic and policy insights through procedures outlined by McDonald and Moffit (1980). The McDonald-Moffit technique calculates a fraction by which the Tobit coefficients may be decomposed into two effects. Part one of the

decomposition represents the effect of a change in an exogenous factor on the probability of the dependent variable being above the limit (i.e., a retail sector's pull factor is above one). The second part is the effect of a change in exogenous variables on the dependent variable assuming the dependent variable is already above the limit (i.e., a retail sector's pull factor is greater than one). McDonald-Moffit argue that the $\beta_1$ coefficients must be adjusted by the second fraction to obtain regression effects for observations above the limit. Results of both parts of the McDonald-Moffit procedures would yield information to extension or outreach personnel in developing retail sector education programs. As for local economic development professionals, results of the McDonald-Moffit analysis would provide information to either strengthen a local retail sector economy or to maintain viability of an already successful local retail sector.

## RESULTS

Table 1 shows statistics for variables employed in this analysis. For average pull factor, the averages ranged from 0.3709 for furniture and home furnishings to 1.0591 for food stores. As for maximum pull factor values, general merchandising had the highest pull factor of 6.202 followed by apparel and accessory stores with 5.274. As for percentage of counties with pull factors greater than one, apparel and accessory stores; furniture and home furnishing stores; and miscellaneous retail stores had only 10.25 percent of total Great Basin counties. Food stores had the largest number of counties (41 percent) with pull factors greater than one.

An interesting aspect of this analysis was to examine the implication of predicting retail potentials when pull factors are censored at zero or one. If a local economic development practitioner or extension/outreach personnel is only interested if a retail sector category exists within a given county, pull factors censored at zero would be adequate. However, if the local economic development or extension/outreach person is interested in estimating the local trade sector's ability to capture trade outside of its boundaries, then pull factors censored at one would be of importance. Given the shift in local government revenue sources from property taxes to sales taxes, capturing local and outside taxable sales has become an area of interest for many local government officials.

Table 2 shows the conditional expectations for each retail sector taken independently of other sectors and results are averaged over the entire sample. For example, the expected values for the Building Materials and Garden Supply Sector and the General Merchandising Sector for

threshold value censored at one are 1.1534 and 1.2369, respectively. While expected values for the same sectors censored at zero are 0.7827 and 0.7689, respectively. Therefore the expected pull factor values for the Building Materials and Garden Supply Stores Sector and the General Merchandising Sector are approximately 47 percent and 61 percent greater, respectively, if it is known that the county's selected retail category is capturing sales outside of its boundaries.

Comparing these expected pull factor values, it becomes evident why rural economic development practitioners and extension/outreach personnel become very interested in capturing local and external retail trade. Not only are the expected pull factors for sectors with a pull factor greater than one larger but these rural counties and communities on average capture higher taxable sales for local government revenues. Therefore extension and outreach programs which provide information to rural decision makers as to maintaining and expanding retail trade capture would be of interest.

McDonald and Moffit have shown that the Tobit coefficients can provide additional information with both economic and policy implications. The McDonald-Moffit technique estimates the two effects of decomposition of Tobit results. First, decomposition represents the effect of a change in an exogenous variable on the probability that the dependent variable being above the limit (i.e. a retail sector with a pull factor equal to one). The second decomposition shows the effect of a change in the exogenous variable on the dependent variable assuming the dependent variable is already above the limit (i.e., sectoral pull factor is greater than one). Coefficients of the first decomposition provide information to extension/outreach personnel as to how changes in exogenous variables would increase the probability of a local retail sector meeting the demands of the local populace. While coefficients of the second decomposition provide information to extension/outreach personnel as to how a county which has a pull factor greater than one or is capturing trade outside its boundaries can maintain and expand its retail capture.

Coefficients shown in Table 3 represent the relationship between a change in county characteristics and a change in the expected pull factor for a county capturing trade outside of its boundaries. The amount of adjustment depends upon the proportions of the sample that is not at the limits, with a higher proportion resulting in a smaller reduction of the coefficient. In this study, the proportion of the pull factor that is not at the limit ranges from 10.25% for the Apparel

and Accessory Store, the Furniture and Home Furnishing Sector, and the Miscellaneous Retail Sector to 41% of counties for the Food Stores Sector.

The resulting coefficients from applying the McDonald-Moffit procedures are shown in Table 3. Evaluated at their sample means, $\frac{\partial E(y_i | y_i > 1)}{\partial X_j}$, the coefficients for each retail sector are the relationship between a change in the independent variable and the expected pull factor for a given sector which has a pull factor greater than one. In comparing coefficients in Tables 2 and 4, the adjusted coefficients are less closely related to changes in county characteristics than indicated by the Tobit results. Specifically, adjusted coefficients of SIC 53 or the General Merchandising Sector are about one-tenth the magnitude of the aggregate Tobit estimates and for SIC 56 or the Apparel and Accessory Stores Sector the adjusted coefficients are about one-fifth of the original estimates. These comparisions indicate that the selected county characteristics were better at differentiating between counties with a retail sector pull factor greater than or equal to one than predicting pull factor value differences for county with outside retail trade capture. An alternative analysis would be that changes in selected county characteristics have a much larger impact on the probability of county's retail sector having a pull factor greater than or equal to one given the county is currently not capturing local trade than on the possibility of increased trade capture for a county's retail sector whose pull factor is already greater than one.

