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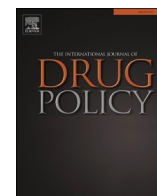
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Research Paper

Antisocial behavior in football matches: Do changes in alcohol sales policy increase violent acts?

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ABSTRACT

Background: The violent behavior of football fans is constantly associated with their drinking habits. Aiming to reduce its impact, policy makers often ban the sales and consumption of alcohol beverages during matches. Nonetheless, there are few papers that empirically analyzed such relationship, and our paper aims to shed light on this question. **Methods:** Our dataset comprises 4,560 matches from the first and second tiers of the Brazilian League, where 245 exhibited at least one antisocial behavior from fans. Ordered logistic regressions are used as method. **Results:** Our empirical findings evidence that the sales of alcoholic drinks do increase the likelihood of severe antisocial behavior. We also observed a higher likelihood of violent cases when the home club loses its match as well as during crowded matches. **Conclusions:** We conclude that the change in the alcohol policy in Brazil did show a significant association with the likelihood of antisocial behavior among football fans. However, since the magnitude of such effect is small, further research is needed to examine the potential benefits of this policy change.

Introduction

Violence during sporting events, particularly in the context of football, has captured global attention due to its potential social, cultural, and safety implications. The phenomenon of fan violence, often characterized by confrontations, vandalism, and antisocial behaviors, raises critical questions about the factors that influence such incidents and strategies to mitigate them. In this study, we search into a specific aspect of this complex issue, examining the impact of alcohol sales on antisocial fan behavior within football stadiums.

This research is motivated by the need to better understand the relationship between alcohol and fan violence in the context of football matches. While alcohol's role in escalating aggressive behavior is well-documented in various settings, its influence within sports stadiums warrants a focused investigation. By gaining insights into this relationship, we aim to contribute to evidence-based policymaking aimed at ensuring the safety and enjoyment of fans attending sporting events.

The Brazilian government took significant steps to address the rise of violence in football stadiums. In 2003, it enacted Law No. 10,671, known as the "Fan Defence Statute," aimed at regulating spectator behavior during football matches. This statute introduced stringent

conditions for spectator entry, including restrictions on prohibited items and behavior, all in a bid to curb antisocial conduct that might disrupt the sporting events. However, a noteworthy shift occurred in 2012 with the introduction of the General Law of the World Cup (Law No. 12,663), which outlined rights and responsibilities in hosting the 2014 World Soccer Cup. This law created an exception to the application of Law 10,671/03, particularly in its article 13-A, lifting the ban on sales of alcoholic beverages during World Cup matches.

After the World Cup, some cities and states decided to continue to allow alcohol sales, likely driven by the potential revenue gains associated with alcohol sales during football matches, and pressure from fans to allow the sales and consumption of alcohol beverage. This unique policy shift offers a valuable opportunity to investigate the association between alcohol sales and antisocial behavior during football matches. Importantly, our analysis assumes that any observed results are not attributable to omitted variables, as no other significant governmental measures were implemented in this regard during the research period, allowing us to discern the specific impact of alcohol sales on the likelihood of antisocial fan behavior. This research contributes to the existing literature by providing a focused examination of this specific context, shedding light on the dynamics of violence in football, and offering

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implications for stadium policies and public safety.

We employ ordered logistic regression to examine the link between alcohol sales at football matches and fan antisocial behavior. Our main variable of interest is a binary variable that captures whether the match has been played in a stadium where the local government has lifted the ban on alcohol sales during football matches. Other variables such as league tiers, stadium characteristics, match timing, and economic factors are also included in the model. This statistical approach enables a precise analysis of how alcohol availability relates to fan conduct. Our dataset includes 4,517 matches from the top two Brazilian football tiers between 2013 and 2018, sourced from match financial reports. We categorize antisocial behavior occurrences into three groups based on severity. This methodology allows us to explore the impact of alcohol sales on fan behavior effectively.

