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Portuguese football league efficiency and players’ wages

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In this article, we use Data Envelopment Analysis (DEA) to measure the efficiency of Portuguese football clubs in the First League for seasons 2002/03 to 2008/09. Clubs spend different amounts of money on their players and use different incentive devices to achieve their aims for each season. Our first aim is to find out whether clubs are spending more money than they need to. Evidence shows that this is the case for several clubs, suggesting that buying players solely with a view to selling them on for future financial gain can seriously damage clubs’ accounts and efficiency. This is all the more remarkable as the competitive level is increasing and Union of European Football Associations (UEFA) is issuing more stringent financial stability conditions. Our second aim is to ascertain the relationship between the players’ wage distribution and the clubs’ efficiency. We demonstrate that a higher wage spread tends to be associated with an increase in efficiency. The implication is that clubs should structure wages so as to have the optimal pay ranking for inducing players’ effort.

**Keywords:** football; efficiency; wage distribution; tournaments; data envelopment analysis

**JEL Classification:** L83; D21; L21; J31; J44

1. Introduction

In the past 20 years, football clubs have become more than simple sport organizations – they have become large companies with high revenues, associated with the increase of ticket prices, transfer fees and prize moneys. The top 20 European clubs’ revenue in 2008/09 was over €3.9 billion (Deloitte, 2010). However, some clubs accumulate losses year after year, which can lead to bankruptcy. The new Union of European Football Associations (UEFA) Financial Fair Play concept (UEFA, 2010) will require that European clubs be more rigorous in managing their assets in order to be allowed to play in UEFA competitions. In this context, this work endeavours to measure the efficiency of Portuguese clubs in managing their resources and to discuss strategies that would improve their results, more specifically with regard to payment schemes.

We use data from the Portuguese First League. This league’s top-ranking clubs are present in major European competitions, are subject to fierce competition and regularly hire star players. Portuguese clubs have won the UEFA Champions League, the UEFA Cup and the former Intercontinental Cup, now known as the FIFA Club World Cup. Portuguese players and coaches have played important roles in top European clubs. In the last 8 years, Portugal has been represented in the UEFA team of the year, the UEFA coach of the year and the FIFA world player of the year. Two of the six highest transfer fees in the world were associated with Portuguese players, with the first place (€93.5 m) occupied by a Portuguese player (Cristiano Ronaldo). At the same time, several

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historical clubs no longer play professional football as they were unable to cope with the need to transform clubs into businesses and ended up in bankruptcy.1

We first propose to apply Data Envelopment Analysis (DEA) to assess whether clubs are spending more resources than they need to achieve efficiency. If this is the case, this circumstance, coupled with the higher competitive level and the stringent financial conditions, means that clubs should revise their overall pay strategy. Second, we aim to ascertain whether players’ wage spread plays a role in inducing effort and has implications for club efficiency. This new element introduces a contribution to literature that uses DEA to measure efficiency in football.

Clubs hiring star players usually have a pay scale where top players earn substantially more than other players. Such skewed pay scales are also found in other business and sports environments. According to the tournament theory (Lazear and Rosen, 1981), firms establish a convex wage structure to induce effort.2 Football offers an opportunity to test this prediction in a special setting: players are a club’s main resource, and teams are relatively homogenous in size and individual demographic characteristics. Moreover, the market is competitive, which indicates that players’ wages are to some extent linked to their individual marginal contribution to team performance.

We proceed as follows: Section II describes the methodology and Section III presents the data used. We analyse the results in Section IV. The last section concludes this article.

II. Methodology

DEA is a nonparametric method widely used to measure relative efficiency using decision-making units in the estimation of the best production frontiers. First introduced by Farrell (1957), recent applications include banks (Chiu et al., 2010), public universities (Kempkes and Pohl, 2010), telecom branches (Kritikos et al., 2010), small and medium enterprises (Reverte and Guzman, 2010), pharmaceutical firms (You et al., 2010), public sector resources (Afonso et al., 2010; Benito et al., 2010) and football (Barros and Leach, 2006).

