Predicting the Financial Benefit from Relocating Struggling NHL Franchises to High-Demand Markets

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Abstract

This paper analyzes the factors determining demand for National Hockey League (NHL) franchises and examines the degree to which these factors affect financial success given hockey-related revenue as an indicator. Using data from nine seasons, the effect of several demand factors on hockey-related revenues was determined through regression analysis. For example, hypothesizing that financially successful NHL franchises are in areas with a high general demand for hockey, some NHL franchises may not be optimally located for financial success. In the regression model, youth hockey participation rates are used as a proxy to measure an area's demand for hockey. Youth hockey participation rates are expected to have a statistically significant positive correlation with hockey-related revenues. Prior to determining optimal relocations, recent financial data is used to identify franchises consistently performing at the bottom of the league financially. Using the statistically significant coefficients from the regression results, optimal relocation areas are selected for the struggling NHL teams. Hockey-related revenues are then predicted for the new locations, using estimated demand factor coefficients obtained from the regression results and new location demand data. Columbus, Ohio; Raleigh, North Carolina; St. Louis, Missouri; and Phoenix, Arizona were selected to relocate to Quebec City, Quebec; London, Ontario; Hartford, Connecticut; and Milwaukee, Wisconsin respectively. After considering relocation costs, all moves were suggested to be financially beneficial. The estimated demand factor coefficients, combined with the new location data, predict an average increase in hockey-related revenue, less relocation costs, of 17% for these moves.

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I. Introduction

Some National Hockey League (NHL) franchises are not located in optimal locations to produce financial success. Many franchises are suffering because they are located in areas with low demand for the NHL. Based on the Forbes' (2012) NHL revenue information, the Toronto Maple Leafs, New York Rangers, Montreal Canadiens, and Vancouver Canucks generated 21.5% of the gross revenue for the 30 teams in the NHL during the 2011-2012 season. These four teams also grossed $237.9 million in operating income, while the bottom thirteen teams grossed a $130.2 million loss during the 2011-2012 season (Forbes, 2012). Eleven of these thirteen financially plagued teams are located in the Sunbelt region, the Midwest, North Carolina, and Tennessee.[2] These areas all share a lack of interest in hockey, as demonstrated by low youth hockey participation rates.

The Atlanta Thrashers recently relocated to Winnipeg and became the Jets. Why would the Thrashers move to a new market one-sixth the population of the current market? Winnipeg has a much larger demand for hockey than Atlanta despite having a smaller population, demonstrated by the recent financial success of the Jets. By relocating from an area with a low demand to an area with a high demand for hockey, one of the financially struggling teams in the NHL became one of the most lucrative.[3]

But what drives demand for the NHL? Is demand driven as a result of the team existing for many years and developing a large fan base due to its historic presence? Do large populations generate a large demand? Does winning games and championships increase demand? Or does a team simply succeed financially because the area has a large demand for hockey in general?

I predict all of the factors mentioned above contribute to the financial success of a franchise. However, I believe the biggest contributor to the financial success of NHL franchises is location, with successful teams located in areas that have a large general demand for hockey. Youth hockey participation rates are used to measure general demand for hockey in a given area because these rates are observable and quantifiable. Of the top four revenue-generating teams, three are located in hockey-loving Canada.

Moving teams from low-demand to high-demand hockey markets in Canada and in the hockey hotbeds of the United States could potentially be lucrative relocations for struggling franchises. This paper aims to determine specifically what generates demand for the NHL and quantify if specific relocations

2 The other two teams are the New York Islanders and Buffalo Sabres.

3 According to the Forbes data, revenues increased from 71 (Atlanta) to 105 million (Winnipeg) from 2010-2011 to 2011-2012 as a result of the move and net operating income increased from -5.2 to 13.3 million (Forbes, 2012).

will be financially lucrative enough to outweigh the cost of moving a team.

The financial success of NHL franchises is determined largely by gross demand.[4] In Section II I briefly review a previous study comparing Canadian and American NHL markets. Section III explains the dependent variable, hockey-related revenue, used in my analysis to quantify financial success. I use data from the past nine seasons of observable, quantifiable factors that may potentially increase demand. Combining this information with previous franchise financial data, the relationship between demand factors and financial status is modeled through regression analysis. Section IV summarizes the data and methodology used in this analysis. The next section, Section V, uses the regression results to quantify and evaluate the demand factor's effect on the dependent variable, hockey-related revenue. In Section VI, the relationship between observable demand factors and financial success is used to predict how revenues may change for struggling franchises after moving to more optimal locations. This section also contains a brief cost-benefit analysis of the relocations selected. I conclude the paper in Section VII, making a final suggestion to the NHL based on my analysis to date.

II. Review of Mowat Centre for Policy Innovation Study

Policy analysts have hypothesized that Canadian teams produce larger revenues and operating incomes, because Canada has a higher demand for hockey than most areas in the United States. The University of Toronto's Mowat Centre for Policy Innovation conducted a study, entitled "The New Economics of the NHL: Why Canada can Support 12 Teams," analyzing the financial success of Canadian franchises (Keller and McGuire, 2011). The authors, Keller and McGuire, create a simple regression to quantify the effect of wealth, population, and geographical location on revenues.[5] For geographical location, a binary variable ("dummy") is created for franchises that exist in Canada. The authors name this dummy variable the "hoser" effect.[6] Based on this analysis they determined that a franchise in Canada generates $24 million more revenue from ticket sales annually than a franchise located in the United States. These conclusions provide a beneficial background for my analysis and predictions. Keller and McGuire's analysis provides the foundation for the

4 Other factors, such as the efficiency of the Management, are also relevant. However, this information cannot be analyzed because the NHL financial information is not publically available, as all teams are privately owned.

5 The authors used the Forbes estimated gate revenues.

6 In Canada "hoser" is a slang term used jokingly between Canadians and is similar to the term "loser." The term originates from hockey because, before Zambonis, the losing team had to "hose" down the ice.

analysis conducted in this paper. Keller and McGuire essentially assume the impact of being located or not located in Canada is constant by using the binary hoser effect. They also fail to model competitive factors, like winning games, that impact demand. I will develop a more complex and accurate econometric model to analyze what affects revenues by using a more measure of hockey demand and accounting for competitive factors.

III. Hockey-Related Revenue

Forbes publishes operating income for NHL franchises. To determine what impacts operating income, cost information would be necessary. Because cost information is not available, revenue is used as an indicator of the financial success.

Hockey-related revenue (HRR) is defined in the 2005 Collective Bargaining Agreement between the NHL and NHL Players Association. HRR is revenue net of "direct costs" for hockey-related activities (NHL CBA, 2005).[7] "Direct costs" include "any cost, including fixed and variable costs, attributable to a revenue-generating activity" such as "arena occupancy costs, and general and administration expenses" (NHL CBA, 2005). In general, HRR is the resulting revenue after the costs are deducted from the gross revenue created by hockey-related activities. HRR does not include revenue received from revenue sharing (revenue sharing redistributes a fraction of revenues from the financially successful teams to the financially unsuccessful teams), relocation of other teams, or interest income (NHL CBA, 2005).

To estimate HRR, I use the Forbes' NHL franchise revenue values over the past 9 seasons. The Forbes revenue is "net of revenue sharing and arena debt service" (Forbes, 2012). "Arena debt service" is the payments made on "arena occupancy costs." By deducting arena occupancy costs, the Forbes data is close to hockey-related revenue. However, Forbes includes revenue received from revenue sharing agreements. Because HRR values are determined before revenue is shared, I adjust the data to pre-revenue sharing values by reversing the revenue sharing agreement.[8] Appendix B provides an example of the adjustments that were made.

IV. Methodology

This section summarizes data sources and modeling used to arrive at the results displayed in Section V. I created a model to determine variables that

7 HRR includes NHL regular season, pre-season, and playoff gate revenues and revenue from local cable broadcast, national broadcasts, local radio broadcast, luxury boxes, novelty sales, concessions, game parking, and other hockey-related activities.

8 I use the revenue sharing formulas from the 2005 CBA to predict what HRR was for each team before these formulas were applied to redistribute revenue among teams.

affect hockey-related revenue. This regression assumes HRR is determined by non-city-specific variables, such as on ice competitiveness, a binary ("dummy") variable for each team ("fixed effect"), and a binary variable for each season ("time-series"). The regression is notated in simple form in Regression 1.

Regression 1: Hockey-related revenue = $\beta_0 + \beta_n$ (non-city-specific variable n) + β_i (dummy for team i) + β_j (dummy for season j) + ε; where n is each non-city-specific variable, i is each team, and j is each season in the data set.

