NBA Expansion and Relocation: A Viability Study of Various Cities

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2004

EXAMINING THE VIABILITY OF VARIOUS CITIES FOR NBA EXPANSION OR RELOCATION

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Abstract – An examination of possible expansion or relocation sites for the NBA is undertaken using a two-equation system requiring two-stage probit least squares (2SPLS) to estimate. The Location Model forecasts the best cities for an NBA team based on the underlying characteristics of current NBA teams. The results suggest that Louisville, San Diego, Baltimore, St. Louis, and Norfolk appear to be the most promising candidates for relocation or expansion.

Introduction & Literature Review

Regardless of the state of the economy, many cities continue their pursuit to entice big league sports franchises to locate within their metropolitan area. For instance, Louisville has been trying to lure a National Basketball Association (NBA) franchise to its city for more than seven years. More recently, New Orleans was successful in attracting the former Charlotte Hornets to move into a new arena in the city.[1] Both Northern Virginia and Washington D.C. are currently looking to house a Major League Baseball (MLB) team. Moreover, Paul Allen was interested in bringing a National Hockey League (NHL) or MLB team to the city of Portland in an effort to provide content for his regional sports network.

Since professional basketball began in the United States in 1946 with eleven teams, three of which are still in existence, some teams have gone out of business while others have moved to different cities and have changed names.[2] Instances of relocation, however, are infrequent. Some of the recent team relocations include the Golden State Warriors move from San Francisco to Oakland (1971); the Rockets move from San Diego to Houston (1971); the Wizards move to Washington in 1974 (renamed the Wizards in 1997 from the Washington Bullets); the Nets move to New Jersey (East Rutherford) from New York (1977); the Jazz move from New Orleans to Salt Lake City (1979); the Clippers move to Los Angeles from San Diego (1984); and the Kings move to Sacramento from Kansas City

[1] The third time was a charm for New Orleans. Twice before the city attempted to land an NBA team since losing the Jazz to Utah in 1979. The NBA blocked an attempt to bring the Minnesota Timberwolves to New Orleans in 1994, and the city made a major effort in 2000 to land the Vancouver Grizzlies, who instead moved to Memphis.

[2] The original teams include the Boston Celtics, Chicago Stags, Cleveland Rebels, Detroit Falcons, New York Knickerbockers, Philadelphia Warriors, Pittsburgh Ironmen, Providence Steamrollers, St. Louis Bombers, Toronto Huskies, and the Washington Capitols. Teams still in existence include the Boston Celtics, New York Knicks, and the Golden State Warriors (by way of Philadelphia and San Francisco).

(1985).[3] The Vancouver Grizzlies move in 2001 to Memphis (over cities such as Louisville, St. Louis, and New Orleans) and the aforementioned Hornets move to New Orleans are the most recent relocations.

One key impetus for relocation is to increase arena-related team revenues. Some owners argue that the increased revenues from a new arena will put a franchise in a better position to bid for quality players, resulting in a better team, drawing more fans, resulting in more revenues and so on. The type of sports facility and lease arrangements are as important as the quality of the market in an owner's location decision.

For instance, in the NFL a few teams have recently relocated to smaller markets in order to play in a new stadium with a "sweetheart" lease agreement, in which the teams are offered more favorable stadium deals in order to entice them to relocate. In 1995, the Raiders moved from Los Angeles (the second largest market in the Country) back to Oakland and the Rams moved from Los Angeles to St. Louis. In 1996, the Browns moved to Baltimore to become the Ravens, while the Oilers moved to Tennessee from Houston (becoming the Titans) the following year.[4] In each of these cases the new market was smaller (in terms of population) than the former market. Moreover, the Hornets move from Charlotte to New Orleans was primarily due to a more appealing facility agreement with

[3] The American Basketball Association (ABA) existed for nine full seasons from 1967 to 1976. During that time, the ABA competed with the established NBA for players, fans, and media attention. In June 1976, the two rival professional leagues merged, with the four strongest ABA teams (the New York Nets, Denver Nuggets, Indiana Pacers, and San Antonio Spurs) joining the NBA. The other remaining ABA teams vanished, along with the ABA itself.

[4] The Oilers moved to Memphis, Tennessee in 1997 from Houston, as the Tennessee Oilers, but did not change their name to the Titans until the move from Memphis to Nashville in 1999. The NFL then expanded back into Cleveland in September 1998, forming the Cleveland Browns, and into Houston, whose expansion franchise commenced play in 2002 as the Houston Texans.

New Orleans for a state-of-the-art facility, however, the relocation placed the team in a smaller media market and a less affluent city.[5]

Team relocations, and the threat thereof, have commensurately increased the value of major league clubs. The Oakland A's and Montreal Expos (MLB), the Minnesota Vikings (NFL), and numerous NHL franchises are also considering new locations. This is primarily due to the fact that the four major sports leagues control the supply of teams, the placement of franchises, and the number of teams that are permitted to locate in any market. In spite of demand, the leagues are reluctant to increase the rate of creating expansion teams. In fact, since the NFL and AFL merged in 1966, the NFL has added only seven other teams, even though several markets desire franchises.[6]

Which cities should teams choose when considering their ideal locale? The choice of a city depends on at least three major factors: the owner's personal preference, the political climate, and the economics of the location. While many team owners are profit-maximizers and make decisions accordingly, some owners may be more personally motivated, perhaps choosing to move a team to a city because it is where they live. For instance, Georgia Frontiere, owner of the St. Louis Rams, moved the team from Los Angeles to her hometown of St. Louis, Missouri. Similarly, the Minnesota Vikings are considering a

[5] The agreement is for a 10-year lease, with the team paying $2 million annual rent and receiving all the revenue from premium seating, advertising, naming rights, concessions, novelty and parking - a guarantee of at least $18 million in annual arena revenue for the team. The rent is subject to adjustment if attendance is under 11,000 a game -- but not less than $1 million. All expenses to move the team were covered by the city of New Orleans, as were all incidentals incurred as a result of the relocation. The team moved into New Orleans Arena, which the city spent $15 million to upgrade to NBA-quality.
New Orleans' median household income is $38,800 a year, below the national average and below Charlotte's median income of $51,000. New Orleans' TV market, ranked 43rd nationally, is the smallest in the NBA; Charlotte's TV market ranks 27th.

move to San Antonio, Texas because owner Billy Joe "Red" McCombs is from there.[7] Personal preference, as in these cases, is idiosyncratic and will therefore not be investigated in this analysis.

