

## Site Attributes in Retail Leasing: An Analysis of a Fast-Food Restaurant Market

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In this article, site-location and market-area factors that contribute to sub shop restaurant sales are identified and prioritized. Several location and market variables are defined and tested within a data set of 42 fast-food outlets from the same franchise chain in North Carolina. Results show that traffic counts, site access and visibility, and market-area income are associated with higher sales, while the ratio of population per competing restaurant is negatively associated with sales. The findings can help leasing agents and shopping center developers market their in-line space.

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**R**etail leasing agents and shopping center developers often market their available space to potential tenants by describing its desirable characteristics—great location, good access and parking, fine visibility, high traffic counts, and surrounding retail uses. High market-area population and income are also often cited to document the desirability of a retail location. Because location-sensitive retail tenants are primarily concerned about the value received from a retail location (i.e., sales) in return for a given rental payment, leasing agents should be keenly interested in which location characteristics transfer most readily to a tenant's bottom line in sales. Which aspects of a retail location affect annual sales for small, start-up, in-line restaurants, and what are

their approximate values to a prospective tenant?

Further, the annual base-rent rate per square foot should reflect the value from a store's location; that is, a positive relationship should exist. It is questionable, however, whether rental rates offered by leasing agents reflect the location benefits of space.

The specific type of fast-food restaurant considered in this article is a sub shop franchise. The restaurant chain that provided data for this study initiated operations in the study area (North Carolina) in the late 1970s. Within ten years, the franchise leasing agent had opened over 50 new franchises in leased retail locations. New leases were signed and franchises opened at the rate of about one per month.

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The typical rental location was an in-line space of approximately 1,200 square feet in a neighborhood or community shopping center anchored by a regional supermarket, a variety store, or a department store. Eventually, the best markets had been tapped, and the available retail locations were becoming less desirable. The franchise developer faced increasingly difficult choices between potential locations in close proximity to existing stores (e.g., less than two to three miles apart in a highly developed urban market), and sites in more rural, low-density residential markets. To maximize sales in this second tier of markets, the franchise developer decided that a formal, analytical approach could be more useful than the largely intuitive store location approach they had been using.

A series of readily available econometric procedures is used here to identify location and market factors that may affect first-year sales in fast-food restaurants. Other variables related to store management are included as well.

## LITERATURE REVIEW

The literature on food and retail site location was reviewed to provide a list of location characteristics, market-area attributes, and other

factors to include in this research. The material from the literature is merged with an interview with the chain's franchise developer/leasing agent to determine which store-location factors practitioners consider important.

### Location factors

The literature on location factors that affect restaurant placement addresses five main variables: 1) access; 2) visibility; 3) traffic counts; 4) center size; and 5) the presence of other complementary stores, including restaurants. Access generally refers to the convenience of local transportation and parking. Several empirical studies have linked access to the location needs of convenience retail stores and restaurants.<sup>1</sup> Visibility concerns the ability of potential shoppers to enjoy an unobstructed view of a store or its sign from a number of vantage points. The importance of this factor has been demonstrated with respect to supermarket location and shopping center vacancy rates.<sup>2</sup> The factor of automobile traffic counts in front of a store or on the nearest public roadway is also an important consideration for restaurant location.<sup>3</sup> Shopping center size, the additional amount and type of non-restaurant retail space, and the anchor tenants for the center are also important considerations.<sup>4</sup> The

