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Comparing competitive balance between genders in team sports

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ABSTRACT

Research question: Interest in women's team sports has increased over time. However, there is still little research comparing competitive balance between genders in the bigger sports leagues. Against this background the main research question is whether there are systematic differences in competitive balance between the genders among the bigger sports leagues.

Research methods: The analysis involves football (soccer), handball and basketball leagues for the period 2007/08–2016/17 (14 leagues and 135 observations) and is based on quantitative methods. Competitive balance is a multidimensional concept, and this paper separately measures win dispersion, performance persistence and prize (here: championship winner) concentration.

Results and findings: In football (soccer), win dispersion is strongly significantly weaker for women's leagues compared to their respective men's leagues, while the results for the other dimensions are mixed. Generally, the level of competitive balance seems weak in women's football (soccer) and in handball. For the latter, there is little difference in competitive balance between the genders. In basketball, the strong significant results for performance persistence suggest that the Women's National Basketball Association (WNBA) is more balanced than the NBA.

Implications: The level of competitive balance in women's football in Europe looks weak, also compared to the women's football in North America. If this leads to competitive balance problems (i.e. lower attendance, ceteris paribus) among women's football in Europe, governing bodies should consider traditional regulations to promote equalization of sporting quality and/or to adjust the framework of the game to better fit women's physiques.

Introduction

Women's team sports at professional level, such as handball and football (soccer) have become steadily more popular (see, for example www.fifa.com and www.eurohandball. com). Recently, a number of club football matches for women in Europe have experienced attendance at a number that previously was reserved for male matches (Magowan, 2019). However, the great interest in these cup matches and matches of a high level of

championship significance (Jennett, 1984) has not been reflected in average league attendance when compared with men's leagues in their respective countries. According to Magowan (2019), the 2016/17 season had an average attendance in the women's top division in England of 1,058 spectators, while it was 708 in France and 946 in Germany. A reason for these low numbers might be historical, as women's league football at (semi-) professional level is relatively new in many countries, especially compared to the men's leagues. In the USA, however, where the historical differences between the genders with regards to soccer are smaller, the interest in women's matches is much higher than in Europe, with an average attendance in 2017 of 5,061 (Goldberg, 2018). This is the case even though today's National Women's Soccer League (NWSL) had its first season as late as in 2013 (FIFA, 2013). However, it is worth noting that USA had conducted the first full-fledged professional women's soccer league in the world in 2001 (Women's United Soccer Association, WUSA), according to the historical overview over professional leagues in women's US Soccer in Congdon-Hohman and Matheson (2014). Another sports league, the Women's National Basketball Association (WNBA), however, has been a (semi-) professional league since the 1997 season (www.wnba.com/history). Here, the regular season average attendance for 2017 was higher than for the NWSL, with an average of 7,716 spectators (WNBA, 2017).

According to Kringstad and Gerrard (2007), competitive balance is about the distribution of sporting outcomes among the teams in a tournament. Fort and Maxcy (2003) divide the empirical literature addressing competitive balance into two parts. One is about the product the involved parties sell to consumers. This product is hypothesized to be positively affected with increased uncertainty of outcome (Rottenberg, 1956), which in turn has the level of competitive balance as a positive determinant. Therefore, according to the uncertainty of outcome hypothesis, improved competitive balance has a positive effect on demand, and hence, also on revenues. The other part focuses on analysing effects on competitive balance from 'the business practices of pro sports leagues' (Fort & Maxcy, 2003, p. 155). This relates to (changes in) market regulations from among other governing bodies in sports. Therefore, from a sports and league management perspective, competitive balance is relevant for a number of reasons. These also relate to knowledge about both drivers behind the level of competitive balance and, as is the focus in this paper, the measured level of competitive balance in the league. Not least, managing sports leagues should also be about securing a minimum level of competitive balance (e.g. Késenne, 2007).

When it comes to women's football, Kjær and Agergaard (2013) claimed that the Scandinavian countries were the pioneers. However, Kringstad (2018) found that the competitive balance level in these women's leagues are weak and that they are significantly weaker than in their respective men's leagues. These results, combined with the fact that relatively few studies have focused on competitive balance in women's team sports, are a motivation behind this paper. Further, since the results on competitive balance in Scandinavian football are from leagues that, at least for men, can be seen as medium-sized leagues, this paper aims to make a broader analysis of measuring competitive balance, both when it comes to larger-sized leagues and also other team sports. This means that a motivation is to compare competitive balance in women's leagues with their respective men's leagues, and to determine whether the differences in competitive balance between the genders in Scandinavian football can also be found in North American soccer and in other team

sports. Against this background, the main research question in this paper is: Are there systematic differences in competitive balance between the genders among the bigger sports leagues?