While our study offers valuable insights, we acknowledge its limitations. Firstly, our research is centered on Brazilian League matches, which may limit the generalizability of our findings to other football contexts. Additionally, we rely on reported incidents, which may not capture the full spectrum of fan behavior. Nevertheless, our research provides a focused and context-specific contribution to the understanding of fan violence dynamics within sports venues.

This paper is organized as follows: The next section provides a literature review on the prohibition of alcoholic beverages in stadiums and the impact of antisocial behavior. Next, the methodology is presented, explaining the dataset and the empirical strategy employed. The Results and Discussion section shows the empirical findings and, lastly, final considerations and suggestions for future research are shown.

Literature review

Violence in sports, particularly football, has been a recurring concern in discussions, often linked to hooliganism (Jewell et al., 2011). While British fans were once notorious for violent behavior both inside and outside stadiums, such occurrences have been observed worldwide throughout the 20th century (Dunning, 2000; Spaaij, 2007; Schaap et al., 2015; Newson et al., 2018), including in countries like Argentina (Moreira, 2007), Brazil (Murad, 2013), Italy (Domizio & Caruso, 2015), the Netherlands (Schapp et al., 2015), and Spain (Delgado & Gómez, 2018). Notably, football hooliganism outside Europe has been associated with higher fatality rates and increased violence (Dunning, 2000).

Acts of violence or antisocial behaviors at sporting events can encompass a wide range of actions, from clashes between fans to racist incidents (Spaaij & Anderson, 2010). Avgerinou and Giakoumatos (2011) classified these behaviors into 11 categories, including swearing, missile throwing, pitch invasion, and violence, among others. Various factors influence violent behavior in football, including macro-level factors such as economic, political, societal, and cultural factors, as well as more immediate factors like team rivalries and match context (Spaaij & Anderson, 2010).

In Brazil, fan violence has been associated with “*torcidas organizadas*” (organized fans in free English translation, or something like *Ultras* in the European football), who have been linked to numerous incidents of violence in stadiums, leading to bans on their presence at sporting events (Lopes & Cordeiro, 2010). The prevalence of alcoholic beverages, illicit drug trafficking, and connections to criminal factions have also played a role in violence during football matches in Brazil (Murad, 2017).

Alcohol policy remains a significant aspect of public policy to reduce crime and health problems globally (Baumann et al., 2012). In sports, policies regarding alcohol sales at stadiums aim to mitigate behavioral issues and ensure the safety of fans, including those who do not consume alcohol (Menaker & Chaney, 2014). Previous research has explored the relationship between alcohol and violence in various contexts. Menaker and Chaney (2014) found a positive relationship between alcohol presence and crimes at American college football games. However, Nepomuceno et al. (2017) suggested that alcohol consumption has limited influence on fan violence in football stadiums in Brazil.

In 2017, 104 violent episodes were recorded in Brazilian football, tragically resulting in the deaths of 11 fans (Pires, 2017). These alarming statistics were further accentuated when research data from sociologist Maurício Murad, cited by the Brazilian Senate Agency, unveiled a total of 160 violent incidents during the Brazilian Serie A (Agência Estado, 2022). Murad’s research claims that 76% of these events were linked to alcohol consumption. The gravity of the situation becomes even more apparent when considering that these same data disclosed 157 fatalities across the top three tiers of the Brazilian League, with the peak occurring in 2013, which saw 30 occurrences. Recent figures continue to highlight the issue, with January and February 2022 recording 15 cases of football-related violence, both inside and outside stadiums in Brazil (Agência Estado, 2022). This distressing trend raises concerns; does a degree of impunity persist in Brazil, tacitly tolerating such incidents?

