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The Relationship Between Public Spending and Employment in the Sports Sector

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ABSTRACT
Objective: This study examines the relationship between public funds allocated to sports and recreation and employment in the sports sector across the EU-27 countries. **Materials and Methods:** A balanced panel dataset covering the 27 countries for the 2011–2024 period was used; 378 country-year observations were analyzed over the 14-year period. **Results:** Although the coefficient for same-year expenditures is positive, it is not statistically significant. In the three-year lagged model, the relationship is positive and significant at the 1% level. No significant interaction effect was found for income group. The unemployment rate is negative and strongly significant in all models. **Conclusion:** No significant relationship was found between public sports and recreation expenditures and sports employment for the same year. The fact that the coefficient with a three-year lag is positive and significant indicates a medium-term relationship. This finding does not suggest that the three-year period represents a causal or singular implementation period.
Keywords: COFOG, Employment in Sports, Lagged Association Analysis, Public Expenditures, Sports Economy.

Spor Sektöründe Kamu Harcamaları ve İstihdam İlişkisi

ÖZ
Amaç: Çalışma, AB-27 ülkelerinde spor ve rekreasyona ayrılan kamu kaynakları ile spor sektörü istihdamı arasındaki ilişkiyi incelemektedir. **Gereç ve Yöntem:** 2011–2024 dönemi için 27 ülkeyi kapsayan dengeli panel veri seti kullanılmış; 14 yıllık dönemde 378 ülke-yıl gözlemi analiz edilmiştir. **Bulgular:** Harcamaların aynı yıl içindeki katsayısı pozitif olmakla birlikte istatistiksel olarak anlamlı değildir. Üç yıl gecikmeli modelde ilişki pozitiftir ve %1 düzeyinde anlamlıdır. Gelir grubu için etkileşim etkisi anlamlı bulunmamıştır. İşsizlik oranı bütün modellerde negatif ve güçlü biçimde anlamlıdır. **Sonuç:** Aynı yıla ait kamu spor ve rekreasyon harcamaları ile spor sektöründeki istihdam arasında anlamlı bir ilişki saptanmamıştır. Üç yıllık gecikmeli katsayının pozitif ve anlamlı olması, orta vadeli bir ilişkiye işaret etmektedir. Bu bulgu, üç yıllık sürenin nedensel bir ilişki ya da tek başına bir uygulama dönemi olduğunu işaret etmemektedir.
Anahtar Kelimeler: COFOG, Sporda İstihdam, Gecikmeli İlişki Analizi, Kamu Harcamaları, Spor Ekonomisi.

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INTRODUCTION

Beyond its positive effects on social welfare and Europe's sociocultural structure, the sports economy has evolved into an industrial structure that influences Gross Domestic Product (GDP) and employment. The sports sector is a dynamic structure that can create employment within the growing service sector—a sector that can integrate with many disciplines beyond manufacturing.

Employment is an important indicator of an economy's health and productivity (Rhodes, 2015). Employment relationships in sports are shaped by the interplay of national legislation, international standards, and the relationships between the public sector and the sports movement. The sports ecosystem is a unique organizational and managerial structure that balances the public interest with the increasing commercialization of sports (Begović, 2025).

Sport now reaches far beyond competitions themselves. Its links with education, media, textiles, tourism, gambling, infrastructure, and other activities give it a measurable economic weight (Mumcu et al., 2019). Within national economies, this expanding network can support demand and business activity (Hadian et al., 2020), and the scale of the global sports market has made it an increasingly influential field (Zhou et al., 2023). In developed economies, the sector is also seen as a channel for supporting growth (Jiang and Liang, 2014). Its worldwide expansion therefore has implications that extend beyond sport-specific outcomes (Tao and Tao, 2025). At the same time, the breadth of these connections makes the sector's economic contribution difficult to isolate with precision (Mumcu et al., 2019). Sport may serve economic, political, social and cultural development objectives together rather than through a single mechanism (Rezaie and Salehipour, 2018). Globalization and advances in information technology have also widened the industry's boundaries: competitive sport now sits alongside fitness and entertainment, education and training, sports tourism, media, equipment, and several related branches (Tao and Tao, 2025). As a result, the sector generates income, trade and employment across a broad international market (Rezaie and Salehipour, 2018). Its connection with wider economic development has consequently become closer (Xiandong, 2014). Countries increasingly monitor this contribution through indicators such as GDP, national income, employment, and public-health outcomes (Rahmani et al., 2024). Sport also retains a public-interest dimension (Solncev, 2012), while simultaneously providing a substantial field for entrepreneurship and job creation (Solncev, 2012).

Available economic indicators describe sport as a field that continues to expand and develop (Bartoluci & Škorić, 2009). This expansion matters for employment because new commercial activities, services and professional roles accompany the sector's growth. This change has been particularly visible in Europe, where sport has taken on a stronger economic profile. Alongside broader efforts to address unemployment, EU initiatives involving facilities, technology, education, mobility programs and new occupational areas have helped enlarge the sector's employment base (Mumcu et al., 2019).

Economic activity in sport is produced at several levels, from large football organizations to neighborhood clubs and fitness centers. Because most sporting services depend heavily on labor, they create jobs not only in delivering activities but also in building, operating, and maintaining facilities. This labor-intensive structure plays sports an important source of local employment (Barbu et al., 2020).

The commercialization of sport has strengthened its connection with economic growth and new employment (Stroe and Barbu, 2006), helping it develop into a rapidly expanding business field (Florea et al., 2018). During the twentieth century, this process also changed leisure: Sporting activity became increasingly organized around markets and consumption as the sector grew more profitable (Reis et al., 2020). In Europe, the widening range of sports-related activities has likewise produced new jobs, with younger workers benefiting especially from this development (Digennaro and Tescione, 2023).

The economic significance of sport is best understood through more than one indicator. Its contribution includes growth, employment, and social welfare, and sectoral performance can be viewed through both labor-market and production perspectives. Employment figures show the industry's ability to absorb workers in manufacturing, services, event organization, and professional sport, thereby supporting diversification and labor-market stability (Alma Savaş, 2024). More generally, changes in labor supply and demand influence production and therefore GDP; higher labor-force participation can expand an economy's growth capacity (Korkmaz, 2025). Sales-based production complements this picture by showing output volume, the contribution to GDP, and the sector's place in trade and household spending.