Political support for a major league team within a city is very important because arenas and stadiums are often financed in part or in full by local governments.[8] The locational decision is usually the result of a bidding competition between the governments of various cities, each offering various amenities to the teams in order to attract the team to their locale. In fact, the moves by the Oilers, Rams, and Raiders were all to smaller markets, but the stadium leases were more favorable in these markets, despite the reduced population of their new locations.

Finally, the economics of the market matters. Regions with larger, richer populations containing large businesses or numerous corporate headquarters are assumed to more readily support a team than a smaller city which lacks these desirable demographic features. However, the three overarching decision criteria can be interrelated. For instance, the degree of public funding is likely to correspond to the size and economic demographics of the market. In fact, there is a correlation of 0.33 (significant at the 1% level) between the percentage of public funding and the population for six cities with NBA teams that are in

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[6] Those teams are the New Orleans Saints (1966), Seattle Seahawks (1974), Tampa Bay Buccaneers (1974), Carolina Panthers (1994), Jacksonville Jaguars (1994), Cleveland Browns (1999), and Houston Texans (2002).

[7] Minnesota Viking owner Red McCombs said the Vikings cannot remain competitive unless they get a new stadium to replace the Metrodome. Getting a new stadium built for the Vikings was Red McCombs' top priority, but measures to finance a stadium in Minnesota have twice failed. McCombs suggestion that the team relocate to San Antonio is unlikely due to the fact that San Antonio is another small market in a state with two teams, the Dallas Cowboys and the Houston Texans.

[8] See Baim and Sitsky (1994) and Rich (2000) for an in-depth discussion of the politics of stadium financing.

relatively smaller population centers. Also, an owner's preferences are likely to be in favor of locating in a large metropolitan area because of the potential favorable economics.

This paper analyzes the economics of each potential market to determine which cities are likely to be the best prospects for expansion or relocation of NBA teams. A hierarchical two-equation system is employed. In the first equation of the Location Model, the 25 current U.S. markets that have NBA franchises are examined to determine the relationship between the underlying factors.[9] It is then used to forecast the relative likelihood of other cities being similar enough to NBA cities to be able to support a team (again based on economic factors, not personal preference or political factors). This model is similar to the analysis for baseball teams by Bruggink and Zamparelli (1999), except that the NBA model has additional variables, two stages, and uses a substantially different econometric approach.

The second equation is a revenue equation. The revenue forecasts generated are used as inputs into the first equation. The logic is that the potential revenues that each location could generate are certainly important factors in an owner's location decision.

One objective of the overall analysis is to be able to aid in the financial decision regarding league expansion or team relocation. The current methodology used in the field involves separate comparisons of cities by population and a few other measures as opposed to an integrated approach that captures the relationships between the factors and relative importance of each factor. A set of models such as described in this paper can be used to rank cities for further, more in-depth analysis, across many sports in many countries.

[9] In 1999 there were 29 teams in the NBA, with two located in Canada (the Vancouver team has recently moved to Memphis, Tennessee), and two each in the Los Angeles and New York areas.

The next section will examine the basic theory underlying the analysis. In the third section, the data, its sources, and its limitations will be described. The analysis and results for the two-equation system will be developed in the fourth section. The final section concludes with a summary and a discussion of the results.

Theoretical Model

The Location Model is a franchise model based on the work most recently of Benjamin Klein (1995). Franchises of the same company have the incentive and desire to locate at least some minimum geographic distance away from each other, but want to maintain similarity in terms of quality and products offered so that uncertainty is reduced for customers. For instance, Domino's Pizza franchises are not allowed to locate near each other unless they are owned by the same franchisee.

Sports teams or franchises operate in a similar manner, and each of the leagues has developed rules regarding franchise movement and location. In the NBA, there is a radius of 75 miles surrounding each NBA team in which no other NBA team is permitted to locate without permission of the incumbent team. To understand the rationale as to why NBA teams chose their current locations, the Location Model takes into consideration the information that is available from current teams, uses that data to determine the common underlying economic factors of existing NBA locations, and applies those factors to the cities currently without NBA teams. In order to discern between successful locations of current NBA teams and less successful ones, the revenue equation within the Location Model accounts for the relative success of each location.

The general model is: *Location = f(market characteristics, revenue potential, political support, owner preferences)*, and *Revenue Potential = g(market characteristics, team characteristics)*. The latter relationship is an input into the former relationship. This creates a hierarchical two-equation system. *Owner preferences* are idiosyncratic because they are based on where an owner would like to locate a team above and beyond the economic and political factors. Moreover, for the cities that do not have an NBA team, it is not feasible to figure out where prospective owners would want to locate a team. Also, franchises that are owned by a group or a corporation would have divergent owner preferences. Hence, owner preferences are excluded from the models.

Similarly, there are issues in trying to model *political support*. First, the political support for constructing an NBA arena in a city without an NBA team may not be revealed in any data available if the issue has not previously arisen. Second, information on political support for other major professional sports teams might be a useful comparable variable. However, many of these cities do not have any other major professional sports teams. Also, if a city has already spent a large sum of public money to build a baseball stadium, it is not obvious whether it is more or less likely to financially support an NBA arena with public funds. Another avenue in modeling potential political support is to note that if political leaders account for the public's preferences when deciding on whether to spend public money, or if the public votes directly on the issue, then a measure of the public's preferences towards basketball might be informative. An explanatory variable, basketball fanaticism, might capture the public's likely support for publicly financing an arena. In fact, there is a correlation of –0.23 between the existing degree of public support for the current arena (for those cities with an NBA team) and the basketball fanaticism ranking (which is defined as

higher means less fanatical), and it is significant at the 5% level.[10] Further, cities with higher populations are more likely to publicly fund an arena.[11] Population is one of the explanatory variables in the model. Therefore, basketball fanaticism and population partially capture the degree of political support that an owner might expect to receive in each potential location.

