Has the extra point for the "regulation tie" increased the number of overtime games?

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Several years ago, the NHL changed their system of awarding standings points. In 1998-1999 and before, teams got 2 points for a win, 1 point for a tie, and 0 points for a loss. But starting in 1999-2000, teams who lost in overtime nonetheless received one point.

This meant that some games would be worth more total points than others. Games won in overtime would be worth 3 points (to the two teams combined), while all other games would only be worth 2 points.

In the first few years of this system, not all overtime games resulted in a winner. From 1999-00 to 2003-04, about 47% of overtime games ended in a victory.[1] And so, in those seasons, games tied after three periods awarded about 2.5 points to the two teams – three points when the game was won, and two points when the game ended in a tie.

Starting in 2005-06, the league instituted a shootout for games that were tied after sudden-death overtime. That meant that, now, 100% of overtime games ended in a victory for one team, and so three points would be awarded for all overtime games.

A summary:

Seasons	Points awarded for non-OT games	Points awarded for OT games
1998-99 and earlier	2	2
1999-2000 to 2003-04	2	2.5
2005-06 and later	2	3

With the new system, it would be in every team's interest to play a lot of overtime games. Currently, a team which loses as many OT games as it wins would capture 1.5 points for each such game. To match that in non-overtime games, the team would have to win 75% of its non-overtime games – and hardly any teams are that good. Even back when OT games were worth only 2.5 points, a non-OT team would have to have a .625 winning percentage to match the points of an average OT team.

So almost all teams, even the best ones, have a strong incentive to play as many overtime games as possible. So, in every NHL game, both teams should adjust their strategy to try to get the game to OT if at all possible – unless, of course, they are so dominant that they feel they have at least a 75% chance of winning in regulation.

[1] Before 1999-00, teams played 5-on-5 in overtime instead of 4-on-4, and only 25-30% of overtime games ended in a goal.

That doesn't necessarily require collusion between the coaches. If the game is tied in the third period, both teams could independently settle on a strategy of slowing the game down – taking longer to move the puck out of their own zone when unchallenged, for instance. They will also be less inclined to take risks. For instance, suppose the game is tied with thirty seconds to go, and team A has the puck deep in team B's zone. The puck comes up the boards towards the blue line, and A's defenseman has to decide whether or not to pinch. Suppose if he does pinch, A has a 10% chance of scoring – but, at the same time, B has a 5% chance of turning the play into a 2-on-1 goal. Without the extra point for overtime, it's a chance worth taking: A's expectation would go from 1 point to 1.05 points. But, with overtime, the expectation would go from 1.5 points to 1.475 points:

Result	Probability	Points	Expectation
A scores	.10	2	0.2
B scores	.05	0	0
Overtime	.85	1.5	1.275
Total			1.475

Basic economics decrees that people respond to incentives. So we would expect to see teams independently pursue strategies to increase their expected standings points – the effect of which would be to increase the proportion of games that go into overtime.

Data

Does the record support the hypothesis?

Kind of. Here is the historical percentage of games that have gone into overtime:[2]

Season	Games	OT games	Percentage
1997-98	**1067**	**211**	**.198**
1998-99	**1107**	**222**	**.201**
1999-2000	1148	249	.217
2000-01	1230	262	.213
2001-02	1230	265	.215
2002-03	1230	310	.252
2003-04	1228	307	.250
2005-06	**1225**	**281**	**.229**
2006-07	**1127**	**259**	**.230**

The three groups of seasons (no extra point for OT, no shootout, shootout) are set off with bolding.

There appears to be clear evidence of an increase in overtime games with the beginning of the extra point in 1999-2000. Indeed, the two earliest seasons, the ones without the

[2] Data for 2006-07 is to late-March. Total games for prior seasons may be slightly inaccurate due to anomalies from the data source and/or my programming. Data from www.hockeynut.com .

extra point, have the lowest proportion of OT games of all nine seasons. The chance of this happening randomly is 1 in 36.

If I run a regression on the "percentage" column, against only a single indicator variable for whether or not the extra point is awarded for an OT loss, the results are significant at p=.04.

And, if I divide the data into two groups – the first two lines in one group, and the other seven in another – and run a t-test on the averages, the Z-score is 7.74, which means the probability of this occuring by chance is pretty much zero.

So there is clear evidence that the introduction of the extra point in OT resulted in more overtime games, just as the economics would predict.

The Shootout

But what about the introduction of the shootout? That had as large an effect on total points as the introduction of the extra point – the first rule change added half a point, and the shootout added another half point. You'd expect the teams' reaction to the shootout to be similar – even more conservative play, and even more overtime games.

