Can International Elite Sport Success Trickle Down to Mass Sport Participation? Evidence from Danish Team Handball

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Abstract

Many scholars do not find evidence of a trickle-down effect from elite sport success to mass sport participation. Contrary to what is assumed by the trickle-down effect "theorem", successful elite sportspeople do not seem to inspire amateurs to take up sport themselves. However, recent studies present evidence that elite sport can have an influence. In this article, we apply regression models on time series data from one of the most successful Danish sports, team handball. Our findings are mixed, but lean towards supporting scholars who argue that trickle-down effects are not necessarily an inherent part of international sporting success. Further studies should examine more sports to identify where trickle-down effects occur and why.

Keywords: Trickle-Down Effects; Elite Sport Success; Mass Participation; Team Handball; Denmark.

JEL Classification: L83; D62; D12

I. Introduction

The question of whether people are inspired by elite sport success to take up sport themselves, or become more active, has been studied intensively in the sport sciences over the years (Weed et al., 2015a). This "trickle-down effect", also pointed to in economic theory and studies (Frick & Wicker, 2016a), assumes that elite sporting success has various (positive) impacts on recruitment and/or activity patterns, thus increasing membership in amateur sport clubs (Nielsen, 2002). This argument is typically used by politicians and public authorities to justify investments in elite sport (De Bosscher, Sotiriadou, & van Bottenburg, 2013), or to use large amounts of money to attract international sporting events to their nation or city (Mahtani et al., 2013). For example, one of the arguments behind the bid for the 2012 Olympics in London was that hosting the event would "inspire a generation" to become physically active (Carter & Lorenc, 2015).

However, while the trickle-down effect assumption seems prevalent among decision and policy makers, previous research has failed to identify a clear connection between elite sport and local participation in sport (De Bosscher et al., 2013). On the other hand, some studies have shown that it is difficult to find evidence of trickle-down effects (Carter & Lorenc, 2015; Craig & Bauman, 2014; Storm & Asserhøj, 2015), and that the effects can even be negative (Feddersen, Jacobsen, & Maennig, 2009; Hogan & Norton, 2000). When positive effects are present, according to Coalter (2004), Weed (2015a), and Haut (2017), they often materialize as re-engagement among participants who had ceased to be active, as decisions to switch to new sporting activities, or more frequent participation among those who are already active. This is backed by research

results from Mutter and Pawlowski (2014b), who find that people who are already active are motivated to train more frequently after they have been exposed to international sporting success.

While previous research is sceptical to the trickle-down idea, new evidence has emerged challenging this research. For example, Weimar, Wicker and Prinz (2014) find positive effects resulting from hosting major sports events on German amateur club membership figures. Similarly, Frick and Wicker (2016a) identify positive effects from World Cup titles won by the national German men's soccer team. Further, Aizawa et al. (2016) find that elderly Japanese who experienced the 1964 Olympics seem to participate more in sport than other generations.

These new studies challenge the overall picture of how elite sport affects mass participation. As pointed out by Frick and Wicker (2016a), differences in methodologies might partly explain the difference of the results. Additionally, findings can vary due to systemic differences across nations and contexts affecting how a potential trickle down-effect materializes – if at all. As can be seen in Appendix 1 – which contains a selective overview of methodologies and findings from (reviewed) published journal papers on the subject – approaches vary from the use of qualitative data (eg. Macrae, 2017) and descriptive analyses of quantitative data (eg. Hodgetts & Duncan, 2015) to systematic reviews (eg. Mahtani et al., 2013), and advanced studies applying correlational analyses (eg. De Bosscher et al., 2013) or multivariate regression estimation techniques (eg. Wicker & Frick, 2016a). Further, the listed papers are based on data from different contexts ranging from Germany (eg. Weimar & Schauberger, 2017) to China (eg. Li & Luk, 2011); over Great Britain (eg. Reis, Frawley, Hodgetts, Thomson, & Hughes, 2017), to Australia (eg. Hodgetts & Duncan, 2015), and Canada (eg. Craig & Bauman,

2014).

