Location, Location, Location?

Sports Franchise Placement in the Four Major U.S. Sports Leagues

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The study of the economics of sports is appealing because of the extensive data available to prove or disprove theoretical assertions about the nature of the sports industry. The examination of sports also allows economists to better understand economic relationships in general. In other industries and economic disciplines, data are not as available as in the sports industry. Extreme popularity combined with government scrutiny places most of the private sports enterprise's business practices and data into the public domain. The sports industry serves as a learning laboratory in which broader economic concepts and theories are examined. In addition to explaining the workings of the sports industry, research in sports economics enhances the knowledge base of the field of economics as a whole.

This chapter is an example of how using available sports industry data to study an economic problem leads to a better understanding of similar situations in other industries. Specifically, this chapter examines the location of franchises in sports leagues. One would expect a league to place its franchises in a network of cities to maximize exposure to its customers' disposable income. This chapter shows, however, that the four major sports leagues in the continental United States do not all locate franchises in this manner. In fact, the less the franchises in a league are dependent on local income, the less likely the franchises are placed in locations with the highest income available. While the facility location problem has been thoroughly studied in other industries, the availability of data in the sports industry provides a unique look into why an organization in any industry may *not* place its business units in a set of locations that maximizes access to local income.

This chapter uses a facility location model from the industrial engineering and management science literature to determine an optimal assignment of sports franchises to metropolitan locations within the continental United States. The model indicates how a league should optimally locate its franchises, and it also shows how a league's existing franchise placement compares with the model's optimal design.

The chapter specifically examines the location of franchises within the four major sports leagues in the continental United States: Major League Baseball (MLB), the National Football League (NFL), the National Hockey League (NHL), and the National Basketball Association (NBA). Each league's franchise locations are compared to the facility location model's best possible design for the league. The architects of these leagues conceivably placed franchises in locations with the greatest potential for franchise and league profitability. The chapter considers the relationship among revenue sharing arrangements, franchise dependence on local income, and how far franchises are located from their optimal placement. This chapter also uses the facility location model to identify the best expansion prospects for each league.

The facility location model is used in industrial engineering and management science to solve various location problems: locating water treatment facilities throughout cities to maximize coverage while minimizing costs; locating warehouses to maximize product distribution at the lowest possible cost; and locating store franchise sites to maximize profits and market share while minimizing costs and customer travel time. Brandeau and Chiu (1989) provide a nice history of the academic research in this area, and Snyder (2006) presents a comprehensive review of recent facility location research.

Most of the research on franchise location in the sports economics literature examines the benefits and costs of locating a sports franchise in a particular city. Baade and Dye (1988), Siegfried and Zimbalist (2000), and Coates and Humphreys (2003) have written seminal papers in this area. This line of research focuses on the economic impact, both tangible and intangible, that sports franchises and their stadia have on a local metropolitan area. Baade and Dye (1988) examine the specific issue of building a new stadium and they characterize the conditions under which local governments should subsidize the costs. Siegfried and Zimbalist (2000) describe the economic environment under which sports leagues abuse their monopoly power to force cities to subsidize sports franchises. They make a number of policy recommendations to adjust the inefficiency and inequity in the market of franchise location. Coates and Humphreys (2003) find that a professional sports franchise has a negative net effect on both earnings and employment in a metropolitan area.

Other research has yielded similar results. Shropshire (1995) describes the tactics that cities employ to capture a sports franchise and the fierce bidding wars that often take place, and Johnson (1983) warns that city officials must be careful yielding to the pressures of sports entrepreneurs. Johnson states that the benefits of hosting a franchise are significantly outweighed by the subsidies demanded by the sports team. Rappaport and Wilkerson (2001) find that there is no benefit to a city hosting a sports franchise if one considers economic activity and tax benefits. However, they point out that "quality-of-life" benefits could justify public expenditures on sports franchises. Nunn and Rosentraub (2003) concur with this point; however, they also point out that a metropolitan region – a city and its suburbs – must act as a collective unit to avoid falling into the trap of a bidding war for a sports facility.

At the macro level for a league, however, is the question of which metropolitan areas to locate in. As a league expands into a new market, leagues must select between potential cities and choose one that is most profitable for the league and the new franchise. Fort and Quirk (1995) examine optimal financial structures of sports leagues, and they recognize that a major problem for leagues is keeping franchises in weak-drawing markets viable.

Bale (2003) provides a comprehensive study of sports and location in his book, Sports Geography. Bale examines the cultural, geographical, and economic influences on the location of sports leagues and their franchises. He points out that while leagues should locate franchises in the highest population centers to gain access to the most income available; it is often history, inertia, and physical landscapes that determine location. Bale recognizes that a more detailed quantitative analysis is necessary to explain the economic geography of sports. This chapter attempts to do this by examining how similar existing league franchise locations are to optimal income-generating locations. This chapter is the first paper to use a facility location model to examine the optimal placement of sports franchises in a league and to identify the best expansion prospects for a sports league.