The data used in this study are from the ten seasons of 2008–2017. The chosen football leagues were at the top of the women's ranking list (national teams) from the Fédération Internationale de Football Association (FIFA) as of March 2018 (FIFA, 2018). These are Germany, France, England and the USA. The French league is chosen instead of the Canadian one because of the structure (i.e. a lack of a domestic premier league at club level) of the domestic football league for women in Canada (see, for example, Canada Soccer, 2017 and Armstrong, 2019). Based on the rankings, Germany and Denmark are the cases for handball. The National Basketball Association (NBA) and the Women's National Basketball Association (WNBA) are included because of their standing in North America.

The structure of this paper is as follows. The next section presents the framework of competitive balance and a review of the literature, focusing particularly on the stream of research addressing competitive balance from a gender perspective. In the research methods, attention is devoted to the measures drawn upon by this study to capture competitive balance as a multidimensional concept. The next part presents the data-sampling process. This is followed by the empirical results and analysis. Finally, discussions and conclusions are provided, before limitations and suggestions for future research are given.

Competitive balance in a gender context

Competitive balance is one of the main concepts in the economics of professional team sports, and goes back to the seminal papers by Rottenberg (1956) and Neale (1964). For example, Rottenberg's uncertainty of outcome hypothesis connects competitive balance to revenues because competitive balance is seen as the driver for uncertainty of outcome, which in turn is an anticipated determinant for demand. However, empirical results do not necessarily support this hypothesis (e.g. Borland & Macdonald, 2003; Cairns et al., 1986; Dobson & Goddard, 2011; Downward & Dawson, 2000). One reason for mixed empirical results might be linked to the complexity of the competitive balance concept in itself, as it has been seen as a 'catch-all' concept (Kringstad & Gerrard, 2007). In this respect, Kringstad and Gerrard (2007) summarize the concept of competitive balance by dividing it between the three fundamental dimensions win dispersion, performance persistence, and prize concentration (see also Gerrard, 2006). Kringstad and Gerrard (2007) further define competitive balance as the distribution of sporting outcomes in a league/tournament. They also suggest that their simple definition can be applied multidimensionally (see also Kringstad & Gerrard, 2004). This implies that the definition can be related both to within-season and across-season competitive balance.

The win dispersion dimension concerns within-season competitive balance. Studies drawing on this dimension find women's football leagues to have a significantly weaker competitive balance than the corresponding men's leagues in all Scandinavian leagues (Norway, Sweden, and Denmark) (Kringstad, 2018) and in Spain (Zambom-Ferraresi et al., 2018). Kringstad (2018) suggests that applying the same structural rules (e.g. the size of the goals) to genders, which in general have different physical capabilities, may be a reason for weaker competitive balance among women's leagues. For Spanish football, Zambom-Ferraresi et al. (2018) propose another explanation in that resources are

concentrated in a way where synergies from the men's teams (same club) are a driver. Further, the calculations presented in Haugen and Guvåg (2018) seem to find similar results when it comes to win dispersion in men's and women's football in several European football leagues.

Also, by looking at win dispersion in college basketball, competitive balance is indicated to be better in the men's leagues by both the Missouri Valley Conference (MVC) (Perline & Stoldt, 2008) and the National Collegiate Athletic Association (NCAA) 'Power Conferences' (Perline et al., 2018). Both articles use differences in revenue levels as an explanation for these results. Berri and Krautmann (2013), however, find that win dispersion is significantly better (in a competitive balance context) in the WNBA compared to the NBA.

The calculations shown in Haugen and Guvåg (2018) give mixed results between the genders when it comes to win dispersion in European handball leagues. On a general basis, Haugen and Guvåg (2018) find handball to have significantly weaker win dispersion than football. They use what they call a speculative explanation for this result when claiming that league governments in handball focus on the national team and not on the national league. Therefore, league governments allow one or two teams to be far ahead of the rest in order to attract the best players.

Across-season competitive balance is both about performance persistence and prize concentration (Kringstad & Gerrard, 2007). When it comes to performance persistence across seasons, Kringstad (2018) finds that the women's leagues in Scandinavian football have a significantly weaker competitive balance compared to their respective men's leagues. On the prize concentration dimension, this paper focuses only on championship concentration. Empirical results on measuring differences in championship concentration between the genders are mixed. Treber et al. (2013) look at intercollegiate basketball (NCAA) and find that championships are more concentrated in the women's league, just as they are in the MVC basketball (Perline & Stoldt, 2008). In Scandinavian football, the results were mixed (Kringstad, 2018) and when comparing the NBA with the WNBA, the differences were small (Berri & Krautmann, 2013). In Spanish football, the men's football league was the most concentrated (Zambom-Ferraresi et al., 2018).

