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**THE INTERDEPENDENCE OF DOMESTIC
AND INTERNATIONAL SUCCESS: THE
CASE OF THE UEFA CHAMPIONS
LEAGUE**

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Abstract

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JEL Classification: N/A

Keywords: competitive balance, domestic competitions, international competitions, Nash equilibrium, UEFA Champions League

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The interdependence of domestic and international success: the case of the UEFA Champions League*

Juan D. Moreno-Ternero[†]

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August 11, 2019

Abstract

This article explores interdependence of domestic and international success in sports where leading clubs enter international competitions while competing in their domestic leagues. Taking as starting point the success of Spanish football teams in the UEFA Champions League during the 2008-2018 decade, we provide a stylized game-theoretical model in which national competitions determine the level of competitive balance therein. We rationalize the hypothesis that intermediate levels of competitiveness within domestic competitions are instrumental in achieving international success.

JEL numbers: C71, Z20.

Keywords: competitive balance, domestic competitions, international competitions, Nash equilibrium, UEFA Champions League.

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1 Introduction

In 1955, the so-called European Champion Clubs' Cup was launched. It was a yearly competition played by the national league football champions of the strongest UEFA (which stands for the Union of European Football Associations, the governing body of football in Europe) national associations.¹ The competition took on its current name (the UEFA Champions League) in 1992, adding a group stage to the competition and allowing multiple entrants from certain countries. It is, by now, one of the most prestigious tournaments in the world and the most prestigious club competition in European football. The clubs that take part in each edition share more than a billion euros in payments from UEFA, with a meritocratic scheme rewarding teams as they advance in the competition.

In its present format, the UEFA Champions League begins with four knockout qualifying rounds and a play-off round. The surviving teams enter the group stage, joining teams qualified in advance. Overall, 32 teams are drawn into eight groups of four teams and play each other in a double round-robin system. The eight group winners and eight runners-up proceed to the knockout phase that culminates with the final match.

Real Madrid is the most successful club in the competition's history, having won the tournament 13 times, including its first five editions. Spanish clubs have accumulated the highest number of victories (18 wins), followed by England (13 wins) and Italy (12 wins). The 10 editions from 2009 to 2018 witnessed a very strong domination of Spanish clubs (Real Madrid and Barcelona) who won 7 editions (and had two editions with Atletico de Madrid as a runner-up), whereas the other 3 editions were won by an Italian, English and German team, respectively.² What could possibly be the reasons for such a streak?

Obviously, Spain enjoyed during that decade the presence of two of the most dominating football players in history (Lionel Messi and Cristiano Ronaldo) who got the so-called Ballon

¹Sixteen teams participated in the first edition: Milan (Italy), AGF Aarhus (Denmark), Anderlecht (Belgium), Djurgården (Sweden), Gwardia Warszawa (Poland), Hibernian (Scotland), Partizan (Yugoslavia), PSV Eindhoven (Netherlands), Rapid Wien (Austria), Real Madrid (Spain), Rot-Weiss Essen (West Germany), Saarbrücken (Saar), Servette (Switzerland), Sporting CP (Portugal), Stade de Reims (France), and Vrs Lobog (Hungary).

²In the so-called UEFA Europa League, the second-tier competition of European club football, Spanish clubs also enjoyed a similar streak, with 6 wins in those 10 editions, whereas the other 4 editions were won by an Italian, a Portuguese and two English teams, respectively.

d'Or (the most prestigious annual football award, awarded since 1956) in all its editions from 2008 to 2017. Moreover, only once within those editions, the runner-up for the Ballon d'Or was another player different from those two.³

Here, we consider a different hypothesis referring to the interdependence of domestic and international competitions. During that decade, the Spanish domestic competition was indeed characterized by the rivalry between the two powerhouses (Barcelona and Real Madrid), each having one of the dominating players mentioned above. But this involved a great amount of effort (and stress) to win domestically (especially during the tumultuous Guardiola-Mourinho era). In general, none of these two teams won easily the domestic competition as opposed, for instance, to the German or Italian case, where Bayern Munich and Juventus overwhelmingly dominated in the last years. On the other hand, with the occasional exception of Atletico de Madrid (which was also an important actor in the UEFA Champions League), they found little competition in the rest of teams playing domestically, as opposed, for instance, to the English case, which witnessed 4 different champions in the last 7 editions of the Premier League (almost 5, as Liverpool was only one point short of Manchester City in 2019, after losing what was a 7-point lead in February). Therefore, our hypothesis is that the success in international competitions requires an intermediate level of competitiveness in domestic competitions. Neither an extremely high domestic competitive level (as in the Premier League), which might require a strong effort to win the tournament domestically, leaving teams exhausted for the last rounds of the international competition, nor a very low domestic competitive level (as in the Bundesliga or Calcio), which might leave teams out of shape and mentally unfitted for the last rounds of the international competition, is a good situation.

