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On the scorecard first: early specialization and the first-mover advantage in international golf competition

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Abstract

In this paper, we apply the concept of the first-mover advantage to golf to examine whether early specialization, measured by the founding year of national golf associations, is associated with international sporting success. For this purpose, we analyze data collected from the OWGR top 100 for the period 1987-2024, measuring success using both quantitative and qualitative indicators to reflect different priorities of the associations. The analyses were based on a multivariate Poisson random intercept model and a multivariate mixed linear random intercept model. Controlling for macroeconomic control variables as well as the COVID-19 pandemic period, we find significant evidence for a performance pattern consistent with the first-mover advantage concept in international golf competition for both quantitative ($p < .001$) and qualitative success ($p = .002$). The results reinforce the findings on a shared management parallel between companies and sports associations and serve as a starting point for future research.

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1. Introduction

The development of elite sports in recent decades has led to higher performance levels and increasing pressure to succeed. As a result, knowledge about factors contributing to success in sports is growing in importance to gain a competitive edge through knowledge advantages. This development also leads to structural change within elite sports associations, which are becoming increasingly professionalized (Nagel et al., 2015), causing their organizational structures to resemble those of companies. Initiated by this change, sports science is progressively drawing on economic theories and concepts used within the corporate context and questioning their applicability to the field of sports. In 2021, a research paper applied the concept of the first-mover advantage to sports for the first time, to explore its potential in explaining competitive success (Daumann et al., 2021). The first-mover advantage, a familiar concept in competition and innovation economics, describes the opportunity for a pioneer company to gain long-term competitive advantages by entering the market early. Equivalently, studies focusing on a first-mover advantage in sports examined whether a first-mover position, operationalized by a comparatively early founding date of national sports associations, is associated with better sporting results in international competition. However, most studies, which were able to obtain empirical evidence for a first-mover advantage in sport, focused predominantly on team sports and examined the team sports of soccer, basketball, volleyball, handball, ice hockey, and rugby (Daumann et al., 2021; 2023). In individual sports, the state of research is comparatively limited. As there are no country-specific world rankings from which success indicators can be derived, the analysis is also more complex. However, an initial study in tennis also provided empirical evidence of the existence of a first-mover advantage in the field of individual sports (Riegler & Daumann, 2026a). These results from previous studies indicate a parallel between companies and sports organizations in terms of success-based decision-making. Since the findings in individual sports are based on male tennis only, the validity of the identified management parallel cannot be transferred to individual sports in general. We aim to address this research gap by applying and analyzing the concept of the first-mover advantage at the international association level in golf, thus covering another individual sports discipline. Golf is a globally highly popular sport with over 38,000 golf courses worldwide (The R&A, 2021), in which the development of athletes is significantly influenced by country-specific educational systems for coaches established by the respective national associations (International Golf Federation, 2013). Therefore, golf is ideally suited for the present study.

2. First-Mover Advantage in Individual Sports

The concept of first-mover advantage was developed by Lieberman and Montgomery (1988) and describes the opportunity for pioneering companies to gain sustainable advantages over subsequent companies by entering the market early. These advantages are triggered by initial access to and securing of limited resources, their technological leadership position, and the generation of product-related switching costs that consumers experience when switching to a competing product as part of a purchasing decision and can ultimately lead to a superior market position. According to Riegler and Daumann (2026b), a first-mover advantage in individual sports can have positive effects in the areas of consumer capital, human capital, and infrastructure, which is reflected, for example, in a larger talent pool or knowledge advantage through learning curve effects. These effects, in turn, can contribute to better sporting performance. To apply the concept of first-mover advantage to the field of individual sports and empirically examine it at the association level in international competition, it is necessary to include macroeconomic control variables in the analysis (Riegler & Daumann, 2026b). This accounts for structural differences between companies and national sports associations, as associations operate under heterogeneous country-specific conditions, for

example in terms of their respective human capital stock, that can influence their success. In addition, when applying the concept of first-mover advantage to an individual sport, the individual athletes represent the product of the associations (Riegler & Daumann, 2026b). To correctly align the empirical analysis with the first-mover advantage concept, the players must therefore be assigned to the associations responsible for their professional development prior to the study.

The study on first-mover advantage in tennis (Riegler & Daumann, 2026a) is the only empirical study within individual sports to date. It considered both quantitative and qualitative success criteria and found initial evidence for a first-mover advantage for both success definitions.