When it comes to explaining differences in the level of competitive balance within and between league(s), the literature – such as, for example, Fort and Quirk (1995), Szymanski (2003), and Kringstad and Gerrard (2007) – has mainly focused on a financial starting point (i.e. drawing power). From there, possible adjustments may take place from various sources, such as institutional regulations on the product market (e.g. revenue sharing) and the labour market (e.g. salary caps), as well as from institutional frameworks (e.g. financial prizes from the UEFA Champions League) (see also Jang et al., 2019). Interestingly, there is also literature focusing on biology, directing attention towards the distribution of players' abilities in the so-called Gould hypothesis. This was originally applied to basketball and more specifically the advantages of very tall players (Schmidt & Berri, 2003; referring to Gould, 1986, 1996; and to Zimbalist, 1992a, 1992b). In a competitive balance context, the hypothesis is that it is positively related to increased population of playing talent. For example, Schmidt and Berri (2003) used the Gould hypothesis to explain the improved competitive balance over time in the major league baseball (MLB), as the sport went from a pool of talent based only on white Americans, to a larger pool that included African-Americans players and later also players from abroad (see also

Berri et al., 2005). In basketball, however, there is a limited population of tall people. These aspects restrict the global market for highly talented basketball players. Thus, based on the Gould hypothesis, NBA is expected to have weak competitive balance (Berri et al., 2005).

Methods

The level of a league's competitive balance is not decided only on the basis of measuring one certain dimension. This paper therefore aims to use the three dimensions stated above separately when measuring competitive balance. Hence, this study has no intention of combining dimensions into one single measure to detect a league's competitive balance level, such as in Humphreys (2002). One reason for this is that converting such a combined measure into a European team sport context, which has a promotion and relegation system between the tiers, is difficult. An overview of measures to measure the various dimensions of competitive balance can be found in, for example, Kringstad and Gerrard (2007), Evans (2014), and Owen (2014).

Based on Noll (1988) and Scully (1989), and presented in Quirk and Fort (1992), the ratio of standard deviation (RSD) has been the most common measure for win dispersion (see Fort, 2007 and Jang et al., 2019). It is defined as follows:

$$RSD = ASD/ISD \qquad (1)$$

where ASD is the actual standard deviation based on each team's win ratio and where draws are valued as half wins (Cain & Haddock, 2006; Fort, 2007; Owen, 2012). ISD is the idealized standard deviation where all teams have an expected win per cent equal to 0.5, equivalent to a perfect ex ante competitive balance (Owen & King, 2015).

However, Owen (2010, 2014), Owen and King (2015), and Lee et al. (2019) argue that the RSD does not take enough into account the factors that vary across leagues (i.e. the number of teams and matches), and they claim that RSD is biased when ex ante competitive balance is not expected to be (close to) perfect. Additionally, see Jang et al. (2019), who provide a list of relevant references in this regard. An alternative is to measure variance or distribution as a share of what Kringstad and Gerrard (2007) categorize as perfect competitive dominance. According to Owen et al. (2007), Horowitz (1997), Fort and Quirk (1997), and Utt and Fort (2002) describe that the situation of perfect dominance from a win distribution perspective is when the best team wins all matches, the second best wins all matches except the ones against the best, and so on. Further, on the basis of simulations, Owen and King (2015) conclude that measuring ASD as a ratio of the standard deviation in the case of perfect competitive dominance (ASD^{ub}) is, for example, a more appropriate measure (ASD^*) than the RSD when comparing win distribution across leagues. Therefore, this paper also uses ASD^*, which is defined as follows (Owen, 2010; Owen & King, 2015; see also Goossens, 2006):

$$ASD^* = ASD/ASD^{ub}, \text{ where } ASD^{ub} = \{[N(N + 1)]/[12(N - 1)^2]\}^{0.5} \qquad (2)$$

This formula is, according to Owen and King (2015), appropriate when ASD is calculated with (N-1) as denominator. In practice, measuring ASD^{ub} in the European leagues is usually straightforward because this formula fits with a balanced match schedule (Owen & King, 2015). However, this is not necessarily the case in North American team

sports. Rather, these leagues typically have a match schedule that deviates from the round-robin balanced schedule, where each team plays the same number of home and away games against each of the contestants. In this paper, to overcome this challenge in the North American team sports, a practical approach is used, even though Owen and King (2015, p. 733) claimed that ' … the simulation methods used can be adjusted to reflect the details of any unbalanced schedule of matches, in which a team may play some teams more frequently than others'. The practical approach used in this paper is to rank the teams on the basis of their ex post results (end-of-season table), and from this position make use of the same principle as in perfect competitive dominance. This is done within the framework of the actual match schedule for each season. Note that, according to Owen and King (2015, p. 743), ASD* is 'overestimating imbalance for shorter seasons', but compared to the RSD, it is among measures that are 'less sensitive to variation in season length and appear to offer a more useful basis for cross-league comparisons of competitive balance'. Owen and King (2015) also claim that using the RSD to compare competitive balance when a different number of games are played can ' … .lead to potentially misleading conclusions about the differences in the underlying degree of competitive balance'. This paper presents both RSD and ASD* because some leagues have few games (mostly among women's leagues), while leagues to be compared (i.e. level of competitive balance) in this study most often have significant differences in the number of teams and games.

