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Spatial Competition and Demand: An Application to Motion Pictures

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Abstract

This paper provides a rich assessment of the demand characteristics for movie theatre attendance in two major metropolitan markets and provides strong support for the importance of spatial characteristics in empirical demand analysis. We provide evidence of the usual competitive effect of location on an exhibitor's demand but also find evidence of a clustering effect: when a group of theatres is in close proximity to each other, their proximity generates additional demand for all theatres within the cluster. The demographic evidence suggests that movie attendance is a normal good but does not support the commonly held industry view that young male viewers drive demand. Finally, we show that attendance at a particular theatre is affected by both the theatre's attributes and the attributes of nearby competing theatres. The attributes we include cover physical features and theatre type.

JEL Classifications: L11, D43, L82

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Economic analysis is fundamentally based on a careful specification of the factors that influence consumer behavior across and within industries. In this paper we use new and complete data drawn from two major metropolitan markets to analyze the empirical determinants of the demand for the movie-going experience in the U.S. theatrical exhibition market. Our study makes five important contributions to empirical demand analysis.

First, we develop a model of consumer behavior that identifies a general process by which consumers choose among products with differentiated attributes. Specifically, we develop a two-stage model of consumer choice. In the first stage, a consumer with particular demographic characteristics decides to purchase from a particular product group, for example, to go to a movie in a particular geographic region, based upon the relative desirability of that product group. In the second stage, conditional upon the decision to purchase, the consumer chooses a particular product, for example, to attend a particular movie theatre within the region, based upon the relative spatial and physical attributes of the products within the group selected in the first stage.

Second, we carefully document the evolution of demand patterns in an industry characterized by some degree of capacity consolidation. The total number of movie theatres in our sample regions declined slightly while the total number of screens increased over the period 1996-2002. This pattern suggests that clustering, both in the form of intra-company consolidation and expansion of capacity, and inter-firm proximal location choice, may have become increasingly important to consumer choice. We find that when the spatial nature of competition is carefully measured, the demand at a given theatre increases with distance to the nearest neighbor of the same type but *decreases* with distance to the next-nearest neighbor. This finding is consistent with the more general spatial demand phenomenon that equilibrium outcomes are determined by a trade-off between negative competition effects and positive market-share effects.[1]

Third, we analyze the importance of product attributes and relative product differentiation in conjunction with the influence of spatial characteristics, to estimate a multi-dimensional model of demand. We find that theatre characteristics, such as stadium seating and digital sound systems, can influence demand depending upon the presence or absence of these attributes relative to neighboring – and so competing – theatres.

Fourth, our extensive demographic data allow us to explore the impact that specific demographic features, such as age, income and gender have on demand. We find, in particular, that movie attendance is a normal good, as might have been expected. By contrast, the evidence does not support the long-held industry view that young male viewers drive demand.

Finally, we estimate demand over a five-year period for this industry, taking explicit account of the possibility that there might be spatial autocorrelation in the data. This analysis provides a new and interesting example of the implementation of and testing for spatial correlation in errors.

In sum, our theoretical and empirical analysis of demand in a dominant U.S. industry sheds light on several fundamental questions relating to consumer choice when products are spatially and physically differentiated and when consumers are heterogeneous. The remainder of the paper is organized as follows. Section I develops our two-stage model of consumer demand. Section II describes the data. Section III

[1] See, for example, Fujita, Krugman and Venables (2001).

presents the empirical implementation and results. Our concluding remarks follow in the final section.

I A Model of Consumer Demand for Movie Attendance

We model the decision of whether and where to view a movie as a discrete choice problem expressed over differentiated products.[2] To model the demand for attendance at a movie offered by a particular movie theatre we need to take account of variation in individual tastes, variation in the product characteristics offered by different theatres (for example, stadium seating, digital sound) and in the spatial characteristics (locations) of the competing theatres. The first two sources of variation in individual demands raise issues that we consider below but that are reasonably familiar. The third source of variation has distinctly spatial aspects that require careful treatment.

Our primary interest in this paper is in the determinants of consumer demand for attendance at particular movie theatres. As a result, we take the location decisions of the individual movie theatres as exogenous. However, we can still draw on developments in location theory and economic geography to analyze how consumers make consumption decisions among these competing theatres. The literature suggests that two opposing effects determine the location decision and, for given location decisions, determine the demand decision. On the one hand, firms want to locate reasonably close to each other in either product or characteristics space in order to create an attractive *cluster* of products that will attract consumers. This has been termed the *market-share effect* by Pinkse and Slade (1998). On the other hand, firms do not want to locate too close to their immediate

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[2] See Anderson, De Palma and Thisse (1992) for an excellent review and development of discrete choice models of this type.

competitors because this leads to strong local competition. Netz and Taylor (2002) refer to this as the *market-power effect* but we prefer to refer to it as a *competition effect*.

One method for capturing the impact of these two effects on demand is to use the two-stage nested process first developed by Ben-Akiva (1973). First assume that the population of potential consumers can be partitioned into J subsets according to some potentially observable demographic variables that influence demand: age, income and education are obvious candidates. For consumers of a particular type j in J we assume that their choice set M (the set of movie theatres) can be partitioned into L subsets M_l, where each subset contains movie theatres with some observable characteristics in common. In order to capture the market-share effect described above, the obvious characteristic to choose is a measure of the individual theatre's location relative to its competitors.

An individual consumer is assumed to follow a two-stage process. First, she chooses the subset from which she will consume with a probability determined by the attractiveness of the subset to her. She then chooses a particular alternative (theatre) from within that subset with a probability determined by the utility offered by that alternative relative to those of its competitors within the subset. In both stages we assume that choice is based on a multinomial logit model.

Suppose that a consumer of type j has chosen subset M_l in the first stage and that the utility she obtains from attending movie theatre m in subset M_l is:

$$\tilde{U}_{jm} = u_{jm} + \varepsilon_{jm} \qquad (m \in M_l) \tag{1}$$

where the ε_{jm} are i.i.d., following a double exponential distribution with mean zero and variance $\mu_2^2\pi^2/6$.[3] Then the probability that she will attend movie theatre m in M_l in the second stage is

$$pr_{M_l}^{j}(m)=\frac{\exp(u_{jm}/\mu_2)}{\sum_{h\in M_l}\exp(u_{jh}/\mu_2)} \qquad (j \in J) \qquad (2)$$

The choice of subset M_l in the first stage is determined by the utility offered by that subset as compared to its competing subsets. Ben-Akiva suggests that the appropriate evaluation is the expected value of the maximum of the utilities $\widetilde{U}_{jm}$, which is given by:

$$S_l=\mu_2 \ln \sum_{h\in M_l}\exp(u_{jh}/\mu_2) \qquad (3)$$

It follows that the probability of choosing the subset M_l from M is

$$pr_M(M_l)=\frac{\exp(S_l/\mu_1)}{\sum_{k=1}^{L}\exp(S_k/\mu_1)} \qquad (4)$$

where μ_1 is a positive constant. Putting (2) and (4) together, we have that the probability of consumer of type j attending movie theatre $m \in M_l \in M$ is

$$pr_j(m)=pr_{M_l}^{j}(m).pr_M(M_l)=\frac{\exp(S_l/\mu_1)}{\sum_{k=1}^{L}\exp(S_k/\mu_1)}\frac{\exp(u_{jm}/\mu_2)}{\sum_{h\in M_l}\exp(u_{jh}/\mu_2)} \qquad (5)$$

If there are N_j consumers of type j it follows that expected demand for movie theatre m is:

$$\widetilde{X}_m=\sum_{j\in J}N_j pr_j(m) \qquad (6)$$

and this movie's expected revenues are $p_m\widetilde{X}_m$.

