# The Effect of Rinks on Shot Rates in the QMJHL

John Tank
johnhtank@gmail.com

## 1. Introduction

The QMJHL (the Q) is incredibly important to the NHL draft, as throughout the past five years, the Q has produced 141 players drafted, including 15 players in the first round. When it comes to analyzing these players, accurate data is crucial. Shots are one of the most important variables when analyzing a hockey player. Not only when analyzing NHL players, but also draft prospects. It is vital for shot-based evaluations such as CorsiFor% or FenwickFor% that these shot totals are accurate. Unlike goals, assists, and points, acquiring data for shots presents its own unique challenges, as these events occur much more frequently throughout the span of a game, and are tracked by hand, leading to an expected greater inconsistently within our data compared to goals and assists. This project's analysis will look into the relative count biases found from rink to rink within the QMJHL, with the end goal to estimate the differences in recording for each rink in order to scale shot data for each rink.

Schuckers and Macdonald created a loglinear model to analyze the recording of events in NHL rinks, looking into several different count biases from rink to rink, including block, takeaways, and shots, Schuckers – Macdonald (2014). Using their model as a framework for this research, we fit a similar statistical regression model scaled to our QMJHL data to estimate these relative differences in expected shots for each rink. While Schuckers and Macdonald were focused on game level data for teams, our focus is on game level data for players.

Overall, we find that most rinks in the QMJHL are consistent when tracking shots, however, the rinks of Acadie-Bathurst, Québec, and Sherbrooke did consistently differ from other rinks in our analysis over several years though no individual year was statistically significant. When analyzing players from these teams it is important to be aware of this, and scaling the shots according to our model would yield better data.

## 2. Data

The data collected for this analysis came directly from the media access page for the QMJHL[1]. The data consisted of box scores of goals, assists, shots, and plus minus for each player from every team throughout the course of a season dating all the way back to the late 1970's. A subset of these data were scraped and put into multiple datasets, one for each season. From there, any player that played fewer than 10 games was excluded from our data. Leaving us with a dataset for each season containing the variables: team, opponent, player, date, goals, assists, points, shots, plus minus, home or away, and rink. Each dataset had over 10,000 data points where each point a player-game, i.e. the statistics for a single player in a single game.

It is important to note, that within our data there were some insistences of rinks changing, from either teams moving cities, or new teams coming into existence. For the sake of our analysis, this was not a problem, as there were cases were rinks changed midseason, and as we'll get into later in the paper, for the rinks we analyzed, there were no rinks where one teamed moved that were significant.

It is also important to note, that the data used for this analysis, differed from the Schuckers-Macdonald in the variation among players. Junior hockey players have much more variability in player strength compared to NHL, as seen as comparing Connor McDavid scored 120 points in 47 games in 2014-2015 season in the OHL to players in that league who scored no points in the whole season.

## 3. Model

The response for our analysis is the number of shots per player because we want to consider the impact of rinks on players. To that end we fit our model, given in Equation (1) below, to each of five seasons: the 2011-12 season through the 2015-16 season. Each model was a Poisson generalized linear model of the form:

$$shots \sim rink + Home/Away + team + Opponent + player. \qquad (1)$$

[1] Thanks to Shane Malloy for allowing access to these data

We used a Poisson distribution as we are modeling shot count data. Although we did not focus on team, opponent, and player in analysis, these were very important covariates in our model to explain variation and, thus, determine how a rink effects specifically affects the amount of shots throughout the course of a game.

For our model, we also made the assumption that all situations were equal for a game being played at home versus away. Meaning, there were an equal about of power plays and penalties given out for each team.

**4. Results**

Before looking directly into how rinks effect shot counts in a game, we first wanted to make sure the estimator Home/Away effect was consistent for each season model from 2011-12 to 2015-16. In each model the estimator was very significant with a p-value of essentially zero.

Table 1: Effect of Home Ice on Shot Counting, 2011-12 to 2015-16

| Year | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|
| Estimator | 0.089 | 0.070 | 0.082 | 0.054 | 0.069 |
| Expected Shot Change | 9.3% | 7.2% | 8.5% | 5.5% | 7.1% |

From the Table 1 above, we can see that for every season, there was a significant increase in expected shots when played at home. This consistency is important for our analysis of rinks because if there was a season where this was not the case, then we would not be able to accurately compare a rink from season to season. Further, we confirm what we would expect to find for any rink, that they count positive events, in this case shots, at a higher rate for the home team.

Table 2 has the standardized rink effects, (individual rink minus league average) divided by rink standard error, for 19 rinks though only 18 teams, between the 2012-13 and 2013-14 season Prince Edward Island moved to Charlottetown. Sherbrooke joined the Q for the 2012-13 season. The standardized rink effect for Acadie-Bathurst in 2012-13 was 1.644 meaning that the average shot rate in that rink was 1.644 standard deviations above the league mean in that season.