The mixed findings provided by existing studies point toward the need for more research into the mechanisms of trickle-down and additional factors determining mass participation. Further, the use of different methodologies needs to be taken into consideration. As pointed out by Frick and Wicker (2016a), secondary data is preferable to primary data; longitudinal data is preferable to cross-sectional data, and multivariate statistical techniques is preferable to bivariate correlations or descriptive analysis.

This study aims to follow this logic to overcome the problems of previous research and to add more evidence from Denmark which has not been studied previously. We use econometric techniques applied to Danish data in order to test whether results from the newly emerging studies are generalizable to other sports and (national) contexts. This is relevant because more evidence on the subject can assist politicians and sport managers in their decision-making regarding – for example – initiatives aimed at enhancing mass participation.

II. Data and Methodology

The Danish case

One of the most successful Danish sports when it comes to international titles is team handball. In the 1990s, the women's national team won two European Championship (EC) titles as well as one Olympic gold medal and one World Championship (WC). This success continued after the millennium until 2004 with a further two Olympic gold medals and one EC title (see Table 1). The men's team won their first EC title in 2008, and repeated their success in 2012 before winning the Olympic gold in 2016.

Table 1: Titles won (gold) by the Danish men and women national handball teams, 1950-2016

Title	Team	Month of title won	Year
European Championship (EC)	Women	September	1994
Olympics Games (OG)	Women	August	1996
European Championship	Women	December	1996
World Championship (WC)	Women	December	1997
Olympic Games	Women	August	2000
European Championship	Women	December	2002
Olympic Games	Women	August	2004
European Championship	Men	January	2008
European Championship	Men	January	2012
Olympic Games	Men	August	2016

Team handball is the second-most popular national sport in Denmark (after soccer) and enjoys a high level of media coverage (Hedal, 2006). This suggests that if trickle-down effects are present in Danish sports, team handball – theoretically – would be a relevant sport discipline where these may be encountered. To test this assumption, we examine whether sporting success demonstrated by the men's or women's Danish national teams in handball have affected amateur participation.

Data

Annual (secondary) data on active adult men's and women's memberships, as well as children's memberships overall, were gathered from the Danish Handball Federation's (DHF's) website. Membership data on children were first separated by gender in 1988, and are therefore handled together below. Figure 1 display the development in annual members (normalized values) for men, women, and children respectively.[i]

Figure 1: Development in annual membership figures (men, women and children), 1964-2016 (normalized values, respective mean: 100) and combined EC, WC and OG top 8-points for the men's and women's national team in handball