[3] See Anderson, De Palma and Thisse (1992) p. 40 for a more extensive discussion.

In (5) the market-share effect is captured by the first term, essentially by the attractiveness of a particular subset of theatres, while the competition effect is captured by the second term, the relative attractiveness of a particular movie theatre within the relevant cluster.

We can further refine this analysis if we assume that consumers behave according to a linear random utility model. Take a particular subset M_l and consumer type j. Assume that the characteristic distinguishing consumer types is income and that consumers of type j have real income y_j. Further assume that the conditional indirect utility that a consumer of type j obtains from attending movie theatre $m \in M_l$ is:

$$\widetilde{V}_m^j = y_j - p_m + a_{jm} + \varepsilon_{jm} \qquad (j \in J; m \in M_l) \tag{7}$$

where the a_{jm} provide observable indices of the attractiveness of theatre $m \in M_l$ to consumers of type j. Anderson *et al.* (*op. cit.*) show that we can recover the utility functions u_{jm} from these indirect utility functions. With respect to expected demand, (7) then implies that we can replace the terms u_{ji} in equations (2), (3) and (5) with the terms $a_{ji} - p_i$.

The direct implication of the above analysis is that a multi-stage decision-making process on the part of consumers determines revenues for a particular movie theatre. First, a consumer decides whether or not to “buy” movie attendance. Given that we assume movie prices to be exogenous, a perfectly reasonable assumption given our data set, this decision will be determined essentially by consumer characteristics or demographics. Then the consumer decides which movie theatre to attend. The two-stage nested approach detailed above suggests that this decision balances the market-share and competition effects.

Given the nature of our data, a particularly appealing measure of the attractiveness of a particular group of movie theatres, and so of the market-share effect, is the geographic extent of the theatres in a particular cluster: the more spread out they are, the less attractive they are as a cluster. This suggests one of two possible approaches. We could follow Netz and Taylor (2002) and measure the number of movie theatres or movie screens within some defined distance of the particular theatre we are considering. The problem that arises here is that the appropriate distance is an empirical matter. As a result, we take a more direct approach by assuming that a theatre, its nearest competitor and its second-closest neighbor create the clustering effect.[4] The implicit assumption is that the potential demand for a particular theatre in a cluster is inversely related to the distance between the theatre under consideration and its second-nearest competitor.

The competition effect is, from (2) and (7), the result of two forces. First, there is a direct competition effect that we can represent as the distance between movie theatre *m* and its nearest competitor. Second, there is an indirect competition effect determined by the characteristics a_{jm} of theatre *m* relative to those of its nearest competitor. There is likely to be some asymmetry in the impact of movie theatre attributes on consumer demand. For example, the impact on demand of offering stadium seating when the nearest competitor does not need not be equivalent to the impact on demand of a theatre not offering stadium seating when the nearest competitor does. This is a point to which we return in our discussion of the empirical implementation and results.

As a result, the model that we estimate can be written:

$$R_i = \alpha + \beta DC_i + \gamma IC_i + \delta MS_i + \zeta Z_i + \varepsilon_i \qquad (8)$$

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[4] This implicitly assumes that there is a reasonably strong distance decay effect on demand.

In (8), R_i measures demand for attendance at movie theatre i, DC_i is a measure of the direct competition that movie theatre i faces, while IC_i measures indirect competition determined by differences in characteristics of theatre i and its direct competitor(s). MS_i measures the market-share effect and Z_i measures the demographic and other variables that are likely to affect individual demand for movie attendance.

One technical problem that might arise in estimating (8) is that the error term for movie theatre m may be correlated with that of movie theatre n if these theatres are located close to each other. Such theatres offer very similar products and have substantially overlapping potential markets. Exogenous changes in the market environment not captured by the regressors in (8) may well, as a result, appear in the error terms for the two theatres. We adopt a method that is standard in the literature[5] by applying a spatial error correction model in which the error term is written

$$\varepsilon_i = \lambda \mathbf{W} \varepsilon_i + \eta_i \tag{9}$$

In (9), ε is a vector of errors for all the movie theatres in our sample, λ is the residual spatial autocorrelation coefficient, $\boldsymbol{W}$ is a symmetric MxM weighting matrix and η is an independently, normally distributed error term with constant variance. The weighting matrix captures the degree of correlation across observations, which we can take to be inversely related to the distance between theatres. A convenient measure of w_{ij} is zero when $i = j$ and the negative exponential of the distance between movie theatre i and movie theatre j when $i \neq j$, reflecting the idea that spatial autocorrelation should decline more than proportionately with distance.

[5] See Netz and Taylor (2002).

II Data Description

The current study examines the demand conditions in two major metropolitan markets: Boston and South Florida. The specific boundaries of these areas were established by Census Metropolitan and Surrounding Area (MSA) classifications. The estimated 2000 population of the Boston MSA was 5,927,382, with 2,269,608 households, and an average household income of $69,836. The population of the South Florida region was 4,726,491, with 1,841,057 households, and an average household income of $57,658. The South Florida region comprises the Fort Lauderdale, Miami, and West Palm Beach-Boca Raton MSAs. The Boston and South Florida markets were selected because of their similar population and household sizes, but regional demographic differences.

The two markets were also chosen because of similarities in their motion-pictures exhibition market characteristics, but apparent differences in evolutionary dynamics. By the end of 2000, the Boston and South Florida markets comprised 63 and 67 movie theatres, respectively. However, in 1996 the Boston market included only 59 theatres, whereas the South Florida market included 72 theatres (See Table 1).

Specifically, in the Boston market, between 1996 and 2000, five theatres closed and nine theatres opened, with the average number of screens per theatre increasing from 6.68 to 8.10, an increase of 21%. In the South Florida market, during the same time period, 18 theatres closed and 13 theatres opened, with the average number of screens per theatre increasing from 8.72 to 10.85, an increase of 23%. The population per screen during this time period decreased in Boston from 15,044 to 11,622, whereas the population per screen held steady at 6,770 in South Florida. In 2000, attendance per screen in Boston and South Florida was 40,754, and 38,063, respectively. In 1996, 14.4% of Boston screens had stadium seating, increasing to 36.6% in 2000. In 1996, 23.4% of South Florida screens had stadium seating, increasing to 53.9% in 2000. Thus, while similar in size, these two markets have experienced markedly different changes in exit and entry patterns and adoption of innovative theatre attributes.