Viewed together, employment and production measures provide a fuller picture of the industry's economic scale and its position in contemporary economies (Alma Savaş, 2024). The European labor market reflects this expansion: as sporting activities diversified under globalization, the sector's workforce increased by about 60% over the preceding decade (Barbu et al., 2020).

Against this background, the present study investigates whether public expenditure on sport and recreation is associated with employment in the sports sector across European Union countries.

The theoretical rationale for the three-year lag is that public spending does not translate into employment immediately. Sports infrastructure and recreational services may involve sequential stages such as

budgeting, bidding, construction or renovation, commissioning, staffing, and developing service capacity. Empirical studies on public infrastructure investments indicate that there are implementation delays—spanning several years—between spending decisions and economic outcomes (Leduc and Wilson, 2013; Abiad, Furceri, and Topalova, 2016). For this reason, the three-year delay has been treated not as a predetermined, fixed causal timeframe, but as a medium-term analysis window. The findings have also been interpreted not as an "effect occurring three years later," but rather as a statistical relationship observed at the three-year lag.

The three-year lag reflects the sequential implementation stages of public expenditures in the sports and recreation sector, including budgeting, bidding, construction/renovation, facility commissioning, and staff hiring. Therefore, the three-year period is treated not as a single, fixed causal lag, but as a medium-term observation window between the short term and the longer term. Leduc and Wilson (2013) and Abiad et al. (2016) demonstrate that delays spanning several years can occur between implementation and economic outcomes in public infrastructure investments; however, this literature does not specifically predict a universal three-year timeframe for the sports sector.

Data on employment in the sports sector;

The long-term pattern of sports employment in Europe shows both growth and marked variation among countries. Male employment in the sector rose from 583,100 in 2011 to 746,400 in 2019 (Eurostat, 2025). By 2014, sport had already become an economic field whose weight in EU national economies was comparable to agriculture, forestry and fisheries combined; estimates placed its contribution at 2% of EU GDP and the employment supported by sports activity at 7.3 million people, or 3.5% of total EU employment (Europorter, 2014). For 2015–2020, sports employment recorded an annual average growth rate of 1.6%, double the 0.8% rate for employment overall. Cyprus (13.6% CAGR), Greece (10.3%), Romania (9.4%) and Belgium posted the strongest increases. By contrast, Lithuania (–4.2% in sport versus +0.3% overall), Austria (–3.5% versus +0.7%) and Slovenia (–2.7% versus +1.3%) were among the countries where sports employment contracted even though total employment grew (Eurostat, 2021). The fitness market followed a similar expansionary course: revenue in the European health and fitness market increased by 1.9% to 26.6 million euros in the 2017 report, which covered the 28 EU member states as well as Norway, Russia, Switzerland, Turkey and Ukraine (EHFMR, 2018). In 2018, sports employment in the EU stood at 1.76 million, and the sector's CAGR for 2013–2018 was 3.2% (Eurostat, 2019). Mumcu et al. (2019) reported that sport represented roughly 2% of GDP in employment terms in EU member states, whereas its share of total employment in Turkey was 0.5% (Mumcu et al., 2019). The pandemic period interrupted this broader trend. From 2019 to 2020, sports employment fell in 16 EU countries, with the largest losses in Croatia, Latvia, Estonia and Malta; among the countries that grew, Romania, Luxembourg, Greece and Cyprus recorded increases of at least 20% (Digennaro and Tescione, 2023). Even so, EU sports employment was 1.3 million in 2020 (Eurostat, 2021). Compared with 2015, this was about 100,000 additional workers and an 8.4% cumulative increase. The sector's employment share rose from 0.64% in 2015 to 0.68% in 2020, and 21 of the 27 member states registered growth over that period. Italy, Spain, Greece and Germany accounted for more than half of the increase (Eurostat, 2021). In 2020, the sector represented 0.7% of EU employment, ranging from 0.2% in Romania to 1.6% in Sweden and 2.2% in Iceland. Apart from Sweden, only Finland, Spain and the Netherlands reached or exceeded a 1% share. Although sport remained a relatively small part of overall employment, its contribution rose in 15 member states between 2015 and 2020 (Eurostat, 2021). The same data can be summarized from another angle: the EU employed 1.3 million people in sport in 2020, with the highest shares in Sweden (1.6%), Finland (1.4%), Spain and the Netherlands (1.0% each). From 2015 to 2020, sports employment grew by an annual average of 1.6% versus 0.8% for total employment, adding around 100,000 workers; more than half of that growth came from Italy, Spain, Greece and Germany, and 21 member states recorded growth. In 2020 alone, however, sports employment declined by 4.0%, compared with a 1.3% fall in total employment (Eurostat, 2021). Recovery was uneven in 2021. Nine countries returned to or surpassed their 2019 levels, including Slovenia (65%), France (54%), Cyprus (27%) and Hungary (21%), while Malta, Latvia and Croatia remained more than 30% below 2019 (Digennaro and Tescione, 2023). EU sports employment nevertheless returned to the pre-pandemic level of 1.37 million, indicating resilience and renewed growth potential (Digennaro and Tescione, 2023). In 2021, those 1.37 million workers represented 0.7% of EU employment. The rebound followed the fall from 1.37 million in 2019 to 1.31 million in 2020 (1.37 million employees in 2019; 1.31 million in 2020). Sweden (1.4%), Finland (1.3%), Spain and France (1.1% each) had the largest national shares, whereas Romania (0.2%), Malta (0.3%), Bulgaria, Slovakia and Poland (0.4% each) had the smallest (Eurostat, 2022). Growth accelerated in 2022: 1.51 million people worked in sport, corresponding to 0.8% of EU employment and a 10.9% increase from 1.36 million in 2021. The definition covers clubs and teams, coaches, self-employed athletes, fitness centers, and event promotion and management. Sweden again had the highest share (1.4%), followed by Finland and Denmark (1.2%), and Spain and France (1.1%); Romania (0.2%), Bulgaria (0.3%), Poland and

