Theory and Evidence…

Understanding Market Factors in Youth Sports:

A Look at the Economics of Youth Ice Hockey

By

Michael Pelts

An honors thesis submitted in partial fulfillment

Of the requirements for the degree of

Bachelor of Science

Undergraduate College

Leonard N. Stern School of Business

New York University

May 2015

Professor Marti G. Subrahmanyam	Professor Vishal Singh
Faculty Adviser	Thesis Adviser

Abstract

I looked at the factors that drive market demand in youth sports using the sport of ice hockey as a case study. My findings indicate that demand does not grow in traditional hockey markets. However, in untraditional markets exogenous events can create large changes in demand. This could be anything from a local sports franchise winning a championship to a work stoppage in a particular sport. I next looked at the possible strategies that an individual firm (for hockey this would ice rinks) in the market could employ given that they have little effect on demand. The findings indicate that price is very highly correlated with change in demand and not traditional demand. While an area with large changes in demand may be inclined to build new facilities, given the fact that this demand is exogenous and might change suddenly, a good strategy a firm could use is increase the volume of kids playing on a particular surface and save in costs on building new facilities. The results indicate that a firm can, in fact, charge a higher price by putting more kids on a playing surface. The results also indicate that youth sports organizations may want to move towards a more informal structure of play. There is a higher demand for hockey that is played with less structure and with more of a focus on development than traditional hockey.

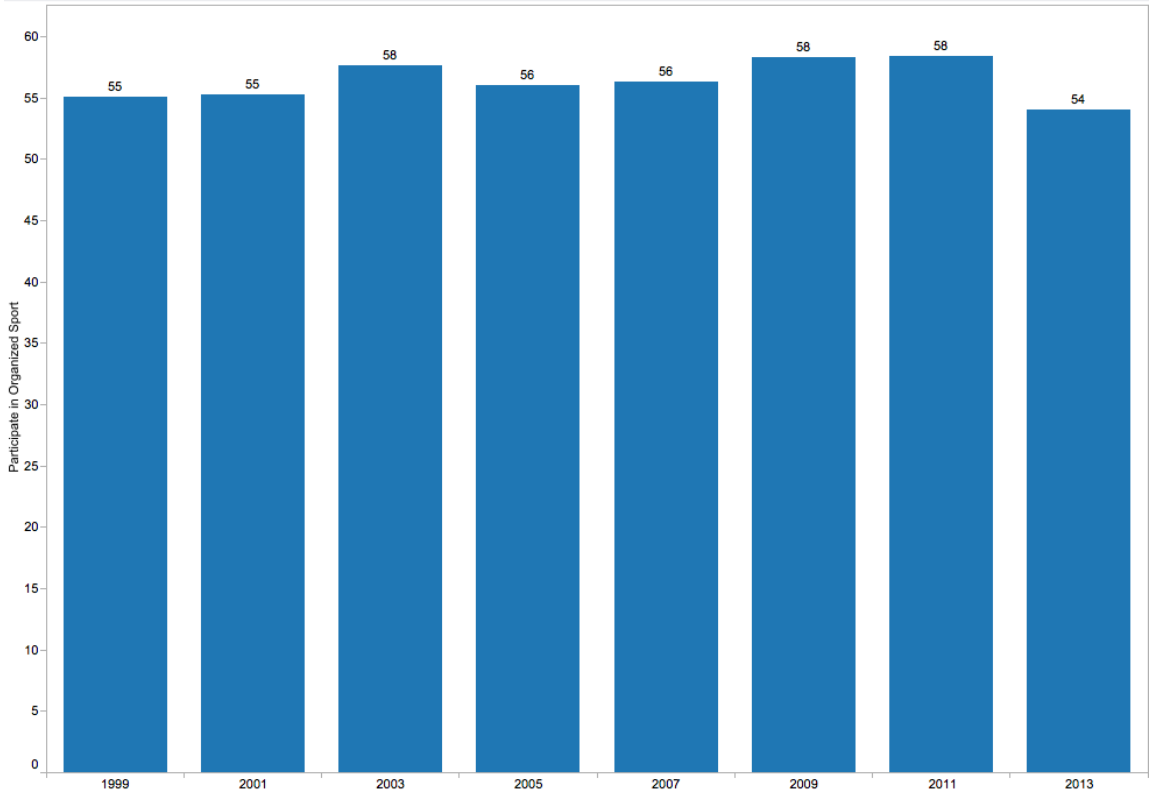
Table of Contents

1. Introduction

Sports play a very central role in the American psyche. Over 100 million people watched the New England Patriots play the Seattle Seahawks in the 2015 Super Bowl.[1] In college athletics, Universities pay on average $1.64 million on salaries for their Division 1 football coaches.[2] Less is known, however, about youth sports. Without the immediate allure of high pay or fame, what drives kids to play a particular sport? And what do these market drivers mean for individual firms participating in the market?

1.1 Market Size

Figure 1
Percentage of Youth Who Particpate in Organized Sports



Source of Data: "Nutrition, Physical Activity, & Obesity Data & Statistics." Cdc.gov. Centers for Disease Control and Prevention, 09 Dec. 2014. Web. 02 May 2015. http://www.cdc.gov/healthyyouth/npao/data.htm

[1] Riccoboni, Anthony. "Super Bowl Ratings: How Many People Watched The New England Patriots, Seattle Seahawks Game?" Ibtimes.com. International Business Times, 2 Feb. 2015. Web. 2 May 2015. http://www.ibtimes.com/super-bowl-ratings-how-many-people-watched-new-england-patriots-seattle-seahawks-game-1803116

[2] Brady, Erik, Steve Berkowitz, and Jodi Upton. "NCAA Football Coaches' Average Salary at $1.64 Million." Usatoday.com. USA Today, 20 Nov. 2012. Web. 02 May 2015.

There are around 54,000,000 kids between the age of five and seventeen in the United States.[3] I will define this as "sports age" kids because anyone older than seventeen would be an adult and anyone younger than five would be too young to play sports. This is the potential market size for youth sports. Figure 1 shows Center for Disease Control (CDC) data on youth participation in sports. In their survey they ask high school students whether they participated in a team sport. While this is not the best sample for the entire age range, it is the best available because there has not yet been a highly expansive data collection on youth sports participation. For 2013, around 54% of survey participants said they had participated in a sport. A reasonable attempt at quantifying the youth sports market is at around 29,000,000 kids in the United States. That is a massive market and there have been relatively few economic research attempts to understand it.

1.2 Health Benefits

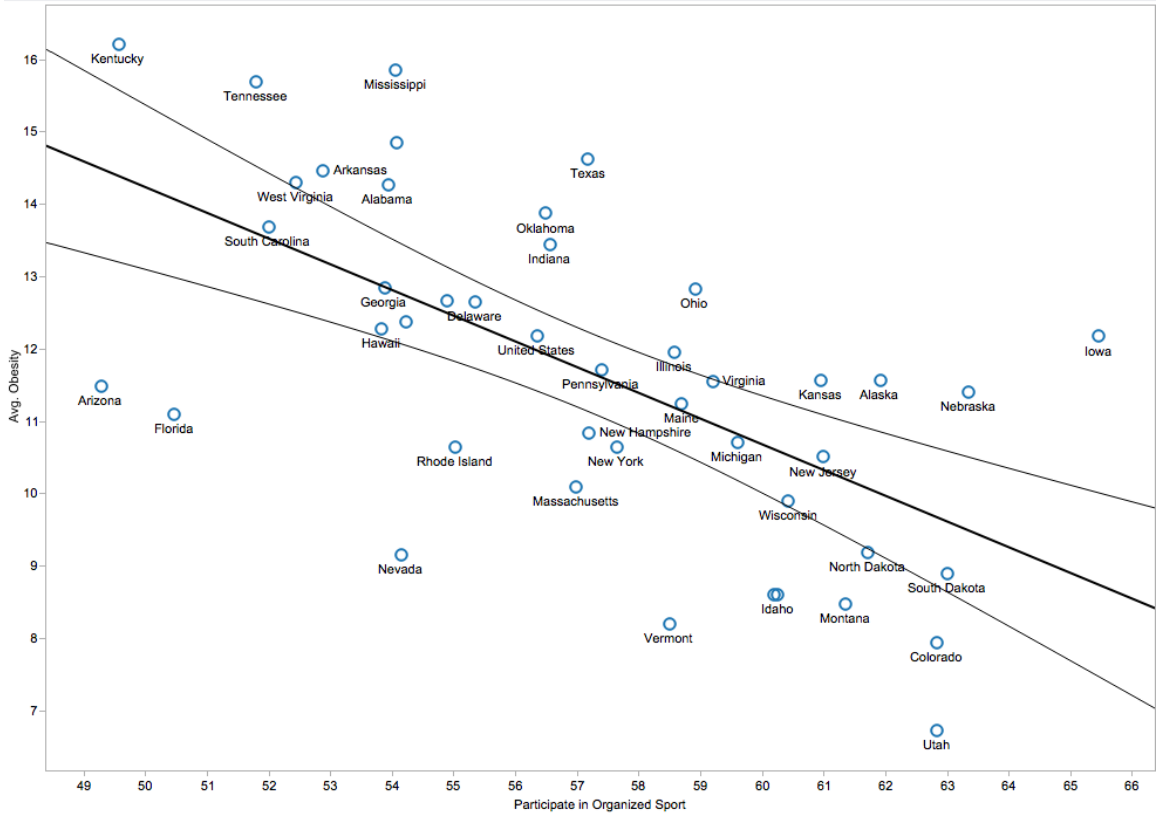
Previous studies have shown a wide ranging set of psychological and physical health benefits from youth participation in sport. One particular study by the International Journal of Behavioral Nutrition and Physical Activity showed that there were different psychological and social health benefits for kids from playing sport. The primary benefits were in improved self-esteem and social interactions. Additionally, the study found that a child benefits more from a team sport than an individual sport.[4] There are also benefits in terms of physical health.

