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CASTELLANOS-GARCÍA, P., KOKOLAKAKIS, Themis <http://orcid.org/0000-0002-2421-8106>, SHIBLI, Simon <http://orcid.org/0000-0002-4420-115X>, DOWNWARD, P. and BINGHAM, J.

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Membership of English sport clubs: A dynamic panel data analysis of the trickle-down effect

Pablo Castellanos-García[a], Themis Kokolakakis[b], Simon Shibli[b], Paul Downward[c] and Jerry Bingham[d]

[a]Department of Economics, University of A Coruña, A Coruña, Spain; [b]Sport Industry Research Centre, Sheffield Hallam University, Sheffield, UK; [c]School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough, UK; [d]UK Sport, London, UK

ABSTRACT

Investments in elite sport and major sporting events are often justified in sport policy by various rationales, one of which is a 'trickle-down' effect whereby successful athletes have a positive impact on general sport participation rates. This effect is likely to be greater when hosting events, as home advantage can contribute to sporting success. The purpose of this research is to explore the possibility of a trickle-down effect on sports club membership in the United Kingdom in the context of the 2012 London Olympic Games. Secondary data were collected on sports club membership levels in 33 sports, over a ten-year period, from 2007–2016 (n = 330). Sporting success was measured by the number of gold medals won in international competitions, the number of major sport events hosted in the UK, and the results of the BBC's Sports Personality of the Year award (SPOTY). The outcomes of a dynamic panel regression analysis show a causal relationship between the trickle-down effect and sports club membership over a four-year period.

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Trickle-down effect; club membership; sporting success; role model; sport event; sport policy

1. Introduction

Sport policy is often justified on the grounds of achieving international sporting success in important events that can lead to a positive impact on general sport participation rates through a 'trickle-down' effect. The impact of home advantage from hosting events is thought likely to increase this effect (Sotiriadou *et al*. 2008, Weed *et al*. 2015).

Public authorities use the trickle-down effect to justify investments in elite sport development (De Bosscher *et al*. 2013), and attract international sporting events (Mahtani *et al*. 2013). The Cabinet Office (2002) in its rationale for investing in elite sport stated:

> *Hence, the clearest rationale for public investment in high performance sport is as a lever for national pride and the so-called "feelgood factor", along with raising interest levels in a sport* (p. 117)

More recently, the successful bid for the 2012 London Olympic Games was justified on the grounds of 'driving up participation in sport' (DCMS 2003). The subsequent key UK policy document *Sporting Future* (HM Government 2015) also emphasises that sporting success inspires people to take part in sport. Similarly, it was argued that the bid by the city of Munich for the 2018 winter Olympics would lead to sport development effects and the promotion of young talent (Wicker and Frick 2016a). The Munich bid was supported by €0.5bn of public money, covering almost 40% of its basic non-

CONTACT Themis Kokolakakis T.Kokolakakis@shu.ac.uk Sport Industry Research Centre, Sheffield Hallam University, Collegiate Crescent Campus, A118 Collegiate Crescent, Sheffield S10 2BP, UK

marketing cost (DW, 2010). The policy significance of raising sport participation is highlighted by the fact that rates have stagnated or fallen across Europe (Lera-Lopez & Marco, 2018). Moreover, Breuer and Feiler (2015) report that recruiting and retaining members of sport clubs is a challenging contemporary issue for club administrators.

The present study examines the trickle-down effect in the context of England using a dynamic-panel data approach to identify if there is a causal relationship between club membership and sporting success. As our literature review demonstrates, membership of sport clubs is an advanced form of participation, in the sense that typically most members come from the pool of sport participants. Furthermore, sport club membership implies a commitment to future participation. From this point of view, given that we are interested in causal links in the trickle-down effect (rather than simple associations), if the latter cannot be proved in the case of membership, then it is unlikely to exist for other forms of general sport participation.

The originality of our research is highlighted by three key points: first, the inclusion of all the sporting inspiration variables in a single model; second, the use of high quality data that are not focused solely on elite sports; and last, but not least, the utilisation of advanced quantitative methodology (dynamic panel data models, controlling for non-sporting independent variables). The current research also differs from other comparable studies because it uses a representative population survey which enables us to apply the analysis to the whole of the population, rather than a specific subsection.

Section 2 provides the theoretical framework of the analysis and reviews the existing literature. Section 3 outlines the data and methods employed in the analysis. Section 4 presents the results and discusses their implications. Small but positive causal impacts of sporting success on club memberships are identified, but the analysis shows that these are surrounded by other contingent factors that should also be taken into account.

2. Theoretical Framework and Literature Review

The so-called 'trickle-down effect' is predicated on the assumption that people are inspired by elite sport success, sports people, or sports events to participate themselves. In other words, elite sport can have a positive impact on the demand for sport at grassroots' level via sporting success, sporting role models and inspiration effects from hosting major events. In our case, this assumption can be expressed schematically as shown in Figure 1. The trickle-down effect is one of the reasons posed to justify the government's rationale for investment in sports, reinforcing the assumed 'virtuous cycle of sports', which is the subject of the 'polemic' by Grix and Carmichael (2012).

If it can be shown that the trickle-down effect exists, it would effectively link investment in elite sports with grassroots sport participation or sports club membership. The research hypothesis is that the three related factors of hosting home events, sporting success and role models (as measured by the BBC's Sports Personality of the Year programme) would generate inspiration to participate in sport, which would be demonstrated by increases in sports club membership. The potential for inspiration is documented in other research (Ramchandani *et al*. 2014), and may also be triggered by role models (Lyle 2009) or by hosting and achieving success in elite events (Ramchandani et al. 2019). The latter paper presents an amendment of the Transtheoretical Model of change, which explains how inspiration, triggered through factors such as elite events can increase sport participation. Exactly the same reasoning can be applied to membership for all the components of the trickle-down effect. As in the case of Ramchandani, Coleman & Christy (2019), whether or not the three components of the trickle-down effect result in inspiration that can change sports club membership is decided by data-based methodologies.