The rest of the paper is organized as follows. In Section 2, we provide an illustration considering the data from 2014 to 2018. To do so, we resort to some natural measures of competitiveness for domestic competitions to test our hypothesis. In Section 3, we provide a stylized model of strategic interaction in which we rationalize our hypothesis that intermediate levels domestically allow to thrive at international ones. We conclude in Section 4.

³This would not explain, however, the record of Spanish clubs in the UEFA Europa League those years.

2 An illustration

In this section, we provide some data regarding the European football competitions during the last years. The tables below collect data for the big four European competitions (La Liga, Premier League, Calcio and Bundesliga) during the 5 seasons from 2013 to 2018 (in which there was always a Spanish winner and two times a runner up). We compute the three focal measures of competitiveness for each of the 4 tournaments each of the 5 seasons.⁴ More precisely, we consider the following:

- *H-Index of competitive balance*: the ratio of the Hirshman Herfindahl Index (HI), which is based on the sum of the quadratic share of points won by each club in a league, to the HI of a perfectly balanced league;
- *Concentration ratio*: the ratio of the share of points won by the first 5 clubs compared with the entire league (CR5), to the same ratio in a perfectly balanced league;
- *Standard deviation of league points* (SDLP).

For all these cases, a decline in competitive balance is reflected by an increase in the index.

We then obtain, for each of the above measures, the rankings of the four leagues for each season. And we take the average for the five seasons. Surprisingly, La Liga yields the same intermediate average (3) for the three measures, as summarized in Table 1. Thus, this is a clear illustration for our hypothesis.

Table 1. Competitive balance rank averages of the Big 4 Leagues during the period 2013-2018.

| CB Index Rank Average | LIGA | PREMIER | CALCIO | BUNDESLIGA |
|-----------------------|------|---------|--------|------------|
| H-rank-average | 3 | 2 | 3.4 | 1.6 |
| CR-rank-average | 3 | 2.8 | 2.8 | 1.4 |
| SDLP-rank-average | 3 | 2.4 | 3.4 | 1.2 |

⁴The literature on sports economics is flooded with measures of competitiveness (e.g., Quirk and Fort 1992; Vrooman 1995; Horowitz 1997; Humphreys, 2002; Fort and Maxcy, 2003; Pawlowski et al., 2010). We decided to restrict our attention to three of them, that are considered somewhat focal.

SEASON 2013-2014

| LIGA | PREMIER | CALCIO | BUNDESLIGA |
|-------------|-------------|-------------|--------------|
| 0,085388994 | 0,080979284 | 0,097142857 | 0,1053864169 |
| 0,082542694 | 0,079096045 | 0,080952381 | 0,0831381733 |
| 0,082542694 | 0,077212806 | 0,074285714 | 0,074941452 |
| 0,066413662 | 0,074387947 | 0,061904762 | 0,0714285714 |
| 0,059772296 | 0,06779661 | 0,057142857 | 0,0702576112 |
| 0,05597723 | 0,064971751 | 0,055238095 | 0,0644028103 |
| 0,05597723 | 0,060263653 | 0,054285714 | 0,0620608899 |
| 0,046489564 | 0,052730697 | 0,054285714 | 0,0608899297 |
| 0,046489564 | 0,047080979 | 0,053333333 | 0,0515222482 |
| 0,045540797 | 0,04613936 | 0,051428571 | 0,0491803279 |
| 0,042694497 | 0,042372881 | 0,047619048 | 0,0480093677 |
| 0,040796964 | 0,039548023 | 0,042857143 | 0,0456674473 |
| 0,039848197 | 0,037664783 | 0,041904762 | 0,0421545667 |
| 0,039848197 | 0,035781544 | 0,041904762 | 0,0421545667 |
| 0,038899431 | 0,035781544 | 0,037142857 | 0,037470726 |
| 0,037950664 | 0,034839925 | 0,034285714 | 0,0316159251 |
| 0,037950664 | 0,033898305 | 0,032380952 | 0,0304449649 |
| 0,037001898 | 0,031073446 | 0,03047619 | 0,0292740047 |
| 0,034155598 | 0,030131827 | 0,027619048 | 0 |
| 0,023719165 | 0,028248588 | 0,023809524 | 0 |