In the above equations, *market characteristics* contain variables such as population, income, competition from other sports teams, basketball fanaticism, and corporate depth. *Team characteristics* contain variables such as prices, winning percentage, and arena quality.

In summary, the theoretical model is a two-equation system measuring whether or not a city is a good candidate for an NBA team. A testable assumption is that there is commonality across NBA cities that allows them to maintain a team over a long period of time. For example, the empirical analysis will determine the importance of population as a common factor that successful NBA teams share.

The two-equation system representing the model is as follows:

$$Y_1 = \alpha Y_2 + \beta_1 X_1 + \mu_1 \quad (1)$$

$$Y_2 = \beta_2 X_2 + \mu_2 \quad (2)$$

where Y_1 is a binary variable, X_1 and X_2 are vectors of independent variables, μ_1 and μ_2 are error terms, α and β_i (i = 1, 2) are vectors of parameters to be estimated, and Y_2 is a continuous variable. Eq. (2) is a revenue equation, and based on the triangular hierarchical structure, feeds into Eq. (1), the location equation. Y_1 takes a value of 1 if the

[10] Data for the degree of public financial support for current arenas comes from Turnkey Sports, LLC.
[11] The correlation between city population and the percentage that an arena was publicly financed is 0.45, which is significant at the 1% level.

city contains an NBA team, and 0 otherwise. The error terms, μ_1 and μ_2, are not uncorrelated because Y_2 is correlated with μ_2, and given that Y_2 is part of Eq. (1), μ_2 is correlated with μ_1.

Eq. (1) models which cities currently have NBA franchises based on X_1, market characteristics, and Y_2, a forecast of potential revenue for an NBA team in that location. Eq. (2) is the forecast equation that is an input into Eq. (1). It is explained by factors in X_2 that affect revenue of NBA teams such as market characteristics and team characteristics.

Data

The cross-sectional data for Eq. (1) of the Location Model consists of 48 observations, with 25 being cities with NBA teams and 23 being cities without NBA teams in 1999 that potentially are the most eligible cities for league expansion or team relocation.[12] There are twelve potential explanatory variables, some of which are correlated (e.g., 1995 MSA population and 2000 MSA population).[13] Each observation represents information for the year 1999 (except where specified).

The dependent variable in Eq. (1), Y_1, is an indicator or dummy variable that delineates a city with an NBA team (or two) from a prospective NBA city without a team for the 1999 season.

In developing a forecasting model for the existence of an NBA team, it is imperative to include the population of the market for each team. Five population variables are

[12] The choice of the 23 non-NBA cities is simply based on MSA population.
[13] These variables were chosen based on a review of the literature, on the availability of data, and on knowledge regarding the theory of demand. Ultimately, the data will determine their applicability.

examined: 1990 city population, 1999 city population, Metropolitan Statistical Area (MSA) population for the years 1995 and 2000, and the MSA population growth over that period.[14] It is likely that an NBA team not only draws from the city in which it is located, but also from the surrounding towns and communities. Therefore, the MSA population is expected to provide the best relative forecast of the population variables. It is expected that the effect of population on whether a city has or attains an NBA team will be positive. A summary of the data is provided in Table 1.

The growth of a community may play a role in whether an NBA team has chosen to locate there, especially if annual growth is significant and consistent. The growth variable is the change in MSA population during the past five years. The expected effect is that a higher population growth rate will increase the probability of an NBA team choosing to locate in a particular area. Alternatively, a city that has significant negative growth (declining population) could decrease the probability of an NBA team choosing to locate in the city.

Typical household income and average pay per worker of the MSA are also included as potential determining factors of NBA franchise location.[15] Other studies have found income to be a significant factor in determining attendance at sporting events.[16] As for location of sports teams, Bruggink and Zamparelli (1999) found that an increase in average household income by $1,000 increased the probability of the city having a Major League Baseball team by 8%. The expected effect is that a higher typical household income in an MSA will increase the probability of an NBA team choosing to locate there.

[14] City population variables derived from U.S. Census data. MSA population data from Places Rated Almanac (2000).
[15] The income variables are average pay per worker by MSA (1999), and typical household income by MSA (1999). *Source:* Places Rated Almanac (2000).

Similarly, a measure of the relative cost of living in these metropolitan areas is considered. To get a reasonable measure of household disposable income, the cost of living index takes into consideration nine items which collectively represent more than 60% of the typical household budget, which vary widely between regions.[17] The annual costs for these items were ranked from lowest to highest and then scored such that 100.00 represents the least expensive, 50.00 indicates the median, and 0.00 ranks as the most expensive city. The theory here is that regions with higher disposable income may choose to allocate a higher percentage of their budget towards recreational and leisure activities, such as attending an NBA game.

The success of sports teams in the modern era is largely dependent on corporate support via the purchase of luxury suites, club seats, sponsorship (including naming rights) and other premium services. The locational analysis includes a measure of corporate supply by using the number of Fortune 500 companies that are headquartered in a relevant city.[18] While not a perfect measure of corporate supply, it is expected that large corporations may want to entertain clients or employees in the luxury suites of a professional sports franchise located within the city in which they are headquartered. Also included are two measures of the number of companies that are considered to be large enough to be interested in premium services such as luxury seats, and profitable enough to be able to afford such services.[19]

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[16] See Rascher (1999) for a discussion of factors that affect demand at sporting events.

[17] Theses nine items include 1) state income taxes, 2) state and local sales taxes, 3) property taxes, 4) home mortgage/rent, 5) utilities, 6) food, 7) health care, 8) transportation, and 9) recreation. The remaining 40% is composed of federal income taxes, investments, and miscellaneous goods and services. *Source:* Places Rated Almanac (2000).

[18] *Source:* Places Rated Almanac (2000).

[19] *Source:* Dun & Bradstreet. Figures were compiled by MSA for companies with more than 25 employees and earning more than $5 million in annual revenues, referred to as "Mid-sized Corporations". Also included was a measure compiled by MSA for companies with more than 50 employees and earnings in excess of $10 million annually, referred to as "Large Corporations".