## CONCLUSIONS

This paper investigated the influence of exogenous factors on pull factor estimates below and above the threshold value. The threshold for pull factors is one meaning that the local retail sector is capturing retail trade not only in the local community but outside its boundaries. Using Tobit procedures, significant exogenous factors were found. An interesting finding is the impact of number of retail trade stores. With a larger number of retail stores, economies of scope are realized by the rural customer which yields higher pull factors. Also, the influences of exogenous factors on different retail sector categories may have different impacts which should be included in an extension or outreach retail sector program.

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**Table 1. Variable Definitions and Statistics, Great Basin Area, 1992.**

| Variable Definitions | Mean | Standard Deviation | Minimum | Maximum | Percent with Pull Factor Greater than One |
|---|---|---|---|---|---|
| Y1: Building Gardening Merchandise | 0.78450 | 0.58748 | 0.000 | 2.119 | 33.33% |
| Y2: General Merchandise | 0.69141 | 1.0234 | 0.000 | 6.202 | 20.50% |
| Y3: Food Stores | 1.0591 | .080482 | 0.000 | 4.294 | 41.00% |
| Y4: Automobile Dealers and Gasoline Stations | 0.85249 | 0.41675 | 0.000 | 1.772 | 30.76% |
| Y5: Apparel and Accessory Stores | 0.44354 | 0.89299 | 0.000 | 5.274 | 10.25% |
| Y6: Furniture and Home Furnishings | 0.37093 | 0.39043 | 0.000 | 1.415 | 10.25% |
| Y7: Eating and Drinking Places | 0.84361 | 0.70207 | 0.2054 | 2.931 | 25.60% |
| Y8: Miscellaneous Retail | 0.69797 | 0.47882 | 0.000 | 2.352 | 10.25% |
| Per Capita Income | 16124 | 4274.9 | 9609 | 28890 | N.A. [a] |
| % of Population 18-64 | 0.92883 | 0.066917 | 0.7759 | 1.109 | N.A. [a] |
| % of Population 65+ | 1.2090 | 0.33104 | 0.5755 | 1.874 | N.A. [a] |
| Population of Largest City | 6476.6 | 9943.9 | 207.0 | 43900 | N.A. [a] |
| Mileage | 93.026 | 65.446 | 15.0 | 253.0 | N.A. [a] |
| Number of Retail Outlets | 97.026 | 89.998 | 6.000 | 355 | N.A. [a] |
| Dummy Structure | 0.61538 | 0.49286 | 0.000 | 1.000 | N.A. [a] |

[a] N.A. is not Applicable

**Table 2. Conditional Expectations of Rural Retail Sector Pull Factors, Great Basin Area, 1992.**

| Variables | $E(Y) = E[Y / y > 0]$ | $E(Y) = E[Y / y > 1]$ |
|---|---|---|
| Y1: SIC 52 | 0.7827 | 1.1534 |
| Y2: SIC 53 | 0.7689 | 1.2369 |
| Y3: SIC 54 | 1.0817 | 1.3101 |
| Y4: SIC 55 | 0.8476 | 1.101 |
| Y5: SIC 56 | 0.5326 | 1.1337 |
| Y6: SIC 57 | 0.3701 | 1.0196 |
| Y7: SIC 58 | 0.8788 | 1.2081 |
| Y8: SIC 59 | 0.7012 | 1.0769 |

**Table 3. Adjusted Tobit Estimates for Rural Retail Sectors with Pull Factors Greater than One, Great Basin Area, 1992.**

| | Estimated Parameters | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Exogenous Variables | SIC-52 | SIC-53 | SIC-54 | SIC-55 | SIC-56 | SIC-57 | SIC-58 | SIC-59 |
| Per Capita Income* | 0.481657 | 0.017787 | 0.010091 | -0.15153 | 1.91504 | -0.12835 | -0.13821 | 0.008045 |
| % of Population Category 18-64 | 2.552687 | -0.34801 | 5.765514 | 0.570898 | -9.0255 | 3.9256 | 2.313258 | 0.55142 |
| % of Population Category 65+ | 0.321979 | -0.00581 | 0.337289 | 0.553997 | 2.082755 | 1.331693 | 0.536664 | 0.016325 |
| Population of Largest City* | -0.03476 | 0.016896 | 0.16809 | 0.10612 | -2.56569 | -0.17816 | -0.11128 | 0.001115 |
| Mileage* | 0.204885 | 0.020537 | 0.087698 | -0.02855 | 2.738955 | -0.10915 | 0.021108 | 0.004202 |
| Number of Retail Outlets* | 0.353259 | -0.00691 | -0.2758 | 0.012493 | 0.5159683 | 0.306237 | 0.050742 | 0.005241 |
| Dummy Variable | -0.00349 | 0.017263 | -0.05768 | 0.164483 | -1.09889 | 0.529931 | 0.210628 | -0.01633 |

Note: (*) denotes variables that are in logs. SIC 52 is Building Materials and Garden Supply Stores; SIC 53 is General Merchandising Stores; SIC 54 is Food Stores; SIC 55 is Automobile Dealers and Gasoline Service Stations; SIC 56 is Apparel and Accessory Stores; SIC 57 is Furniture and Home Furnishing Stores; SIC 58 is Eating and Drinking Places; and SIC 59 is Miscellaneous Retail Establishments.