The literature has focused on two main approaches when it comes to measuring performance persistence. First, Daly and Moore (1981) used the Spearman's rank correlation coefficient (SRCC) for measuring correlation across seasons, in which Groot (2008) later applied Kendall's Tau as an alternative measure. Second, Eckard (1998, 2001) and Humphreys (2002) used measures on the long-term variance in performance. The second approach is not included in this paper due to methodological difficulties in European team sports regarding the promotion and relegation system between the hierarchically ranked tiers. In line with previous studies (e.g. Daly & Moore, 1981; Maxcy, 2002; Maxcy & Mondello, 2006), this paper draws on the SRCC (3) to measure correlations across seasons:

$$SRCC = 1 - \frac{6 \sum_{i=1}^{N} (a_{i,t} - a_{i,t-1})^2}{N(N^2 - 1)} \qquad (3)$$

where $a_{i,t}$ is the ex post rank (standing at the end-of-regular-season t) for team i, while $a_{i,t-1}$ is the ex ante ranking (standing at the end-of-regular-season t-1) for the same team, i. However, this measure of performance persistence across seasons also has challenges in that not all teams are continuously playing in the league (i.e. top-division tier) over a long-term period, or even across seasons. Daly and Moore (1981) addressed this by only including the teams that continuously participated in MLB in North America over the sample period. This paper adopts a different approach, where new teams are included as the lowest ex ante ranked team in their first season, when expansions take place in the given North American team sports.

When applying SRCC in a competitive balance context, the starting point in this paper is the ex post rank among the teams that finish the regular season t in the top division. Normally in Europe, a few teams at the end-of-regular-season table will not have

played in the top division in the previous season (season t-1), because of the promotion−relegation system. In the constructed t-1 ranking for the teams finishing the regular season t in the top division, the promoted teams are ranked on the basis of their internal ranking in the regular season t-1 in the second tier, and ranked behind the teams that played in the top tier in the same season. Therefore, in these leagues, expansions or reductions of the top tier are only an adjustment of the general calculations. This approach also includes other adjustments such as relegation on an administrative basis.

As for the distribution of championship winners, this paper follows, for example, Gerrard (2004, 2006), Kringstad and Gerrard (2007), Kringstad (2018), and Zambom-Ferraresi et al. (2018) in applying the Herfindahl's index (HI) as the measure for concentration:

$$HI = \sum_i \left(\frac{W_i}{T}\right)^2 \qquad (4)$$

where W_i is the number of championships won by team i during T seasons. This paper uses a ten-season period (T = 10) for analysis, except for the NWSL where only five championships have been played during this period (i.e. T = 5). To account for this, the normalized HI (= HI*) is adopted. Following Owen et al. (2007), HI* = (HI−HI$_{lb}$)/(HI$_{ub}$−HI$_{lb}$), where HI$_{ub}$ = 1 in this paper (upper bound) and HI$_{lb}$ = 1/T (lower bound). For the NWSL, HI*(T = 5) will be calculated, and then there will be another adjustment to HI**(T = 10). HI**(T = 10) is the calculated HI that leads to that HI*(T = 10) equalling HI*(T = 5). This means for the NWSL that HI** = H*(HI$_{ub}$ − HI$_{lb}$) + HI$_{lb}$, where HI** and HI$_{lb}$ have T = 10, and H* have T = 5.

The empirical results in this paper are based on two-sample tests for differences in competitive balance between the genders in a certain domestic team sport. League by league, the results on RSD, ASD* and SRCC are tested for normality by the Shapiro−Wilk W test in Stata (www.stata.com). If the data for at least one of the two leagues in the same country are non-parametric, then the two-sample Wilcoxon rank-sum (Mann−Whitney) is applied. This is the case for German handball on the RSD, and for the ASD* and SRCC in Danish handball. When both samples are parametric, t-tests for either equal or unequal variance are applied. The latter is used for German and English football on SRCC, and for basketball on ASD* and SRCC. All other tests are t-tests for equal variance.

Data

The data in this paper are from the seasons 2007/08–2016/17 and come from three of the biggest football leagues in Europe (England, Germany and France) with regards to both genders. Further, because women's soccer in the USA is number one on the FIFA national team ranking, the NWSL and MLS (men's major league soccer) are also included. These countries are in the upper part of the FIFA ranking for women's football (soccer) as of March 2018 (together with Canada) (FIFA, 2018). Note that NWSL had its first season in 2013. Handball is another sport that is popular among both men and women. Germany (number one for men) and Denmark (number one for women) are chosen as two of the highest ranked leagues by the European Handball Federation (EHF) for the 2017/18 season, when taking both genders into consideration (EHF, 2016a; 2016b). Moreover, because of the relatively long history of the WNBA, it is included along with the NBA. Table 1 summarizes the leagues and team sports examined in this paper.