The theoretical approach around inspiration therefore underlines the possibility of change rather than the necessity of change. For example, Weed *et al*. (2015) found that there is no evidence of an 'inherent' trickle-down effect, but only of a potential effect which, if properly leveraged, can re-engage lapsed participants.[1] This result appears reasonable in the sense that for people to be

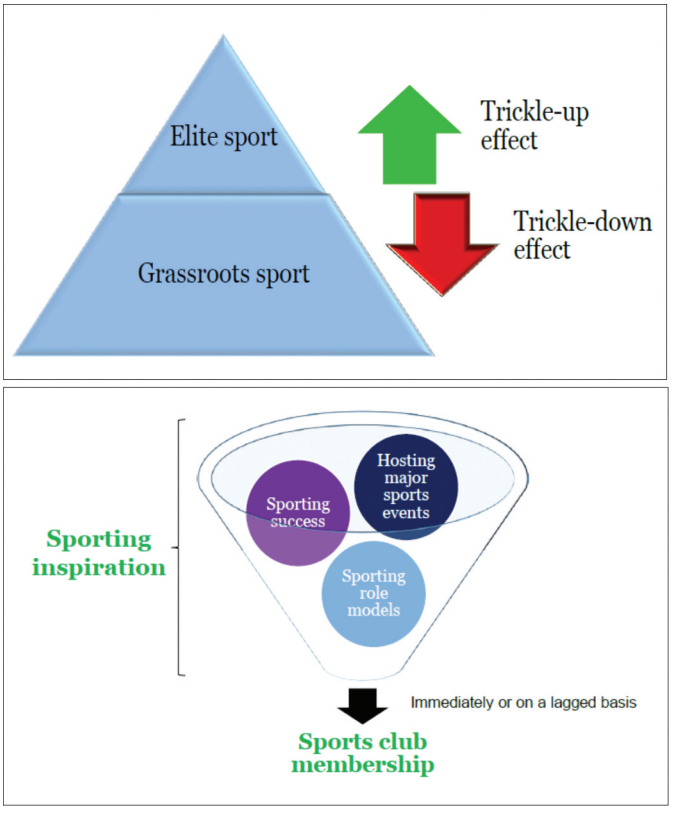

Figure 1. The trickle-down effect. *Source*: Own elaboration

inspired by sport, they must already have some relationship with sport. Hence, a mega event, such as the Olympic Games hosted on home soil may not necessarily inspire the behaviour of non-participants but perhaps more likely, the behaviour of existing participants. Evidence of this notion is found in Kokolakakis *et al*. (2019) where the most significant changes in participation around the London Olympic Games were associated with participants already participating in sport intensively. Dawson (2019) also provides a review of the trickle-down effect and, like Weed *et al*. (2015), argues that it is likely to be valid only in terms of increasing the frequency of participation of existing participants and also in 'typically less active individuals' such as females and ethnic minorities. The idea that particular sections of the population are more inclined to experience the trickle-down effect is also supported by Frawley and Cush (2011) who showed that club registrations of adults and juniors in Australia, following the 2003 Rugby World Cup, increased by 5% and 20% respectively. Wicker and Frick (2016a) found that the success of the German male football team had a positive impact on female participation in the period 2006–2010 but not in 2002. They also argued that the trickle-down effect may depend on other factors such as the personality of players and style of play. Similarly, Lyle (2009) argued that to inspire people to participate, domestic success is not enough: an additional requirement is whether the athlete concerned is perceived as a role model. This argument is applicable to both individual athletes and teams, as illustrated by the SPOTY results.

Frick and Wicker (2016) pointed out that previous research failed to find convincing evidence for the trickle-down effect primarily because the data used and the methods applied (cross-sectional data and correlations) were inadequate. Studies, such as Hogan and Norton (2000) or Hanstad and Skille (2010), which do not find an effect, use descriptive and correlation analysis to derive conclusions on the trickle-down effect. In contrast, Weimar *et al*. (2015) examined the case of Germany

based on time series data of 41 years. They answered conclusively that elite sport can be linked to sports club membership. Their research reinforced the need to account for the time-dimension of the trickle-down effect. In other words inspiration can take time to result in behaviour change.

The current research fills some important gaps in this literature: Firstly, while several studies have examined the links between participation or membership and each of the facets of the trickle-down effect, none (prior to Weimar *et al*. 2015) examine them within a single model. An exception is the research by Downward *et al*. (2016), linking sport participation to health; however, they did not make an explicit differentiation of the three facets of the trickle-down effect. This enhanced complexity of analysis is addressed in the current research using the context of England. Secondly, in previous studies, longitudinal data is largely absent and relatively short time periods are used for the analysis. In addition, the subjective perceptions of clubs, participants, and policy makers have been measured rather than using objective data of actual success (as defined by gold medals won) and actual participation, as measured by surveys (Hindson *et al*. 1994, Frick and Wicker 2016). Panel data including actual success and actual participation are employed in this study. Thirdly, past methods of analysis have not been adequate to isolate the trickle-down effect (Weimar *et al*. 2015). It is important to use regression models applied to panel data, while at the same time controlling for non-sporting independent variables, notably economic factors such as income or working time that may also influence people's behaviour (Wicker *et al*. 2009). This is the case in the current research. Finally, this research focuses on membership rather than general participation in order to restrict the dependent variable to people that already have some relationship with sport, and may therefore be inspired by it (Weed *et al*. 2015). In this sense, membership can be viewed as an advanced stage of participation (the Active People Survey – APS- used in the current study asks the membership question to existing sport participants). In other words, if the trickle-down effect cannot be demonstrated in the case of sports club membership, then it is unlikely to be demonstrated at all.

As the paper of Weimar *et al*. (2015) supports a positive relationship between inspiration from elite sport events and club membership in Germany, an English study using lagged effects and panel data could, if positive, strengthen further the significance of this important result. In addition, the finding of Weimar *et al*. (2015), that the trickle-down effect could last for up to four years into the future, is not self-evident and further analysis and evidence is required to explore it. With this point in mind our study follows the recommendation of Wicker and Frick (2016b) that evidence from other countries (outside Germany) needs to be analysed for a more holistic picture to be formed, and thus where possible, our results are compared with those of Weimar *et al*. (2015).

3. Methodology

3.1. Data Collection and Variables

In line with previous research (Weimar *et al*. 2015, Frick and Wicker 2016, Wicker and Frick 2016a), the current study uses panel data collected across subjects (a range of sports) over a period of time.

