THE ECONOMIC VALUE OF ON-PREMISE SIGNAGE

To help promote understanding of the value of signage to businesses—and by extension, to communities—The Signage Foundation, Inc., is re-publishing this scientific study conducted by the University of San Diego in 1997. This study represents the first scientific research based on thorough, state-of-the-art statistical analysis, which provides clear evidence and conclusions that on-premise signage does, indeed, have a positive and significant impact on businesses and local governments.

sfi signage foundation, inc.

About The Signage Foundation, Inc.

The Signage Foundation, Inc., is a not-for-profit, non-partisan organization dedicated to fulfilling the educational, research, and philanthropic purposes of on-premise signage. SFI was established in 2002 as a 501(c) (3) public foundation through its supporting organizational alignment with the International Sign Association. The Foundation is governed by a board of directors representing the diversity and professional depth within the large community of individuals that believe in the social and economic value of on-premise signage.

The Signage Foundation, Inc. affirms signage as a fundamental component of today's communication system and as a necessity for the development of a visually pleasing, economically healthy, and diverse community. The Signage Foundation promotes intelligent and productive use of on-premise signage and storefronts that benefits every sector of the U.S. economy.

The Signage Foundation, Inc., is committed to expanding the knowledge base on the use and benefits of signage products through peer-reviewed research to facilitate the operation within the marketplace by manufacturers, suppliers, and individuals in their efforts to design, build, and sell innovative products. Each fall, The Signage Foundation hosts the National Signage Research and Education Conference in conjunction with the University of Cincinnati's Colleges of Design, Architecture, Art, and Planning, and Business.

While SFI commissions original research and publishes the results as original treatises, in the interest of promoting signage information to a broader audience, it also condenses and republishes (with permission) existing articles and studies.

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Overview

Signs are one of the most visible means of communication for a business. They help brand the business, provide information about products and services, and point customers to the exact location. Once inside the business, signs can serve as "silent salespersons," dramatically improving sales of promotional items. In brief, effective signage translates to customers, providing a means of communicating that is significantly more cost-effective than other types of advertising.

Yet signs also can be controversial. Sign code officials might place onerous restrictions on signs in an attempt to create "ideal" community aesthetics. Restrictions that impede businesses can have the opposite effect, leading to a difficult business environment. A robust business community provides the tax base that leads to better roads, schools, and parks.

It is this tightrope that communities must walk when attempting to regulate signage. Federal regulations do protect some forms of communications. (See The Signage Foundation, Inc., publication, "Signs and Federal Laws of Protection," to learn more.)

On-premise signage is a significant component in a successful retail endeavor.

This study, conducted at the University of San Diego in 1997, was the first to use statistical analysis to detail the positive impact that on-premise signage has on businesses. This groundbreaking study was followed in 2012 with additional research conducted at the University of Cincinnati. That report, also titled "The Economic Value of On-Premise Signage," heavily references the 1997 work, which has led The Signage Foundation to republish the original study. The 2012 report, along with additional SFI-sponsored research, is available at the SFI website, www.thesignagefoundation.org.

This 1997 study began at the behest of the California Sign Association (formerly the California Electric Sign Association), which founded the Sign Guidelines Committee. The research was supported and funded by the California Sign Association, the International Sign Association, the Sign Users Council of California, the Business Identity Council of America, and the University of San Diego School of Business Administration.

Executive Summary

By Sandy Smith
For The Signage Foundation, Inc.

Signs have a significant and measurable impact on business success. This has long been assumed to be true based on anecdotal evidence and business testimonials. For the first time, however, this assumption has been proven in a thorough analysis conducted at the University of San Diego. This rigorous academic research used data from three case studies—a large fast food chain, a national home décor retailer, and auto dealers in a major metropolitan city—to convey the various factors that impact a business success.

Signs were shown to be an important method of communicating goods and services to potential customers, and of driving sales results. Sign changes, such as the addition of signs or improvement in design, were shown to further enhance sales.

Signs have been proven to drive sales results. Adding signs or improving design further enhance sales.

In the case of a large fast-food chain, researchers studied 162 locations in Southern California, including annual sales and demographic data. They found a strong correlation between sales increases and the number of signs. Quantitative conclusions included: One additional sign yielded sales increases of 4.75 percent, an impact greater than the increases brought on by a larger building, longer hours, or longevity at the location.

The addition of a sign also brought a higher number of transactions. When extrapolated into sales figures, researchers determined that the addition of one sign at every fast-food outlet in Los Angeles would raise revenues by $132 million, adding $10 million to the sales tax base.

The type of sign also had an impact on the number of transactions, yielding:

- 15.6 percent increase for a 144-square-foot pole sign
- 9.3 percent increase for a 225-square-foot monument sign
- 2.5 percent for a 6-square-foot directory sign
- 1.3 percent for a 36-square-foot building sign

The analysis of the home décor retailer used sales data from Pier 1 Imports. Sales revenues from a seven-year period were studied for 100 locations that had modified, added, or deleted signage. To be included in the study, locations had to provide at least one year's sales data before and after the sign change, and not be subject to other influences, such as building remodeling, shopping center remodeling, etc.

The addition of a new building sign, pole sign, or freestanding multi-tenant sign was found to add between 5 and 15 percent to a site's sales revenues. Some of the greatest increases came when the retailer added a new sign to a side of the building that previously had no signage. Lower-performing stores benefited most from these additions.

Updating or improving signs also yielded significant sales improvements. Combining a building sign modification with two additional minor changes resulted in a 16 percent weekly sales increase. Adding a small directional sign in a shopping center added 10 percent to the weekly sales totals, while the improvement to a multi-tenant sign in a shopping plaza brought increases of 1 percent for one sign and 3 percent for two or more signs.

Despite the positive impact on business—and the related influence on sales tax collections—signs can be heavily regulated. However, this can impact the success of a business and lead to frustration for potential customers.

A consumer survey conducted by Dr. Jacqueline Brown questioned customers of eight San Diego auto dealers soon after the city had limited the size and placement of business signs. The study found that the vast majority of patrons at the dealership did not believe the signs should be reduced in size.[1]

The survey also revealed the importance of signage both as advertising and as a locator. In all, 68 percent of those surveyed responded that the sign had been an important factor in finding the dealer's location. Eighteen percent said they were aware of the service department because of the dealer's sign.

One of the auto dealers had been forced to remove a sign to become compliant with the new code. Approximately 21 percent of that dealer's customers reported that the establishment was hard to locate because it had no sign.

Codes that overly restrict signs can negatively affect businesses and frustrate the customers attempting to locate them.

More than three-fourths of respondents believed auto dealers should be able to install signs of the same size as other businesses in the area; 22 percent believed dealers should be allowed larger signs than other businesses.

This 1997 research and its 2012 follow-up study prove that signs remain an important avenue of communication between businesses and potential clientele. The end result is a successful business serving the needs of its customers and the community.

[1] Brown, Jacqueline J. Mission Valley Automobile Dealers' Marketing Research Project (1988).

Research Study of Signage Performance

The University of San Diego

By

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1997

Summary of the Research Program and Key Findings

On-premise signage must be interpreted as a marketing device, in addition to its role as a communications or identity device. Urban planners and community regulatory agencies should be careful to take into account the possibility that increasingly restrictive on-premise signage policies will have a deleterious effect on retail performance. This, in turn, leads to a deleterious effect on the sales taxes generated by these revenues.

In this research program, we built upon earlier research on signage and anecdotal information to systematically investigate the financial impact of on-premise signage on a store's revenues. Using data from hundreds of sites, representing two major kinds of retailers, we found that on-premise signage has a statistically significant, and financially substantive impact on the revenue of a site.