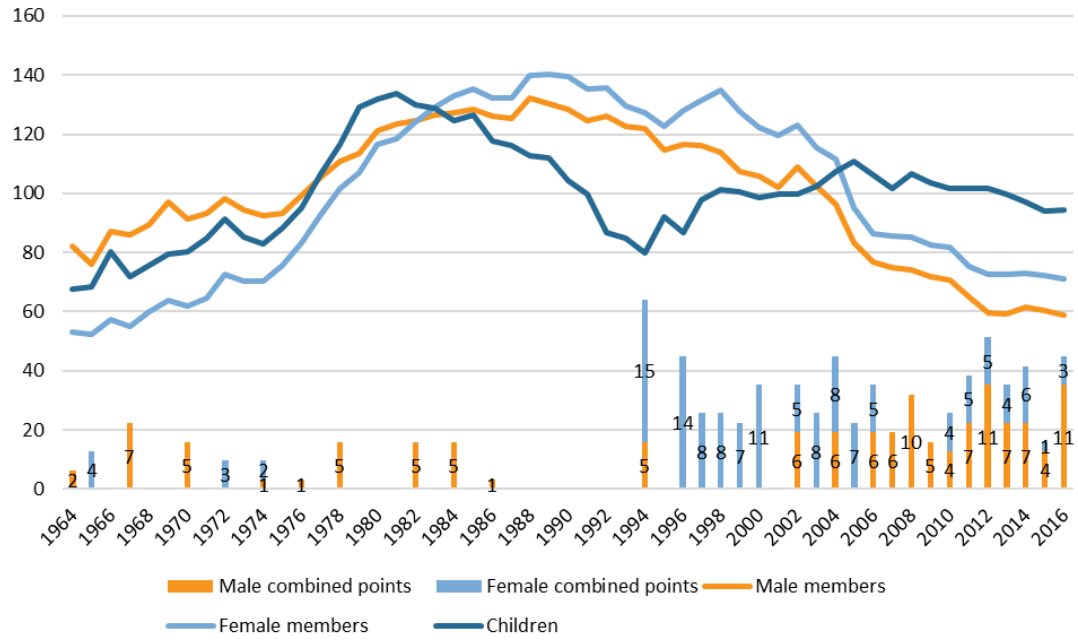

Figure 1 shows a general increase in all membership figures, peaking around the mid-1980s then slowly declining thereafter. Top 8 points awarded at ECs, WCs, and OGs (where gold medals won at these tournaments are awarded 8 points, silver medals 7 points, down to 8th places which are awarded one point) reflects the variation in Danish men's and women's international success.

It appears that participation peaked in the eighties, where the national teams were not particular successful. However, after a large decline in children's memberships between 1982 and 1994, it started increasing between 1995 and 2005 more or less in parallel with the success of the women's national team. This correlates with the rhetoric that young people are the most likely to be inspired by their heroes on the sporting field (Carter & Lorenc, 2015). Adult membership declined during Denmark's most successful period in international handball, and this also applies to children's

memberships between 2005 and 2016, despite this being the most successful period for the men's national team.

Statistical Methods and Variables

Inspired by Frick and Wicker (2016a), we deploy regression model techniques to test how sporting success influences membership with membership data being our dependent variable. This approach makes it possible to capture different aspects of trickle-down in the same methodologic design.

According to De Bosscher (2013), studies examining trickle-down effects usually treat the question on one of three dimensions; a) The inspirational function of elite performances (see for example: Hogan & Norton, 2000); b) The inspirational function of elite athletes (sport stars as personalities) (see, for example: Mutter & Pawlowski, 2014a); and c) The inspirational function of legacy of elite events (see for example: Aizawa et al., 2016).

Our estimation strategy aims at covering all of these aspects, which have only been covered sporadically in existing literature and are usually analyzed separately. First, dimension a) is taken into consideration by using international results of the Danish men and women national teams as the independent variable(s). While Frick and Wicker (2016a) argue that elite sport is a winner-takes-all market, and hence use gold medals as indicators of sporting success, we argue that a strong performance, not necessarily materializing in a gold medal, may also influence amateur participation in a positive way. Therefore, and thus improving existing research, we use a linear index based on top-eight successes in the WC, EC and OG as described by Storm, Nielsen and Thomsen (2016), allowing for higher variation in this independent variable instead of entering titles won as dummy variables.

Results are entered to our models in the year events are won because trickle-down effects are more likely to be noticed shortly after the positive result (Nielsen, 2002). Yet, for titles won in December (se Figure 1), the potential effect is expected to set in the following year, and variables are entered as N+1.[ii] Because the data points are relatively few, we combine the results from OG, EC and WC into one variable in our primary models to ensure robustness. Thus, in the years where two championships took place, the aggregate of the top 8 points have been accumulated.

Second, and in relation to b), it is well known that star players can affect attendance at sports games (Jewell, 2017). Theoretically, this assumes that the presence of certain sports stars could have an inspirational effect on amateurs. To test the inspirational effect of sports stars, we construct models including dummy variables for outstanding athletes in the years where they were key figures in the Danish national teams.

The third dimension c) is covered by a host dummy testing whether Denmark hosting/co-hosting a tournament materializes as a membership legacy due to the increased focus on the event in the media.

