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Abstract

In the current National Hockey League (NHL) points system (PS), there are increased incentives for teams to play overtime games against nonconference opponents. We use empirical data across three recent NHL PSs to test if and when teams have responded to these incentives. We find that in the current PS, several teams are playing a significantly higher proportion of overtime games against nonconference opponents than within-conference ones, and that overtime games are also significantly more likely to occur in the months leading up to postseason play.

Keywords

National Hockey League, overtime, incentives, scoring systems

Introduction

Following a lockout and the cancelled 2004-2005 season, the National Hockey League (NHL) instituted rule changes designed to increase its popularity, the first of which was a shootout at the end of any overtime session ending in a tie. Along with the shootout came an updated points system (PS), in which teams earning a win,

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either in regulation, overtime, or the shootout, received two points, while teams losing in overtime or in the shootout received one point. The change eliminated the possibility of a game ending in a tie, which, for seasons prior to the 2004, awarded each team one point apiece.

Combined with the NHL's standards for postseason qualification, the newest PS increased the incentives for teams to play for overtime in certain situations but to avoid overtime in others (Longley & Sankaran, 2007). NHL teams qualify for postseason play by finishing among the top eight teams in their conference, as judged by cumulative season points. However, while qualification is done within each of the two conferences, roughly 20% of a team's games are played against teams from the opposing conference. As a result, the system incentivizes teams playing in nonconference games to play for a tie at the end of regulation because (i) one team will still earn the maximum two points, (ii) each team is guaranteed at least one point, and (iii) ceding a point to the opposition does not hurt playoff positioning.

Thus, we hypothesize the likelihood of overtime in the newest PS is higher among games played between two nonconference opponents. We also propose that within a season, the likelihood of overtime increases for games played later in the season, when the start of the playoffs is imminent. We study all regular season NHL games from the 1997-1998 to 2011-2012 seasons, covering three unique PSs. We find a significantly higher proportion of games reach overtime when the two participating teams are from different conferences and that specific franchises have been taking advantage of the overtime incentives more than others. Further, our results suggest that the odds of overtime are significantly higher for games played in the final months of each season in the newest PS only.

To date, ours is the first study of the newest PS to find significant changes in overtime likelihood by month category and by whether the participating teams were from the same conference. Our results raise into question the NHL's system that incentivizes teams to play for overtime in nonconference games. With teams scheduled to play a greater proportion of nonconference games as part of realignment for the 2013-2014 season, this issue could be magnified.

NHL Scheduling

The NHL, based on revenue, is the fourth largest sporting league in North America. There are 30 NHL teams, each of which plays 82 regular season games between October and mid-April.[1] As currently constructed, the franchises are split into two conferences of 15 teams each, the Eastern Conference, consisting of five teams in each of the Atlantic, Northeast, and Southeast Divisions, and the Western Conference, with five teams in each of the Northwest, Central, and Pacific Divisions.

NHL teams play 41 home and 41 away games each season, a mix of divisional, non-divisional conference, and nonconference contests. We refer to a nonconference game as one played between two teams from different conferences, and a conference

game as one in which both teams align from the same conference. Likewise, a divisional game refers to one featuring two teams from the same division. In the 2011-2012 season, 24, 40, and 18 of a team's games were divisional, non-divisional conference, and nonconference ones, respectively. This schedule distribution has been relatively constant for several years, although for each of the three seasons between 2005 and 2008, teams played only 10 nonconference games.

Postseason qualification and success are the primary goals of each franchise, with a disproportionate amount of team revenue earned in playoff ticket sales (Leeds & von Allmen, 2002). While the league's PS has changed twice over the past two decades, standards of qualifying for the playoffs have remained the same in that time period. Since 1980, eight teams in each conference have earned a playoff spot based on regular season performance. In each conference, teams finishing first in their respective divisions, as judged by the total number of points earned for the season, earn one of the top three playoff seeds, with the remaining five seeds awarded to the teams with the next highest point totals. Unlike other sports such as baseball or basketball, where several teams are essentially eliminated by the middle of the season, the majority of hockey teams contend for a playoff spot until the final few weeks of the season, and each year, several teams miss out on postseason qualification by just a few points. In the final 2011-2012 regular season standings, for example, only 14 points separated the Eastern Conference's last place team (Montreal, 78 points) from the final spot in the playoffs (Ottawa, 92 points). Since 2000, the NHL has been on par with the National Football League in terms of sporting organizations with the highest amount of parity (Rockerbie, 2012).