1. For fast-food restaurants, see R. Pillsbury, "From Hamburger Alley to Hedgerose Heights: Toward a Model of Restaurant Location Dynamics," *The Professional Geographer*, v. 39, no. 3 (1987): 326-344. This topic was addressed for convenience retail by Y. Lee and M. McCracken, "Spatial Adjustment of Retail Activity: A Spatial Analysis of Supermarkets in Metropolitan Denver, 1960-1980," *Regional Science Perspectives*, v. 12, no. 2 (1982): 62-75. In a personal interview (Chapel Hill, North Carolina, 1987), P. Slomiany discussed access needs of sub shops. Finally, access was featured in H. Timmermans, "Locational Choice Behavior of Entrepreneurs: An Experimental Analysis," *Urban Studies*, v. 23 (1986): 231-240.
2. Lee and McCracken, 62-75, covered supermarket visibility issues. For shopping center visibility, see N. Ordway, A. Bul, and M. Eakin, "Developing a Visibility Index to Classify Shopping Centers," *The Appraisal Journal* (April 1988): 233-242. Slomiany also considers the issue of visibility in leasing sub shops at particular locations.
3. Pillsbury, 326-344.
4. For the importance of shopping center size, see Timmermans, 231-240. Pillsbury, 326-344, discusses locational ambiance for fast-food restaurants. For complementary nonrestaurant uses, see A. Okabe, Y. Asami, and F. Miki, "Statistical Analysis of Spatial Association of Convenience Goods by Use of a Random Clumping Model," *Journal of Regional Science*, v. 25, no. 1 (1985): 11-28. Slomiany also looks for a potential location's "energy level" in leasing store space.

presence of other fast-food restaurants or food stores may help rather than hinder sales, which indicates that shoppers may be attracted to an area rather than to a specific store. The presence of other restaurants in the immediate vicinity is often referred to as a restaurant cluster.<sup>5</sup>

### **Market-area characteristics**

Before analyzing a store's market-area characteristics, the market area of the store must be defined. Traditional retail market analysis employs a form of the gravity model to determine the market area of a shopping center or store.<sup>6</sup> A retail use is assumed to possess a spatial monopoly within its primary market area. A market area may be defined by several factors, including distance or driving time to direct competitors, the size of both the competitors and the proposed retail use, and the attractiveness of competitors compared with the subject. Within a market area, sales depend on both the number of shopper visits and the income of the shoppers.

Clearly, the dominance of a store within a particular market area is largely determined by demographic factors. But which of the numerous factors are most important? Population and the number of households are linked to retail sales in many economic studies,<sup>7</sup> as are income and per capita income.<sup>8</sup>

### **Other factors that affect sales**

The other factors that pertain to sales are primarily associated with

such store-operator characteristics as education, previous restaurant experience, financial assets, and ownership stability. Finally, certain macrolocation market factors such as whether a store is located in a college town or in a suburban location may be correlated with differing levels of sales and seasonal sale cycles.<sup>9</sup>

## **DATA COLLECTION AND VARIABLES**

Initially, the availability of internal and secondary data for the approximately 50 sub shops in the franchise chain already opened was determined. Store-specific data for the study were obtained from the franchise developer. These internal data were supplemented by local demographic and economic information.

To compare store performance across place and time, the most appropriate measure of store performance (i.e., dependent variable) was determined to be each store's first-year revenues. Reported store revenue data since opening were available on a monthly basis, and 42 stores had been open for at least one year. The complete data base contained 42 observations and 36 variables.

Store revenues and all other financial variables were adjusted to a base year of 1986 through use of the Consumer Price Index (CPI) deflator. All information on store owners was provided by the fran-

5. See Pillsbury, 326-344, for fast-food restaurants in Atlanta; and Okabe, Asami, and Miki, 11-28, for analysis of food retailers in Tokyo.

6. Two good texts are N. Carn, J. Rabianski, R. Racster, and M. Seldin, *Real Estate Market Analysis: Techniques and Applications* (Englewood Cliffs, N.J.: Prentice-Hall, 1988), 184-192; and J. Clapp, *Handbook for Real Estate Market Analysis*, (Englewood Cliffs, N.J.: Prentice-Hall, 1987), 38-41.

7. See, for example, C. Ingene and E. Yu, "Environment Determinants of Total per Capita Retail Sales in SMSAs," *Regional Science Perspectives*, v. 12, no. 2 (1982): 52-61. Lee and McCracken, 62-75, also associated declining population with store closure.