III. Empirical Analysis

To estimate the demand function for movies, we begin with a straightforward demand specification. We propose that film attendance at theatre *i* is determined by a vector of theatre characteristics, which include the direct, indirect, market-share, and demographic effects described in the model developed above. In particular, attendance will be influenced by the number of screens at that theatre, the distance of the theatre to neighboring theatres, the seating and sound attributes of the theatre, and a variety of demographic characteristics of the market surrounding the theatre. The number of screens at a given theatre is a measure of product quality: the greater the number of screens the wider the variety of movies that are likely to be shown. The distance to neighboring theatres reflects the availability of substitutes and potential clustering effects. The physical features of the theatre potentially draw consumers to one theatre rather than another and demographic characteristics reflect consumer ability and willingness to pay to attend movies.

We expect attendance to increase with the number of screens and the distance to the nearest competing theatre. If a clustering or market-share effect exists among groups of theatres, we expect attendance to be inversely related to the distance to the second-closest theatre. Further, attendance should increase with income and population density as measured by number of households in the vicinity of a given theatre. The impact on demand of theatre characteristics such as stadium seating and digital sound is likely to be less straightforward. On the one hand, these features might increase demand overall by improving the quality of the movie-going experience. On the other hand, they might affect demand at a particular theatre because of that theatre's superior characteristics relative to its competitors.

A. Empirical Implementation.

We begin our empirical demand analysis with an ordinary least squares estimation of the tickets per screen sold by a theatre as a function of that theatre's attributes, or:

$$\boldsymbol{Q} = \boldsymbol{X}\beta + \varepsilon \qquad (10)$$

Demand is measured by the number of tickets sold per screen annually, with the observations presented in $\boldsymbol{Q}$, an $Nx1$ vector. Theatre attributes are contained in $\boldsymbol{X}$, an NxK vector. The vector ε contains error terms that we assume to be normally distributed and independent.

As a baseline, we estimate the following equation, checking first for the possible presence of heteroskedacticity in the error terms:

$$TIXPERSCREEN_i = B_0 + B_1SCREENS_i + B_2DISTANCE1_i + B_3DISTANCE2_i + B_4DISTANCE3_i + B_5HOUSEHOLDS_i + B_6MEAN\ AGEi + B_7MEAN\ INCOME_i + B_8ENTRY_i + B_9EXIT_i + \varepsilon_i \qquad (11)$$

The estimation uses data from both the Boston and South Florida markets in the year 2000. $TIXPERSCREEN_i$ measures the total number of tickets sold per screen at the *i*th theatre in 2000.[6] $SCREENS_i$ measures the number of screens available at a given theatre. The $DISTANCEJ_i$ variables capture the distance to the first-, second-, and third-closest movie theatre to the *i*th theatre. The present analysis focuses on the demand for movies at first-run, second-run, and arthouse theatres. We report results separately for cases in which distances are measured to theatres of the same type and to theatres of any type. $HOUSEHOLDS_i$, $MEAN\ AGE_i$, and $MEAN\ INCOME_i$, measure the number of households, the mean age, and mean income, respectively, within three-, five-, and ten-mile radii of the *i*th theatre, with these data drawn from the 2001 Census estimates.

$ENTRY_i$ and $EXIT_i$ are dummy variables that equal one if a theatre experienced an entry or an exit event, respectively, during 2000, and zero otherwise. An entry event is defined as a new theatre opening, or an existing theatre re-opening after a period of not operating. A theatre can re-open under new ownership or re-open following a renovation, or both. An exit event is defined as a theatre closing, either permanently or temporarily, due to an anticipated change of ownership or a renovation project. The purpose of including these two variables is to control for missing months of revenue data by identifying the events that would lead to a bias towards under-reported revenues.

Table 2 presents descriptive statistics for our sample and Table 3 presents the results of the estimation of (11). The Breusch-Pagan statistics indicate the presence of heteroskedasticity and the reported results correct for this.

We next extend our baseline analysis to test for the presence of spatially autocorrelated error terms. The model in this case can be written as:

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[6] The total number of tickets sold was determined by dividing a theatre's total annual revenues by the average ticket price in the corresponding market.

$$\boldsymbol{Q} = \boldsymbol{X}\beta + \varepsilon \qquad (12)$$

with

$$\varepsilon = \lambda \boldsymbol{W}\varepsilon + \eta \qquad (13)$$

Now the vector η contains normally distributed, independent error terms, and the scalar λ detects the presence of spatial autocorrelation, if any. Solving for ε yields:

$$\varepsilon = (\mathbf{I} - \lambda\, \boldsymbol{W})^{-1}\, \eta \qquad (14)$$

Thus, we re-estimate Equation 11 using maximum likelihood estimation, replacing the error term ε_i with the spatial autocorrelation correction in Equation 14.[7] The results of this estimation are presented in Table 4. Since the spatial autocorrelation coefficient λ does not differ significantly from zero, the results need not be corrected for spatially correlated errors. Thus we focus on the results presented in Table 3.

B. Empirical Results.

A particularly noteworthy result captured in the analysis of spatial demand relationships among theatres of the same type in Table 3 is that the distance to the closest theatre (*DISTANCE1*) has a significant and positive impact on attendance, while the distance to the second-closest theatre (*DISTANCE2*) has a significant and negative impact on attendance. The first result supports the hypothesis that the distance to the nearest theatre reflects the degree of substitutability of one theatre for the next: the further the next theatre from theatre *i*, the less substitutable attendance at the next theatre is for theatre *i*, and so the greater the attendance at theatre *i*. This is the usual demand effect that we

[7] We employ Luc Anselin's SpaceStat to estimate spatial effects. Our weights matrix uses the negative exponential of the distance between theatres i and j, with zeros along the diagonal. This weights matrix is

would expect, representative of the direct competition effect, or market-power effect, described in our theoretical model. The second result indicates that the closer the second-closest theatre of the same type is to theatre *i*, the *higher* theatre *i*'s attendance will be. This provides evidence of important clustering effects, reflective of the market-share effect described in the model.[8]

Neither the direct competition effect nor the market-share effect are significant when theatre *i*'s location is considered relative to any theatre type, suggesting that competitive and complementary demand effects occur among products with similar attributes but not across product groups. This suggests that grouping theatres into markets by classification (e.g., first-run, second-run) yields well-defined "nests".

The results in Table 3 also indicate that *SCREENS, HOUSEHOLDS,* and *MEAN INCOME,* are positive and significant at the .01 or .05 levels in all of the regressions. The number of screens impacts attendance even though the dependent variable, *TIXPERSCREEN*, measures per-screen rather than total theatre attendance. In other words, the *SCREENS* effect is capturing a factor influencing demand beyond the pure volume effect on revenues that a theatre with a larger number of screens should enjoy. Simply put, the result on *SCREENS* supports the hypothesis that movie attendance at a given theatre will increase if the theatre offers greater product variety. The demographic variables indicate that attendance increases with population density, a straightforward volume effect, and income, suggesting that movies are normal goods.