NHL PSs

Three 20-minute periods comprise regulation time in NHL games. Because teams generally score only a few goals apiece, it is common for regulation play to end in a tie score. A 1983 rule change implemented the first 5-minute overtime period to be played for NHL regular season games tied after 60 minute. The overtime format instituted was that of "sudden-death," which ended the game when either team scored. In the case of no scoring, each team was awarded a tie. Up until, and after this rule change, winning teams received two points and losing teams zero points counting toward regular season standings. For games ending in a tie, each team received one point apiece.

The first update in the league's PS was implemented at the conclusion of the 1998-1999 season. In future games, each team was to be automatically awarded one point when the score was tied after three periods, and if a team scored in overtime, that team was to be given an additional point. The new system increased the possible share of points awarded to teams reaching overtime from two to three, although overtime games ending in a tie still yielded one point per team. This change was made due to frustration on behalf of NHL league officials with regard to the frequency of games ending in ties (Abrevaya, 2004). Too often, league officials

Table 1. NHL Points Systems Over Time.

Phase	Years	Description	Points (win)	Points (tie)	Points (Loss)
*PS*0	1910-1911 to 1982-1983	No OT	2	1	0
*PS*1	1983-1984 to 1998-1999	OT, no s/o	2	1	0
*PS*2	1999-2000 to 2003-2004	OT, no s/o	2	1	0 (REG), 1 (OT)
*PS*3	2005-2006 to 2011-2012[a]	OT, s/o	2	n/a	0 (REG), 1 (s/o or OT)

Note. n/a = not applicable; NHL = National Hockey League; OT = overtime; *PS* = points system; REG = regulation; s/o = shootout.
[a]The 2004/2005 season was cancelled.

hypothesized, teams in overtime played for a tie. Coinciding with this PS change was the removal of an extra skater for each team at the start of overtime, also done with the intent of increasing overtime scoring. As a result of the fewer number of on-ice participants and this PS change, the percentage of overtime games ending in a tie dropped substantially (Abrevaya, 2004). Such a points structure lasted until the end of the 2003-2004 season.

After a labor dispute with the players union, the NHL owners cancelled the 2004-2005 season, and when play resumed in 2005, it did so under a new labor agreement. As part of this agreement was a second change to the points structure. A shootout was implemented at the end of any overtime session ending in a tie, with the winners of the shootout awarded the same number of points (2) as winners in regulation or winners in the 5-minute overtime. The losing team from the shootout received the same number of points (1) as had the team lost in overtime. As a result of this change, and unlike after the previous PS update, a guaranteed three total points was shared between teams reaching overtime. This PS has remained since 2005, and pending settlement of the current labor disagreement, it will be maintained when play resumes.

For sake of clarity, we refer to the NHL PSs as *PS*0, *PS*1, *PS*2, and *PS*3 (Table 1) for the remainder of the article. *PS*0 refers to the NHL era of no overtime games during the regular season (up until the 1982-1983 season), while *PS*1 (the 1983-1984 to 1998-1999 seasons) refers to games played after overtime was implemented, but before teams losing in overtime were also awarded a point. *PS*2 (1999-2000 to 2003-2004) refers to the five seasons in which losing teams in overtime received a point but games could still end in a tie, and *PS*3 is our indicator for the current points structure, where a shootout concludes any overtime session ending in a tie.

Analysis of NHL PSs

Empirical and theoretical studies of the effects of PS changes have focused mostly on the differences in team behavior and outcomes between games played in *PS*1 and *PS*2.