Table 1. Leagues for Both Men and Women.

Football (soccer)	Handball	Basketball
France (Fra)	Denmark (Den)	North America
Germany (Ger)	Germany	
England (Eng)		
North America (NA)		

Note. Data sources: rsssf.com, wikipedia.org, mlssoccer.com, nba.com, espn.com, fawsl.com, dhf.dk, sporten.dk and flashscore.dk.

Several of the leagues included in this study are characterized by differences in number of games played for genders. Because some of these leagues have relatively few games, both RSD and ASD* are adopted as measures for win dispersion. This is in turn motivated by the criticisms in Owen and King (2015). Table 2 gives an overview of the number of teams and games for each league for the last season of the sample period.

Empirical results

The following section presents the empirical results. Table 3 shows measures of the three dimensions of competitive balance in football (soccer), where two measures are for win dispersion, while the other two dimensions have one measure each.

The interpretation of the calculated values in Tables 3–5 is that when RSD is equal to one, the actual standard deviation of win percentage is equal to the ex ante expectation of a perfect balanced league in the win dispersion dimension. For the same dimension, the ASD* measures closeness to perfect competitive dominance. In Table 3, this means that for women's leagues in European football, the win dispersion measured by the RSD is from nearly two to nearly two-and-a-half times the dispersion of ex ante perfect competitive balance, which is consistent with the results in Kringstad (2018). Further, the calculated values of the ASD* in these leagues are between 0.71 and 0.80. This means that the standard deviation of their actual win percentages is between 71% and 80% of the standard deviation of the win percentages in a perfectly dominant league. One reason for the differences in the results of RSD and ASD* in England is related to both the number of teams in the top divisions and to the fact that one of the women's seasons had few matches (only one match against each other). According to Owen and King (2015) this means that the ASD* might be overestimated for the women's league. On the other hand, their suggestion is that the ASD* should be preferred when there are such differences in the number of

Table 2. The Number of Games and Teams in the Leagues for the 20(16/)17 Season.

	Football (soccer)				Handball				Basketball			
	Women		Men		Women		Men		Women		Men	
	G	T	G	T	G	T	G	T	G	T	G	T
Ger	22	12	34	18	26	14	34	18	–	–	–	–
Fra	22	12	38	20	–	–	–	–	–	–	–	–
Eng*	16	9	38	20	–	–	–	–	–	–	–	–
NA	24	10	34	22	–	–	–	–	34	12	82	30
Den	–	–	–	–	22	12	26	14	–	–	–	–

Notes. *In the case of the English Football Association Women's Super League (FA WSL), it is the 2016 season that is presented in the table, because 2017 was only a spring season, where 9 teams played 8 games each. G = number of games; T = number of teams.

Table 3. Competitive Balance in Football (Soccer) for the Period 2007/08–2016/17.

	Win dispersion						Performance persistence			Championship concentration	
	RSD			ASD*			SRCC			HI	
	W	M	Δ	W	M	Δ	W	M	Δ	W	M
Ger	2.21	1.63	0.58***	0.72	0.45	0.27***	0.82	0.47	0.35***	0.30	0.54
Fra	2.45	1.58	0.87***	0.80	0.41	0.39***	0.77	0.56	0.21***	1.00	0.22
Eng	1.92	1.87	0.05	0.71	0.49	0.22***	0.56	0.75	0.19*	0.34	0.30
NA	1.41	1.13	0.29**	0.45	0.31	0.14***	0.42	0.32	0.10	0.28	0.16

Notes. ***Significant at 1% level. **Significant at 5% level. *Significant at 10% level. Note: Period for women in England: 2006/7–2016; Period Major League Soccer (MLS): 2008–2017; Period National Women's Soccer League (NWSL): 2013–2017, and this league's HI(T=5) = 0.36 and HI*(T=5) = 0.2. For MLS and NWSL, HI is calculated on the basis of the play-off winners.
W = Women; M = Men.

Table 4. Competitive Balance in Basketball for the Period 2007/08–2016/17.

	Win dispersion						Performance persistence			Championship concentration	
	RSD			ASD*			SRCC			HI	
	WNBA	NBA	Δ	WNBA	NBA	Δ	WNBA	NBA	Δ	WNBA	NBA
NA	1.91	2.87	0.96***	0.49	0.53	0.04	0.33	0.64	0.31***	0.24	0.16

Notes. ***Significant at 1% level. **Significant at 5% level. *Significant at 10% level. Championship concentration on basis of play-off winners.

Table 5. Competitive Balance in Handball for the Period 2007/08–2016/17.