Based on the theoretical and empirical findings, we derive the research question and hypothesis as follows:

Research question: Does a first-mover advantage exist in golf?

H1: The longer a national golf association exists, the more successful it is.

3. Methodology and Empirical Results

Our analysis is based on the available year-end rankings of the top 100 players in the Official World Golf Ranking (OWGR) from 1987 to 2024 (Official World Golf Ranking, 2025). Similar to earlier studies (Daumann et al., 2023; Riegler & Daumann, 2026a), we included the national golf associations as representatives of their respective countries within the analysis to reflect their position in international competition. As the player's take on the role of associations' products within the analysis, the players were assigned to the corresponding associations using a two-step process that considered sport-specific characteristics. If the country represented was also the athlete's country of birth, the player was assigned to that association, as it can be assumed that, out of all national golf associations, this association played the most significant role in the player's golfing development. If the country of birth and the country represented differed, the player was assigned to the association that had the greatest influence on his sporting development leading up to becoming a professional. Accordingly, the decisive allocation criterion in this second step was the country in which the player lived most of the time between taking up golf and turning professional. All publicly available sources were used to obtain this information. Players without clear assignment information were not included in the analysis. The 3,800 ranking data points throughout the entire observation period refer to a total of 735 players, of whom 703 were assigned to the respective associations based on the first criterion and 28 based on the second criterion. Since the OWGR top 100 reflects an open ranking, the presence of countries varied within the individual observation years. To be able to reflect performance declines of countries, we included a country for all observation years once it was ranked in at least one year. The only requirement was that the respective national golf association already existed during the different observation years in question.

In order to capture different strategic directions of associations we considered two separate research approaches, reflecting quantitative and qualitative aspects of sporting success. Within the quantitative success approach (Model 1), the dependent variable captured the absolute number of players of a country who were ranked within the OWGR top 100 in a given observation year. Countries that were not represented in the ranking within an observation year were coded with the value "0". In the qualitative approach (Model 2), the dependent variable was derived from the ranking position of a country's highest-ranked player within the OWGR top 100 in an observation year. If a country was missing in an observation year, we considered it with the ranking value "101". Both approaches are in line with previous research analyzing success in single individual sports disciplines at country

level (e.g., Filipcic et al., 2013; Reid et al., 2007; Riegler & Daumann, 2026a), while the qualitative approach has been tailored to our sample size.

The first-mover advantage was operationalized as a predictor based on the founding year of national golf associations. The founding year represents the logical choice, as it marks the beginning of centralized sport-specific development within a country and creates the first opportunity for associations to rank their players in the world rankings. This reflects the logic of market entry in an economic context and is consistent with previous research in the field of sports (Daumann et al., 2021, 2023; Riegler & Daumann, 2026a). The data for the founding years was collected online between November and December 2025.

Furthermore, we included GDP (constant) per capita (constant in 2015 US dollars) and population size as macroeconomic control variables in the analysis to be able to transfer the concept of first-mover advantage to the field of sports (Riegler & Daumann, 2026b). The data for GDP (constant) per capita (World Bank, 2025) and population size (International Monetary Fund, 2025) were collected on December 17, 2025. Due to the right-skewed distribution of both control variables, we performed a log transformation prior to the analyses.

In addition, we considered the period of the COVID-19 pandemic using a dummy variable, enabling the results of the study to be controlled for potential confounding factors in the years 2020 to 2022.

The hypothesis was tested based on analytical models that were selected according to the characteristics of the respective dependent variables. In Model 1 the analysis was performed using a multivariate negative binomial random intercept model, which, in addition to the panel data structure, specifically considered the characteristics of the dependent variable, as an overdispersed, right-skewed count variable. Since the dependent variable in Model 2 was continuous and qualitative, a multivariate mixed linear random intercept model was used, by also taking into account the panel data structure. An initially used random slopes specification (for GDP (constant) per capita and population size) in Model 2 revealed variance components of the slopes close to zero, indicating negligible country-related heterogeneity, which is why we proceeded with a random intercept model for reasons of parsimony.

To increase the interpretability of the macroeconomic control variable's main results both within and between countries, we used a Mundlak specification in all models, by adding the country-specific mean values of GDP (constant) per capita and population size as second-level control variables. Possible correlations in subsequent periods were captured in all analyses using a within-group correlation structure with an autoregressive process of order 1.