HICB

| | | | |
|-------------|-------------|-------------|--------------|
| 111,4395688 | 112,5155607 | 113,0376417 | 112,65240307 |
| | HICB ranks | | |
| 1 | 2 | 4 | 3 |

C5ICB

| | | | |
|-------------|-------------|-------------|--------------|
| 150,6641366 | 151,7890772 | 148,5714286 | 145,85480094 |
| | C5ICB ranks | | |
| 3 | 4 | 1 | 2 |

SDLP

| | | | |
|-------------|-------------|-------------|--------------|
| 18,28747055 | 19,27337951 | 19,44898861 | 17,365355037 |
| | SDLP ranks | | |
| 2 | 3 | 4 | 1 |

SEASON 2014-2015

| LIGA | PREMIER | CALCIO | BUNDESLIGA |
|-------------|-------------|-------------|--------------|
| 0,090038314 | 0,083094556 | 0,085883514 | 0,0944976077 |
| 0,088122605 | 0,075453677 | 0,069101678 | 0,0825358852 |
| 0,074712644 | 0,071633238 | 0,068114511 | 0,0789473684 |
| 0,073754789 | 0,066857689 | 0,063178677 | 0,0729665072 |
| 0,072796935 | 0,06112703 | 0,06219151 | 0,0586124402 |
| 0,057471264 | 0,05921681 | 0,058242843 | 0,0574162679 |
| 0,052681992 | 0,05730659 | 0,055281343 | 0,0550239234 |
| 0,048850575 | 0,053486151 | 0,054294176 | 0,0526315789 |
| 0,04789272 | 0,051575931 | 0,053307009 | 0,0514354067 |
| 0,046934866 | 0,045845272 | 0,051332675 | 0,0514354067 |
| 0,046934866 | 0,044890162 | 0,048371175 | 0,04784689 |
| 0,044061303 | 0,044890162 | 0,048371175 | 0,04784689 |
| 0,039272031 | 0,042024833 | 0,045409674 | 0,0442583732 |
| 0,035440613 | 0,039159503 | 0,042448174 | 0,043062201 |
| 0,033524904 | 0,037249284 | 0,041461007 | 0,0418660287 |
| 0,033524904 | 0,036294174 | 0,04047384 | 0,0418660287 |
| 0,033524904 | 0,036294174 | 0,036525173 | 0,0406698565 |
| 0,033524904 | 0,033428844 | 0,033563672 | 0,0370813397 |
| 0,027777778 | 0,031518625 | 0,023692004 | 0 |
| 0,019157088 | 0,028653295 | 0,01875617 | 0 |

HICB

| | | | |
|-------------|-------------|-------------|--------------|
| 115,4636603 | 109,2656601 | 109,5940337 | 108,08303381 |
| | HICB ranks | | |
| 4 | 2 | 3 | 1 |

C5ICB

| | | | |
|-------------|-------------|-------------|-------------|
| 159,7701149 | 143,2664756 | 139,3879566 | 139,5215311 |
| | C5ICB ranks | | |
| 4 | 3 | 1 | 2 |

SDLP

| | | | |
|-------------|-------------|-------------|--------------|
| 21,06031439 | 16,34907047 | 16,09601127 | 13,587287407 |
| | SDLP ranks | | |
| 4 | 3 | 2 | 1 |

SEASON 2015-2016

| LIGA | PREMIER | CALCIO | BUNDESLIGA |
|-------------|-------------|-------------|--------------|
| 0,086832061 | 0,078412391 | 0,08708134 | 0,1024447031 |
| 0,085877863 | 0,068731849 | 0,0784689 | 0,0908032596 |
| 0,083969466 | 0,067763795 | 0,076555024 | 0,0698486612 |
| 0,061068702 | 0,063891578 | 0,064114833 | 0,0640279395 |
| 0,059160305 | 0,063891578 | 0,061244019 | 0,0605355064 |
| 0,057251908 | 0,060987415 | 0,058373206 | 0,0582072177 |
| 0,049618321 | 0,060019361 | 0,054545455 | 0,0582072177 |
| 0,045801527 | 0,058083253 | 0,051674641 | 0,0582072177 |
| 0,045801527 | 0,049370765 | 0,04784689 | 0,0523864959 |
| 0,042938931 | 0,048402711 | 0,044019139 | 0,0500582072 |
| 0,041984733 | 0,045498548 | 0,044019139 | 0,0477299185 |
| 0,041984733 | 0,045498548 | 0,043062201 | 0,0465657742 |
| 0,041030534 | 0,043562439 | 0,043062201 | 0,0442374854 |
| 0,041030534 | 0,041626331 | 0,040191388 | 0,0442374854 |
| 0,040076336 | 0,040658277 | 0,038277512 | 0,0430733411 |
| 0,03721374 | 0,040658277 | 0,037320574 | 0,0419091967 |
| 0,03721374 | 0,037754114 | 0,037320574 | 0,0384167637 |
| 0,036259542 | 0,035818006 | 0,036363636 | 0,0291036088 |
| 0,034351145 | 0,032913843 | 0,029665072 | 0 |
| 0,030534351 | 0,016456922 | 0,026794258 | 0 |