Slovakia (0.4%), and Croatia and Lithuania (0.5%) were at the lower end (Eurostat, 2023). Compared with 2021, employment increased in 23 countries. Malta (137.5%), Greece (47.6%) and Estonia (42.9%) led the rise, while Latvia (–13.3%), Cyprus (–10%), Bulgaria (–9.8%) and Finland (–3.0%) declined. Because the sector is small in several of these economies, modest headcount changes can produce large percentage movements (Eurostat, 2025). The EU total reached 1.55 million in 2023, equal to 0.76% of employment and 2.2% above the 2022 level of 1.51 million. Sweden (1.33%), Denmark (1.25%) and Spain (1.16%) had the highest shares; Romania (0.28%), Bulgaria (0.37%) and Slovakia (0.40%) had the lowest (Eurostat, 2024). In 2024, sport accounted for 0.8% of total EU employment, with country shares ranging from 0.2% in Romania to 1.5% in Sweden. Sweden, Denmark, Spain, Finland, France, Estonia, Ireland, the Netherlands and Portugal all recorded shares of at least 1%. Between 2021 and 2024, the sector's contribution to national employment rose in 22 of the 27 countries. The EU total reached 1.6 million workers in 2024, and 22 countries increased employment relative to 2023; Croatia (26.5%), Slovakia (24.0%) and Lithuania (22.7%) had the largest gains. Romania (–25.0%), Luxembourg (–12.0%) and Austria (–11.6%) fell after two years of growth, while declines continued in the Czech Republic (–17.2%) and Latvia (–8.2%) (Eurostat, 2025).

MATERIALS AND METHODS

The empirical analysis uses a country-level panel to assess the relationship between government expenditure on sport and recreation and sports employment in the European Union. It covers all 27 EU member states from 2011 through 2024. With one observation for each country and year, the balanced dataset contains 378 observations across fourteen years. The dependent variable is sports employment as a percentage of total employment. The principalexplanatory variable is government expenditure on sport and recreation as a share of GDP, measured under COFOG code GF0801, “Recreational and sporting services.” GDP per capita, unemployment and population enter the specifications as controls. GDP per capita and population were transformed into natural logarithms to reduce scale differences between countries. Sports employment figures come from Eurostat's employment-in-sport series, while expenditure data are drawn from Eurostat's functional classification of general government expenditure. GDP per capita, unemployment and population were obtained from the World Bank's World Development Indicators. This framework allows us to consider the contemporaneous and delayed expenditure-employment relationship alongside income, labor-market, and demographic conditions.

The share of sports employment in total employment and the share of public sports and recreation spending in GDP are ratio variables. This approach allows for cross-country comparability. However, changes in the denominator can directly affect these ratios. If total employment declines while sports employment remains constant, the sector’s share of employment may increase. Similarly, fluctuations in GDP can alter the share of public sports spending in GDP, even if nominal spending remains unchanged. For this reason, we interpreted the results as the combined effect of these ratio variables, and we further tested measurement sensitivity using alternative definitions. In this study, both the dependent variable and the primary explanatory variable are expressed as ratios. Therefore, the coefficients should be interpreted not as absolute increases in employment or absolute increases in expenditure, but as the relationship between changes in percentage points of these shares. In particular, because changes in total employment or GDP can affect the share level even if the absolute component remains unchanged, the results have been evaluated with this sensitivity in mind.

Table 1. Research Hypotheses.

	Hypothesis	Conclusion
H^1	There is a positive relationship between the share of public sports and recreation expenditures in GDP and the share of sports employment in total employment for the same period.	Not supported
H^2	The relationship between public sports and recreation expenditures and sports employment varies across different time lags.	Partially supported
H^3	The relationship between public sports and recreation expenditures and sports employment varies depending on the country’s income group.	Not supported

Hypothesis tests present a mixed picture. H1 was not supported. H2 was partially supported because the model showed a positive, significant relationship with a three-year lag. H3, however, was not supported because the interaction with income group was not statistically significant. These results were interpreted not as claims of causal effects, but as relationships observed within the context of panel data.

Statistical analysis

The analysis began with checks of the panel structure and missing observations, followed by descriptive statistics. Pairwise correlations were then reviewed, and variance inflation factors were calculated as a multicollinearity diagnostic. Pooled OLS, fixed effects, and random-effects specifications were estimated in sequence. A Hausman test was used to

select between the two panel estimators, and its result favored the fixed-effects approach.

Diagnostic testing of the fixed-effects specification covered non-constant error variance, serial correlation and dependence across countries. The Breusch-Pagan test, the Breusch-Godfrey/Wooldridge procedure and the Pesaran CD test were used for these purposes. All three problems were detected. The final estimations therefore rely on Driscoll-Kraay robust standard errors, which provide more dependable inference when heteroskedasticity, autocorrelation and cross-sectional dependence occur together.

To examine the timing structure, public sports and recreation spending was estimated in separate models with no lag, a one-year lag, and a three-year lag. The three-year lag serves as an analysis window representing the medium-term period that may be required for planning, implementation, facility commissioning, and developing service capacity. This choice is not based on the assumption that three years is a single, definitive causal period. The present analysis is not a full distributed lag model that incorporates all lags in the same equation. Therefore, the three-year coefficient is interpreted not as an "impact period" independent of other lags, but as the lagged relationship observed across alternative time lags. The two-way fixed-effects model was used to control for common-year shocks in addition to country effects.

As part of the robustness analysis, the public sports and recreation expenditure variable—which is lagged by three years—must be estimated separately under a two-way fixed-effects model, incorporating year fixed effects that control for common-year shocks in addition to country fixed effects. The use of Driscoll-Kraay robust standard errors in this model allows us to test whether the three-year relationship persists independently of common EU-wide annual shocks.

To ensure that income group interactions can be reported in a reproducible manner, the method section must clearly specify which classification or threshold was used to derive the high-income indicator. Because the current article does not include this threshold information, we assumed no new classification and added no hypothetical criterion.

Two alternative measures were used in the robustness checks. In the first model, the number of jobs in the sports sector was used as the dependent variable instead of the share of sports employment in total employment. In the second model, public spending on sports and recreation was measured as a share of total public spending rather than as a share of GDP. In both controls, the public spending coefficient for the same year was not statistically significant. The unemployment coefficient remained negative and significant. Thus, the results did not depend solely on the initial choice of denominator.