	Win dispersion						Performance persistence			Championship concentration	
	RSD			ASD*			SRCC			HI	
	W	M	Δ	W	M	Δ	W	M	Δ	W	M
Ger	2.31	2.67	0.35***	0.75	0.73	0.02	0.82	0.87	0.05	0.42	0.54
Den	2.29	2.23	0.06	0.74	0.68	0.06	0.70	0.66	0.04	0.28	0.24

Notes. ***Significant at 1% level. **Significant at 5% level. *Significant at 10% level. W = Women; M = Men.

teams and games. Hence, in sum, the win dispersion dimension of competitive balance shows that it is much weaker among the women's football leagues compared to their respective men's leagues in Europe. This is also evident as the average ASD* for the women's leagues in Germany, France and England is about 0.74 compared to 0.45 for the respective men's leagues. As such, results for Germany and France are consistent with Haugen and Guvåg (2018). An interesting observation is that the average level for the men's leagues in Europe is similar to win dispersion (ASD*) for the NWSL. However, the men's North American soccer (MLS) is also significantly better balanced here than in the respective women's league.

When it comes to performance persistence, the strong, significantly weaker competitive balance for the women's leagues in Germany and France is in line with the findings in Scandinavian football (Kringstad, 2018). Again, relatively large differences in the level of persistence across seasons between the genders are observed, with an SRCC of around 0.8 in these women's leagues compared to around 0.5 for the men's leagues in the same country. SRCC equal to one is equivalent to a complete replication of the

ranking from last season, while an SRCC equal to zero means no correlation in rankings across the two seasons. An interesting result is found for the men's English Premier League, as the performance persistence is very high compared to the German Bundesliga and the French Ligue 1, and close to the average on these countries' female football leagues. Moreover, in England, the women's league is actually better balanced (weak significant) than the men's league, when it comes to performance persistence. The English league for women is hence better balanced in this dimension than the German and the French women's leagues. In North America, there is no significant difference between the NWSL and the MLS. In general, the results for performance persistence are not one-sided between the genders, as in win dispersion. Further, competitive balance for this dimension in football also seems to be better in North America compared to Europe.

Consistent with the literature, it is more difficult to find a clear pattern when it comes to championship concentration between the genders. The interpretation of the HI is that perfect dominance gives HI = 1 and when HI = 0.1, it measures perfect competitive balance. The men's league is more concentrated in Germany (dominated by Bayern Munich), while in England and North America the differences between the genders are small for the measured HI. The French league, however, stands out from the others by having a relatively moderate concentration of championship winners for the men's league (Ligue 1), while the women's league (Divison 1 Féminime) has a perfect competitive dominance in this dimension, as Olympic Lyon won all the championships over the ten seasons (in fact, this team only lost four league matches during the ten seasons analysed in this paper).

Table 4 shows that in professional basketball in North America, the results differ significantly from the football (soccer) leagues in Table 3, in that win dispersion is not worse, but rather slightly better in the WNBA compared to the NBA, when applying the ASD*. Drawing on the RSD, however, the difference is strongly significant, which is consistent with the findings in Berri and Krautmann (2013), using the same measure (RSD) for the seasons 1997–2010. In other words, this is another case where the criticism in Owen and King (2015) is relevant, as the RSD is expected to be higher for the NBA, with 2.5 times as many teams and close to the same proportion of the number of games as the WNBA (see Table 2).

The WNBA is strongly and significantly better balanced when it comes to the performance persistence dimension of competitive balance. The measured HI, on the other hand, suggests that the WNBA is (slightly) more concentrated than the NBA. Looking at ASD*, the average is much lower (better balanced) than for women's football in Europe. The same results apply for performance persistence.

Based on the German and the Danish handball leagues presented in Table 5, it is difficult to find any one-sided results in competitive balance between the genders, when ASD* is used for measuring win dispersion. However, similar to the basketball leagues, in Germany especially, the number of teams and games for men are higher (Table 2). According to Owen and King (2015), this may explain why the RSD suggests a strong significant difference towards weaker balanced men's leagues in German handball. In general, the calculated averages indicate that these leagues have weak competitive balance when it comes to win dispersion (for Germany, this is consistent with Haugen & Guvåg, 2018) and also for performance persistence, as well as for the championship concentration in German handball. Compared to football, the two first dimensions are in line with the women's league in Germany and France. Findings therefore suggest that there may be a general competitive balance problem for domestic handball leagues.

Conclusions and discussions

The focus in this paper has been on analysing whether there are systematic differences in competitive balance between the genders among the bigger sports leagues. Interestingly, this study shows that there are indeed gender specific differences in sports, however, this is not the case for all sports included in this paper. When it comes to football (soccer), competitive balance seems to be weaker in the women's league, while in North American basketball the tendency is rather the opposite. In handball, there may be no significant differences in competitive balance between the genders.