HICB

| | | | |
|-------------|-------------|-------------|--------------|
| 111,3389371 | 108,4876707 | 110,3509535 | 109,96651222 |
| | HICB ranks | | |
| 4 | 1 | 3 | 2 |

C5ICB

| | | | |
|-------------|-------------|-------------|--------------|
| 150,7633588 | 137,0764763 | 146,9856459 | 139,55762515 |
| | C5ICB ranks | | |
| 4 | 1 | 3 | 2 |

SDLP

| | | | |
|-------------|-------------|-------------|--------------|
| 18,10321286 | 15,43841756 | 17,24704399 | 15,502582538 |
| | SDLP ranks | | |
| 4 | 1 | 3 | 2 |

SEASON 2016-2017

| LIGA | PREMIER | CALCIO | BUNDESLIGA |
|-------------|-------------|-------------|--------------|
| 0,088487155 | 0,088068182 | 0,085849057 | 0,0971563981 |
| 0,085632731 | 0,081439394 | 0,082075472 | 0,0793838863 |
| 0,074215033 | 0,073863636 | 0,081132075 | 0,0758293839 |
| 0,068506185 | 0,071969697 | 0,067924528 | 0,0734597156 |
| 0,063748811 | 0,071022727 | 0,066037736 | 0,058056872 |
| 0,060894386 | 0,065340909 | 0,059433962 | 0,058056872 |
| 0,059942912 | 0,057765152 | 0,058490566 | 0,0568720379 |
| 0,053282588 | 0,043560606 | 0,056603774 | 0,0533175355 |
| 0,052331113 | 0,043560606 | 0,05 | 0,0533175355 |
| 0,051379638 | 0,042613636 | 0,046226415 | 0,0509478673 |
| 0,04376784 | 0,042613636 | 0,045283019 | 0,0497630332 |
| 0,04376784 | 0,041666667 | 0,044339623 | 0,0485781991 |
| 0,042816365 | 0,041666667 | 0,04245283 | 0,0450236967 |
| 0,037107517 | 0,038825758 | 0,040566038 | 0,0450236967 |
| 0,037107517 | 0,038825758 | 0,038679245 | 0,0438388626 |
| 0,034253092 | 0,037878788 | 0,033962264 | 0,0438388626 |
| 0,033301618 | 0,037878788 | 0,032075472 | 0,0379146919 |
| 0,029495718 | 0,03219697 | 0,030188679 | 0,0296208531 |
| 0,020932445 | 0,026515152 | 0,024528302 | 0 |
| 0,019029496 | 0,022727273 | 0,014150943 | 0 |

HICB

| | | | |
|-------------|-------------|-------------|--------------|
| 114,6350583 | 113,4283173 | 114,6279815 | 108,34830754 |
| | HICB ranks | | |
| 4 | 2 | 3 | 1 |

C5ICB

| | | | |
|-------------|-------------|-------------|--------------|
| 152,2359657 | 154,5454545 | 153,2075472 | 138,19905213 |
| | C5ICB ranks | | |
| 2 | 3 | 4 | 1 |

SDLP

| | | | |
|-------------|------------|-------------|--------------|
| 20,62567383 | 19,8510241 | 20,79726703 | 13,940583534 |
| | SDLP ranks | | |
| 3 | 2 | 4 | 1 |