Capitalizing on the legal exception that emerged following the FIFA World Cup, some Brazilian states and cities opted to continue the sale of alcoholic beverages during domestic football competitions. These unique circumstances provide a valuable opportunity to compare the prevalence of violence between stadiums that upheld or rescinded the ban on alcoholic beverages. It is noteworthy that some researchers have employed different methodologies to assess the incidence of violence. For instance, Kalist and Lee (2016) considered occurrences in the surrounding area of the stadium, relying on data recorded in police bulletins. Nepomuceno et al. (2017) based their analysis on results from court proceedings, while Spaite et al. (1990) used data from hospital admissions. Our paper focuses on antisocial behaviors occurring inside stadiums during football matches, as reported in referees’ summaries and match reports.

Data and empirical method

Dataset

The data comprises matches from the top two tiers in Brazilian football: Series A and B. Both tiers are played by twenty teams, in double round robin design, totaling 38 matches per team. The researched period includes the seasons between 2013 and 2018. The data has been gathered from official match reports of each match available at the website of the Brazilian Football Confederation (CBF).

Each year, there are four teams that undergo promotion and relegation between the first and second tiers, as well as between the second and third tiers. Taking into account these dynamic changes, our study encompasses a total of 55 participating teams, representing 22 Brazilian states and spanning across 70 cities. Furthermore, these matches were hosted in ninety-four distinct stadiums. In each season of these championships, there are 38 rounds featuring 10 games each, resulting in a total of 380 games per season. Therefore, when considering both leagues, there are a combined 760 games per season. With our research spanning across six seasons, we analyzed a total of 4,560 matches. Nonetheless, 41 matches were excluded due to being played behind closed doors, one match removed as it lacked an official match report, and another match was eliminated because of a double walkover (W.O.) result. Consequently, our final sample consists of 4,517 matches for analysis. Concerning antisocial behaviors, we observed 245 instances within this sample, constituting 5.42% of the valid dataset.

Econometric analysis

The methodological approach consists in ordered logistic regression, since the dependent variable is ordered considering the level of antisocial behaviors practiced during football matches. The variable of interest is a dummy (*a*) that captures whether the match has been played in a stadium where the ban of alcohol beverages has been lifted – it takes 1 for matches held in cities where the sales of alcohol beverages in football stadiums was allowed, and 0 otherwise. The other explanatory variables include dummies for the Brazilian League tiers (*I*), dummy for the

stadiums that have been built or refurbished for the FIFA World Cup 2014 (*b*), a weekend dummy (*w*), dummy for the period of the match (afternoon/evening) (*p*), a dummy for derby¹ (“clássicos”) matches (*c*), goals difference in the match (*g*), number of defeats of the home team prior that match (*d*) and the occupancy rate in that match (*o*). The control variables (*CV*) include the unemployment rate in the state where the match took place, the city’ gross domestic product (GDP) per capita, and the state’ Human Development Index (HDI). Home and away team fixed effects, as well as season fixed effects, have been incorporated into the models to account for unobservable characteristics, club-specific attributes, and seasonal variations in Brazilian football. It is important to note that four models were estimated in this analysis. The baseline model, Model 1, does not include home or away team fixed effects or season fixed effects. These fixed effects are gradually introduced in subsequent models. The final model, Model 4, includes all three fixed effects. The complete model is outlined as follows:

$$v_{it} = \beta_0 + \beta_1 a_{it} + \beta_2 l_{it} + \beta_3 b_{it} + \beta_4 w_{it} + \beta_5 p_{it} + \beta_6 c_{it} + \beta_7 g_{it} + \beta_8 d_{it} + \beta_9 o_{it} + \beta_{10} u_{it} + \beta_{11} gdp_{it} + \beta_{12} hdi_{it} + \alpha_j + \alpha_k + \gamma_t + \varepsilon_{it}$$

Where:

- i* = a given match
- t* = a given season
- α_j = home club FE
- α_k = away club FE
- ε_{it} = error term

Dependent variable

The antisocial behavior (*v*) is measured by a variable that corresponds to the presence of antisocial behavior in each match, which, according to Law No. 10,671/03, are: use of flares, throwing objects on the field of play, acts of racism and homophobia, bomb blasts and occasional and/or generalized fights in the stands. These acts are reported in the match report, by the match referee or the match delegate. Table 1 shows the types of occurrences in the 4,517 matches. Overall, there were 245 matches with at least one occurrence of anti-social behavior (5.42%). However, some matches experienced multiple occurrences, totaling 292 cases.