---

[3] U.S. Census Bureau. "Census 2010, 2000, 1990." Social Explorer. Web. 02 May 2015. http://www.socialexplorer.com/explore/tables

[4] Eime et al. International Journal of Behavioral Nutrition and Physical Activity 2013, 10:98 http://www.ijbnpa.org/content/10/1/98

Figure 2
Correlation Between Obesity and Sports Participation



Source of Data: "Nutrition, Physical Activity, & Obesity Data & Statistics." Cdc.gov. Centers for Disease Control and Prevention, 09 Dec. 2014. Web. 02 May 2015. http://www.cdc.gov/healthyyouth/npao/data.htm

Figure 2 shows state-by-state data from the CDC on obesity rates and the percentage of kids who participate in a sport. There is a positive correlation between the states with fewer kids playing sports and higher obesity rates. This chart is evidence that there is a relationship between participation in sports and physical health. The United Nations believes that sports participation can have a positive impact on health because it is an enjoyable way for people to be active, and it promotes healthy lifestyles and attitudes.[5]

---

[5] United Nations. "Chapter 2 Sport and Health - The United Nations." PROMOTING HEALTH CHAPTER 2 (n.d.): 27-29. Web. 2 May 2015.

1.3 Goal of the Thesis

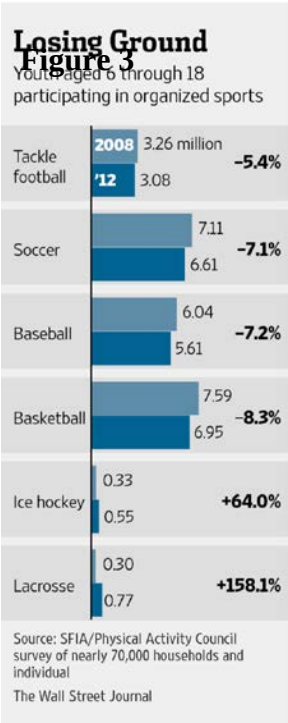


Figure 3

Sports may have positive health benefits, but youth participation in sports, especially major sports, has been on a decline. Figure 1 shows that from 1999 to 2013 there is fairly steady sport participation around 55%. However, the trend does show that there is a bit of decline of participation into 2013.

The data for total sports participation and sport-by-sport participation among youths is limited. However, a few organizations have attempted to quantify the numbers.

Figure 3 shows that participation in the traditional sports is on the decline. Overall, this figure shows a decline of about 6% participation in the six sports shown from 2008 to 2012. The CDC survey shows around a 4% decline from 2007 to 2013. The decline in traditional sports can partially be explained by an overall decline in sports participation.

On the growth side, Hockey and Lacrosse have seen a dramatic rise in participation. These are smaller, more niche sports. One possible explanation for their growth is that the sport has pushed expansion into new markets. For example, the National Hockey League put expansion teams into markets like Florida, Texas, California and Tennessee that are not traditional hockey states. Hockey's growth in comparison to other sports along with USA Hockey's unmatched data collection make it the perfect sport to analyze and try to understand what factors affect market demand.

I have a strong working relationship with USA Hockey, the governing body for Amateur hockey in the United States. They provided me with their state-by-state registration numbers. These numbers allow me to understand demand drivers. They also allowed me to survey ice rink owners that are members of their Serving the American Rinks (Star) program.[6] This information allows us to understand the actions of individual firms in the market.

USA Hockey's registration numbers for youth ice hockey players have grown exponentially since the early 1990's; however, ice rinks are largely an unprofitable business. USA Hockey has begun to implement new methods for developing players under a program called the American Development Model (ADM).[7]

The ADM has wide ranging effects, from different training methods for kids to simply trying to make hockey more fun for children. Below is an exert on the ADM from their website:

> "Many athletes spend too much time traveling, competing and recovering from competition and not enough time preparing for it. Second, there is too heavy a focus on the result rather than the performance. This attitude leads to long-term failure, as coaches forgo the development of skills to focus on specific game tactics. And third, too many athletes are specializing too early on. An early focus on just one or two sports often leads to injuries, burnout and capping athletic potential."[8]

The main crux of the ADM is about moving away from a traditional focus on wins and losses to a focus on the best ways to develop a child as an athlete. But one of the larger effects is on how the game is played for kids at younger ages. USA Hockey is pushing for games played the width of the ice instead of the length of the ice. The idea behind this change in playing surface dimensions is that small children should not be

[6] "Home." Starrinks.com. Serving The American Rinks, n.d. Web. 02 May 2015.
[7] USA Hockey. "Printable ADM Guide." A BRIGHTER FUTURE FOR ALL (n.d.): n. pag. Admkids.com. USA Hockey. Web. 2 May 2015. http://assets.ngin.com/attachments/document/0042/7978/USA100001-NewspaperRev3_2013.pdf
[8] "About ADM." Admkids.com. USA Hockey, n.d. Web. 02 May 2015.

playing on the same surface as grown professionals. A National Hockey League sized ice rink is too big for young kids and they will not be able to touch the puck enough to develop hockey skills. USA Hockey is also mandating that organizations put more kids on the ice at the same time for practices for similar developmental reasons.

Ice rink owners, however, have not been pleased with USA Hockey's guidelines. Many of them have built their business model around selling hours of ice time to teams. If more kids are on the ice at the same time, it means that they will be selling less hours of ice time.

I set out to understand market factors in this unique industry. Kids are not paid to play hockey or any other amateur sport. I believe that a child's desire to play a sport is driven by largely exogenous demand factors. An individual rink cannot affect the demand for hockey in their area. The same can be said for a baseball organization or a football program. I decided to look at demand fluctuations in youth hockey at a national and state level along with differences in rink owner business pricing and operation decisions to determine the optimal strategy for profitability in this industry.

2. Methodology

I analyzed my hypothesis by looking at five data sets. These data sets allowed me to look at the population of kids in the United States, youth health data, the number of hockey players in the country, variations in individual rink business operations, and state level independent variables.

2.1 Census Data

I gathered data from the last three Censuses taken every ten years by the United States government. I primarily zeroed in on data on age breakdowns in the United States. I looked at the number of kids between the ages of 5 and 17 to get a good understanding of how the population of sports age kids changes

2.2 Center for Disease Control Survey

The Center for Disease Control collects "data about youth dietary and physical activity behaviors and about school policies and practices to encourage healthy eating, and physical activity, and prevent obesity. These data are collected through surveillance systems administered by CDC's Division of Adolescent and School Health."[9] I zeroed in on data on sports participation and obesity rates because they were the most telling numbers relating to whether sports had a positive health benefit.

2.3 USA Hockey Data

My third dataset is the year over year USA Hockey registration numbers. The numbers are shown in total in the United States from 1991 to 2014. They are also shown state-by-state from 2001-2014 and segmented by age from 2007-2014. The variations in composition are a result of variations in USA Hockey's collection processes. They did not start collecting state-by-state data until 1999 or segmented data until 2007.[10]

[9] "Nutrition, Physical Activity, & Obesity Data & Statistics." Cdc.gov. Centers for Disease Control and Prevention, 09 Dec. 2014. Web. 02 May 2015.
[10] "Membership Statistics." Usahockey.com. USA Hockey, n.d. Web. 02 May 2015. http://www.usahockey.com/page/show/839306-membership-statistics

I went about analyzing the data by comparing year over year changes in total numbers, state level numbers, and segmented state level numbers. I grouped together major hockey states (as defined by the top fifteen states in terms of players/ population) and minor hockey states (as defined as the last 35 states and Washington DC in terms of players/ population) along with expansion markets and non-expansion markets. I used these groups to compare changes in the numbers based on different parameters. Finally, I looked at exogenous variables and their effect on demand fluctuations.

2.4 Ice Rink Survey Data

The other dataset I collected from USA Hockey is a primary dataset. I sent out a survey to ice rink owners in the United States with the help of USA Hockey's affiliate, Serving the American Rinks (STAR). I was trying to collect more micro data on individual rinks prices and player quantities in an attempt to derive price elasticity. Unfortunately, that information was more difficult to come by, however, the rinks did provide very good information on what their prices were for a sheet of ice for an hour and whether or not they ran their own hockey programs. They also provided information on whether or not they followed USA Hockey ADM guidelines. This data set allowed me to compare business practices among rinks.