The *p*-Median Facility Location Model

The *p*-median facility location model finds the location of an exogenous number of facilities, denoted by *p*, on a network so that the total cost of serving the network is minimized. Hakimi (1965) first defined the *p*-median problem using a network of nodes and arcs. He described each node as a source of demand and the arcs represented transportation connections between the nodes. Facilities could be located at any node or at any point on the arcs. Hakimi proved that at least one optimal solution to the *p*-median problem existed such that facilities were located entirely on the nodes in the network. This was an important result because many location applications require that facilities be built on existing nodes within a network. Without Hakimi's result, the problem would also be significantly more difficult to solve, as the model would have to consider a set of infinite location possibilities within the arcs on the network. ReVelle and Swain (1970) were the first to formulate the *p*-median problem as an integer programming model, and Daskin (1995) provides an excellent description of the model used in contemporary research.

In the context of this chapter, the *p*-median model locates a predetermined number, *p*, of sports franchises on a network that has three hundred nodes. The nodes are the three hundred highest personal income earning metropolitan statistical areas (MSA) in the United States as reported by the U.S. Department of Commerce's Bureau of Economic Analysis for 2006.[1] The distances between nodes are calculated using "as the crow flies" measurements using the latitude and longitude of the primary city in the MSA.

The *p*-median model assigns *p* sports franchises to *p* unique nodes within the 300-node network. Each sports franchise has exclusive access to the income at its home node. The model then assigns the income at each of the remaining nodes that did not receive a franchise to one of the *p* franchises. The model calculates the total income-weighted distance in the network by multiplying the income at each node by the distance to its assigned franchise and then summing these products. This is referred to as *distanced income* throughout the remainder of the chapter. The p-median model locates the franchises optimally by minimizing the distanced income in the network. By minimizing the network's distanced income, accessibility to income is maximized.

The model in this chapter is similar to ReVelle and Swain (1970), although Daskin's (1995) notation is used. One small change is made to these models: this chapter adds a factor, α, to control how sensitive the model is to distances between the nodes. This addition is important because it facilitates a consideration of the amount of income that will actually travel to a nearby franchise in the network. The model follows:

Inputs:

h_i = income at node i where $i \in [1,300]$ and each node is an MSA

d_{ij} = distance between node i and candidate site j where $i, j \in [1,300]$

p = number of sports franchises to locate

α = level of sensitivity of the distance between node i and candidate site j

Decision Variables:

$$X_j = \begin{Bmatrix} 1 & \text{if a sports franchise is located at candidate site } j \\ 0 & \text{if not} \end{Bmatrix}$$

$$Y_{ij} = \begin{Bmatrix} 1 & \text{if node } i \text{ is served by a sports franchise at node } j \\ 0 & \text{if not} \end{Bmatrix}$$

Using this notation, the p-median problem is formulated as follows:

MINIMIZE $$\sum_i \sum_j h_i (d_{ij})^{\alpha} Y_{ij} \quad (1a)$$

SUBJECT TO $$\sum_j Y_{ij} = 1 \qquad \forall i \quad (1b)$$

$$\sum_j X_j = p \quad (1c)$$

$$Y_{ij} - X_j \le 0 \qquad \forall i, j \quad (1d)$$

$$X_j = 0,1 \qquad \forall j \quad (1e)$$

$$Y_{ij} = 0,1 \qquad \forall i, j \quad (1f)$$

The objective function (1a) minimizes the total distanced income in the network. While the ReVelle/Swain and the Daskin models only consider the case when α is equal to one, the objective function (1a) is more robust as it uses α to examine the model's sensitivity to distances between the nodes.

Constraint (1b) requires each demand node i to be assigned to exactly one sports franchise j, and constraint (1c) allows only p sports franchises to be located. Constraint (1d) links the nodes where sports franchises are located (X_j) and the demand nodes (Y_{ij}). The constraint only allows demands at node i to be assigned to a sports franchise at location j ($Y_{ij} = 1$) if a sports franchise is located at node j ($X_j = 1$). Constraints (1e) and (1f) simply require that X_j and Y_{ij} have a value of either zero or one.

To illustrate how the p-median model works, Figure 1 exhibits a simple four node network of cities A, B, C, and D with incomes of 4, 5, 5, and 10 respectively. The distances between the cities are indicated on the figure. Suppose that two sports franchises are to be located at two of the cities in the network. The p-median model considers each of the six possibilities in which the franchises may be placed: AB, AC, AD, BC, BD, and CD.

<< Figure 1 about here >>

If the sports franchises are placed at cities A and B, then D's income would go to franchise A (because A is the closest franchise to D) and C's income would go to B. Using a value of 0.5 for α, the distanced income for a placement at A and B is 204.67 ($10*200^{0.5} + 5*160^{0.5}$). Table 1 lists the distanced income for each of the six possible placements. The p-median model would determine that the optimal placement of the two sports franchises is at cities B and D which has the lowest distanced income. It is intuitive that the sports franchises would be placed at B and D or at C and D because these cities have the highest income. The optimal placement turns out to be B and D, because the income at city A is closer to B than it is to C.