For the football (soccer) leagues (France, Germany, England and North America), competitive balance is strongly and significantly weaker for women compared to the respective men's leagues for the dimension of win dispersion. Hence, this paper supports the results in Kringstad (2018) on Scandinavian leagues and Zambom-Ferraresi et al. (2018) on Spanish football, as well as for a number of other European football leagues in Haugen and Guvåg (2018). When it comes to performance persistence, the only study that measures this dimension in women's football seems to be Kringstad (2018) for Scandinavia, who also found here that the women's leagues have a strong, significantly weaker competitive balance. However, the results in this paper are not that clear. Only France and Germany have a strong significant difference between the genders, while it is smaller and insignificant among the soccer leagues in North America. England is the big exception, where the women's league has a (weak) significantly better competitive balance than the men's league in the performance persistence dimension. Moreover, an interesting observation from this paper is that the most popular league, the English Premier League, has a weak competitive balance in the performance persistence dimension, with an index in line with the women's leagues in France and Germany. This is much weaker than for the other football leagues for men in this study. A more detailed analysis of competitive balance in English football (both genders) is beyond the scope of this paper, but is an obvious possibility for future research.

While Haugen and Guvåg (2018) claim that handball has a significantly weaker win dispersion than football, it is only for the men's leagues that this result seems to be valid in this study. Further, interpreting the values from the measured competitive balance indexes, European football leagues for women may have a competitive balance problem. This is also the case for handball, regardless of gender, and especially for the dynamic competitive balance in men's handball in Germany. For these leagues, based on the uncertainty of outcome hypothesis, weak competitive balance may affect demand negatively. Especially in leagues struggling with low demand, smaller interest can be challenging for revenues, relatively speaking, as this can be a threat for the financial viability at league level. Thus, this is at the core of managing professional leagues. Here, league associations should be aware of the findings from several studies concerning the negative relationship between weak competitive balance and broadcaster viewers (see, for example, Buraimo & Simmons, 2008 and García & Rodrígues, 2006), as well as the positive relationship between uncertainty of match outcome and competitive intensity to attendance in the UEFA Women's Champions League (Valenti et al., 2019). However, historically mixed empirical results on the uncertainty of outcome hypothesis requires further analysis to detect whether weak competitive balance negatively affects demand in these leagues. Another consequence of weak competitive balance in European team sports is

the potential threat to create a breakaway league, as the suggested European Super League in male football (Hoehn & Szymanski, 1999; Ramchandani et al., 2018).

Another interesting finding from analysing competitive balance in different football leagues is that competitive balance seems to be better in the North American NWSL compared to the European women's football leagues. Moreover, for the competitive balance measures adopted in this paper, NWSL is either equally or better balanced than the men's leagues in Europe. Further, the MLS seems to be better balanced than the men's leagues in European football. Analysing possible reasons for the much better competitive balance in North America compared to the football leagues in Europe should be of great interest for future research, as well as for league management. In North America, a difference from the European teams seems to be the use of salary caps and drafting systems (Jewell, 2014; MLS, 2018; www.nwslsoccer.com/roster-rules). However, more research is needed to analyse whether these labour market restrictions are drivers for better competitive balance in the MLS and NWSL compared to European football (soccer) leagues. Note that introducing labour market restrictions in a given European league is not straightforward, both because it may reduce a league's top teams' international competitiveness and because the Bosman's verdict restricts the use of labour market restrictions. An alternative, also suggested by Kringstad (2018), is to look at the revenue side of the clubs, where one example is to apply a relatively equal distribution of revenues from, for example, the sale of media rights at league level. Here, the MLS has a business model that seems to deviate from the European football clubs (Lucas, 2018; MLS, 2018; Szymanski, 2015). Whether interventions, both from the product and the labour market, should be introduced or extended in European leagues are issues highly relevant for league management. One complication is, however, that subsequent effects may not only be on competitive balance, because they could also happen at the expense of domestic clubs' international competitiveness (see, for example, Jang et al., 2019). The latter is especially relevant in European football and handball, through the Champions League arranged by both UEFA and the EHF.

Handball has approximately 70% female players, with 19 million female players (Saavedra et al., 2018) amongst a total of 27 million players (IHF, 2019), whereas about 25% of the basketball players in the USA are female (Sports & Fitness Industry Association, 2012). Hence, of the sports studied in this paper, football (soccer) is the one where the worldwide differences in participation between genders are greatest, as the share of women players was tallied to be about only 10% at the start of the sample period (Kunz, 2007). Combining this result with the fact that, in many leagues, full professionalism with a significant level of wages (higher than players' opportunity costs) makes the pool of talent much larger in men's football compared to women's football. Hence, if the Gould hypothesis is valid, this hypothesis may be a plausible explanation for the significant differences in competitive balance between the genders in football (soccer). Further, interpreting Treber et al. (2013), there is an analogy from basketball, where the interest, the opportunities and the financial pay-off for players have been much higher for men. These aspects are very interesting for management of sports leagues and for future research, both because there is an increasing number of women players and because the wage level, at least in the bigger leagues, is growing. Following the Gould hypothesis and the weaker competitive balance in women's football, a policy implication is to increase the number of women players willing to put their effort into reaching the required playing level. This is important both for domestic governing bodies as well as the UEFA and FIFA, and would also require

attention to the matter of reducing the counter effects of a lack of financial rewards, following Treber et al. (2013). Looking back to competitive balance in the NWSL, the level is in line or better than that of the men's European football leagues, indicating that their way of structuring the league play is more effective. However, in a competitive balance context, this can also be reflected by the Gould hypothesis, as the pool of talented players is larger, compared to what has been the situation even among the biggest women's leagues in European football. For example, in 2016, there were close to 107,000 registered female football players in England (UEFA, 2016), whereas already ten years earlier, the number in the USA was close to 1.7 million (Kunz, 2007).