Further, as other factors may also influence sport participation, we control for general trends by using a variable covering the total (aggregated) Danish membership for all organized sports (DIF memberships). In correspondence with Haut and Gaum (2017) and Wicker and Frick (2016a), we argue that this data represents other significant trends in sport participation resulting, for example, from changes in average annual working hours or annual real wages in the industrial sector, which is usually anticipated to affect mass participation patterns. Finally, similarly to Frick and Wicker (2016a) we include a lagged dependent variable in our AR1 models (see below),

because a current year's memberships "strongly" depend on the "respective number in the previous year." (p. 260)

In our adult models, we distinguish between men and women, thus estimating separate gender models because determinants of participation are expected to be different for men and women (Downward, Lera-López, & Rasciute, 2014). As mentioned above, data for children by gender are not available for the entire period, and are thus handled together.[iii]

As our data were collected for the same observational unit at multiple time periods, we are thus dealing with time series data. We have tested for stationarity and find that all three dependent variables contain time trends (as described in Durlauf & Phillips, 1988). To address this problem, we present three sets of regression models for each dependent (male adults, female adults, and children respectively): ordinary least squares (OLS) (equation 1), first order autoregression (AR1) (equation 2) and first difference regression (equation 3).[iv]

[1] $Y = \beta_0 + \beta_1 X_1 + e$

[2] $Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 X_1 + e_t$

[3] $\Delta Y_t = Y_t - Y_{t-1}$
$\Delta X_t = X_t - X_{t-1}$
$\Delta Y_t = \beta_0 + \beta \Delta X_t + e_t$

The first difference model is the traditional approach to avoiding the problem of non-stationary variables. However, since using first differences to correct for non-stationarity removes the information about equilibrium relationships between variables that can be seen when they are expressed in their original units, we have also included

OLS models. For robustness, we include first order autoregression models for each dependent variable. Dickey-Fuller tests of the variables as well as the residuals of the OLS models show that we should place most weight on the first difference models.[v]

III. Results

Tables 2–4 summarize the results of the estimated regressions for the effect of handball sporting success on club membership among adult men, adult women and children. We further ran models including "sports star" variables (not reported, but available upon request). However, we found no evidence that these exercise a positive influence on memberships. Due to the above-mentioned problems with relatively few data points, variables considering the presence of sports stars were, thus, excluded from our final models. This did not change the overall results.

Table 2: The impact of combined title standings (top 8 points) on the number of active adult men in the Danish Handball Association (DHF) 1964–2016

	Model 1.1 (OLS)	**Model 1.2 (AR(1))**	**Model 1.3 (First Difference)**
Lagged dependent	---	0.974***	---
		(0.033)	
Female WC EC OG	-206.704	-118.958**	-51.433
	(207.061)	(47.075)	(41.386)
Male WC EC OG	-1286.227***	-81.486	-75.122
	(247.047)	(69.656)	(53.715)
Female host	-2460.901	-295.381	-252.174
	(2871.797)	(655.789)	(462.551)
Male host	720.490	718.293	100.349
	(3680.425)	(835.026)	(652.747)
DIF membership	2.912	-0.587	2.547
	(2.305)	(0.537)	(3.847)
Constant	26,452.91***	1889.797*	-148.514
	(3030.494)	(1087.989)	(198.114)
R-squared	0.405	0.970	0.103
N	52	52	51

Note: Displayed is the unstandardized coefficient (SEs in parentheses): *p < 0.10, **p < 0.05, ***<0.01. *Female WC EC OG, Male WC EC OG, Female host* and *Male host* are lagged one year.

Table 3: The impact of combined title standings (top 8 points) on the number of active adult women in the Danish Handball Association (DHF) 1964–2016

	Model 2.1 (OLS)	**Model 2.2 (AR(1))**	**Model 2.3 (First Difference)**
Lagged dependent	---	0.990***	---
		(0.032)	
Female WC EC OG	-118.300	-118.452**	-52.965
	(212.590)	(45.930)	(40.585)
Male WC EC OG	-1293.825***	-52.836	-38.595
	(253.644)	(68.121)	(52.675)
Female host	-1804.037	513.283	341.762
	(2948.492)	(641.481)	(453.598)
Male host	72.586	891.304	118.454
	(3778.716)	(816.820)	(640.113)
DIF membership	12.952***	-0.743	5.498
	(2.366)	(0.679)	(3.772)
Constant	8557.678***	1699.464**	-45.894
	(3111.428)	(708.439)	(194.279)
R-squared	0.486	0.977	0.114
N	52	52	51

Note: Displayed is the unstandardized coefficient (SEs in parentheses): *p < 0.10, **p < 0.05, ***<0.01. *Female WC EC OG*, *Male WC EC OG*, *Female host* and *Male host* are lagged one year.