In our regression analysis of a fast-food chain, we found that measures using two different procedures, multiple regression and Auto Regressive Integrative Moving Averages (ARIMA) time-series analysis, leads us to similar conclusions. On-premise signage is a significant constituent of the factors causing the success of a retail endeavor. Depending on the type of sign addition or modification, we found that a new building sign, a new pole, or a freestanding, multi-tenant sign tends to add 5 percent to 15 percent to a site's sales revenues. In addition, even small directional signs, intended only to help the store-bound shopper find the site, tend to add around 10 percent to a site's revenues. This should not be interpreted as a prescription, that is, merely adding signage for the sake of adding signage will not result in increased sales. However, the research results do suggest that the addition of signage for good reason, such as to advertise the store to passing traffic that did not previously see the site's identity, or to help guide shoppers to a hard-to-get-to site as a prescription does result in substantially increased sales revenues.

A new building sign, a new pole, or a freestanding, multi-tenant sign tends to add 5 percent to 15 percent to a site's sales revenues.

Goal of the Study

The major goal of this study is to develop an understanding of the role of on-premise signage with respect to its economic impact on financial performance by site. From a marketing perspective, the value of on-premise signage is not adequately defined by replacement cost only. In addition to its other roles, on-premise signage is a marketing tool, similar to other forms of advertising. Thus, one of the appropriate ways to assess its value is in terms of the sales revenue that it generates. These generated sales are a function of the present and future effects of signage, thus the value of an on-premise sign can be understood as the net present value of a future stream of revenues generated by its existence.

As with many forms of advertising, it can be difficult to assess the effect of any particular sign, just as it is often difficult to assess the exact effect of any particular advertisement. At any point in time, most firms operating in the retail environment are engaged in the implementation of a complex marketing strategy composed of multiple marketing variables (product characteristics; pricing structure; advertising campaigns; sales force activities; sales promotions, such as couponing and sampling; and distribution strategies) in an uncontrollable environment of competitor actions, customer desires, regulatory agency requirements, stakeholder demands, and so forth.

There is a gap in both the marketing and economics literature regarding the specific impact of on-

premise signage vis-à-vis this complex mix of marketing variables. Our goal in this program is to supplement the anecdotal information regarding the effects of on-premise signage that are otherwise available. For communities with sales taxes, there are specific causal connections linking the impact of signage on retail sales revenues and, thus, the impact of sales revenues on sales-tax revenues.

The Mission Valley Auto Dealers Market Research Project

In 1988, Dr. Jacqueline Brown, then at the University of San Diego, investigated consumer perceptions of on-premise signage at eight large San Diego automobile dealerships.

Although a new city of San Diego ordinance had restricted the size and placement of business establishment signs, this study found that the vast majority of patrons at the dealership did not believe the signs should be reduced in size.[2]

Summary of the Findings

More than 350 customers at eight large San Diego car dealerships completed questionnaires while visiting the dealer for service. Questions concerning on-premise signage were embedded in a larger survey asking patrons about various aspects of their service experience.

Almost 18 percent of the respondents indicated they became aware of the service department by seeing the dealership sign. Thus, the signage becomes one of the most powerful advertising vehicles the dealership has for generating new business. As we would expect, the largest group of respondents (35 percent) said they learned about the service department while purchasing a car. Another 29 percent learned about the dealership through word-of-mouth recommendations; this makes adequate signage important, so the business can be located, in addition to its advertising value. The Yellow Pages accounted for less than 10 percent of awareness creation.

More than 68 percent of the respondents suggested that on-premise signage was important in aiding their location of the dealership. Only 17 percent believed that signs were unimportant. Although most persons (76 percent) believed signs would be fine kept at the same size, 22 percent thought the signs should be even larger. Only 2 percent of the respondents wanted smaller signs at the dealership.

More than 68 percent of those surveyed while receiving service at an auto dealer indicated that on-premise signage had been important in finding the dealership.

One of the dealerships had been recently forced to remove its large sign. Twenty-one percent of the respondents indicated "that now the dealership was hard to find because it 'had no sign' or 'should get its sign fixed.'"[3]

Most of the survey respondents (77 percent) believed there should be equity with respect to the allowed size of the on-premise signage among several different kinds of business establishments,

[2] Brown, Jacqueline J. Mission Valley Automobile Dealers' Marketing Research Project (1988).
[3] Ibid, page 21.

including gas stations, restaurants, and hotels. A significant group (22 percent) indicated that the dealerships should be allowed larger signs, and only 2 percent suggested that these signs should be smaller than other businesses in the area.

Conclusions

There was no evidence from this study that a majority, or that even a significant group of people, want to see on-premise signage removed or reduced in size. This is in spite of the fact that the signs at the automobile dealerships constitute some of the largest examples of on-premise signs in the study area. The results suggest that on-premise signs serve two very important services: they are an important advertising source that generates new and ongoing revenue for firms, and they are an important source of directional information to geographically guide the customer to the sites.

Signs serve two important functions:
**** Advertising that generates new and ongoing revenue for businesses; and***
**** Providing directional information to guide customers to business sites.***

The Case of a Fast-Food Chain

The purpose, in this phase of the research program, is to explore one specific methodological approach for the study of the economic value of on-premise signage on the sales performance of individual retail sites. We intend to extend what is often anecdotal literature with more methodologically sound research and, to that end, provide an interpretation of the technical results that will allow the lay person to ascertain the economic value of on-premise signage. This report describes our first source of data and reports the results of this phase of the study to explain the variation in the firm's sales performance, especially as this performance is impacted by on-premise signage.

In this report, we discuss our study and our analyses of the sales performance for a sample of fast-food restaurant sites owned by a large American corporation. The chief purpose of the study was to determine the effects of on-premise signage on the dollar revenues and the number of transactions for more than 150 individual restaurant sites. We utilized a cross-sectional study (using multiple regression) with a series of variables that we hypothesized to have an impact on sales performance.

Due to the proprietary nature of the study, the results and specific descriptions of some of the predictor variables have been disguised. The results have been transformed from absolute dollar effects to percentage effects. This preserves the magnitude of the effects and protects the confidentiality of the data. The descriptions of some of the predictor variables have been generalized but not to the extent that the models are devoid of meaning. Again, for proprietary reasons, the firm providing the data requested that its identity not be disclosed at this time. The data source firm is a well-known organization primarily involved in the production and delivery of fast-food products.

We developed the multiple regression model to identify the factors that can have a significant impact on the sales performance for a sample of restaurants. While our goal is to understand the basis for annual sales revenues (in dollars), separate examinations were also conducted of the firm's performance in terms of the annual number of transactions and the average dollar amount spent per transaction.

The Sample

The sample was obtained from a large national firm competing in the fast-food industry. As is typical for firms of this nature, they operate thousands of retail stores throughout the United States and abroad. In order to obtain a sample of sites subjected to similar marketing promotions, we chose to collect cross-sectional data from 162 restaurants in a major metropolitan area of southern California. The sample was collected in mid-1995 and the performance figures are from the firm's 1994 fiscal year. Data was developed from company records, city and county traffic engineering offices, and from census data, some of which was updated to the current time frame with additional survey work and/or projections.

Findings

We used regression analysis to identify those variables that have statistically significant effects on sales and then estimated the magnitude of those effects. The equation that is estimated with regression analysis is called the best equation, in that this equation leaves the smallest amount of variation in sales at the 162 restaurant locations unexplained, using a specific set of explaining factors. The interested reader is referred to the Methodology and Technical Results section for in-depth descriptions of the methodology and the statistical findings.

For each additional sign installed at a site, annual sales dollars are expected to increase by 4.75 percent. For a typical store with annual sales revenues of $500,000, this translates to a $23,750 increase per additional sign.

Three basic models were used to empirically test and explain the effects of a variety of marketing variables, including on-premise signage variables, on firm performance:

1. The first model was used to predict annual sales revenue for one fiscal year.
2. The second model was used to predict the number of transactions for the same fiscal year.
3. The third model was used to predict the average dollar amount spent per transaction.

Although our primary focus in this study is to ascertain the effects of on-premise signage, it is necessary for methodological reasons to also include other kinds of variables in our model as well.

Our regression analysis revealed that measures of site performance were significantly affected by the number of signs per site, and the type of signs at a particular site (i.e., site identifier signs, directional signs, menu boards, etc.)

We found that the number of signs at a particular site have a significant positive impact on both the annual sales revenue and the number of annual customer transactions. Other sign and nonsign variables were also found to impact site performance, but at slightly lower levels of statistical significance than

the ones generally employed for market research. These other variables are addressed in more detail in the Technical Results section of the report.

