Decomposing the Win-Wage Relationship in Pro Team Sports

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Introduction and Literature Review
The core production process in professional team sports involves converting financial input into sporting output. Efficient teams are able to minimise the costs of playing talent and maximise the sporting performance of their playing squad. The simplest formalisation of the sporting production process is the linear win-wage relationship in which the number of wins is treated as directly proportional to the team’s expenditure on player salaries. The win-wage relationship is often expressed as the cost-per-win ratio. It is well established that in most professional team sports there is a degree of financial determinism in that sporting performance is positively correlated with salary costs although the degree of correlation varies across sports and across time. In baseball Doug Pappas was one of the first to measure team efficiency in the MLB using a cost-per-win ratio (see Lewis, 2003). In soccer, Szymanski has analysed the win-wage relationship using league points as the measure of sporting performance (Szymanski & Kuypers, 1999; Kuper & Szymanski, 2012). The aim of this present study is to: (i) propose a method of decomposing the win-wage relationship into two component sub-processes; and (ii) illustrate the decomposition using data from the FA Premier League in soccer.

Theoretical Framework
The sporting production process of transforming financial expenditures on playing talent into sporting performance can be broken down into two components. First, there is the acquisition process by which teams allocate their available financial resources to assemble a playing squad (or “roster”). This involves scouting to identify potential recruits as well as assessing the team’s own current squad and the “graduates” from their youth development programme. It also requires the capability to value playing talent to determine the optimal allocation of the team’s available financial resources. The ultimate measure of efficiency in the acquisition process is the cost per unit of playing talent in the team’s squad where costs can include both wage costs, and acquisition and development costs. The efficiency of the acquisition process can be termed transactional efficiency since it is the measure of the terms of exchange on which playing talent is acquired. The second component of the sporting production process is the deployment process in which the playing squad is used to compete in sporting contests. This involves the coaching of players - training, team selection and choice of game tactics – and depends on the capabilities of the coaching staff to transform individual playing talents into an effective team. The efficiency of the deployment process is measured by the sporting performance achieved relative to the team’s playing resources. This efficiency is best termed transformational efficiency.

Let $WINS = \text{sporting performance}$, $WAGES = \text{player costs}$, and $QUALITY = \text{a measure of the team’s stock of playing talent}$. It follows that sporting efficiency (i.e. output-input ratio) can be expressed as:

\[(1) \quad \text{Sporting Efficiency} = \frac{WINS}{WAGES}\]

It can be shown that, by introducing a measure of playing talent, sporting efficiency can be decomposed into the product of two ratios:

\[(2) \quad \frac{WINS}{WAGES} = \left(\frac{QUALITY}{WAGES}\right) \times \left(\frac{WINS}{QUALITY}\right)\]

$QUALITY/WAGES$ represents transactional efficiency since it measures the amount of playing talent per dollar spent on player salaries. $WINS/QUALITY$ represents transformational efficiency, providing a measure of the number of wins achieved per unit of playing talent. The key empirical issue to operationalise this decomposition is the development of an appropriate measure of playing talent.

Data and Methods
The dataset used in this study consists of a panel of ten seasons, 1996/97 – 2005/06, of the FA Premier League in England, the top domestic soccer league based on revenues and global TV viewing figures. With 20 teams in the league each season, this yields a sample size of 200 team-season observations. Sporting performance is measured by
total league points gained (LEAGPTS) with 3 points for a win, 1 point for a tied game and zero points for a loss. Teams play a pure round-robin 38-game regular season, playing every team once at home and once away so that the maximum attainable number of league points is 114 (= 3 points per win x 38 games). The measure of costs is relative wages costs (RELWAGES) defined as total staff wage costs divided by the league average for the season. The use of relative wage costs controls for inflation of player wages. The stock of playing talent is measured using the methodology proposed by Gerrard (2001) to construct a team quality index (TQI). Gerrard’s methodology involves a hedonic-pricing analysis of player transfer fees to identify the components and weightings of the TQI.

A two-stage analysis is undertaken. The first stage is ratio analysis in which the three efficiency ratios are calculated for all teams for all seasons. Teams are categorised as high/medium/low efficiency based on deviations from the mean efficiency ratio (with medium efficiency defined as within two standard deviations). Teams with high levels of transactional and/or transformational efficiency are identified and analysed in more depth. The second stage is regression analysis in which the two sub-processes are estimated as multivariate relationships. Two multiple regression models are estimated. Model 1 is a wage cost equation of transactional efficiency in which RELWAGES is estimated as a function of TQI and other player quality characteristics. Model 2 is a sporting performance equation of transactional efficiency in which LEAGPTS is estimated as a function of TQI and other possible determinants of team performance including shared team experience (Berman et al., 2002) and performance dynamics.

**Results and Discussion**

There are three key findings:

1. The wage cost equation of transactional efficiency shows that the TQI measure of team quality is insufficient and requires to be supplemented with additional measures of team quality including age, experience, international status and goals scored.

2. Similarly the sporting performance equation for transformational efficiency shows that the bivariate (i.e. ratio) approach is insufficient with shared team experience and performance dynamics emerging as significant determinants of team performance.

3. Bolton Wanderers emerges as one of the most efficient teams in English Premiership soccer during the period under investigation (both in the ratio analysis and the regression analysis). The reasons for this will be discussed in the presentation.

**References**


