

## **Retail and Service Demand Thresholds for Wisconsin**

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How does our local economy compare to other similar places is frequently raised in the form of "We'd like to have a "x" store?" Threshold analysis is one tool that gives a preliminary estimate of what may be possible. The authors note it is a broad brush approach that eliminates several alternatives, but does not insure that the remaining options are truly viable options. That requires further detailed analysis.

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# **Retail and Service Demand Thresholds for Wisconsin**

Steven C. Deller and William F. Ryan

## Abstract

Understanding the ability of a local market to support a particular type of establishment is a prerequisite to designing effective development strategies. While several factors contribute to the vitality of the local retail market, the most fundamental factor is the relative size of the market in terms of potential customers. Specifically, given a retail market of a particular population size the natural question is what types of establishments can it support. In this paper we review the underlying economic theory and empirical approaches used to lend insight into this question. We also provide the reader with an updated set of empirical estimates for Wisconsin that can be used by local economic development practitioners and entrepreneurs.

## Introduction

In recent years, economists, sociologists, political scientists and planners have conducted applied research and extension programs throughout the nation directed toward helping local economic development practitioners develop a stronger set of self-development strategies (Daniels, 1989). One of the more popular strategies suggested and adopted focuses on the promotion and retention of retail and service businesses. In several states, extension programs are established which help communities better understand their retail and service markets. Prepared with a fundamental understanding of their local market, community leaders can better implement effective development policies while entrepreneurs can make more informed business development decisions.

A common set of tools used to assess local retail and service markets is referred to as Trade Area Analysis (Stone and McConnon, 1980 and 1984; Shaffer, 1989). The power of the Trade Area Analysis method is its ability to estimate market population and market surplus/leakage, by sector, in a dynamic framework with computational simplicity. Details of the method is available from a variety of sources such as Hustedde, et al. (1984), Harris et al. (1990) and Deller et al. (1991) and the reader is referred to those references.

Another market analysis tool, though less commonly used, is demand threshold analysis. The demand threshold is defined as the minimum market size required to support a particular type of retail or service business and still yield an acceptable rate of return for the business owner (Berry and Garrison, 1958a and 1958b; Parr and Denike, 1970; Salyards and Leitner, 1981; King, 1984; Schular and Leistritz, 1991; and Deller and Harris, 1993). The concept is based on the

internal economy of the firm and the characteristics of consumer demand. Demand thresholds are usually measured in terms of the population required to support one or more firms of a certain type.

For example, demand thresholds give insight into the size of the market, as measured by population, required to support a barber shop, a used car dealership, or a hardware store. Given the fundamental differences across these types of establishment, one would expect the required market population to vary and demand threshold analysis lends insight into these differences by store type.

Empirical estimates of market thresholds are numerous (see for example, Berry and Garrison, 1958a and 1958b; Foust and Pickett, 1974; Murray and Harris, 1978; Salyards and Leitner, 1981; and Schular and Leistritz, 1991). Methods for estimation of these threshold range from the simplistic (e.g., McConnon, 1989) to the complex (e.g., Deller and Harris, 1993). The intent of this applied research project is to provide the reader with an overview of the underlying economic theory and empirical approaches used in estimating market thresholds. We also provide the reader with an updated set of empirical estimates for Wisconsin. We also review a number of ways in which market threshold analysis can be used in analyzing the strengths and weaknesses of the local market as well as suggest ways in which individual entrepreneurs can use threshold estimates to make more informed business decisions.

#### A Review of Market Threshold Analysis

Threshold analysis is rooted in central place theory (CPT) in two ways. First, CPT predicts that there is a direct and positive relationship between the population of the central place and the number of functions provided in that central place. Here, number of functions can be proxied by the number of retail and service firms within the central place. In other words, as the population of the central place increases, so does the number of firms within the place.