<< Table 1 about here >>

Selecting alpha: How far will income travel to support a sports franchise?

The p-median model in this chapter includes the factor, α, to control how sensitive the model is to distances between the nodes and the income at selected nodes. The greater α is, the greater the distance factor is relative to the income at a node. When a higher α used in the *p*-median model, the less sensitive the model is to the income at the node where a franchise is placed. A lower α forces the model to place franchises at the highest income nodes.

To illustrate the effect of selecting α, the *p*-median model was used to optimally locate eight franchises across the continental United States using three different α values: 1.0, 0.5, and 0.1.[2] The choice of α affects how sensitive the model is to the distance between nodes when minimizing distanced income in the network. Table 2 exhibits the different optimal placements of the eight franchises based on the values of α that are used.

<< Table 2 about here >>

When α is equal to one, the model selects Lakeland, Florida, as one of the eight optimal locations for a sports franchise in the continental United States even though Lakeland is the ninety-ninth largest MSA. The model does this because Lakeland is located near three large income nodes: Tampa Bay, Orlando, and Miami. With alpha equal to one, the model is not sensitive to the lower income at Lakeland. The model considers that the income from Tampa Bay, Orlando, and Miami will travel to Lakeland to support the franchise.

When a very small value of α is used, the model is extremely sensitive to the income at each node and income from nearby cities is not used to support a sports franchise at another node. When α was set to 0.1, the model simply placed the sports franchises in the eight highest income MSAs in the continental United States.

When α was set to 0.5, the model finds an appropriate optimal location for the eight franchises. This alpha establishes a balance between placing franchises in high income MSAs and allowing nearby income to support a sports franchise. The model selects Miami, instead of Lakeland, which seems appropriate given that Miami has the highest income of MSAs in Florida. The model also does not locate a franchise in Seattle, and instead places a franchise in Washington, D.C. Figure 2 and Figure 3 show the differences in locations selected when different alphas are used in the model. An α of 0.5 is used to determine the optimal locations of franchises for the remainder of the chapter.

<< Figure 2 about here >>

<< Figure 3 about here >>

Optimal Franchise Location in the Four Major Sports

The *p*-median model is used to examine how each of the four major United States sports leagues has located franchises in comparison to the *p*-median model's optimal franchise placement. The analysis only considers MSAs in the continental United States and does not address the issue of the optimal number of franchises within one MSA.

Major League Baseball (MLB) currently has thirty teams including a franchise in Toronto, Canada, and two franchises in each of the Chicago, Los Angeles, New York, and San Francisco MSAs. Thus, MLB has franchises in twenty-five MSAs in the continental United States. The *p*-median model identified the twenty-five optimal franchise locations for MLB. Table 3 compares the actual and the optimal locations of franchises for MLB. There are only three cities where MLB should not be located according to the model: Baltimore, Cleveland, and Milwaukee. The three cities where MLB should instead be located are Portland, San Antonio, and Charlotte.

<< Table 3 about here >>

The *p*-median model can also indicate how close a league's actual franchise placement is to the optimal franchise assignment. The model's objective function (1a) minimizes the distanced income from each of the model's 300 MSAs to their assigned sports franchises. A comparison is made between the distanced incomes of the leagues' actual and optimal franchise locations. MLB's actual distanced income is 43,576,898 while its optimal distanced income is 41,925,259.[3] The ratio of the actual distanced income to the optimal distanced income measures the level of inefficiency of the actual franchise location system. In the case of the MLB, the Franchise Location Inefficiency Ratio is 1.039. (MLB's actual franchise location is 3.9% inefficient.)

The National Football League (NFL) currently has thirty-two franchises in thirty different MSAs in the continental United States. There are only two MSAs in which the NFL has multiple franchises: New York and San Francisco. The *p*-median model identified the thirty optimal franchise locations for the NFL. Table 4 compares the actual and the optimal locations of franchises for the NFL. There are six cities where the NFL should not be located according to the model: Baltimore, Buffalo, Green Bay, Indianapolis, Jacksonville, and Nashville. The six cities where the NFL should instead be located are Las Vegas, Los Angeles, Portland, Rochester, Salt Lake City, and San Antonio. Figure 4 is a map with the thirty optimal NFL locations. The NFL's Franchise Location Inefficiency Ratio is 1.185.

<< Table 4 about here >>

<< Figure 4 about here >>

The National Basketball Association (NBA) currently has thirty franchises including one in Toronto, Canada and two in both the New York and Los Angeles markets. The NBA has franchises in twenty-seven different MSAs in the continental United States. The *p*-median model identified the twenty-seven optimal franchise locations for the NBA. Table 5 compares the actual and the optimal locations of franchises for the NBA. There are seven cities where the NBA should not be located according to the model: Cleveland, Indianapolis, Milwaukee, Memphis, Oklahoma City, Orlando, and Sacramento. The seven cities where the NBA should instead be located are Cincinnati, Kansas City, Pittsburgh, San Diego, Seattle, St. Louis, and Tampa Bay. The NBA's Franchise Location Inefficiency Ratio is 1.095.

