Profit or win maximization - an explicit game theoretic approach

Kjetil K. Haugen,
Molde University College

Harry Arne Solberg,
Sør-Trøndelag University College
Research topic:

The financial problems in European club football:
• Why are enormous revenues not enough?

Outline:
• The background: Some figures
• What have economic theory told us – so far
• A game-theory approach
<table>
<thead>
<tr>
<th></th>
<th>01/02</th>
<th>02/03</th>
<th>03/04</th>
<th>04/05</th>
<th>05/06</th>
<th>06/07</th>
<th>07/08</th>
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<tbody>
<tr>
<td>England: Premier League</td>
<td>130</td>
<td>178</td>
<td>222</td>
<td>240</td>
<td>200</td>
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<td>89</td>
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<td>-102</td>
<td>-15</td>
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<td>-84</td>
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<td>-265</td>
<td>-234</td>
<td>1</td>
<td>-1</td>
<td>-40</td>
<td>-66</td>
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### Turnover per club (€-million)

<table>
<thead>
<tr>
<th></th>
<th>01/02</th>
<th>02/03</th>
<th>03/04</th>
<th>04/05</th>
<th>05/06</th>
<th>06/07</th>
<th>07/08</th>
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</thead>
<tbody>
<tr>
<td>England: Premier League</td>
<td>87</td>
<td>90</td>
<td>00</td>
<td>99</td>
<td>100</td>
<td>114</td>
<td>122</td>
</tr>
<tr>
<td>England: Championship</td>
<td>16</td>
<td>13</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>Germany</td>
<td>58</td>
<td>62</td>
<td>59</td>
<td>69</td>
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<td>77</td>
<td>79</td>
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<tr>
<td>France</td>
<td>32</td>
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<td>33</td>
<td>35</td>
<td>46</td>
<td>49</td>
<td>49</td>
</tr>
<tr>
<td>Italy</td>
<td>57</td>
<td>58</td>
<td>58</td>
<td>61</td>
<td>64</td>
<td>53</td>
<td>71</td>
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</table>
The average English club (€-million)

<table>
<thead>
<tr>
<th>Club</th>
<th>Operating profit / loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premier League</td>
<td>6,1</td>
</tr>
<tr>
<td></td>
<td>11,8</td>
</tr>
<tr>
<td>Champion-ship</td>
<td>-3,9</td>
</tr>
<tr>
<td></td>
<td>-5,4</td>
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</tbody>
</table>
The average English club (€-million)

<table>
<thead>
<tr>
<th></th>
<th>Operating profit / loss</th>
<th>Pre-tax profit / loss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>06/07</td>
<td>07/08</td>
</tr>
<tr>
<td>Premier League</td>
<td>6,1</td>
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</tr>
<tr>
<td>Championship</td>
<td>-3,9</td>
<td>-5,4</td>
</tr>
</tbody>
</table>
• 35 of 72 clubs in the Football League undergone insolvency proceedings 2000-2009

• Famous clubs with financial difficulties:
  – Leeds, Borousia Dortmund, Schalke 04, Lazio, Fiorentina,…..
  – Norway: All elite clubs, with the exception of Rosenborg
The editorial in Økonomisk Rapport (a Norwegian financial magazine)

- Investing in Norwegian football is the most stupid thing one can do if the aim is to make money.
Why – according to economic theory?
A one club perspective
Negative shift in revenues

- Costs
- Revenues
- Deficit

PM-club
WM-club
Talent

€
Two club regime

\[ W_{vm} \]

\[ W_{pm} \]

\[ AR_y \]

\[ MR_y \]

\[ AR_x \]

\[ MR_x \]

\[ L^{*}_{PM} \]

\[ L^{*}_{VM} \]
## Scotland 2000/01

<table>
<thead>
<tr>
<th>Clubs</th>
<th>Ranking</th>
<th>Profit ranking</th>
<th>Profit/loss £-mill.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Celtic</td>
<td>1</td>
<td>11</td>
<td>11,190</td>
</tr>
<tr>
<td>Rangers</td>
<td>2</td>
<td>12</td>
<td>17,531</td>
</tr>
<tr>
<td>Hibernian</td>
<td>3</td>
<td>5</td>
<td>1,990</td>
</tr>
<tr>
<td>Kilmarnock</td>
<td>4</td>
<td>3</td>
<td>853</td>
</tr>
<tr>
<td>Hearts</td>
<td>5</td>
<td>10</td>
<td>3,776</td>
</tr>
<tr>
<td>Dunfermline</td>
<td>6</td>
<td>8</td>
<td>3,026</td>
</tr>
<tr>
<td>Dundee</td>
<td>7</td>
<td>7</td>
<td>2,505</td>
</tr>
<tr>
<td>Aberdeen</td>
<td>8</td>
<td>9</td>
<td>3,220</td>
</tr>
<tr>
<td>Motherwell</td>
<td>9</td>
<td>4</td>
<td>1,462</td>
</tr>
<tr>
<td>St. Jonstone</td>
<td>10</td>
<td>2</td>
<td>339</td>
</tr>
<tr>
<td>Dundee Un.</td>
<td>11</td>
<td>6</td>
<td>2,370</td>
</tr>
<tr>
<td>St. Mirren</td>
<td>12</td>
<td>1</td>
<td>+54</td>
</tr>
</tbody>
</table>
The basic equilibrium model:

Main result:
”Marginal Revenues with respect to talent should equate in equilibrium”

Assumption to derive above solution: (quote)
”The approach we adopt in this paper is to assume that the firm treats its own contract sales as under its own control, while it assumes that no contract sales take place among other teams.”