Second, and perhaps more fundamental, CPT predicts that goods will have a specific limitation to the size of their market in a spatial sense. The spatial radius of this market is termed the *range* of the good. The larger the range of the good, the larger the spatial size of the market supporting that good. The key determinants of a good's range is the demand for the good and the cost of supplying the good. Specifically, the interaction of the market demand (i.e., the Lösch demand cone which is a spatial representation of a traditional demand curve) and the firm's cost structure determines the range or market size of the good. Given that the cost structure facing the firm is determined exogenously from CPT (i.e., factor prices and the good's production technology) the primary determinant of a good's range, or spatial market, will be the characteristics of the good's aggregate demand structure (i.e., the Lösch demand cone). A spatial equilibrium is achieved when the dollar volume under the demand structure is just sufficient to cover operating costs and allow an acceptable rate of return.

Threshold analysis attempts to proxy the demand structure for a good or service by relating population to the number of functions (i.e., number of businesses) within a particular central place. Berry and Garrison (1958a and 1958b) suggested that this relationship can be expressed as:

$$P = \alpha(B)^\beta$$

where P is the place's population, B is the number of businesses of a particular type within the place, and  $\alpha$  and  $\beta$  are parameters to be estimated. The nonlinear specification follows from CPT. In practice, the estimated equation is commonly a double-log model in which population increases at an exponentially faster rate than the number of businesses. Given estimates of  $\alpha$  and  $\beta$ , one may substitute a numerical value for B and solve for the population required to support the number of firms selected (e.g., B=1 results in an estimate of the population required to support one establishment of a particular type). Hence, a proxy measure for the size of the supporting demand structure for the good is provided.

For example, using data from Wisconsin Foust and Pickett (1974) found that the estimated parameters are  $\alpha = .913$  and  $\beta = .326$  for barber shops. Substituting these values into the above equation we can calculate the population required to support one (B=1), two (B=2), or ten (B=10) barber shops. Performing the calculation results in 632 persons required to support one barber shop, 5,297 required for two and 18,372 persons required to support three barber shops.

Two reasons have been advanced for the non-linear pattern observed in the results of Foust and Pickett and others (Shaffer, 1989). First, the threshold estimate represents the minimum population required to support a particular establishment, clearly the establishment can support a greater number of customers. Second, indivisibility of the investment in any type of establishment prevents marginal adjustment until some higher service level threshold is met and a second firm appears. In other words, lumpiness in investments requires exponential growth in market size.

#### Applications in Educational Programming

Estimates of market thresholds have been used in extension educational programming in two distinct ways. First, threshold estimates have been used in strategic planning exercises where the focus of the effort is in the area of commercial center revitalization or retail and service development in general. Often the use of alternative analytical techniques, such as pull factors, location quotients, population-employment ratios, or resident surveys, will identify retail and service businesses that warrant further investigation for development potential. The introduction of population threshold estimates sheds additional light on the development potential.

Consider, for example, a community of 5,000 persons in which a weakness (i.e., development potential) has been identified in the SIC code sector "general merchandise." Discussions amongst local residents reveals that access to a mass discount merchandiser, such as Wal-Mart or K-Mart would have a positive benefit on the community. The natural next question is whether a town of 5,000 persons can support such an establishment. The tools of market threshold analysis can

shed light on this fundamental question. In other words, market threshold analysis is an additional tool which can be used to help "rule-out" or "rule-in" potential businesses for a commercial center.

The second use of market threshold analysis is in the area of business planning. Increasingly potential entrepreneurs are required by financial organizations to develop detailed business plans. While the cost side of the business plan is often easier for the entrepreneur to develop and commit to writing, the potential revenue side of the business plan is often guess-work at best. Here, market threshold estimates, in conjuncture with the tools of Trade Area Analysis and a host of other market analysis tools, can begin to help the entrepreneur think through the market potential of his or her business idea. In short, market threshold analysis helps frame the basic marketing question: can a community of a given size support a particular type of establishment?