<< Table 5 about here >>

The National Hockey League (NHL) currently has thirty franchises and only twenty-four of these are located in the United States. The NHL is represented in twenty-one different MSAs in the continental United States. The NHL has a large presence in Canada and six of its franchises are located there. The NHL also has multiple franchises in New York and Los Angeles. The *p*-median model identified the twenty-one optimal franchise locations for the NHL in the continental United States. Table 6 compares the actual and the optimal locations of franchises for the NHL. There are five cities where the NHL should not be located according to the model: Buffalo, Columbus, Nashville, Pittsburgh, and San Jose. The five cities where the NHL should instead be located are Cincinnati, Houston, Kansas City, Seattle, and San Francisco. The NHL's Franchise

Location Inefficiency Ratio is 1.187. Table 7 summarizes the distanced incomes and the inefficiency ratios for the four leagues.

<< Table 6 about here >>

<< Table 7 about here >>

Why are the leagues not located optimally?

The *p*-median model is useful, in the sports industry and elsewhere, because it identifies an optimal placement of an organization's facilities to maximize exposure to customers and their income. With the data that is available in the sports industry, however, further analysis can be done to examine why it may not be prudent for an organization to use the optimal *p*-median model solution. It is also possible to characterize the organization that is more or less likely to use the optimal placement. This analysis and discussion serves as an example of how sports economics can be used to guide policy makers in other industries.

Of the four major U.S. sports, Major League Baseball is the closest to an optimal franchise location design. Individual MLB franchise revenue also has the highest correlation with local income among the four leagues. The coefficient of determination (R-squared) between 2006 MLB franchise revenue and personal income in a franchise's home city was 0.797. Because an MLB franchise has many home games (81 per season) and because MLB franchise television revenue comes mostly from local media outlets, it is not surprising that MLB franchises are so dependent on the city in which they are located.

When compared to MLB, the National Football League's franchise location design is much farther from an optimal placement with a Location Inefficiency Ratio of 1.185. The NFL has an extensive league-wide revenue sharing arrangement and individual franchises are much less dependent on local income. Most of the NFL's revenue comes from a national broadcast rights agreement, and individual franchises only have 8 home games per season. Table 8 shows that the NFL's coefficient of variation of 2006 revenue is considerably lower than all of the other leagues. The NFL also has the lowest coefficient of determination (R-squared) between 2006 NFL franchise revenue and personal income in a franchise's home city at 0.548. Because NFL franchises are not as dependent on income from their individual franchise location, they are not located as optimally as franchises in the other leagues.

<< Table 8 about here >>

The National Basketball Association falls in the middle of MLB and the NFL with a Franchise Location Inefficiency Ratio of 1.095. The NBA is also between MLB and the NFL in terms of its dependence on local markets. NBA franchises have 41 home games each season, limited revenue sharing, and broadcast revenue that comes from both local and national media outlets. The coefficient of determination (R-squared) between 2006 NBA franchise revenue and personal income in a franchise's home city was 0.748.

With greater revenue-sharing, fewer home games, and a lucrative national television rights contract, a league has less pressure to locate a franchise in a city with the highest income available. The local market is not essential to ensure that a new franchise is profitable. A league can capitalize on other incentives from smaller cities – tax breaks, publicly-funded stadiums, and other government subsidies – to replace the income lost by not locating in a larger market. As MLB, the NBA, and the NFL demonstrated, the less an organization's franchises are dependent on local income, the less likely the franchises will be placed in the *p*-median model's optimal solution.

On the surface, the National Hockey League appears to throw a wrench in the argument that sub-optimal franchise location occurs when a league is not dependent on local income. The NHL has the worst Franchise Location Inefficiency Ratio of 1.187, even though NHL franchise revenue is strongly correlated with the income available in local markets. The coefficient of determination (R-squared) between 2006 NHL franchise revenue and personal income in a franchise's home city was 0.785. Larger markets do generate more revenue for NHL franchises, yet the *p*-median model indicates that the NHL places its franchises in too many smaller markets. For example, the model suggests that the NHL should move its franchise from Buffalo and place it in Houston. What the *p*-median model does not consider is that the percentage of income spent on hockey most likely varies more from market to market than in any other sport. Buffalo is a "hockey town;" Houston is not. While the NHL may not be placing its franchises optimally according to the *p*-median model, the NHL's current placement could be optimal if consumer "disposable hockey income" was available to be used in the model instead of personal income.