After running Regression 1, I obtain β_i for every team. This β_i is the fixed effect; therefore, the fixed effect for each team is obtained from regression results in Section V.[9] I also create a Ordinary Least Squares (OLS) regression that assumes a team's effect on hockey-related revenue (fixed effect) is determined by city-specific variables. The regression is notated in simple form in Regression 2.

Regression 2: β_i (fixed effect) = $\beta_0 + \beta_c$ (city-specific variable c) + ε; where c is every city-specific variable (such as population) and i is each team.

IV.A. A Methodology for Fixed Effect Time-Series Regression

Using the 31 different teams as panel data and the successive seasons as a time series, I create a fixed effects time-series regression.[10] The fixed effects model creates a dummy variable for each team, not including the Montreal Canadiens, to adjust for the fact that each team's location and fan base is different.[11] There is no dummy created for the Canadiens because they are used as a standard of comparison for the other teams. The model assumes each team's impact on the dependent variable, HRR, is constant over time, or "fixed." This model assumes season-to-season changes in HRR are due to hockey becoming more popular over time and other non-city specific variables changing within each team.

Variables correlated with a team's location, such as population, are not included in the fixed effects regression because population is assumed to be included in the fixed effects for each team. For example, metropolitan area population remains relatively constant for each team over this period. A team with a large population may have higher HRR, but the fixed effect for each team captures this increase in hockey-related revenue. Theoretically, I could have included city-specific variables, such as population, in the fixed effects

9 The coefficients in the data results are the β's

10 Thirty-one teams exist in the data because Atlanta moved to Winnipeg for the 2011-2012 season.

11 Any team could be selected for comparison because it would not make a difference econometrically.

regression if there was temporal variation in these variables within each city. However, the practical problem is that these city-specific variables do not vary much within each city and therefore, do not explain team variation around the mean of HRR. As a result, relegating these city-specific variables to a secondary regression, with the dependent variable being the fixed effect, is appropriate. This secondary regression is explained is Section IV.B.

Factors that are not correlated with the fixed effects that have temporal variation, denoted as "non-city-specific" variables, are included in this regression in addition to the fixed effects and time-series. These variables are explained in the next Section, IV.A.1.

The time series created with respect to seasons over time adjusts for the increase in popularity. To create a time series, a dummy variable for each season is created, not including 2002-2003. For the 2002-2003 season there is no dummy variable created because it is used as a comparison for the other seasons, as the Canadiens were used for the fixed effects. There are nine seasons from 2002-2003 to 2011-2012.[12]

IV.A.1. Non City-Specific Variables

I collected data for the variables below throughout the nine seasons of data. For every season there are 30 teams. Therefore, there are 270 observations for each of the following variables.[13]

Relative Power Index (RPI)

Because the NHL includes overtime and shootout wins, a normal "winning percentage" does not completely explain a team's on-ice success. Many teams play tougher schedules, leading to a lower winning percentage. Therefore, the ESPN-calculated Relative Power Index (RPI) is used. RPI is calculated as: 25% multiplied by team winning percentage, 50% multiplied by opponents' average winning percentage, and 25% multiplied by opponents' opponents' average winning percentage (ESPN RPI data). To calculate winning percentage, ties count as half a win and half a loss. ESPN reports RPI on a scale of 0 to 1. I adjusted this scale by multiplying the data by 100 to present a range from 0 to 100. The regression results in Section V, Data, will now be representative of a 1-percentage point change in RPI. In general, RPI offers a comparison of the competitive strength of each team.

A team that does well competitively is expected to generate a greater demand. Fans are more likely to watch a winning team. An increase in fans

12 T here are not ten seasons because there was a lockout during the 2004-2005 season.

13 Twenty-nine teams account for nine observations each (one every season). Atlanta accounts for eight observations and Winnipeg accounts for 1 observation.

increases HRR by increasing attendance. In addition, ticket prices increase as demand increases. Fans are more likely to watch a winning team on TV. Increased viewership increases TV ratings. Increased TV ratings increase the amount businesses are willing to pay for commercials, increasing advertising revenue. An increase in advertising revenue increases the amount local broadcasting stations are willing to pay NHL franchises for local broadcast rights. An increase in local broadcasting contracts increases the revenue for the winning franchise. Therefore, a winning team increases gate revenues and sponsorships, increasing total HRR. As a result, RPI is expected to have a positive correlation with hockey-related revenue. A team that wins consistently will also yield larger local TV contracts. However, the impact of winning on TV contracts is likely lagged, since the contracts are established in advance of a given season.

Home Playoff Games

This variable is the number of home playoff games an NHL franchise had in a given season. If the team did not make it to the playoffs, this number would be zero. A home playoff game creates additional HRR because franchises host additional games that generate revenue. Fans pay increased prices for playoff tickets. Therefore, a playoff game creates much more revenue than a regular season game. An analysis of the 2010-2011 season regular season ticket prices compared to playoff season tickets determines an estimate of how much more playoff tickets cost. The average ticket cost for the 2010-2011 regular season for the top ten franchises was $70.102 (Team Marking Report, 2011). In comparison, the average ticket cost for the first round of the 2010-2011 playoffs for the top franchises was $228.24 (Seat Geek, 2011). An increased number of games at an increased ticket cost creates additional HRR. In result, the number of home playoff games is expected to have a positive correlation with hockey-related revenue.

Stanley Cup Dummy (lagged)

The Stanley Cup dummy has a value of 0 if the team did not win a Stanley Cup in the previous season and a value of 1 if the team did win a Stanley Cup in the previous season. Winning a Stanley Cup in one season is expected to increase fan following in the previous season due to the increase in new fans. A championship winning team creates a contagion and this contagion is expected to continue into the following season. This contagion is often referred to as a "bandwagon." Fans may "hop on board this bandwagon" and support the team and after they win the championship. In addition, an old fan is likely to become a bigger supporter during and after a team wins a championship. The creation

of new fans and increased demand by old fans increases demand for the team's services as a whole, increasing hockey-related revenue.

New Arena Dummy

The new arena dummy variable has a value of 1 if the team built a new arena or significantly updated their arena within four years of the relevant season in the data and has a value of 0 otherwise. Teams increase hockey-related revenue when they create a new arena because it temporarily increases demand for watching the team play. A paper by Ken Perry concludes that new arenas have a statistically significant impact on attendance in the NHL (Perry, 2009). The increase in attendance creates higher revenue in ticket sales; thus, creation of a new arena increases hockey-related revenue.

IV.A.2. Model Notation

The fixed-effects time-series regression is notated in Regression 3.

Regression 3: Hockey-related revenue = $\beta_0 + \beta_1$ (RPI) + β_2 (home playoff games) + β_3 (Stanley Cup dummy) + β_4 (new arena dummy) + β_i (team i dummy) + β_j (season j dummy) + ε; where i is every team except for the Montreal Canadiens and j is every year except for season 2002-2003.

IV.B. Methodology for OLS Regression on Fixed Effects

After running the regression 3, I obtain β_i for every team. This β_i is the fixed effect. To analyze what determines the fixed effect, the β_i's from the fixed effects time-series regression are regressed on the observable factors that are specific to a team's location. These variables are denoted as "city-specific variables."

I used an ordinary least squares regression with the dependent variable being the team fixed effects. I used the variables explained below to analyze their effect on the team fixed effects and ultimately, HRR.[14] I took an average of the area youth hockey participation rates, metropolitan population, average metropolitan area income, and years with team over the time period (2003-2012) because the fixed effect is constant over time.

IV.B.1. City-Specific Variables

Average Area Youth Participation Rate

Youth hockey rates are used as a proxy to determine demand for hockey in a given area. An area with a higher demand for hockey would have a higher youth participation rate. Table 4.3 highlights the percentage of youth (under

14 The fixed effect has a one-to-one direct relationship with HRR. Therefore, the variables that determine the fixed effect have a direct one-to-one relationship with HRR.

18) ice hockey players compared to the entire youth population in the area that each team is located. The demand for hockey is likely easier to measure than other sports, such as football, because players must register with USA Hockey or Hockey Canada in order to play on a team. Refer to Appendix E to see how these percentages were obtained.

[TABLE 4.3 AT END]

It is no surprise that the most lucrative team in the NHL, the Maple Leafs, also has the highest youth participation rate. It is also no surprise that Atlanta, previous home of the struggling Thrashers, has the lowest youth participation rate. Hockey participation rates are used as an indicator of demand for hockey in the area where the team is located. Greater demand for hockey, as measured by youth hockey participation rates, increases the TV contracts a team can obtain, as well as increases attendance and ticket prices. Therefore, I believe higher youth participation signals a higher demand for hockey and leads to a larger fixed effect and larger hockey-related revenue.