I also segmented the states into major and minor states (same guidelines as above). I used the segments to compare overall prices between major and minor states. I then compared prices amongst these segments further segmented down into two other levels. The first level is whether they rinks run their own hockey programs or if they simply sell their ice in hour sheet allotments to outside hockey teams. The second level is

whether the rinks follow USA Hockey ADM guidelines. These guidelines include having kids, under the age of 12; play their games the width of the sheet of ice instead of the length of the sheet.

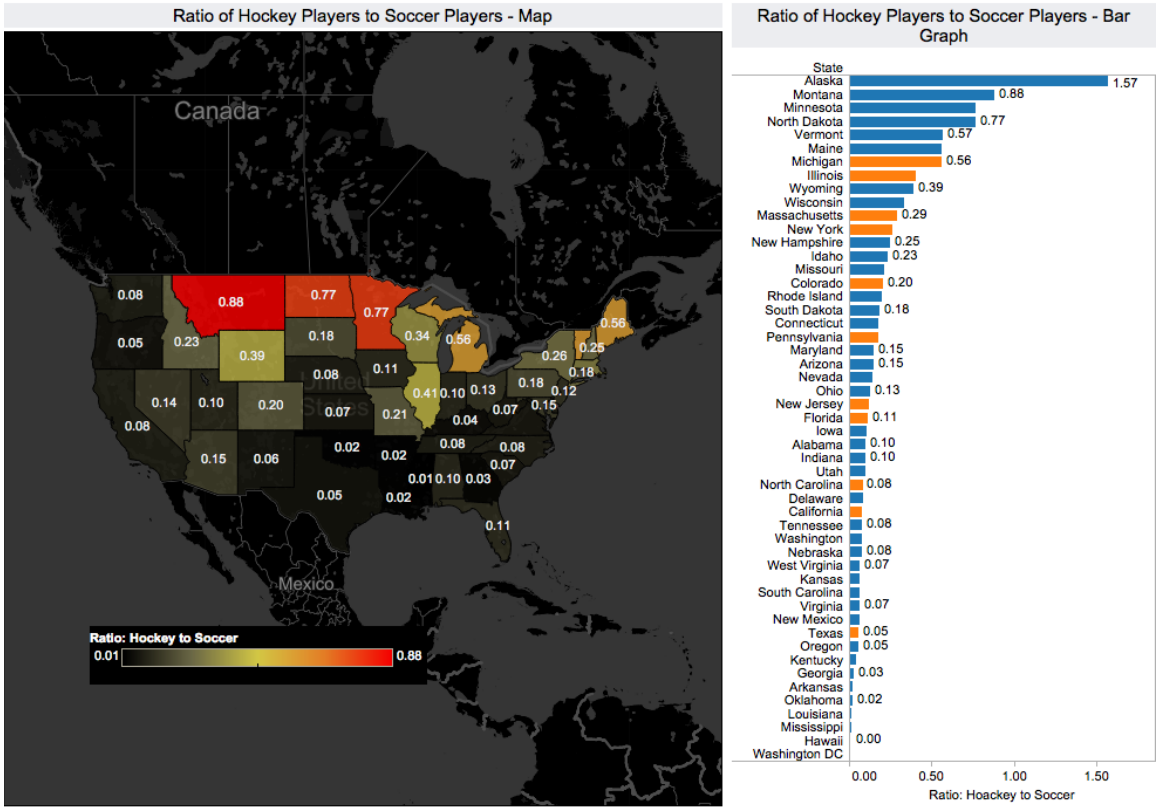
2.5 State Variables

The third dataset is a collection of variables that explain variations in state registration numbers. These variables included basic state level data such as average temperature, median income, and population. There was also information on the prevalence of professional and college hockey teams in the state, and whether the state produced Olympic players on the last four Olympic teams. The final piece of information was the prevalence of other sports in each state. There is data on youth soccer numbers, and the number of professional sports franchises.

3. Results

3.1 Geographical Perspective

Figure 4
Ratio of Hockey Players to Soccer Players by State



Data Source: "Membership Statistics." Usahockey.com. USA Hockey, n.d. Web. 02 May 2015. http://www.usahockey.com/page/show/839306-membership-statistics
"Key Statistics | US Youth Soccer." Usyouthsoccer.org. US Youth Soccer, n.d. Web. 05 May 2015. http://www.usyouthsoccer.org/media_kit/keystatistics/.

Figure 4 shows a ratio of hockey to soccer players in the 2013 season by state. The more colorful states on the map have a higher ratio of hockey to soccer players and represent areas where hockey is relatively more popular. I wanted to use another sport to show the relative popularity of hockey by state. Soccer was the only major sport that had registration data for the most recent season easily available. States that have a higher ratio are traditional hockey states. These states are in the north, have NHL teams, have college teams, or successful players that came from the state. I next chose to look at state variables that might cause variations in the relative popularity of the sport within a state.

Figure 5

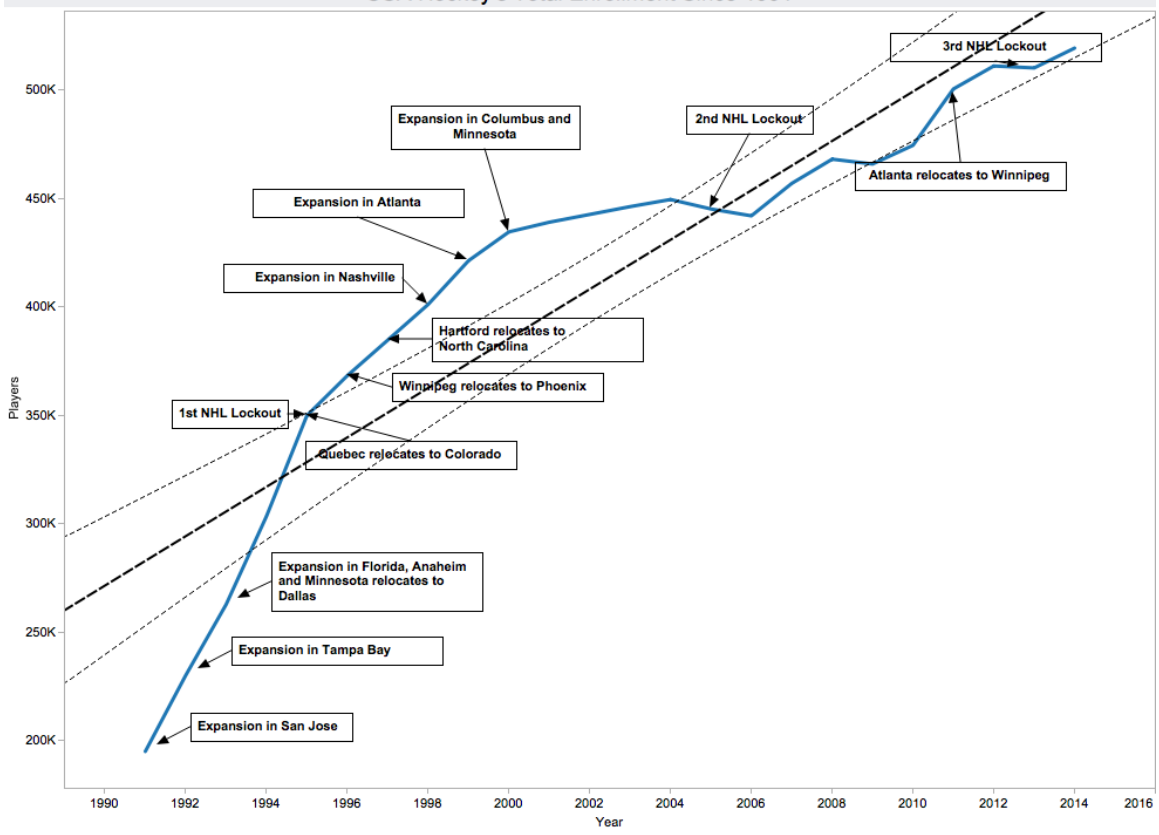
```
lm(formula = log(Players) ~ log(Population) + NHL + Stanley_Cups +
    Defunct + D1College + D3College + AHL + Big4 + NFL + MLB +
    MLS + Tot_Olympians + Income + Temp + Recent_Cups + Playoffs,
    data = Thesis)

Residuals:
     Min       1Q   Median       3Q      Max
-1.38017 -0.36164 -0.05052  0.43487  0.93742

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)      7.851e-01  2.672e+00   0.294  0.77077
log(Population)  8.350e-01  1.902e-01   4.391  0.00011 ***
NHL              6.706e-02  4.666e-01   0.144  0.88658
Stanley_Cups    -2.786e-01  3.037e-01  -0.917  0.36555
Defunct         -2.760e-01  2.273e-01  -1.214  0.23336
D1College        2.393e-01  1.382e-01   1.731  0.09272 .
D3College       -1.027e-01  7.167e-02  -1.433  0.16129
AHL              1.142e-01  1.964e-01   0.581  0.56488
Big4            -3.717e-02  2.567e-01  -0.145  0.88577
NFL              6.007e-01  3.466e-01   1.733  0.09240 .
MLB              7.830e-02  4.525e-01   0.173  0.86368
MLS             -3.015e-01  3.579e-01  -0.842  0.40561
Tot_Olympians    1.408e-03  5.164e-02   0.027  0.97841
Income           2.382e-05  1.532e-05   1.555  0.12948
Temp            -1.282e-01  1.530e-02  -8.379 1.11e-09 ***
Recent_Cups      2.504e-01  3.587e-01   0.698  0.49002
Playoffs         1.620e-02  2.275e-02   0.712  0.48146
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.6747 on 33 degrees of freedom
  (1 observation deleted due to missingness)
Multiple R-squared:  0.8714,    Adjusted R-squared:  0.809
F-statistic: 13.97 on 16 and 33 DF,  p-value: 2.377e-10
```