#### Estimates for Wisconsin

As previously noted there are numerous ways in which to estimate the theoretical relationship between number of establishments and population threshold outlined above. For illustrative purposes we have elected to use the simplest approach as applied by McConnon (1989). Using data from the 1992 *County Business Patterns* for the state of Wisconsin we have calculated an *average threshold* by simply dividing the state's population by the number of establishments in the state for a given SIC grouping. The results of this exercise is reported in Tables 1 and 2. Here we provide an average measure of the population base or trade area population supporting these types of establishments in the state of Wisconsin.

The analysis has several limitations and should be viewed as preliminary in nature. First, the *County Business Patterns*, while one of the most widely referenced resources used in analyzing local economies, is limited, particularly in analyzing smaller, more rural markets.

- ✓ The universe of businesses is only for those with one or more employees. Immediately, small self-proprietary establishments, such as a "mom n' pop" store with no formally paid employees are not included. As a result of this omission from the database our estimated thresholds are high (i.e., the denominator in our calculation is biased downward).
- ✓ The universe of businesses reflect activity in the month of March. Hence, many seasonal dependent businesses, such as summer tourism sensitive businesses, are not captured in our calculation: hence again our estimated thresholds may appear high.
- ✓ Business SIC coding used in *County Business Patterns* is not precise. For example, a full-service hotel with a restaurant may be coded as a hotel, but not as a restaurant. A mass merchandiser like Wal-Mart may be coded as a General Merchandise Store, hiding the fact that it competes with shoe stores, apparel stores, pharmacies and other retail categories that have their own SIC codes.

A second set of limitations to the analysis reported here is reflective of the simple averaging method adopted for estimating the Wisconsin thresholds.

- ✓ By computing a simple average the nonlinearities dictated by central place theory is lost.
- ✓ Thresholds as presented here ignore the fact that businesses of the same SIC code are of different sizes. A community may be able to support three small hardware stores, but only one large hardware store. Accordingly, this technique could be improved if "number of businesses" were replaced with more descriptive information such as number (and competitive quality) of square feet of retail space, restaurant seats, barber chairs, etc.

- ✓ Location specific characteristics which influence market potential, such as income, average age and life-style preferences within the community, are ignored. Accordingly, it is often useful to calculate comparative thresholds for specific, comparable communities with similar economic and demographic characteristics
- ✓ Finally, threshold levels do not guarantee that a business will be profitable. They are simply a reflection of the number of businesses that exist and ignore over capacity within a particular business category.

Regardless of these severe limitations, the estimated threshold reported in Tables 1 and 2 represent a first step in providing current market threshold estimates for the state of Wisconsin.

Table 1 provides demand thresholds at the two, three and four digit SIC levels. The two digit grouping represents the greatest level of aggregation and the least amount of detail. The four digit grouping provides more descriptive business categories, but may be less reliable given the SIC coding limitation discussed earlier.

In reviewing the analysis reported in Table 1 it becomes readily clear that the number of people per store varies considerably by type of establishment. For example, it takes a much larger population to support a general merchandise store (6,859 persons) than an eating and drinking establishment (460 persons). This comparison makes intuitive sense. General merchandise stores, such as Wal-Mart, K-Mart or Shopko, tend not to locate in communities with less than 5,000 persons while almost every hamlet in Wisconsin has a diner or tavern.

Care must be taken in interpreting these state-wide averages. For example, the analysis reported in Table 1 seems to indicate that most hamlets should be able to support some type of health care service establishment which appears to have a market threshold of only 637 persons. When one considers this particular industry, however, one must recognize that health care establishments tend to "cluster" together in one geographic location. In this case, the city of Madison is a good example where the University Hospitals, Meriter and St. Marys tend to foster "agglomeration" in service delivery. Here agglomeration economies refers to the benefits that accrue when firms locate in proximity to one another. New car dealerships tend to cluster together as do shoe stores within shopping malls. The simple state-wide average method adopted for this study ignores the forces of agglomeration economies.