A verage Metropolitan Area Population

An area with a larger metropolitan population is expected to have a larger fixed effect and thus, higher hockey-related revenue, ceteris paribus. A larger population may potentially create a larger fan base. The larger the fan base, the larger the demand for hockey, and the more HRR that team may generate. However, population is only an indicator of potential fan base. Therefore, it would not be surprising if population did not have a significant impact on the fixed effects and thus hockey-related revenue. A prime case for this phenomenon is the Atlanta Thrashers. Being in the Atlanta Metropolitan Area, the Thrashers have one of the largest metropolitan populations, as shown in Table 4.4. However, they also have a low youth participation rate. Therefore, they likely have a much smaller fan base compared to the Montreal Canadiens.[15] However, all else constant, a larger city is expected to have larger HRR.

[TABLE 4.4 AT END]

Average Metropolitan Area Income

An area with a larger average metropolitan area income is expected to have a larger fixed effect, leading to higher HRR, ceteris paribus. The more money an area has to spend on consumption, the more likely they are to spend more on hockey. In addition, price levels vary from city to city; therefore, areas with higher cost of living may have higher ticket prices as well, generating more HRR. However, it would not be surprising if income had little effect or

15 Multiplying participation rates by population we can determine Montreal amounts to .21 and Anaheim amounts to .0045. This suggests Montreal has a demand for hockey almost 47 times that of Atlanta.

no effect on the fixed effect, because each area's consumers' willingness to pay is not observable. For example, Washington D.C. may have a higher average income than Toronto, but fans in Toronto may have a much higher willingness to pay which would undermine the effect of income on the fixed effects. This willingness to pay may also be captured by the youth participation rate, as an area with a higher demand for hockey based on youth participation rate will also have a higher willingness to pay. Average metropolitan area income, converted from nominal to real (with 2003 as the base year), is shown in Table 4.5. [TABLE 4.5 AT END]

Years Since Team was Formed

This variable is simply [season year]-[year team was formed] where "year team was formed" is the exact year the team entered the NHL.

[TABLE 4.6 AT END - INCLUDE FOOTNOTE]

Reviewing the information above, the six teams that have existed the longest, known as the "Original Six," are also consistently among the top ten in terms of HRR. The longer a team exists, the more time it has to broaden its fan base and establish more lucrative local TV contracts and sponsorships. Therefore, a team that exists longer compared to another team is expected to have more fans, increasing the fixed effects and HRR, holding all else constant.

Pre-Loyalty Dummy

There are metropolitan areas with multiple teams. In the Los Angeles Metropolitan Area, the Anaheim Ducks and Los Angeles Kings exist. In the New York City Metropolitan Area the New York Islanders, New York Rangers, and New Jersey Devils exist. I create a dummy variable equal to 1 for the newer teams in the Los Angeles and New York area. The Rangers and Kings existed before the Ducks entered the L.A. area and the Devils and Islanders entered the New York area. When new teams enter, they are expected to have a more difficult time to gain new fans due to previously established team loyalties. Fans are not likely to become loyal to a new team when they are already loyal to another team. Therefore, if a team currently exists in a market, the new team may not gain as much support as the previous team in that area. Therefore, the Ducks, Devils, and Islanders have a binary variable (dummy) equal to 1, as they were new teams entering markets where teams existed. The dummy predicts the amount that team loyalties matter.

I assign new locations with a pre-loyalty dummy equal to 1 if they are within 70 miles of another team. Seventy miles is just over one hour driving and therefore, the previous team will have a strong loyalty presence in that area. I expect the average fan will still make a trip to see a game if they are

about 70 miles away from an arena. In addition, I expect the team to have a large TV presence within 70 miles of the team's location.

IV.B.2. Model Notation

Regression 4: Team Fixed Effect = $\beta_0 + \beta_1$ (youth participation) + β_2 (metro population) + β_3 (metro average income) + β_4 (years with team) + β_5 (Pre-Loyalty Dummy) + ε

IV.C. Conclusion

By combining the OLS Regression (fixed effects as the dependent variable) and the Fixed Effects Time-Series Regression (HHR dependent variable), a two-stage model is created. The first stage is the OLS model to predict the fixed effects. The second stage takes the predicted fixed effects and binserts it into the Fixed Effects Time-Series model. By combining both models, HHR for new locations can be predicted. Without the first stage prediction of the fixed effects, the fixed effect for a new location cannot be predicted because the fixed effect is unobservable.

The results in Section V, Data, will determine what impacts HRR to create a predictive model to determine HRR for new locations. Most importantly, the results will predict if moving teams from low-demand to high-demand hockey areas, based on youth participation rates, is a viable solution to the financial struggles of some of NHL teams.

V. Conclusion

Using the methodology from Section IV, I ran Regressions 3 and 4 in a statistical software package (Stata) to produce the results below. In addition, I analyze the results to create a predictive model of HRR.

V.A. Fixed Effects Time-Series Regression (second stage)

Regression 3: Hockey-related revenue = $\beta_0 + \beta_1$ (RPI) + β_2 (home playoff games) + β_3 (Stanley Cup dummy) + β_4 (new arena dummy) + β_i (team *i* dummy) + β_j (season *j* dummy) + ε; where *i* is every team except for the Montreal Canadiens and *j* is every year except for season 2002-2003.

As explained in Section IV, Methodology, when reading the fixed effects by team below, the coefficient refers to the amount each particular team makes compared to the Montreal Canadiens, ceteris paribus. In addition, when reading the results of the time series by season, the coefficient refers to the additional amount of hockey-related revenue compared to the 2002-2003 season, holding all else constant. If hockey became more popular over time, the coefficient on each season will increase over time. Because HRR was adjusted

to 2003 USD for all years, coefficients on the season variables will be independent of inflation. The coefficients on the non-city-specific variables (RPI, home playoff games, Stanley Cup dummy, and new arena dummy) suggest the amount in dollars that hockey-revenue changes due to a one-unit increase in these variables.

The constant in the regression results below coincides with the Montreal Canadiens' 2002-2003 season with RPI=0, 0 playoff games, not winning a Stanley Cup in the previous season, and not having a new arena.

V.A.1. Data Results [THIS SECTION AND TABLE 5.1 WILL BE PLACED AT END]

V.A.1. Data Analysis

Using the regression results from Table 5.1, the fixed effects can be analyzed. Every team, excluding the Rangers, is highly correlated with hockey-related revenue due to t-statistics greater than 1.96 that are significant at the 95% confidence interval. The Rangers are correlated with hockey-related revenue at the 80% confidence interval.

To further understand the coefficients on the fixed effects, take for example the fixed effect of the Toronto Maple Leafs. The coefficient of 27.97 means the Toronto Maple Leafs make 27.97 million (2003 USD) more in HRR than the Montreal Canadiens in a given season if the other variables are held constant. This means in a given season, if both teams have the same RPI, the same number of home playoff games, no Stanley Cup win in the previous season, and the same arena status, the Maple Leafs make 27.97 million in 2003 USD more than the Canadiens before the revenue sharing formula is applied. This makes sense intuitively because the Toronto Maple Leafs are the most lucrative team in the NHL. In addition, the fixed effect of the Phoenix Coyotes can be analyzed. The coefficient of -67.92 means that the Phoenix Coyotes make 67.92 million (2003 USD) less in HRR compared to the Montreal Canadiens in a given season if all other variables are held constant. This also makes sense intuitively because the Phoenix Coyotes are struggling financially. By using the Montreal Canadiens as a standard of comparison we can also analyze differences between any two teams. For example, the results in Table 5.1 suggest the Maple Leafs make 95.89 million (2003 USD) more than the Coyotes before revenue sharing, ceteris paribus.[16]

The time-series trend can also be analyzed by using the regression results in Table 5.1. The coefficients for the 2006-2007 through 2011-2012 seasons are statistically significant at the 95% confidence interval. These results sug-

16 Calculated as the difference between the Maple Leafs' and Coyotes' fixed effects.

gest the majority of the seasons are correlated with HRR. The coefficient on the 2010-2011 season suggests that in the 2010-2011 each team made 17.68 million (2003 USD) more than in the comparison season, 2002-2003. This suggests the Maple Leafs would have made 17.68 million (2003 USD) more in 2010-2011 than in 2002-2003 if they had the same RPI, arena status, number of home playoff games, and Stanley Cup status in both seasons, before the revenue sharing formula is applied. As hypothesized, the coefficients on each season increase over time, suggesting that hockey gained popularity over time because HRR for each team increased over time, all else constant. For example, from the 2010-2011 to 2011-2012 season the results suggest HRR increased $11.36 million holding all else constant.[17] As the NHL gains popularity, demand increases and therefore ticket and gate revenues increase. In addition, an increase in general NHL demand increases TV contracts. The increased revenue from gate revenue and TV contracts increases hockey-related revenue. Note that by missing a season, the league's growth is stalled as popularity ceases to increase and may even temporarily decrease. However, the lack of significance on the coefficients for the 2003-2004 and 2005-2006 seasons do not allow us to conclude that the lost season decreased popularity. It is important to reiterate that these are adjusted in 2003 U.S. dollars and the increase in coefficients over time is not due to inflation, but other factors such as popularity.[18]