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then row-standardized such that the sum of the weights in each row equals 1, following the methodology presented in Netz and Taylor (2002).

C. The Clustering Effect and Regional Malls.

Since theatres are often located near regional malls, it is tempting to suggest that our distance parameters are acting as surrogates for the potentially positive impact on demand of nearness to a mall.[9] There are good reasons for rejecting this hypothesis in favor of the more direct hypothesis that, even given the competition and market-share effects, the presence of a mall should increase demand. In particular, the former hypothesis might be consistent with the sign on the *DISTANCE1* parameter but is not consistent with the sign on the *DISTANCE2* parameter.[10] Nevertheless, it is reasonable to check whether or not the impact of the distance parameters disappears once we account for the presence of a regional mall. To test this hypothesis, we construct a new variable, *MALL,* equal to one if a regional mall is within a 2-mile radius of a given theatre, and zero otherwise. We then repeat the tests in Table 3 adding *MALL* to each regression. The results are presented in Table 5.

We find that *MALL* does, indeed, have a positive influence on film attendance, but this is significant at the .10 level or better in only three out of six of the regressions. Moreover, controlling for the presence of malls has no impact on the sign or significance of the *DISTANCE1* and *DISTANCE2* parameters. Thus, while there might be a "mall effect" on demand, this should be seen as distinct and separate from the market-share and competition effects that we have identified.

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[8] Note that this interpretation implicitly treats the relevant market as radial in nature. See Ben-Akiva, De Palma, and Thisse (1989). Note also that, given the cross-sectional nature of our data for any given year, the theatre location choices can be taken as given in that year.

[9] We are grateful to William Klemperer and Jonathan Taylor for drawing this to our attention.

[10] The reasoning is that the greater the distance to the *n*th nearest neighbor the more likely is it that there will be a regional mall within the same distance.

D. Demand Over Time.

We now turn to estimating demand for the movie-going experience for each year from 1996 through 1999. In each case we repeat the core regression analysis of Equation 11.[11] In Table 6, we correct for heteroskedasticity. In Table 7, we control for possible spatial autocorrelation. Since the spatial autocorrelation coefficient does not differ significantly from zero in any of these regressions, we focus on the results presented in Table 6.

The results for 1999 have much in common with those for 2000. Movie attendance is positively related to the number of screens, households and income, and the distance parameters capturing the competition and market-share effects behave in much the same manner as in 2000. By contrast, over the 1996 through 1998 periods the only consistently significant predictors of demand are the numbers of households in the vicinity of the theatres, income levels, and whether or not a theatre experienced an entry event.

These results suggest that as the industry evolved during the late 1990s, the importance of the competition and market-share effects and of product variety (as measured by the number of screens) increased over time. One possible explanation for this change in demand behavior can be found from careful examination of Table 1, documenting industry capacity changes during the period of study. The general trend in both the Boston and South Florida markets was towards an increase in the number of screens at a given theatre and a general rise in the proportion of megaplex theatres. As a result, when a consumer chose to go to the movies in the later part of our study period,

[11] Note that *MALL* is excluded from the analysis, since mall location data were available for only 2000. More generally, we think that this year-by-year approach is more appropriate than constructing a matched panel for the complete period, since our demographic data are drawn from Census data covering a single year.

she was consuming a product with arguably superior physical and quality attributes than in the earlier part of the period. Now a visit to the movies involves a choice of a film from among a much wider range of product offerings in a more custom-designed space. The rise in the importance of the number of screens can thus be explained by these industry-wide changes in the characteristics of the product on offer.

Moreover, we would argue that the same industry evolution led to a strengthening of both the competition and market-share effects in the later years of our study. An increase in the average number of screens per theatre has two effects. First, we should see increased overlap in the films being shown at neighboring theatres, strengthening the competition effect.[12] Second, the size, as measured by screens, of any three-theatre cluster also increases, increasing the critical mass of products (movies) being offered by any group of theatres and so increasing the attractiveness of each cluster, strengthening the market-share effect.

E. Relative Product Characteristics.

We next extend our analysis to consider how demand for movie attendance is affected by the specific product characteristics of individual theatres. In doing so we focus our attention on the sound features and on the type of seating of the individual theatres. As we noted above, these characteristics can be expected to affect demand in one of two ways. First, there is a direct effect through an overall increase in product quality. Second, there is a comparative effect determined by the presence or absence of a particular characteristic *relative* to a theatre's competitors.

[12] Analysis of weekly film schedules for a sample of first-run theatres in the Boston area in 2000 shows that there is considerable overlap in the film schedules of neighboring first-run theatres.

We test for the first, direct effect by introducing the dummy variables *DIGITAL, DOLBY,* and *STADIUM,* which equal one if a theatre offers digital sound, Dolby sound, and stadium seating, respectively, and zero otherwise. To test for the second, comparative effect we introduce the attribute comparison variables *DIGITAL COMPARISON, DOLBY COMPARISON,* and *STADIUM COMPARISON.* Consider, for example, *DIGITAL COMPARISON.* A given theatre's sound attributes are compared to its closest neighbor's. If this theatre offers digital sound and its neighbor does not, the comparison variable equals 1, reflecting a potentially positive competitive advantage of offering a product feature when the nearest competitor does not do the same. If both theatres offer digital sound or if neither offers digital sound, the comparison variable equals 0, reflecting neither a competitive advantage nor disadvantage with regards to the digital sound attribute. And if a given theatre does not offer digital sound when its nearest neighbor does so, the comparison variable equals -1, capturing the potential relative disadvantage the given theatre experiences with regards to the digital sound attribute. The definitions are analogous for *DOLBY COMPARISON* and *STADIUM COMPARISON.*

We begin by repeating the core estimation of Equation 11 and exploring the impact of the presence of digital sound on attendance.[13] The results for 1999 and 2000, comparing a theatre's attributes to the nearest neighbor of any type, are presented in Table 8.[14] In 1999, the direct and comparative effects of digital sound on movie attendance

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[13] We do not examine digital sound and stadium seating simultaneously, since we anticipate possible multicollinearity between *DIGITAL* and *STADIUM.* Both product attributes are relatively new innovations and quite often appear simultaneously at a given theatre. Similarly, *ENTRY, EXIT,* and *MALL* were excluded from the regressions due to possible multicollinearity with the attributes dummy variables.

[14] We limit our analysis to 1999 and 2000 since theatres closed or were renovated during our period of study and previous theatrical attributes cannot be confirmed.

were both positive and significant. By contrast, in 2000 only the direct effect of digital sound was significant, the comparative effect had essentially disappeared. While these results reflect only two years of industrial evolution, they provide a provocative snapshot of the strategic importance of competitive adoption of a new technology. Digital sound not only improves the overall quality of the movie-going experience, it also offers theatres a competitive edge. As the innovation becomes more widely adopted, the strategic importance of the new technology diminishes, with only the general demand-enhancing effects of the attribute remaining.