SEASON 2017-2018

| LIGA | PREMIER | CALCIO | BUNDESLIGA |
|-------------|-------------|-------------|--------------|
| 0,088235294 | 0,096061479 | 0,08987701 | 0,1005988024 |
| 0,074952562 | 0,077809798 | 0,086092715 | 0,0754491018 |
| 0,072106262 | 0,073967339 | 0,072847682 | 0,0658682635 |
| 0,069259962 | 0,07204611 | 0,068117313 | 0,0658682635 |
| 0,057874763 | 0,067243036 | 0,068117313 | 0,0658682635 |
| 0,056925996 | 0,060518732 | 0,060548723 | 0,0634730539 |
| 0,055028463 | 0,051873199 | 0,056764428 | 0,0610778443 |
| 0,052182163 | 0,047070125 | 0,053926206 | 0,0586826347 |
| 0,048387097 | 0,045148895 | 0,051087985 | 0,0562874251 |
| 0,048387097 | 0,042267051 | 0,051087985 | 0,051497006 |
| 0,046489564 | 0,042267051 | 0,040681173 | 0,0502994012 |
| 0,046489564 | 0,042267051 | 0,038789026 | 0,0491017964 |
| 0,046489564 | 0,040345821 | 0,037842952 | 0,0467065868 |
| 0,04459203 | 0,039385207 | 0,037842952 | 0,0431137725 |
| 0,043643264 | 0,038424592 | 0,036896878 | 0,0431137725 |
| 0,040796964 | 0,035542747 | 0,036896878 | 0,0395209581 |
| 0,040796964 | 0,034582133 | 0,035950804 | 0,0371257485 |
| 0,027514231 | 0,031700288 | 0,033112583 | 0,0263473054 |
| 0,020872865 | 0,031700288 | 0,023651845 | 0 |
| 0,018975332 | 0,029779059 | 0,01986755 | 0 |

HICB

| | | | |
|-------------|-------------|-------------|--------------|
| 111,3639555 | 112,8874641 | 114,3648372 | 108,58732834 |
| | HICB ranks | | |
| 2 | 3 | 4 | 1 |

C5ICB

| | | | |
|------------|-------------|-------------|--------------|
| 144,971537 | 154,8511047 | 154,0208136 | 134,51497006 |
| | C5ICB ranks | | |
| 2 | 3 | 4 | 1 |

SDLP

| | | | |
|-------------|-------------|-------------|--------------|
| 18,22693207 | 19,17090723 | 20,55102763 | 13,987973359 |
| | SDLP ranks | | |
| 2 | 3 | 4 | 1 |

3 The benchmark model

Let N describe a set of $n > 2$ domestic (national) league competitions. Each competition is ruled by a *National League Association* in charge of logistic aspects and day-to-day operations for the league, as well as the revenue sharing from broadcasting rights (the major source of revenues for teams).⁵ There will, nevertheless, be a *National Football Federation*, in charge of the national team and with indirect influence on the domestic competition (sometimes even in charge of alternative domestic competitions to the national league, such as the case of the King's Cup in Spain or the FA Cup in England).⁶ There is an ongoing bargaining process between these two entities to control the business of football within each nation.⁷ We shall assume that the outcome of this bargaining process determines an index indicating the strength of each domestic competition. More precisely, for each $i \in N$, let $\alpha_i > 0$ denote such a country index associated to it. We do not specify how this index is obtained, but rather assume that it is a sort of amalgam of the so-called (UEFA) country coefficient and the strength of the national team.⁸

We make the following assumption, which implies that the distribution of indices is not highly skewed and that, therefore, the coefficients of the considered competitions do not differ much.⁹ Formally, let $\underline{\alpha} = \min\{\alpha_i : i \in N\}$ and $\bar{\alpha} = \frac{\sum_{i \in N} \alpha_i}{n}$. Then,

Assumption 1: $(n + 1)\underline{\alpha} > n\bar{\alpha}$.

For each competition $i \in N$, we denote by β_i the competitive balance associated to it. We assume that, for each $i \in N$, $\beta_i \in [0, M]$.¹⁰ It can be safely argued that competitive balance

⁵This is, for instance, the case of the so-called English Football League in England or the Professional Football League in Spain.

⁶For instance, all of England's professional football teams are members of the Football Association. It has veto power over the appointment of the League Chairman and Chief Executive and over any changes to league rules. The English Football League is self-governing, subject to the FA's sanctions.

⁷Occasionally, the coexistence of these two bodies is somewhat contentious, as in Spain nowadays. See, for instance, <https://www.bbc.com/sport/football/49125627>

⁸The (UEFA) country coefficient is used to rank football associations within Europe, and determine the number of clubs from each association that will participate in the UEFA competitions.