3.1.1 Dependent and Core Independent Variables

Sports club membership is the dependent variable which is analysed in terms of the core independent variables from which a trickle-down effect might be related. In this case it is: sporting success (as measured by the number of gold medals won), hosting events (the number of events hosted), and role models (the results of Sports Personality of the Year). The dependent variables included total membership in 33 sports over ten years (2007–2016) drawn from Sport England's APS.[2] The APS was conducted over ten waves from 2005/6 to 2015/16 and samples (ranging in size from c. 150,000 to c. 360,000) were drawn from every local authority in England. For the purposes of this research, club membership is therefore based on data which relates solely to England (88% of the UK population). In the APS, respondents were asked to detail all the sports in which they participated and whether or not they were members of a club or organisation for each sport stated. The overall sample size (n) is

330 (33 sports (N) x 10 years (T)).[3] To accommodate the use of lagged variables, where possible, the dataset included additional information for the period 2003–2006. As explained in the section 3.2, it should be noted that although the data input is specific for each sport, the results, because of the nature of the panel data, do not differentiate between sports and relate to the portfolio of 33 sports as a whole.

Two variables were derived to measure membership, one for adults and one for juniors less than 18 years old. This distinction reflects the structural life-changes occurring at this age (job, independence from parents, university studies) which may influence club membership (Fernández-Villaverde and Krueger 2007). The estimation of the membership was achieved by obtaining the percentages of sport club members from the APS for each year and applying them to the population of participants under examination. The word 'membership' (instead of 'member') is used because people can be members of more than one sports club simultaneously. In this case, for instance, a person who is a member of both a football club and a basketball club would be represented twice in the sample.

Added to the APS data were external data measuring sporting events hosted in the UK, role models, and sporting success. The home events variable included all instances of hosting a European or World championship in a sport or the Olympic Games (in the 2012 data). Information on home events was provided by UK Sport from their Gracenote Podium Performance database. The events were recorded by a binary 0/1 code per sport per year. It should be noted however that permanent events of global significance, such as Wimbledon (tennis), were not included in the analysis as they show no pattern of variation. This notwithstanding, sporting success at Wimbledon, as reflected in championships won or 'star' athletes, are relevant factors that might affect changes in membership and hence are included in the analysis. For the London 2012 Olympic Games, each sport contested in the 33 sports under review is treated as a separate event.

The role model element of sporting inspiration was measured by the voting patterns for 1st to 3rd place for both the athlete of the year, and the team of the year from the BBC's Sports Personality of the Year (SPOTY) award, which is held every December. These data are readily available in the public domain. For each sport and every year we attached 3 points for first place in the individual award and the team award; two points for second place; and one point for third place. Finally, we attach 0 points for sports that do not appear in the first three places of SPOTY, for either individual athletes or teams, as these are assumed not to have achieved adequate publicity to affect the role model effect.

The measure of sporting success is accounted for by the number of gold medals won at the Olympic Games, World or European Championships or an equivalent event per sport. While usually such a variable takes a binary 0/1 form per sport as, for example, in Weimar *et al*. (2015), in the case of this paper richer data in the form of the total number of gold medals won are included. We have ignored lesser positions because of the disproportionate amount of attention given to gold medallists or champions.

3.1.2. Control Variables

Further variables, associated with the economy and demographics, were added to the analysis to control for confounding factors that might influence sport club membership. Economic and demographic data are derived from the APS. An increase in income is usually associated with conflicting effects: on the one hand, it facilitates the economic requirements of membership (e.g. subscriptions and sportswear); on the other hand, if this increased income is associated with more responsibilities and more work time, there will be a decrease in free time and hence in participation and membership (Wicker *et al*. 2013, Kokolakakis *et al*. 2015).

The popularity of fitness clubs may also act as a substitute for club membership in the more traditional and Olympic sports examined in this research (Borland & MacDonald, 2003). Technological change in leisure suggests that many people spend increasing amounts of time indoors for entertainment. Such a tendency has often been identified as a major trend in checking the growth rates of sport participation and sports club membership (Weimar *et al*. 2015). Consequently, in the dataset, statistics compiled by the Office for National Statistics (ONS) measuring internet use are also included. These data illustrate that the

Table 1. Overview of variables.

Variable	Description	Category	Source
Membership	Senior memberships in sports clubs 18+ and Junior memberships in sports clubs under18	Scale variable	APS (Active People Survey)
Gold medals	Winner of Gold Medal in Olympics, World or European level or similar	Scale variable per sport for each competition	Gracenote Sports Podium Performance, provided by UK Sport
Star	1–3 scores according to the BBC Sports Personality of the Year	Ordinal variable	Sports Personality of the Year records
Home events	Hosting a European/World Championships, or Olympic Games	Binary variable (per sport for each competition)	UK Sport
Income	Real net national disposable income per capita	Scale variable	ONS (Office for National Statistics)
Work time	Average weekly hours of work per worker	Scale variable	ONS/Labour Force Survey
Number of adults	Total number of population aged 18+	Scale variable	ONS/Census, mid-year estimates
Number of juniors	Total number of juniors aged 16–17	Scale variable	As per seniors, above
Daily internet use	Proportion of people using the internet daily	Scale variable	ONS
Fitness	Total members of fitness clubs	Scale variable	Based on APS

most significant recent societal change is in the use of technology: between 2007 and 2016 the percentage of adults using the internet daily has increased from 45% to 82%. By contrast, the percentage that has taken up membership in fitness clubs has fluctuated between 9% and 12% over the same period. Finally, lagged memberships are considered to be relevant to the analysis to account for the change in sports club membership. Table 1 below illustrates the variables used in the present study and the general sources of the data.

3.2. Regression Analyses

The membership and the three sports variables form the core part of analysis. Any sign of positive significant relationship between success, home events, or stars with sports club membership would be evidence of a trickle-down effect in sport.

Four models were estimated, for senior and junior sports club membership. In all cases the dependent variable was the annual number of memberships per sport as recorded in APS. All models included a lagged membership variable, sporting success, home events and role model variables based on SPOTY. In addition, Model 2 included lagged variables in success, home events, and SPOTY; and Model 3 additionally incorporated leisure related variables such as fitness club membership and personal computer use. Model 4 focuses on the sports club membership levels of juniors (aged 16 and 17).