In addition, the physical size of the establishment, the number of hours of operations, and a number of demographic factors also had a significant impact on total sales revenues.

Model 1: Annual Sales Dollars

In Table 1 we see the results for a multiple regression model predicting Annual Sales Dollar revenues at 162 fast food sites.

Model 1 uses actual annual fiscal year sales dollars for each site as the dependent (y) variable, and explains 33.7 percent of the variation in sales. This is very good for this type of model. The coefficients are significant at the 90 percent level of assurance.

Table 1-Model 1: Annual Sales Dollars as Function of On-Premise Signage and Other Marketing Variables

Variable	Variable Description	% Impact on Revenue	$ Impact on Revenue (at a Site with $500,000 in Annual Sales)
Y	Annual Sales Dollars		
x_1	Total Number of all Site Signs (impact of 1 additional sign)	4.75%	$23,750
x_2	Building Size (impact of 100 additional sq. ft)	1.07%	$5,350
x_3	Hours of Operation (drive-thru & dining room per week) (impact of adding 1 hour per week)	0.18%	$900
x_4	Building Age in Years (impact of 1 additional year of age)	0.45%	$2,250

Model 1 predicts:

X_1 On average, for each additional sign installed at a site, annual sales dollars are expected to increase by 4.75 percent. This translates to a $23,750 increase for each additional sign at a typical store with annual sales revenues of $500,000.

X_2 For each additional 100 square feet in building size, annual sales revenue is expected to increase by 1.07 percent. This translates to a $5,350 increase for each additional 100 square feet at our typical store with $500,000 of annual sales revenues.

X_3 For each additional hour per week in the number of hours that the dining room or drive-thru is open for business, annual sales revenues are expected to be 0.18 percent higher. This translates to a $900 increase for each additional hour per week that either the drive-thru is open at a typical store with annual sales revenues of $500,000.

X_4 For each year of a building age, annual sales dollars are expected to increase by 0.45 percent. This translates to a $2,250 increase for each year of store age at our typical store.

Implications of Model 1 for the Economic Value of On-Premise Signage

As one example of the implications of this model, let's look at the 1994 market sales data[4] for fast-food restaurants in Los Angeles. The estimated annual sales revenues for the area are almost $2.8 billion.

Model 1 suggests that the addition of one more sign at each fast-food restaurant in the area would add more than $132 million in annual revenue. At a sales-tax rate of 7.5 percent, the addition of one sign at each site would raise almost $10 million in additional tax revenue.

Conversely, Model 1 suggests that the loss of one sign at each fast-food establishment in the area would decrease the annual sales revenue by more than $132 million. Thus, the tax base would also decrease by almost $10 million.

Although one could argue that this is the implication of a regression model where other variables are held constant (the ceteris paribus assumption), the point is still clear that on-premise signage has a significantly large impact on retail-sales revenues, and therefore, the tax base.

The addition of one more sign at each area fast-food restaurant would add more than $132 million in annual revenue. At a sales-tax rate of 7.5 percent, the addition of one sign at each site would raise almost $10 million in additional tax revenue.

Model 2: Analysis of Annual Transactions

Next, we examined the annual number of transactions at each site as the dependent (y) variable.

Table 2 – Model 2: Annual Number of Transactions as a Function of On-Premise Signage and Other Marketing Variables

Variable	Variable Description	% Impact on Transactions	Impact on Annual Transactions (at a site with 100,000 annual

[4] From Restaurant Trends QSR MarketSHARE, Report for Los Angeles, California, midyear 1995. Includes the categories: hamburger, roast beef, chicken, and pizza.

			transactions)
Y	Annual number of Transactions		
x_1	Total Number of All Site Signs (impact of 1 additional sign)	3.94%	3,940
x_2	Building Size (impact of 100 additional sq. ft.)	1.55%	1,550
x_3	Hours of Operation (drive-thru & dining room per week) (impact of 1 additional hour)	0.16%	160
x_4	Building Age (in years) (impact of 1 additional year)	0.49%	490
x_5	Value of Owner-Occupied Housing Within 1.5 Miles (impact of $1,000 additional value)	0.08%	80

Model 2 predicts:

x_1 For each additional sign installed at a site, the annual number of transactions are expected to increase by 3.93 percent. This translates to 3,940 transaction increase for each additional sign at a typical store with 100,000 annual transactions.

x_2 For each additional 100 square feet in building size, the annual number of transactions is expected to increase by 1.55 percent. This translates to 1,550 more transactions for each 100 square feet at our typical 100,000 transaction store.

x_3 For each additional hour per week in the number of hours that the dining room or the drive-thru is open for business, the annual number of transactions is expected to be 0.16 percent higher. This translates to 160 more transactions for each additional hour the site is open.

x_4 For each year of building age, the annual number of transactions are expected to increase by 0.49 percent. This translates to 490 more transactions for each additional year of age at our typical 100,000 transaction store.

x_5 For every increment of $1,000 in the average value of owner-occupied housing within a 1.5-mile radius, the annual number of transactions are expected to increase by 0.08 percent. This translates to 80 more transactions for each additional $1,000 of housing value.

With respect to on-premise signage, this model suggests that the number of signs located at a site has a significantly positive impact on the number of transactions. Also, as the size of the building is increased, the annual number of transactions increases. Specific types of signs did not have a statistically significant impact in this particular model.

Implications of Model 2 for the Economic Value of On-Premise Signage

Model 2 confirms the effects seen in Model 1. We again see that the addition of one sign will have a favorable impact on the number of transactions at the site. If we use an average value of $5 per

transaction for a typical fast-food site, we see that the addition of one sign increases the revenue by almost $20,000. This is not much different from the figure of $23,750 found per sign in Model 1.

Model 3: Analysis of Average Transaction Amount

The last general type of model we constructed used the average dollar amount spent per transaction as the dependent variable. We developed this model to detect whether signage has an impact on the average amount spent per transaction as well as the total number of transactions.

Model 3 uses the ratio of annual sales divided by annual transactions as the dependent (y) variable.

Table 3 – Model 3: Average Transaction Amount as a Function of On-Premise Signage and Other Marketing Variables

Variable	Variable Description	% Impact on Transaction Amount	$ Impact on Transaction Amount (Site with $5 Average Transaction)
Y	Average Dollar Amount per Transaction		
x_1	225 Sq. Ft. Monument Sign (Impact of 1 Additional Sign)	9.3%	$0.46
x_2	144 Sq. Ft. Pole Sign (Impact of 1 Additional Sign)	15.6%	$0.78
x_3	6 Sq. Ft. Directory Sign (Impact of 1 Additional Sign)	2.5%	$0.12
x_4	36 Sq. Ft. Building Sign (Impact of 1 Additional Sign)	1.3%	$0.06
x_5	Median Rent within 0.5 Miles (Impact of additional $100 rent)	-1.5%	-$0.07
x_6	Daytime Employment within 0.5 Miles (Impact of 100 Additional Persons	-0.062%	Negligible (but statistically significant)
x_7	Single Males within 1.5 Miles	-0.028%	Negligible (but statistically significant)

Model 3 Predicts:

x_1 is the impact of a 225-square-foot monument sign on the average transaction amount, as a percent of average transaction size, thus the presence of this sign increases the average transaction amount by 9.3 percent. This translates to a $0.46 increase in the transaction size for a site with an average transaction of $5.00.

x_2 is the impact of a 144-square-foot monument sign on the average transaction size, as a percent of average transaction amount, thus the presence of this sign increases the average transaction amount by 15.6 percent. This translates to a $0.78 increase in the transaction size for a site with an average transaction of $5.00.

x_3 is the impact of an additional directory sign on average transaction size, as a percent of average transaction amount, thus the presence of this sign increases the average transaction amount by 2.5 percent. This translates to a $0.12 increase in the transaction size for our typical site.

x_4 is the impact of a 36-square-foot building sign on average transaction size, as a percent of average transaction amount, thus an additional building sign of this size increases the average transaction size by 1.3 percent. This translates to a $0.06 increase in the transaction size for a site with an average transaction amount of $5.00.

x_5 is the impact of an additional $100 median rent (0.5 mile radius) on average transaction size, as a percent of the average transaction amount, thus an additional $100 in median rent within a 0.5-mile radius decreases the average transaction size by 1.15 percent. This translates to a $0.07 decrease in the transaction size for a site with an average transaction amount of $5.00.

x_6 is the impact of another 100 daytime employment (0.5 mile radius) on average transaction size, as a percent of average transaction amount, thus an additional 100 daytime workers within a 0.5 mile radius decreases the average transaction size by 0.06 percent. This was found to be a statistically significant impact, although its financial impact is negligible unless daytime employment in the area were to increase dramatically.