Abrevaya (2004) found *PS*2 games were more likely to reach overtime compared to those played in *PS*1. The author also cited a borderline and positive

significant effect of divisional games on the odds of overtime, although this effect was over all games from 1995-1996 to 2001-2002, and not separated by points structure. Longley and Sankaran (2007) suggested that while more overtime games may be likely in *PS*2, certain theoretical conditions exist where a team's optimal strategy would be to avoid overtime. Easton and Rockerbie (2005) suggested team strategies, with regard to the employment of offensive and defensive talent used in nonconference and conference games, should differ between *PS*1 and *PS*2, and used empirical results to show these changes occurred. Looking only at a sample of games played in *PS*2, Shmanske and Lowenthal (2007) found that home teams played less conservatively in overtime of nonconference games than in conference games and hypothesized that this difference was because the optimal within-game point distribution of these games changed based on if the opposing team was from the same conference.

The amount of work devoted to *PS*3, however, is limited. Franck and Theiler (2012) compared games played in *PS*3 to those played in *PS*1, finding an increased overall likelihood of overtime with the current PS. These authors also found no significant change in overtime probability comparing divisional to non-divisional games. To the best of our knowledge, no study has attempted to find the effect of either the month of the game or whether or not the game was played between conference opponents on the likelihood of overtime. Next, we describe our approach in estimating if these associations exist in each PS.

Our Approach

Our goal is to identify game factors that influence the likelihood of overtime across three PSs, *PS*1, *PS*2, and *PS*3. Specifically, we focus on the effect of whether or not the game was played between two teams from the same conference and the time of year when the game was played.

Our dependent variable is an indicator for whether or not the game reaches overtime (Yes/No). Our first covariate of interest is whether or not the game was a nonconference one (Yes/No). A related control variable we also considered was whether or not the game was a divisional one. However, this game trait was previously found to be a nonsignificant predictor for the likelihood of overtime in *PS*3 (Franck & Theiler, 2012), and we feel that conference status may be the stronger predictor as far as team strategy. Specifically, while winning a division guarantees a top three playoff seed within a conference, the remaining five playoff teams can come from any division within that conference. As a result, ceding a point in a non-divisional conference game has roughly the same negative impact on a team's playoff chances as doing so in a divisional game. Meanwhile, allowing an opponent to earn a point in a nonconference game has no negative effect on a team's playoff chances. This distinction provides the possible incentive for teams to play for overtime in nonconference games, and we argue a conference indicator for each game might have a stronger association with team strategy than a division one.

Previous attempts to account for within-season changes on overtime likelihood controlled for the number of days into the season in which the game occurred (Abrevaya, 2004; Franck & Theiler, 2012). Abrevaya (2004) found no evidence of a time effect using this variable in *PS*1 and *PS*2 games, while Franck and Theiler (2012) found the number of days into the season to be positively associated ($.01 < p$ value $< .05$) with the odds of overtime among *PS*1 and *PS*3 games. In both cases, the authors assumed both a linear association between game day and the log odds of overtime and that this association was equivalent across PSs. Instead, we propose controlling for the month in which the game occurred, and separating these effects by PS. We choose four monthly categories, September–December, January–February, March, and April, because a team's playoff chances (and thus, possibly, overtime incentives) seem likely to be equivalent within each of those four intervals.

Because overtime games are more likely when played between two evenly matched teams, different proxy's for team strength have been suggested, including the total number of goals scored and given up by each team playing over the entire season, the points that each team finished the season with, and the Las Vegas odds for the game (Franck & Theiler, 2012; Shmanske & Lowenthal, 2007). Similar to Abrevaya (2004) and Franck and Theiler (2012), we use the absolute value of the difference in the seasonal average goal differentials between the two participating teams to account for differences in team strength, where a team's seasonal average goal differential is defined as:

$$\text{Seasonal avg. goal differential} = \left(\frac{\text{Total goals scored} - \text{total goals allowed}}{82}\right).$$

We hypothesize that as the absolute difference in seasonal average goal differential between two teams rises, the likelihood of overtime will decrease.[2]

Our Method

Our sample consists of all NHL regular season games from the 1997-1998 to 2011-2012 seasons ($n = 16{,}851$). The website www.nhl.com is used to gather all individual game data and identify conference associations, while www.hockey-reference.com is used for team goal differentials in each season. The data are aggregated in Excel and analyzed using *R* statistical software. We set the significance level for our hypothesis tests at .05.