In addition to the time-series and team fixed effects, an analysis of the variables included in the regression above can determine the effect of these variables on HRR. As predicted, the number of home playoff games a team plays has a statistically significant positive correlation, at the 95% confidence interval, with hockey-related revenue. The coefficient on home playoff games suggests each home playoff game a team plays creates an additional 1.67 million (2003 USD) in hockey-related revenue. This coefficient suggests that a team with home ice advantage for the entire playoffs that wins the Stanley Cup could make up to 26.67 million (2003 USD) in additional playoff revenue.[19] As explained earlier, this makes sense intuitively because home playoff games create additional HRR. Although teams contribute a percentage of their playoff ticket sales to revenue sharing, they are still likely to have large gains from home playoff games, as confirmed by the results in Table 5.1.[20] Therefore, it is

17 I used the difference between the coefficients on these two seasons.

18 The results are in 2003 USD due to the fact that hockey-related revenue is adjusted to 2003 USD and we are determining the variables effect on real USD, not nominal.

19 A team can have a maximum of 16 home playoff games in a given season. However, the data for home playoff games has an observed maximum of 14 because it is extremely unlikely that a team will be the home team for every round and every series will go 7 games.

20 Teams only contribute a percentage less than or equal to 50% of their revenue for a sold-out regular season game. Teams charge elevated ticket prices for playoff games.

important to consider the potential gains from a successful post-season.

Using the regression results from Table 5.1, the effect of a new arena on hockey-related revenue can also be analyzed. With a t-statistic of 2.97, a new arena is positively correlated with hockey-related revenue and statistically significant at a 95% confidence interval. The coefficient on this variable suggests that for the first four years with a new arena the team makes an additional 10.11 million (2003 USD). Using this coefficient and the season coefficient, we can predict that the New York Rangers made 21.46 million (2003 USD) more hockey-related revenue compared to the previous season when they updated Madison Square Garden for the 2011-2012 season.[21] As predicted, this makes sense intuitively because a new arena increases attendance and thus increases HRR.

The value of the constant for the 2002-2003 season in Table 5.1 above suggests that the Montreal Canadiens made 83.18 million (2003 USD) in that season, assuming RPI=0, 0 playoff games, no Stanley Cup in the previous season, and no new arena in the past four years, before they contributed funds to the revenue sharing agreement. In addition, the regression suggests that the fixed-effects time-series regression with the variables used explains 87.09% of the variation in hockey-related revenue.

V.A.3. Preliminary Predictive Model for Hockey-Related Revenue

Using the coefficients from the regression results above a predictive model can be created to predict HRR. The numerical coefficient values replace the β's from Regression 3.

Predictive Model 1[22]: Hockey-related revenue = 83.18083 + (team fixed effects) + (season coefficient) + .227638(RPI) + 1.66661(home playoff games) + 5.074734(Stanley Cup dummy) + 10.10505(new arena dummy)

Considering the example of the Philadelphia Flyers in the 2011-2012 season, the team fixed effects would be -22.85209 and the season coefficient would be 29.03692. Given that the Flyers did not win a Stanley Cup in 2010-2011, did not build a new arena recently, played 6 home playoff games, and had an RPI of 58.1, the effect of these variables can be calculated as: 1.66661(6) + .227638(58.1) = 23.22 million. Therefore, the predicted hockey-related revenue for the Flyers in 2011-2012 is 83.18083 - 22.85209 + 29.03692 + 23.22 = 112.6 million in 2003 USD. Converting this number to 2012 dollars, using 2003 and 2012 Consumer Price Index (CPI) values, the model predicts that the

21 Also holding constant the RPI, home playoff games, and Stanley Cup dummy. Calculation: 11.359 + 10.10505 = 21.46405

22 In this equation, HRR represents pre-revenue sharing in 2003 dollars.

Flyers made about $140.1 million (2012 USD) during the 2011-2012 season (112.6*(229/184)).[23] According to the adjusted Forbes pre-revenue sharing data, the Flyers actually made $132 million during the 2011-2012 season.

For an analysis of optimal relocations, this model alone falls short at predicting HRR for a new location because the fixed effect for the new location is not available. An OLS regression to predict the team fixed effect solves this problem and allows us to combine both models to create a two-stage model that predicts the hockey-related revenue of a new team.

V.B. OLS Regression on Fixed Effects (first stage)

When predicting a new team's hockey-related revenue, the predicted location's fixed effect will be inserted into "team fixed effects" in Predictive Model 1 above. As explained in Section IV, Methodology, I ran an OLS regression of the fixed effects coefficients on the city-specific variables from Table 5.1.

V.B.1. Data Results [THIS SECTION AND TABLE 5.2 WILL BE PLACED AT END]

V.B.1. Data Analysis

Using the regression results from Table 5.2, the independent variables' effects on the team fixed effect can be analyzed. As hypothesized, youth participation rates have a positive statistically significant correlation with the team fixed effect. The coefficient on youth participation rates suggests that a one-percentage point increase in average youth participation rate increases the fixed effect by 2.98 million in 2003 USD. The Maple Leafs have a youth participation rate of about 8%, compared to the Stars, who have a participation rate of about 0.01%. Assuming Dallas and Toronto were identical in all aspects other than youth hockey participation, the coefficient suggests that the Maple Leaf's fixed effect would be 23.8 million, in 2003 USD, higher than the Stars.[24] This suggests that the Maple Leafs also make an additional $23.8 million HRR in each year over the course of the 2002-2003 to 2011-2012 seasons because there is a higher demand for hockey in Toronto compared to Dallas.[25] Therefore, the prediction that teams in a region with a higher demand for hockey, based on youth participation rates, have higher HRR was correct.

The regression results in Table 5.2 indicate that metropolitan population size has a statistically significant positive correlation with the fixed effect. The

23 The fixed effect coefficient is -22.85 from Table 5.1 and (229/184) is the 2012 to 2003 CPI ratio, adjusting to nominal dollars.

24 The increase in 2012 (nominal) dollars is $35.49 million. I calculated this as 23.8*(229/184).

25 The fixed effect has a directly related one-to-one effect on hockey-related revenue in the second stage of the two-stage regression.

coefficient on metropolitan population suggests that a metropolitan area with identical income, years with team, youth participation rate, and identical pre-loyalty status as another metropolitan area will have a team that makes 2.23 million (2003 USD) more than a team in another metropolitan area with 1 million fewer inhabitants before revenue sharing.[26] This makes sense because cities with bigger populations are more likely to have a larger fan base. The more hockey fans in a city, the greater the demand for hockey. A greater demand leads to a higher fixed effect and higher HRR.

In addition, the number of years since the team was formed has a statistically significant positive correlation with the fixed effects. The coefficient suggests that a team gains an additional 392,060 in 2003 USD with each additional year of existence. An old team like the Detroit Red Wings, which has existed for about 80 years, is expected to have a higher fixed effect than a new team like the Coyotes, which has existed for about 16 years. The coefficient suggest the Red Wings will have about a 25 million 2003 USD higher fixed effect than the Coyotes, ceteris paribus, over the course of the 2002-2003 to 2011-2012 seasons because they have had time to obtain a larger fan base than the Coyotes.

Pre-loyalty, or incumbency, also has a statistical impact on the fixed effect. The coefficient on the pre-loyalty dummy suggests that teams entering areas with fans loyal to previous teams have a fixed effect that is 29.9 million (2003 USD) less than the incumbent team.[27] To provide an example of this effect, I compare the Kings to the Ducks by combining the pre-loyalty and years with a team in existence effect. The Kings and Ducks have the same metropolitan information and thus, their fixed effect differs only in years with team and pre-loyalty. The Kings existed for 26 years before the Ducks entered the Los Angeles area. Therefore, the model predicts the Kings' fixed effect is 40.04 million higher than that of the Ducks, in 2003 USD.[28] This means that if the two teams have the same RPI, past Stanley Cup status, number of home playoff games, and arena status in any given season, the Kings will generate an additional 40.04 million (2003 USD) HRR over the Ducks. This makes sense because the Kings fans remained loyal to the Kings when the Ducks entered the market, resulting in the Ducks having a more difficult time developing a fan base.