Each type of sign studied was shown to increase the average transaction size.

x_7 is the impact of another 100 single males (1.5 mile radius) on average transaction size, as a percent of the average transaction amount, thus an additional 100 single males within a 1.5-mile radius decreases the average transaction size by 0.03 percent. As with x_6, this was found to be a statistically significant impact, although its financial impact is negligible. We report it here because it raises an interesting question: perhaps, by implication, areas with larger households would have larger transaction sizes.

It is clear from this model that on-premise signage has a significantly positive effect on the average dollar amount spent per transaction. We found that the 225-square-foot monument signs, the 144-square-foot pole signs, the 6-square-foot directory signs, and the 36-square-foot building signs all increased the average transaction size.

Certain demographic factors, such as daytime employment within a 0.5-mile radius of the site, median rent of units located within a 0.5-mile radius, and the number of single males within a 1.5-mile radius have a negative, although generally small impact, on the size of the average transaction.

Limitations of the Fast-Food Study and Directions for Future Research

One of the limitations of this pilot study is the result of particular characteristics of the sample. Although the overall number of sites in this study was greater than 160, there were some subsets that had to be investigated on a site-by-site basis. These kinds of problems can be minimized by increasing the number of sites used from future data sources.

Another limitation to the study arises from the common business sense. Multiple regression is a technique that relies on variation in the data. Given the relatively standardized types of signs used by one firm, there is, in some sense, not a great deal of variation in some of the independent sign variables. Also, there is not a great deal of variation in the performance of each site, since very poorly performing areas will tend to go away. One way to deal with this methodologically is to increase the sample size in order to increase the power of the technique. It is possible that the impact of signage could be more conclusively identified with a larger sample size that would allow a more powerful statistical analysis.

Furthermore, the sign variables across the various sites with respect to this particular sample are derived from one firm in the fast-food industry. All of the sites certainly have what the firm believes to be a minimally adequate amount of identifiable signage, otherwise the firm would not choose to locate at the particular site. Therefore, one problem for this research is that the sample is devoid of the opposite end of the spectrum, which would be a site without any signs on the premises.

As with most basic research, we initially developed a data set based on our theoretical expectations. Some variables that we would have liked to include were too expensive, or too time-consuming to obtain. We believe we would also benefit from larger sample sizes for two reasons. First, the statistical power of the analysis can be increased with larger samples. Second, some unusual profiles at specific sites created anomalous situations that sometimes confounded our interpretations. The impact of these anomalies may be clarified with larger samples. The result would be a greater degree of confidence in our findings. Also, increasing the sample size is typically a relatively easy hurdle to overcome.

One of the largest hurdles we faced with each firm is the time and effort that is necessary to invest to create a relationship of trust between the researchers and the data source. This relationship of trust is imperative, so that we can gain access to proprietary data, and so that the source will be assured that confidential information will not be distributed to unauthorized parties.

The Case of a Large Retail Chain: Pier 1 Imports

In the first phase of this project, we conducted an exploratory investigation using data from the fast-food industry. In this phase of the project, we extend the research regarding the economic value of on-premise signage on the sales performance of individual retail sites to a chain of retail stores. The two principal investigators independently pursued two different methodologies using the same data as a starting point. We intend to extend what is often anecdotal literature with more methodologically sound research and, to that end, transform the methodology in such a manner that will allow the lay person to ascertain the economic value of on-premise signage. This report describes our second source of data and reports the results of our studies to assess the impact of on-premise signage on the financial performance of a site.

In this report we discuss our study and our analyses of the sales performance for a sample of retail sites owned by Pier 1 Imports. Pier 1 Imports is a well-known organization that can best be described as "a specialty retailers of decorative home furnishings, gifts, and related items."[5]

The chief purpose of this study was to determine the effects of on-premise signage on the dollar revenues for about 100 individual retail sites. We utilized two separate, but related techniques, and each of the two principal investigators independently pursued analyses using multiple regression and a time series analysis technique called ARIMA.

Due to the proprietary nature of the study, the results and specific descriptions of some of the predictor variables have been disguised. The results have been transformed from absolute dollar effects to the percentage effects. This preserves the magnitude of the effects and protects the confidentiality of the data. The descriptions of some of the predictor variables have been generalized, but not to the extent that the models are devoid of meaning. We developed both a series of multiple-regression models and a series of ARIMA models to identify the factors that can have a significant impact on the sales performance for a sample of retail sites.

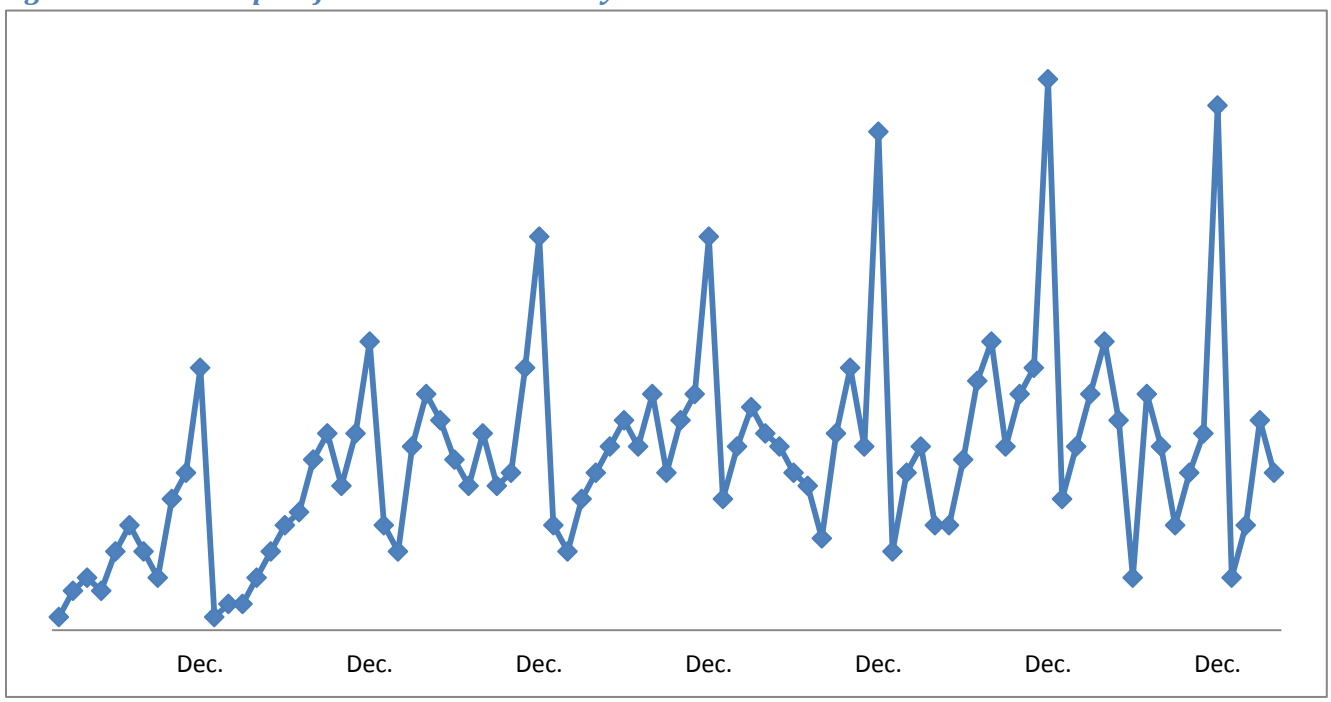
The Data

The data set we investigated consisted of about seven years of weekly sales dollar data for each of about 100 individual retail sites for the regression analyses and almost 50 sites for the ARIMA analyses spread all across the United States. As previously discussed, the data for this phase of the study was provided by a nationally known retail chain with more than 500 stores across the United States. The analyses presented here are different from the cross-sectional analysis performed in the exploratory phase of the research in that the data is longitudinal; that is, we were provided with weekly sales data over the course of a seven-year period ending in mid-1996. Store histories were screened to find sites with several characteristics. First, of course, sites needed to have modifications, additions, or deletions (events) of on-premise signage. Second, these modifications needed to have at least a year of data on both sides of the event in order to construct reliable methods. Third, we tried to find sites that were not concurrently subject to other major influences, such as building remodeling, shopping-center remodeling, severe weather, road construction, and so on. Finally, we examined individual scatter plots of the sites to check for any other visually apparent anomalies, such as chunks of missing data due to the accounting and reporting processes. This screening process resulted in the development of almost 40 site models.