Since the national golf association of the United States of America is one of the oldest associations and consistently accounted for a very large share (31-60%) of the OWGR top 100, we performed all analyses again without the USA as a robustness check. This enabled us to verify whether potential associations observed were indeed linked to a first-mover advantage rather than reflecting an US effect. All analyses were performed using the statistical program R (version 4.5.2), with results considered significant for p-values below 0.05.

Table I: Quantitative success indicator: Associations between founding year, macroeconomic factors, and the COVID-19 pandemic period with the number of top 100 ranked OWGR players of a country.

	Model 1a: Full Sample		Model 1b: Ex-USA Sample	
Fixed effects	Estimates	p	Estimates	p
Intercept	-4.419	.128	-3.089	.254
Founding year	-0.041	<.001	-0.037	.001
Log GDPpc (const.)	0.936	.002	0.982	.002
Log population	0.174	.801	0.420	.575
Mean log GDPpc (const.) (mean within each country, level 2 predictor)	-0.666	.103	-0.811	.051
Mean log population (mean within each country, level 2 predictor)	0.248	.722	-0.155	.837
COVID-19 pandemic period	-0.006	.950	-0.026	.828

Note: Analysis was conducted using a multivariate negative binomial random intercept model with Mundlak specification including autocorrelation (R package: glmmTMB; function: glmmTMB with residual correlation via AR1), with observations from different years nested within countries.
Model 1a: N = 1,322 observations in 35 groups; $R^2m = 0.44$, $R^2c = 0.85$.
Model 1b: N = 1,284 observations in 34 groups; $R^2m = 0.36$, $R^2c = 0.75$.

The results for the quantitative success indicator are summarized in Table I. Controlling for differences in GDP (constant) per capita and population size and considering the COVID-19 pandemic period, Model 1a shows a significant association between the founding year of national golf associations and success ($p < .001$). Accordingly, an earlier founding year is associated with a larger number of OWGR top 100 players in a country. The increase in GDP (constant) per capita within a country shows a significant coefficient in Model 1a ($p = .002$), according to which an increase is positively correlated with the number of top 100 players of a country. The robustness check results in Model 1b are in line with the observed associations for the founding year of national golf associations ($p = .001$) and GDP (constant) per capita ($p = .002$) in Model 1a, regarding their significance and directions. In both models, there were no significant coefficients for the COVID-19 pandemic period, neither the between-country main effects of GDP (constant) per capita and population size, nor for within-country changes in population size.

Table II: Qualitative success indicator: Associations between founding year, macroeconomic factors, and the COVID-19 pandemic period with the ranking position of a country's OWGR top 100 player.

	Model 2a: Full Sample		Model 2b: Ex-USA Sample	
Fixed effects	Estimates	p	Estimates	p
Intercept	-1160.285	.005	-1103.822	.006
Founding year	0.644	.002	0.609	.003
Log GDPpc (const.)	-14.586	.021	-14.586	.024
Log population	-1.224	.941	-1.587	.925
Mean log GDPpc (const.) (mean within each country, level 2 predictor)	13.316	.104	14.269	.084
Mean log population (mean within each country, level 2 predictor)	-0.518	.975	1.062	.951
COVID-19 pandemic period	-0.896	.671	-0.929	.668

Note: Analysis was conducted using a multivariate mixed linear random intercept model with Mundlak specification including autocorrelation (R package: nlme; function: lme with residual correlation via corAR1), with observations from different years nested within countries.
Model 2a: N = 1,322 observations in 35 groups; $R^2m = 0.25$, $R^2c = 0.56$.
Model 2b: N = 1,284 observations in 34 groups; $R^2m = 0.21$, $R^2c = 0.51$.

Table II presents the results based on the qualitative success indicator. Considering the control variables, Model 2a shows a positive significant association between the founding year of national golf associations and sporting success ($p = .002$), with older associations being associated with a better ranking position of their best player in the OWGR top 100. According to the results of Model 2a, GDP (constant) per capita has a negative significant coefficient ($p = .021$). Hence, an increase in GDP (constant) per capita within a country correlates with a better ranking position. The remaining control variables show no significant relationships. The robustness check in Model 2b provides additional evidence for the significance of the coefficients of GDP (constant) per capita and founding year of national golf associations indicating their robustness even without the dominant US presence.

