Points Scoring Systems in Formula 1: A Game Theoretic Perspective

Krystsina Bakhrankova

Abstract An efficient points scoring system is often vital to encouraging competition in a sport. It is also related to the viewership and spectator numbers crucial to lasting popularity and financial success. This paper analyzes the three points scoring systems of the last twenty seasons in Formula 1 (1991-2010) from a game theoretic perspective to examine their competitive impact.

1 Introduction

With an estimated annual turnover of 4 billion USD and some 50 000 employees in over 30 countries, Formula 1 is a truly global sport and business. Started as a primarily European competition, it is "the longest-established motorsport championship series in the world" with races presently spanning five continents. Surpassed only by the Olympic Games and the World Cup, it is the third most watched sport broadcast in 185 countries for some 850 million fans [8].

In recent years, challenged by legislative changes in the advertising regulation and diminishing public interest, Formula 1 was forced to look for new global sponsors as well as circuits in the emerging markets of Asia and the Middle East. Another attempt to reinvent the competition is related to two transitions in the scoring system in the last twenty years. From its inception in 1950, various rules have existed with respect to the number of races that counted towards the World Championship, team (constructor) points, and points for the fastest lap. Eventually, the system settled on awarding points to the top six finishers (10-6-4-3-2-1) in 1991, only to be altered to eight scoring places (10-8-6-5-4-3-2-1) in 2003 and to ten places (25-18-15-12-10-8-6-4-2-1) in 2010. This paper uses game theory to analyze these two shifts and verify their competitive effects.

Krystsina Bakhrankova
SINTEF Technology and Society, Applied Economics, Postboks 4760 Sluppen, 7465 Trondheim, Norway, e-mail: krystsina.bakhrankova@sintef.no
2 Relevant Literature

Due to its highly competitive and constantly changing environment, Formula 1 is often considered an appropriate arena for lessons in optimal business performance and strategy (e.g., [8], [4], and [7]). However, none of the existing works analyze the competitive impact of the recent changes in the points scoring system. The relevant literature applying game theory in this context comes from soccer (e.g., [6] and [2]).

3 The Game Theoretical Model

Building on the game theoretic framework developed in [5] and extended in [6], the following assumptions are made:
1. Two drivers referred to as $D_1$ and $D_2$ are analyzed;
2. Their performance levels – driving skills and car capabilities – are known;
3. The Grand Prix outcome is uncertain;
4. The reciprocal uncertainty assessments are agreed on (complete information);
5. Two choices of strategy referred to as $A$ (aggressive) and $D$ (defensive);
6. Both drivers make their strategic choices simultaneously before the race start;
7. The objective of each driver is to maximize his expected point score.

3.1 Competition During a Race

First, an in-race rivalry between two drivers for each place from the 1st to the 10th is analyzed as a separate game. The following Table 1 demonstrates such a situation for two significantly unequal drivers ($D_1$ is better than $D_2$). Here, $p_{12}$ is a probability that $D_1$ finishes 1st (ahead) and $D_2$ – 2nd (behind), $p_{21}$ is vice versa, and $p_{out}$ is a collusion probability, when both are ousted and score 0 points. In addition, the pay-offs are calculated for each driver and each system: $S_1(10-6-4-3-2-1)$, $S_2 (10-8-6-5-4-3-2-1)$, and $S_3 (25-18-15-12-10-8-6-4-2-1)$.

<table>
<thead>
<tr>
<th>D1</th>
<th>D2</th>
<th>$p_{12}$</th>
<th>$p_{21}$</th>
<th>$p_{out}$</th>
<th>$P(D_1)_{S_1}$</th>
<th>$P(D_2)_{S_1}$</th>
<th>$P(D_1)_{S_2}$</th>
<th>$P(D_2)_{S_2}$</th>
<th>$P(D_1)_{S_3}$</th>
<th>$P(D_2)_{S_3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
<td>0.70</td>
<td>0.10</td>
<td>0.20</td>
<td>7.6</td>
<td>5.2</td>
<td>7.8</td>
<td>6.6</td>
<td>19.30</td>
<td>15.10</td>
</tr>
<tr>
<td>D</td>
<td>A</td>
<td>0.60</td>
<td>0.30</td>
<td>0.10</td>
<td>7.8</td>
<td>6.6</td>
<td>8.4</td>
<td>7.8</td>
<td>20.40</td>
<td>18.30</td>
</tr>
<tr>
<td>A</td>
<td>D</td>
<td>0.85</td>
<td>0.05</td>
<td>0.10</td>
<td>8.8</td>
<td>5.6</td>
<td>8.9</td>
<td>7.3</td>
<td>22.15</td>
<td>16.55</td>
</tr>
<tr>
<td>D</td>
<td>D</td>
<td>0.80</td>
<td>0.15</td>
<td>0.05</td>
<td>8.9</td>
<td>6.3</td>
<td>9.2</td>
<td>7.9</td>
<td>22.70</td>
<td>18.15</td>
</tr>
</tbody>
</table>

When normal form games are constructed for each system, it is observed that the unique pure-strategy Nash equilibrium shifts from $(D, A)$ in $S_1$ to $(D, D)$ in $S_2$.