Field	Definition
NHL	Number of NHL teams in a state
Stanley_Cups	Number of Stanley Cup wins by state
Defunct	Number of NHL/WHA teams that are now defunct in a state
D1College	Number of Division 1 College hockey teams in State
D3College	Number of Division 3 College hockey teams in State
AHL	Number of minor league teams in state
Big4	Number of Big4 Sports teams in state
NFL	Number of NFL teams in state
MLB	Number of MLB teams in state
MLS	Number of MLS teams in state
Tot_Olympians	Total Olympians from state since 2002
Income	Average income in state
Temp	Average temperature in state
Recent_Cups	Whether a team has won a Stanley cup in the last 10 years
Playoffs	How many times at team has made the playoffs

Figure 5 shows regression output with the number of players registered in a state divided by the population of a state as the dependent variable (players per population). A number of state level independent variables were used in the regression included the number of NHL teams, college teams, Stanley Cup victories, income, and average temperature. The only two variables with significance were the number of Division 1 NCAA college hockey teams at the 10% level and the average temperature at the .1% level. This story is not particularly interesting because it merely means that the coldest states play ice hockey the most. This would be expected. However, I still thought there was an interesting story to be told by looking at changes in the number of players per state and the different variables that may cause those changes. I next looked at time series data of USA Hockey's registration numbers to understand what causes changes in demand for hockey.

3.2 Time Series Perspective

Figure 6
USA Hockey's Total Enrollment Since 1991



Data Source: "Membership Statistics." Usahockey.com. USA Hockey, n.d. Web. 02 May 2015. http://www.usahockey.com/page/show/839306-membership-statistics

Figure 6 shows USA Hockey's total registration numbers from 1991 to 2014. The number of kids playing hockey in the United States has grown exponentially since 1991. However, there are severally trends in the overall growth. The largest growth happens from 1991 to 1996 and is a very linear pattern. After the initial growth, the numbers continue in an upward trend at a slightly reduced rate. Other trends show declines in 2005 to 2006 and again in 2013. The chart helps tell an initial story of what drives demand for youth hockey. The largest growth comes in the early 1990's. During that time the NHL

was expanding in the south and other non-traditional markets. Between 1991 and 1994 the NHL added teams in San Jose, Anaheim, Tampa Bay and the Miami area. As can be seen in the chart, growth slows after 1995, which can be attributed to the NHL's first lockout in that year. Further statistical analysis will show the affect of NHL labor disputes on player registration. After the NHL completed expansion in 2000, growth slows again. We can see drops in registration in 2005-2006 and again in 2013, which can be attributed to the second and third lockouts. There is, however, a steep rise in registration after 2010, which may be attributable to the success of the United States Men's hockey team at the Vancouver Olympics.

The initial story this chart tells is that demand for ice hockey can be attributed to factors largely exogenous to USA Hockey and the individual hockey associations and rinks. Major shifts in demand come around the times where big things were taking place in the NHL or the US National hockey team. To drive a little bit further into the story I next decided to segment states into traditional and untraditional markets.

Figure 7

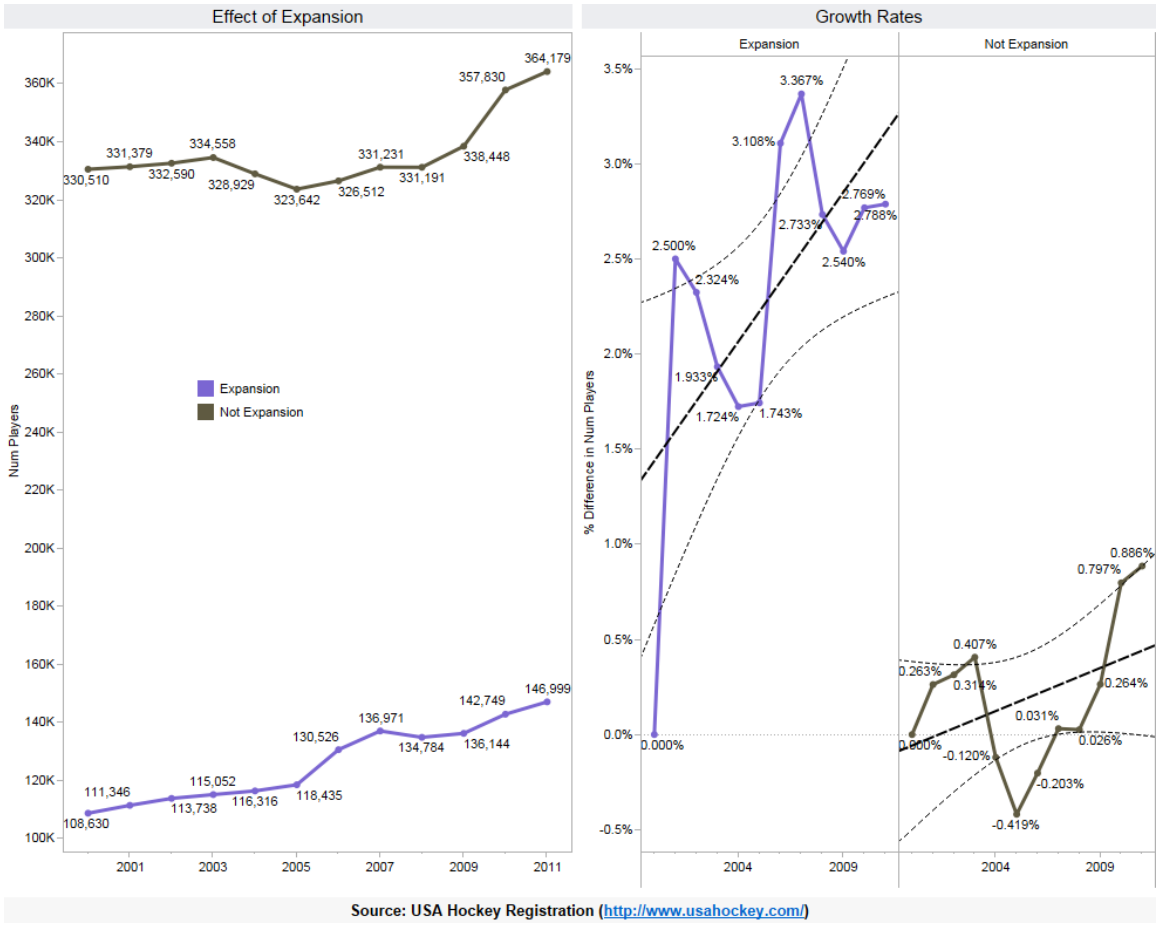


Figure 7 shows the growth in USA Hockey registration numbers segmented by states that received expansion or relocated NHL franchises from 1990 to 2001 and ones that did not. Non-expansion states include states that have older NHL franchises and states that do not have NHL franchises. The graph shows that there is significantly higher growth in states that received an expansion franchise. It should also be noted that the chart only shows growth from 2001 to 2014 because USA Hockey did not collect state-by-state level data until that time. The majority of states received their franchises in the 1990's, so the growth might have even been larger if we could see data back to that time period.