8. Ibid.

9. Based on discussions with Slomiany.

chise developer from internal company records.

Store market areas were determined based on a simplified version of the gravity model as well as through direct surveys of customer addresses (using a dot plot technique) at 11 stores in Raleigh and Chapel Hill, North Carolina.<sup>10</sup> The near-twin approach was used to determine market areas for stores in other cities and towns.<sup>11</sup>

Demographic variables within each store's market area were calculated for the initial year of store operations using census tract data on level of population, number of households, and personal income. Secondary data sources included the North Carolina Division of Employment and Training and the North Carolina Department of Transportation.

Other variables, especially those related to site location, were collected by visiting each store location and conducting a visual inspection of current conditions. For stores that had opened more than two years earlier, the franchise developer was queried about changes in conditions during the intervening period.

Table A in the Appendix contains all 35 independent variables organized into the broad categories of site location, market area, and other factors; each variable in the data set; and the expected relationship between each variable and store revenues.

### Variables

The dependent variable (*ANN-REVS*) is the inflation-adjusted dollar amount of the first year's annual gross revenues, measured in thousands of dollars.

The access index variable (*ACC*) was based on access to the site, including the presence of a median strip or one-way street, both of which were considered negative factors. Close proximity to a major intersection and distance from the front of the store to parking were scored positively. The maximum *ACC* score was 11 points.

The visibility index variable (*VIS*) was based on several factors, most significantly unobstructed visibility of the store from five frontal locations at the curb. Corner locations scored best, while interior space at regional shopping malls generally had the worst scores. The maximum *VIS* score was 10 points.

Other location variables include *ACCVIS*, an interaction term that combines the access and visibility indices; *AADT*, the average annual daily traffic count in front of the store; and *ENLEV*, the energy level of the surrounding area, measured by the square footage of space within a two-block radius of the store. *COMPET* indicates the number of restaurants in the immediate vicinity.

*RENTSF* is the annual base rent per square foot called for in the lease. Market variables include *HH* for households; *POP* for population; *INC*, representing market-area personal income; *PCINC*, indicating per capita income; *UNEMP* for the county's unemployment rate; and *URB*, identifying whether the market is located in an urban area, based on 1980 Standard Metropolitan Statistical Areas (SMSAs).<sup>12</sup>

### STATISTICAL PROCEDURES

After the data were computerized, the correlation coefficients be-

10. Clapp, 39-41.

11. Ibid., 38.

12. All financial variables such as income, per capita income, and net worth of owner were also tested in the logarithm functional form.

tween each variable and annual revenues were calculated. Next, all of the variables were entered into a regression model to determine the relative importance of each variable in explaining annual first-year sales. Finally, the most promising variables were subjected to additional statistical procedures to confirm the efficacy of the findings.

### Variable means and Pearson Correlation coefficients

Table 1 contains the mean values and Pearson Correlation coefficients for all location and market-area variables as well as for selected other variables in the data set with statistical significance set at  $\alpha = .25$ . The correlation coefficients could be used to determine which variables tentatively show

an important relationship to annual sales, without holding other variables constant.

An average store in the study had annual first-year sales of \$204,000, with about 21,100 cars per day passing in front of the store. Access was generally good, with fair visibility. The immediate area around a store contained on average 85,000 square feet of space and ten restaurants. Average base rent was \$12.22 per square foot per year.