As in any spatial model of competition, the distance between competitors can affect the success of a business. The distance in miles to the nearest city with an NBA team is used as a measure of spatial competition. All else equal, it is expected that franchises that are located far distances from other franchises have a higher likelihood of success.[20]

A competitor to sports franchises is other major professional sports teams located in the same area. For instance, a fan may choose to attend a hockey game instead of a basketball game. However, if there was not a hockey team nearby, the fan may choose the basketball game for lack of other sporting alternatives. Therefore, the hypothesis is that the fewer other major professional sports teams there are, the higher will be the likelihood of success of an NBA team. The number of teams in the other major professional sports leagues (NHL, NFL, and MLB) is used as a proxy for sports entertainment competition. Bruggink and Zamparelli (1999) found that the number of other sports teams had a *positive* effect on the location of MLB teams, stating that "the placement of other professional teams establishes the city as 'major league'."[21]

Similarly, another measure, an index of the recreational assets available within an MSA, is included. This is determined by a factor analysis assessed on thirteen criteria to rate an MSA's supply of recreation assets.[22] These totals are ranked from most (100.0) to least (0.0) supply of recreational assets. The hypothesis here is that the lesser the supply of

[20] However, while it is true that distance isolates the franchise from competition, the amount of isolation from competitors also has the negative effect of increasing team travel costs. This paper analyzes revenues, not costs. In general, the variation in costs from franchise to franchise is not a function of locational attributes, but on decisions regarding team salary and marketing expenditures, for instance. An analysis of profits was considered, but reliable profit data are unavailable.

[21] Bruggink and Zamparelli (1999), p. 55.

[22] This includes: 1) amusement and theme parks, 2) aquariums, 3) auto racing, 4) college sports, 5) gambling, 6) golf courses, 7) good restaurants, 8) movie theater screens, 9) professional sports, 10) protected recreation areas, 11) skiing, 12) water areas, and 13) zoos. *Source*: Places Rated Almanac (2000).

recreational assets (lower index score), the lesser the recreational alternatives to attending an NBA game.

Recently, Scarborough Sports Marketing created an index of basketball fanaticism based on their survey of U.S. markets. This index is a measure of the importance of basketball to local residents. For instance, some regions, such as Indiana, North Carolina, Louisville, and New York City, are known as basketball 'hotbeds'. The index is used as a measure of consumer demand for NBA games and ranges from 1 for the most fanatical city to 63 for the city with the least fanaticism.

-- Insert TABLE 1--

Eq. (2) utilizes a panel data set consisting of nineteen variables for each team in the NBA (except the two Canadian teams) over the years 1997-1999.[23] There are three dependent variables: attendance, an estimate of gate receipts, and total team revenue. The focus of this part of the research is to create a forecasting model of financial success in the NBA with the proxy for success being total game attendance, gate receipts, or total revenue. Unlike the NFL, total revenues in the NBA are highly correlated with gate receipts because there is not a significant amount of revenue sharing in the NBA.[24]

[23] The Canadian teams are excluded for lack of comparable data. In excluding the Canadian teams there are 27 teams. Therefore, there are 81 observations (27 teams for three seasons).

[24] For the corresponding years, in the NFL, the 32 franchises share approximately 80% of gross revenues. In MLB, teams share approximately 33% of total revenues, the NBA shares in excess of 35% of league revenues, and the NHL shares approximately 30% of total revenues. In most leagues, certain localized revenue streams are exempted from the revenue sharing formula, including revenues generated by the stadium as opposed to the team, such as premium seating (club seats and luxury suites), sponsorship, parking, and concessions. Stadium-based revenues are increasing at impressive rates, growing more dramatically in recent years due to luxury suites, naming rights, etc. Hence, the recent boom in stadium construction is significantly in response to these revenue sharing exemptions.

Average attendance is being used instead of total attendance because there was a lockout during the 1999 season causing approximately 32 games of the 82 game season to be cancelled, including the All-Star Game but not the playoffs. High attendance represents one of the goals of a sports organization. See Table 2 for a summary of the data utilized for Eq. (2).

-- Insert TABLE 2--

High gate receipts are another goal of sports organizations. Gate receipts also help account for capacity constraints, whereas attendance does not. For instance, smaller arenas can charge higher prices if the supply of seats is less than demand, mitigating part of the capacity constraint issue. Ticket prices vary significantly across teams, and by solely using attendance, this price information would be lost. Gate receipts are estimated using actual attendance and average ticket price for all three years. Actual gate receipts are proprietary information, so attaining correct information is difficult. Therefore, an estimate is used. For the one season of actual reported gate receipts for NBA teams that is available, the correlation between the estimate and the actual is a 0.94.[25] This analysis uses the estimate based on attendance and average ticket price.

The third measure of revenue is total team revenue as reported by Forbes magazine. Gate receipts do not capture other localized revenue sources such as media, sponsorship, concessions and parking.

The level of an individual team's financial success is dependant on the team's ability to capitalize on the local market in terms of stadium economics.

[25] The actual reported gate receipts are for the year 1999.

The independent variables used to predict financial success or to measure attendance demand are prices, team winning percentage, a measure of the quantity of 'star' players, the age of the venue, the year of the season, basketball fanaticism, household income, number of other professional sports teams located in the MSA, 2000 MSA population, recreational and cost of living indices, number of Fortune 500 companies headquartered in MSA, the number of mid-sized and large corporations in MSA, and distance to nearest NBA city.

There is a vector of prices that fans pay to attend sporting events. These include the ticket price, the price of a 12 oz. beer, the price of a hot dog, the price of a 12 oz. soda, and the price of parking.[26] The first law of demand predicts that higher prices will lead to lower levels of demand, *ceteris paribus*. Ticket prices average $44 for the sample, with a low of $24 and a high of $87.