The importance of including a lagged membership variable in the models can be seen in Figure 2. It shows the overall level of sports club membership across all sports, from ten years of the APS. The levels had limited variation from year to year, ranging between 10.2 m and 9.3 m adults. The overall picture is one of gradual year on year decline from APS2 to APS7 followed by growth in the post-London 2012 period, to reach 96% of the APS2 peak at the final data point for APS10. This notion of relative stability supports the argument that the current year's club membership levels are heavily influenced by last year's levels. Hence the inclusion of such a variable is strongly justified by the data.

The panel-data nature of the data and the recognised need to include lagged membership in the analysis means that ordinary least squares (OLS) regression cannot be used (Bond 2002, Hsiao 2003). The appropriate analysis is dynamic panel-data regression. Table 2 below, outlines the models estimated. For illustration, the basic equation for Model 2 on which the causality argument is based, is:

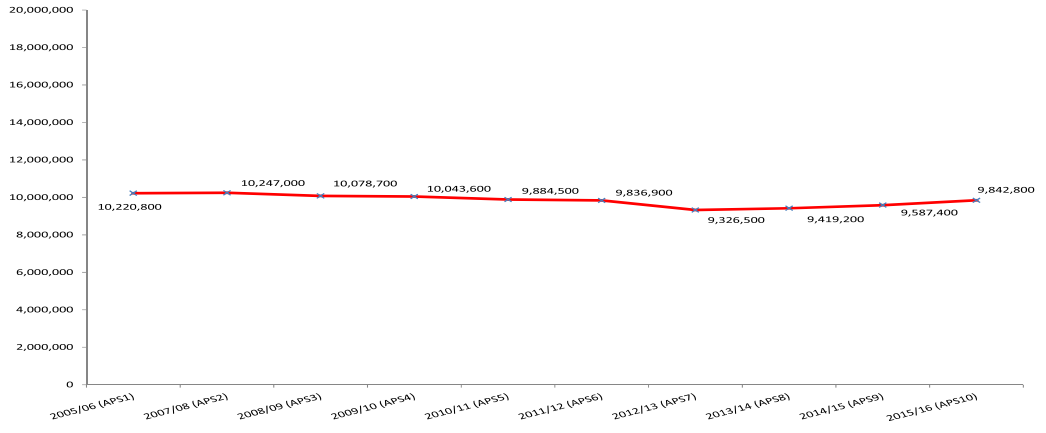

Figure 2. Sport club membership, Active People Survey, APS1-APS10.

$$\begin{aligned}\text{MEMBERSHIP}_{it} = {} & \beta_0 \text{MEMBERSHIP}_{i,t-1} + \sum_{k=0}^{4} \beta_{1k} \text{STARS}_{i,t-k} \\ & + \sum_{k=0}^{4} \beta_{2k} \text{HOME EVENT}_{i,t-k} + \sum_{k=0}^{4} \beta_{3k} \text{GOLD MEDALS}_{i,t-k} \\ & + \beta_4 \text{ADULTS}_{it} + \beta_5 \text{WORKTIME}_{it} + \beta_6 \text{INCOME}_{it} + \varepsilon_{it}.\end{aligned}$$

Where k indicates lagged effects of up to four years ago.

Table 2. Estimated models .

	Model 1	Model 2	Model 3	Model 4 (Juniors)
Dependent variable	Membership	Membership	Membership	Membership
Independent variable categories	Lagged membership Sport success Sport stars Home events Economic variables Population variables	As in Model 1 Lagged sport success Lagged sport stars Lagged home events	As in Model 2 Other leisure variables	Lagged membership Sport success Sport stars Home events Population variables Growth rates
Estimator	Arellano and Bond	Blundell and Bond	Arellano and Bond	Arellano and Bond
Diagnostics	Second order autocorrelation Sargan test Wald test Sensitivity test	Second order autocorrelation Hansen tests	Second order autocorrelation Sargan test Wald test	Second order autocorrelation Sargan test Wald test

To estimate these models the guidelines are that the sample size meets the condition that the ratio of the number of independent variables to the number of cases (sample size, n = TxN) should be 1:5 at most (Hair *et al*. 2010, p. 100). This criterion requires a minimum sample of 135 for the models estimated, which is achieved throughout.

The characteristics of the data, comprising a small number of years (T < 20) and a large number of sports (N > 20), suggest that the Arellano-Bond (AB) dynamic panel-data approach (Arellano and Bond 1991) should be used (Bruno 2005). Additional advantages of the AB approach are its suitability for: dealing with missing observations appropriately; handling of a small number of annual observations and controlling for autocorrelation in time series data (Wicker and Frick 2016b). Moreover, the AB model facilitates instrumental variables estimation to control for the endogeneity of the lagged membership variables and other sports success variables as factors influencing memberships. The

use of this estimator requires that the dependent variable measures absolute membership numbers. In essence AB examines differences (e.g. membership this year minus membership last year). An extension to the core AB model, the System-Generalised Method of Moments (System-GMM) estimator of 1998, 2000), or Blundell *et al*. (2000) was also identified to be of value in estimating Model 2. It should be noted that although the data input is specific for each sport, the results in the subsequent regression analyses do not differentiate between sports. Any effects that are identified apply as an average to the portfolio of 33 sports in the sample and technically cannot be attributed to any specific sport. For example, it might seem reasonable to assume that if a tennis player won SPOTY, we would see a positive impact on tennis club membership. The nature of the model is that technically we cannot make this conclusion. However, as will be seen later, occasionally there is evidence of a disproportionate effect in specific sports as a result of changes in the independent variables.

3.3. Diagnostic Tests

The AB model can be estimated by different methods: using either standard errors or robust standard errors, and, independently of the former choice, using either a one-step or a two-step procedure. Usually, researchers prefer two-step estimators with robust standard errors, because they are more efficient (Windmeijer 2005). This is the case adopted in the current paper. Relevant diagnostic tests examine the overall appropriateness of the variables and estimation of the models. The diagnostics for the models include: the AB test on second order autocorrelation AR(2); the Sargan and Hansen tests of over identifying restrictions (Sargan 1958, Hansen 1982); and the Wald test of whether all the coefficients are zero.

In the case of Model 2, the Blundell and Bond (BB) estimation procedure allows the computation of the Hansen test instead of the Sargan test in the AB case. Finally, for Model 1, as a sensitivity test, the equivalent static model (i.e. without lagged membership) with the same remaining variables was tested to check for autocorrelated errors and hence the need for a dynamic form of model (Wooldridge 2002). In other words this procedure ensures that the model passes the diagnostics in a static form before proceeding to a dynamic analysis. Having satisfied the requirements of the diagnostic testing, there is a solid basis from which to present and discuss the results of each model.