The estimates illustrate the relationships within the panel data framework and are not interpreted as definitive proof of causality. The lagged coefficients are also treated not as defined causal effects of public sports expenditures, but as observed medium-term relationships between spending and subsequent sports employment.

RESULTS

The following section presents and interprets the empirical relationship between public sport and recreation expenditure and sports employment, using the accompanying tables and figures.

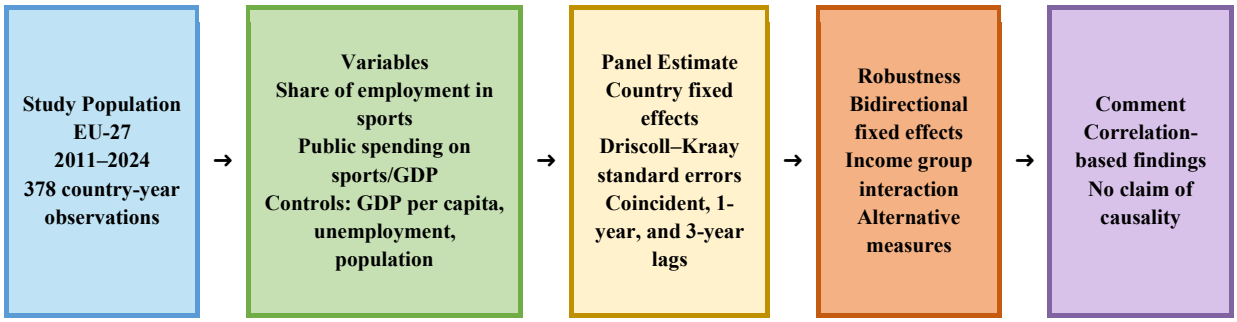


Figure 1. The empirical panel data analysis framework of the study.

Note: The figure illustrates the research universe, variables, panel data estimation, lagged models, and robustness checks in a single flowchart. Regional classification is not an analytical variable.

Table 2. EU-27 countries included in the study.

Country Group	Countries	Number of countries
Northern Europe	Denmark, Finland, Sweden	**3**
Western Europe	Austria, Belgium, France, Germany, Ireland, Luxembourg, Netherlands	**7**
Southern Europe	Croatia, Cyprus, Greece, Italy, Malta, Portugal, Slovenia, Spain	**8**
Central and Eastern Europe	Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia	**9**

Note: The regional classification was created to facilitate the visual presentation of the countries included in the study. The regional group variable was not used in the analyses.

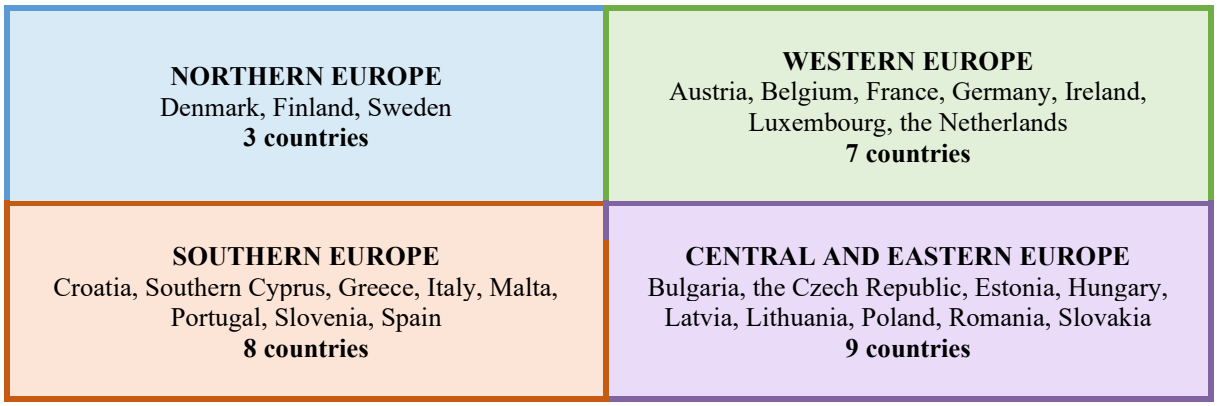


Figure 2. Regional distribution of the EU-27 countries covered by the study.
Note: The regional classification was created to facilitate the visual presentation of the countries covered by the study. The regional group variable was not used in the analyses.

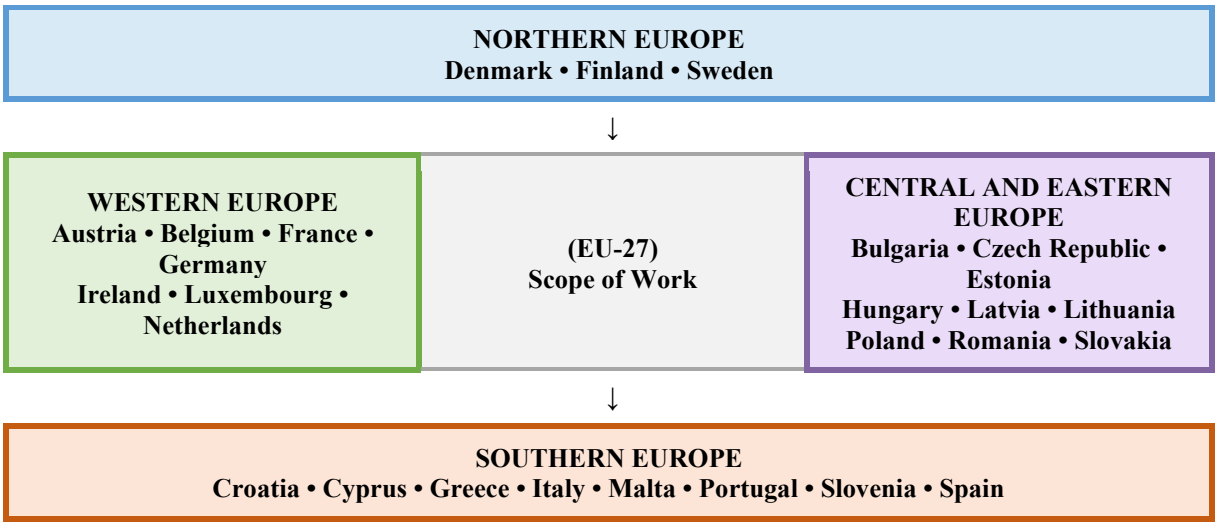


Figure 3. Schematic regional distribution of the EU-27 countries included in the study.
Note: This diagram is a schematic representation that does not claim to be geographically accurate. Its primary purpose is to facilitate the identification of regions within the text. The regional group variable was not used in the analyses. The regional classification was prepared to facilitate the visual presentation of the countries included in the study. The regional group variable was not used in the analyses.