The revealed differences in market population threshold is a reflection of the demand for the particular type of establishment as well as the cost structure of operating the establishment. Generally, establishments which face higher levels of demand and lower overall operating costs will have a lower market threshold than firms facing lower demand and/or higher operating costs. These differences can be better understood by examining market thresholds at the two, three and four digit SIC levels.

Take, as an example, the threshold population required to support a general grocery store (SIC 5410), about 2,570 people. Whereas, a more specialized type of food store, such as candy store (SIC 5440), requires a much larger market population, about 35,000 persons. This large difference in threshold estimates reflects not only problems outlined earlier with the SIC coding scheme, but also fundamental differences in the types of products sold. People generally make frequent trips to grocery stores buying a variety of items at any given time, including candy. The number of shopping trips to

speciality stores, such as a candy store, tends to be much less frequent. In our example here, a special trip to a speciality candy store may be limited to certain times of the year such as selected holidays.

As we move to even more specialized types of businesses (four digit level), the increase in the required market population becomes even more pronounced. Generally, these more specialized types of establishments will locate in places higher on the hierarchy of central places within a region, such as Madison, Eau Claire and Milwaukee and service a much larger geographic area. In these "central" location, the market demand is sufficient to cover operating costs and earn the owner of the business a fair rate of return on their investment.

In addition to the level of establishment specialization, the type of the good or service being offered for sale also plays an important role in market potential. As alluded to with the candy store example, the frequency of purchase is a driving factor in establishment location decisions. A helpful way to view this problem is in the convenience of the good or service. In short, consumers tend not to shop around for convenience items such as food stuff and gasoline service stations. The frequency of the purchase makes price comparative shopping prohibitatively costly. Whereas non-convenience goods, such as jewelry, automobiles, boats, etc., people will tend to shop around comparing products and prices. Businesses offering non-convenience goods and services will require larger markets and tend to cluster together. The clustering of new car dealerships is evidence of these economic forces. When considering these various forces, a clearer picture of the logic behind retail and service firm location becomes apparent.

The final set of analysis presented for consideration (Table 2), groups all SIC industries and sorts by market threshold from the smallest to the largest. Care must be taken in interpreting the rankings in Table 2 due to the lumping of two, three and four digit SIC codes. By definition, the rankings in Table 2 are subject due to double counting as one moves from four, to three, to two digit aggregations.

#### Application of the Results

To highlight some of the applications that arise from the use of demand threshold analysis, three market areas of varying size are examined. These market areas, Ladysmith (Rusk County), Menomonie (Dunn County) and Wausau (Marathon County), represent varying sizes and geographic locations (Table 3).

For each market area, the "actual" number of restaurants, food stores, furniture stores, hardware stores and florists were tabulated using Yellow Pages listings. Market area population was then divided by the demand threshold figure for each of the selected business types. The resulting figures represent "potential" numbers of businesses that the market area could support using this technique. Actual and potential businesses in the three market areas for each of the five business categories were then compared and reported in Table 3. By examining the difference between the number of businesses that actually exist and the number that could be supported by the market using demand threshold analysis lends insight into market strengths and weaknesses.

As an example, examine the actual number of restaurants in Ladysmith (24) and the potential number (19). Based on this analysis, the variety of restaurants in Ladysmith appears to be a strength for the community. Alternatively, are there simply too many restaurants in the Ladysmith market area? Conversely, for Menomonie, there are currently 30 restaurants in operation with the potential for 46, given the market threshold analysis. Does this suggest that there is opportunity for food service expansion in Menomonie?

Two important issues arise from the analysis presented in Table 3. First, what is the relevant market population upon which to base the market potential computations? Is it the city boundaries of Ladysmith or Menomonie or is it some larger area such as the county? For illustrative purposes, we have elected to use the county population. One can rightly claim that such a selection is *ad hoc* and over simplifies the notion of a spatial market area. Ladysmith, for example, draws people from the southeast corner of Price County and the northeast corner of Taylor County. Care must be taken in using market threshold estimates in computing market potential.