Model: (quote)
”n-person nonzero sum differential game”
Our approach – a different approximation:

Instead of looking at a $n$-player dynamic game – a league, we introduce the concept of a single decisive match:

"A single match between two teams with significant economic consequences."

Then, we are able to model the problem as a 2-player simultaneous game with complete information.
The model – assumptions: (1)

0) Two sports teams are engaged in an upcoming match against each other.

i) The teams, named $T_1$ and $T_2$, have made a player buying decision. That is, they have decided to buy a new player, but not the price/quality.

ii) The two teams are assumed to be perfect clones, so they are equally good. Hence, the probability of a win for any team before the talent acquisition is $\frac{1}{2}$.

iii) Both teams can choose from the same two-dimensional strategy space $\{E_p, C_p\}$. $E_p$ means buying an expensive player, while $C_p$ means buying a cheap player. Buying an expensive player if the other team buys a cheap player leads to a probability advantage/increase of $\epsilon > 0$ of winning the match.

iv) We assume that the two team’s ”buying markets” are non-connected. That is, the prices of the players ($c_E, c_C$) are exogenously given and not affected by the upcoming game$^5$. $c_E$ and $c_C$ denote prices for the expensive and cheap players respectively.
The model – assumptions: (2)

v) The playing strength (quality) and price of each of the expensive players and each of the cheap players are identical. That is, they are also cloned in pairs.

vi) Each team must decide on which player to buy without knowledge about the other team’s choice. That is, a simultaneous game.

vii) The team winning the single decisive match receives a pay-off of \( R \) (common for both teams), the loosing team receives a pay-off of zero.

viii) Profit maximising players maximise expected pay-off. Win maximising players maximise the probability of winning.

ix) All information above, 0) – viii), is common knowledge (e.g. available for both players) and there is no more information available for any player. That is, a game of complete information.
Nash equilibrium – Win max: \( \{ E_p, E_p \} \)
Nash equilibria – \( \Pi \) max: \( \{E_p, E_p\} \) and \( \{C_p, C_p\} \)

\[
\begin{align*}
E_p & \quad \frac{1}{2}R - c_E \\
\left( \frac{1}{2} + \epsilon \right)R - c_E & \quad \left( \frac{1}{2} - \epsilon \right)R - c_C \\
\left( \frac{1}{2} + \epsilon \right)R - c_E & \quad \frac{1}{2}R - c_E \\
\left( \frac{1}{2} - \epsilon \right)R - c_C & \quad \frac{1}{2}R - c_C
\end{align*}
\]

\( \epsilon R > c_E - c_C \) or \( \epsilon R < c_E - c_C \)
Preliminary conclusions:

i. 2 structurally different possible solutions (as opposed to classical theory)

ii. \{E_p, E_p\} Prisoner’s Dilemma

iii. Possibility of explaining differences between US an European sports without differing objectives.

if

\[ R_{US} \ll R_{EU} \]

downarrow

\[ \epsilon R_{US} < c_E - c_C \text{ and } \epsilon R_{EU} > c_E - c_C \]
Relaxing model assumptions:

Restrictive assumptions above may be relaxed:

i)  Unequal teams

ii) Differing $R$ between teams

iii) Differing talent qualities and prices i.e. $c_E^i, c_C^i$

Opens up a lot of possibilities. We analyze one:

a)  $T_1$ is better than $T_2$

b)  $R_2 > R_1$
Results:

- Main result (after some algebra):
  - Existence of different "pooling" or non-coordinating NEs.
  - If $R_2 > R_1$, \{C_p, E_p\} is a unique NE.
    - Competitive balancing NE
  - If $R_1 > R_2$, \{E_p, C_p\} is a unique NE.
    - Competitive imbalancing NE
Model criticism:

- Talent prices are endogenous to the model. i.e. the typical situation of price competition for talent is not present. "Teams are really far away from each other" – highly unrealistic (?)
- 2 teams – not a league. However, if the trick of "significant decisive match" is accepted – OK
- Obviously a lot of other simplifying assumptions. For instance, pure simultaneous talent acquisition, complete information etc.
Conclusions:

• A different, and hopefully more flexible and versatile modelling environment for analyzing equilibrium talent acquisition.

• Simplicity leads to enhanced analytic possibilities. For instance, adding incomplete information versions should be relatively straightforward.

• Regulation: If our main conclusion of difference in $R$ as means of explaining structural differences between US and EU team sports is believed, then regulation is "simple" and possible. Preferences are hard to regulate, agreeing on different revenue structures related to CL-qualification should be feasible.