Table 3. Descriptive statistics.

Variable	Observation	Mean	Standard deviation	Minimum	Maximum
Share of employment in sports	378	0.68	0.30	0.12	1.60
Public spending on sports and recreation	378	0.38	0.17	0.10	1.30
GDP per capita (ln)	378	10.30	0.61	8.89	11.83
Unemployment rate	378	8.06	4.45	2.02	27.69
Population (ln)	378	15.82	1.34	12.94	18.24

Note: The variables for GDP per capita and population were used after taking their natural logarithms. The share of sports employment refers to the percentage of sports employment within total employment, while public spending on sports and recreation refers to its percentage share of GDP.

For the EU-27 sample, sports employment averaged 0.68% of total employment between 2011 and 2024. Public sport and recreation expenditure averaged 0.38% of GDP. The distance between the minimum and maximum values further shows that countries differ considerably in employment shares, public expenditure, income, unemployment and population.

Table 4. Definition of variables and data sources.

Variable	Description	Unit of measurement	Source
Share of sports employment	The share of sports employment in total employment	Percentage	Eurostat, Employed persons in sport by sex
Public spending on sports and recreation	General government spending under COFOG GF0801 "Recreational and sporting services"	Percentage share of GDP	Eurostat, General government expenditure by function (COFOG)
GDP per capita	GDP per capita, in current U.S. dollars	Natural logarithm	World Bank, WDI
Unemployment rate	The proportion of unemployed persons in the total labor force	Percent	World Bank, WDI
Population	Total population	Natural logarithm	World Bank, WDI

Note: For the sports employment variable, the gender filter is set to "Total," and the unit of measurement is "Percentage of total employment." Public spending on sports and recreation corresponds to the COFOG classification code GF0801, "Recreational and sporting services." The variables GDP per capita and population were included in the model after taking their natural logarithms.

Eurostat's employment-in-sport statistics provide the dependent variable, defined as persons working in sport relative to total employment. The expenditure measure comes from Eurostat's COFOG database and uses GF0801, "Recreational and sporting services." GDP per capita, unemployment, and population were sourced from the World Bank's World Development Indicators.

Table 5. Correlation matrix.

Variables	1	2	3	4	5
1. Share of sports employment	1.000				
2. Public spending on sports and recreation	0.274	1.000			
3. GDP per capita (ln)	0.580	0.106	1.000		
4. Unemployment rate	-0.016	-0.059	-0.239	1.000	
5. Population (ln)	0.005	0.128	-0.042	0.116	1.000

The correlation matrix shows a positive association between sports employment and public sport and recreation expenditure (r = 0.274). Countries and years with a larger expenditure share therefore tend to display a somewhat larger sports-employment share. The coefficient is modest, however, so regression models are needed before drawing stronger conclusions. Sports employment has a stronger bivariate association with GDP per capita (r=0.580), indicating that the employment share is generally larger in more economically developed countries. Its

correlations with unemployment and population are comparatively small.
Correlations among the explanatory variables remain low. None approach the commonly used 0.80 warning level, suggesting the variables do not convey substantially duplicate information and can be entered together in the panel models.
The variance inflation factors support the same conclusion. Values range from 1.03 to 1.08, well below conventional thresholds, and indicate no multicollinearity problem.

Table 6. Comparison of panel regression models.

Variables	Pooled OLS	Fixed effects	Random effects
Public spending on sports and recreation	0.391***	0.016	0.047
Per capita GDP (ln)	0.288***	-0.040	0.047
Unemployment rate	0.009***	-0.020***	-0.016***
Population (ln)	-0.003	0.162	0.012
Constant	-2.465***	—	0.120
Number of observations	378	378	378
R^2	0.401	0.225	0.196
Model significance	p < 0.001	p < 0.001	p < 0.001

Note: ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively.

The pooled OLS estimates initially show a positive and statistically significant coefficient for public sport and recreation expenditure. In that specification, a larger expenditure share is associated with a larger share of employment in sport. GDP per capita and unemployment are also statistically significant under pooled OLS.
The result changes after unobserved, time-invariant country characteristics are controlled. In the fixed-effects model, the expenditure coefficient remains positive but loses statistical significance. This contrast suggests that the pooled association is partly driven by persistent structural differences between countries: countries with larger sports sectors may also spend more, whereas year-to-year changes within the same country show a weaker connection.
The random-effects specification yields a similar expenditure result: the coefficient is positive but insignificant. Unemployment is negative and significant in both panel estimators, indicating that sport's share of employment tends to fall when general unemployment rises.
These differences underline the need to account for country-specific characteristics. The Hausman test was therefore used to decide whether fixed or random effects provided the more appropriate estimator.
The Hausman statistic is $\chi^2 = 15.635$ with $p = 0.00355$. Because the probability value is below 0.05, the consistency assumption required for random effects is rejected. Subsequent analysis consequently uses the fixed-effects model.

Table 7. Assumption tests for the fixed effects model.

Test	Purpose	Test value	p	Result
Breusch-Pagan test	Heteroscedasticity	BP=98.334	<0.001	Heteroscedasticity is present
Breusch-Godfrey/Wooldridge test	Autocorrelation	χ^2=86.658	<0.001	Autocorrelation is present
Pesaran CD test	Cross-sectional dependence	z=5.494	<0.001	Cross-sectional dependence is present

The diagnostic tests identify all three forms of disturbance considered. The Breusch-Pagan result has a p-value below 0.05, rejecting constant error variance. The Breusch-Godfrey/Wooldridge test detects serial correlation, meaning that disturbances are related over time. The Pesaran CD test also indicates dependence across country units.
Cross-sectional dependence is plausible when EU members are exposed to shared economic, political, or regional shocks. Given the combined diagnostic failures, the fixed-effects model was re-estimated with Driscoll-Kraay errors. The calculation uses an HC1 adjustment and a lag length of two periods.