When the *p*-median model is used in other industries to identify an optimal facility placement, additional factors that affect a facility's profitability must also be taken into account. The income available at a node may not be the only factor. The model should be adjusted to consider subsidies and externalities at each node if it is to properly identify an optimal facility placement. As the analysis of the four major sports organizations in the U.S. demonstrates, the *p*-median model's optimal solution is less likely to be the best option for an organization if its facilities are less dependent on the income available at a node on the network.

Expansion

Since 1990, all of the four major U.S. sports created new franchises and expanded into new markets. Table 9 details these changes. According to the *p*-median model, Major League Baseball did the best job in expanding to optimal locations. Major League Baseball added five new teams, and, considering where the other MLB franchises were already located, four were placed in optimal locations: Miami, Phoenix, Denver, and Tampa Bay. Because of its existing Baltimore franchise, the p-median model would have placed a new MLB franchise in Charlotte instead of in Washington, D.C.

<< Table 9 about here >>

According to the *p*-median model, the NBA did poorly by moving from Seattle to Oklahoma City. Before this move, the NBA also located two new franchises in Memphis and New Orleans instead of in St. Louis and Kansas City. The NFL also did not fare well by moving two franchises out of Los Angeles. The NFL optimally placed franchises in St. Louis and Charlotte, but it did not do well by placing teams in Baltimore, Nashville, and Jacksonville, instead of in Los Angeles, Portland, and San Antonio.

Since 1990 the National Hockey League expanded into nine new markets in the continental United States. The *p*-median model agreed with six of the moves: Dallas, Miami, Atlanta, Phoenix, Denver, and Tampa Bay. The model did not concur with the moves into Columbus, Charlotte, and Nashville. Instead it would have placed franchises in Houston, Seattle, and Cincinnati.

The *p*-median model also identified two expansion prospects for each of the leagues. Using each league's existing franchise locations, the model is able to find the best locations for two new franchises if the league were to expand into two new markets. Table 10 indicates where p-median model suggests the four leagues should locate their next two franchises if they decided to expand.

<< Table 10 about here >>

Conclusion

The analysis presented in this chapter has a few limitations. The first is that the model does not consider the possibility of placing multiple franchises in a single location. Certainly, there are markets – New York, Los Angeles, and Chicago – that easily support multiple franchises. In its current form, the model is unable to determine whether it would be better to place a third MLB franchise in New York or a new franchise in Charlotte.

A second limitation with this application of the *p*-median model is that the percentage of income a sports league captures may vary from market to market. This limitation was discussed previously with respect to the NHL. Although Houston may have more total income available than Buffalo, the income spent on hockey may be greater in Buffalo than in Houston. This limitation can be dealt with by surveying residents in cities to determine their willingness to spend on particular sports, but these data are difficult to accurately acquire.

A third limitation is that the *p*-median model assigns income from cities that do not receive franchises entirely to the closest franchise. There are fans, however, that do travel further than the closest franchise to another franchise that they identify better with. Allowing income from nearby nodes to go to franchises that are further away can change the optimal placement of franchises. For example in the NFL, the Harrisburg, Pennsylvania, MSA is closest to the Baltimore Ravens franchise, and Harrisburg is officially assigned to Baltimore in the NFL broadcast rights contract. However, the Pittsburgh Steelers are the most popular franchise in the Harrisburg area according to the local CBS television affiliate.[4] Making an adjustment to account for this limitation would also require acquiring data that is difficult to obtain.

Even with these limitations, the *p*-median model provided a unique look into how and why a sports league places its franchises in a set of locations that may or may not maximize the league's access to local income. This chapter showed that the four major sports leagues in the continental United States do not all locate franchises optimally according to the model. When a league has more revenue-sharing, fewer home games, and a shared national television rights contract, the league has less pressure to locate where the highest local income is. The league looks for other incentives – typically in the form of tax incentives from local governments – and places franchises in smaller markets.

Figure 1: A four-node network. Miles between the nodes are indicated on the line segment and income at each node is noted in parentheses.

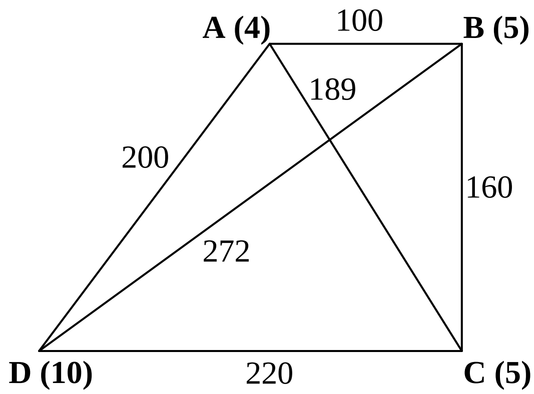

Figure 2: Optimal franchise placement in an eight team league when alpha is 1.0: The Lakeland Result