We used a DEA-CCR model (Charnes et al., 1978). The input used in Model 1 is the total wages paid by the club. Model 2 considers total wage divided into three inputs: the sum of the five highest wages, the sum of the five lowest wages and the remaining sum. The aim is to ascertain whether the wage distribution, captured by the distance between these three variables, has any impact on club efficiency. The use of wages as an incentive device would explain why some clubs are able to increase their efficiency by structuring the pay scale so as to induce effort.

We define output as rank in the First League, which attributes the league title, qualification to UEFA tournaments and relegation to the Second League. In order to emphasize the importance of a high ranking, especially to gain access to UEFA tournaments, we use a logarithmic scale (the inverse of the league rank).3

III. Data

We use Quadros de Pessoal (QP), a longitudinal matched employer–employee data set collected by the Ministry of Labour. The survey is mandatory and includes over 250 000 firms and 2 million individuals on average each year (1986–2008). We only consider clubs from the First League with more than 12 players appearing in the last 7 years of the survey (2002–2008), as this period provides a stable setting in terms of the rules governing competitions and clubs’ internal organization.

We collect monthly wages from QP and match that information with club statistics for seasons 2002/03 to 2008/09. We obtain information for 19 clubs, corresponding to 2630 players and 79 clubs occurrences (not a balanced panel). We divide each team’s yearly wages into total wages, sum of the five highest wages, sum of the five lowest wages and the total minus the previous two. Wage data are confidential. Nevertheless, Table 1 presents the ratio of the five highest to the five lowest wages (season 2008/09). Notice that the top three clubs have ratios higher than 70. The question is how this relationship translates into efficient use of resources. The wage difference is particularly evident for clubs with a better average performance, traditionally those with more

1 One of the most prominent cases was Boavista: the Portuguese champion in 2000–2001 and semi-finalist of the UEFA Cup in 2002–2003, it ceased to have professional football in 2008.

2 It has also been suggested that wage dispersion can induce lower team performance (Akerlof and Yellen, 1988). Recently, San and Jane (2008) presented evidence of this theory, though applied to the professional baseball league in Taiwan, a young and small sports market.

3 This scale gives more prominence to a rise at the top of the table than to a rise at the bottom. Therefore, there is a significant difference between climbing one position from second to first (which allows the club to be champion) and climbing one position from seventh to sixth.
financial resources. This may be taken to suggest that clubs set up an internal tournament among players as an incentive device.

**IV. Results**

We apply DEA to all seven seasons (79 clubs occurrences). Table 1 shows the results for season 2008/09: values for achieved efficiency, rank resulting from the efficiency values, difference between efficiency rank and league rank and change in efficiency rank between the two models.

The results from Model 1 show that for some clubs the efficiency rank is higher than their league position, while for others the opposite occurs. Notably, clubs that spend more on players and are successful in achieving top positions in the league are also the poorest performers in the efficiency ranking, that is, those with the highest difference between league rank and efficiency rank. Smaller clubs with less valuable players seem to get comparatively more out of their resources (Naval and P. Ferreira).

In Model 2, we divide total wages into three inputs, as previously explained. The results are slightly different from the efficiency ranks reached with the first model. To obtain a clearer picture of these differences, we compute the changes in efficiency ranks between the two models in Figs 1 and 2. In Fig. 1, we plot the change in efficiency rank for clubs where the ratio of the five highest wages to the five lowest wages is higher than 15. In Fig. 2, we perform the same exercise, but for those clubs with a ratio lower than 15. As can be observed, the majority of the clubs in Fig. 1 increase their relative efficiency when we separate the total wage variable (moving from Model 1 to Model 2). The reverse happens in Fig. 2, where the clubs with the lowest ratios decrease their efficiency. This result indicates that team wage distribution is relevant to the efficient use of resources. As such, clubs’ strategic use of pay ranking improves teams’ results.