Table 1
Occurrences: types and total observations.

Types of occurrences	Observations
Throwing objects	121
Bengal Flares	50
Pitch Invasion	31
Riot	25
Firecrackers	20
Quarrels, confrontation, and widespread conflicts	16
Laser Pointers	10
Spitting from the crowd	7
Vandalism	5
Racism	3
Approach to the referee from individuals unrelated to the match	2
Hot-air Balloons	1
Fireworks	1
Total	292

¹ We classify derby (or “clássico”, in Brazilian Portuguese) as matches between clubs from the same state, following similar definition from previous works Madalozzo and Villar (2009) and Gasparetto and Barajas (2016) show evidence that derby matches increase the demand for tickets and broadcast demand in Brazilian football, while Ge et al. (2021) observe a higher likelihood of vehicle thefts after derby matches in Brazil.

The classification of each occurrence has been done from the referee’s report, later assigning codes to the cases. We considered as anti-social behavior any mention of the referee in relation to the throwing of objects on the pitch, use of flares, invasion of the field, racist or homophobic cursing, fights of various levels between supporters and any other mention that could be considered as anti-social or violent behavior that could be related to the use of alcoholic beverages. For the purposes of this research, 13 groups of occurrences were characterized through codification.

The dependent variable is sorted into three categories, based on Avgerinou and Giakoumatos (2011) approach. We considered that this division could serve as a basis to group the behaviors in this study, although they analyzed both occurrences inside and outside stadiums. For this work, we have: Group 1, with occurrences without physical damage and material damage, such as racism, use of flares, spitting, use of fireworks, uses of laser beams, use of bombs and field invasion; Group 2, encompassing only the throwing of objects (for being the category with more observations); and group 3, with occurrences involving physical and material damage such as, riots, generalized fights and acts of vandalism. The grouping of the games into these three groups was based on the least to most serious behaviors. In addition, if a match presented more than one type of occurrence, it was classified according to the most severe type of behavior. In other words, if a match presented the throwing of an object and a fight among supporters, for instance, it was classified in Group 3 - physical and material damages.

Explanatory variables

The variable of interest, “Alcohol” (*a*), takes value equals 1 for all matches where sales and alcohol consumption were allowed. It is built in line with Chastain et al. (2017), who analyzed the impact of sales of alcoholic beverages and its relationship with stadium attendances.

The search for the laws lifting the ban on sales of alcoholic beverages during football matches was conducted through the website “Municipal Laws” or “State” ones, considering the words “alcoholic beverages”, “stadiums” and the name of the cities or states that hosted matches during the research period. The information has been double-checked via sports newspapers or websites which documented the lift in the ban on sales of alcoholic beverages. The sample comprises eight states: Bahia, Espírito Santo, Minas Gerais, Pernambuco, Rio de Janeiro, Rio Grande do Norte and Santa Catarina; and four cities: Belém/PA, Cuiabá/MS, Pelotas/RS and Santos/SP. Table 2 shows the Brazilian regions and cities which changed their laws for allowing the sales and consumption of alcoholic beverages in sport venues.

Additionally, the model incorporates five binary variables: the variable “Serie A” (*l*) to differentiate the matches of this tier to the second

Table 2
States and cities in Brazil that changed their laws lifting the ban on sales and consumption of alcohol beverages in sport venues.