The typical market area for a store was a two-to-three-mile radius (less in urban areas). The average market area contained 20,800 persons in 7,900 households. Total personal income was \$206 million, with per capita income at \$10,400. Unemployment was 4.5%, gener-

TABLE 1 Means and Correlation Coefficients for Selected Variables

Variable	Mean Value	Pearson Correlation Coefficient	Statistical Significance*
<u>Dependent variable</u>			
ANNREVS	\$203,571	1.000	0.000
<u>Site location</u>			
AADT	21,081 (number of cars)	0.399	0.009
ACC	9.0 (index)	0.158	0.318
VIS	5.9 (index)	0.222	0.156
ACCVIS**	15.0 (index)	0.247	0.116
ENLEV	85,240 (square feet)	0.204	0.196
COMPET	10.31 (number of stores)	0.283	0.070
RENTSF	\$12.22	-0.110	0.487
<u>Market area</u>			
POP	20,804 (population)	0.229	0.144
HH	7,914 (households)	0.250	0.111
INC (thousands)	\$205,885	0.465	0.002
PCINC	\$ 10,400 (per capita)	0.403	0.008
PCINCLOG	2.29 (logarithm)	0.403	0.008
UNEMP	4.5%	-0.197	0.212
URB	0.86 <sup>†</sup>	0.286	0.066
POPCOMPT***	2,211 (population per competitor)	-0.081	0.617
<u>Franchise operator-management</u>			
COLDEG	0.69	0.193	0.218
OWNCHG	0.19	-0.247	0.116
NETWORTH	\$107,200	-0.220	0.162

\*PROB > |R| under  $H_0$  (hypothesis):  $RHO = 0$

\*\*Included as an interaction variable for ACC and VIS

\*\*\*Included as an interaction variable for POP and COMPET

<sup>†</sup>URB, COLDEG, and OWNCHG are dummy variables, where 0 if condition is not met and 1 if condition is met

*Among site-location factors, traffic counts, the number of other restaurants nearby, and the combined effects of access and visibility all are positively associated with sales.*

ally below the national average. The vast majority of stores were located in urban areas.

Store managers were generally college educated, with a reported net worth of about \$107,000. Almost one-fifth of stores changed ownership during the first year.

Correlation coefficients show that both location factors and market factors may be associated with first-year annual revenues. Among site-location factors, traffic counts, the number of other restaurants nearby, and the combined effects of access and visibility all are positively associated with sales. Rent per square foot shows no relationship to sales. This indicates that space may be inefficiently priced, assuming that percentage rents do not make up the difference. Virtually all of the market characteristics except the unemployment rate show potential relationships with sales. Because these variables are similar, the task is to find the best one among the group. Among the management factors, owner change and an owner's education and net worth appear related to revenues.

#### **Stepwise regression**

Stepwise regression was employed to determine the relative importance of these factors in explaining annual first-year revenues. This procedure also provides a convenient way to deal with potential multicollinearity problems in the

data set (e.g., the market-area variables). All 35 independent variables were placed into a stepwise regression model, with the reject parameter set at  $\alpha = .15$ . The results of stepwise regression are shown in Table 2. The partial  $R^2$  statistic is a convenient tool because it shows the proportion of change in sales explained by each variable.

The total  $R^2$  of the model is .624, with an  $F$ -statistic of 8.05, which is significant at  $\alpha = .01$ . In other words, the seven variables shown in Table 2 account for just over 62% of the variation in annual first-year sales. Stepwise selected seven variables in explaining annual first-year sales: two from the site-location category, *AADT* and *ACCVIS*; and two from the market-area category, *INC* and *POPCOMPT*. Three management factors unrelated to location and market were also selected: *NETWORTH*, *OWNCHG*, and *COLDEG*. These results are stronger than the correlation coefficients from Table 1 because they hold the effects of other variables constant.

The results show that market-area income alone can explain approximately 20% of annual first-year sales. The interaction between population and the number of nearby restaurants accounts for 10% of sales. Traffic counts represent almost 8%, with access and visibility less important at just over 5%

**TABLE 2 Results of Stepwise Regression Procedure**

Variable	Step	Partial $R^2$	$F$ -Statistic	$PROB > F$
<i>INC</i>	1	.203	10.16	0.003
<i>POPCOMPT</i>	2	.107	6.03	0.019
<i>OWNCHG</i>	3	.082	5.08	0.030
<i>AADT</i>	4	.079	5.52	0.024
<i>ACCVIS</i>	5	.052	3.96	0.057
<i>COLDEG</i>	6	.055	4.53	0.040
<i>NETWORTH</i>	7	.047	4.20	0.048
<i>MODEL</i>		.624	8.05	0.001

of sales. The three management factors combined represent about 18% of sales.