The R-squared suggests that the variables in this OLS regression explain 73.71% of the variance in the fixed effects. The remaining 26.29% of variation may be due to unobservable factors in each city. This OLS model would

26 Adjusted to nominal this number becomes 2.77 million in 2012 USD.
27 The only city-specific variable that will differ is the years a team exists.
28 Calculation: (26*0.39)+29.9 = 40.04

be more accurate if more precise data were available, for example, exact metropolitan area youth participation rates. However, unobservable city-specific factors are included in the fixed effect for cities that currently have a team. Therefore using only the second-stage regression to analyze hockey-related revenues for current teams explains 87.09% of the variance in hockey-related revenue. However, for the cities without teams, their fixed effect must be predicted using the OLS model.

V.C. Complete Predictive Model for Hockey-Related Revenue

The OLS regression in Table 5.2 provides a predictive model for the team fixed effect as shown in Predictive Model 2 below.

Predictive Model 2: Team Fixed Effect = -52.93255 + 2.979706(youth participation) + 2.226185(metro population) – 0.4450235(metro average income) + 0.3920605(years with team) – 29.90464(pre-loyalty dummy)

As stated earlier, the team fixed effect is "plugged in" to the fixed-effect time series, Regression 4. The complete combined predictive model for hockey-related revenue is presented below.

Combined Predictive Model: Pre-revenue sharing hockey-related revenue = 83.18083 + [-52.93255 + 2.979706(youth participation) + 2.226185(metro population) - 0.4450235(metro average income) + 0.3920605(years with team) – 29.90464(pre-loyalty dummy)] + (season coefficient) + 0.227638(RPI) + 1.66661(home playoff games) + 5.074734(Stanley Cup dummy) + 10.10505(new arena dummy)

Based on the Flyers information for average participation, average population, average income, and years with a team, their predicted fixed effect is: -52.93255+2.979706(.8444646)+2.226185(5.903039)-0.4450235(39.29073) + 0.3920605(45) – 29.90464(0) = -37.11. Therefore the predicted HRR equation for the Flyers becomes: 83.18083 – 37.11 + 29.03692 + 23.22 = 98.326 (2003 USD).[29] Adjusting back to nominal 2012 USD, this number becomes $122.37 million, compared to the pre-revenue adjusted Forbes $132 million value. In addition to the 2011-2012 Philadelphia Flyers, I used the predictive models above (Combined Predictive Model and Predictive Model 1) to compare predicted to actual HRR for each team over the past nine seasons.

Using the combined predictive model, I can estimate HRR for new locations with the same method used above for the Philadelphia Flyers. After applying the revenue-sharing agreement explained in Section III.A, I can also predict post-revenue sharing hockey-related revenues.

V.D. Conclusion

29 The season effect is 29.03 and 23.22 was calculated in Section V.A.3.

The fixed effect provides differences in HRR based on city-specific variables. The second-stage model includes the fixed effects and adds the effect of the particular season, RPI, Stanley Cup dummy, Home Playoff Games, and New Arena dummy. Essentially, the fixed effect is the most important aspect of determining the long-term financial success of a given team, or proposing new locations for current teams, because all other variables in the second stage model are short term and vary from season to season. A team may play well and have a new arena one year, leading them to short-term financial success. However, the team could suffer financially in the absence of on-ice success and a new arena. Therefore, the fixed effects and predicted fixed effects are the most important indicators in determining the long-term financial viability of new locations and analyzing the long-term financial struggles of current teams. Therefore, I will use the fixed effect as the most important indicator of future financial success when determining new locations for currently struggling teams.

VI. Predictions

This section will select currently struggling NHL teams to relocate and will use the Combined Predictive Model to predict HRR for the new locations. As explained in the conclusions from Section V, Data, the fixed effect is the best comparison for determining the long-term financial success and for analyzing the struggles of current teams. Table 6.1 identifies the eleven teams experiencing the greatest financial difficulties. I calculated an average of real HRR and operating income during the previous three seasons.

VI.A. Selecting Teams to Move

[TABLE 6.1 AT END]

The Phoenix Coyotes, Nashville Predators, and Carolina Hurricanes are teams in need of relocation based on their low fixed effect, which represent low predicted long-term financial success. The Columbus Blue Jackets are an additional team to consider for relocation due to their low fixed effect and negative operating income. Therefore, I select the Coyotes, Predators, Hurricanes, and Blue Jackets as the currently struggling teams for relocation analysis.

VI.B. Selecting New Locations for Teams

By moving the four teams indicated above to high-demand areas, their HRRs should increase. The OLS regression results shown in Table 5.2 suggest that years of team existence, metropolitan population, loyalty, and the youth participation in the area are positively and significantly correlated with HRR.

Therefore, when considering new locations to relocate teams, these four factors were considered. By bringing a team back to an area that previously had a team, the relocated team is expected to regenerate a following from residents who were fans of the team that previously existed. Therefore, I included the years a team previously existed when predicting the fixed effect for the new city. For example, if I moved a team back to Hartford, I assume they would become the Whalers; the Whalers previously existed in Hartford for 26 years. Table 6.2 contains information on the metropolitan areas that I believe could be successful based on the statistically significant variables in Table 5.2.

[TABLE 6.2 AT END]

High participation rates are apparent in Table 6.2 for most areas and areas with a team in existence for an extended period of time are apparent for Quebec and Hartford. Table 6.2 includes all of the information needed to predict the fixed effect for each team used in the fixed effect time series regression.

Using Predictive Model 2 the fixed effect for each possible new city can be predicted using the information from Table 6.2. I calculate the fixed effect for the new locations using the same method I used in my example of the Philadelphia Flyers. After calculating the fixed effect for the new cities, as shown in Table 6.3, I predict the season effect. I will predict hockey-related revenues for the 2012-2013 season.[30] Therefore, the 2012-2013 season coefficient must be predicted, as it is part of the Combined Predictive Model used to predict HRR.

To predict the effect of the 2012-2013 season I first calculated the average percentage increase in hockey-related revenue between the last three seasons.[31] I predicted the 2012-2013 season coefficient, assuming the season effect would grow at this rate for the 2012-2013 season.[32] Using this method, I estimated the 2012-2013 season coefficient to be 30.94 million in 2003 USD.

In addition to the season effect, the new arena effect is calculated using information from Table 6.2. Because the Kings won the Cup last season, all of the new locations have a dummy equal to 0 for the Stanley Cup Dummy. In addition, because the 2012-2013 season has not yet been completed, RPI and home playoff games can't be determined. I use the observed means from the past nine seasons for RPI and home playoff games.[33] Using the observed means assumes the team moving to the new location is average competitively.

30 This assumes the 2012-2013 season is a full, 82 game season. I realize that the current 2012-2013 season is a shortened, 48 game season.

31 Calculation: Average of (2711-2394)/2394, (2394-2358)/2358, and (2358-2248)/2248 is 6.55%, these numbers are real HRR (2003 USD).

32 Calculation: (1.0655)*(29.03692) = 30.94

33 The observed mean RPI was 55.2263 and the observed mean for home playoff games was 2.862.

To predict the new team HRR shown in Table 6.3, I use Equation 10.

Equation 10: Predicted HRR = (229/184) x [83.18083 + (predicted fixed effects) + (30.93741) + 0.227638(55.2263) + 1.66661(2.862) + 10.10505(new arena dummy)]

[TABLE 6.3 AT END]

Using the results from Table 6.3, the top four areas for the four teams relocating are Quebec, London, Hartford, and Toronto, based on fixed effect. However, if a team moves within 50 miles of another franchise, the incumbent franchise must approve the move due to league relocation guidelines. Therefore, the Maple Leafs would have to approve a second team entering Toronto and a first team entering Hamilton, Ontario.[34] In order to gain the Maple Leafs' approval, the new team would likely have to pay the Leafs a potentially large sum of money. A team in London would not be entering the Maple Leafs' 50 mile radius territory and therefore, would not have to pay the Maple Leafs any sum of money.

The econometric model predicts moving a team to Toronto or Hamilton would only make about $1 to $5 million more than moving a team to Milwaukee or Seattle. Therefore, it is better to relocate a team to Milwaukee or Seattle over Hamilton or Toronto. In these locations the new team will not have to gain the Maple Leafs' approval and pay them a potentially large sum of money. The Mowat Policy paper and many hockey fans believe moving a second team to Toronto or to Hamilton are optimal moves for currently struggling teams. However, these proponents may be underestimating the loyalty of fans in this area to the Maple Leafs. Despite relocating to the area with the largest youth participation rates and large population, it is unlikely a new team in Hamilton or Toronto would generate revenues large enough to benefit from relocating after they pay for the Leafs' approval. This is further substantiated by the fact that the econometric model predicts that a new team in Hamilton or Toronto will do only marginally better than a new team in Milwaukee or Seattle.