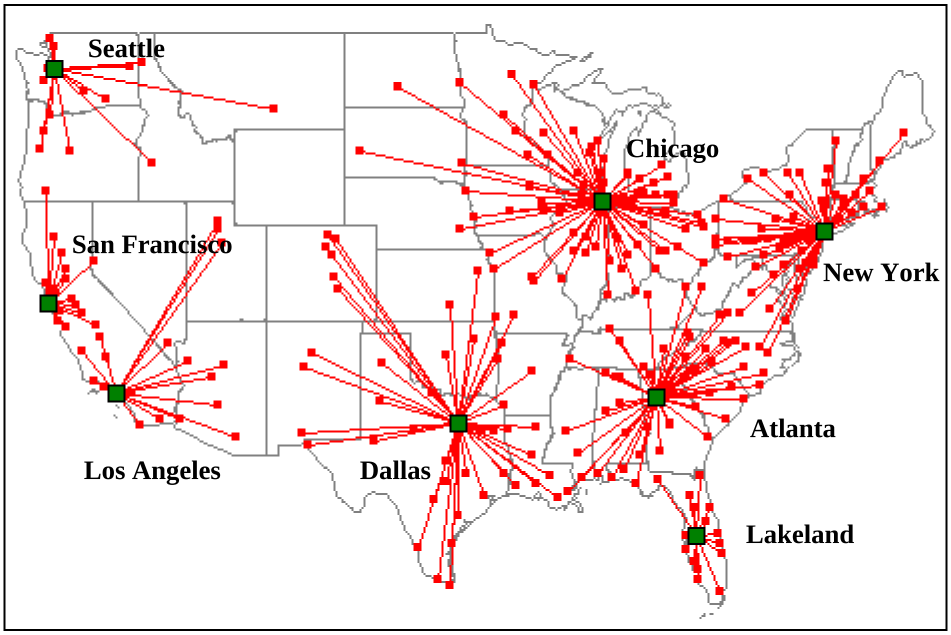

Figure 3: Optimal franchise placement in an eight team league when alpha is 0.5

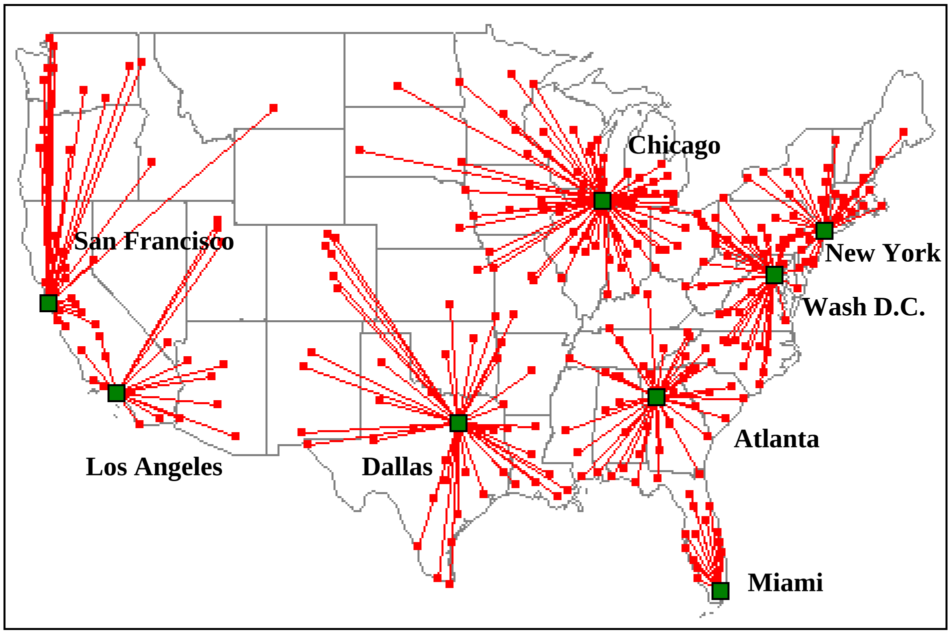

Figure 4: The Optimal Franchise Locations for the NFL

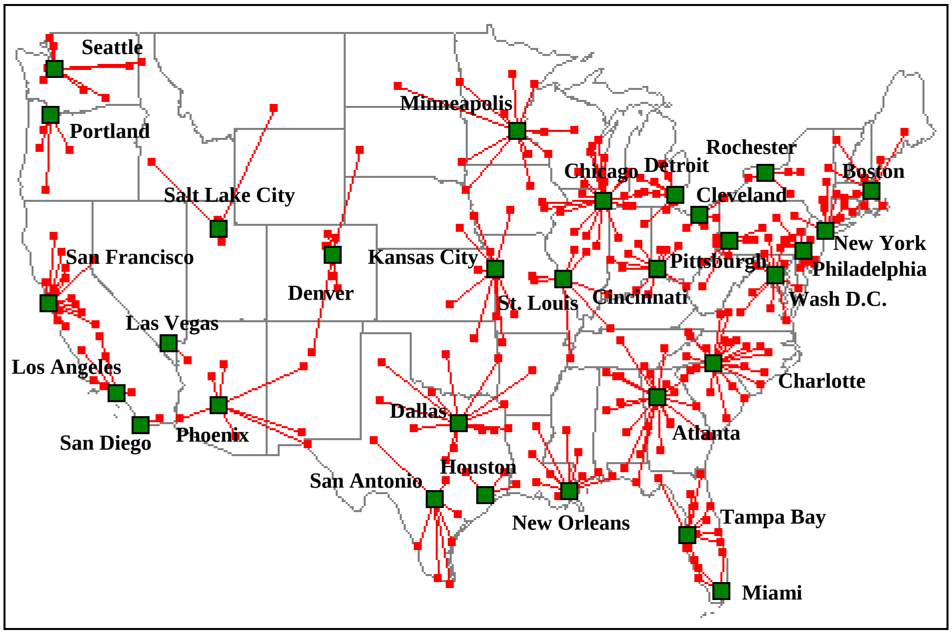

Table 1: Distanced income on a four node network

Franchise Placement	Distanced Income
AB	204.67
AC	191.42
AD	118.74
BC	188.32
BD	103.25
CD	118.24

Table 2: Optimal Franchise Locations of 8-Team League

alpha = 1.0		alpha = 0.5		alpha = 0.1	
MSA Rank	MSA	MSA Rank	MSA	MSA Rank	MSA
1	New York	1	New York	1	New York
2	Los Angeles	2	Los Angeles	2	Los Angeles
3	Chicago	3	Chicago	3	Chicago
6	San Francisco	4	Washington D.C.	4	Washington D.C.
7	Dallas	6	San Francisco	5	Philadelphia
11	Atlanta	7	Dallas	6	San Francisco
13	Seattle	10	Miami	7	Dallas
99	Lakeland, FL	11	Atlanta	8	Boston

Table 3: Actual vs. Optimal Franchise Locations for the MLB

Actual Location		Optimal Location	
MSA Rank	MSA	MSA Rank	MSA
1	New York	1	New York
2	Los Angeles	2	Los Angeles
3	Chicago	3	Chicago
4	Washington D.C.	4	Washington D.C.
5	Philadelphia	5	Philadelphia
6	San Francisco	6	San Francisco
7	Dallas	7	Dallas
8	Boston	8	Boston
9	Houston	9	Houston
10	Miami	10	Miami
11	Atlanta	11	Atlanta
12	Detroit	12	Detroit
13	Seattle	13	Seattle
14	Minneapolis	14	Minneapolis
15	Phoenix	15	Phoenix