**Table 1. Portuguese First League clubs: DEA results**

<table>
<thead>
<tr>
<th>Club</th>
<th>Rank in the First League&lt;sup&gt;a&lt;/sup&gt;</th>
<th>5 higher wages/5 lower wages</th>
<th>Efficiency</th>
<th>Efficiency rank</th>
<th>League rank</th>
<th>Efficiency rank</th>
<th>Efficiency</th>
<th>League rank</th>
<th>Efficiency rank</th>
<th>League rank</th>
<th>Model 1 – Model 2&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porto</td>
<td>1</td>
<td>70.51</td>
<td>0.26</td>
<td>7</td>
<td>–6</td>
<td>0.95</td>
<td>4</td>
<td>–3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Sporting</td>
<td>2</td>
<td>95.69</td>
<td>0.15</td>
<td>10</td>
<td>–8</td>
<td>0.64</td>
<td>7</td>
<td>–5</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Benfica</td>
<td>3</td>
<td>73.57</td>
<td>0.09</td>
<td>13</td>
<td>–10</td>
<td>0.33</td>
<td>9</td>
<td>–6</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Nacional</td>
<td>4</td>
<td>4.28</td>
<td>0.72</td>
<td>4</td>
<td>0</td>
<td>0.78</td>
<td>6</td>
<td>–2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Braga</td>
<td>5</td>
<td>19.77</td>
<td>0.14</td>
<td>11</td>
<td>–6</td>
<td>0.27</td>
<td>10</td>
<td>–5</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Leixoes</td>
<td>6</td>
<td>15.99</td>
<td>0.36</td>
<td>6</td>
<td>0</td>
<td>0.54</td>
<td>8</td>
<td>–2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Academia</td>
<td>7</td>
<td>6.09</td>
<td>0.26</td>
<td>8</td>
<td>–1</td>
<td>0.27</td>
<td>11</td>
<td>–4</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Guimaraes</td>
<td>8</td>
<td>15.55</td>
<td>0.14</td>
<td>12</td>
<td>–4</td>
<td>0.22</td>
<td>13</td>
<td>–5</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Maritimo</td>
<td>9</td>
<td>3.068</td>
<td>0.81</td>
<td>2</td>
<td>7</td>
<td>1.00</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>P. Ferreira</td>
<td>10</td>
<td>6.56</td>
<td>1.00</td>
<td>1</td>
<td>9</td>
<td>1.00</td>
<td>2</td>
<td>8</td>
<td>–1</td>
<td>–1</td>
<td></td>
</tr>
<tr>
<td>Rio Ave</td>
<td>11</td>
<td>6.35</td>
<td>0.22</td>
<td>9</td>
<td>2</td>
<td>0.23</td>
<td>12</td>
<td>–1</td>
<td>–3</td>
<td>–3</td>
<td></td>
</tr>
<tr>
<td>Naval</td>
<td>12</td>
<td>4.73</td>
<td>0.80</td>
<td>3</td>
<td>9</td>
<td>1.00</td>
<td>3</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>V. Setubal</td>
<td>13</td>
<td>3.85</td>
<td>0.70</td>
<td>5</td>
<td>8</td>
<td>0.80</td>
<td>5</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Belenenses</td>
<td>14</td>
<td>15.27</td>
<td>0.09</td>
<td>14</td>
<td>0</td>
<td>0.14</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** Results obtained with the General Algebraic Modelling System (GAMS). Model 1 considers total wages (the value of the players) as an input. Model 2 separates the wage variable into three inputs: sum of the five highest wages; sum of the five lowest wages; and the remaining sum. DEA, data envelopment analysis.

<sup>a</sup>Rank in the First League considering the 14 clubs present in QP.

<sup>b</sup>Difference between the efficiency rank.

![Figure 1. Variation (difference) in the efficiency rank from Model 1 to Model 2 for clubs with the wage ratio higher than 15 (five higher wages divided by the five lower)]
V. Conclusions

We have shown that some clubs are spending more on wages than they should, given that more spending does not translate into efficient use of the resources in every case. In addition, a wider wage distribution within each team is associated with better performance in terms of efficient use of resources. These findings agree with the predictions of several human resource management theories, and in particular the tournament theory: the size of the difference in pay rank increases as contestants approach the top, resulting in a convex wage curve, which happens in clubs with a higher ratio of the top five wages to the bottom five wages.

There are cases of Portuguese clubs that no longer play professional football because they became insolvent. These cases should serve as a warning for sports institutions. Clubs must rigorously manage their resources to guarantee the sustainability of their existence. Although in recent years Portugal has experienced slow economic growth compared with other European countries, this country’s top football clubs manage to reach the highest ranks in European competitions. This is partly explained by their strategic use of players’ wages, not only to stimulate individual effort, but also to hire higher quality players.

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