Figure 1 is an exemplary plot of the weekly sales revenues for one of the sites. This plot is suggestive of the dramatic seasonality exhibited by each and every site in the study. As is the case with many consumer retail businesses, this site indicates seasonal spikes near Christmas followed by a slight slump after the holiday.

[5] Company source.

Figure 1 – An Example of a Time Series: Weekly Sales Revenues Over a Seven-Year Period



Findings

We used the regression analysis to identify those variables that have statistically significant effects on sales and then estimated the magnitude of those effects. The equation that is estimated with regression analysis is called the best equation, in that this equation leaves the smallest amount of variation in sales at the retail-store locations unexplained, using a specific set of explaining factors.

We also used time-series analysis called ARIMA to model the sales at individual sites and assess the impact of changes in the on-premise signage. Each set of analyses will be described individually in the next sections of the report.

Regression Analysis of On-Premise Signage Modifications

A Description of the Regression Procedure

The purpose of this analysis is to explain as much of the variation in sales as possible using available data and especially to find out to what extent signage has had an impact on sales. A single variable, referred to as a dummy variable by regression analysts , was used to account for differences in all nonsignage change site specific factors between each site and an arbitrary site, other than those specifically accounted for. This is a well-accepted practice that works well unless these other factors change significantly over the period of data analysis. Given the large number of sites included in the study, this methodology is appropriate.

Nominal weekly sales data were available from 95 sites with sign changes (some data series were incomplete, but included because enough observations existed before and after the signage change to

measure the impact of the signage change), for a seven-year period. Nominal sales data were not adjusted for inflation due to the large number of regional markets represented in the analysis. Thus, the trend in weekly sales represents an increase in price as well as increases in unit sales of products.

For the regression analysis, the data were also converted from weekly to monthly data. One difficulty with the data set is that individual store sales are reported at the end of each week, since some weeks have portions of two contiguous months in them.

As one can easily observe in the figure exemplifying one store's sales over time, seasonality is a significant source of variation in sales data. A variable was included to account for sales deviation from the lowest sales month of February. A time variable was included to account for any trends. The model was also adjusted to account for a national advertising campaign implemented by the company during the period of study.

Sign changes were coded into 11 different kinds based on the type of change. We included a variable for each type of sign change in one regression. The analysis reveals whether each type of sign change, in the aggregate, had an effect on sales.

Results of the Regression Analysis

The best regression model explained 82 percent of the month-to-month and site-to-site variation in sales. This represents a high degree of explanatory power in light of the fact that these sites are located all over the country and sales conditions change over time at many of the sites. As expected, the trend of the average monthly sales increased significantly. A national promotion campaign was also significantly successful, lifting weekly sales by about 11 percent per site after the campaign began as compared to before.

Adding a major building sign increased weekly sales by 9 percent. When two minor sign modifications also were added, sales increased 16 percent.

Certain types of signage changes also had an aggregated significant effect on sales. Major building-sign modifications and additions increased weekly sales by more than 9 percent, as a percentage of median sales. Another type of building signage modification was a major building sign combined with two other rather minor changes. This resulted in more than a 16 percent increase in weekly revenues. The evidence suggests changes to freestanding, multi-tenant signs (adding the firm's name to the identity signs) resulted in an aggregated 1 percent increase in revenues for one plaza sign and a 3 percent increase when two freestanding multi-tenant signs were added.

ARIMA Analysis of On-Premise Signage Modifications

A Description of the ARIMA Procedure

ARIMA analysis is one of a set of time-series-analysis techniques that can be used to model sites on an individual basis. It uses the individual site's sales history to develop a mathematical model describing the data. Once an appropriate model is identified, a priori identified interventions can be assessed. In this research, the a priori identified interventions took the form of on-premise signage changes of various

kinds, as well as a nationwide promotion campaign. An advantage of this kind of analysis is that the magnitude of specific changes at specific sites can be determined.

There are two popular managerial uses for ARIMA. First, once a parsimonious model of an existing set data is constructed, it can be used to make predictions about future sales. Second, the ARIMA technique can be used to assess the impact of some event, such as a change in distribution strategy, that might have occurred during the course of the time series.

Many sales data are characterized by three kinds of forces or drivers: trend, seasonality, and moving average shocks. Sales may be trending up or down, they may be subject to Christmas spikes or winter lulls, and one period's sales level may be closely connected to a previous period's sales levels. ARIMA mathematically models these forces. Then this model is used to predict future sales or assess the impact of intervention events.

As with many forecasting techniques, ARIMA models are more robust when built from several years of sales history. Thus, they are not generally useful for predicting new product sales unless that product is a close extension to, or replacement for, an existing product that does have an available sales history. Typically, better models are constructed when there is enough sales history to cover four or more seasonal cycles.

Although several different ARIMA models can exist that explain the data from our source, we pursue a parsimonious solution; that is, we seek a model that will optimize simplicity, accuracy, and predictive ability. Without suffering the detailed specifications of the model that fit this data, we identify and estimate an ARIM (011) (011) model. This means that there is trend (the Integrative or I component) at both the weekly level and at the seasonal (yearly) level. In addition, this is a moving average series (the MA component) at both the weekly and seasonal level.

Sometimes we want to assess the impact of some kind of shock to the time series. For example, the distribution channel may undergo a radical change, an advertising campaign may begin, or a competitor may introduce a new product into the marketplace. In this example, the store was significantly renovated at a point in the second year of the time series. This intervention event was explicitly modeled and the results suggested that this event contributed almost $2,500 to the weekly sales of the store.

Significant building sign changes brought an average increase of 5 percent in weekly sales. Low-performing stores saw weekly sales increases of as much as 15 percent.

For a presentation of the results, we categorized the signage changes into similar groups: building signs, pole and freestanding, multi-tenant signs, and special directional signs. The results for each of these categories will be presented in turn. Again, in order to preserve the confidentiality of the data, each sign's impact will be reported as a percentage of the median sales for the previous

year. For example, a sign with a $10,000 weekly impact at a site with sales of $100,000 per week would have a percentage effect of 10 percent. Median sales per site generally ranged from $3,000 to $30,000 per week.

Building Sign Effects

Generally speaking, the effect of a significant building signage change was substantively positive and typically increased weekly sales by around 5 percent. One site with atypically high sales revenues exhibited an increase of less than 1 percent, while another site with relatively low sales exhibited an increase of more than 15 percent. There is considerable variety in the nature of these signs; some events are the replacement of aging signage, while other events are the addition of new signage to previously unsigned building elevations exposed to passing traffic.