This interpretation is supported by our analysis of Dolby sound. When the results in Table 8 were repeated using Dolby sound variables, neither *DOLBY* nor *DOLBY COMPARISON* was significant in either year. Since the Dolby stereo technology was introduced in the mid-1970s, it is reasonable that any competitive advantage based on this attribute would have been fully realized by the late 1990s. Indeed, it is reasonable to suggest that as the industry evolves, the presence of an older technology such as Dolby sound might actually have a negative impact on attendance, since its presence serves as a signal to consumers of a generally lower-quality and outdated theatre-going experience. In fact, while statistically insignificant, the sign on *DOLBY* was negative in 1999 and the sign on *DOLBY COMPARISON* was negative in both 1999 and 2000.

A slightly different pattern emerges when we replace digital sound with stadium seating in the analysis. *STADIUM COMPARISON* was positive and significant in 1999 while *STADIUM* was statistically insignificant. In 2000, neither stadium seating measure was significant. The suggestion in this case is that, although seating type has little impact on overall demand, theatres have a strategic motivation to incur the expense of installing stadium seating, a typical prisoners' dilemma outcome.

When the regressions in Table 8 are repeated changing the attribute comparisons to the nearest neighbor of the same type, instead of any type, the *DIGITAL* dummy remains positive and significant but all other dummies are insignificant. This suggests that the advanced sound characteristics of movie theatres are, indeed, valued by consumers more than, for example, seating attributes. There is the further suggestion that product attributes matter *across* different products (i.e., across theatre type), whereas our earlier analysis of spatial characteristics demonstrated their importance *within* product classes (i.e., among same theatre types, but not across theatre types).

F. Extended Demographic Analysis.

The significance of broadly defined demographics found throughout our analyses suggests the merit of careful attention to the demographic characteristics that drive movie theatre attendance. Table 9 presents estimation results of the core estimations of Equation 11, replacing the average measures of income and age with percentages of the population falling within various income and age classifications. We do not correct for spatial autocorrelation in this analysis since earlier results indicated that the extent of spatial correlation is not statistically significant. Further, we add a variable to control for gender, and we introduce median property values as an alternative measure for the wealth of the population. In the reported regressions all demographics are measured within a 5-mile radius of each theatre.

When *MEAN INCOME* is replaced by the percentage of the population whose income is above a particular threshold ($35,000, $75,000, and $100,000), we uncover a more detailed picture of how income influences film attendance. As the percentage of the population increases in any one of these three income classifications, movie attendance is positively and significantly impacted at the .01 significance level, as shown in Regressions II, III, and IV. These results together provide evidence that movies are normal goods throughout the income distribution.

The conventional industry claim that young male viewers drive the demand for movies is not supported by our data. Neither the age distribution nor the percentage of population that is male is a statistically significant predictor of movie attendance. These results, combined with our earlier analysis, suggest that while population size (as measured by number of households) and income are significant factors in determining movie attendance, spatial and product attributes influence the demand for movies more than age and gender demographics.

IV. Conclusion

In order to understand important industrial economic decisions, such as product design, location choice, and degree of product differentiation, we must identify the theoretical and empirical determinants of demand. This study of the motion-pictures theatrical market examines a prominent U.S. industry and extensively documents its demand foundations. It develops insights into several fundamental questions relevant to consumer choice in the face of significant spatial and physical product differentiation.

Our empirical analysis is based on a two-stage model of consumer choice motivated by developments in modern economic geography that explicitly incorporate product differentiation and demand heterogeneity. The resulting estimates present evidence that both competition and market-share effects are important influences on demand at a particular movie theatre. Our data further suggest that demand is affected by relative physical attributes: in the movie theatre case, by the type of sound system and the quality of seating offered by competing theatres. Our analysis provides additional evidence that the adoption of new technologies depends on the demonstrated impact of innovation on demand. Finally, our demographic analysis demonstrates support for some, but not all, industry priors on the empirical determinants of demand. In particular, while movie attendance appears to be a normal good at all income levels, we find no evidence that the proportion of young males within a particular market significantly impacts demand.

Our study points to promising new avenues for future research. First, our analysis can be extended to wider markets within the motion-pictures industry and to other industries characterized by significant spatial and physical product differentiation, including the airlines industry, the fast-food industry, and hospitality services. Second, our estimations of demand can serve as a basis for explicitly modeling location choice. Finally, our results suggest that further study of differentiation within the motion-pictures theatrical market in the form of film-programming choice will enhance our understanding of how relative and absolute product attributes influence consumer choice.

Table 1: Descriptive Statistics by Metropolitan Market

	Boston Metro. and Surrounding Area					South Florida Metro. and Surrounding Area				
Variable	1996	1997	1998	1999	2000	1996	1997	1998	1999	2000
Total Number of Theatres	59	61	63	63	63	72	74	77	75	67
Total Number of Screens	394	443	481	484	510	628	649	739	753	727
Number of Megaplex Theatres	13	16	19	19	21	15	16	22	25	28
Number of Megaplex Screens	180	221	271	271	304	244	260	371	431	489
Number of Stadium Theatres	4	7	10	11	13	9	10	15	18	21
Number of Stadium Screens	57	98	148	154	187	147	163	274	334	392
Number of New Theatres Added	3	4	7	1	2	2	2	5	3	3
Number of New Screens Added	19	46	66	6	33	32	21	111	60	58
Number of New Megaplex Theatres	0	3	3	0	2	2	1	6	3	3
Number of New Megaplex Screens	0	41	50	0	33	32	16	111	60	58
Number of New Stadium Theatres	1	3	3	1	2	1	1	5	3	3
Number of New Stadium Screens	7	41	50	6	33	18	16	111	60	58

Table 2: Descriptive Statistics by Year for All Open Theatres Reporting Revenues to E.D.I.

	1996		1997		1998		1999		2000	
Variable	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
TIX PER SCREEN	.039	.022	.040	.024	.039	.030	.036	.024	.034	.022
SCREENS	8.43	4.30	8.75	4.34	9.92	5.13	10.09	5.46	10.47	5.79
REAL REVENUE	1.18	0.90	1.26	0.96	1.32	1.04	1.38	1.36	1.36	1.41
DISTANCE1	3.73	3.30	3.68	3.11	3.49	3.52	3.63	3.53	3.55	3.56
DISTANCE2	6.31	4.39	6.16	4.15	6.09	4.52	6.31	4.96	6.24	4.70
DISTANCE3	8.37	6.72	8.17	6.58	7.91	6.45	8.21	7.97	8.14	6.84
STADIUM							0.25	0.43	0.31	0.46
DOLBY							0.08	0.27	0.07	0.25
DIGITAL							0.47	0.50	0.53	0.50
THEATRES	N=107		N=108		N=115		N=118		N=116	

Tickets per screen are measured in millions of tickets per screen.
Real revenue is measured in millions of 1982-84 dollars.
Distances measure the distance to the first-, second-, and third-closest theatre of the same type.
Stadium, Dolby, and Digital are dummies equal to 1 if a theatre has an attribute; 0 otherwise. Because theatres closed or were renovated during the earlier period of our period of study, reliable attributes data are from 1999 and 2000.