Table 4: The impact of combined title standings (top 8 points) on the number of active children in the Danish Handball Association (DHF) 1964–2016

	Model 3.1 (OLS)	**Model 3.2 (AR(1))**	**Model 3.3 (First Difference)**
Lagged dependent	---	1.016***	---
		(0.054)	
Female WC EC OG	-825.999*	522.288***	344.622**
	(477.792)	(177.966)	(142.932)
Male WC EC OG	-555.109	278.074	135.759
	(570.061)	(199.237)	(185.508)
Female host	786.507	1022.461	417.480
	(6626.674)	(2257.69)	(1597.461)
Male host	8384.833	3293.978	453.201
	(8492.584)	(2906.076)	(2254.321)
DIF membership	18.741***	-7.161***	6.879
	(5.319)	(2.279)	(13.285)
Constant	53,886.61***	7146.308**	211.135
	(6992.868)	(3448.843)	(684.203)
R-squared	0.237	0.913	0.163
N	52	52	51

Note: Displayed is the unstandardized coefficient (SEs in parentheses): *p < 0.10, **p < 0.05, ***<0.01. *Female WC EC OG, Male WC EC OG, Female host* and *Male host* are lagged one year.

As can be seen from the tables, our models reveal significant effects for some of our success variables. This is the case for the Female WC EC OG in model 1.2 (at the 5% level), and Male WC EC OG in model 1.1 (1% level) for adult men's participation although these results are negative. Model 1.3 (preferred), however, does not show any significant effect. Besides the lagged dependent variable (1.2) (1% level), no other variables reflect significant effects on men's participation.

The sporting success variables for adult women reveal negative significant effects in model 2.1 (1% level) and 2.2 respectively (5% level), but no significant effects can be identified in our preferred first difference model. As in the men's models, only the lagged dependent is significant among the rest of the entered variables.

For children, our model output suggests some effect in relation to sporting performance of the women's national team. However, while they appear significant and

positive in the auto regression model (3.2) (1% level) and the preferred first difference model (3.3) (5% level), they are negative in model 3.1. Hence, the figures produced by the models only partly support the theoretical assumption that sporting success can have a positive impact on participation levels.

Figure 1 shows children's membership increased parallel to the success of the women's team (from 1994), and that of (from 2003) the men's team. However, this effect was not consistent as there was a decline in all membership figures after 2005, including that of children, despite the continued success of the men's team and to a lesser extent that of the women's team.

In total, this pattern indicates that if a trickle-down effect is present, it is not permanent. Following the initial excitement of attaining success, people seem to adjust to the successful status of their national representatives, and are less affected by results now perceived as "normal" or expected.

IV. Conclusion

This paper has aimed to test whether results from recent studies of the trickle-down effect can be generalized to other nations and sport disciplines. Deploying an improved methodological design – incorporating several aspects of trickle-down and more variation in our success variables than previously seen – we produce a mixed set of results. The weight of evidence, however, suggests that trickle-down effects in Danish handball cannot be said to exist *per se*. Even though some of the model output indicates a positive effect, negative effects are found in other cases. In relation to our preferred models, output indicates an effect in respect of children for limited periods.

The significant effects found in the children's models are associated with the start of the successful period of Danish handball, and only indicate that trickle-down effects can occur under specific circumstances and in relation to specific groups.

Further, these are not permanent, and the total impression from our analysis suggests that even though sporting success might inspire some children, over time they adapt to high levels of success which seems to remove the inspirational function of elite sport performances. Further, the personality of star players and hosting a tournament does not seem to affect membership.

Perspectives

The findings generally support the argument put forward by Weed et al. (2015a) that the trickle-down effect is not an inherent part of the outcome of elite sporting success. This is an important finding. On the one hand, it cannot be denied that in some sports and in specific contexts, trickle-down effects are occurring, as also shown in some German studies (eg. Frick & Wicker, 2016a; Weimar et al., 2014). On the other hand, our results suggest that this happens rarely and certainly not automatically, as is often assumed by politicians or public authorities who argue that hosting sporting events or supporting elite sport will translate into higher mass sport participation levels.