Table 4 – The Effect of Building Sign Additions and Modifications

Increase	Type of Modification
6.7%	Replaced aged building signage with new backlit signage system
15.5%	Replaced aged building signage with new backlit signage system
1.1%	Replaced aged building signage with new backlit signage system
3.5%	Replaced aged building signage with new backlit signage system
0.3%	Replaced aged building signage with new backlit signage system *(Note: Site already experiences atypically high sales for the chain.)*
13.4%	Addition of new backlit signage system to rear entrance
5.4%	New signage on previously unsigned side of building
5.7%	Replaced existing building signage with larger signage
11.9%	Replaced existing building signage with larger signage
1.2%	Relocated existing signage to a different side of the store
5.4%	Replaced existing building signage with larger signage and new neon
4.5%	Replaced existing building signage with newer signage
5.1%	Relocated existing building and window signage to different sides
2.5%	New signage on previously unsigned side of building
3.0%	New signage on previously unsigned side of building
7.1%	New signage on previously unsigned side of building
23.7%	New signage on previously unsigned side of building *(Note: Site experiences atypically low sales, resulting in large percentage increase, although the dollar amount was commensurate with other site effects.)*
2.5%	New signage on previously unsigned side of building
4.3%	Replaced aged building signage with new signage system
5.2%	New signage on previously unsigned side of building
3.2%	New signage on previously unsigned side of building

Pole and Freestanding, Multi-Tenant Sign Effects

As we see in Table 5, the addition of pole signs and plaza identity signs with the firm's name had a consistently substantive impact on revenue. These signs more than likely have a significant impact on passing traffic.

Table 5 – The Effect of Pole Sign and Plaza Identity Sign Additions and Modifications

Increase	Type of Modification
8.5%	New pole sign
12.3%	New pole sign
4.9%	New pole sign
9.6%	Addition of chain identity on plaza identity sign
12%	Addition of chain identity on plaza identity sign
10.8%	Addition of chain identity on new plaza identity sign
4.1%	Addition of chain identity on plaza identity sign
4.7%	Addition of chain identity on new plaza identity sign
5.2%	Addition of chain identity on plaza identity sign

The addition of either a new pole sign or the company's logo to a plaza identity sign increased sales by 4-12 percent.

Directional Sign Effects

Rather surprisingly, the addition of small, reflective directional signs often resulted in substantial increases in revenues. These are typically used to help guide shoppers to sites with difficult or not-so-obvious ingress routes from major thoroughfares. They are also easily seen in the headlights of a shopper's vehicle. Thus, the impact of these signs is probably due to the ability to guide a site-bound shopper more than any specific advertising effect.

Table 6- The Effect of Directional Sign Additions

Increase	Type of Modification
9.1%	Addition of 2 new directional signs
9.9%	Addition of 2 new directional signs
4%	Addition of 2 new directional signs
12.4%	Addition of 2 new directional signs

A small directional sign brought revenue increases of about 10 percent.

Conclusions

Analysis of a data set from a nationally known retailer using two different procedures, multiple regression and ARIMA time-series analysis, leads us to similar conclusions. On-premise signage is a significant constituent of the factors causing success of the retail endeavor. Depending upon the type of sign addition or modification, we found that a new building sign, a new pole, or a freestanding multi-tenant sign tends to add 5 percent to 15 percent to a site's sales revenues. In addition, even small directional signs, intended only to help the store-bound shopper find the site, tend to add around 10 percent to a site's revenues. This should not be interpreted as a prescription; that is, merely adding signage for the sake of adding signage will not result in increased sales. However, the research results do suggest that the addition of signage for good reason, such as to advertise the store to passing traffic that did not previously see the site's identity, or to help guide shoppers to a hard-to-get-to site, as a prescription, does result in substantially increased sales revenues.

Methodology for the Case of a Fast-Food Chain

Potential Study Methodologies

We considered the possible use of three different methodological techniques to assess the impact of on-premise signage on site performance. The first is to track a particular site's performance, change the signage, then continue to track the performance. This is known as a field experiment. The difference in site performance before and after the change is attributed to the changes made in the signage. The second is a cross-sectional approach using multiple regression analysis to assess the impact of a group of variables across a large number of individual retail sites. The third is a longitudinal approach called time-series analysis.

Field Experiments

Studies in the field experiment category have been previously performed, often on an ad-hoc basis as the result of some external event, for example, a change in local sign ordinances. However, unless this type of field experiment is carefully designed and controlled, it is subject to several dangers that affect the validity of the results.

First, only the impact of the unique sign change particular to that event are considered; other kinds of sign changes may have other kinds of effects. Second, the change observed at the site may also be due to other components of the firm's marketing mix, such as advertising or sales promotion activities. Third, the change could also be externally influenced by the marketing activities of competitors in the trade area or by changes in the economic environment (e.g., the beginning or end of a tourist season). Fourth, unless an experimental design study of this kind is carefully conducted over a sufficiently large and random sample of sites, the results are not generalizable beyond the specific site. Thus, given the potential problems, this type of methodology was not our first choice for the study. Furthermore, the typically anecdotal evidence available today is often of this type of pseudo-experimental design, and the validity or reliability of such evidence may suffer from one or more of these serious problems.

Cross-Sectional, Multi-site Studies

The other major methodological approach we considered was to perform a cross-sectional analysis of a large number of specific sites. Using statistical techniques, such as multiple regression, we can take into account a wide variety of the components that may vary from site to site. Some of these components include aspects of the signage itself (e.g., setback, height, impact, contrast, square footage); local ordinances; population density in the trade area; vehicular traffic; hours of operation; and the type of area (e.g., urban, commercial, light industrial, suburban). With this information, in combination with disguised site-by-site performance data, we can construct a model to explain the impact of the signage on site performance, as well as compare that impact with other variables mentioned. Thus, such a model may be able to partition the various effects into individual components, as well as identify important interaction effects between some of these components.

Although there are several benefits to the use of this method, the largest potential problem is that the impact of the signage may not be distinguishable from random variation in the data. The principal means to minimize this problem is to carefully measure those variables that are included in the model,

and to construct as large a sample as possible (in this context, a large sample means information about several hundred sites.) Empirical estimation of the performance model is the only way to understand the magnitude of this issue.

The first strength of this methodology comes from the very means of reducing the problem mentioned above. By having a large, carefully designed sample, we increase both the generalizability and face validity of the results across a broad range of situations. Second, using a multivariate, cross-sectional analysis will allow us to understand and compare the impact of the signage in relation to a host of signage components, local ordinances, and demographic information. Third, the model can be expanded by an individual firm to incorporate other marketing mix variables (e.g., site-by-site advertising, sales promotions, or price changes) in order to construct a more all-encompassing model of site performance.

The Use of Cross-Sectional, Multi-site Studies

Using statistical techniques of multiple regression, we were able to take into account a wide variety of the components that may vary from site to site. Some of these components could include aspects of the signage itself (e.g., setback, height, impact, contrast, and surface area); local ordinances; population density in the trade area; vehicular traffic; hours of operation; and the type of area (e.g., urban, commercial, light industrial, suburban). With this information, in combination with site-by-site performance data, we can construct a model attempting to explain the impact of the signage on site performance, as well as compare that impact with other variables mentioned.

Although there are several benefits accruing from the use of this method, the largest problem we face is that the impact of the variation in signage may not be distinguishable from random variation in data. Although experience, common sense, and our expertise in marketing and economics lead us to firmly believe that on-premise signage has an absolute and critical impact on sales revenue, it may, nonetheless, still be difficult to measure these effects.

Experience, common sense, and our expertise in marketing and economics lead us to firmly believe that on-premise signage has an absolute and critical impact on sales revenue.

Our choice of methodology (multiple regression) requires significant variation in both the predictor and criterion variables. Thus, the best data for research would consist of wide variation in the signage variables. However, most firms, unless they can meet some minimum level of signage requirements at a particular site, will not construct a retail site; they'll look elsewhere. Although this sort of poor signage would create a richer data set, it would be a silly business decision. As a result, we are faced with trying to tease out the effects of relatively small levels of variation in the predictor variables. The principal means to minimize this problem is to carefully measure those variables that are included in the model, and to construct as large a sample as possible (in this context, a large sample means information about several hundred sites).

Empirical estimation of the performance model is the only way to understand the magnitude of this potential lack-of-variation problem. In other words, we have to give it a try and see what happens. Thus, a pilot study is invaluable for determining the ongoing efficacy of the research project.