But the opposite happened. In 2005-06, the first year of the shootout, the proportion of overtime games actually *dropped* from the previous season (which was actually two years earlier because of the lockout). In fact, in the two seasons before the shootout, about 25% of games were regulation ties – but in the two seasons after, it was only 23%. What's going on?

First, notice that the 2002-03 and 2003-04 seasons had a very high proportion of OT games compared to the seasons before. Was there a rule change in 2002 that caused this to happen?

Kind of – in those two seasons, and the one before, goals scored were at historic lows:

Season	Goals per game (OT/SO not included)	Percentage of games going to OT
1997-98	**5.31**	**.198**
1998-99	**5.20**	**.201**
1999-2000	5.46	.217
2000-01	5.53	.213
2001-02	5.16	.215
2002-03	5.20	.252
2003-04	5.11	.250
2005-06	**6.01**	**.229**
2006-07	**5.75**	**.230**

You'd expect that the fewer goals scored, the closer the games would be, and the more tie games after three periods. Using only the middle five rows, to keep the rules constant, I ran a regression of overtime percentage on goals per game.

The r-squared was .44, which was not statistically signficant (p=.23). However, the relationship was strong in a hockey sense -- every additional tenth of a goal scored reduced the percentage of OT games by seven thousandths (.007). Let's assume that's true regardless of which of the three OT rules is in effect, and normalize every row to 5.5 goals per game:

Season	Actual goals per game (OT/SO not included)	Percentage of games going to OT if GPG were 5.5 using 7% adjustment factor
1997-98	**5.31**	**.185**
1998-99	**5.20**	**.180**
1999-2000	5.46	.214
2000-01	5.53	.215
2001-02	5.16	.191
2002-03	5.20	.231
2003-04	5.11	.223
2005-06	**6.01**	**.265**
2006-07	**5.75**	**.247**

Now, we have an obvious effect for both rule changes. The introduction of the extra point in 1999 raised the proportion of overtime games from about 18% to about 21%. Then, the introduction of the shootout bumped it up even further, to about 26%.

I do have to say, though, that I'm not 100% sure the adjustment is kosher. The "7%" figure has a standard error of 4.5 percentage points, so it's not very precise (as evidenced by the fact that it's not statistically significant from zero). And it does seem kind of high.

And other research gives us reason to believe it's not very accurate at all.

In 2004, Alan Ryder wrote a study called "Poisson Toolbox," in which he examined what happens when you assume that teams score goals according to the Poisson distribution. On page 9, Ryder gives the formula for computing the probability of a tie game. For teams scoring a combined 5 goals per game each, the probability is 18.4%. For teams scoring 6 goals per game, the chance is 16.7%. By this logic, increasing by one goal per game should create 1.7% more overtime games, not 7% as we found.

However, there are reasons we can't take the Poisson method at face value.

First, 18.4% and 16.7% seriously underestimate the actual proportion of regulation ties actually observed, which suggests that goals may not be close enough to Poisson for the 1.7% result to hold.

Second, the result assumes two equal teams. In real life, teams are often mismatched. That should reduce the number of ties – but the observed percentage of overtime games goes the other way – it's more, not less, than predicted.

What should we do? Let's start with the 18.4% and 16.7% numbers. The real life numbers appear to be in the low 20s. So let's bump up both numbers by multiplying them by 1.25. That gives us 23% and 20.9%.

That's a 2.1 percentage point adjustment – still much less than the 7% from the little regression.

Just for an example, let's look at what happens if we assume a 2.5% adjustment factor. 2.5% is exactly one standard deviation away from 7%; also, it's close to the 2.1% estimate from the Poisson method. (More importantly, I have the calculations already done for 2.5% as I write this, and I'm too lazy to recalculate.)

Season	Goals per game (OT/SO not included)	Percentage of games going to OT if GPG were 5.5 using 2.5% adjustment factor
1997-98	**5.31**	**.193**
1998-99	**5.20**	**.194**
1999-2000	5.46	.216
2000-01	5.53	.214
2001-02	5.16	.224
2002-03	5.20	.245
2003-04	5.11	.240
2005-06	**6.01**	**.242**
2006-07	**5.75**	**.236**

If 2.5% is the correct factor, then we have no evidence that the shootout increased the number of regulation ties – the post-shootout numbers look similar to the two closest pre-lockout seasons. But there is still strong evidence that the extra point did increase the incidence of overtime games.

Regardless, we need to do a bit more research to figure out the best adjustment factor – perhaps by looking at more seasons, or subsets of seasons.