Table 3: Ordinary Least Squares Estimation of 2000 Linear Demand for Movies
Demographics from 3-Mile, 5-Mile, and 10-Mile Radii for Each Theatre

	Three Closest Theatres of Same Type			Three Closest Theatres of Any Type		
Variable	3-Mile Demo.	5-Mile Demo.	10-Mile Demo.	3-Mile Demo.	5-Mile Demo.	10-Mile Demo.
CONSTANT	-0.35269E-03 (-0.220)	0.12920E-01 (0.839)	0.14075E-01 (0.666)	-0.11354E-01 (-0.613)	0.75789E-02 (0.417)	0.12186E-01 (0.514)
SCREENS	0.23711E-02 (8.076)***	0.24386E-02 (8.091)***	0.23710E-02 (7.799)***	0.24685E-02 (8.466)***	0.25353E-02 (8.229)***	0.24992E-02 (7.995)***
DISTANCE1	0.12871E-02 (2.752)***	0.14071E-02 (3.040)***	0.13298E-02 (2.902)***	0.14393E-02 (1.320)	0.15989E-02 (1.406)	0.13278E-02 (1.188)
DISTANCE2	-0.12934E-02 (-2.799)***	-0.15624E-02 (-3.327)***	-0.16866E-02 (-3.427)***	0.10303E-02 (0.805)	0.64306E-03 (0.499)	0.40752E-03 (0.290)
DISTANCE3	-0.20978E-04 (-0.100)	0.56991E-04 (0.269)	0.87501E-04 (0.386)	-0.15226E-02 (-1.427)	-0.15684E-02 (-1.436)	-0.16337E-02 (-1.464)
HOUSEHOLDS	0.13625E-06 (3.008)***	0.64238E-07 (3.042)***	0.25261E-07 (2.544)**	0.15179E-06 (2.732)***	0.65530E-07 (2.349)**	0.24866E-07 (1.862)*
MEAN INCOME	0.27731E-06 (3.694)***	0.28755E-06 (4.018)***	0.38586E-06 (4.212)***	0.28899E-06 (3.741)***	0.28441E-06 (3.894)***	0.37134E-06 (4.041)***
MEAN AGE	-0.28553E-03 (-0.950)	-0.66005E-03 (-2.047)**	-0.85085E-03 (-1.784)*	-0.15958E-03 (-0.478)	-0.61033E-03 (-1.655)	-0.83986E-03 (-1.610)
ENTRY	-0.24938E-01 (-3.952)***	-0.23731E-01 (-3.638)***	-0.22791E-01 (-3.553)***	-0.24204E-01 (-3.772)***	-0.23091E-01 (-3.378)***	-0.22361E-01 (-3.323)***
EXIT	-0.12426E-02 (-0.338)	-0.84412E-03 (-0.233)	0.32005E-03 (0.082)	-0.20158E-03 (-0.055)	0.52828E-03 (0.142)	0.17388E-02 (0.425)
R^2	0.48003	0.48083	0.46674	0.46390	0.45779	0.44333
Breusch-Pagan	16.9506	17.7015	17.0170	14.1038	15.4667	13.1003

Dependent variable is tickets per screen sold in 2000. Significance levels *.10, **.05, ***.01; t-ratios in parentheses. Sample size is 116. Results corrected for heteroskedacticity.

Table 4: Maximum Likelihood Estimation of 2000 Linear Demand for Movies
Controlling for Spatial Autocorrelation
Demographics from 3-Mile, 5-Mile, and 10-Mile Radii for Each Theatre

	Three Closest Theatres of Same Type			Three Closest Theatres of Any Type		
Variable	3-Mile Demo.	5-Mile Demo.	10-Mile Demo.	3-Mile Demo.	5-Mile Demo.	10-Mile Demo.
CONSTANT	-0.551339E-03 (-0.030)	0.127023E-01 (0.654)	0.145374E-01 (0.531)	-0.105611E-01 (-0.525)	0.804016E-02 (0.370)	0.12309E-01 (0.402)
SCREENS	0.236404E-02 (8.128)***	0.243334E-02 (8.296)***	0.237722E-02 (8.048)***	0.245308E-02 (8.552)***	0.252375E-02 (8.605)***	0.250555E-02 (8.343)***
DISTANCE1	0.130172E-02 (1.978)*	0.142105E-02 (2.163)**	0.132253E-02 (1.981)*	0.152905E-02 (1.240)	0.16747E-02 (1.340)	0.131049E-02 (1.022)
DISTANCE2	-0.12777E-02 (-1.879)*	-0.155017E-02 (-2.282)**	-0.16918E-02 (-2.351)**	0.948551E-03 (0.622)	0.57153E-03 (0.371)	0.425274E-03 (0.268)
DISTANCE3	-2.91578E-05 (-0.074)	4.921E-05 (0.126)	9.17468E-05 (0.232)	-0.150598E-02 (-1.320)	-0.154703E-02 (-1.333)	-0.164293E-02 (-1.341)
HOUSEHOLDS	1.36424E-07 (3.612)***	6.42482E-08 (3.483)***	2.51005E-08 (2.374)**	1.50292E-07 (3.435)***	6.51215E-08 (2.897)***	2.47575E-08 (1.851)*
MEAN INCOME	2.79495E-07 (3.259)***	2.88318E-07 (3.326)***	3.8495E-07 (3.452)***	2.90785E-07 (3.364)***	2.85345E-07 (3.214)***	3.70918E-07 (3.235)***
MEAN AGE	-0.283661E-03 (-0.805)	-0.655324E-03 (-1.550)	-0.861314E-03 (-1.437)	-0.173974E-03 (-0.461)	-0.618283E-03 (-1.338)	-0.842974E-03 (-1.281)
ENTRY	-0.249672E-01 (-3.918)***	-0.237004E-01 (-3.741)***	-0.22848E-01 (-3.601)***	-0.241886E-01 (-3.706)***	-0.230042E-01 (-3.520)***	-0.224098E-01 (-3.429)***
EXIT	-0.167721E-02 (-0.312)	-0.117946E-02 (-0.221)	0.495402E-03 (0.090)	-0.624697E-03 (-0.116)	0.215524E-03 (0.040)	0.182675E-02 (0.326)
λ	-0.32332E-01 (-0.383)	-0.262711E-01 (-0.312)	0.145459E-01 (0.173)	-0.398005E-01 (-0.472)	-0.324121E-01 (-0.384)	0.941945E-02 (0.112)
R^2	0.4805	0.4806	0.4669	0.4633	0.4565	0.4439

Dependent variable is tickets per screen sold in 2000. λ is spatial autocorrelation coefficient.
Significance levels *.10, **.05, ***.01; z-values in parentheses. Sample size is 116.