Figure 8

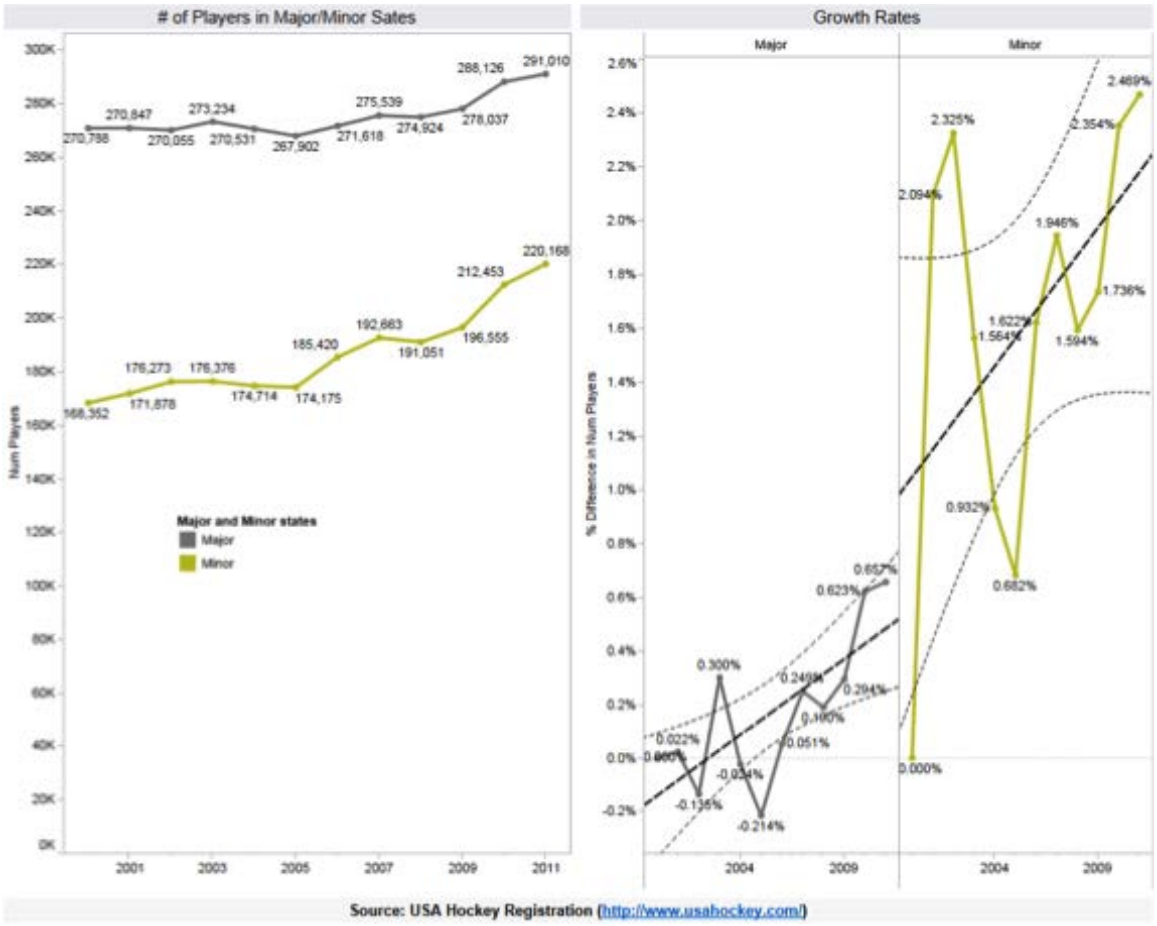
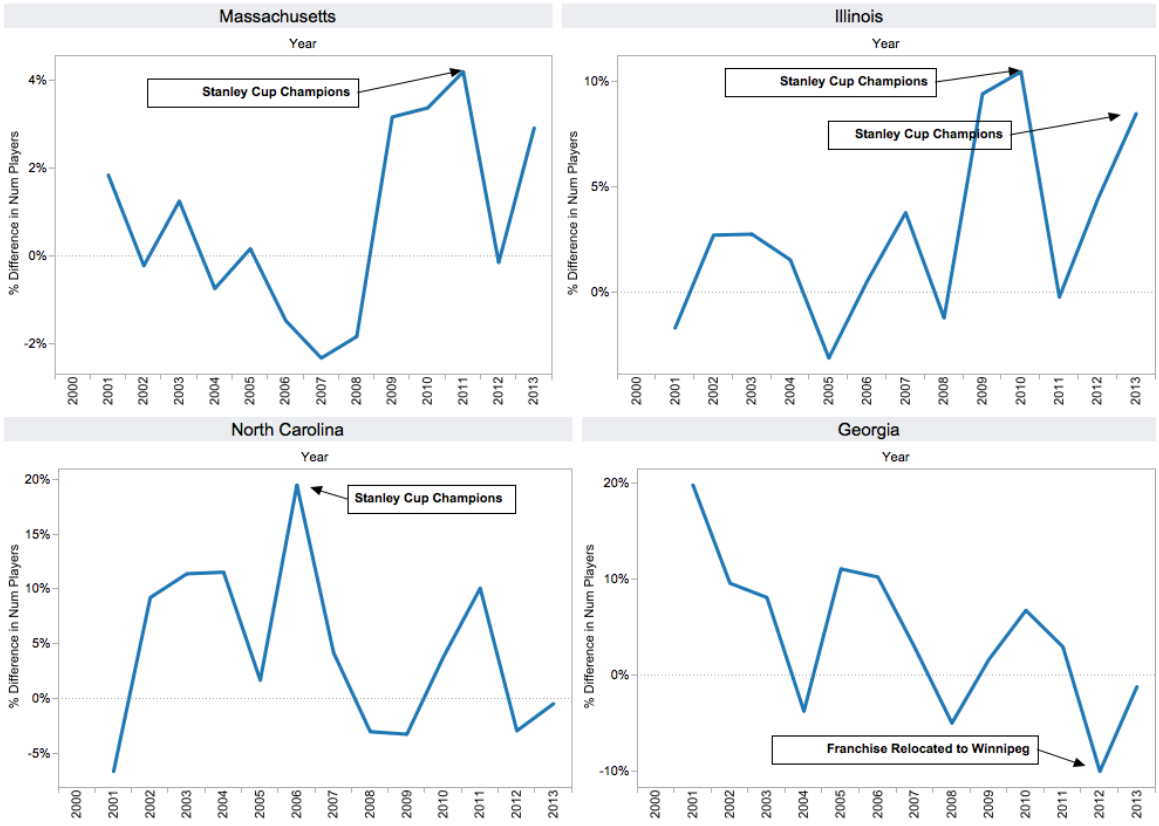


Figure 8 shows growth in registration in major hockey states and minor hockey states. Major hockey states are the fifteen largest in terms of players per population and minor states are the thirty-five other states and Washington D.C. This graph shows that there has been dramatic growth in the minor hockey states and relatively little in the traditional states. Most of the growth in the traditional states comes from Minnesota, which was one of the NHL expansion states in the late 90's. What this indicates is that there is a relative plateau on how high the number of players per population can grow. The traditional states are saturated, but the new markets are growing at a fairly large rate.

To understand what factors cause the change I next looked at demand growth on a year-by-year basis for specific states.

Figure 9
Year over Year Change for Selected Sates



Data Source: "Membership Statistics." Usahockey.com. USA Hockey, n.d. Web. 02 May 2015. http://www.usahockey.com/page/show/839306-membership-statistics

Figure 9 shows the year-over-year change in number of registered players for four states. In Massachusetts, Illinois and North Carolina, we can see very dramatic changes in the number of registered players the year after their NHL teams won the Stanley Cup. I looked at Georgia specifically because Atlanta was the only NHL team to relocate during this time period. This graph shows a dramatic decrease in the amount of players the year after Atlanta relocated to Winnipeg. Figure 9 shows that exogenous events like a team winning a championship have a great effect on demand for youth hockey.

Figure 10

```
Call:
lm(formula = Change ~ Lockout + Olympic + NHL + Players, data = Thesis)

Residuals:
     Min       1Q   Median       3Q      Max
-0.89550 -0.03999 -0.00587  0.03053  1.31506

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.335e-02  7.124e-03   3.277   0.0011 **
Lockout     -2.626e-02  1.274e-02  -2.062   0.0396 *
Olympic      2.524e-02  1.274e-02   1.982   0.0479 *
NHL          1.213e-02  7.320e-03   1.657   0.0981 .
Players     -6.314e-07  3.721e-07  -1.697   0.0902 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1344 on 684 degrees of freedom
Multiple R-squared:  0.02095,   Adjusted R-squared:  0.01522
F-statistic: 3.659 on 4 and 684 DF,  p-value: 0.005851
```

Figure 11

```
Call:
lm(formula = Change ~ Cup + Lockout + Olympic + Players, data = Thesis)

Residuals:
      Min        1Q    Median        3Q       Max
-0.095753 -0.026045 -0.002243  0.024902  0.161390

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  3.247e-02  8.929e-03   3.636 0.000441 ***
Cup          1.346e-02  6.667e-03   2.019 0.046153 *
Lockout     -1.859e-02  1.074e-02  -1.730 0.086708 .
Olympic      3.894e-02  1.074e-02   3.624 0.000459 ***
Players     -8.858e-07  2.751e-07  -3.220 0.001734 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.04403 on 99 degrees of freedom
Multiple R-squared:  0.2591,    Adjusted R-squared:  0.2292
F-statistic: 8.657 on 4 and 99 DF,  p-value: 4.926e-06
```

Field	Definition
Lockout	Whether the NHL had a work stoppage in a year
Olympic	Whether it was an Olympic year
NHL	Whether a state has an NHL team or not
Players	The number of registered amateur players in a state
Cup	Whether a state's NHL team won the cup in a year

Figures 10 and 11 show regression outputs with year-over-year change in registration numbers as the dependent variables. Figure 9 is a regression of all of the states yearly changes since 2002. Figure 10 just shows the states that won Stanley Cups in that time period. In both regressions Olympic years had positive effect on registration numbers. Lockouts had negative effects on all states, but less of an effect on states that had won Stanley Cups. Additionally, the number of players in a state had a negative effect. This is interesting because it indicates that the states with a large youth hockey following have less of a yearly increase than the states that have a smaller following. This seems to indicate that there is a plateau on how high the numbers can reach. Finally, I analyzed the effect of Stanley Cup victories by putting in a dummy variable of 1 for the season in which a team won the Stanley Cup, 2 for the year after because this is when the cup should have the largest effect, and 1 again the year after that because there should be a lingering effect of a Stanley Cup victory. The regression indicates that teams see a larger increase in the number of players registered when they win the Stanley Cup.