We start by looking at the overall probability of each game reaching overtime over each season, separated based on whether or not the game was played between two teams from the same conference. Next, we look at the probability of overtime by PS, conference status, and month category. We use χ^2 tests to identify significant differences in

Overtime probability by PS.

Table 2. Probability of Overtime by Game Variables.

Variable		*PS*1 ($n = 2{,}173$) 1997-1998 to 1998-1999	*PS*2 ($n = 6{,}068$) 1999-2000 to 2003-2004	*PS*3 ($n = 8{,}610$) 2005-2006 to 2011-2012	*p*-Value
Conference	Same	0.202	0.237	0.232	.019
	Different	0.202	0.234	0.254	.027
	p Value	.969	.835	.081	
Month	September–December	0.201	0.246	0.220	.005
	January–February	0.219	0.221	0.238	.363
	March	0.204	0.234	0.256	.085
	April	0.157	0.251	0.293	<.001
	p Value	.265	.244	.001	
Overall		0.202	0.236	0.236	.002

Note. *PS* = points system. *p* Values calculated using χ^2 tests for association.

Overtime probability by PS, within each month category (September–December, January–February, March, and April).
Overtime probability by PS, within-conference game status (Yes/No).
Overtime probability by month category, within each PS.
Overtime probability by conference game status (Yes/No), within each PS.

A χ^2 test of association using overtime by month category within *PS*3, for example, will tell us if the likelihood of overtime is significantly different between the 4 monthly categories, among games played in the newest PS.

Using various control variables, we model the likelihood of overtime for each game using logistic regression within each PS. Our outcome variable is *overtime*, a dummy variable for whether or not the game went to overtime. Games played between September and December serve as a reference group for dummy variables for whether the game was played between January and February (variable *midyear*), in March (*lateyear*), or in April (*endyear*). We use *nonconference* as an indicator for whether or not the game was played between nonconference opponents, and *teamdiff* as our proxy for relative team strength. Because our primary focus is on the effect of month category and conference status on the probability of overtime within each PS, and not on the equivalences of overtime likelihood between *PS*1, *PS*2, and *PS*3, we fit three separate models, one for each PS.

Our last analysis attempts to identify if specific teams have identified the increased incentives in *PS*3 to play for overtime when competing in nonconference games. To do so, we isolate all contests played by each individual team and calculate the odds of overtime in nonconference games versus conference games, adjusting for *midyear*, *lateyear*, *endyear*, and *teamdiff*. An adjusted odds ratio (OR) is calculated twice for

each team, first using all games played in *PS*3 and again using all games played in both *PS*1 and *PS*2. The latter estimates can serve as a reference group to which we can compare our *PS*3 ORs. We combine games played in *PS*1 and *PS*2 in this analysis for two reasons. First, new teams were added before each of the 1998-1999 (Nashville), 1999-2000 (Atlanta), and 2000-2001 (Columbus, Minnesota) seasons, and we want to be able to maintain all 30 current teams in this approach.[3] Second, overtime participants are guaranteed a share of three points in *PS*3, not a trait of games played in *PS*2, suggesting that the strongest incentives for overtime would be found in nonconference *PS*3 games. Thus, we aim to test if overtime likelihood is higher in nonconference games within specific teams, using empirical data from before and after the implementation of *PS*3.

Results

Overtime probabilities appear higher in games from *PS*2 and *PS*3 than in *PS*1 (Figure 1). There is not overwhelming evidence of differences in overtime likelihood by whether or not the game was played among two teams from the same conference until the 2010-2011 and 2011-2012 seasons, where the observed probability of overtime in nonconference games was 4.7% and 5.8% higher, respectively.