Table 5: Ordinary Least Squares Estimation of 2000 Linear Demand for Movies
Controlling for Proximity to Regional Malls
Demographics from 3-Mile, 5-Mile, and 10-Mile Radii for Each Theatre

	Three Closest Theatres of Same Type			Three Closest Theatres of Any Type		
Variable	3-Mile Demo.	5-Mile Demo.	10-Mile Demo.	3-Mile Demo.	5-Mile Demo.	10-Mile Demo.
CONSTANT	-0.29820E-02 (-0.186)	0.91356E-02 (0.600)	0.13818E-01 (0.672)	-0.15192E-01 (-0.832)	0.19277E-02 (0.108)	0.10661E-01 (0.457)
SCREENS	0.23532E-02 (7.942)***	0.24270E-02 (7.901)***	0.23711E-02 (7.662)***	0.24363E-02 (8.165)***	0.25071E-02 (7.853)***	0.24833E-02 (7.665)***
DISTANCE1	0.12797E-02 (2.798)***	0.14045E-02 (3.138)***	0.13416E-02 (3.045)***	0.14882E-02 (1.392)	0.16696E-02 (1.509)	0.14374E-02 (1.352)
DISTANCE2	-0.11763E-02 (-2.443)**	-0.14134E-02 (-2.897)***	-0.15131E-02 (-2.980)***	0.12479E-02 (1.000)	0.89649E-03 (0.717)	0.62353E-03 (0.458)
DISTANCE3	-0.62855E-04 (-0.304)	0.37730E-05 (0.018)	0.20019E-04 (0.096)	-0.16053E-02 (-1.520)	-0.16444E-02 (-1.518)	-0.17009E-02 (-1.526)
HOUSEHOLDS	0.13120E-06 (2.950)***	0.62469E-07 (3.047)***	0.24651E-07 (2.559)**	0.14635E-06 (2.656)**	0.64479E-07 (2.359)**	0.24377E-07 (1.854)*
MEAN INCOME	0.27949E-06 (3.765)***	0.29595E-06 (4.359)***	0.39714E-06 (4.524)***	0.29146E-06 (3.827)***	0.29382E-06 (4.281)***	0.38371E-06 (4.375)***
MEAN AGE	-0.25962E-03 (-0.864)	-0.63156E-03 (-1.999)*	-0.93474E-03 (-2.043)**	-0.11505E-03 (-0.351)	-0.55274E-03 (-1.537)	-0.90285E-03 (-1.794)*
ENTRY	-0.25532E-01 (-4.103)***	-0.24564E-01 (-3.881)***	-0.23998E-01 (-3.925)***	-0.24845E-01 (-4.024)***	-0.24010E-01 (-3.713)***	-0.23590E-01 (-3.752)***
EXIT	-0.13944E-02 (-0.377)	-0.85695E-03 (-0.238)	0.81062E-03 (0.208)	-0.62654E-03 (-0.172)	0.23181E-03 (0.064)	0.19286E-02 (0.483)
MALL	0.38994E-02 (1.228)	0.48525E-02 (1.544)	0.60561E-02 (1.911)*	0.49794E-02 (1.584)	0.59477E-02 (1.896)*	0.68499E-02 (2.156)**
R^2	0.48685	0.49147	0.48335	0.47510	0.47388	0.46478
Breusch-Pagan	18.4726	19.7772	18.0305	16.4394	18.2956	16.1161

Dependent variable is tickets per screen sold in 2000. Significance levels *.10, **.05, ***.01; t-ratios in parentheses. Sample size is 116. Results corrected for heteroskedacticity. The mall variable equals 1 if a regional mall is located within a 2-mile radius of a given theatre, and 0 otherwise.

Table 6: Ordinary Least Squares Estimation of Linear Demand for Movies: 1996-1999

Variable	1996	1997	1998	1999
CONSTANT	0.68146E-01 (3.223)***	0.40406E-01 (1.826)*	0.58739E-01 (2.392)**	0.12762E-01 (0.805)
SCREENS	0.37492E-03 (0.846)	0.78820E-03 (1.843)*	0.74762E-03 (1.444)	0.21675E-02 (6.400)***
DISTANCE1	-0.39729E-04 (-0.056)	0.59083E-03 (0.575)	0.34556E-03 (0.396)	0.90141E-03 (1.747)*
DISTANCE2	-0.14174E-02 (-1.591)	-0.19030E-02 (-1.639)	-0.10876E-02 (-0.961)	-0.17056E-02 (-2.080)**
DISTANCE3	0.25869E-03 (0.602)	0.32911E-03 (0.584)	-0.23374E-03 (-0.339)	0.51851E-03 (1.318)
HOUSEHOLDS	0.62044E-07 (1.933)*	0.74224E-07 (2.154)**	0.77739E-07 (1.490)	0.90903E-07 (2.763)***
MEAN INCOME	0.12723E-06 (1.466)	0.23807E-06 (2.562)**	0.23767E-06 (2.349)**	0.40406E-06 (5.018)***
MEAN AGE	-0.10128E-02 (-2.434)**	-0.62330E-03 (-1.314)	-0.11001E-02 (-1.987)*	-0.81627E-03 (-2.414)**
ENTRY	-0.29856E-01 (-5.636)***	-0.23958E-01 (-3.530)***	-0.16361E-01 (-2.210)**	-0.91137E-02 (-1.148)
EXIT	-0.50601E-01 (-5.873)***	0.53599E-02 (0.429)	-0.49427E-02 (-0.530)	-0.24015E-01 (-9.271)***
Sample Size	107	108	115	118
R^2	0.30352	0.22474	0.17096	0.42573
Breusch-Pagan	25.7184	49.4339	164.8558	57.2118

Dependent variable is tickets per screen sold in each year.
Demographics are from 5-mile radii around each theatre.
Distances are to three closest theatres of same type.
Significance levels *.10, **.05, ***.01; t-ratios in parentheses.
Results corrected for heteroskedacticity.

Table 7: Maximum Likelihood Estimation of Linear Demand for Movies: 1996-1999
Controlling for Spatial Autocorrelation