Although this research is an assessment of the impact of on-premise signage, there are statistical requirements concerning model specification that force us to expand the kinds of variables we test. Our models need to try to specify as many of the predictor variables as is parsimonious for the explanation of the phenomenon. In other words, we needed to try to put into the model all the major forces that would impact site performance.

We chose to use regression analysis to identify those variables that seemed to have statistically significant effects on sales and then estimate the magnitudes of those effects. The equation that is estimated with regression analysis is the "best" in that it leaves the smallest amount of variation in sales at the restaurant locations unexplained, using a specific set of explaining factors.

The Predictor Variables Used in the Case of a National Fast-Food Chain

In order to effectively use multiple regression, it is important to try to identify all of the important factors that affect the level of sales. Thus, we initiated our study by consulting experts in the business to help us identify the most important factors. In order to construct an adequately specified model, we needed to obtain data in four general categories:

1. site data
2. sign-specific data
3. site-specific marketing efforts, and
4. site-specific performance data

With data from our first source of data (DS1), we tested approximately 150 potential predictor variables to empirically assess and predict the effect on:

1. annual sales dollar revenues
2. the annual number of transactions
3. the average dollar amount spent per transaction

These predictor variables represented sign-specific variables, such as the number of signs at a site, their heights, types, and surface area; and site-specific variables such as lot size; building size; the number of seats; the number of parking spots; average traffic counts; hours of operation; trade area housing prices; and trade area daytime employment. The kinds of independent variables we collected for these analyses are described below, followed by a specific listing of the predictor variables we tested.

Sign-Specific Variables

- Building signs
- Monument signs
- Pole signs

- Special directional or menu boards
- Height of signs
- Number of signs per site
- Square footage of each sign
- Cumulative square footage of all signs

Site-Specific Variables

- Area of building lot
- Area of building
- Whether or not there was a dining room or drive-thru
- Number of seats in the dining room
- Hours of operation for both the dining room and drive-thru
- Average daily vehicle traffic

Demographics of Primary Trade Area

- Housing prices
- Daytime employment rates
- Incidence of single males
- Incidence of families
- Trade area radius in concentric perimeters – half mile increments up to 3 miles

Site-Specific Performance Data

- Monthly and annual transactions per site
- Monthly and annual sales revenues per site

Technical Results for the Case of a Fast-Food Chain

As previously discussed, we chose to use regression analysis to identify those variables that seemed to have statistically significant effects on sales and then estimate the magnitude of those effects. The equation that is estimated with regression analysis is the "best" in that it leaves the smallest amount of variation in sales at the 162 restaurant locations unexplained, using a specific set of explaining factors. When we report that a variable is significant at the 95 percent level, it means that we can reject the hypothesis that the coefficient is zero. If we accept the alternative hypothesis, that the variable has the estimated directional effect on sales, we will be wrong less than 5 percent of the time.

Three basic models were used to empirically test and predict the effect on annual sales revenues, the number of transactions, and the dollar amount spent per transaction. The first model was used to predict annual sales revenue during the fiscal year of the mid-1990s. The second model was used to predict the number of transactions during the same fiscal year. The third model was used to predict the

average dollar amount spent per transaction. This was calculated by dividing the annual sales revenue at each site by the number of transactions at each site.

We began with an exploratory analysis attempting to predict the dependent variables for the three models with the kinds of variables mentioned above. Although our primary focus in this study is to ascertain the effects of on-premise signage, it is necessary for methodological reasons to also include other kinds of variables in our models. This is done in order to lessen the effects of model misspecification. The validity of any particular model depends on the extent to which is takes into account all of the necessary variables that can explain the variation in their dependent variable. These other variables also give us an opportunity to contract and compare the size of their effects with the size of the effects from on-premise signage.

The reader will quickly notice that, though it would be reasonable to believe advertising has an impact on sales performance, there are no advertising variables explicitly contained in these models. Advertising variables were not included because the sample was chosen in such a way that all of the sites were subject to the same advertising and promotion campaigns; thus there would be no variation in advertising variables from site to site.

This was purposefully done in order to simplify the data collection and, therefore, to reduce the data-collection costs for this exploratory study.

The variables reported in the three models are a direct result of the model development process and were retained because they were statistically significant at the 95 percent level of confidence. We found a few substantively interesting independent variables that did not quite meet this confidence level, but we chose to include them in the models. However we explicitly indicate any variation from this norm, and report the appropriate level of confidence generated by all variables.

Three different models were tested analyzing the effects on (1) annual sales dollars per site, (2) annual number of transactions per site, and (3) average dollar amount spent per transaction. Several statistically significant variables were used in each model to determine their effects.

Because of the proprietary nature of the data, we transformed the actual coefficients into percentage terms. So, for purposes of this report, the beta coefficent will refer to a percentage increase in sales at a hypothetical site with sales being average annual sales.

Sales at restaurants are influenced by a large number of factors. The purpose of this study is to determine whether the type, the number of signs, and/or the size of signs are statistically impacting measures of revenue. It is apparent that signs affect sales, but due to the large number of other factors that can influence sales at restaurants, it is likely that only a few of the most important sign characteristics will be significant at the 95 percent level.

Regression analysis revealed that the total sales revenues at the 162 restaurants studied were significantly affected by the number of signs per site, the type of signs at a particular site (i.e., site identifier signs, directional signs, menu boards, etc.), the physical size of the establishment, the number

of hours of operation, and a number of demographic factors. In general, we find that the number of signs at a particular site and the site identifier signs have a significant positive impact on both the annual sales revenue and the number of annual customer transactions. With few exceptions, we include only those factors that are significant at the 95 percent level or higher in the models we report below. Other sign and nonsign variables were found to impact sales at lower levels of significance. In general, their estimated coefficients, though not significant at the 95 percent level, support our general conclusions.

The regression equation is of the general form:

$$y = a + b_1(x_1) + b_2(x_2) + b_3(x_3) \ldots b_n(x_n)$$

where the dependent variable (y) is being explained by the independent variables (x's). The coefficients (b's) can be interpreted as measures of the impact that a change in each corresponding independent variable has on the dependent variable, keeping the value of the other independent variables constant. The value of the constant term is only required to estimate the level of the dependent variable (y), but is not relevant to estimating the impact of each independent variable on the dependent variable (y). In order to disguise proprietary information, we have not included the value of the constant.

In this study, the dependent variable (y) is some measure of site performance, such as annual sales, annual transactions, or the average amount of each transaction.

The final models representing the best fits of data for the three dependent variables investigated in this study are discussed in sequence here. Generally, only those variables that are significant at the .05 level are included in the models. The .05 level of significance is commonly found in market research. It means that significant results should occur by random chance only 5 times in 100 studies. This is a strict confidence level for business research, especially given the exploratory nature of this study, and it represents a standard level of confidence used in market research.

Model 1: Annual Sales Dollars

In Table 7 below we see the results for a model predicting annual sales at 162 sites. Model 1 uses actual annual fiscal year sales dollars for each site as the dependent (y) variable, and explains 33.7 percent of the variation in sales. This is very good for this type of model. The coefficient on x is significant at the 94 percent level, while all of the other coefficients are significant at the 95 percent level or higher. In the table below, that means that each of the p values is .06 or less.

Table 7 – Model 1: Annual Sales Dollars as a Function of On-Premise Signage and Other Marketing Variables

Variable	Variable Description	B_n (%)	P	$ Impact on Transaction Amount (Site w/$5 Average Transaction
Y	Annual Sales Dollars			
X_1	Total Number of All Site Signs (impact of 1 additional sign)	4.75%	0.019	$23,750
X_2	Building Size (impact of 100 additional sq. ft)	1.07%	0.026	$5,350
X_3	Hours of Operation (drive-thru & dining room per week) (impact of adding 1 hour per week)	0.18%	0.000	$900
X_4	Building Age in Years (impact of 1 additional year of age)	0.45%	0.45	$2,250
X_5	Index of Drive-Thru Hours/Dining Room Hours (the ratio of the drive-thru to dining room hours)	11.9%	0.060	
X_6	Index of Floor Space to the Number of All Types of Signs (Impact of an extra 100 sq. ft. of floor space per sign on the annual sales)	0.04%	0.002	
X_7	Value of Owner Occupied Housing (1.5 mile radius around the site)	0.05%	0.030	
X_8	A Company Specific Proprietary Variable	12.1%	0.013	
X_9	A Company Specific Proprietary Variable	17.25%	0.003	

Model 2: Analysis of Annual Transactions

Next, we examine the annual number of transactions at each site. The "best" model explaining the number of transactions contains all of the same variables as the dollar sales model.