Table 2 shows the overtime probabilities across our PS, conference, and month categories. Only among games played in *PS*3 does there appear to be a moderate evidence ($p < .10$) that overtime probability differs between nonconference and conference games. The observed overtime probabilities in April, the final month of the regular season, are significantly different across PSs, as roughly twice as many April games in *PS*3 go to overtime (29.3%) compared to April games in *PS*1 (15.7%). Within games played in *PS*3, overtime probability rises over month categories.

Model estimates for *PS*1, *PS*2, and *PS*3 logistic regression functions, with dependent variable *overtime*, are shown in Table 3. Conference status (variable *nonconference*) and month category (variables *lateyear* and *endyear*) are significant predictors of overtime in *PS*3. The adjusted odds of overtime in *PS*3 contests are significantly higher in nonconference games (OR 1.16, 95% CI [1.02, 1.32]) than in conference games. Compared to games played between September and December, the adjusted odds of overtime among *lateyear* games (OR 1.23, 95% CI [1.08, 1.41]) and *endyear* games (OR 1.52, 95% CI [1.24, 1.86]) are significantly higher in *PS*3. In all models, as *teamdiff* increases, the likelihood of overtime decreases. Month category and our *nonconference* indicator are not significant predictors of overtime in either of our *PS*1 or *PS*2 models.

Figure 2 shows each team's adjusted odds of overtime comparing nonconference games versus within-conference games, separated by phase (old PSs = {*PS*1, *PS*2}, new PSs = *PS*3). The dotted line indicates a rough significance cutoff using a .05 level test for each OR estimate. Points lying outside the cutoff represent OR estimates significant at the 5% level. An exact cutoff is not equivalent for all team models because (i) the four recent expansion franchises, Atlanta, Columbus,

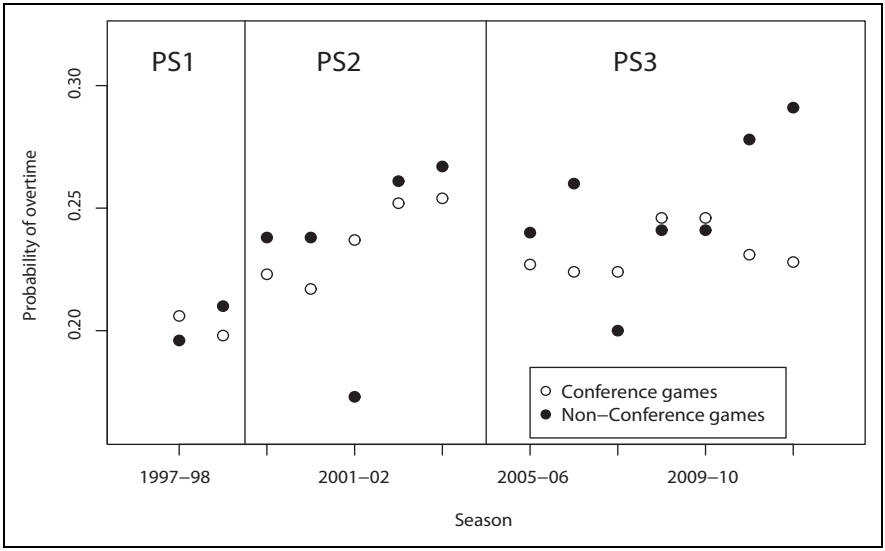

Figure 1. Season overtime probability by conference variable, points system.

Table 3. Model Estimates (SE) by Points System.

Coefficient	*PS*1 (n = 2,173) 1997-1998 to 1998-1999	*PS*2 (n = 6,068) 1999-2000 to 2003-2004	*PS*3 (n = 8,610) 2005-2006 to 2011-2012
Intercept	−1.136 (0.115)**	−0.976 (0.063)**	−1.182 (0.052)***
teamdiff	−0.394 (0.125)**	−0.223 (0.066)**	−0.213 (0.064)**
nonconference	−0.027 (0.115)	−0.021 (0.069)	0.145 (0.066)*
midyear	0.107 (0.128)	−0.134 (0.071)	0.098 (0.061)
lateyear	0.017 (0.152)	−0.064 (0.084)	0.209 (0.069)**
endyear	−0.301 (0.200)	0.023 (0.140)	0.416 (0.104)**

Note. *PS* = points system. Dependent variable: *overtime*. SE = Standard Error.
*p < .05. **p < .01.