Limitations and future research

The limitations of this study point towards potential avenues for future research: If (potential) trickle-down effects do not occur – or only occur under specific circumstances – our examination of handball is only a first step towards understanding the complexity of the trickle-down phenomenon. Thus, future studies should examine more sports to identify where trickle-down effects may materialize, for how long and most importantly, what drives them. Recent studies (eg. Chalip, Green, Taks, & Misener, 2017; Taks, Green, Misener, & Chalip, 2018) aim at examining how specific campaigns can be used in connection to sports events to leverage mass participation

levels. Collecting more of this kind of evidence on the trickle-down effect could assist policy makers, politicians, and sport managers in clubs to better understand how the relation between elite sport success, or the hosting of sporting events, and mass participation works. This can lead to more efficient and better strategies in relation to raising levels of mass participation in the future.

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Appendix 1: Selection of Reviewed Published Journal papers on the Trickle-down Effect

Authors	Title	Methodology	Findings
Haut & Gaum (2017)	Does elite success trigger mass participation in table tennis? An analysis of trickle-down effects in Germany, France and Austria.	Correlations analysis of table tennis across three nations.	Effects are not automatic, and mainly found in Austria under specific circumstances.
Weimar & Schauberger (2017)	The impact of sporting success on student enrollment	Balanced panel regression on student enrollment.	Promotion and relegation of the local German football club influences the number of student enrollments in the upcoming semester.
Reis et al. (2017)	Sport participation legacy and the Olympic Games: The case of Sydney 2000, London 2012, and Rio 2016	Three case studies comparing findings from various research projects focusing on sport participation legacies.	Achieving sport participation legacies is only realizable if host governments engage the community, develop long-term strategies, and coordinate efforts.
Macrae (2017)	Delivering sports participation legacies at the grassroots' level: the voluntary sports clubs of Glasgow 2014	Thematic analysis of open-ended questionnaires and interviews conducted in two phases in relation to London 2012 and Commonwealth Games in Glasgow 2014.	The bid team should build club capacity, retaining members in the long-term and promoting general visibility of the clubs throughout the event.
Frick & Wicker (2016b)	The trickle-down effect: how elite sporting success affects amateur participation in German football	Longitudinal data on number of sports clubs, female memberships and male memberships.	Only World Cup titles for the German male national team had a significant positive effect on participation, while no effect was found for female World Cup titles and European Championship titles (male and female).
Wicker & Frick (2016a)	Recruitment and retention of referees in nonprofit sport organizations: the trickle-down effect of role models	Secondary panel data on the number of referees and the recruitment of new referees in German football.	The number of referees promoted to the status of first Bundesliga have a positive effect on the number of new referees, while the number of referees promoted to the status of FIFA referee does not.
Wicker & Frick (2016b)	The inspirational effect of sporting achievements and potential role models	Longitudinal data on female and male club memberships and amateur teams.	Mixed results. Sporting success does not automatically result in inspirational effects.

	in football: a gender-specific analysis		
Aizawa et al. (2016)	Long-term impact of the Tokyo 1964 Olympic Games on sport participation: a cohort analysis	Survey data over a 20-year period.	Individuals who experienced the 1964 Olympic Games participated in sport more frequently than other generations.
Carter & Lorenc (2015)	A qualitative study into the development of physical activity legacy from the London 2012 Olympic Games	Interviews with eight inactive people and four physical activity promotion specialists.	Watching elite athletes is unlikely to inspire to participation among the physically inactive, while positive experiences of Olympic related events may result in intention to participate in community events and physical activities.
Misener, Taks, Chalip & Green (2015)	The elusive "trickle-down effect" of sport events: assumptions and missed opportunities	Document analysis and semi-structured interviews.	Assumptions by various stakeholders are made that events in themselves are sufficient to increase sport participation, while strategies and tactics in many cases are absent.
Murphy, Lane & Bauman (2015)	Leveraging mass participation events for sustainable health legacy	Literature review.	There is a potential to use mass sport events as a public health approach to promote physical activity among "non-sporty" members.
Hodgetts & Duncan (2015)	Quantitative analysis of sport development event legacy: an examination of the Australian Surf Life Saving Championship	Secondary data on sport development on different event locations.	Mixed findings. Hosting an event may offer some retention and nurturing opportunities for sports development.
Weed et al. (2015b)	Developing a physical activity legacy from the London 2012 Olympic and Paralympic Games: a policy-led systematic review	Systematic review of studies found in five databases.	The demonstration effect is not inherent, but a potential, which, if properly delivered, may have a positive effect on sport participation.
Weimar et al. (2014)	Membership in Nonprofit Sport Clubs: A Dynamic Panel Analysis of External Organizational Factors	Dynamic panel data regressions applied to 12 Olympic Sports in the 1970 to 2011-period.	Trickle-down effects are found in relation to the hosting of major sport events.