The model uses the loyalty dummy to adjust for loyalty of fans. However, it only has the loyalty of fans to the Rangers and Kings as observations, due to the fact that these are the only incumbent teams in metropolitan areas with multiple teams. As a result, the loyalty effect is based on loyalty of Rangers and Kings fans. Maple Leafs and Canadiens fans are often viewed as the most diehard fans in the NHL. Therefore, I believe the loyalty effect would have a likely larger negative effect on a new team in Toronto or Hamilton than the econometric model predicts. As a result, I believe my estimates for Toronto

34 Hamilton is within 50 miles of Toronto. However, London lies outside of the 50 mile territorial zone and would not have a conflict with the Toronto Maple Leafs.

and Hamilton could be inflated.

In addition, the fixed effect of Hamilton is lower than that of any team currently in the NHL, suggesting that moving a team to Hamilton is not beneficial for any team in the NHL. If the new arena effect for Hamilton is not included, their predicted HRR becomes only $75.53 million. This HRR is less than the predicted 2012-2013 revenue for all teams I consider relocating, except Carolina, as shown in Table 6.8.[35] Because the econometrics and economic intuition suggests Toronto and Hamilton are not optimal cities for relocation, I will model the move of the four teams to Quebec, London, Hartford, and Milwaukee.[36]

VI.C. Hockey-Related Revenue Prediction Calculations

Table 6.4 lists new potential areas and current teams from highest to lowest fixed effect. I match the current team with the highest fixed effect with the new location with the highest fixed effect.

[TABLE 6.4 AT END]

I plan to move the Blue Jackets to Quebec, Hurricanes to London, Predators to Hartford, and Coyotes to Milwaukee. Matching the highest to lowest fixed effect for current to new locations maximizes the total profitability of the moves.[37] For example, if I were to move the Blue Jackets to Milwaukee, Table 6.4 suggests that the move would not be profitable if the team performed the same (same amount of home playoff games and RPI) in each city.[38] Table 6.4 shows each move will lead to a higher fixed effect, suggesting that each move will be profitable, holding constant RPI, new arenas, Stanley Cups, and home playoff games. Therefore, a prediction of the fixed effect for each move verifies the profitability of moving these teams to the new four areas. An analysis of the fixed effects also predicts that the moves will increase HRR by 65.71 million in 2012 USD.[39] Accounting for London's new arena, the model predicts an increase of 81.96 million 2012 USD.[40] Table 6.5 displays the HRR for the four teams I consider relocating in 2011-2012.

[TABLE 6.5 AT END]

Therefore, based on the fixed effects analysis, I believe moving these four

35 Carolina is just slightly lower at 75.18 million.

36 Many people have suggested moving a team to Seattle. I also believe moving a team to Seattle is a viable and profitable move. However, I believe Milwaukee, Quebec, Hartford, and London are more beneficial locations.

37 If I were only to move the Coyotes, the best location for them would be Quebec. In addition, if I were not going to move the Blue Jackets, I would move Phoenix to Hartford, Nashville to London, and Carolina to Quebec to maximize total profitability.

38 Milwaukee already has an arena for the Bucks and they will have the same Stanley Cup dummy status.

39 Calculation: ((total of new fixed effects)-(total of current fixed effects))*(229/184).

40 Calculation: (10.04*(229/184)) + 65.71 = $81.96 million.

teams will increase hockey-related revenues by 27.41%.[41] This assumption holds constant RPI, home playoff games, and Stanley Cup dummy from 2012-2013 as in 2011-2012. This 27.41% increase supports moving teams from low to high-demand markets. In order to have a concrete example of what revenues may look like, I insert the fixed effects for the new areas into the second-stage regression; then I add the predicted 2012-2013 season (which is 30.94), RPI, Stanley Cup Dummy, and New Arena Dummy effects. I assume each team will have the same RPI and number of home playoff games as they did in the previous season. For example, the new Quebec team will have the same RPI (52.5) and number of home playoff games (0) as the 2010-2011 Columbus Blue Jackets, as shown in the Table 6.6. Every team has a Stanley Cup dummy (lagged) of 0, since the Kings won the cup last year. Table 6.6 summarizes this information.

[TABLE 6.6 AT END]

Equation 11: Predicted HRR = (229/184) x [83.18083 + 30.9374 + (fixed effect calculated in Table 6.4) + .227638(Previous RPI) + 1.66661(Previous Playoff Home Games) + 5.074734(Previous Stanley Cup Dummy) + 10.10505(new arena dummy)]

Using the information from Table 6.4, Table 6.6, and Equation 11, I calculate the predicted 2012-2013 HRR, shown in Tables 6.7 and 6.8. I also calculate every current NHL team's 2012-2013 HRR. To calculate the 2012-2013 HRR, I take the average of the growth rates in HRR between the last three seasons for each team. I assume each team will grow at their respective average growth rate and calculate the predicted 2012-2013 HRR based on this assumption.[42] Although I believe my model is an accurate predictor, I believe using growth rates and previous numbers are a more accurate predictor of future HRR. Therefore, I did not use my model to predict future revenues of teams that currently exist.

[TABLE 6.7 AT END]

Winnipeg Case Study Comparison

To further analyze the accuracy of my results, I applied the method in Table 6.7 to predict the 2011-2012 HRR for the Winnipeg Jets, who relocated from Atlanta to Winnipeg before the 2011-2012 season. I will compare the 2011-2012 predicted HRR to the actual 2011-2012 Winnipeg HRR to verify my results. I used Winnipeg's metro population, participation rate, years with team, loyalty dummy, and metro income to predict the fixed effect. I predicted Winnipeg's fixed effect as -51.61, compared to the actual fixed effect coeffi-

41 Calculation: 81.96/299 = 27.41%.

42 Calculation: (1+growth rate)*(2011-2012 pre-revenue sharing HRR).

cient of -49.34 (given in Table 5.1). In addition, I calculated the coefficient for the 2011-2012 season using the method for the 2012-2013 season coefficient.[43] The predicted coefficient for the 2011-2012 season was 18.113, compared to the actual 2011-2012 season coefficient of 29.037 (given in Table 5.1). Winnipeg did not have a new arena and the Atlanta Thrashers had a 2010-2011 RPI of 53.7, did not win a Cup in the 2010-2011 season, and played zero playoff games. I assumed that Atlanta would perform the same in Winnipeg, as with the predictions in Table 6.7. Based on all of this information I use Equation 10 to predict that the Winnipeg Jets will have a HRR of $77.22 million (2012 USD). Because Atlanta only made $57.53 million (2011 USD) during the 2010-2011 season and had a growth rate of essentially zero over the past few years, my predictions predict this move will be lucrative and increase revenue for the team by about 35%.[44]

Winnipeg's actual HRR during the 2011-2012 season was $93.75 million (2012 USD). Using the actual 2011-2012 season coefficient, rather than the underestimated coefficient, the prediction for Winnipeg's HRR would be about $91 million.[45] Additional adjustment for actual RPI and home playoff games did not change the prediction of $91 million because the 2011-2012 Jets did not show much improvement over the 2010-2011 Thrashers in on-ice performance.[46]

Based on this case study, one limitation of the relocation predictions lies within the predicted season coefficient. From the 2010-2011 season to the 2011-2012 season the season coefficient skyrocketed upwards, suggesting a large increase in hockey revenues across the league most likely resulting from an increase in the league's popularity. The coefficient on the statistically significant seasons (2006-2007 to 2011-2012) has always increased (see Table 5.1). By assuming only a 6.55% increase in the season coefficient and estimating an increase from 29.037 to 30.94, I believe my estimates for the new teams are conservative. Because even these conservative results estimate the moves to be lucrative, I am confident that these moves would be beneficial for the teams involved.

VI.D. Predicted League Effect and Revenue Sharing Effect from Moves

The analysis in Section VI.C was based on predicted pre-revenue sharing values for HRR. When relocating a team, it is important to analyze the predicted post-revenue sharing HRR because this is the relocating team's final

43 Calculation: Average of (2394-2358)/2358, (2358-2248)/2248, and (2248-2227)/2227 is 2.46%, these numbers in this formula are real HRR (2003 USD).