### Weighted least squares

To support the potential relationships between the four location and market factors and annual sales, a weighted least squares procedure was conducted. This analysis provides marginal propensity coefficients (analogous to the  $\beta$ s in the Appendix), which show the effects on sales caused by a one-unit change in each independent factor. The complete results of a weighted least squares analysis of the seven variables shown in Table 2 are presented in the Appendix in Table B. For the location and market area variables, the results are as follows.

*AADT* has a marginal propensity coefficient of 2.47, and a *t*-statistic of 3.83, significant at  $\alpha = .05$ . For a one-unit change (1,000 cars per day) in *AADT*, there is a corresponding 2.47-unit positive change in annual revenues, *ANNREVS*, measured in thousands of dollars. In other words, each car passing on an average day increased first-year sales by \$2.47, on average, if all else is held constant.

For *ACCVIS*, the coefficient is 0.7, with a *t*-statistic of 1.97. This is significant at  $\alpha = .10$ . Every additional point on the combined access-visibility index increased sales by \$700 the first year.

For the market-area variables tested, the logarithm of income, *LINC*, has a coefficient of 56.2 and has a *t*-statistic of 5.15, statistically significant at  $\alpha = .05$ . The interpretation of this logged variable indicates that for each unit change in the logarithm of market-area income, there is a positive

\$56,200 change in annual revenues. Close to the average market-area income of \$206 million, this corresponds to approximately \$270 more in annual sales for every additional million dollars in market-area income.<sup>13</sup>

For *POPCOMPT*, the ratio of population per restaurant in the immediate area, the coefficient is  $-0.02$ , with a *t*-statistic of  $-4.43$ . This is significant at  $\alpha = .05$ . Every additional unit in the ratio was associated with a decrease of \$20 in sales the first year.

For management-related variables, higher owner net worth and a store owner change in the first year were associated with lower sales. A college degree was found to relate positively to annual sales.

### CONCLUSION

Leasing agents should find that providing prospective in-line restaurant tenants with data on market-area income, traffic counts, access, visibility, and the ratio of population to restaurants helps them effectively market the space.

In the site-location category, traffic counts in front of a store and to a lesser extent the access-visibility index are positively associated with sales. These results are consistent with the literature cited earlier.<sup>14</sup> Among the stores studied, visibility is somewhat more important than access. No relationship is apparent between the square footage in a development and the first-year sales.

Market-area demographics are important to sub shop sales. Of the numerous market-area variables tested, the logarithm of total personal income within a market area

13. For another example, if there were two different market areas, one at the average level of \$206 million (log 12.24), and one at \$250 million (log 12.43), the second store could be expected to have an additional \$10,680 in first-year sales ( $.19 \times 56.2 \times \$1,000 = \$10,680$ ).

14. See Lee and McCracken, 62-75, Timmermans, 231-240, and Pillsbury, 326-344.

is dominant. In fact, income is the single most important factor in determining first-year revenues. The positive relationship between income and sales supports the findings of earlier studies.<sup>15</sup> While other demographic characteristics may also be associated with sales, income is the best indicator of sales potential. No relationship is apparent between the unemployment rate and sales.

Finally, the importance of the ratio of population per competitor restaurant suggests that sub shop restaurants may benefit from proximity to other fast-food restaurants. This variable, which is difficult to interpret, was more powerful than an explicit restaurant-cluster dummy variable or the number of competitors. The negative sign on *POPCOMPT* can perhaps be explained by the fact that as the number of persons per restaurant in the market area decreases, the draw from outside the market area also decreases, thus reducing revenues.