16	San Diego	16	San Diego
17	***Baltimore***	19	Denver
19	Denver	20	St. Louis
20	St. Louis	22	Tampa Bay
22	Tampa Bay	23	Pittsburgh
23	Pittsburgh	***25***	***Portland***
24	***Cleveland***	26	Cincinnati
26	Cincinnati	28	Kansas City
28	Kansas City	***35***	***San Antonio***
34	***Milwaukee***	***37***	***Charlotte***

Table 4: Actual vs. Optimal Franchise Locations for the NFL

Actual Location		Optimal Location	
MSA Rank	MSA	MSA Rank	MSA
1	New York	1	New York
3	Chicago	***2***	***Los Angeles***
4	Washington D.C.	3	Chicago
5	Philadelphia	4	Washington D.C.
6	San Francisco	5	Philadelphia
7	Dallas	6	San Francisco
8	Boston	7	Dallas
9	Houston	8	Boston
10	Miami	9	Houston
11	Atlanta	10	Miami
12	Detroit	11	Atlanta
13	Seattle	12	Detroit
14	Minneapolis	13	Seattle
15	Phoenix	14	Minneapolis
16	San Diego	15	Phoenix
17	***Baltimore***	16	San Diego
19	Denver	19	Denver
20	St. Louis	20	St. Louis
22	Tampa Bay	22	Tampa Bay
23	Pittsburgh	23	Pittsburgh
24	Cleveland	24	Cleveland
26	Cincinnati	***25***	***Portland***
28	Kansas City	26	Cincinnati
32	***Indianapolis***	28	Kansas City
37	Charlotte	***31***	***Las Vegas***
39	***Nashville***	***35***	***San Antonio***
44	***Jacksonville***	37	Charlotte
49	***Buffalo***	***50***	***Rochester***
62	New Orleans	***51***	***Salt Lake City***
145	***Green Bay***	62	New Orleans