Craig & Bauman (2014)	The impact of the Vancouver Winter Olympics on population level physical activity and sport participation among Canadian children and adolescents: population based study	Children (5-19 years of age) where surveillanced with pedometers and parents asked whether the children participated in organized sport in order to assess if the 2010 Vancouver Olympics had a trickle down effect.	No positive effects were found. The amount of mean steps were, in fact, lower during the Olympic period compared to pre- and post Olympic periods.
Mutter & Pawlowski (2014b)	The Causal Effect of Professional Sports on Amateur Sport Participation – An Instrumental Variable Approach	Primary data from amateur triathlons were modelled using OLS and 2SLS regressions in order to see whether already active where affected by professional role models.	Results clearly show that amateurs influenced to participate more if they perceive professional triathlon relevant for them.
Mutter & Pawlowski (2014a)	Role models in sports: – Can success in professional sports increase the demand for amateur sport participation?	Ordered response regression models are used to test stated motivational effects of professional sports on sport participation among male and female amateur soccer players.	Results suggests that professional soccer can initiate participation. However, environmental issues, as for example infrastructure and campaigns, have to be implemented in order to institutionalize motivational effects. Effects are mainly found among persons already active.
Ramchandani, Kokolakakis & (Coleman, 2014)	Factors influencing the inspirational effect of major sports events on audience sport participation behaviour	Multinomial logistic regression were applied to survey data collected at ten British sports events.	A majority of respondents stated they were inspired by participating in the event they attended.
Hamer, Weiler & Stamatakis (2014)	Watching sport on television, physical activity, and risk of obesity in older adults	Survey data from English longitudinal Study of aging (64.9 ± 9.2 years) where analysed applying X^2 and ANOVA tests.	No positive relation between watching elite sport on television and physical activity levels. On the contrary, elderly watching sport on television had a higher risk of becoming obese.

Mahtani et al. (2013)	Can the London 2012 Olympics "inspire a generation" to do more physical or sporting activities? An overview of systematic reviews	An overview of systematic reviews.	There is a general lack of evidence that hosting the Olympic Games leads to an increase in sports participation.
De Bosscher et al. (2013)	Scrutinizing the sport pyramid: an examination of the relationship between elite success and mass participation in Flanders	Pearson's r correlations analysis of across 20 sports in Flanders.	Trickle-down effects does not occur automatically. However, they may be found under specific circumstances.
Wicker & Sotiriadou (2013)	The Trickle Down effect: What Population Groups Benefit From Hosting Major Sport Events?	Regression models deployed on survey data from Australian Exercise, Recreation and Sport Survey (ERASS).	Findings suggest that younger people, less educated people and aboriginal people are more likely to be more active due to Melbourne hosting the 2006 Commonwealth Games.
Veal, Toohey & Frawley (2012)	The sport participation legacy of the Sydney 2000 Olympic Games and other international sporting events hosted in Australia	Descriptive analysis of national survey data related to specific sports.	Mixed results. In some cases positive developments occur, while in others not. Authors argue that developments in participation are not solely connected to hosting events.
Li & Luk (2011)	Impacts of the 4th East Asian games on residents participation in leisure sports and physical activities: The case of Macau, China	Surveys and qualitative interviews.	Some potential effects are identified suggesting that a sport event may act as a short term "catalyst to stimulate public interest in leisure sport" (p. 389).