Variable	1996	1997	1998	1999
CONSTANT	0.678824E-01 (3.048)***	0.44341E-01 (1.484)	0.573425E-01 (1.622)	0.123547E-01 (0.552)
SCREENS	0.380611E-03 (0.884)	0.772796E-03 (1.565)	0.799467E-03 (1.259)	0.216264E-02 (6.226)***
DISTANCE1	-0.134921E-03 (-0.165)	0.704093E-03 (0.633)	0.285577E-03 (0.265)	0.920663E-03 (1.322)
DISTANCE2	-0.14173E-02 (-1.465)	-0.190589E-02 (-1.610)	-0.104813E-02 (-0.810)	-0.165532E-02 (-1.897)*
DISTANCE3	0.287412E-03 (0.568)	0.299957E-03 (0.504)	-0.191601E-03 (-0.252)	0.495831E-03 (1.103)
HOUSEHOLDS	6.18251E-08 (2.768)***	7.22949E-08 (2.749)***	7.97085E-08 (2.564)**	9.15249E-08 (4.313)***
MEAN INCOME	1.30713E-07 (1.322)	2.17799E-07 (1.750)*	2.42799E-07 (1.618)	4.08893E-07 (4.229)***
MEAN AGE	-0.100853E-02 (-2.151)**	-0.681422E-03 (-1.061)	-0.110071E-02 (-1.474)	-0.819413E-03 (-1.760)*
ENTRY	-0.308776E-01 (-3.135)***	-0.226848E-01 (-2.153)**	-0.16133E-01 (-1.607)	-0.897178E-02 (-0.901)
EXIT	-0.497707E-01 (-2.632)**	0.458503E-02 (0.347)	-0.551189E-02 (-0.569)	-0.238924E-01 (-3.279)***
λ	-0.354408E-01 (-0.408)	0.799309E-01 (0.933)	-0.408265E-01 (-0.486)	-0.288763E-01 (-0.342)
Sample Size	107	108	115	118
R^2	0.3104	0.2122	0.1717	0.4245

Dependent variable is tickets per screen sold in each year.
Demographics are from 5-mile radii around each theatre.
Distances are to three closest theatres of same type.
λ is spatial autocorrelation coefficient.
Significance levels *.10, **.05, ***.01; z-values in parentheses.

Table 8: Ordinary Least Squares Estimation of 1999 and 2000 Linear Demand for Movies with Theatre Sound Attributes

Variable	1999		2000	
CONSTANT	-0.55953E-02 (-0.312)	0.12791E-02 (0.070)	0.86990E-02 (0.469)	0.13582E-01 (0.707)
SCREENS	0.15943E-02 (4.109)***	0.19223E-02 (5.677)***	0.18948E-02 (4.662)***	0.22215E-02 (6.030)***
DISTANCE1	-0.21840E-02 (-1.600)	-0.22536E-02 (-1.641)	0.19545E-02 (1.578)	0.19492E-02 (1.584)
DISTANCE2	0.24153E-02 (1.879)*	0.20029E-02 (1.496)	0.13210E-02 (0.801)	0.10077E-02 (0.590)
DISTANCE3	-0.62126E-03 (-0.558)	-0.61542E-03 (-0.518)	-0.21306E-02 (-1.660)	-0.20801E-02 (-1.567)
HOUSEHOLDS	0.11566E-06 (2.844)***	0.10406E-06 (2.596)**	0.61566E-07 (2.130)**	0.54832E-07 (1.916)*
MEAN INCOME	0.39904E-06 (4.847)***	0.39605E-06 (4.722)***	0.29811E-06 (4.130)***	0.29470E-06 (4.045)***
MEAN AGE	-0.55097E-03 (-1.545)	-0.61729E-03 (-1.691)*	-0.63814E-03 (-1.714)*	-0.69790E-03 (-1.794)*
DIGITAL	0.99665E-02 (2.461)**		0.77951E-02 (2.205)**	
DIGITAL COMPARISON		0.44211E-02 (1.743)*		0.24540E-02 (1.051)
R^2	0.38167	0.36960	0.41293	0.39961
Breusch-Pagan	55.0651	52.4798	23.3720	19.9363

Dependent variable is tickets per screen sold in each year.
Demographics are from 5-mile radii around each theatre.
Distances are to three closest theatres of any type.
Digital comparison variable equals 1 if a given theatre has the digital sound attribute but its nearest neighbor does not; 0 if both theatres either have the digital sound attribute or do not have the attribute; and -1 if a given theatre does not have the digital sound attribute but its nearest neighbor does.
Significance levels *.10, **.05, ***.01; t-ratios in parentheses.
Sample size is 118 and 116 for 1999 and 2000, respectively.
Results corrected for heteroskedacticity.

Table 9: Ordinary Least Squares Estimation of 2000 Linear Demand for Movies
Extended Demographic Analysis

Variable	(I)	(II)	(III)	(IV)	(V)
CONSTANT	-0.31150E-01 (-0.306)	-0.33226E-01 (-0.321)	-0.17314E-01 (-0.165)	-0.75006E-02 (-0.070)	-0.47699E-01 (-0.443)
SCREENS	0.24278E-02 (7.837)***	0.24199E-02 (7.790)***	0.24702E-02 (7.957)***	0.24688E-02 (7.953)***	0.24141E-02 (7.603)***
DISTANCE1	0.13504E-02 (3.013)***	0.13572E-02 (3.035)***	0.13014E-02 (2.920)***	0.13052E-02 (2.907)***	0.13429E-02 (2.868)***
DISTANCE2	-0.16674E-02 (-3.338)***	-0.16587E-02 (-3.337)***	-0.15201E-02 (-3.053)***	-0.14235E-02 (-2.838)***	-0.14738E-02 (-2.822)***
DISTANCE3	0.13511E-03 (0.666)	0.13297E-03 (0.657)	0.67668E-04 (0.319)	0.20155E-04 (0.092)	0.16648E-04 (0.072)
HOUSEHOLDS	0.60990E-07 (2.768)***	0.65070E-07 (3.063)***	0.62471E-07 (2.951)***	0.61147E-07 (2.902)***	0.44426E-07 (2.095)**
%INCOME 35,000+	0.43966E-03 (3.438)***	0.46167E-03 (3.701)***			
%INCOME 75,000+			0.48915E-03 (4.482)***		
%INCOME 100,000+				0.59905E-03 (4.455)***	
%AGE10 TO 24	0.41627E-03 (0.917)				
%AGE25-		0.22685E-03 (0.727)	0.27430E-03 (0.859)	0.42097E-03 (1.300)	0.23519E-03 (0.661)
%MALE	0.28571E-04 (0.013)	0.45588E-04 (0.020)	-0.24873E-04 (-0.011)	-0.24169E-03 (-0.106)	0.72491E-03 (0.316)
MEDIAN PROPERTY VALUE					0.93595E-07 (3.102)***
ENTRY	0.41035E-02 (1.285)	0.40595E-02 (1.268)	0.50675E-02 (1.622)	0.51585E-02 (1.645)	0.53783E-02 (1.676)*
EXIT	-0.24839E-01 (-3.955)***	-0.24867E-01 (-3.960)***	-0.24658E-01 (-4.114)***	-0.24843E-01 (-4.081)***	-0.24532E-01 (-4.088)***
MALL	-0.57138E-03 (-0.151)	-0.75851E-03 (-0.200)	0.32282E-03 (0.087)	0.18953E-03 (0.051)	0.58302E-04 (0.015)
R^2	0.48805	0.48754	0.49889	0.49540	0.47338
Breusch-Pagan	21.4373	21.4242	20.7701	19.9757	20.4204

Dependent variable is tickets per screen sold in 2000. Sample size is 116. Distances are to three closest theatres of same type. Demographics are from 5-mile radii around each theatre.
Significance levels *.10, **.05, ***.01; t-ratios in parentheses. Results corrected for heteroskedacticity.

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