Table 2: Standardized Rink Effects by Rink and Season

| | Seasons | | | | | |
|---|---|---|---|---|---|---|
| Rinks | 2011 | 2012 | 2013 | 2014 | 2015 | Average |
| Acadie-Bathurst | 0.808 | 1.644 | 0.860 | 1.681 | 0.684 | 1.135 |
| Baie-Comeau | 1.417 | 0.209 | 0.165 | -0.673 | -1.466 | -0.070 |
| Blainville-Boisbriand | -0.993 | -0.189 | 0.713 | 0.067 | -0.190 | -0.119 |
| Cape Breton | 0.004 | -0.488 | -1.086 | -0.222 | 0.437 | -0.271 |
| Charlottetown | NA | NA | 0.748 | 0.426 | -0.304 | 0.290 |
| Chicoutimi | -0.606 | 0.206 | -0.177 | -1.317 | -0.542 | -0.487 |
| Drummondville | -0.994 | -0.779 | 0.621 | -0.812 | -0.554 | -0.504 |
| Gatineau | -0.437 | -0.786 | -1.278 | 0.867 | -0.745 | -0.476 |
| Halifax | -0.355 | -1.333 | -0.370 | -0.299 | 0.842 | -0.303 |
| Moncton | -0.237 | 0.096 | -1.241 | 1.231 | 0.602 | 0.090 |
| PEI | 0.088 | 0.138 | NA | NA | NA | 0.113 |
| Quebec | -1.231 | -0.480 | -0.374 | -0.754 | -1.259 | -0.819 |
| Rimouski | -0.659 | -0.396 | 0.450 | 0.680 | 1.046 | 0.224 |
| Rouyn-Noranda | 0.823 | -1.073 | -0.760 | -0.266 | 0.644 | -0.127 |
| Saint John | 0.109 | 0.211 | -0.597 | 0.608 | 0.080 | 0.082 |
| Shawinigan | 0.861 | 0.603 | -0.462 | -0.420 | -0.962 | -0.076 |
| Sherbrooke | NA | 1.485 | 0.658 | 0.419 | 1.345 | 0.977 |
| Val-d'Or | 0.146 | 0.942 | 1.383 | -0.215 | 0.365 | 0.524 |
| Victoriaville | 1.258 | -0.010 | 0.747 | -1.001 | -0.025 | 0.194 |

**5. Analysis**

Our focus here is on the rink effects, so this section will discuss the rink effect results given in the previous section. As seen in Table 2, there were no Z-scores that were greater than 2 or less than -2. Despite this, the three rinks of Acadie, Québec, and Sherbrooke all produced consistent Z-scores. None of the individual season rink effects are significant, i.e. have a standardized effect larger than two. We note that Acadie-Bathurst, Quebec and Sherbrooke all had rink effects that were the same direction across all five seasons. Most notably out of the three was Acadie-Bathurst, who produced the highest average Z-Score of the three, and also had the two highest Z-scores of any rink, with 1.681 in 2014 and 1.644 in 2012.

Despite having no rink effects that were highly significant, these trends in the rinks do certainly suggest that these rinks should be considered for when analyzing players from these teams. Below we focus on Table 3 has the expected shots rates relative to the league average for Acadie-Bathurst for the five seasons of data that we analyzed. As we can see from this table, we would expected a roughly a 7.86% increase in shots for a game played in Acadie-Bathurst across the seasons. These rates apply only to players when they shoot in that rink. Consequently the effective rate for a player on the Acadie-Bathurst Titan is about half the given rate for a given season.

Table 3: Acadie-Bathurst Shot Rates Relative to League Average

| Year | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | Average |
|---|---|---|---|---|---|---|
| Percent | 6.10% | 9.20% | 5.60% | 14.10% | 4.30% | 7.86% |

.

**6. Conclusion**

In this paper we have proposed a variation of the Schuckers-Macdonald model for estimation of hockey rink effects. Our focus here is the effect of recording in individual rinks on player level shot rates per game. To estimate those effects, we used a Poisson Generalized Linear Model (GLM) applied separated to each of five seasons worth of data. One avenue for future work would be to consider zero-inflated Poisson regression. Ultimately the results of our GLM analysis were that the estimated rink effects indicate that there are not large effects due to the recording in these rinks. These conclusions are mostly in line with Schuckers and Macdonald (2014) who found few differences between rinks in the recording of most events, including shots.

To illustrate the impact of the rink effects we observed we consider a specific player. In the upcoming 2017 NHL Draft, Central Scouting has 28 players listed from the QMJHL as potential draft prospects. When analyzing players who play for either

Acadie, Québec, and Sherbrooke, it important to scale our data for shots because in each case, players on these teams play half of their games in rinks that record shots differently than other QMJHL rinks. For example when looking into a prospect like Antonie Morand from Acadie, who is currently ranked as the 53rd best prospect by Central Scouting, we find in his 2015-16 season he recorded 81 total shots, including 41 home. In order to scale our data for Morand, we will have the following predicted total shots,

$$\frac{41}{1+0.0786} + 40 = 78.$$

Here we have not adjusted the away shots for Morand (since we can assume those effects would average out), it is possible to do such an adjustment. For future analysis into this subject, we hope to look into the rink effects for both the OHL and WHL in order to get a sense on how rinks affect all major junior hockey league prospects.

**References**

Michael Shuckers and Brian Macdonald. Accounting for Rink Effects in the National Hockey League's Real Time Scoring System. https://arxiv.org/pdf/1412.1035.pdf, 2014.