Even if we did that, though, there would be other contributing factors to consider. For instance, at the same time the NHL instituted the shootout in 2005-06, they announced more stringent enforcement of clutching and grabbing. This resulted in more penalties, which is presumably part of the reason goal scoring rose.

However, all else being equal, more penalties should reduce the number of regulation ties. That's because, in the absence of penalties, both teams have an incentive to keep the game slow to take it to overtime. But if one team gets a man advantage in a tie game late in the third period, they have a good chance to secure their full two points without overtime – and at very little risk, because the chance of the other team scoring shorthanded is slim.

So the tendency of teams to play conservatively because of the shootout might be counterbalanced by an increase in aggressive, risk-free man-advantage play. I don't know how big an effect this would be – I'd guess it's fairly small – but it's something you'd have to consider.

Third Period Effects

Obviously, any incentive to shoot for a regulation tie would occur only if the game is already tied. If a team is ahead, it wants to stay ahead; if behind, it wants to catch up. All of the change in behavior related to overtime should be observed if, and only if, the game is tied.

It would also seem that the effect should be higher in the third period. Overtime is much more likely in a tie game with ten minutes to play than a game with fifty minutes to play. If the change in team play is proportional to the probability of achieving the incentive, we should see a stronger effect later in the game.

Here's a chart of how often games went into overtime, counting only games that were tied after forty minutes:

Season	Percentage of games tied after two periods	Percentage of those games going to OT
1997-98	**.207**	**.389**
1998-99	**.220**	**.348**
1999-2000	.231	.408
2000-01	.234	.389
2001-02	.241	.392
2002-03	.228	.434
2003-04	.237	.457
2005-06	**.237**	**.372**
2006-07	**.222**	**.408**

The results are mixed, and interesting. For the first two years of the study, the effect seems to exist for the entire game. There are fewer third-period ties going to OT, but there are also fewer third-period ties in general. So teams seem to have adjusted their play all through the game, not just in the third.

But, now, check 2002-03 and 2003-04. In those seasons, there was a very high proportion of third-period ties going to overtime. But the number of third period ties was pretty average. Was there some rule change in those two years that affected only the third period? One possibility is that referees those years were exceptionally reluctant to call third-period penalties in close games, and that kept scoring down.

But the data don't support that:

Season	Percentage of two-period tie games going to OT	Goals scored in third period of games tied after two periods
1997-98	**.389**	**1.570**
1998-99	**.348**	**1.463**
1999-2000	.408	1.570
2000-01	.389	1.635

2001-02	.392	1.470
2002-03	.434	1.544
2003-04	.457	1.567
2005-06	**.372**	**1.855**
2006-07	**.408**	**1.880**

The number of third period goals in 2002-03 and 2003-04 are average – but the percentage of regulation ties is very high.

Summing Up

So I'm not sure what to think. There is clear evidence that teams skated to more regulation ties starting in 1999-2000, when they received the extra point for an overtime loss. But, then, there was another sudden increase in overtime games in 2002-03, which also carried over to the next season – even though there was no obvious change in the conditions of the game.

Finally, the addition of the shootout in 2005-06 made overtime even more desirable. But there was no increase in regulation ties at that point. In fact, there was a slight drop, proabably attributable to the increased scoring. Adjusting for the increase, the frequency of overtime was roughly the same as in the two previous years.

There is a possible explanation for the absence of this second increase. The rule change of 1999-2000 increased the point expectation of a tie from 1.00 to 1.25. It's possible that teams took maximum advantage of that incentive at the time. So, after the introduction of the shootout, there was little else teams could do to take advantage of it.

For instance, suppose you drop a dollar bill on the street, and you find that 99.8% of people are willing to stop and pick it up. Then, you drop a two-dollar bill on the street. The number of willing people increases from 99.8 to 99.9% -- but it's barely measurable. Even though the changes in incentives are equal (in each case, an extra dollar), the change in response happens only for the first incentive.

The same could be true for overtime. When the extra point was added in 1999, it's possible that almost every team started slowing the play down when the score was tied, and that they did so to the maximum possible (without being called for delay of game). Although the subsequent shootout rule made ties even more desirable, there was little else teams could do, except to take slighly fewer risks. And so, the second change in behavior was barely noticeable in the statistics.

I'm not sure whether or not this is the right answer, but I find it at least plausible. I do suspect that the change in behavior for the second incentive would have to be smaller than for the first incentive. But not zero -- I suspect that the increase in penalties has, to some extent, counteracted the tendency towards more ties, and if we adjust for that, we'll see a small increase.

But that's just a hunch.

-- Phil Birnbaum (revised 3/30/07)