⁹An interpretation is that we actually restrict our analysis to those domestic competitions including likely winners of the international competition.

¹⁰The precise value of the upper bound M will depend on the specific measure of competitiveness being considered.

is essentially determined by regulation. North American professional sports have long been implementing draft systems (in which weaker teams have priority to pick draftees each season) or wage caps to increase competitive balancedness within their competitions. Such measures do not have the same tradition in European sports, but competitive balancedness is certainly a concern therein too. The so-called *financial fair play* is a scheme pursuing that goal. The allocation of revenues raised from broadcasting rights, the most important source of revenue for professional sports, is certainly driven (at least, partially) by that goal too (e.g., Bergantiños and Moreno-Ternero, 2019). Thus, we shall consider that β_i is a decision variable for each domestic competition $i \in N$, which generates a strategic interaction among competitions, formalized by means of a game, as follows.

Let $\Gamma = \{N, [0, M]^n, \pi\}$ denote the resulting game in which N is the set of players, $[0, M]$ is the strategy space for each player and $\pi : [0, M]^n \rightarrow [0, 1]$ the payoff function. More precisely, for each $i \in N$, let $\beta = (\beta_i, \beta_{-i}) \in [0, M]^n$ be the strategy profile, and $\pi(\beta_i, \beta_{-i})$ denote the likelihood that a team from competition i wins the international tournament.¹¹ We assume that $\pi(\beta_i, \beta_{-i})$ is an increasing function of the domestic index (α_i), the residual competitive balance of the domestic league ($M - \beta_i$), and also the total (weighted by competitive balance) strength of the participating competitions ($\sum_j \alpha_j \beta_j$). Formally,

$$\pi(\beta_i, \beta_{-i}) = \alpha_i(M - \beta_i) \sum_j \alpha_j \beta_j. \quad (1)$$

3.1 The Nash equilibrium

The next result describes the Nash equilibrium of this game.

Proposition 1 *The Nash equilibrium of game Γ is obtained when*

$$\beta_i = \left(1 - \frac{n\bar{\alpha}}{(n+1)\alpha_i}\right) M,$$

for each $i \in N$.

Proof. Let $\beta^* = (\beta_1^*, \dots, \beta_n^*)$, where $\beta_i^* = \left(1 - \frac{n\bar{\alpha}}{(n+1)\alpha_i}\right) M$, for each $i \in N$. Let $i \in N$. It suffices to show that $\pi(\beta_i^*, \beta_{-i}^*) \geq \pi(\beta_i, \beta_{-i}^*)$, for each $\beta_i \in [0, M]$. Now, the partial derivative

¹¹The notation β_{-i} refers to the resulting vector in $[0, M]^{n-1}$ after getting rid of β_i at $\beta \in [0, M]^n$.

of $\pi(\beta_i, \beta_{-i}^*)$ with respect to β_i is

$$\begin{aligned}\frac{\partial \pi(\beta_i, \beta_{-i}^*)}{\partial \beta_i} &= -\alpha_i \left(\sum_{j=1}^n \alpha_j \beta_j \right) + \alpha_i^2 (M - \beta_i) \\ &= \alpha_i \left(\alpha_i M - 2\alpha_i \beta_i - \sum_{j \neq i} \alpha_j \beta_j \right).\end{aligned}$$

Thus, the first-order conditions amount to solving $2\alpha_i \beta_i + \sum_{j \neq i} \alpha_j \beta_j = M\alpha_i$, for each $i \in N$. Equivalently, $A\beta = c$, where

$$A = \begin{pmatrix} 2\alpha_1 & \alpha_2 & \dots & \alpha_n \\ \alpha_1 & 2\alpha_2 & \dots & \alpha_n \\ \dots & \dots & \dots & \dots \\ \alpha_1 & \alpha_2 & \dots & 2\alpha_n \end{pmatrix},$$

and

$$c = \begin{pmatrix} M\alpha_1 \\ M\alpha_2 \\ \dots \\ M\alpha_n \end{pmatrix}.$$

Thus,

$$\beta = A^{-1}c = \begin{pmatrix} \left(1 - \frac{n\bar{\alpha}}{(n+1)\alpha_1}\right) M \\ \left(1 - \frac{n\bar{\alpha}}{(n+1)\alpha_2}\right) M \\ \dots \\ \left(1 - \frac{n\bar{\alpha}}{(n+1)\alpha_n}\right) M \end{pmatrix}.$$