44 Assuming zero growth, the predicted 2011-2012 HRR for Atlanta is the same as the 2010-2011 HRR.

45 Calculation: 77.22 + 13.595 = 91 million (13.595 = (229/184) * (29.037-18.113))

46 They had 0 playoff games and an RPI of 54.7.

HRR. In addition, it is important to analyze the effect of moving teams on other teams in the NHL. I use Equations 1 and 2 to predict the "minimum" and "midpoint" (as defined by the revenue sharing agreement) for the 2012-2013 league.[47] I then calculate the amount needed for the lower earning teams from revenue sharing (redistribution amount).[48] I assume the Central League Funding Stage will supply 25% of the redistribution amount.[49] Because the placement of teams in the 2012-2013 playoffs is unpredictable, the Playoff Funding stage is not considered in this analysis. Therefore, the calculation for the Supplemental Funding Phase, explained in Section III.A.1. is applied to cover the remaining 75% of needed revenue. I use Equation 12 to calculate post-revenue sharing HRR.

Equation 12: Post-revenue sharing HRR = Pre-revenue sharing HRR – Central League Funding Contribution – Supplemental Funding Contribution + Amount received from Revenue Sharing.

The calculations can be found in greater detail in Appendix C. I applied this same method to the pre-relocation league and post-relocation league. The results are shown in Table 6.8 and 6.9.

[TABLE 6.8 AT END]

Based on Table 6.8, the predicted revenue shared is 4.3% of HRR. This is consistent with the 4.4% calculated earlier.

[TABLE 6.9 AT END]

VI.E. Conclusions

VI.E.1. Cost or Benefit for Teams not Relocating

The teams moving are not the only teams affected by the relocation. The revenue sharing agreement depends on the revenues of other teams in the league. By reviewing the net change in HRR from the revenue sharing before and after moving the four teams, the effect of the moves on the rest of the league can be analyzed. Table 6.10 summarizes the net cost or benefit for all other teams not relocating.

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47 I use the player's share as 50% because the newest 2012-2013 CBA changes the player's share to 50%. This new CBA is not yet available to the public and I make the assumption that the league will maintain the same revenue sharing agreement.

48 First, I calculate the available compensation for each team (HRR-Midpoint). Then, I find the needed compensation for each team (Midpoint – max(HRR, minimum)). I eliminate any team in the top half of the league in HRR or with a designated market area of over 2.5 million households. Then, I use previous calculated pre-revenue sharing HRR to calculate growth rates over time. I reduce the needed compensation for teams growing less than the league growth rate based on the reduction numbers found in the 2004-2005 CBA (25% reduction for first time offenders, 40% for consecutive second time offenders, 50% for third consecutive or greater, offenders). I then calculated the sum for adjusted needed compensation. This is the total amount needed for revenue sharing.

49 Therefore, I take (25% x total needed revenue)/30 from every team.

[TABLE 6.10 AT END]

Table 6.10 suggests the majority of the league's post-revenue HRR will only change slightly as a result of relocating teams. However, the results suggest the top teams are negatively affected by losing a few million dollars. It may be surprising that the top teams contributing substantial amounts to revenue sharing may lose money rather than benefit from this move. The percent of the total supplemental funding phase the top 10 teams contribute to revenue sharing does not change. The amount needed for the supplemental funding phase is dependent on how much the lower-earning teams need. As the four teams relocate, the total league HRR increases. As the total league HRR increases, the midpoint increases. As the midpoint increases, the redistribution amount needed also increases.[50] The relocations increase the midpoint, therefore requiring the top teams to contribute a few million more HRR.

Although these teams may be worse off in the 2012-2013 season, they may be better off in the long term. Moving teams to high-demand locations may increase the amount of money the NHL can receive in national and regional TV contracts. TV contracts may grow because overall league popularity will likely increase as aggregate demand for the NHL increases as a result of current teams moving to high demand locations. Although the potential increase in TV contracts may be hard to predict, the increase would reduce the net loss, or possibly create a net gain, for the top teams that may lose money.

VI.E.2. Cost or Benefit for Teams Relocating

[TABLE 6.11 AT END]

Upon preliminary review, the average predicted percent increase of 36.6% using Table 6.11 justifies moving all of the teams above to the new locations. However, relocation costs must be considered before justifying the moves.[51]

VI.F. Relocation Costs and Considerations

London, Ontario

The NHL requires a $60 million fee for relocating a team. London would need to build a new arena to host an NHL team. The home of the Winnipeg Jets, the MTS Centre, was built in 2004 for a cost of $133 million (Fitzsimmons, 2009). Adjusted for inflation, this number becomes $162 million.[52] Because London is a small city, London needs an arena similar to Winnipeg's to host a team. Therefore, London's arena will likely cost around $162 million. As a result, the total cost of relocating Carolina to London is $222 million. A $222

50 The midpoint = (total HRR * Players' share) / 30.

51 Average increase differs from gross increase, as shown in Table 6.11.

52 Note that property value disparities between Winnipeg and London were not considered and the stadium cost is a "ball park" estimate.

million 30-year loan at 6.5% would cost the London team about $16.8 million per year. Adjusting for the cost, my results predict the new London team would still make about $33 million more (44% increase) during the 2012-2013 season in London compared to Carolina.[53]

It is likely that current owners will sell a relocating team to new investors, as demonstrated by the purchase of the Thrashers from Atlanta Spirit LLC by True North Sports and Entertainment Limited (Forbes, 2012). Forbes estimates the Carolina Hurricanes are worth $162 million (Forbes, 2012).[54] A 30-year, $162 million loan at 6.5% interest would cost the investors about $12 million per year to buy the Hurricanes. Including the relocation fee, payment for the Hurricanes, and cost to build a new arena, the move to London is still beneficial, with a predicted $21 million gain for the 2012-2013 season.[55] This $21 million gain amounts to a 28% increase in HRR. These gains will likely continue into the future, predicting the move to be a long-term financially lucrative relocation.

Quebec, Quebec

Quebec has already broken ground on a new $400 million arena that will hold over 18,000 spectators, with expected completion in 2015. This stadium is funded entirely by the province and the city of Quebec (Canadian Press, 2012). In addition, Quebecor CEO, Pierre Karl Paldeau has already expressed great interest in investing in a team that would move to Quebec. The combination of Quebec's potentially lucrative location, new stadium, and a potential investor make the city a frontrunner for an NHL team. The stadium is being built in hopes to bring back an NHL team and eventually host the Winter Olympics (AP, 2009). The NHL team would likely pay $5 million per year in rent to play games at the arena (Canadian Press, 2012).

However, there are concerns about Columbus's current contract with Nationwide. Nationwide invested $52 million in the Blue Jackets. As a result, Nationwide has a 30% ownership interest in the franchise. The Blue Jackets extended their contract to stay in the Columbus Arena until 2039. In addition, Nationwide paid $28.5 million to keep their name on the Blue Jackets' Arena, even though Nationwide sold their ownership of the arena (TLHocking & Associates LLC, 2012). This creates a legal dilemma if the Blue Jackets were to break their contract and move to Quebec. Nationwide Insurance is headquar-

53 125-17-75 = 33.

54 The Forbes valuation is "value of team based on current arena deal (unless new arena is pending) without deduction for debt (other than arena debt)." Therefore, this valuation includes the $3 million arena yearly contract as stated by "Comparison of Operating Costs for Similar Arenas" (TLHocking & Associates LLC).

55 33 – 12 = 21.

tered in Columbus, Ohio. Therefore, Nationwide would likely not approve of Columbus moving to Quebec even if the move was lucrative for them, given their 30% stake in the team. As a result, the Blue Jackets may have to pay Nationwide a large sum of money to break their contract.

It is difficult to predict the cost for the Blue Jackets to break their contract. However, in a worst-case scenario I predict a settlement with current owners, Nationwide, and potential investors would cause the potential investors to return the $28.5 and $52 million to Nationwide in addition to the 30% stake they would receive from a sale of the team.[56] Therefore, the potential investors in Quebec would pay the $145 million Forbes valuation of the Blue Jackets, pay the $60 million relocation fee, and return the $80.5 million to Nationwide.[57] A 30-year, $285.5 million loan at 6.5% interest would cost the investors $21.6 million per year. In addition, the investors would pay an additional $5 million in arena rent, as mentioned above. As a result, I predict the move will generate $25.4 million in additional HRR, after all costs are accounted for, in 2012-2013.[58] This 30% predicted increase predicts that the move of the Blue Jackets to Quebec would be lucrative. This percentage increase will likely continue into the subsequent seasons, resulting in large long-term gains.