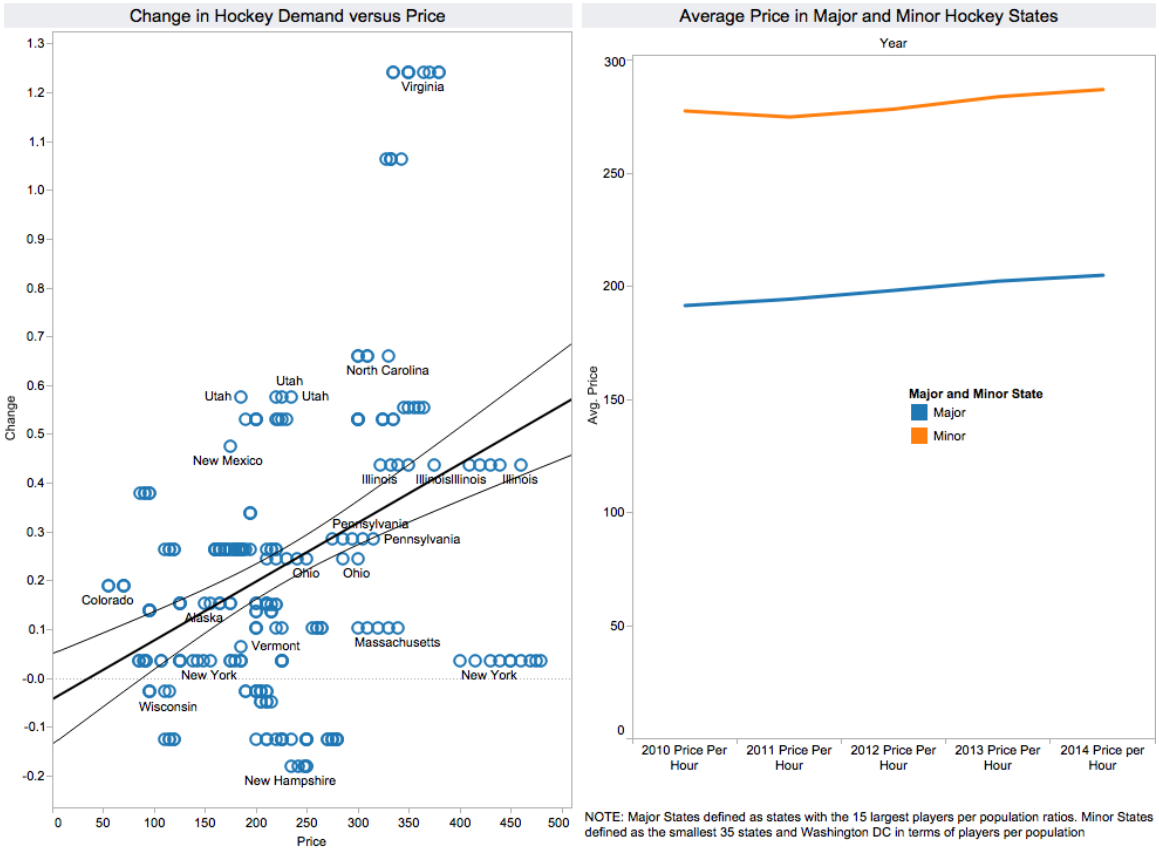
Through analyzing USA Hockey registration numbers I have begun to understand what drives market demand in youth sports. The numbers indicate that the states that have the largest number of players per population are the traditional, cold, hockey states. However, these states are not seeing much increase in their registration numbers, while the total registration numbers have increased drastically. This indicates that there is a plateau for how popular the sport can become in a state. The growth is largely being found in non-traditional hockey markets. This demand change is being driven by exogenous events like a team winning the Stanley Cup, the NHL locking out its players and missing a portion of the season, NHL expansion and Olympic years. The numbers

indicate that demand growth in youth hockey, and most likely other youth sports as indicated by the lack of growth in traditional sports, is driven by exogenous events that individual firms do not have much effect on. What can a firm participating in this market do to be profitable when they have little control over the popularity of their product?

3.3 Individual Firm Level Perspective

I tried to answer the question by collecting primary survey data from ice rinks in the United States. These rinks represent the individual firms participating directly in the youth hockey market. I wanted to analyze their business practices, as well as their prices and hockey quantities to understand what a firm can do to be profitable in this market.

Figure 12
Prices based on demand for hockey



NOTE: Major States defined as states with the 15 largest players per population ratios. Minor States defined as the smallest 35 states and Washington DC in terms of players per population

The left chart in Figure 12 shows the relationship between the prices that ice rinks in a state charge for an hour of ice in relation to the change in number of hockey players in that state from 2001 to 2014. The right chart shows the price charged by traditional and non-traditional hockey states. There is a positive relationship between the growth in players and the price a rink charges. Additionally, the traditional states cannot earn as much per hour as the non-traditional states. This means that areas where there has been an increase in demand can charge the highest price, not the states that actually have the most players. This is somewhat not intuitive because the laws of traditional supply and demand would mean that states with more players (or more demand) should be able to charge higher prices. This seems to indicate that traditional states have the correct amount of rinks for their players, but states that have seen growth might not have enough rinks built. As shown in the above section about registration numbers, demand for youth sports changes because of exogenous factors. While, the price information might indicate that an area needs more rinks, rink owners might want to be wary of building new facilities because an exogenous event might cause the demand to go down. An area would then be left with too many rinks. This would support a model where rink management should put more kids on the ice at the same time instead of opening new rinks, which is essentially the goal of the American Development Model. With this theoretical strategy in mind, I decide to next look at rink prices depending on whether the rink follows ADM guidelines or not.

Figure 13
Prices based on whether rinks adhere to ADM guidelines

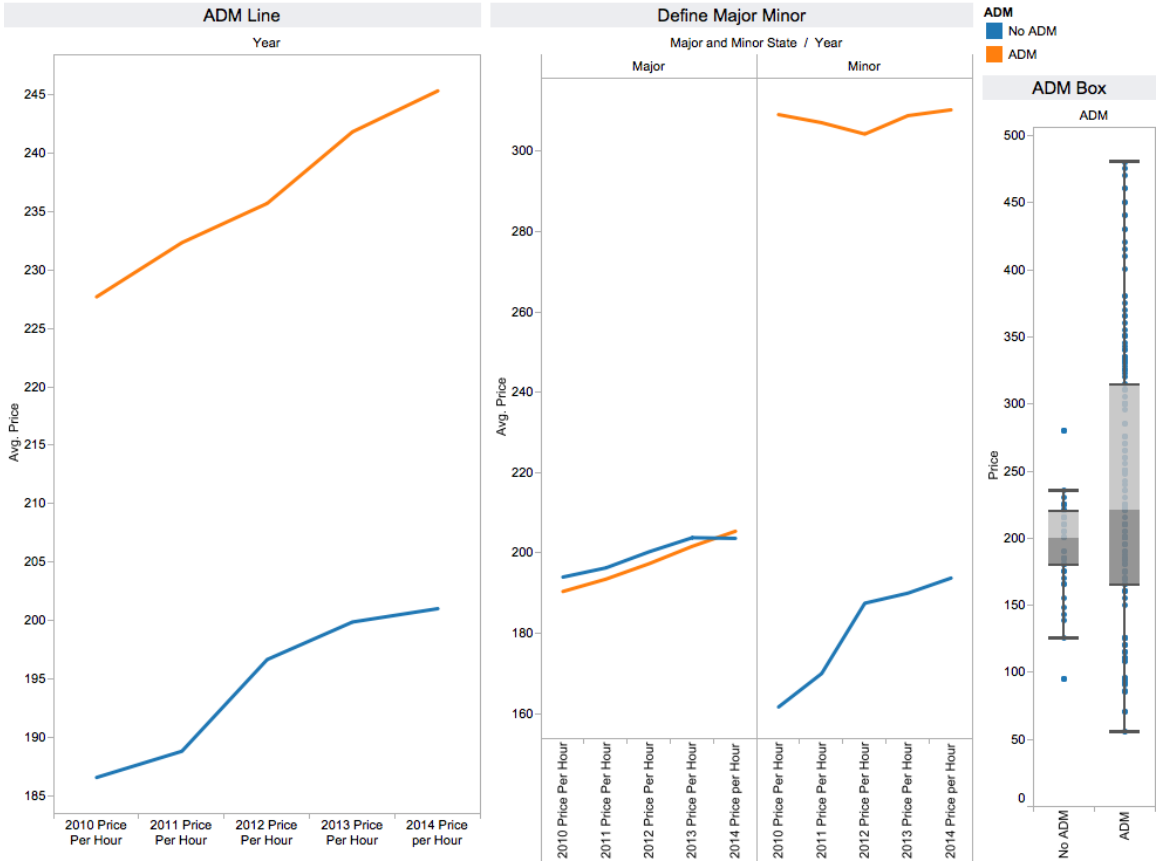


Figure 13 shows the price that a rink can charge depending on whether they do or do not follow ADM guidelines. The top left and right charts show that, on average, a rink that follows ADM guidelines can charge more for an hour of ice than a rink that does not. The bottom chart breaks the relationship broken down into major and minor states. The major states do not have much of a price advantage whether they follow ADM guidelines or not, however it does seem that the price for rinks that follow the ADM is growing. The minor states, however, can charge significantly more if they follow the ADM. This supports the information found in figure 11. The demand is growing in the minor states, and they can charge more for an hour of ice than the major states, but they might want to delay opening new facilities. The above figure says that instead of opening new rinks,

rink owners can put more kids on the ice at the same time and charge significantly more for that hour of ice time. The figure shows that kids have a greater willingness to pay for ADM hockey. However, it might not be a flawless transition to start charging more for an hour of ice. Parents might react negatively to an increase in price per hour even if their kid is getting more time on the ice.