4. Results and Discussion

Table 3 summarises the main information used for the trickle-down effect, per year. Column four shows the positive effect generated each year by home events and sport success based on Model 2 of section 3.2. They affect the present and the future membership. Similarly, column seven shows how each year's membership is affected by the present and the past events and sports success variables based on the same model. The last column includes the percentage of sport membership explained by the trickle-down effect, represented by the ratio of columns seven and five.

As shown in Table 3 there is an increase in gold medals won between 2003 (15) and 2016 (77). Olympic years are associated with spikes in gold medals won and the general trend is upward. During the first four years of the sequence (2003–2006), the UK won an average of 19 gold medals per year. This number increased to 54 for the four year period 2013–2016, representing an increase of 185%.

Next, column five of Table 3 includes the sports club membership levels for the years 2008–2016 derived from APS. They confirm the pattern outlined before, whereby sports club membership declined from 2008 to 2011. The fall was particularly noticeable in 2011, coinciding with the last economic recession, and also during a year when there was a decline in the positive effect generated by home events and sporting success (152,568 – as shown in column 4). In 2012, the year of the London Olympic Games, there was the first increase in sports club membership in the time series. The fall observed the next year was probably a reflection of the intense activity in the Olympic Games

Table 3. Gold medals and home events, 2003–2016.

1 Year	2 Gold medals	3 Home events	4 Positive effect on membership	5 Sports club membership	6 Change in sports club membership	7 Impact of trickle-down effect	8 Explained variation in membership
2003	15	3	80,621				
2004	19	2	70,127				
2005	17	4	102,035				
2006	25	3	98,821				
2007	23	5	130,728				
2008	48	6	194,002	3,373,000		168,326	5%
2009	31	10	234,156	3,338,000	−35,000	290,320	9%
2010	46	8	225,909	3,337,000	−1,000	227,459	7%
2011	35	5	152,568	2,839,000	−498,000	248,984	9%
2012	55	24	526,666	2,953,000	114,000	400,573	14%
2013	37	3	120,661	2,588,000	−365,000	226,191	9%
2014	60	1	126,975	2,823,000	235,000	363,057	13%
2015	43	5	167,129	2,836,000	13,000	226,919	8%
2016	77	5	229,009	2,911,000	75,000	185,744	6%

Source: SIRC, Sport England

(which could not be sustained at this level) and the fact that there was a very big decline in the positive effect generated by gold medals and home events, from about 527,000 in 2012 to almost 121,000 in 2013 (column 4). Since 2013, there is an increasing trend in sports club membership approaching the three million mark, which although a recovery, is still below the first figure recorded in 2008 of 3.37 million.

According to column six of Table 3, the actual change in club membership bears little resemblance to the effect attributable to the independent variables as predicted by the models. Indeed, in some years, for example 2009 (a year associated with the last economic crisis), actual club membership decreases despite increases in the indications of the trickle-down effect in columns four and seven. The variation between columns four and six in Table 3 can be explained by two key factors: firstly, the impact of other significant variables not included in the model; and secondly, the impact of lags in the effects attributable to occurrences in previous years.

The four most important years that affected the trend of sports club membership are: 2012, 2009, 2016, and 2010 as shown in column four of Table 3. The dataset suggests that the biggest effect on sports club membership was hosting the London 2012 Olympic Games and the test events in the run-up to the Games. Furthermore, whilst the boost of the London Olympics in terms of home events cannot be reproduced in the short term, Olympic years are likely to influence sports club membership positively on the basis of gold medals won. The last column is the percentage of membership explained by the trickle-down effect variables. For example, sports club membership in 2011 was 2.84 million. In the same year the positive effect from the trickle-down variables was about 249,000 representing 9% of total sports club membership. Annually the effect of the three independent variables on sports club membership varied from 5% to 14%, showing that there must be other factors that affect membership more significantly.

The remaining section presents the results for the Models 1–4 as outlined in the methodology. Throughout this section, L1 represents the lagged values of one period (a year), L2 of two periods and so on. Based on the experience of Weimar *et al*. (2015), up to four lags were modelled in the regressions. Throughout the results, the diagnostic tests confirm that each model has passed the relevant conditions and should therefore be accepted.

4.1. Model 1

In the first model the set of independent variables includes one lagged variable in membership (Membership_L1), the three inspiration variables of stars, home events and gold medals, and three socio-economic variables: the population of adults, work time (hours worked per person) and

Table 4. Results of the dynamic panel regression (AB) for Model 1, 2007–2016.

Variables	Coefficient	p-value	Comparison with Germany
Membership _L1	0.455	0.000***	*(growth rate)
Stars	1348.46	0.024**	not significant
Home events	5572.74	0.000***	**
Gold medals	−458.70	0.462	not significant
Number of adults	−0.003	0.000***	not significant
Work time	−10,874.35	0.000***	**
Income	3.440	0.000***	**(GDP)
Tests		**p-value**	**Model accepted?**
AR(2)		0.140	yes
Sargan test (non-robust errors)		0.835	yes
Wald test		0.000	yes
Sensitivity analysis (Wooldridge test)		0.846	yes

Note: AB = Arellano and Bond; *p < .1; **p < .05; ***p < .01.

income. The data are considered at an aggregate level (all 33 sports) from the perspective of the 'current' year. No lags in the inspiration variables are included in Model 1. Consequently, Model 1 is a basic demonstration of concept looking for a direct relationship between sports club membership and the independent variables. Table 4 below shows the results of this model.

During the ten years under review, lagged data on sports club membership, home events, number of adults, work time and income are significant at the 1% level. The variable 'Stars' appears significant at the 5% level, whilst the variable 'Gold medals' is not significant. The variables 'number of adults' – a control variable – and 'Stars' are significant in this study but not in Weimar *et al*. (2015), whilst the variable 'Gold medals' is not significant in both cases.

The results imply that the previous year's sports club membership levels are a very good indicator of future membership levels. 'Home events' is another positive and significant factor, consistent with previous research such as in Frawley and Cush (2011) and Weimar *et al*. (2015). This outcome may be the result of the increased media attention when a major sport event takes place on home soil. The level of significance indicates that 'home events' is the most important component of the trickle-down effect in Model 1. The model's coefficient suggests that if the UK hosts a major sport event, then the positive effect on senior membership would be around 5,500 people across the 33 sports in the year under consideration.