Table 5: Actual vs. Optimal Franchise Locations for the NBA

Actual Location		Optimal Location	
MSA Rank	MSA	MSA Rank	MSA
1	New York	1	New York
2	Los Angeles	2	Los Angeles
3	Chicago	3	Chicago
4	Washington D.C.	4	Washington D.C.
5	Philadelphia	5	Philadelphia
6	San Francisco	6	San Francisco
7	Dallas	7	Dallas
8	Boston	8	Boston
9	Houston	9	Houston
10	Miami	10	Miami
11	Atlanta	11	Atlanta
12	Detroit	12	Detroit
14	Minneapolis	***13***	***Seattle***
15	Phoenix	14	Minneapolis
19	Denver	15	Phoenix
24	***Cleveland***	***16***	***San Diego***
25	Portland	19	Denver
27	***Sacramento***	***20***	***St. Louis***
29	***Orlando***	***22***	***Tampa Bay***
32	***Indianapolis***	***23***	***Pittsburgh***
34	***Milwaukee***	25	Portland
35	San Antonio	***26***	***Cincinnati***
37	Charlotte	***28***	***Kansas City***
45	***Memphis***	35	San Antonio
48	***Oklahoma City***	37	Charlotte
51	Salt Lake City	51	Salt Lake City
62	New Orleans	62	New Orleans

Table 6: Actual vs. Optimal Franchise Locations for the NHL

Actual Location		Optimal Location	
MSA Rank	MSA	MSA Rank	MSA
1	New York	1	New York
2	Los Angeles	2	Los Angeles
3	Chicago	3	Chicago
4	Washington D.C.	4	Washington D.C.
5	Philadelphia	5	Philadelphia
7	Dallas	***6***	***San Francisco***
8	Boston	7	Dallas
10	Miami	8	Boston
11	Atlanta	***9***	***Houston***
12	Detroit	10	Miami
14	Minneapolis	11	Atlanta
15	Phoenix	12	Detroit
19	Denver	***13***	***Seattle***
20	St. Louis	14	Minneapolis
21	***San Jose***	15	Phoenix
22	Tampa Bay	19	Denver
23	***Pittsburgh***	20	St. Louis
33	***Columbus***	22	Tampa Bay
37	Charlotte	***26***	***Cincinnati***
39	***Nashville***	***28***	***Kansas City***
49	***Buffalo***	37	Charlotte

Table 7: Distanced Income and Inefficiency Ratios

		Distanced Income		*Inefficiency*
League	*U.S. Locations*	*Optimal*	*Actual*	*Ratio*
MLB	25	41,925,259	43,576,898	1.039
NBA	27	39,870,214	43,672,274	1.095
NFL	30	37,101,601	43,949,728	1.185
NHL	21	46,929,814	55,702,822	1.187

Table 8: Comparison of Franchise Location and Revenue among the Four Major Sports

League	*Home Games*	*Franchise Location Inefficiency Ratio*	*Franchise Revenue Coefficient of Variation*	*Franchise Revenue and MSA Income R-Squared*
MLB	81	1.039	0.220	0.797
NBA	41	1.078	0.238	0.748
NFL	8	1.185	0.126	0.548
NHL	41	1.187	0.229	0.785

Table 9: Actual vs. Optimal Expansions since 1990

Major League Baseball

Actual Expansion		Optimal Expansion	
MSA Rank	MSA	MSA Rank	MSA
10	Miami	10	Miami
15	Phoenix	15	Phoenix
19	Denver	19	Denver
22	Tampa Bay	22	Tampa Bay
4	***Washington D.C.***	***37***	***Charlotte***

National Basketball Association

Actual Expansion		Optimal Expansion	
MSA Rank	MSA	MSA Rank	MSA
45	***Memphis***	***20***	***St. Louis***
62	***New Orleans***	***28***	***Kansas City***
13	***Left Seattle***	***13***	***Stay in Seattle***
48	***Oklahoma City***		

National Hockey League

Actual Expansion		Optimal Expansion	
MSA Rank	MSA	MSA Rank	MSA
40	Left Hartford	40	Left Hartford
7	Dallas	7	Dallas
10	Miami	10	Miami
11	Atlanta	11	Atlanta
15	Phoenix	15	Phoenix
19	Denver	19	Denver
22	Tampa Bay	22	Tampa Bay
9	***Houston***	***33***	***Columbus***
13	***Seattle***	***37***	***Charlotte***
26	***Cincinnati***	***39***	***Nashville***

National Football League

Actual Expansion		Optimal Expansion	
MSA Rank	MSA	MSA Rank	MSA
20	St. Louis	20	St. Louis
37	Charlotte	37	Charlotte
2	***Left Los Angeles***	***2***	***Stay in Los Angeles***
17	***Baltimore***	***25***	***Portland***
39	***Nashville***	***35***	***San Antonio***
44	***Jacksonville***		

Table 10: Future Optimal Expansions for each of the Four Major Sports Leagues

	MLB	NBA	NFL	NHL
Expansion Prospect 1	Charlotte	Seattle	Los Angeles	Seattle
Expansion Prospect 2	Portland	St. Louis	Portland	Houston

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[1] See http://www.bea.gov/bea/regional/reis/
[2] Mark Daskin's Sitation software (version 5.7.0.26) was used to obtain the results.
[3] Distanced income is in millions of dollars. The specific value has no useful interpretation. What matters for the study is the comparison between the actual and optimal values of distanced income.
[4] See http://www.eveningsun.com/localnews/ci_11481650?source=rss