Minnesota, and Nashville, all played a fewer number of games than other NHL teams and (ii) the number of games in *PS*3 was higher than in the collection of games from *PS*1 and *PS*2. However, all OR estimates depicted within the significance cutoff are associated with a p value > .05, and likewise p value < .05 for all observations outside the cutoff.

In *PS*3, it appears several franchises have recognized the increased incentives to play for overtime in nonconference games. If, conditional on month category and *teamdiff*, *nonconference* was independent of *overtime*, we would expect one or two of our 30 *PS*3 OR estimates to be significant due to chance. However, there is

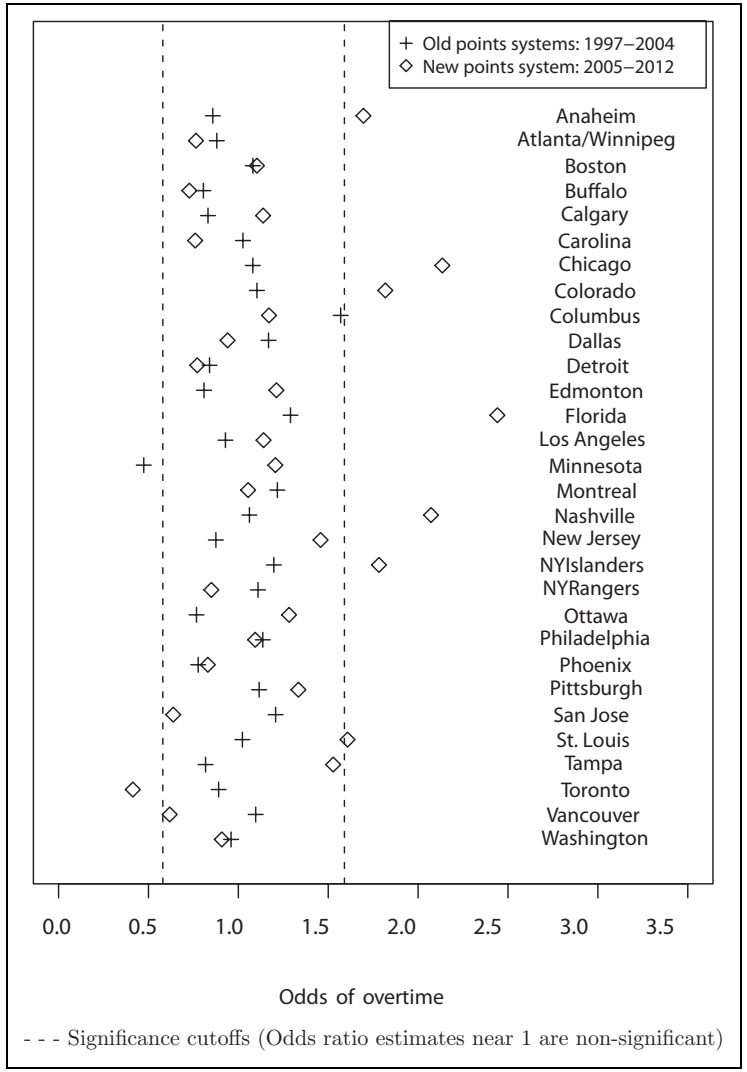

Figure 2. Team-specific adjusted odds of overtime for nonconference versus conference games.

significant ($p < .05$) evidence of increased odds of overtime in nonconference *PS*3 games for 7 of the 30 franchises, Anaheim, Chicago, Colorado, Florida, Nashville, New York Islanders, and St. Louis. Further, the adjusted *PS*3 odds are extremely significant ($p < .005$) for Florida (OR 2.44, 95% CI [1.54, 3.86]), Nashville (OR 2.07, 95% CI [1.28, 3.36]), and Chicago (OR 2.14, 95% CI [1.35, 3.39]). Meanwhile,

Table 4. Number of Games Played Under Current and Proposed Conference Alignments.