Winning percentage is expected to be an important proxy for the quality of the home team. The winning percentage in the year each season began, for years 1997 through 1999, was used.[27] Numerous studies have found winning to be an important determinant of attendance demand.[28] As expected, the average winning percentage is near 0.500 (at 0.514), with the minimum at 0.134 and the maximum at 0.817.[29]

Lagged winning percentage is also expected to affect demand because the previous season's performance affects season ticket sales and the appeal of early season games. For instance, Rascher (1999) shows that in baseball an extra win by the home team in the previous season increases per game attendance by about 450 fans for the first half of the

[26] This data comes from the Fan Cost Index™ published annually by Team Marketing Report.
[27] However, to create a fair forecast , all cities were assumed to have a winning percentage of 0.500, given that non-NBA cities do not have a winning percentage at all.
[28] For example, see Burdekin and Idson (1991), Hausman and Leonard (1997), Hoang and Rascher (1999), and McDonald and Rascher (2000).

season, but declines in magnitude, to 150 fans per game, and in significance, with the t-statistic dropping from 7.64 to 3.02, for the second half of the season.

Relative to other major professional sports, the NBA markets its product by focusing on the individual talent of the players more so than the quality of each team. It is expected that the star power of the players on a team affects the demand for games above and beyond their skill in producing wins. The analysis uses the number of All-Star votes that each team received as a proxy for the individual star power of each team.

Sports teams in the U.S. have been on a facility construction spree in the last decade. The older, sterile domes built in the late 1960s and early 1970s have given way to newer, higher quality, entertainment oriented facilities. These facilities increase the revenue streams for NBA and NHL teams by as much as 50% because they offer better amenities including premium seating, parking, food, drink, and non-game entertainment. In Major League Baseball, a new stadium can generate more than $40 million in new stadium revenue annually.[30] The analysis uses the age of the sports venue as a proxy for the quality of the experience that the fan receives that is unrelated to the game itself. The remaining variables were described above.

Analysis & Results

The Location Model creates a forecast of the best cities for NBA expansion or relocation based on economic factors that exist in current NBA cities. The dependent variable, whether the city has an NBA team, is an indicator variable. The model is a two-equation system with a binary dependent variable and a continuous endogenous variable.

[29] Winning percentage is not exactly at 0.500 because the data does not include the two Canadian teams who have subpar records.

The type of triangular system described in Section II requires a two-stage probit least squares (2SPLS) estimation technique.

The first stage is the estimation of Eq. (2), the revenue equation. Typically, OLS estimation would be unbiased and efficient, but there are a few econometric issues that prevent straight OLS from working. First, the revenue equation is estimated using data for 27 teams over 3 years. The error structure exhibits cluster correlation. For each team, the error term for three years is auto-correlated. Even though there is not correlation across teams, there is correlation of the errors within each team. The effect of cluster correlation is to inflate t-statistics. In this case, the t-statistics are about 12% higher when not accounting for the cluster correlation problem. The solution involves estimating robust errors by analyzing a cluster variable in the model itself.

The second estimation problem is that one of the dependent variables, attendance, is censored because of the capacity constraint of the size of an arena. True demand may be larger than actual attendance, but the size of the arena prevents the full demand from being satisfied. Interval regression offers a solution in the tradition of Tobit.

In calculating the correlation between each of the variables, income and population, as expected, are correlated – people in large cities have higher incomes. Another multicollinearity issue is between population, the number of corporate headquarters, and the number of non-NBA sports teams. The smallest bi-variate correlation between these variables is 0.73. While not surprising that corporations and sports teams locate in large population centers, the interpretation of the individual effects of these factors on NBA team location could be inefficient, although not biased, if included simultaneously in econometric

[30] See CSL, Inc. (1999).

analysis. Given that the goal in this step of the analysis is not to interpret individual effects, but to create an endogenous variable to be used in the next step, these variables were included in the analysis.

Sensitivity analyses showed that there was no omitted variable bias. Evidence of heteroscedasticity was accounted for using White's corrected errors. Log-linear models were estimated, but the levels models had superior fit. Log-linear models are often used in demand estimation, but only because the elasticities are easy to calculate. In this case that reason is not compelling enough to use log-linear models. Table 3 shows the results of the revenue and attendance equations estimation.

--Insert TABLE 3--

Overall, the attendance model is extremely statistically significant with a Wald Chi^2 statistic of 74.14. Both the gate receipts and total revenue models have $\overline{R}^2$ greater than 0.53 and F-values that are significant at the 1% level. Each of the stage one models is statistically significant and provide suitable endogenous variables for stage two. Basketball fanaticism, household income, previous season's winning percentage, and age of the arena are consistently statistically significant with the expected signs.[31] Interpreting the marginal impacts of a few of the variables that do not suffer from multicollinearity, a 5% increase in household income is associated with an 8% increase in gate receipts. An increase in winning percentage by 0.100 (e.g., from 0.500 to 0.600 is eight more wins) is associated with a rise in

[31] Prices were not found to be an important factor (except to the extent that there was multicollinearity) in forecasting attendance, with no t-statistic exceeding 0.40. Cost of living, all-star

gate receipts of 4%, or $1.35 million. Each additional year a stadium ages lowers gate receipts by about $235,000.

Table 4 shows the forecasts of attendance, gate receipts, and total revenue for each NBA and non-NBA city, sorted by decreasing gate receipts.[32] Gate receipts range from a high of $84 million in Chicago, down to $32 million in El Paso, Texas. Based on these stage one results (revenues), the best cities for expansion or relocation are Memphis, Hartford, Baltimore, Louisville, San Diego, Las Vegas, and Nashville.

--Insert TABLE 4--

The second stage of the 2SPLS involves the estimation of Eq. (1) with the estimated dependent variable from Eq. (2) as an endogenous variable in the model. Again, the attendance, gate receipts, and total revenue estimates from Table 3 are regressors in the estimation of Eq. (2). A number of sensitivity tests were performed on the model before final selection occurred. Scatter plots and the Cook-Weisberg test show that heteroscedasticity is an issue with the data. White's corrected errors are used to avoid inflated t-statistics from heteroscedasticity. There appears to be an omitted variable or more based on the results of the Ramsey RESET test.

Table 5 shows the results of the probit analysis. Overall, the models are significant at the 5% or better level. Interpretation of the marginal impacts shows that a 10% increase

votes, and distance to nearest NBA city also proved to be insignificant predictors of attendance and revenue.