Model 1 also implies that there is an association between the 'Stars' variable and 'current' membership. The results of SPOTY are the outcomes of voting by the public who may already have internalised the sporting success of the 'current' year. Hence these results are strongly associated with the very top of elite sport success and may actually be acting in this case as a proxy for sporting success.

The coefficient value suggests that an increase in the star value (e.g. from zero in the past year to 1, via a third place in SPOTY, this year) for a sport would have a positive effect of almost 1,350 sports club members. Similarly, on average, an increase from 0 to 3 (first place in the competition) would have a positive effect of approximately 4,050 members. Technically, as the model looks at average effects across the 33 sports, the effect of the 'Stars' variable is virtually a constant and any positive effects will be felt across the portfolio.

Both income and work time variables are significant. The work time results capture the effect that in working more hours there is less leisure time and therefore less inclination to become a sports club member. This effect is consistent with previous research showing a negative effect of increased work time on sports club participation (Downward, 2007; Wicker *et al*. 2013). The opposite is indicated by income, which provides people with the means to pay for club fees and other sport-related expenditure. As income rises, sports club membership would be expected to increase in the current year (Borland 2003, Kokolakakis *et al*. 2015). The model suggests that an increase in average

('real') income of £1,000 would be associated (on average) with a positive effect on sports club membership of around 3,400. Finally, in the UK the number of adults in the population is significantly and negatively associated with membership, reflecting perhaps the effect of an ageing population on sport participation generally and sports club membership specifically.

Model 1 however is simply a basic test of concept. By introducing lagged inspirational variables into the analysis and making the model more 'dynamic', a more granular analysis of the factors which impact on sports club membership and the timing of these effects can be derived. These are shown in Models 2 and 3.

4.2. Model 2

Model 2 introduces further dynamic elements to the sport related inspiration variables used to test for the trickle-down effect. It examines the impact of 'home events', 'stars' and 'gold medals', on club membership not only in the current year (as in Model 1), but also lagged effects from the previous four years. In addition, the influence of all of the other non-sporting variables used in Model 1 is tested. The data are considered at the aggregate level (for all 33 sports examined), associating current sports club membership with occurrences that happened up to four years ago. Model 2 is likely to be more realistic than Model 1, as the three inspiration effects may take more than one year to affect sports club membership and may also last longer than one year. More importantly, Model 2 allows causal claims rather than association to be identified because of the use of the lagged variables, if the validity of the instruments is demonstrated. The results in Table 5 show the impact of the independent variables on the number of 'current' sports club members.

During the ten years under review, historical data on sports club membership and 'Stars_L3' (i.e. the results of SPOTY from three years ago) are significant at the 1% level. The variables 'Home events' and 'Home events_L2' are significant at the 5% level, whilst the variable 'Gold medals_L1' is significant at the 10% level. When we compare these findings with the equivalent results of Weimar *et al.* (2015) we conclude that lagged membership, home events, and historical versions of the gold medals variables

Table 5. Results of the dynamic panel regression (Blundell and Bond) for Model 2, 2007–2016.

Variables	Coefficient	p-value|	Comparison with Germany
Membership_L1	0.957	0.000***	*(growth rate)
Stars	−184.47	0.930	not significant
Stars_L1	−2540.77	0.294	not significant
Stars_L2	3740.54	0.248	not significant
Stars_L3	7816.88	0.000***	not significant
Stars_L4	−1900.73	0.753	not significant
Home events	8747.87	0.030**	**
Home events_L1	−2349.43	0.613	not significant
Home events_L2	9025.67	0.036**	not significant
Home events_L3	−6023.92	0.152	not significant
Home events_L4	−3819.67	0.345	not significant
Gold medals	75.12	0.969	not significant
Gold medals_L1	1820.02	0.093*	not significant
Gold medals_L2	−2579.67	0.104	not significant
Gold medals_L3	−642.86	0.706	not significant
Gold medals_L4	1765.71	0.259	*
Number of adults	0.020	0.218	not significant
Work time	−23,834.02	0.141	**
Income	−9.773	0.438	not significant
Tests		p -value	Model accepted?
AR(2)		0.106	yes
Hansen test of over identification		0.835	yes
Difference-in-Hansen tests of exogeneity of instrument subsets		0.696	yes

Note: *p < .1; **p < .05; ***p < .01.

are significant in both studies. A measure of role model inspiration (Stars_L3) and home events from two years ago are also significant in this model.

Like Model 1, the regression results in Model 2 imply that past club membership levels are a very good indicator of future membership. The positive coefficient implies a 'build-up' effect whereby the membership within sports clubs generates its own membership.

The inclusion of lagged independent variables in the model creates various interpretational challenges. Typically, there may be a period of participation of different frequencies and intensities before a decision is made to join a club. For example, the Weimar *et al*. (2015) found that the trickle-down effect on membership in Germany may take four or five years providing a 'gradualist' explanation from initial participation leading to the decision to join a club. The most far-reaching conclusion is that for all three inspiration-related variables at least one lag is statistically significant in terms of the positive effect on club membership. This finding, together with the validity of the 'instruments' used in the analysis, creates the possibility that all three sporting independent variables may have caused increases in sports club membership. This interpretation is strengthened by the Sargan/Hansen diagnostics which control for unobserved effects such as reverse causality between membership and the independent variables.

The coefficient values suggest that an increase in the star value (e.g. from zero in the past year to 1, via a third place in SPOTY, this year) would have a positive effect of 7,800 members across the 33 sports three years later. Although the model does not differentiate between sports, it is worth speculating that most of the positive effect would be felt in the sports in question. For example, in 2011 Mark Cavendish (cycling) won SPOTY and the associated 41,000 rise in cycling membership, between 2011 and 2014, is about 178% of what would be predicted by the model, showing that although there may be a wide distribution of membership effects across 33 sports, the greatest effect in this instance was in Mark Cavendish's sport of cycling.