	Eastern Conference Teams			Western Conference Teams		
Opponent type	Divisional	Non-Divisional, Conference	Non conference	Divisional	Non-Divisional, Conference	Non conference
Current	24	40	18	24	40	18
Proposed	36	14	32	38	16	28

the estimates for games played before the implementation of *PS*3 appear to be mostly evenly distributed between the significance cutoffs.

It is important to note that the OR estimates in Figure 2 are not independent, because teams play one another over the course of each season. For example, if a few teams strive for overtime in nonconference games at the end of a season, their opponents would also potentially find themselves in a higher proportion of nonconference overtime contests. Interestingly enough, in *PS*3, the odds of overtime for Toronto's nonconference games are actually significantly lower than their within-conference games (OR 0.41, 95% CI [0.22, 0.79]).

Discussion

Empirical evidence suggests that several teams have identified that an optimal strategy with the current points structure is to play for overtime in nonconference games because two points are still possible, one point is guaranteed and playoff positioning is not impacted.

The effect of this strategy on NHL standings would seem likely to grow if teams were to play a higher proportion of nonconference games. Looking past the 2012-2013 season, which featured a reduced number of regular season games due to another lockout, a greater proportion of nonconference games appears imminent. With the main intention of cutting down on the current travel load of several Western Conference teams, NHL league officials proposed a radical realignment for the 2013-2014 season. The plan would create two divisions of seven teams apiece in the Eastern Conference, and two divisions of eight teams apiece in the Western Conference (nhl.com, 2011). The realignment also proposes a more balanced schedule, in which all teams would play opponents in the other conference twice. As a result, if the proposal is implemented, teams would play nearly twice as many nonconference games compared to the current schedule (Table 4).

Along with the realignment and scheduling change, however, is the possibility of an updated standard of playoff eligibility, where the top four teams in each division would automatically qualify. In another possible scenario, the top three teams in

each division would receive automatic playoff spots, with the final two spots in each conference relegated to a league-wide "wild-card" qualification (LeBrun, 2012). As a result, because ceding a point against within conference, non-divisional opponents would not likely hurt playoff positioning in the new proposal, the highest incentives for overtime games, which currently exist in 18 nonconference games per season for each team, would become more frequent. In fact, more than half of a team's games (46 for Eastern Conference teams and 44 for Western Conference teams) would occur against opponents fighting a different set of teams for playoff qualification. As a result, the effect of NHL PS incentives on league outcomes could grow in the proposed realignment.

While ORs are a useful metric for identifying the significance of the association of an exposure with a binary outcome, effect size is also important. That in mind, in *PS*3, 109 of the 472 (23.1%) within conference *PS*3 Florida Panthers games went to overtime, compared to 42 of the 102 (41.2%) nonconference games. If the Panthers' proportion of nonconference games going to overtime was equivalent to that of their within-conference average, roughly 20 of those overtime games, or three per season, would have been decided in regulation.

While previous work suggested that competing against a divisional opponent was unrelated to overtime probability, our results suggest that a conference variable may be an important predictor of overtime. We hypothesize that this is the case because NHL playoff qualification is based on cumulative season points relative mostly to other teams in the conference and that the only direct benefit of winning a division is a top three seed.

In *PS*3, the proportion of nonconference overtime games is roughly 2% higher than conference games, which is not a large difference. However, nonconference games are not evenly distributed over the course of an NHL season. In *PS*3, for example, only 3% of April games were nonconference ones, compared to 20% of contests played between September and February, and 14% of March games. Because overtime games are more frequent in the later portions of the season, adjusting for a month variable, as is done in the logistic regression model of *overtime* in *PS*3, is important in identifying the significance of a conference effect.