[32] Results shown are for the 1999-2000 NBA season. The Lakers and Clippers have the same forecast because the variables in the model are market specific, and therefore the same for both teams. The only difference between teams sharing a locale is winning percentage, and, in this table, all teams'

in attendance, gate receipts, or total revenue is associated with an 11%, 10%, and 17% increase in the probability that a city is suitable for an NBA team, respectively.

--Insert TABLE 5--

Conclusion & Discussion

The forecasts for which cities are "best" for NBA expansion or relocation are shown in Table 6. The cities of Louisville and San Diego lead the list of potential candidates. This model examines the underlying economic structure of the cities to create forecasts for expansion or relocation of NBA teams. Models of this sort could be used for many other sports in other regions or countries.

--Insert TABLE 6--

Before the 2001-2002 season, the Vancouver Grizzlies of the NBA had to make a location decision. The team decided to move out of Canada and created a short list of possible locations that they believed could sustainably and successfully support the franchise. The list contained the cities of San Diego, Las Vegas, New Orleans, Memphis, and Louisville. The city of San Diego showed no interest in obtaining the Grizzlies because at the time the city was embroiled in a half-built publicly financed baseball stadium issue. The NBA ruled out the city of Las Vegas because of its ties to gambling. St. Louis had been a contender the year prior to the sale, with the failed purchase of the team by St. Louis Blues

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winning percentages were set to 0.500 in order to create comparable forecasts for cities without NBA

(NHL) owner, Bill Laurie, who would not open the Savvis Center to a an NBA team of which he was not the owner. The three final locations were quickly narrowed to two, as New Orleans was unable to generate an offer that was suitable to the Grizzlies. The decision between Memphis and Louisville was tipped in favor of Memphis when Federal Express (FedEx), whose headquarters are in Memphis, made a naming rights offer and equity purchase of the team.[33] The results here lend credence to the location decision made by the Grizzlies.

More recently, the Hornets considered Louisville, Norfolk, VA, and New Orleans for their relocation out of Charlotte before agreeing to terms with New Orleans. Based on the findings here, the Hornets might have been better off moving to Louisville. Attendance last season in New Orleans was below expectations.

Changes in the revenue generating capability of sports facilities are among the most important factors that have improved the profitability of team sports franchises recently. All four of the major professional sports leagues have recently seen an increase in the variance of team valuations because much of facility revenues are retained by the team owners. Although the size and magnitude of a team's market is important in determining its revenue-generating ability in the league, facility economics has quickly caught up with market size in determining financial success, as evidenced by the recent franchise moves and the awarding of a new NFL franchise in Houston over Los Angeles. Therefore, one of the determinants of the profitability of any major professional sports franchise is the type of lease agreement it

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teams (which do not have a corresponding winning percentage).

[33] Memphis had attracted enough investors to buy a 49 percent interest in the team, while Louisville investors were only able to offer a 20 percent stake in the team. FedEx helped to seal the deal for Memphis by agreeing to pay $100 million for naming rights for a new stadium in Memphis and the team (Memphis Express), matching the offer of Tricon Global Restaurants (parent company of

has, and the quality of its stadium. Hence, an important aspect of the location decision is not only the underlying economics of the market, but the actual lease agreement offered to a team by each city. This model can be used to help determine the size of the inducement needed by a smaller market in order to win the franchise free agency battle over a larger market. In other words, if the market economics are better in a larger city, models of this sort can help determine how much better a lease agreement has to be from a smaller city in order to convince an owner to move to the smaller city.[34]

For example, if an expansion team were considering a relatively larger market like Kansas City (population of 1.8 million) versus a smaller market like Buffalo (population of 1.2 million), the model forecasts that a Kansas City team would generate about $8 million more per year in total revenue (about 17% more) than a team in Buffalo. In order for a team to move to Buffalo, the lease agreement would have to include at least $8 million more per year in expected revenue that the team was able to keep. For instance, the combination of lower rent, property tax, sales tax, percentages of parking, concessions, etc. that the team keeps would have to add up to at least $8 million more than the lease in Kansas City offered.

In a real example, in choosing New Orleans over Louisville, the Hornets assessed expected attendance, gate receipts, and total revenues. According to the findings here, expected total revenues were about the same, but attendance and gate receipts were forecasted to be higher in Louisville than in New Orleans. Presumably, the lease agreement in New Orleans accounts for the difference from the expected lease agreement in Louisville.

In choosing Memphis over New Orleans, Louisville, St. Louis, Las Vegas, and San Diego, the Grizzlies chose the market with the highest expected attendance and gate receipts,

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Kentucky Fried Chicken, Pizza Hut and Taco Bell) that reportedly offered $100 million for the naming rights of the new arena.

but not the highest total revenue. However, as described above, San Diego was not in a position to offer to build a new facility and the owner of the Savvis Center in St. Louis was not interested in having an NBA team in the facility unless it was owned by him.

By utilizing an hierarchical two-equation system involving the underlying economic factors which are deterministic for a team's success, this paper serves to aid in the financial decision regarding league expansion or team relocation. This integrative approach effectively captures inter-relationships between factors as well as the relative importance of each factor. A set of models such as described in this paper are not solely applicable to NBA franchise locational decisions, and can instead be used to rank cities for further, more in-depth analysis, across many sports in many countries.

[34] We thank a reviewer for noting this use of the model.