Perhaps an alternative way to phrase the question is: to operate this establishment in this location, I require so many customers, how large, in a geographic sense, must my market be in order to ensure I have a sufficient number of customers? If the market threshold is high, and the population density of the region is low, people must be willing to travel greater distances to purchase my goods or services. Is this a reasonable distance and what is my competition within that distance?

Second, notice that the market potential appears to be much greater for the largest city reported in Table 3. In this example, there appears to be significant market potential for development in Wausau. Note, however, that the economic theory upon which market threshold analysis is based suggests that there is a nonlinear relationship between number of establishments and market population. The simple state-wide averages reported in Tables 1 and 2 and used in Table 3, ignore this important consideration. Again, these updated threshold estimates for Wisconsin must be viewed as preliminary and used in the most elementary ways.

Certainly, there are other market factors that need to be considered when answering these questions. The reader is directed back to the limitations of threshold analysis described earlier. In any case, demand threshold provides one measure of business development opportunities in a community and can be used as one indicator of market potential.

#### Using the Threshold Data

The state-wide "average thresholds" presented in this report provide a preliminary guideline in understanding how well a market area can support a particular type of business. As the technique has various limitations as identified earlier, it should be used with caution.

One way to address the limitations and improve the reliability of this technique is to adjust the threshold based on the actual number of like businesses in two or three comparable market areas. An "adjusted threshold" can be estimated based on the state-wide average and the threshold levels calculated for these comparable market areas.

The worksheet on the following page can be used to estimate the threshold for a particular type of business and to determine how many businesses can be supported in a given market area using this estimate. Instructions are as follows:

1. Record the "Business Category" and corresponding "SIC" code. To the extent possible, choose an SIC category that clearly describes the subject business. However, recognize that threshold levels for precise four-digit SIC categories may not include like businesses that are captured under another SIC code.
2. Identify and record the names of three comparable market areas for which location specific threshold levels can be calculated. These market areas should have similar economic and demographic characteristics (including population). For retail businesses, the selected market areas should have similar mass-merchandise impacts so that an "apples-to-apples" comparison can be made.
3. For each of the three comparable market areas, record population and number of businesses within this SIC category. The number of businesses can be determined by studying the Yellow Pages, listings from the Chamber of Commerce, and discussions with operators of like businesses.
4. For each of the three comparable market areas, calculate and record a threshold level by dividing "Market Area Population" by "Number of Businesses". Also record the corresponding "Statewide" threshold level from Table 1.
5. To determine the number of like businesses supported in the subject market area, record the "Market Area Population" and the "Threshold Level" selected. The threshold level you use should be within the range calculated for the comparable market areas and for the entire state. Calculate and record the "Number of Businesses Supported" by dividing "Market Area Population" by the "Threshold Selected."

Business Category: \_\_\_\_\_ SIC Code: \_\_\_\_\_

Threshold Estimates:

	<u>Statewide</u>	<u>Market Area 1</u>	<u>Market Area 2</u>	<u>Market Area 3</u>	<u>Adjusted Threshold</u>
Population	_____	_____	_____	_____	
÷ Number of Businesses	_____	_____	_____	_____	
= Threshold	_____	_____	_____	_____	_____

Number of Businesses Supported:

Population (subject area) \_\_\_\_\_  
 x Threshold (adjusted) \_\_\_\_\_  
 = Number of Businesses \_\_\_\_\_

### Summary

Downtown revitalization and retail/service development remains a focal point of many community development efforts. While many analytical tools have been advanced for identifying market strengths and weakness, few of these tools address the ability of a local market to support a particular type of establishment. The intent of this applied research project is to provide a first step in deriving a set of market population threshold estimates for the state of Wisconsin. Using data from the *County Business Patterns* for 1992 and the state's population a set of simple average threshold estimates for Wisconsin is reported. The limitation of a simple state-wide average of obvious and current research efforts are underway to refine the estimates provided here.

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