4. Concluding Remarks

The aim of the study was to explore whether early specialization, initiated by the early founding of an association and the resulting formation of golf-specific structures within a

country, leads to better performance. Our results indicate significant evidence for a first-mover advantage in international golf. The earlier a national golf association was founded, the more successful it is in international comparison. This applies equally to both definitions of success examined. Countries with historically older associations therefore achieve better sporting results in relation to the absolute number of their players and the ranking position of their best player in the OWGR top 100. The results of the main analyses were also empirically supported by the robustness checks, which ruled out the possibility that the combination of the United States' sporting dominance and its association's early founding led to systematic bias. Our data therefore matches H1. In addition, the results show that an increase in GDP (constant) per capita within a country is associated with improved sporting performance. These results are in line with findings from previous studies regarding the importance of financial resources for success in golf (e.g., Fry, 2015; Stoszkowski & Collins, 2011).

Following tennis (Riegler & Daumann, 2026a), golf is thus the second individual sport for which empirical evidence of a first-mover advantage has been found. The results also represent further justification for the management parallel between companies and sports associations and should be viewed as a starting point for future research. Accordingly, future research could use proxies to examine which of the three first-mover advantage components mainly contributes to the observed association, which would support the development of future action implications for national golf associations. Our findings should therefore be seen as an initial contribution towards establishing a new field of research in golf, which could provide national golf associations with important guidance for strategic decisions in the future.

The results must be interpreted in the context of several limitations, including potential omitted variables that influence sporting success, omitted cultural factors that may have influenced the founding of national golf associations, and alternative definitions of sporting success. Due to the dominant US presence in the top 100 rankings, expanding the sample in future research (e.g., to the top 300) would help generate the necessary cross-sectional variance between countries to account for potential confounding cultural factors. In addition, the indicator used for measuring qualitative success might reflect individual talent rather than association performance. To address and weaken this limitation, we conducted additional analyses using the cumulative ranking of the two or three best players of each country in the OWGR top 100. These results also support the findings presented in Table II and are documented in the appendix (Tables AI and AII).

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Appendix

Table AI: Qualitative success indicator: Associations between founding year, macroeconomic factors, and the COVID-19 pandemic period with the cumulative ranking of a country’s two best OWGR top 100 players.

	Model 3a: Full Sample		Model 3b: Ex-USA Sample	
Fixed effects	Estimates	p	Estimates	p
Intercept	-1892.525	.012	-1746.634	.014
Founding year	1.078	.005	0.987	.007
Log GDPpc (const.)	-22.141	.012	-22.093	.014
Log population	1.928	.933	1.489	.949
Mean log GDPpc (const.) (mean within each country, level 2 predictor)	19.396	.130	21.811	.085
Mean log population (mean within each country, level 2 predictor)	-6.466	.784	-2.882	.905
COVID-19 pandemic period	0.216	.941	0.248	.934

Note: Analysis was conducted using a multivariate mixed linear random intercept model with Mundlak specification including autocorrelation (R package: nlme; function: lme with residual correlation via corAR1), with observations from different years nested within countries.
Model 3a: N = 1,322 observations in 35 groups; $R^2m = 0.26$, $R^2c = 0.69$.
Model 3b: N = 1,284 observations in 34 groups; $R^2m = 0.21$, $R^2c = 0.63$.

Table AII: Qualitative success indicator: Associations between founding year, macroeconomic factors, and the COVID-19 pandemic period with the cumulative ranking of a country's three best OWGR top 100 players.

	Model 4a: Full Sample		Model 4b: Ex-USA Sample	
Fixed effects	Estimates	p	Estimates	p
Intercept	-2298.795	.025	-2050.549	.027
Founding year	1.353	.009	1.198	.011
Log GDPpc (const.)	-25.241	.017	-25.157	.020
Log population	2.203	.936	1.798	.949
Mean log GDPpc (const.) (mean within each country, level 2 predictor)	19.929	.224	24.033	.127
Mean log population (mean within each country, level 2 predictor)	-9.995	.725	-4.239	.884
COVID-19 pandemic period	0.527	.880	0.570	.874

Note: Analysis was conducted using a multivariate mixed linear random intercept model with Mundlak specification including autocorrelation (R package: nlme; function: lme with residual correlation via corAR1), with observations from different years nested within countries.
Model 4a: N = 1,322 observations in 35 groups; $R^2m = 0.27$, $R^2c = 0.74$.
Model 4b: N = 1,284 observations in 34 groups; $R^2m = 0.20$, $R^2c = 0.66$.