We provide strong evidence that teams in *PS*3 are more likely to play an overtime game in the months of March and April. Looking at the distribution of overtime *PS*3 contests over time, we found 95 of the 285 (33.3%) April games went to overtime between the 2008-2009 and 2011-2012 seasons, compared to 57 of the 234 (24.4%) April games between 2005-2006 and 2007-2008. Thus, it seems that a time effect has been strongest in recent seasons.

We hypothesize that teams adjust their strategy to try and accumulate as many points as possible with the playoffs imminent and the games seemingly more important, even if playing for overtime also gives their opponents one or two points. A logical counterargument to this thought, however, might be that the proximity of postseason play encourages teams to compete at a higher level, thus increasing the likelihood of more tightly contested games. Closer games in the latter months of the

season might be one explanation for the significant month category effects found in *PS*3. We used each game's goal differential as a proxy for roughly how close that game was, and found the proportion of contests decided by two goals or less actually decreased slightly over the course of the season in *PS*3, from 43.5% (September to February average), to 42.2% (March), to 39.9% (April). The proportions of games decided by three goals or less were also roughly equivalent across months in *PS*3. Thus, in the current PS, overtime likelihood appears to increase in the latter months of the season even as the games themselves do not get noticeably closer.

In month category, conference status, and absolute season average goal differential, we tried to account for possible predictors of overtime likelihood, but what also causes overtime are team and player specific characteristics that change game-to-game. An ideal model of overtime likelihood would factor in a form of player health and the relative playoff chances of both teams entering the game. For example, teams may be extra likely to avoid overtime at the end of a season when facing a team they are directly competing against for a playoff spot. Accounting for team characteristics that vary by game, or identifying the within-game behaviors (like shots or goals) that change by the month category or conference status of each game, are areas for future research.

We accounted for the talent disparity between the two competing teams using *teamdiff*. While other related control variables are possible, using *teamdiff* did not have a large effect on our month and conference coefficient estimates. Specifically, coefficient estimates using models fit without *teamdiff* were within one hundredth of a decimal point of the ones provided in Table 4. As in Franck and Theiler (2012), we attempted to account for the correlation of outcomes within a team's season using a generalized linear mixed effects model of overtime, including a random intercept for each team and season combination, in addition to the fixed effects in Table 4. These random effects were nonsignificant and did not noticeably change the fixed effect estimates provided here.

The current NHL PS appears to yield an on-ice product that responds to incentives. This is not to say, however, that the league is opposed to the behaviors encouraged by these incentives. For one, the extra overtime point created more parity in the standings (Easton & Rockerbie, 2005). Further, NHL Commisioner Gary Bettman claimed that revenues for the 2012 season, at an estimated $3.2 billion, represented a 50% increase over the past 7 years (Staples, 2011). Perhaps, the larger issue raised for the league is that specific teams appear to be targeting the PS inefficiencies more often, leaving some competitors out in the cold.

One competing points structure would award an additional point to teams victorious in regulation. In the Swiss Ice Hockey National League (Swiss NL), for example, a 2006 rule change implemented a shootout simultaneously changing the PS, so that teams winning in regulation received an additional point (for a total of three). The reward for overtime or shootout victories, meanwhile, was kept at two points. Franck and Theiler (2012) found that overtime likelihood in the Swiss NL did not change after the 2006 rule change. Perhaps the NHL, as it considers a

massive realignment, scheduling, and playoff eligibility shift, could use such empirical comparisons to guide discussion of a related PS change.

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Notes

1. The 2007-2008 season actually included two September games as well, but all other seasons going back as far as 1997-1998 began in October.
2. Franck and Theiler (2012) used separate models of overtime, with one model controlling for absolute goal differential and the other using the teams' win probability, calculated with Las Vegas odds for that game. The estimates for other fixed effects in their models were relatively similar, given either proxy for relative team strength.
3. It is worth noting that the first season by a Winnipeg team in our study was 2011-2012, after the Jets were purchased from previous owners of the franchise in Atlanta. Because the Winnipeg team shared mostly the same players as the previous Atlanta team, this franchise is considered as one for this analysis.

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