Frawley & Cush (2011)	Major sport events and participation legacy: The case of the 2003 Rugby World Cup	Case study consisting of qualitative interviews and descriptive data analysis.	Increase in senior and junior memberships following a hallmark event. However, potentially part of larger trend.
Dawson & Downward (2011)	Participation, spectatorship and media coverage in sport: some initial insights	Regression model techniques deployed on public available data for British mass participation and habits regarding spectating at live sports events and TV viewing of sports (and TV coverage in general).	Some relation between tv-viewing of sport and participation is identified. However, increased viewing of TV in general is associated with a decrease in sport participation.
McCartney et al. (2010)	The health and socioeconomic impacts of major multi-sport events: systematic review (1978-2008)	A systematic review of existing studies.	The review did not find evidence of clear positive or negative health related legacies of hosting major sports events. However, future events cannot be expected to automatically produce benefits.
Hanstad & Skille (2010)	Does elite Sport Develop Mass Sport? A Norwegian Case Study	Qualitative interviews, document analysis and Pearson's r correlations analysis on biathlon.	Increased income from elite performances helps the federation to prioritize recruitments of mass participation. However, no elite sport generate mass sport *per se*.
Girginov & Hills (2008)	A Sustainable Sports Legacy: Creating a Link between the London Olympics and Sports Participation	Literature review and two case studies.	Achieving sustainable sport participation is not realizable without significant changes in the Olympic setup being made.
Vescio, Wilde & Crosswhite (2005)	Profiling sport role models to enhance initiatives for adolescent girls in physical education and sport	Analysis of role models and their effect on adolescent girls in two Sydney high schools. Survey (n=357) and two focus groups.	Very few girls (8.4%) perceived a sports person to be their role model.

Nielsen (2002)	Skaber elite bredde - og omvendt? En analyse af resultater og tilgang i udvalgte idrætsgrene 1981-2001 [Does elite sport success trickle-down to mass participation? Or the other way around? An Examination of selected sports, 1981-2000]	Descriptive analysis of international elite sport success and membership figures in 15 Danish sports, 1981-2001.	No evidence is found that elite sport success determines mass participation.
Hogan & Norton (2000)	The 'Price of Olympic Gold'	Simple OLS-regression and analysis of descriptive data.	No existence of a trickle-down effect on mass participation is found. While elite sport success in Australia has increased in the period studied (1976-1995), the number of sedentary and overweight people in the population has increased.
Hindson, Gidlow & Peebles (1994)	The trickle down-effect of top level sport: myth or reality? A case study of the Olympics	Questionnaires: The effect of Albertville and Barcelona's effects on club membership in New Zealand.	Limited effects are found. Elite sporting results might hinder and not foster increased participation.
Irlinger (1994)	The Contribution of Televised Sports to the Spread of Sports Activities	Analysis of results from national surveys on sports activities among the French population.	No evidence is found that televised sport inspires people to take up sport themselves.

[i] Our period covers 1964–2016 as these data are updated and available. Data prior to 1964 – according to DHF – contains significant counting errors, and are thus excluded from the study. In 2016, there were respectively 15,857 (1964: 22,105) adult males, 16,599 (1964: 12,404) adult females, and 72,577 (1964: 51,956) child members of DHF.

[ii] In order to take into account potential lagged effects in other years where the championships have taken place earlier in the year, we have also run models with lagged results for all years, revealing the same results as our reported findings.

[iii] It should be mentioned here that it is a potential limitation of this study that separate data on girls and boys does not exist. According to Biskup & Pfister (2009), girls and boys are likely to be affected by international sporting success or role models differently.

[iv] In addition, and for robustness, we have run OLS models using percentage change as well as models including time trend and lagged dependent variables (similar to Frick & Wicker, 2016a) reaching the same overall conclusions as presented in the results section (These specific results are not reported here, but are available upon request).

[v] The Dickey-Fuller tests show that our dependent variables contain time trends, and the residuals show that the non-stationarity on the dependent and independent variables are not co-integrated (Bhaskara, 2007).