States	Law
Bahia	Law nº 12,959. 14 th February 2014
Espírito Santo	Law nº 10,309. 09 th December 2014
Minas Gerais	Law nº 21,737. 05 th August 2015
Paraná	Law nº 19,128. 25 th September 2017*
Pernambuco	Law nº 15,709. 05 th January 2016
Rio de Janeiro	Law nº 7,083. 16 th October 2015
Rio Grande do Norte	Law nº 9,838. 10 th April 2014
Santa Catarina	Law nº 17,477. 11 th January 2018
Cities	Law
Belém	Law nº 93,543. 27 th December 2017
Cuiabá	Law nº 6,040. 16 th February 2016
Pelotas	Law nº 6,314. 08 th January 2016
Santos	Law nº 301. 01 st February 2015**

* Revoked in March 2018 by court decision. ** Revoked in February 2017 by court decision.

one, since the elite division is usually more competitive than the previous divisions, so it is possible that it has more occurrences; a variable to differentiate the stadiums used in the World Cup, built or renovated for it - 2014 World Cup Stadiums" (*b*) – with the possibility of fewer problems in these stadiums than in others in the country, considering their better structures, amenities, accesses, etc.; a dummy variable for matches played on "Weekends" (*w*), usually with larger attendance, as considered by Rees and Schnepel (2009), which may lead to a higher probability of occurrence of antisocial behavior; another dummy variable to identify the matches that were played during the day ("1" for "day; "0" for night (*p*), to observe whether there are differences in the time of the games (Menaker & Chaney, 2014); finally, a dummy was added to capture the disputes of local derbies (*c*). These games are played by teams that have a years-long rivalry, attracting larger audiences (Buraimo et al., 2009; Iho & Heikkilä, 2010), and consequently possibilities for abnormal behavior and acts of violence (Menaker et al., 2018). In this study, matches played by teams from the same state were assigned the value '1' to form the variable, following the research methodology of Menaker et al. (2018).

The model also includes some continuous variables, such as: the variable "Goals Difference" (*g*), which represents the difference between goals scored by the home team and goals conceded; if positive, the home team won the match, and if negative, it lost. The variable "cumulative defeats" (*d*) shows the evolution of a club's negative performance, as a way to highlight that the number of defeats may provoke antisocial behavior in stadiums. Rees and Schnepel (2009) established the stadium capacity as a measure of size and Nepomuceno et al. (2017) presented the number of tickets used in the match with the same intent. We have incorporated the variable "percentage of occupancy" (*o*), calculated as the ratio between the number of tickets sold and the stadium capacity for each match. This variable allows us to account for the varying sizes of stadiums and provides a more accurate representation of the actual crowd size at matches. It helps us examine whether venues with higher attendance levels are associated with an increased likelihood of antisocial behavior.

Lastly, three socioeconomic factors are included: the unemployment rate (*u*) in each state, the logarithm of annual GDP per capita of the cities (*gdp*) where the games were held, both made available by the Brazilian Institute of Geography and Statistics (IBGE), and the Human Development Index (HDI) of the states (*hdi*), freely available at the Atlas Brazil website.

Results and discussion

Table 3 shows the descriptive statistics. The number of games with antisocial behavior was 245, corresponding to 5.42% of the full sample. Group 1 has 94 observations, while Groups 2 and 3 have 108 and 43 observations each, respectively. Alcohol sales were permitted in 1,069 games. Table 4 shows the outputs of the four ordered logistic models modelling the antisocial behaviors of Brazilian fans. The coefficients are presented by odds ratio, which facilitates the interpretation of how each explanatory variable impacts the likelihood of different levels of the outcome. In an ordered logistic regression, an odds ratio greater than 1 suggests an increased likelihood of a higher category of the dependent variable, while an odds ratio less than 1 indicates a decreased likelihood.

Overall, we firstly observe that the selling of alcohol beverages is statistically associated with the antisocial behavior of football fans in Brazil. The variable (*a*) is positive and significant at 5% in model 1, and at 1% level for all other models. Initial evidence that antisocial behavior is higher on first tier matches is shown, although it loses significance when fixed effects are added into the modelling. Moreover, the models show evidence that matches played at world cup stadiums has higher likelihood to exhibit more violent antisocial behaviors from fans as well as derby matches, matches with larger goals difference and those with higher attendance figures. We also observe that some socioeconomic factors play significant role increasing the likelihood of more severe

Table 3
Descriptive statistics.