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Appendix

Table 1: Simple Statistics of the NBA Revenue Model Data

	Minimum	Mean	Median	Maximum	Std. Dev.
Dependent Variable:					
Avg. Attendence at Games	9,968	17,075	17,072	23,988	2,927
Estimated Gate Receipts of Each Team's Home Games	$ 19,379,892	$ 34,547,708	$ 33,501,678	$ 69,567,390	$ 11,700,000
Total Revenue (millions)	$ 34.5	$ 70.7	$ 67.4	$ 152.2	$ 24.3
Independent Variables:					
Arena Seat Capacity	16,311	19,586	19,600	24,042	1,647
Year Season Began	1997	1998	1998	1999	0.82
Avg. Ticket Price	$23.69	$44.01	$43.09	$86.82	$12.37
Concessions Price[1]:	$6.00	$8.90	$8.75	$11.75	$1.21
Avg. Beer Price	$2.50	$4.10	$4.00	$6.00	$0.63
Avg. Hotdog Price	$1.00	$2.50	$2.50	$4.00	$0.51
Avg. Soda Price	$1.50	$2.30	$2.25	$4.50	$0.47
Total Price[2]:	$36.44	$61.30	$58.00	$123.32	$15.94
Avg. Parking Price	$0.00	$8.38	$7.00	$27.00	$4.71
Basketball Fanaticism Index	1.0	22.0	16.0	59.0	16.9
Recreational Index Ranking	65.7	88.1	89.8	99.7	8.7
Number of Other Major Sports Teams Located in City	0.0	2.1	2.0	7.0	1.8
MSA Household Income	$68,000	$83,089	$83,400	$100,203	$9,252
MSA Population, 2000	1,253,523	3,763,065	2,891,595	9,187,860	2,583,405
Mid-Sized Corporations in MSA	842	3,565	3,300	8,267	2,497
Large Corporations in MSA	395	1,814	1,733	4,115	1,276
Fortune 500 Companies Headquartered in MSA	0.0	13.0	11.0	52.0	13.5
Cost of Living Index Ranking	0.0	25.0	21.3	91.8	23.2
Team Winning Percentage	0.13	0.51	0.54	0.82	0.16
Previous Season Team Winning Percentage	0.13	0.52	0.54	0.84	0.17
Number of All-Star Votes Received	20,631	925,597	601,359	5,597,842	1,045,122
Age of Arena	1.0	11.2	8.0	39.0	10.5
Distance to Nearest City with NBA Franchise	81.6	216.3	181.3	533.0	126.7

Note: 1. Total of Beer, Hotdog and Soda Prices.
2. Total of Concessions, Ticket, and Parking Prices.

Table 2: Simple Statistics of the NBA Location Model Data

	Minimum	Mean	Median	Maximum	Std. Dev.
Dependent Variable:					
NBA Team Located in City	0.00	0.52	1.00	1.00	0.50
Independent Variables:					
MSA Population Growth, 1995-2000	-1.2%	5.9%	5.1%	21.6%	4.7%
MSA Population, 2000	712,460	2,451,255	1,619,450	9,220,312	1,947,821
MSA Population, 1995	669,998	2,340,977	1,629,508	9,054,394	1,923,162
Basketball Fanaticism Index	1.0	27.2	26.0	63.0	18.6
MSA Household Income	$52,700	$77,935	$77,150	$100,203	$10,393
Number of Other Major Sports Teams Located in City	0.0	1.5	2.0	7.0	1.5
Fortune 500 Companies Headquartered in MSA	0.0	8.4	4.0	52.0	9.3
Mid-Sized Corporations in MSA	289	2,190	1,612	8,267	1,975
Large Corporations in MSA	153	1,113	762	4,115	1,036
Recreational Index Ranking	42.5	85.1	87.5	100.0	10.9
Cost of Living Index Ranking	0.0	36.1	35.0	95.5	25.3
Avg. Nielsen T.V. Ratings for NBA Games in City	0.9	2.6	2.0	6.9	1.61
Avg. Nielsen T.V. Ratings for 6 NBA Games in City	1.5	4.6	4.2	13.1	2.25
Distance to Nearest City with NBA Franchise	45	274	194	2,560	361

Table 3: Attendance and Revenue Regression Results

Model:	Attendance	Gate Receipts	Total Revenue (millions)
Adjusted R^2	--	0.55	0.53
F-Value or Wald Chi^2	74.14***	13.42***	7.86***
Number of Observations	81	81	81
Independent Variables:			
Constant	1447.55	-39,100,000**	-24.4
	(0.19)	(-2.14)	(-0.56)
Basketball Fanaticism Index	-91.06***	-319,263***	-0.35
	(-3.28)	(-4.38)	(-1.62)
Number of Other Major Sports Teams Located in City	405.40	1,209,033	2.79
	(1.12)	(0.82)	(0.70)
Population of Local MSA	0.0000485	1.71	0.0000031
	(0.10)	(1.39)	(1.09)
Index of Recreation Opportunities	27.09	118,218	0.26
	(0.75)	(1.15)	(1.06)
MSA Household Income	0.1490*	680.2***	0.00044
	(1.67)	(3.26)	(0.95)
Number of Mid-Sized Companies in CMSA	-0.924	-4208*	0.00034
	(-0.74)	(-1.76)	(0.06)
Current Season Winning Percentage	1451.47	9,033,650	36.53*
	(0.52)	(0.87)	(1.72)
Previous Season Team Winning Percentage	8136.83***	13,500,00***	22.96**
	(4.02)	(2.82)	(1.97)
Age of Arena	-73.06	-235,793*	-0.52
	(-1.37)	(-1.65)	(-1.62)

Significance: * - 10% level; ** - 5% level; *** - 1% level.