Model 2 uses actual annual fiscal year transactions for each site as the dependent (y) variable, and explains 38.3 percent of the variation in sales. This is very good for this type of model. All of the coefficients on x are significant at the 95 percent; that means that each of the p values is .05 or less.

Table 8 – Model 2: Annual Transactions as a Function of On-Premise Signage and Other Marketing Variables

Variable	Variable Description	B_n (%)	P	$ Impact on Revenue (at a Site w/$500,000 in Annual Sales)
Y	Annual Number of Transactions			
X_1	Total Number of All Site Signs (impact of 1 additional sign)	3.94%	1.145	3940
X_2	Building Size (impact of 100 additional sq. ft)	1.55%	0.001	1550
X_3	Hours of Operation (drive-thru & dining room per week) (impact of adding 1 hour per week)	0.16%	0.001	160
X_4	Building Age in Years (impact of 1 additional year of age)	0.49%	0.26	490
X_5	Value of Owner Occupied Housing (1.5 mile radius around the site)	0.08%	0.000	80
X_6	Index of Drive-Thru Hours/Dining Room Hours (the ratio of the drive-thru to dining room hours)	14.07%	0.022	
X_7	Index of Floor Space to the Number of All Types of Signs (Impact of an extra 100 sq. ft. of floor space per sign on the annual sales)	0.033%	0.010	
X_8	A Company Specific Proprietary Variable	11.57%	0.015	
X_9	A Company Specific Proprietary Variable	16.15%	0.005	

Model 3: Analysis of Average Transaction Amount

The last general type of model constructed utilized the average dollar amount spent per transaction as the dependent variable. We developed this model to detect whether signage has an impact on the average amount spent per transaction as well as the total number of transactions.

Model 3 uses the ratio of annual sales divided by annual transactions for each site as the dependent (y) variable, and explains 38.3 percent of the variation in sales. As we have previously noted, this is good for this type of model. All of the coefficients on x are significant at the 95 percent; that means that each value of the p value is .05 or less.

Table 9 – Model 3: Average Transaction Amount as a Function of On-Premise Signage and Other Marketing Variables

Variable	Variable Description	B_n (%)	p	Impact on Annual Transactions (at a site with 100,000 annual transactions)
y	Average Dollar Amount per Transaction			
x_1	225 Sq. Ft. Monument Sign (Impact of 1 Additional Sign)	9.3%	0.023	$0.46
x_2	144 Sq. Ft. Pole Sign (Impact of 1 Additional Sign)	15.6%	0.006	$0.78
x_3	6 Sq. Ft. Directory Sign (Impact of 1 Additional Sign)	2.5%	0.012	$0.12
x_4	36 Sq. Ft. Building Sign (Impact of 1 Additional Sign)	1.3%	0.005	$0.06
x_5	Median Rent within 0.5 Miles (Impact of additional $100 rent)	-1.5%	0.000	-$0.07
x_6	Daytime Employment within 0.5 Miles (Impact of 100 Additional Persons	-0.062%	0.000	Negligible (but statistically significant)
x_7	Single Males within 1.5 Miles	-0.028%	0.000	Negligible (but statistically significant)
x_8	A Company Specific Proprietary Variable	2.98%	0.011	

References

Ellis, Seth, Ph.D.; Johnson, Robert, Ph.D., Murphy, Robin, M.B.A.: "The Economic Value of On-Premise Signage." California Electric Sign Association, University of San Diego, International Sign Association, Sign Users Council of California, Business Identity Council of America, 1997.

Appendix

To Learn More

Those wanting to learn more about the economic value of signs, or signs in general, may find the following publications useful. All are available through The Signage Foundation, Inc. and on our website, www.thesignagefoundation.org.

"The Economic Value of On-Premise Signage, 2012."

"Signs and Federal Protection."

"Amortization Explained."

Testimonials

The scientific study verified what sign end users have known for many years: signs have a direct impact on achieving business goals. The following pages include information from three well-known brands, detailing the ways that signage has enhanced their businesses.

January 16, 1996

TO WHOM IT MAY CONCERN
c/o Bill Moore
Bill Moore and Associates
P.O. Box 6153
Albany, CA 94706

In late December 1994 we raised an existing sign to 75 feet above grade from its prior 45 feet above grade. We raised the sign to increase the visibility from the motorists -- our customers -- and avoid the obstruction from the trees.

During calendar year 1994, we sold 27,956 rooms. During calendar 1995, we sold 34,653 rooms.

No changes were made on the highway or at the interchange. No changes were made at the property. The additional 6697 room increase is attributable only to the increased visibility of the sign.

Sincerely,

Tab Sims

Tab Sims
Motel 6 Marketing Department

A Division of
Foodmaker, Inc.
100 N. Barranca Avenue
Suite 200
West Covina, CA 91791-1600
818/858-0668
FAX: 818/858-0379

Date: 3/ 01/ 96

Sign Users Council of California
29170 Heathercliff Road, Suite #6
Malibu, CA 90265

Attention: CESA Sign Guidelines Committee

Dear Committee Members

We were asked to search our records for any unusual cases where signs have been made a difference to an existing Restaurant. I asked around and one was brought to my attention. It was a Restaurant that is among the vary first Restaurants developed in our chain. It opened on November 1st, 1958. Restaurant # 9.

We learned we could add a Pylon Sign in 1992 and the New Sign was installed at the end of our fiscal year. Initially we observed a modest increase in sales, then the power was connected, and the sales steadily increased.

There was no doubt that the Sign would add value to our business, however to verify the magnitude a study was necessary. Through an analyses method that compares the individual Restaurant in question to a Control Group of the nearest 15 Restaurants, combined with sales data for 8 weeks prior to the added Sign and 8 weeks after, including a factor for seasonality that has a seven year history built in; this Restaurant Sales increased 8.8% as compared to the Control Group that increased 4.9%.

Revisiting the initial findings again in 1995, some three years latter, we find an even greater separation of Restaurant # 9 and the Control Group. An 8.1% increase vs. a 2.0% for the Control Group. This observation is significant, as it points to the lasting benefit a Sign adds to the business. This benefit also is passed on to sales tax dollars and a healthy business enviorment is the result.

Hopefully this information is of some value to you, I am sorry we have no other examples to offer at this time. Should other examples come to my attention we will gladly pass them on for your evaluation.

Respectfully Yours

John A Emanuelli
Reg. Construction Mgr.

namco®

January 4, 1996

To Whom It May Concern
c/o Mr. Bill Moore
Bill Moore and Associates, Inc.
1057 Solano Avenue
POB 6153
Albany, CA 94706-0153

I am responding to your request for documentation relative to the value and importance of retail signage.

As you know, we were without signage at one of our premier locations for approximately one year. During that period, we had little to no recognition which resulted in lower than anticipated sales.

Signage was fabricated and installed approximately one year after we opened and we immediately noticed an increase in sales. The first full week after the signage was installed resulted in a revenue increase of 72.84% (this week this year vs this week last year).

Since that time, sales have steadily increased, and we are nearing year-end with an overall year to date increase of 2.47%. While this number may seem relatively small, we overcame a -31% deficit based on year to date revenue before the signage was installed.

Signage was the only recognizable addition or change to this space. Therefore I am confident that signage is vital to a successful retail operation.

Sincerely,

Deborah L. Olivero
Manager Design and Construction

NAMCO CYBERTAINMENT INC.
877 Supreme Drive, Bensenville, Illinois 60106 Phone: 708.238.2200 Fax: 708.238.0560