Table 8. Results of the fixed-effects model with Driscoll-Kraay robust standard errors.

Variable	Coefficient	Driscoll-Kraay Std. Error	t value	p
Public sports and recreation expenditures	0.016	0.069	0.234	0.815
Per capita GDP (ln)	-0.040	0.054	-0.741	0.459
Unemployment rate	-0.020***	0.002	-8.571	<0.001
Population (ln)	0.162*	0.089	1.817	0.070

Note: ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively. Alternative lag lengths and HC corrections for the Driscoll-Kraay errors did not make the public sport and recreation expenditure coefficient significant, supporting the stability of the contemporaneous result.

With Driscoll-Kraay inference, public sport and recreation expenditure remains positive, but the estimate is statistically insignificant. Thus, for the EU-27 over 2011–2024, within-country changes in expenditure as a share of GDP are not associated with a detectable change in sports employment during the same year.

GDP per capita has a negative but insignificant coefficient. Unemployment, by contrast, is negative and significant at the 1% level, implying that higher unemployment is associated with a lower sports-employment share. Population is positive and significant at the 10% level, suggesting a weak positive association between country size and sports employment.

When evaluated together, the simultaneous models do not show a statistically significant relationship between public sports and recreation expenditures and sports employment for the same year. This result necessitated a separate examination of the timing using lagged models.

In the main model, the coefficient for public sports and recreation spending is 0.016; while positive, it is not statistically significant (p=0.815). A one-percentage-point increase in spending is associated with a 0.016 percentage-point higher share of sports employment in the same year; however, the coefficient is not statistically significant. The simultaneous coefficient in the two-way fixed-effects model is also 0.014 and is not statistically significant (p = 0.820). This model controls for both country and common-year effects, but does not separately test the three-year lagged expenditure coefficient in the current table. Lagged models show a different timing pattern. The one-year lagged coefficient is 0.086 and is not statistically significant (p=0.111). The three-year lagged coefficient is 0.123 and is significant at the 1% level (p<0.001). Accordingly, a one percentage point higher share of spending in GDP is associated with an approximately 0.123 percentage point higher share of sports employment three years later. On a more realistic scale, a 0.10 percentage point difference in the spending share is associated with an approximately 0.012 percentage point higher employment share. This pattern is consistent with a medium-term time lag rather than a simultaneous relationship. Spending may take time to translate into facility and service capacity, organizational continuity, and personnel demand. However, the three-year lag does not indicate that spending produces a causal effect exactly three years later. The findings merely show that a statistically significant relationship exists at a three-year lag. The three-year lagged coefficient of 0.123 indicates that a 1 percentage point increase in the share of public sports and recreation spending in GDP is associated with a 0.123 percentage point increase in the share of sports employment in total employment three years later. This statement does not imply a 12.3% increase in the absolute number of employees and should not be interpreted as a causal multiplier. In the income group interaction model, the coefficient for expenditure × high income is -0.013 and is not statistically significant (p=0.933). This result does not support the notion that the expenditure-employment relationship differs statistically across income groups in the current specification. However, because the current file does not explain the classification/threshold used to define the high-income group, you must clearly specify this definition in the resubmission. Additionally, the current table does not test the income-group difference separately for the three-year lagged specification. Across all specifications, unemployment has a negative coefficient and is significant at the 1% level. Sports employment is therefore linked not only to sector-specific expenditure but also to the condition of the wider labor market. As unemployment increases, sport's share of total employment tends to contract. The pattern suggests that general economic conditions dominate in the short run, while any relationship with public sports expenditure is more likely to emerge over a longer horizon.

Robustness analyses: Two alternative definitions assess whether the simultaneous result is sensitive to the choice of measurement. When the number of jobs in sports is used instead of the share of sports employment, public spending is again insignificant for the same year. Similarly, when public spending on sports and recreation is measured as a share of total public spending rather than as a share of GDP, the coefficient for the same year does not become significant. In both checks, the unemployment coefficient is negative and significant. Because the current dataset does not include a separate estimation table for these alternative models, no numerical

values are reported; only the direction and significance reported in the current analysis output are presented here.

Robustness: We conducted robustness analyses using two alternative measures to assess sensitivity to the ratio definitions in the base model. In the first check, the number of jobs in the sports sector was used as the dependent variable instead of the share of sports employment in total employment; in the second check, the share of public sports and recreation expenditures in total public expenditures was used instead of their share in GDP. In the current analysis output, the only information retained for these two alternative specifications is that the public expenditure coefficient was not statistically significant for the same year. Table 10 shows the numerical results that can be verified in the current dataset and the reporting status of the alternative specifications.

Table 9. Final model, lagged effects, and additional analysis results.

	Main model		Model with 1-year lag		Model with 3-year lag		Interaction model		Bidirectional fixed effects	
Variable	**Coefficient**	**p**	**Coefficient**	**p**	**Coefficient**	**p**	**Coefficient**	**p**	**Coefficient**	**p**
Public sports and recreation expenditures	0.016	0.815	—	—	—	—	0.016	0.766	0.014	0.820
Public sports and recreation expenditures with a 1-year lag	—	—	0.086	0.111	—	—	—	—	—	—
Public sports expenditures with a 3-year lag	—	—	—	—	0.123	<0.001	—	—	—	—
High-income group	—	—	—	—	—	—	0.040	0.520	—	—
Public expenditures × high-income group	—	—	—	—	—	—	-0.013	0.933	—	—
Per capita GDP (ln)	-0.040	0.459	-0.024	0.629	-0.003	0.957	—	—	-0.200	<0.001
Unemployment rate	-0.020	<0.001	-0.019	<0.001	-0.016	<0.001	-0.018	<0.001	-0.013	<0.001
Population (ln)	0.162	0.070	0.063	0.422	0.011	0.909	0.070	0.540	-0.233	<0.001
Number of Observations		378		351		297		378		378

Note: Every specification uses fixed effects with Driscoll-Kraay robust errors. "—" denotes a variable that is absent from the relevant model. Country effects are included in the main, one-year lag, three-year lag, and interaction specifications; the two-way model additionally controls for year effects. Lagging expenditure shortens the usable sample because early observations no longer have preceding values.