Applying the Gould hypothesis in a competitive balance context to the basketball leagues (NBA and WNBA), the higher number of men's basketball players in North America may be compensated for by the lower number of teams in the WNBA. In handball, more women play the game. Therefore, one should expect the women's leagues to have a better competitive balance than their respective men's leagues, but this is not supported by the results in this study. The counter-effect of smaller financial rewards in women's basketball, mentioned in Treber et al. (2013), may also be relevant in handball, where wages at least at the top level, seem to be higher for men, when a comparison is made between the highest paid male players (Arshad, 2018) with the highest paid female players (Handball Planet, 2018).

Another study focusing on biology and sports (football) is Pedersen et al. (2019). They direct the attention to the physical differences between the two genders and elucidate how this affects the game when comparing women's games to men's games (see also FIFA, 2015). Although not related to a competitive balance context as such, Pedersen et al. (2019) claim that physical differences in an equal framework (i.e. size of the field, size of the goal etc.), makes the game 'much more demanding for women' (p. 1). Juxtaposing their reasoning with the findings in this study can offer an interesting research agenda. More specifically, this study finds that competitive balance is much weaker in women's leagues compared to men's leagues for football (soccer), while such gender differences are not observed in handball and basketball. Interestingly, in a similar vein to Pedersen et al. (2019), it is possible to propose that this can be attributed, at least partly, to the fact that whereas basketball and handball have gender-specific structural frameworks, the structural framework in football is irrespective of gender, despite physical differences (FIFA, 2015; International Handball Federation, 2016; NBA, 2018; WNBA, 2018). Thus, combining competitive balance and sports science seems promising. Findings in this respect will have potential major implications for league management, both at the national and international level.

To conclude, this paper finds that in football (soccer), win dispersion and, in part, performance persistence give a clear indication of weaker competitive balance for women's leagues compared to the respective men's leagues. However, these results are not applicable in handball, while in North American basketball, the WNBA may rather be better balanced than the NBA. Hence, this paper shows mixed results regarding differences in competitive balance between genders in team sports. Due to the mixed results and that some leagues have (very) weak competitive balance in this study, policy and management implications are multi-faceted (i.e. differences related to genders, sports, and continents). Women's football associations, especially in Europe, should analyse the significantly weaker competitive balance compared to the respective men's leagues and consider

possible actions from market regulations and/or from the sporting framework. The level of market regulations as well as tournament structure differ between European and North American football (soccer). These can be important tools for football associations in Europe to reduce the indicated competitive balance gap across the Atlantic. Moreover, this study find that handball has a weak competitive balance in general. This implies that handball associations need to consider whether their current tournament and market structure are appropriate. The results of this study also imply that in Europe, domestic handball associations (both genders) and domestic women's football associations need to take their competitive balance situation seriously. Does the weak competitive balance in these leagues reduce interest in relative terms and urge an underlying threat related to the creation of European Super Leagues?

Limitations and future research

This study has only focused on team sports, even though research have also been conducted on competitive balance between the genders in individual sports, such as tennis (Du Bois & Heyndels, 2007) and 100-metre races in athletics (Frick & Scheel, 2014). A limitation is related to the number of leagues studied. Because the sample period in this study goes back ten seasons, the priority has been to use relevant leagues within this constraint. Another limitation is that this study focuses on competitive balance, and hence other factors affecting demand are not included. These aspects should be taken into account in future research. The first can be solved by applying cross-sectional analysis over many leagues. Demand studies can both analyse effects from competitive balance on demand and, not least, a panel data analysis could include a number of other possible determinants, such as uncertainty of outcome at match level. Kringstad and Olsen (2016) analyse the relationship between revenue distribution and sporting outcome in football (soccer). A similar analysis would have been interesting for the leagues in this study. Further, cross-sectional analysis on competitive balance, based on data from many domestic leagues and both genders can be used in regressing variables related to, among others, the distribution of drawing power, market interventions, and tournament and prize structure. By including a gender dummy variable, this would extend the analysis and management implications from this study by isolating gender effects on competitive balance drivers. In addition, future research should also, based on the findings in Pedersen et al. (2019), examine if differences in competitive balance between genders can be attributed to structural differences between men's and women's sports.

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