Thus, for each $i \in N$,

$$\beta_i = M \left(1 - \frac{n\bar{\alpha}}{(n+1)\alpha_i}\right) > 0,$$

where the inequality follows by Assumption 1. \blacksquare

Note that the structure of payoff functions we use allows for a simple but important observation. Given the strategic choices of other countries in terms of their competitive balance, the payoff function of country i is *single-peaked* with respect to its own competitive balance. That is for every set of choices β_{-i} there exists $\hat{\beta}_i$ such that the payoff function $\pi_i(\beta_i, \beta_{-i})$ is increasing for $\beta_i < \hat{\beta}_i$ and is decreasing for $\beta_i > \hat{\beta}_i$. As we indicated above, this observation makes a lot of sense. Indeed, high levels of competitive balance in the domestic competition would hurt

the effort exerted at the international competition (teams would be exhausted to play at the international competition because of the ruthless competition they face domestically). Now, low levels of competitive balance in the domestic competition might also hurt the effort exerted at the international competition as strong teams would not be seriously challenged domestically, which would render them unprepared to face the much tougher competition existing in the international tournament (excessive confidence, out-of-shape behavior).¹²

Obviously, the optimal amount of domestic competitive balance depends on the index α_i . Two competitions with the same index would select the same level of competitive balance, and would therefore achieve the same likelihood to win the international competition. In particular, if $\alpha_i = \alpha$, for each $i \in N$, then the previous equilibrium would be symmetric, involving the same competitive balance for each country; namely, $\frac{n}{n+1}M\alpha$ (and, thus, an equal sharing of likelihood of international success).

3.2 Comparative statics

The next result summarizes the comparative statics analysis with respect to the exogenous parameters in this model; namely, the values of the strength indices of the national competitions (α_i).

Proposition 2 *The competitive balance a national competition selects in equilibrium increases with the strength index of such a competition, whereas it decreases with the strength index of the other competitions.*

Proof. For each $i \in N$, let $\beta_i = \left(1 - \frac{n\bar{\alpha}}{(n+1)\alpha_i}\right)M$, i.e., the Nash equilibrium strategy for competition i . Then, we have the following partial derivatives:

$$\frac{\partial \beta_i}{\partial \alpha_i} = -\frac{M}{n+1} \frac{\partial \left(\frac{\sum_{j=1}^n \alpha_j}{\alpha_i}\right)}{\partial \alpha_i} = \frac{M}{n+1} \frac{\sum_{j \neq i} \alpha_j}{\alpha_i^2} > 0.$$

and

$$\frac{\partial \beta_i}{\partial \alpha_j} = -\frac{M}{n+1} \frac{\partial \left(\frac{\sum_{k=1}^n \alpha_k}{\alpha_i}\right)}{\partial \alpha_j} = -\frac{M}{(n+1)\alpha_i} < 0.$$

for every $j \neq i$. Thus, β_i is increasing in its own strength index α_i and decreasing in α_j for each j different from i . ■

¹²One might also argue that a very low level of competitive balance might render the domestic league unattractive to import high talent, which would in itself render teams weaker for the international competition.

4 Discussion

Our paper could be considered as part of the fast-expanding literature on the economic design of sporting contests.¹³ We have studied in this paper the interdependence of domestic and international success, motivated by the case of the UEFA Champions League. We have provided empirical evidence that the success of Spanish teams in last years is linked to the intermediate level of competitive balancedness of its domestic competition (La Liga) with respect to the other big European competitions (Premier League, Calcio and Bundesliga). We have also provided a stylized game-theoretical model to rationalize this hypothesis.

Our research might sound reminiscent to the interesting research undertaken by Pawlowski et al., (2010). They explored the effect of the increase in payouts from the UEFA Champions League (in 1999-2000) on the performance of top clubs in domestic football leagues. More precisely, they treated that policy change as a natural experiment to compare the level of competitive balance in five top European leagues (England, Spain, Italy, Germany, and France) before and after the turn of the millennium. Based on several competitive balance measures, they reported significant decrease in competitive balance after the modification of the payout system. Their analysis is purely empirical and does not include a theoretical model, such as the one we consider here. Furthermore, their analysis is precisely made right before the decade of Spanish domination in European tournaments that we consider here.