Annual base rent per square foot does not show any relationship to annual first-year sales. This may be partially explained by the omission of percentage rents from the analysis. It is plausible to assume, however, that the absence of a strong relationship between base rent and sales implies some potential inefficiency in rent structures among the stores studied. Leasing agents may not be realizing full value from the space they are leasing. Future store-location analysis could be refined to include optimum square footage for each store as a factor in the site location.<sup>16</sup>

Leasing agents and shopping center developers may also favorably consider certain operator-

management characteristics shown to be related to first-year sub shop sales. A store ownership change in the first year, probably associated with a sale under less than optimum sale conditions, is linked with substantially diminished sales among the study population. Unfortunately, this variable is not known prior to the leasing decision, and hence is not useful to the agent in selecting a potential tenant. Among the study population, the most important positive factor for the franchise developer to consider is whether an owner possesses a college degree. Further research could corroborate this finding in a larger data set with more variation among individual store owners. Owner-reported net worth is negatively associated with sales, probably indicating that a more "hands-on" management style results in the increased presence of an owner-operator in the store and thus higher revenues. This would indicate that an optimum operator, from the standpoint of maximizing sales, would be a recent college graduate with a limited net worth regardless of previous restaurant experience.

The findings of this research could be used by leasing agents, shopping center developers, and restaurant site locators to lease in-line fast-food restaurant space. The information could be expanded into a data base for purposes of strategic site location for sandwich restaurants or other similar retail uses. Further, expanding the use of the regression model to project sales at any proposed location could be a feasible extension of this research.

Local market data is a potentially important component in new site-location analysis for a multi-

15. See Ingene and Yu, 52-61 as well as Pillsbury, 326-344.

16. H. Williams, K. Kim, and D. Martin, "Location-Spatial Interaction Models: Benefit-Maximizing Configurations of Services," *Environment and Planning A*, v. 22 (1990): 1079-1089.

location chain. Suitable demographic evaluation should include small-area demographic analysis to prevent stores from competing for the same shopping population. In addition, competitive forces should be estimated and expected branch performance should be analyzed.<sup>17</sup>

Finally, this research demonstrates that using a small data set and contemporary statistical tech-

niques can help leasing agents and retail location specialists find store locations. Because these research techniques are commonly available and in light of the increasingly competitive nature of the retail business, the use of a site-location model as a strategic management tool should become more common.

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17. A. Collins, "Store Location Planning: Its Role in Marketing Strategy," *Environment and Planning A*, v. 21 (1988): 625-628.

## APPENDIX

### Additional statistical procedures

The complete list of variables used in the analysis is shown in Table

A. These variables were used for all correlation analysis and were input to the stepwise procedure. More generally, the regression equation generated by stepwise is:

**TABLE A Variables by Category and Their Expected Relationship to Sales**

Name	Description	Expected Relationship to Annual Sales
<u>Dependent variable</u>		
<i>ANNREVS</i>	Annual sales in the first year	
<u>Site location</u>		
<i>AADT</i>	Traffic counts in front of store	+
<i>ACC</i>	Access to store—index	+
<i>VIS</i>	Visibility of store from street—index	+
<i>ACCVIS</i>	Combination of <i>ACC</i> and <i>VIS</i>	+
<i>ENLEV</i>	Energy level—square footage within 2 blocks	+
<i>ACTGEN</i>	Activity generator—employment within 1/2 mile	+
<i>SUBURB*</i>	Location at a suburban shopping mall	-
<i>RENTSF</i>	Rent paid per square foot/year	+
<i>COMPET</i>	Number of restaurants within 1/2 mile	-
<i>CLUSTER*</i>	Store is in a restaurant cluster	+
<u>Market area</u>		
<i>POP</i>	Population in market area	+
<i>HH</i>	Households in market area	+
<i>INC</i>	Income in market area	+
<i>GQ</i>	Group quarters in market area	?
<i>POPGROW</i>	Population growth rate	+
<i>PCINC</i>	Per capita income	+
<i>UNEMP</i>	Unemployment rate	-
<i>PCINCLOG</i>	Logarithm of <i>PCINC</i>	+
<i>URB*</i>	Urban area (in an SMSA)	+
<i>COLMKT*</i>	College town	+
<i>BEACH*</i>	Beach town	-
<i>DOWNTN*</i>	Downtown location	?
<i>POPCOMPT</i>	Market area population per competitor	+
<i>INCCOMPT</i>	Market area income per competitor	+
<u>Management</u>		
<i>NCNUM</i>	North Carolina store number, an identifier	
<i>OTHSTORE</i>	Number of other franchise stores owned	+
<i>COLDEG*</i>	Two- or four-year college degree	+
<i>RESTEXP</i>	Years of restaurant experience	+
<i>INSPECT</i>	Monthly inspection scores	+
<i>OWNCHG*</i>	Owner change in first year	-
<i>NETWORTH</i>	Net worth reported by owner	-
<i>ADVINDX</i>	Advertizing index (1-5 scale)	+
<i>ADINUM</i>	Number of other franchise stores in SMSA	+
<u>Competitive from within franchise</u>		
<i>CANNIBPC</i>	Percentage of market area overlap with another store of same franchise	-
<i>CANNIBL*</i>	The presence of another store of same franchise within 3 miles	-