Assessment of Endogeneity and Reverse Causality: Despite the use of panel estimators, lagged variables, and robust inference methods, the analysis does not establish causality. Reverse causality is possible. Countries with a larger and more visible sports labor market may attach greater political and economic importance to the sector and, as a result, spend more. Therefore, the direction of the relationship cannot be assumed to run solely from spending to employment. Unobserved or unmodeled factors—such as private sports investments, the number of businesses, facility capacity, participation levels, local government preferences, and sports culture—may influence both spending and employment. For this reason, the estimates have been interpreted as panel data relationships. Public spending, with a three-year lag, is positively and significantly related to sports employment; however, this result does not establish a definitive causal effect.

Table 10. Status of Numerical Reporting for Robustness Analyses.

Specifications and numerical reporting
Base model - Coefficient: 0.016; Driscoll-Kraay standard error: 0.069; t: 0.234; p: 0.815; N: 378.
Alternative 1 (dependent variable: number of sports jobs) - Coefficient: not numerically reported in the source; Driscoll-Kraay standard error: not reported; t: not reported; p: not significant; N: not reported.
Alternative 2 (share of expenditure in total public expenditure) - Coefficient: not reported numerically in the source; Driscoll-Kraay standard error: not reported; t: not reported; p: not significant; N: not reported.

Note: Since the source analysis output for the alternative models does not include the numerical coefficient, the Driscoll-Kraay standard error, the t-statistic, or the number of observations, these values have not been assumed.

DISCUSSION

Sport affects economic activity through several channels. Direct effects include the income and jobs produced within the sector; indirect effects arise when sport increases demand for tourism, accommodation, transport and media; and induced effects follow when sport-related wages support additional household consumption (Li, Macauley and Wicker, 2021). The network extends further to activities such as motor vehicles, boating, construction, electronics and landscaping, adding to its employment reach (Dudfield, 2014). This makes sport a heterogeneous industry rather than a single line of business. Professional teams, leagues, marketing companies, fitness facilities and sports media all require different occupational profiles. Technological change, growing demand and the internationalization of sporting activity have expanded this range of work in recent years.

The benefits of this expansion are not confined to athletes. It has also created positions for people whose careers are connected to sport through management, services, communication and other supporting functions (Digennaro and Tescione, 2023).

As an economic sector, sport is closely connected with competition, equipment markets and service provision (Halaskova et al., 2024; Wisniewski, 2020; Ma et al., 2021; Lu and Wei, 2022; Vamplew, 2023). It has consequently become both a contributor to twenty-first-century development and an important employer. Job creation is one of the principal ways the industry supports regional economies (Zhou et al., 2023), and its workforce includes direct and indirect employment worldwide (Atılgan and Tükel, 2020). Employment is also central to the EU's treatment of sport; the Commission's White Paper presents the sector as a meaningful source of work (Mumcu et al., 2019). Major events can add demand in event operations, hospitality, transport, media, marketing, and security by attracting visitors and attention. These jobs provide household income and support related local industries (Zhou et al., 2023). In the present sample, sport accounted for an average of 0.68% of total employment during 2011–2024, while public sport and recreation expenditure averaged 0.38% of GDP. Wide minimum-maximum ranges point to substantial differences between EU countries in sectoral employment, expenditure, income, unemployment and population.

GDP share provides a second perspective on the sector's economic importance. It places sport relative to the size of the national economy rather than measuring only employment. A stable GDP share means that sport and the overall economy have expanded at broadly comparable nominal rates. The sector may therefore be growing in absolute value without changing its structural position in the economy (Nestorović et al., 2025).

The correlation analysis in this study identifies a positive association between public sport and recreation expenditure and the share of employment in sport.

Higher aggregate spending shares are associated with higher shares of employment in the sports sector. However, this bivariate relationship does not, on its own, indicate that public spending has a causal effect on employment.

GDP per capita displays the strongest correlation with sports employment in the matrix. The result is consistent with a larger sports-employment share in more developed economies. The repeated pattern should be understood as a bivariate association rather than an independent causal influence.

The pooled OLS comparison likewise produces a positive and significant expenditure coefficient. Once fixed effects are introduced, however, the relationship becomes weaker. This suggests that the pooled result reflects, at least in part, differences between countries that typically spend more and have larger sports labor markets, rather than a consistent response to annual spending changes within each country.

Nazarov et al. (2023) investigated whether higher general-government expenditure on recreation and sport changes sports entrepreneurship and participation. Their model associated a 1% spending increase with a 5.48% rise in value added at factor cost for sports enterprises. The estimated response was smaller for revenue or gross premiums (0.85%) and smallest for market size (0.4%).

Using Behavioral Risk Factor Surveillance Systems data for all 50 U.S. states, Humphreys and Ruseski (2007) examined public expenditure together with participation. They reported a positive relationship between spending on parks and recreation and participation in outdoor activity.

Nestorović et al. (2025) used Eurostat employment data for 2019–2024 to describe a sector that is active but still limited in structural weight. Employment indicators point to cyclical movement, professionalization and a comparatively stable qualified workforce, whereas the sports share of GDP remains broadly unchanged despite sizeable nominal growth. In this account, activity can expand in absolute terms while contributing a persistently small proportion of the national economy, especially where public financing is dominant and sectoral diversification is limited.

The Driscoll-Kraay fixed-effects estimate in the present study is positive for public sport and recreation expenditure but statistically insignificant. Within the EU-27 during 2011–2024, changes in the expenditure share therefore do not correspond to a measurable contemporaneous change in sport's share of total employment.

GDP per capita is negative in the model but not significant. Unemployment is negative and significant at the 1% level, indicating that sports employment declines relative to total employment as unemployment rises. Population is positive at the 10% level, suggesting only a weak positive

relationship with the employment share. These results reinforce the conclusion that the immediate expenditure coefficient is limited.

Wang et al. (2022) found that greater government sports expenditure can produce a "threshold effect" in regional development and support lasting service-sector jobs. Using European Statistical Office (Eurostat) information, Nestorović (2025) similarly argues that spending on infrastructure and mass participation can protect employment opportunities for younger workers, particularly sports-science graduates. EU planning has reflected the sector's economic size, including investments of approximately 265 million between 2014 and 2020. Such initiatives show an effort to use multiple policy instruments to stimulate the sports economy and capture its wider benefits (Mumcu et al., 2019).