Another somewhat related investigation is Haan et al., (2012). The early 90's witnessed two major changes in European football; namely, the Bosman ruling and the new format of the UEFA Champions League. The former, which lifted the restrictions on foreign EU players within national leagues and allowed players in the EU to move to another club at the end of a contract without a transfer fee being paid, fostered international trade in talent. The latter, increased the pool of candidates to win a large amount of prize money. Haan et al., (2012) used a theoretical model to study how these two ingredients might affect competitive balance within (and quality differences between) national competitions. They find that, when combined, talent flows from small to large countries. As a result, competitive balance increases in all but the very smallest countries.¹⁴ The effect of domestic competitive balance to be successful at the

¹³See Szymanski (2003) for an excellent survey of the initial steps of such a literature. See also, for instance, Corchón and Dahm (2010) for the somewhat related field of endogenous contests.

¹⁴With international trade in talent, large countries (which provide higher returns) become recipients of talent. Wages increase in small countries, but decrease in large ones. The wage increase in small countries hurts small

UEFA Champions League is, nevertheless, not explored in their model.

Getting back to our analysis, one might argue that the season just finished (in which four English teams played the finals of the UEFA Champions League and the UEFA Europa League, for the first time in history) contradicts our hypothesis. Several caveats should be made about it. First of all, we would need to observe a larger number of seasons to be able to compare this success of English teams with the success of Spanish teams during the preceding decade. Second, we should not forget the random element inherent to the game of football, which was clearly exemplified in the semifinals of both tournaments.¹⁵ Finally, the outcome of the Premier League during the season 2018-2019 (with Manchester City and Liverpool getting close to 100 points, whereas the other teams falling well below) resembled the outcome of the Spanish League during most of the previous decade (but actually not this season, in which Real Madrid was never competitive enough), so it might actually be confirming our hypothesis, rather than contradicting it.

Our analysis might suggest some policy implications, as in the case of Bundesliga, where Bayern Munich has strongly dominated the competition for the last years. During those years, an almost recurrent policy of Bayern (with unmatched economic strength within Germany) has been to attract talent from within Bundesliga. Most of the leading players or rising stars from opposing German teams were subsequently acquired by Bayern Munich.¹⁶ This was typically praised as a successful policy. We do not claim it was not a helpful strategy to secure domestic leadership all these years. We do claim, nevertheless, that it might have been counterproductive

teams more than large ones. Therefore, competitive balance decreases. The wage decrease in large countries benefits small teams more, so competitive balance increases. As for the increase in the changes to get prize money, it is relatively more important for small teams. Hence, competitive balance increases in all countries, and talent flows from large to small countries, provided international trade is possible. Nevertheless, and as mentioned above, when combined, the trade effect dominates the Champions League effect.

¹⁵In the UEFA Champions League, Liverpool lost 3-0 in Barcelona and had an amazing comeback in Liverpool that very few predicted, as it can be checked in the data from the online betting companies; Tottenham scored three goals in the second half of the game in Amsterdam (the third one in the fifth minute of extra time) to secure qualification to the final game; Chelsea advanced to the final game of the UEFA Europa League only after penalty shootouts. This is in line with Schokkaert and Swinnen (2016), who recently documented that, in the UEFA Champions League, qualification in lower rounds has become more predictable, whereas outcomes at later stages have become less predictable.

¹⁶For instance, Gotze, Lewandowski and Hummels from Dortmund in 2013, 2014 and 2016, respectively; Neuer and Goretzka from Schalke 04 in 2011 and 2018; Rudy and Sule from Hoffenheim in 2017, etc.

for international success and Bayern would be better off internationally by attracting more foreign talent (at least, relatively speaking). Not only because of the conventional argument that better decisions are made when the pool of options is richer; but also because stronger contenders domestically might help international success. Actually, the last time Bayern won the Champions League was in 2013, precisely against Borussia Dortmund, which had been a very strong contender domestically too (winning the previous two Bundesligas).¹⁷

The case of Calcio and Juventus is somewhat reminiscent of the case of Bundesliga and Bayern just described. Incidentally, it seems that Juventus followed last season the strategy we suggested above for Bayern, acquiring Cristiano Ronaldo. Many observers considered Juventus one of the front runners to win the Champions League that year, until the amazing performance of the underdog Ajax in Turin during the second game of the quarterfinals.¹⁸

¹⁷It is also fair to acknowledge that, during the Guardiola era, Bayern was a very strong contender in the UEFA Champions League, only being disqualified each of the three years in the semifinals. Funnily enough, that happened, sequentially, against Real Madrid, Barcelona and Atletico de Madrid... the three Spanish teams!

¹⁸Maybe partly motivated by that, and possibly adopting the strategy we suggest, Juventus has just brought in De Ligt, captain of Ajax last season.

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