\*Dummy variable coded 1 if conditions are fulfilled, 0 if not

$$\begin{aligned}
 ANNREVS = & \beta_0 + \beta_1 INC \\
 & + \beta_2 AADT + \beta_3 ACCVIS \\
 & + \beta_4 NETWORTH \\
 & + \beta_5 POPCOMPT \quad (1) \\
 & + \beta_6 COLDEG \\
 & + \beta_7 OWNCHG + U
 \end{aligned}$$

**Regression diagnostics and the final model**

After the stepwise procedure, the seven-variable model was run using ordinary and weighted least squares. Subsequently, several additional procedures were conducted on these seven variables to refine the functional form, determine regression diagnostics, and test for heteroscedasticity.

Univariate analysis of the variables determined that logarithmic functional form modifications to market-area income (new variable—*LINC*) and owner net worth (new variable—*LNETWORT*) were a better fit for these two variables in the model. Based on this new information, an ordinary least squares (OLS) run based on Equation 1 was performed. This model as a whole, under approximate estimates in OLS, produced an *F*-value of 9.27, which is statistically significant at  $\alpha = 0.05$ . The model's adjusted  $R^2$  is 0.59.

As part of the regression diagnostics, several tests for outliers, univariate plots, and heteroscedas-

ticity were performed, including residual plots, Spearman rank order correlation, and the Breusch-Pagan test.<sup>1</sup> Positive findings with respect to heteroscedasticity necessitated use of weighted least squares (WLS). Results of the statistical tests after adjustments are shown in Table B.

Interpretation of variables use WLS data for both the parameter estimates and the *t*-test of statistical significance. In nearly all cases, WLS and OLS coefficient values are similar. Because WLS corrects for the heteroscedasticity problems, the results are *BLUE*. Unless noted, all independent variables are statistically significant at  $\alpha = .05$ .

**TABLE B Model Results after Weighted Least Squares**

Variable	$\beta$	<i>t</i> -statistic
<i>INTERCEPT</i>	-432.43*	-3.41
<i>LINC</i> (%)	56.2*	5.15
<i>AADT</i> (thousands)	2.47*	3.83
<i>ACCVIS</i> index score	0.7**	1.97
Owner change	-60.49*	-6.41
College degree	57.56*	3.93
<i>LNETWORT</i>	-20.9*	-2.49
<i>POPCOMPT</i>	-0.02*	-4.43

\*Significant at  $\alpha = .05$

\*\*Significant at  $\alpha = .10$

1. See K. Bollen and R. Jackman, "Regression Diagnostics: An Expository Treatment of Outliers and Influential Cases," *Sociological Methods and Research*, v. 13, no. 4 (1985): 510-542.