Dependent variable			Percentage	-	Frequency
Matches with antisocial behaviors (Occurrences)			5.42%	-	245
Group 1			2.08%	-	94
Group 2			2.39%	-	108
Group 3			0.95%	-	43
Binary variables		Mean	Std. deviation	Frequency	
Alcohol	0.2366	0.4251	1,069		
Serie A	0.5014	0.5000	2,265		
2014 Stadiums	0.2234	0.4166	1,009		
Weekend	0.5572	0.4968	2,517		
Derby	0.0819	0.2742	370		
Day Shift	0.3518	0.4776	1,589		
Continuous variables		Mean	Std. deviation	Min.	Max.
Goals Difference	0.4762	1.4595	-5	6	
Defeats	6.8424	4.7720	0	28	
Unemployment Rate	3.8877	0.9898	2.300	8.400	
% Occupancy	33.58	24.70	0.19	182.41 [†]	
GPD per capita (R\$) [*]	39,850	21,205	7,566	186,382	
GPD per capita (ln)	10.4866	0.4648	8,9315	12,1356	
HDI	0.7582	0.0484	0.631	0.854	

[†] Some matches exceeded the maximum capacity. In few particular cases when the demand is much higher than the capacity, some clubs use temporary stands to increase the seats and reach higher attendance levels.

^{*} R\$ = Brazilian Real. It is the official currency of Brazil.

Table 4
Ordered logistic regressions outputs.

Variables	Model 1	Model 2	Model 3	Model 4
Alcohol	1.4632** (0.2512)	2.1171*** (0.5222)	2.1155*** (0.5276)	2.3364*** (0.6284)
Serie A	1.6232*** (0.2670)	1.6863** (0.4015)	1.0127 (0.3123)	1.0037 (0.3154)
2014 Stadiums	0.8242 (0.1371)	0.6835 (0.1691)	0.6395* (0.1653)	0.6285* (0.1706)
Weekend	1.1780 (0.2160)	1.2532 (0.2343)	1.2941 (0.2491)	1.2912 (0.2494)
Derby	1.8241*** (0.3504)	1.7620*** (0.3559)	1.7629*** (0.3775)	1.8062*** (0.3894)
Goals Difference	0.8527*** (0.0393)	0.8516*** (0.0408)	0.8747*** (0.0434)	0.8709*** (0.4331)
Defeats	1.0085 (0.0143)	1.0074 (0.0153)	1.0115 (0.0156)	1.0115 (0.0157)
% Occupancy	1.0195*** (0.0026)	1.0221*** (0.0032)	1.0203*** (0.0034)	1.0210*** (0.0034)
Day Shift	1.0485 (0.1806)	1.0323 (0.1821)	0.9578 (0.1765)	0.9421 (0.1746)
Unemployment Rate	1.3433*** (0.1025)	1.6905*** (0.1967)	1.6798*** (0.1963)	1.6804*** (0.2178)
GDP per capita (ln)	0.7484 (0.17712)	0.6020 (0.1992)	0.6261 (0.2135)	0.6665 (0.2442)
HDI	95,0378** (216,5656)	27,641.02*** (102,495.50)	41,234.21*** (155,327.30)	294,715.60** (1,789,632)
Cut1	5.7617 (2.0009)	9.2455 (3.6286)	10.7233 (3.8403)	13.9330 (4.3907)
Cut2	6.2855 (2.0017)	9.7835 (3.6294)	11.2757 (3.8414)	13.4872 (4.3918)
Cut3	7.5883 (2.0061)	11.1044 (3.6326)	12.6154 (3.8449)	14.8276 (4.3952)
Home Team FE	No	Yes	Yes	Yes
Away Team FE	No	No	Yes	Yes
Season FE	No	No	No	Yes
Test omodel (prob)	35.44 (0.0622)	N/A	N/A	N/A
McFadden's R ²	0.0601	0.1049	0.1385	0.1423

P<0.01 = ***; p<0.05 = **; p<0.10 = *

antisocial behaviors: those matches played in cities with higher unemployment rates and higher HDI exhibit higher probability of more violent acts from fans.