Figure 14
Prices based on if rinks run their own hockey programs

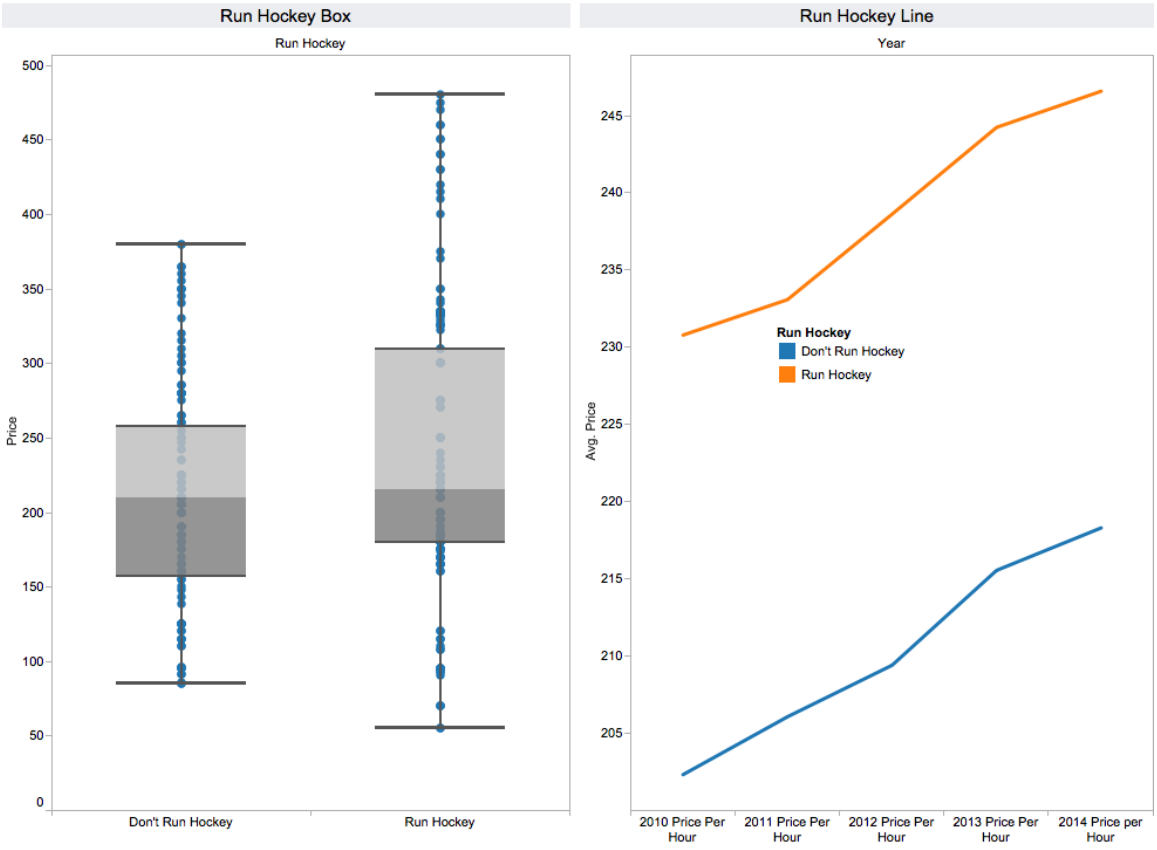


Figure 14 shows what might be the solution to increasing price for ADM ice. The left and right charts show whether a rink runs their hockey programs or not.. These charts indicate that a rink that runs its own hockey programs can charge higher prices for an hour of ice on average than rinks that just sell ice time to hockey associations. This is important in relation to the ADM because rinks that run hockey have the benefit of not

specifying their specific price for an hour of ice. Rinks that run their own programs are essentially accounting for the price of an hour of ice based on the total price they charge their players for a season, instead of specifying the price when selling it to an association. These rinks can simply sell seasons of hockey to players at a higher price and allow them more times on the ice by putting more players on the ice at the same time. This allows them to essentially charge more for each hour of ice without parents noticing the dramatic increase in price.

I next wanted to illustrate these figures more effectively through statistical analysis, so I ran a regression with price as the dependent variable and the variables demonstrated above as well as a few other variables as the independent variables.

Figure 15

```
Call:
lm(formula = Price ~ Num_Sheets + ADM + Run_Hockey + Change,
    data = Thesis)

Residuals:
     Min       1Q   Median       3Q      Max
-170.691  -57.111    6.777   43.123  263.680

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  137.542     15.813   8.698 3.97e-16 ***
Num_Sheets    18.877      6.078   3.106  0.00211 **
ADM           32.497     11.698   2.778  0.00587 **
Run_Hockey    19.073     10.898   1.750  0.08129 .
Change        93.871     17.484   5.369 1.76e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 82.97 on 259 degrees of freedom
Multiple R-squared:  0.1906,    Adjusted R-squared:  0.1781
F-statistic: 15.25 on 4 and 259 DF,  p-value: 3.278e-11
```

Field	Definition
Num_Sheets	Number of ice sheets in a rink
ADM	Whether a rink follows ADM guidelines or not
Run_Hockey	Whether a rink runs its own hockey programs or not
Change	Hockey registration change from 2001-2014

Figure 15 shows regression output with price per hour as the dependent variable and the number of sheets a rink has, whether the rink runs the ADM or not, whether a rink runs its own hockey programs, and the change in hockey registration in a state as the independent variables. All of the independent variables are significant. The largest one is the change in the number of players at the .1% level, which shows that rinks that have seen the greatest change in demand can charge the highest price. The number of sheets is significant at the 1% level, which means that rinks that have more sheets charge more per hour. The ADM variable is significant at the 1% level, and has a coefficient of 32.497, which means that rinks that follow ADM guidelines can charge, on average, $32.50 more than rinks that do not. Also significant, but only at the 10% level is whether a rink runs its hockey programs or not. The coefficient is 18.877, so rinks that run their programs can essentially charge around $19 more than other rinks.

Figure 16

```
Call:
lm(formula = Price ~ Num_Sheets + ADM + Major_ADM + Major + Run_Hoc
key +
    Change, data = Thesis)

Residuals:
     Min       1Q   Median       3Q      Max
-166.688  -40.259   -0.773   31.480  277.414

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  145.183     22.259   6.523 3.65e-10 ***
Num_Sheets    13.554      5.752   2.356   0.0192 *
ADM          117.568     21.310   5.517 8.40e-08 ***
Major_ADM   -118.539     25.182  -4.707 4.11e-06 ***
Major         20.921     22.155   0.944   0.3459
Run_Hockey    18.428     10.354   1.780   0.0763 .
Change        13.248     20.777   0.638   0.5243
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 76.86 on 257 degrees of freedom
Multiple R-squared:  0.3109,    Adjusted R-squared:  0.2948
F-statistic: 19.33 on 6 and 257 DF,  p-value: < 2.2e-16
```

Field	Definition
Num_Sheets	Number of ice sheets in a rink
ADM	Whether a rink follows ADM guidelines or not
Major_ADM	An interaction variable for whether a state is major and follows the ADM
Major	A dummy variable for whether a state is a major hockey state
Run_Hockey	Whether a rink runs its own hockey programs or not
Change	Hockey registration change from 2001-2014

Figure 16 is another regression output that shows the same dependent and independent variables as figure 15, but with the independent variables “Major” and “Major_ADM” included. The output shows that there is a negative correlation for “Major_ADM”, which means that rinks in major states that follow ADM guidelines

cannot charge as much as rinks in minor states that follow the ADM. Another notable result is that "Change" is no longer significant, but that is most likely because the change in demand is captured in the "Major" and "Major_ADM" variables.

The conclusions I drew from analyzing individual firms in the market are fairly straightforward. A rink that has seen a large demand increase can charge a significantly higher price for their ice. However, they might want to limit their costs by putting more kids on the ice at the same time instead of opening new facilities. Additionally, rinks that follow ADM guidelines can charge a higher price. The final conclusion is that rinks should integrate their business model by running their own hockey programs.

4. Conclusions

The purpose of this thesis was to understand what drives market demand in youth sports, a massive market that we know relatively little about. From the market constraints that I discovered, I then wanted to look at what an individual firm can do, given those constraints, in order to be profitable within the market. While I am restricted by the data available about other sports, I do believe that some conclusions can be drawn from the hockey data and extrapolated to other amateur sports. However, keep in mind that more studies should be conducted on other sports to see if my conclusions hold true.

