

**Impact of a change in the scoring system on the  
competitive balance: The Six Nations Championship**

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## **1. THEORETICAL FOUNDATION**

In a competition, the scoring system may be represented by  $R = \{P_w, P_t, P_l\}, \mathbf{b}\}$ , being  $P_w, P_t$  and  $P_l$  the points assigned to each team in each match to win (w), tie (t) or lose (l), respectively;  $\mathbf{b}$  is a vector of possible additional assignments to the score by result; specifically, we consider them bonuses assigned to each team for demonstrating special offensive or defensive capacity, which is transformed into points and added to those obtained from the match result. Even if the scoring system complies with the condition of stability, that is, distributes a fixed amount of points in each game, there is another possible cause of instability or impossibility of knowing a priori the number of points they will be awarded in the championship: the introduction into the scoring system of bonuses.

This has occurred in rugby, particularly in the *Six Nations Championship* since in 2017 it adopted this scoring system established by World Rugby, and which had already been used in several leagues. Until that date, the current system was:  $R = \{2, 1, 0\}, \mathbf{0}\}$ . Currently, the scoring system is:  $R = \{2, 1, 0\}, \mathbf{0}\}$ , with  $\mathbf{b} = \{G_s, b_o, b_d\}$ , where:  $G_s$  represents the number of bonus points assigned to the Grand Slam;  $b_o$  denotes the number of points assigned to the offensive bonus; and  $b_d$  indicates the number of points assigned to the defensive bonus.

## **2. TARGETS**

In sports economics, measuring the competitive balance of a league is done through normalised indices. These indices require that the maximum level of concentration is known. Which situation represents the maximum concentration? How is the competitive balance affected if the scoring system changes? We see it in rugby, particularly in the *Six Nations Championship*.

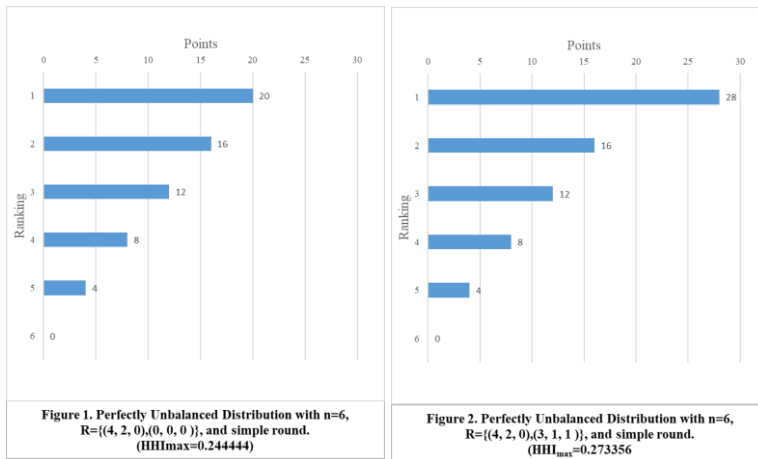
## **3. METHODOLOGY**

We use the Herfindahl-Hirschman (HHI) and Distance to Competitive Balance (DCB) indices. The change of scoring system highlights the need to normalize the HHI, since the maximum values that can be reached with each scoring system vary. The standardized HHI is:  $HHI_N = (HHI - HHI_{min}) / (HHI_{max} - HHI_{min})$ .

The solution proposed by Gayant & Le Pape (2015) to compare is to use the reconstructed data. However, this procedure means altering the latent competition mechanism. Avila-Cano & Triguero-Ruiz (2018) obtain the maximum concentration levels and the distributions that generate them. What is the magnitude and meaning of the differences? Triguero-Ruiz & Avila-Cano (2019) define  $DCB=HHI_n^{1/2}$ . This is a cardinal index of competitive balance, which is based on the concept of distance.

#### 4. RESULTS

The main European rugby leagues (French Top14, English Premiership or Scottish Pro14) have a maximum of 14 teams and  $HHI_{min}=0.07143$ ; without bonuses  $HHI_{max}=0.09890$  and with bonuses  $HHI_{max}=0.10876$ . For six teams these values are:  $HHI_{min}=0.16667$ ,  $HHI_{max}=0.24444$  and  $HHI_{max}=0.27336$ . With these results, in Figures 1 and 2 we show the distributions generating minimum competitive balance among different scoring systems.

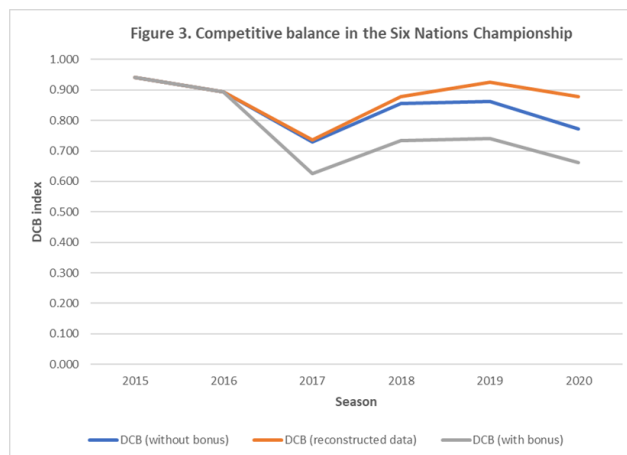


**Comentado [S1]:** En Figure 5, ¿es Complete-Cascade Distribution?  
 SI. Lo cambiamos nosotros en la figura

Figure 3 shows that consideration of the true maximum concentration, which can be achieved by varying the scoring system, represents a significant increase compared to the competitive balance with respect to those proved to use wrong maximum values. Note that the reconstruction of data means an increase of the concentration with respect to the values obtained with the original data. However, the application of the

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true maximum value of concentration, implies a significant decrease in concentration. In other words, the consideration of the true maximum implies an increase of the competitive balance with respect to the initial assessment, and not a decrease as the reconstruction of the results would indicate.



## 5. CONCLUSIONS

The introduction of bonuses in the *Six Nations Championship* has meant a considerable increase in competitive balance and it is useful to have the true value of the maximum concentration.

## 6. REFERENCES

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- Gayant, J. P., & Le Pape, N. (2015). The metrics of competitive imbalance. In *Disequilibrium sports economy: Competitive imbalance and budget constraints* (Vol. edited by W. Andreff, pp. 104–130).