The variable of interest *Alcohol* shows statistical significance in all suggested models. Model 1, without controlling for teams and seasons, shows a 46.32% higher probability of the most violent behaviors in matches with sales of alcoholic beverages than in matches they are not allowed. After including all control variables, the likelihood of the most antisocial behavior events occurring in matches with sales of alcoholic beverages increases by 134% compared to matches where they are not allowed.

The dummy that identifies the games played in the *Serie A* showed statistical significance at 1% in model 1, and at 5% in model 2. However, from model 3 onwards, there is no significance. Apparently, the inclusion of team controls (home and away) is more significant than the tier differences themselves. In this case, the differences in odds are not captured by differences between tiers, but by the identification of some clubs, playing at home or as visitors, as their fans might be prone to cause problems and antisocial behaviors.

The stadiums built or renovated for the 2014 World Cup also show significant difference compared to other stadiums in models 3 and 4, at 10%. The odds ratio coefficient value is below 1, meaning that the relationship is negative, i.e., it is considered that the stadium quality is important to evidence the decrease of likelihood events analyzed. “Weekend” did not show statistical significance in all models, which implies that the likelihood of occurrences is not associated with the day a match is played.

Derby matches showed positive significance, corroborating prior findings of Menaker et al. (2018) who analyzed the relationship between this kind of match and antisocial behaviors. In the most complete model (model 4), a derby match has an 80.62% higher probability of the most antisocial behaviors compared to ordinary matches. The goal difference exhibited statistical significance in all models, characterized by a negative coefficient. Consequently, when the goal difference is negative, indicating a defeat for the home team, there is an associated increase in the likelihood of severe antisocial behavior occurrences during the match, with each additional “negative” goal by the home team contributing to this likelihood. This finding aligns with the results reported by Rees and Schnepel (2009). On the other hand, the cumulative defeats variable did not show significance in any model.

The occupancy rate shows statistical significance in all models, which suggests that crowded matches are more likely to exhibit antisocial behavior occurrences. Despite the statistical significance, the degree of likelihood is smaller than other variables. The 1% increase in the percentage of occupancy generates a 2.01% rise in the probability of severe antisocial occurrences. Our empirical findings do not corroborate the analyses of Kalist and Lee (2016) and Schapp et al. (2015) on the effect of game time on crimes, as no model showed a statistically significant coefficient at 5%, for the day shift dummy. Regarding the socioeconomic variables, the unemployment rate is statistically significant at 5% and positive in all models, the GDP per capita does not attain statistical significance, and the HDI is significant in all models at 1%.

Our empirical findings align with existing literature, indicating that the sale and consumption of alcoholic beverages in football stadiums tend to increase the likelihood of antisocial behavior during football matches. It is important to acknowledge the challenge of establishing a direct causal link between alcohol sales and antisocial behavior at football matches. Indeed, the methodology employed in our study does not permit causal inference. Nevertheless, our work provides valuable empirical evidence suggesting a significant association between the lifting of the ban on alcoholic beverage sales during football matches and antisocial behavior in the Brazilian League.²

It is important to highlight that the occurrence of antisocial behavior consists in about 5% of all football matches during the research period. This is certainly an undesirable feature that should be eradicated but cannot be considered as an alarming condition for Brazilian domestic football. Our main empirical finding suggests that sales and consumption of alcoholic beverages inside football stadiums tend to increase the likelihood of antisocial behaviors, but the magnitude is small. League organizers, football clubs and policy makers need to be aware of this potential negative effect. Nevertheless, the sales and consumption of alcoholic beverages is also associated with social practices and cultural identities as well as with commercial aspects of the sport, as Palmer (2011) emphasizes. In this sense, one may argue that sports-associated drinking could enhance the atmosphere of attending football matches for a significant portion of the fans as well as a revenue raise for clubs (Martin et al., 2022), which cannot be ignored. Therefore, further research shedding light on this matter is suggested.