4.1 Demand Drivers

The USA hockey data told a story that states where hockey is traditionally popular are the colder states or the states that have a history of hockey. However, these states have seen stagnation in terms of demand growth. Although, the data I have had access to regarding other sports is limited, I believe it tells a similar story. Football,

soccer, baseball, and basketball have all seen a decline in demand in recent years (see figure 3). This is probably because these sports are widely popular and marketed across the United States. Essentially, the stagnation we see in the traditional hockey states is true for all states regarding the bigger sports because those sports are popular in all states. There seems to be a limit to the growth of a sport in a particular area.

When looking at change in demand for youth hockey, the demand drivers are largely exogenous events that individual firm participants have no control over. These events are NHL expansion, a team winning a Stanley Cup, an NHL work stoppage, and an Olympic year. It would be reasonable to extrapolate this conclusion to other sports. It is simply logical to assume that if the Seattle Seahawks win a Super Bowl, more kids will play football in Washington State.

4.2 Firm Strategies

The broadly applicable conclusions that come out of the data that I collected from rinks is that the firms that can charge the highest price are the firms that have seen the greatest increase in demand in their area caused by exogenous events. Bringing this to other sports, it would also be reasonable to conclude that growth markets can most likely charge higher prices than saturated ones. The implication here is that it is important for a firm to know whether an exogenous event has happened in their area and when to profit from that event. This doesn't even have to be exclusively for youth sports programs. Sports apparel companies, equipment companies, video game companies and other related firms could profit by knowing how outside events affect sport demand.

The other issue that firms may have is a short-term mindset. If they see growth in demand they may be inclined to increase supply. In this case, supply would be more sports facilities. However, an exogenous event like a work stoppage in their sport could decrease the demand and they would be left with an excess supply. Instead, firms should keep a long-term demand mindset. Until they can understand the long-range growth, they should focus on limiting costs regarding short-term demand fluctuations. As shown through the rinks that follow ADM guidelines this could be done by putting more kids on a playing surface instead of building new surfaces. This can be applicable to other sports. For example, kids can play on smaller soccer fields or football fields. Additionally, firms can greater profit by integrating their programs with the example of rinks that run their own hockey programs as the model.

4.3 Policy Implications

Market Participants

Individual firms must understand how demand is driven by exogenous events and must be able to understand when those events happen. There is essentially an arbitrage opportunity for firms that operate in the youth sports market.

Additionally, firms must keep a long-term view on demand and understand that they may want to limit their long-term costs by not increasing supply. They should better utilize their facilities and charge a higher price for their current product when they are faced with growing demand. Once they understand long-term demand they can decide whether increasing supply is a good decision.

Sports Federations

It is important to note that the ADM has other features besides simply putting more kids on the ice at the same time. The core of the ADM is about allowing kids to play with less of a focus on wins and develop skills through less formal play. Allowing kids to touch the puck more and play with more people is in direct contrast with the traditional idea of having kids play in a sort of mini-NHL type program where they play a lot of games on an NHL sized ice surface. The situation is very similar in other sports where parents seemed more concerned that their kid is playing like the professionals instead of if they are developing. Youth sports in America have become very "professionalized".[11] The fact that rinks can charge more for the ADM is great support for moving away from the traditional system we have for sports towards a system more like the ADM that puts more emphasis on what is best for a child.

Although more information is necessary for other sports, sports federations, such as USA Hockey, now have a quantifiable measurement of how certain events affect the demand for their sport. They should focus on partnering with professional leagues in their specific sport. Through these partnerships they can spread the sport through expansion to markets that are not saturated. Additionally, federations should work with colleges in order to spread the game.

---

[11] Cox, Jordan. "The Professionalization of Youth Sports in America." Baylor-ir.tdl.org. Baylor University, Aug. 2011. Web. 11 May 2015. https%3A%2F%2Fbaylor-ir.tdl.org%2Fbaylor-ir%2Fbitstream%2Fhandle%2F2104%2F8204%2FJordan_Cox_masters.pdf%3Fsequence%3D1

Underserved Market

This is an underserved market and there is very limited data available about youth sports participation. However, the market has important business opportunities and health implications. There is a great opportunity for either a state or federal body, or some private organization to collect data on this market so that we can better understand it.

Works Cited

“About ADM." Admkids.com. USA Hockey, n.d. Web. 02 May 2015.

"Average Mean Temperature Index by Month." *Esrl.noaa.gov*. National Oceanic and Atmospheric Association, n.d. Web. 10 May 2015. <http://www.esrl.noaa.gov/psd/data/usclimate/tmp.state.19712000.climo>.

Brady, Erik, Steve Berkowitz, and Jodi Upton. "NCAA Football Coaches' Average Salary at $1.64 Million." Usatoday.com. USA Today, 20 Nov. 2012. Web. 02 May 2015.

"Clubs." *MLSsoccer.com*. Major League Soccer, n.d. Web. 10 May 2015. <http://www.mlssoccer.com/clubs>.

Cox, Jordan. "The Professionalization of Youth Sports in America." Baylor-ir.tdl.org. Baylor University, Aug. 2011. Web. 11 May 2015. <https%3A%2F%2Fbaylor-ir.tdl.org%2Fbaylor-ir%2Fbitstream%2Fhandle%2F2104%2F8204%2FJordan_Cox_masters.pdf%3Fsequence%3D1>.

DeNavas-Walt, Carmen, and Bernadette D. Proctor. "Immigration and Poverty in the United States." *The American Economic Review* 99.2, Papers and Proceedings of the One Hundred Twenty-First Meeting of the American Economic Association (2009): 41-44. *Census.gov*. United States Census Bureau, Sept. 2014. Web. 10 May 2015. <https://www.census.gov/content/dam/Census/library/publications/2014/demo/p60-249.pdf>.

"Division III Men's Hockey Teams." *D3hockey.com*. D3Hockey, n.d. Web. 10 May 2015. <http://www.d3hockey.com/teams/men>.

Eime et al. International Journal of Behavioral Nutrition and Physical Activity 2013, 10:98 http://www.ijbnpa.org/content/10/1/98

"Home." Starrinks.com. Serving The American Rinks, n.d. Web. 02 May 2015.

"Key Statistics | US Youth Soccer." *Usyouthsoccer.org*. US Youth Soccer, n.d. Web. 05 May 2015. <http://www.usyouthsoccer.org/media_kit/keystatistics/>.

"The Mag's Ultimate Standings 2014." *Espn.go.com*. ESPN Internet Ventures, n.d. Web. 10 May 2015. <http://espn.go.com/sportsnation/teamrankings>.

"Membership Statistics." Usahockey.com. USA Hockey, n.d. Web. 02 May 2015. http://www.usahockey.com/page/show/839306-membership-statistics

"Men's NCAA Division I College Hockey Teams." *Americanhockeycenter.com*. American Hockey Center, n.d. Web. 10 May 2015. <http://www.americanhockeycenter.com/college_hockey/mens-ncaa-division1-hockey-teams.htm>.

"National Weather Service, Alaska Region Headquarters, AK." *Arh.noaa.gov*. National Weather Service, Alaska Region Headquarters, AK, n.d. Web. 10 May 2015. <http://www.arh.noaa.gov/cliMap/akCliOut.php>.

"NHL/WHA Team Index | Hockey-Reference.com." *Hockey-Reference.com*. Hockey Reference, n.d. Web. 10 May 2015. <http://www.hockey-reference.com/teams/>.

"Nutrition, Physical Activity, & Obesity Data & Statistics." Cdc.gov. Centers for Disease Control and Prevention, 09 Dec. 2014. Web. 02 May 2015.

Riccoboni, Anthony. "Super Bowl Ratings: How Many People Watched The New England Patriots, Seattle Seahawks Game?" Ibtimes.com. International Business Times, 2 Feb. 2015. Web. 2 May 2015

"State Totals: Vintage 2013." *Census.gov*. United States Census Bureau, n.d. Web. 10 May 2015. <http://www.census.gov/popest/data/state/totals/2013/index.html>.

"Team Directory | AHL." *Theahl.com*. The American Hockey League, n.d. Web. 10 May 2015. <http://theahl.com/team-directory-s11579>.

"Team USA." *Eliteprospects.com*. Eliteprospects, n.d. Web. 10 May 2015. <http%3A%2F%2Fwww.eliteprospects.com%2Fteam.php%3Fteam%3D1626%26year0%3D2014>.

United Nations. "Chapter 2 Sport and Health - The United Nations." PROMOTING HEALTH CHAPTER 2 (n.d.): 27-29. Web. 2 May 2015.

USA Hockey. "Printable ADM Guide." A BRIGHTER FUTURE FOR ALL (n.d.): n. pag. Admkids.com. USA Hockey. Web. 2 May 2015. http://assets.ngin.com/attachments/document/0042/7978/USA100001-NewspaperRev3_2013.pdf

U.S. Census Bureau. "Census 2010, 2000, 1990." Social Explorer. Web. 02 May 2015. http://www.socialexplorer.com/explore/tables

Wallerson, Ryan. "Youth Participation Weakens in Basketball, Football, Baseball, Soccer." Wsj.com. The Wall Street Jounral, 31 Jan. 2014. Web. 12 May 2015. <http://www.wsj.com/articles/SB10001424052702303519404579350892629229918>.