Agha (2025) offers a more cautious interpretation from public-finance and welfare-economics perspectives. Large public outlays for major events may fail to create durable, high-quality work when most event-period jobs are temporary, poorly paid and insecure. Once the event ends, the remaining burden may appear as a fiscal loss to the public sector.

Lag models are based on the idea that public spending may not be directly correlated with employment within the same year due to implementation and operational processes. The one-year lagged expenditure coefficient is positive but not statistically significant. The three-year lag coefficient, however, is positive and statistically significant at the 1% level. A broader body of literature on public infrastructure investment indicates that the transformation of allocated resources into actual spending and productive infrastructure can span multiple years (Leduc and Wilson, 2013). Studies conducted for developed economies also reveal that the short- and medium-term outcomes of public investment vary over time depending on implementation effectiveness and economic conditions (Abiad et al., 2016). These studies do not validate three years as a universal timeframe for the sports sector; they merely support the theoretical plausibility of the lag mechanism.

In the three-year lag model, the coefficient of 0.123 indicates that a one percentage point higher share of public sports and recreation spending in GDP is associated with a 0.123 percentage point higher share of sports employment three years later. The corresponding estimated relationship for a 0.10 percentage point difference in the share of spending is approximately 0.012 percentage points. These figures are correlation coefficients; they should not be interpreted as structural or causal multipliers.

For this reason, the finding of a three-year lag should be interpreted not as evidence that "the effect emerges exactly three years later," but rather as a statistical association observed in the medium term among the alternative lags examined. When translating this finding into a policy recommendation, the composition of spending, the implementation period, the actual commissioning of facilities, and the rate at which personnel demand arises must all be taken into account.

Recent work also treats sports facilities and event organization as instruments of regional development and employment, while stressing that the expected benefits should be weighed against their costs (Kutluay Tutar and Abukalloub, 2025).

The economic contribution of sport is therefore distributed across several mechanisms: sectoral employment, local and regional spending generated by events, and infrastructure investment that can support development. Employment is a central part of this contribution. In 2023, 1.55 million people worked in sport in the European Union, equivalent to approximately 0.76% of total employment (Eurostat, 2024).

In middle- and high-income economies, the sector's relevance is increasingly economic as well as social. Physical activity has social value, but sport also contributes through value added and employment, with growth in these dimensions capable of exceeding economy-wide averages (Commission of the European Communities, 2007).

When all the findings were evaluated together, no significant relationship was found between public sports and recreation expenditures and sports employment for the same year. The coefficient with a three-year lag, however, is positive and significant. This pattern is consistent with medium-term mechanisms such as the completion of facilities, the establishment of service capacity, and the emergence of personnel needs. However, the current research design does not demonstrate that the three-year lag represents a unique causal lag.

Study Limitations and Strengths

The scope of the study has certain limitations. The sample is limited to the EU-27 countries and the 2011–2024 period. Therefore, the results cannot be directly generalized to different groups of countries or longer periods. Sports employment is represented in the baseline model by its share of total employment. This ratio is influenced by changes in both sports employment and total employment. Consequently, an increase in this share does not necessarily imply an absolute increase in employment within the sports sector in every case.

Expenditure is measured through the broad COFOG GF0801 category, "Recreational and sporting services." This aggregate does not reveal which amounts directly generate jobs and which finance construction, maintenance, organization, or general service provision. The specifications also omit private investment, the number and structure of sports enterprises and clubs, and cross-country differences in sports policy.

A fundamental limitation of the analysis is causality. Fixed effects, lagged variables, and robust standard errors enhance the model's statistical reliability;

however, they do not eliminate reverse causality or unobserved variable bias. Furthermore, the three-year lagged coefficient has not been reported separately under two-way fixed effects in the current file. Therefore, no claim of robustness is made regarding whether the three-year relationship remains significant when annual fixed effects are included. To complete this check numerically, re-estimation using the original panel data and estimation code is required.

The three-year lagged coefficient is positive and statistically significant in the model that includes country fixed effects. However, in the current table of estimates, this lagged coefficient is not reported separately under the two-way fixed effects model, which includes both country and year fixed effects. Therefore, the three-year finding has been interpreted not as definitive evidence of robustness to common annual shocks, but rather as a medium-term relationship observed in the model with country fixed effects.

CONCLUSION

Public spending on sports and recreation serves social and health objectives. This study examined the relationship between such spending and employment in the sports sector using the EU-27 panel data. The expenditure coefficient for the same year is positive but not statistically significant. The coefficient with a three-year lag is positive and significant. This finding indicates a medium-term relationship; it does not prove that spending generates a causal employment effect exactly three years later. The fact that the unemployment coefficient is negative and strongly significant across all models indicates that sports employment is sensitive to general labor market conditions. The results highlight that, in evaluating public sports policies, not only the level of spending but also its timing, composition, and general economic conditions must be taken into account.

A three-year lag in the relationship suggests that public sports expenditures should be evaluated within the context of medium- and long-term planning. However, policy recommendations should not be based solely on a single lag coefficient. The type of expenditure, implementation capacity, effective use of facilities, and continuity of services must all be monitored together.

In addition to investments in buildings and facilities, programs in education, coaching, sports management, recreational services, and human resource development are also important. Ensuring that public programs are implemented in alignment with private sports investments and youth employment policies can support the sector's employment capacity. This statement is not a claim of causality but a policy implication developed based on current findings and the literature.

The fact that the unemployment coefficient is negative and significant in all models indicates that sports employment cannot be evaluated separately from general economic conditions. Therefore, sector policies must be addressed in conjunction with labor market, vocational education, and service sector policies.

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Conflict of Interest

The authors declare that there is no potential conflict of interest regarding the research, authorship, and/or publication of this article.

Author Contributions

Planning, design: MK, ASY; **Materials, methods, and data collection:** MK, ASY, BD; **Data analysis and interpretation:** MK, ASY, HG; **Writing and revisions:** HG, BD, NO.

Ethical Approval

The research relies exclusively on publicly accessible secondary data. It includes neither human participants nor information that can identify individuals; ethics committee approval was therefore not necessary.

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