Table 4: Forecasted Attendance, Gate Receipts, and Total Revenue

City/Team (sorted by gate receipts)	Forecasted Attendance	Forecasted Gate Receipts	Forecasted Total Revenue
Chicago Bulls	20,108	$ 45,283,019	$ 103,944,723
New Jersey Nets	19,667	$ 44,609,289	$ 103,666,295
New York Knicks	18,717	$ 41,543,980	$ 96,906,295
Washington Wizards	19,704	$ 41,358,306	$ 83,281,956
Los Angeles Clippers	17,899	$ 38,422,655	$ 97,575,067
Los Angeles Lakers	17,899	$ 38,422,655	$ 97,575,067
Seattle SuperSonics	19,757	$ 38,312,641	$ 71,904,303
Detroit Pistons	18,249	$ 34,583,135	$ 77,497,291
Houston Rockets	18,325	$ 34,298,557	$ 69,692,269
Boston Celtics	18,218	$ 33,924,509	$ 68,763,022
Indiana Pacers	19,235	$ 32,993,512	$ 66,299,117
Philadelphia 76ers	17,729	$ 32,781,592	$ 75,895,337
Portland Trail Blazers	18,715	$ 32,330,039	$ 64,190,119
Memphis	18,796	$ 31,596,200	$ 59,847,117
Utah Jazz	18,622	$ 31,209,019	$ 62,109,120
Hartford	18,134	$ 30,943,166	$ 56,251,917
Phoenix Suns	18,286	$ 30,498,141	$ 72,479,118
Minnesota Timberwolves	17,526	$ 30,384,199	$ 67,701,633
Miami Heat	18,315	$ 29,977,964	$ 67,583,986
Baltimore	17,560	$ 29,429,689	$ 64,518,291
Louisville	18,311	$ 28,911,371	$ 59,396,878
San Diego	17,372	$ 28,460,087	$ 66,524,446
Las Vegas	17,545	$ 27,242,661	$ 59,699,671
Nashville	17,528	$ 26,882,101	$ 58,132,275
Milwaukee Bucks	16,978	$ 26,290,903	$ 58,624,142
Sacramento Kings	17,138	$ 26,101,881	$ 52,459,725
Golden State Warriors	15,762	$ 26,011,957	$ 63,966,882
Honolulu	16,467	$ 25,830,914	$ 50,552,504
San Antonio Spurs	17,354	$ 25,604,283	$ 54,161,323
Norfolk, Virginia Beach, Newport News	17,058	$ 24,720,174	$ 59,816,386
Dallas Mavericks	15,907	$ 24,685,943	$ 60,500,450
Charlotte Hornets	16,516	$ 23,644,230	$ 51,580,247
St Louis	16,074	$ 23,606,227	$ 62,257,248
Atlanta Hawks	15,625	$ 23,464,312	$ 62,783,478
Orlando Magic	16,506	$ 23,263,533	$ 55,287,320
New Orleans	16,314	$ 22,026,250	$ 59,897,920
Jacksonville	16,085	$ 21,331,308	$ 54,111,519
Cincinnati	15,644	$ 20,361,607	$ 53,771,644
Cleveland Cavaliers	15,119	$ 20,272,483	$ 56,035,523
Austin - San Marcos	15,931	$ 19,766,609	$ 49,390,583
Denver Nuggets	14,939	$ 19,541,896	$ 51,326,220
Kansas City	15,280	$ 19,503,955	$ 54,329,534
Albuquerque	15,394	$ 17,362,572	$ 45,547,891
Columbus	13,879	$ 13,684,159	$ 45,976,470
Pittsburgh	13,357	$ 12,543,029	$ 48,788,601
Omaha	13,553	$ 12,345,181	$ 39,255,986
Buffalo - N.Falls	13,659	$ 11,974,656	$ 46,414,481
Oklahoma City	11,432	$ 11,114,854	$ 33,726,430
Tucson	11,071	$ 10,608,078	$ 31,618,100
El Paso	9,311	$ 10,178,875	$ 19,506,282

Note: Bolded cities are those without an NBA team in 1999.

TABLE 5: Two-Stage Probit Least Squares Results

Model:	NBA Indicator Variable	NBA Indicator Variable	NBA Indicator Variable
Wald Chi-Squared	5.84**	12.66***	9.86***
Number of Observations	45	45	45
Independent Variables:			
Constant	-3.30**	-3.16***	-5.95***
	(-2.21)	(-3.08)	(-2.98)
Attendance from Stage One	2.14e-4***		
	(2.42)	--	--
Gate Receipts from Stage One		1.15e-7***	
	--	(3.56)	--
Total Revenue from Stage One			0.0855***
	--	--	(3.14)

Significance: * - 10% level; ** - 5% level; *** - 1% level.

Table 6: Forecast Results for Location Model Predicting Probable NBA Cities

City/Team (sorted by gate receipts)	Forecasted Probability (Attendance)	Forecasted Probability (Gate Receipts)	Forecasted Probability (Total Revenue)
Atlanta Hawks	1.000	1.000	1.000
Boston Celtics	1.000	1.000	1.000
Chicago Bulls	1.000	1.000	1.000
Dallas Mavericks	1.000	1.000	1.000
Detroit Pistons	1.000	1.000	1.000
Houston Rockets	1.000	1.000	1.000
Los Angeles Lakers	1.000	1.000	1.000
Los Angeles Clippers	1.000	1.000	1.000
Minnesota Timberwolves	1.000	1.000	1.000
New York Knicks	1.000	1.000	1.000
New Jersey Nets	1.000	1.000	1.000
Golden State Warriors	1.000	1.000	1.000
Philadelphia 76ers	1.000	1.000	1.000
Washington Wizards	1.000	1.000	1.000
Portland Trail Blazers	1.000	1.000	1.000
Seattle SuperSonics	0.997	0.998	0.990
Phoenix Suns	0.937	0.989	0.947
Utah Jazz	0.963	0.962	0.912
Charlotte Hornets	0.919	0.954	0.896
Indiana Pacers	0.873	0.953	0.901
Orlando Magic	0.816	0.862	0.817
Louisville	0.740	0.743	0.751
Milwaukee Bucks	0.501	0.709	0.520
Denver Nuggets	0.675	0.707	0.715
San Antonio Spurs	0.404	0.703	0.549
San Diego	0.696	0.677	0.658
Miami Heat	0.675	0.585	0.615
Las Vegas	0.416	0.345	0.442
Baltimore	0.252	0.288	0.256
St Louis	0.271	0.279	0.299
Cleveland Cavaliers	0.351	0.262	0.323
Norfolk, Virginia Beach, Newport News	0.220	0.255	0.352
Memphis	0.486	0.241	0.331
Pittsburgh	0.333	0.163	0.328
Hartford	0.209	0.155	0.164
Nashville	0.125	0.115	0.152
Sacramento Kings	0.130	0.107	0.087
Austin - San Marcos	0.073	0.055	0.118
Kansas City	0.017	0.015	0.036
Cincinnati	0.003	0.001	0.004
New Orleans	0.002	0.000	0.004
Columbus	0.002	0.000	0.004
Jacksonville	0.000	0.000	0.000
Albuquerque	0.000	0.000	0.000
Buffalo - N.Falls	0.000	0.000	0.000

Note: Bolded cities are those without an NBA team in 1999.