Hartford

Hartford's XL Center holds just under 15,000 fans for hockey, making the arena a viable NHL arena (AEG Facilities, 2013). The Nashville Predators owners have to pay a settlement fee of $10 million to leave Nashville, assuming losses prevail (TLHocking & Associates LLC, 2012). However, this $10 million is already included in the Forbes estimate of their valuation. Forbes estimates the Predators are worth $167 million. Therefore, the cost to potential investors is $227 million, including the relocation fee. A 30-year, $227 million loan at 6.5% interest would cost investors about $17 million per year. Therefore, after accounting for costs, I believe moving Nashville to Hartford would result in a loss of $2 million in HRR for the 2012-2013 season. Therefore, the move of Nashville to Hartford will likely not be lucrative, as these losses may continue into the future.

Consequently, I will instead analyze moving the St. Louis Blues to Hartford. I select St. Louis because they have the lowest fixed effect of all teams considered after Columbus, Carolina, Nashville, and Phoenix. Their

56 Would likely be larger, but the new investors of the Blue Jackets have the fact that the Blue Jackets lose money every year to help them in the litigation that would ensue. Therefore, the sale and relocation of the Blue Jackets is justified.

57 This is under the assumption that the relocation fee will continue to be $60 million (what Winnipeg paid to the NHL for the relocation of the Atlanta Thrashers to Winnipeg).

58 125 + 12 (2012 USD new arena effect) – 21.6 - 5 - 85 = 25.4.

predicted 2012-2013 post-revenue sharing HRR is $98 million. Forbes values the Blues as the lowest-valued NHL franchise at $130 million. Therefore, it will cost potential investors $190 million after the relocation fee is added to the cost to acquire the Blues. A 30-year, $190 million loan at 6.5% interest will cost potential investors $14 million per year. Therefore, the financial gain from moving St. Louis to Hartford is about $6 million.[59] Because these gains will continue into the future, I predict the relocation of St. Louis to Hartford to be financially lucrative.

Milwaukee

Milwaukee's BMO Harris Bradley Center holds almost 18,000 fans for hockey, making it a viable NHL arena (BMO Harris, 2013). The NHL currently owns the Coyotes; therefore, the NHL is currently losing millions on their ownership of the Coyotes. According to Forbes, the Coyotes are worth $134 million (Forbes, 2012). The total cost to potential investors becomes $194 million when accounting for the NHL relocation fee. A 30-year, $194 million loan would cost about $14.8 million per year at 6.5% interest. As a result, the potential gain for relocating Phoenix to Milwaukee, less costs, becomes $4.2 million per year. Although this seems like a small gain, the gain will continue into the future, resulting in large long-term gains. Therefore, I predict this move will be financially beneficial for the Coyotes.

Investors

According to the Mowat Policy study, Gary Bettman, the NHL's Commissioner, has hinted that a new location must have adequate fan support, serious investors, an NHL-sized arena (18,000 seats, however Bettman stated the 15,000 MTS Centre was adequate for Winnipeg), and no territorial conflicts with current teams (50 mile zone) (Keller and McGuire, 2011). My econometric model predicts that all of the potential areas above have adequate fan support and research shows that if London builds an arena, all areas will have an adequate arena. In addition, the areas I selected do not have territorial conflicts with any other teams. However, serious investors in London, Hartford, and Milwaukee have not been identified. Serious investors are the last aspect needed for these potential moves to become realistic. Because Quebec City has a serious investor (Paldeau), the city is a realistic potential relocation for an NHL team.

Summary of Moves after Costs

[TABLE 6.12 AT END]

59 118 – 14 – 98 = 6.

Although the percentage increase is small for St. Louis and Phoenix, this increase is expected to continue into future seasons. Therefore, Table 6.12 shows all the moves, which are potentially beneficial and viable, with an average HRR increase of about 17%.

VI.G. Limitations and Uncertainties

The NHL franchises are private and actual team HRR is not available to the public. The data in this analysis was obtained by adjusting Forbes revenue to pre-revenue sharing HRR. Therefore, if Forbes revenues are far from actual NHL revenues, net of revenue sharing and arena debt, my analysis is based on flawed data. In addition, the NHL's revenue sharing agreement is very complex. Because I follow the NHL's revenue sharing formulas, I believe the methods I used to estimate the effect of the revenue sharing agreement are close to correct. Without actual revenue sharing numbers and HRR from the NHL, these predictions may not be completely accurate.

There are two small possible inaccuracies with the assumptions of my econometric model. The first is the years with team variable. My predictive model assumes bringing back the teams to areas that previously had teams, specifically Hartford and Quebec, will generate the same interest these teams once had.[60] I name this effect the "previous fan" effect. It is likely that the support for the Hartford Whalers and Quebec Nordiques has dissipated over time. Therefore, bringing back these teams may not generate the predicted increases in HRR. Of the predicted HRR for Hartford, $12.7 million is attributed to the "years with team" effect.[61] For Quebec, $11.7 million of the predicted hockey-related revenue is attributed to the "years with team" effect.[62] It is likely that bringing back the Nordiques and Whalers will regenerate some interest. However, assuming they will regenerate the same interest they had in the past may be unlikely. Therefore, the additional $12.7 and $11.7 million in hockey-related revenue may be overstated. If the $12.7 million is not included in my prediction for Hartford, the gains from moving St. Louis become negative. However, even if the $11.7 million was not included in the estimate for Quebec, the move still generates a predicted $13.44 million during the 2012-2013 season.[63] Therefore, even if the Quebec Nordiques regenerate no interest from the "previous fan" effect, the move will still be very lucrative.

In addition, my model does not adjust econometrically for the fan loyalties present in a given area without a team. The loyalty effect only accounts for fan loyalties in areas with a team present. Hartford is located between Boston

60 My predictive model counts years with teams previously in existence when bringing back a team.
61 (229/184) * (.39206) * (26 years) = 12.68.
62 (229/184) * (.39206) * (24 years) = 11.71.
63 110.59 – 11.7 – 85.45 = 13.44.

and New York City. Therefore, many Boston Bruins and New York Rangers fans are likely to live in the area. These fan loyalties are not observed; therefore, the loyalties were not included in my econometric model. However, the fans in the new suggested locations may be willing to adopt the new team as their team because of the convenience in traveling to games and presence in the local TV market. Therefore, fan loyalties should not have a large effect on HRR for the suggested areas because they are not very close to other teams. As a consequence of the fan loyalty effect, my results may be slightly overstated.

Although a critique of the econometric model used suggests the estimates of gains from moving teams may be slightly overestimated, the Winnipeg Jets case study in Section VI.C suggests the opposite. In this case study, I used the method that was used to predict estimates for 2012-2013 HRR for teams selected for relocation to predict the 2011-2012 HRR for the recently relocated Winnipeg Jets. The prediction for the Winnipeg Jets was $16.5 million less than the actual 2011-2012 pre-revenue sharing HRR.[64] This case study suggests that the model results are conservative, rather than over-estimated. There is a possibility that a new team generates additional interest. Because the move from Atlanta to Winnipeg is the only information I have available for a new team during the time period of my data, I decided not to adjust econometrically for a "new team effect."

Because my results are conservative, there is a possibility that moving the St. Louis Blues to Hartford could be lucrative even if the "previous fan" effect is not included. Because the "previous fan" effect will likely have some beneficial effect on the Hartford Whalers and because my results are conservative, I predict the move of St. Louis to Hartford will be financially beneficial.

VII. Final Suggestion and Conclusion

Summary

After collecting and analyzing data, a two-stage econometric model was created to predict HRR for new locations and analyze factors that affect HRR. I discovered that long-term demand for an NHL franchise (determined by HRR) positively correlated with the area's youth participation rate, metro population, years with a team in existence, and fan loyalties in the area. After identifying demand factors, I selected optimal locations for struggling NHL franchises using the predictive model. Accounting for relocation costs, I determined the predicted net benefit from relocating current teams to the optimal areas I selected. The average net benefit for relocating teams was determined to be 17%, predicting that moving teams from low to high demand markets is

64 93.75 – 77.22 =16.53.

financially beneficial.

Final Suggestion to the NHL

Assuming the Forbes data correctly reflects post-revenue sharing revenue, I believe my results are accurate. Because the Winnipeg Jets case study suggests my results are conservative, I believe relocating Columbus, Carolina, St. Louis, and Phoenix will be financially beneficial. As a result, I recommend that the NHL move Columbus, Carolina, St. Louis, and Phoenix to Quebec, London, Hartford, and Milwaukee respectively. The only missing link that is needed to complete these financially beneficial moves is serious NHL investors in London, Hartford, and Milwaukee (Quebec already seems to have a serious investor). If the NHL was to move just one team, I suggest that moving them to Quebec will be both optimal and realistic based on my analysis. In general, I believe that relocating struggling teams to high-demand markets will solve the financial troubles for the NHL's struggling teams.