Model 2 shows that staging home events may have a catalytic effect on club membership for two years after the event. As a test of reasonableness, in 2011, the UK hosted a gymnastics World Cup event in Glasgow and the Trampolining World Championships in Birmingham. Subsequently, adult membership of gymnastics and trampolining increased from 22,000 in 2011 to 24,500 two years later. Similarly high profile home events in 26 sports were staged in the London 2012 Olympic Games. In volleyball, a sport in which the UK had no recent Olympic tradition, club membership increased from almost 10,500 in 2012 to 15,000 in 2014, as predicted by the model. The two year effect following the Olympics is consistent with the research by Kokolakakis *et al*. (2019).

The inspiration to increase sports club membership may be achieved through sporting success when people attend live events or follow them through the media. This effect creates a direct link between elite sport and grassroots membership, which in this study occurs within two years (including the current one). In the Weimar *et al*. (2015) research, for the success variable, a four-year lag is significant, indicating that a prolonged period for the trickle-down effect to occur is plausible. As a test of reasonableness, in 2012, the GB women's team won a gold medal in the World Archery Field Championships, hosted in France. Archery club membership increased from approximately 55,500 in 2012 to almost 58,000 in 2013. In cricket, the year 2009 was the most successful in the period under examination, with the England women's team winning the ICC (50-over) World Cup in Australia and the Twenty20 World Cup in England. Following this success, cricket club membership increased from 237,000 in 2009 to 251,500 the year after.

Overall, these are important results showing that there is a measurable element of trickle-down effect on membership via all three sport-related independent variables. The trickle-down effect in the UK and in Germany may last four and five years respectively (including the current year). Other factors that relate to leisure time, and which are possible substitutes for sports club membership, such as fitness membership and internet use, have not been examined yet and are shown in Model 3 below.

4.3. Model 3

Model 3 is an extension of Model 2 which includes the effects of internet use and fitness club membership on the current numbers of sports club membership. For ease of illustration Model 3 shows only the effect of other leisure activities on membership (Table 6). Although the model is dynamic (as Model 2), for the two leisure variables the data are considered at an aggregate level (all 33 sports) from the perspective of the 'current' year. Hence, club membership in 2010, for example, is associated with fitness membership and internet use of 2010. Membership of fitness clubs has increased considerably in the last six years and it is interesting to test whether this growth is at the expense of more traditional pursuits such as sports club membership. Internet use is at the heart of indoor entertainment which competes against sport participation and other activities for people's limited time. Thus, Model 3 in Table 6 shows the impact of the additional leisure-related independent variables on the number of 'current' sports club members.

In the current study, the variable 'Fitness membership' appears significant at the 10% level, whilst the variable 'Internet use' is not significant. The direction of change in the two models (positive or negative coefficients), between pairs of variables, is identical, strengthening the confidence in the results.

Both studies suggest that there is a negative effect on 'current' sports club membership in years when there is an increase in fitness club membership. In other words, Table 6 shows that the membership of fitness clubs is in direct competition with, or a substitute for, membership of more traditional sports clubs. Fitness clubs absorb a large share of both free time and consumer expenditure. As a result, they reduce the income and time available for more traditional sports club membership and participation. Furthermore, the increase in supply of fitness clubs since 2012 and the reduction in membership fees via budget operators have made fitness memberships more accessible to the wider population. From the point of view of working people, an advantage of fitness clubs is the flexibility of long opening hours, whereas training schedules in sport clubs are relatively inflexible. This interpretation is also supported by the negative effect of the work time variable in Model 1. The coefficient of 'fitness membership' suggests that an increase in fitness club membership of 1,000 would be associated with a negative effect of 347 in sports club membership levels across our 33 sports.

The influence of leisure activities indicates that the main trade off amongst the variables used is between membership of traditional sports clubs and fitness clubs. This research describes the nature of the trade-off; however, one needs to keep in mind that both activities contribute positively towards physical activity and wellbeing.

4.4. Model 4

Since younger people are likely to behave differently in terms of their membership decisions, an analysis of the sports club membership of juniors is presented in Model 4.

This model deals with membership amongst juniors (16 and 17 years old) in the current year in terms of past membership lagged by one year, stars, home events, gold medals, internet use and

Table 6. Results of the Dynamic Panel Regression (AB) for Model 3, 2007–2016.

Variables	Coefficient	p-value	Comparison with Germany
Fitness membership	−0.347	0.070*	*
Internet use	−12,283.98	0.106	not significant
Remaining variables	Included		
Test	**p-value**		**Acceptance**
AR(2)	0.208		yes
Wald test	0.000		yes

Note: *p < .1; **p < .05; ***p < .01.

Table 7. Results of the Dynamic Panel Regression (AB) for Model 4, 2007–2016.

Variables	Coefficient	p-value	Comparison with Germany
Membership_L1	0.053	0.716	not significant
Stars	195.34	0.733	not significant
Home event_L1	1764.27	0.039**	***
Gold medals	573.15	0.131	not significant
Growth of membership_L1	−2.661	0.061*	***
Internet use	−347.56	0.021**	not significant (PC ownership)
Test		**p-value**	**Acceptance**
AR(2)		0.3089	yes
Sargan Test (non-robust errors)		0.9286	yes
Wald test		0.000	yes

Note: *p < .1; **p < .05; ***p < .01.

past growth of membership. The junior membership numbers are based on a subset of the APS and are subject to greater sampling errors. As a result, the structure of the model was changed, introducing a greater degree of 'history' in the form of last year's membership growth in order to pass the diagnostic tests and to derive conclusions about the trickle-down effect. The variables 'Membership_L1' and 'Growth of Membership_ L1' are consistent with the requirements of AB modelling and variables in the Weimar *et al.* (2015) respectively. The variables 'Stars', 'Home event L1', and 'Gold medals' represent the trickle-down effect. Finally, internet use is an important variable that may account for time use to a greater extent in juniors than in adults. Table 7 presents the results for Model 4 for the period 2007–2016.

During the ten years under review, in the case of juniors, the variables 'Home events_L1' and 'Internet use' are significant at the 5% level, whilst the variable 'Growth of

membership_L1' is significant at the 10% level.

The results imply that last year's growth rate in membership is a significant factor associated with the current level of junior sports club membership. This variable accounts for the relationship between past membership and present, generated through the networking of club members or the marketing and development efforts of sports clubs. The result shows a slight fluctuation in the pattern of junior membership with past growth followed by decline and vice versa, indicating basic stability in numbers.