Conclusions

Existing research predominantly focuses on violence in US sports or European football. In this paper, we conduct an analysis in a unique context characterized by distinct cultural, social, and economic factors, as well as conflicting legislation, which was appropriate for inspecting these issues. After the 2014 FIFA World Cup in Brazil, some states and cities lifted the ban on sales and consumption of alcoholic beverages inside football stadiums, in defiance of the current federal legislation. This paper aimed to contribute to this discussion, focusing on the potential relationship between the sales and antisocial behavior of football supporters.

Our empirical results indicate that allowing sales of alcoholic beverages inside football stadiums is positively associated with a higher likelihood of more severe occurrences of antisocial behavior during the matches. Indeed, the four models demonstrate a positive and statistically significant relationship between these factors. We offer evidence that for *Serie A* matches (first tier) the increase in likelihood of antisocial behavior is only significant without controlling for clubs fixed effects, which means that the behavior of certain fans might be driving a significant portion of the violence observed. This is worth further study. Other characteristics also showed significance in the models, such as that derby matches have higher probability of antisocial behavior. Regarding the sport-related factors, when the home club loses its match there is a higher probability of more severe antisocial acts, but a

² For a robustness check, we carried out a negative binomial regression to further examine the relationship between the presence of alcohol sales in football stadiums and the occurrence of antisocial behaviors during matches. In this modelling, the dependent variable was not limited to ordered levels of antisocial behaviors but instead considered the count of occurrences, regardless of their specific type. This approach allowed us to explore whether the presence of alcohol sales remained a significant predictor of antisocial behavior when accounting for the overall count of incidents. The findings corroborate the outcomes derived from the ordered logistic regression, further enhancing the robustness of our analysis, and reaffirming the significant association between the availability of alcohol sales in football stadiums and the incidence of antisocial behaviors during matches.

sequence of defeats does not imply any significant change in the likelihood of violent behavior from fans. Lastly, crowded matches tend to show higher likelihood of antisocial behavior occurrences.

A limitation of this research is that the match report only exhibits what the referee witnessed and reported. In this sense, some other unreported antisocial behavior may also have occurred. Additionally, we just focused on antisocial behaviors that took place inside the football stadiums. We acknowledge that other violent actions may have happened around the venue, on the streets nearby or in bars. No available report has been found for adding these into our dataset, but we assume that it does not constitute an issue since such violent behaviors are not directly related to the sales and consumption of alcoholic beverages inside the stadiums. Furthermore, it is essential to highlight that we lacked access to data regarding the volume of alcohol sold and consumed during the matches. It is conceivable that higher quantities could be linked to increased incidents of antisocial behaviors or even more severe manifestations. Regrettably, due to data limitations, we were unable to explore this aspect in our current study. Nevertheless, it presents an intriguing avenue for future research.

Further research can further explore the impact of policy changes related to alcohol sales in different contexts, providing insights into their diverse effects. Additionally, our findings suggest that specific fan groups might significantly influence the occurrence of violence within the broader dataset. Therefore, future studies with larger datasets may offer a more comprehensive understanding of this complex relationship. Beyond our primary focus on potential negative impact of alcohol sales, upcoming research could also investigate certain positive aspects of such policies on fan behavior and social practices, as well as their implications for revenue generation by sport clubs.

CRediT authorship contribution statement

Marke Geisy da Silva Dantas: Visualization, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization, Funding acquisition, Writing – original draft, Writing – review & editing. **Luciano Menezes Bezerra Sampaio:** Supervision, Methodology, Conceptualization, Funding acquisition, Writing – review & editing. **Thadeu Gasparetto:** Methodology, Formal analysis, Conceptualization, Validation, Visualization, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.drugpo.2023.104273](https://doi.org/10.1016/j.drugpo.2023.104273).

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