The trickle-down effect is expressed through home events from last year. Model 4 also shows a negative relationship between membership and internet use among juniors, illustrating the negative influence of indoor entertainment on sports club membership in this age group. Intensive internet use increased very rapidly in the UK during the period under investigation (from 45% of adults to 82%). As juniors increase their internet use, their level of sports club membership will decline. As a test of reasonableness, intensive internet use among the population increased from 49% in 2008 to 55% in 2009; at the same time the level of junior sports club membership (in the sports under consideration) declined from 420,000 to 402,000, as suggested by Model 4. The fact that the internet is a substitute for sports club membership amongst juniors, suggests that it will be increasingly difficult to attract new young members to sports clubs, and thereby establish positive sport participation habits to be carried into adulthood.

5. Conclusions

This study reveals evidence of a trickle-down effect on sports club membership amongst adults from sporting success, stars, and hosting home events that is causal. The trickle-down effect can therefore be said to have three dimensions: Firstly, elite sporting success has a positive inspiration effect on the population, contributing to some people becoming sports club members. Secondly, the evidence indicates that people are inspired to become sports club members by elite athletes as a result of their personalities and popularity. Thirdly, hosting major sports events has a positive effect on the

population in the host country to become sports club members. This outcome is likely to be achieved through increased media exposure and greater numbers watching the sport, either live, or on television.

Past membership levels and home events are consistently significant in all models; hence they are the most important influences on sports club membership. Other contributory variables are fitness membership and gold medals-lagged, work time, income, stars-lagged, home events lagged, and stars. In terms of the important trickle-down effects, the most important variable is home events followed by sporting stars and gold medals. As an example, the trickle-down effect helped the recovery in sport membership, which was in a long-term decline after the London Olympics.

That said, caution should be attached to the results. Although the three inspiration variables have a statistically measurable and significant positive impact on sports club membership, they are associated with relatively small effect sizes on memberships (up to 14%). This finding implies that the inspiration variables are not the only factors that influence sports club membership, with previous levels of sports club membership being the most significant. Although the trickle-down effect was consistently positive, the actual change in sports club membership some years was negative. The positive impacts of the trickle-down effect variables have therefore been offset by stronger negative impacts attributable to other variables.

An important result from the analysis is that the models show an inverse relationship between sport club membership on the one hand and other pursuits such as fitness club memberships and internet use on the other hand (the latter only in the case of juniors). The above-mentioned relationship with fitness clubs is consistent with Hallmann, Felier and Breuer (2015) who argued that the market can substitute for public provision. Internet use was a significant negative influence in the membership decisions of juniors, illustrating that developments in technology represent a challenge to sports participation generally and sports club membership specifically. The growth of the fitness club sector has absorbed some consumer spending and free time, leading to negative effects on membership of more traditional sports clubs. The importance of free time on membership decisions is also underlined by the negative association between hours worked and sports club membership in Model 1.

The present research has implications for policy and sport management. The current economic environment favours intensive use of the internet and expansion in membership of fitness clubs; both are identified as factors that limit sports club membership. An active sport policy is required to counteract negative influences and promote growth in sport club membership, whereby participants are enabled to take advantage of opportunities to engage in more flexible ways (Kumar *et al*. 2018, 2019). The existence of a trickle-down effect effectively links the economy of elite sport with the grassroots. Elite home events, sporting success and role models can be used as instruments to increase sports club membership, although the impact attributable to them is modest. It also implies that the economic impact of sport events should include the effect of increasing sports club membership that is linked to such events. Higher membership leads to greater consumer spending in sport equipment and sport fees which ultimately generate revenue for the government, partially offsetting the initial investment on events. At the same time this can only happen if the sport clubs have the capacity to market themselves for more members and take advantage of the potential created by the trickle-down effect. In other words, the supply side of club membership should be able to adjust quickly to any changes in demand. National governing bodies and federations may assist clubs through financial help and advice in this direction. Specific activities are needed to facilitate the impact of the trickle-down effect, including links between sport and art as suggested by Chalip (2006) or media initiatives such as the BBC's 'Get Inspired' initiative, which helps people to choose sport activities through media stories, governing bodies and sports clubs. This help and associated impact should happen quickly and certainly within the first three years after an event. The issue of legacy following a home event or sporting success is determined within this time period. This conclusion supports previous research on sport participation following the Olympic Games (Kokolakakis *et al*. 2019).

Regarding opportunities for future research, we suggest the following directions: (i) Analyse sport participation rather than simply club membership; (ii) Examine if patterns vary by population segments (e.g. gender, age, ethnicity, region); and (iii) Check if the effects vary under different frequency of participation definitions.

In the meantime, what can policy makers learn from this research? First, there is evidence that a 'trickle-down' effect exists and can be measured. However, this statement is subject to the caveats that the explanatory power of the model is modest, the interpretations are nuanced, and the effect is an average effect.

Second, where perhaps in the past policy makers and politicians have made unsubstantiated assumptions about the 'trickle-down' effect, there is a new realism emerging in the UK's latest policy for sport (*Sporting Future* 2015, p32).

Where it is the intention to use events or success as a stimulus for demand, we expect the sector to be clearer on how precisely it will do so. This will mean more rigorous application of the same set of filters that would be used for any marketing activity – who is the target audience, what is the message, who is the messenger, what is the channel, and how will it be activated with genuinely linked opportunities?

Third, this greater rigour, called for by the Government itself, provides a strong rationale for the use of techniques such as programme theory and logic models to underpin the implementation and evaluation of interventions that employ the 'trickle-down' effect. We now have causal evidence that the trickle-down effect exists, working through sporting success, stars, and hosting home events. Future research should focus on how these effects work.

Notes

1. Weed *et al*. (2015) refer to a 'demonstration effect' which we take to be synonymous with a 'trickle-down' effect.
2. Archery, athletics-field, athletics-running, badminton, basketball, boxing, canoeing, climbing, cricket, curling, cycling, equestrian, football, golf, gymnastics, hockey, ice skating, judo, netball, rowing, rugby league, rugby union, sailing, shooting, skiing, squash, swimming, table tennis, taekwondo, tennis, volleyball, weightlifting, and wrestling.
3. Throughout the article *T* is used for the number of years, *N* for the number of sports and *n* for the sample size ($n = T \times N$).

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ORCID

Pablo Castellanos-García http://orcid.org/0000-0001-5760-759X
Themis Kokolakakis http://orcid.org/0000-0002-2421-8106
Simon Shibli http://orcid.org/0000-0002-4420-115X

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