Goal or Foul? Unravelling the Link between the 2006 FIFA World Cup and Criminal Activity in German Cities

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Abstract

Sport events are seen as a method for governments and organizations to obtain economic, employment, and tourist benefits while also enhancing city infrastructure. Scholars, on the other hand, doubt the real advantages, claiming that they are frequently inflated to justify high expenditures. Little study has been conducted on the negative consequences, particularly on criminal reactions, of large-scale events. This research explores the aftermaths of the 2006 FIFA World Cup in Germany, concentrating on crime rates in the host cities. Using a two-way fixed effects model combined with a matching methodology, the study examines the influence of the World Cup on crime rates in 2006, accounting for disparities across cities while considering heterogeneous responses for the country's historical East-West divide and population density. When crime statistics in 2006 are compared to those three years prior to the tournament, it is discovered that, in the short term, hosting the World Cup had no effect on crime, robbery, or burglary. When checking for the heterogeneity of the effect, however, statistically significant findings for two of the three outcome variables are discovered.

Keywords: Sports economics, Crime, Football World Cup, Event Studies, Economic Externalities, Negative Spillovers, Mega Events

JEL Classification : L83, Z29, K42, Z21

1. Introduction

Hosting a mega-event such as the FIFA World Cup or the Summer Olympics is a decision that carries significant weight in the world of sports policy. The selection process for the host country is more political in nature than a straightforward assessment of its infrastructure and soccer culture. The requirements to host the event are extremely strict, and massive investments must be made to be able to logistically hold the inflow of people attending the event. Countries pursue the event, at least in part, because of the powerful economic impact boosters claim it will have on the country fortunate enough to host it. Hosts and bidders usually justify their decision by praising their potential impact. To do so, many organizers and promoters either fund or widely disseminate ex-ante studies that tend to highlight the positive effects of the event (Horne, 2004; Maennig et al., 2007; Saayman et al., 2008; Barrios et al., 2016).

Indeed, mega events like the FIFA World Cup and the Olympic Games are known to have a significant impact on the appearance of cities. In the short term, host countries often invest heavily in building new infrastructure, such as stadiums, transportation systems, and hotels, which can create employment opportunities and boost economic activity in the construction sector, therefore creating a chain reaction to a multitude of other sectors. Moreover, mega events can stimulate economic activity in several ways, they can not only create jobs but also increase the demand for goods and services and generate tax revenues. As a matter of fact, during the event itself, visitors spend money on tickets, food, accommodation, and souvenirs, which can stimulate local businesses and generate additional revenues for the host country.

Nonetheless, the impact of mega events extends beyond the short term. In fact, there is a substantial body of evidence demonstrating that these events can greatly boost urban growth in host cities over the long term (He et al., 2020). Certainly, mega events serve as a catalyst for further investment in infrastructure and development in the host cities. For example, a city that hosts the FIFA World Cup may use the event as an opportunity to build new housing, parks, and public spaces, all of which can help to attract new residents and businesses over time.

In addition to their economic impact, mega events are often utilized as political tactics to leverage what is known as the "image impact". Stakeholders in a host city or region may see a mega-event as a chance to revitalize the area and improve its image in the international arena, both of which can have long-term consequences (Kelly and Fairley, 2018; Scandizzo and Pierleoni, 2018). On one hand, a country hosting a successful event can gain international recognition, boost tourism, and attract new investment. Whereas, on the other hand, hosting a mega event have some downsides that could generate relevant negative outcomes that might affect a country's economy.

First, countries hosting mega-events need to make significant investments, and the cost of these investments is rising. Academic literature suggests that any increased economic activity resulting from mega events is routinely outdone by additional public budgetary commitments. Practically speaking, taking the World Cup as a case study, FIFA in 2006 required cities to have: (1) 12 stadiums with a capacity of 40,000-80,000 and 150 training grounds; (2) Nearby airport with a minimum capacity of 1,450 passengers per hour; (3) 72 base camp hotels for players and referees, 4 hotels per stadium location, from 1,760 to 8,080 hotel rooms for spectators. Second, assuming that the World Cup provides some economic benefits to the chosen venues, it is unclear whether the Mega Event as a whole promotes an increase in negative externalities. With negative externalities being: traffic congestion, increased crime rates, impact on the environment, increased prices of land and housing, goods and services, road accidents, preservation of local culture, and the relationship between tourists and locals (Andersson et al., 2004; Biagi et al., 2014).

The aim of this research is to understand the effects of mega events on the socioeconomical characteristics of cities that hosted the event, shedding light on the least praised negative outcomes, with a full focus on crime. Crime itself is one of a country's main negative economic indicators and it is saliently the most frequently overlooked, under-investigated, and misperceived side effect of big events (Campaniello, 2013). Besides, crime has been seen as a key economic indicator since 1968, when the pioneering work of Becker (1968) and the following research of Ehrlich (1973) demonstrated that crime is in fact an economic activity. The core premise is that most illegal actions, particularly those performed to benefit the criminal, are

rational acts. While considering illegal conduct, criminals balance the predicted rewards and costs. As a result, burglary and robbery can actually be seen as low-skilled occupations.

Although we tend to think of criminal activities outside the realm of legitimate work, there are some potential reasons why this characterization could be valid. Firstly, individuals who engage in criminal activities may do so because they have limited opportunities for legal employment (Freeman, 1996). This may be due to factors such as a lack of education, training, or experience. In this sense, they could be seen as low-skilled workers who are unable to find legitimate work. Secondly, some types of criminal activities such as petty theft or drug dealing require little specialized skills or knowledge. Thus, in these cases, criminals may be seen as engaging in low-skilled work, albeit illegal work (Becker, 1968). Nonetheless, there are markets for illegal goods or services that requires some level of skill or expertise, such as counterfeiting or identity theft.

Apart from the definition of crime itself in economic terms, it is the result of criminal activities that causes substantial costs to individuals, businesses, and last but not least governments. Victims of crime can incur direct costs such as medical expenses or property damage, as well as indirect costs such as lost wages or psychological trauma. Businesses can suffer from theft, fraud, or vandalism, which can result in lost profits and increased insurance premiums. And finally, governments to respond to crime must spend resources on law enforcement, court systems, and incarceration, which can divert funds away from other public services. It is estimated that the City of Chicago spent more than $1.3 billion on enforcement in 2013, with robberies alone costing city citizens $500 million (Twinam, 2017).

As for other mega events, certain studies suggest a potential rise in specific types of crimes associated with the event, while others indicate no significant impact or even a decrease in crime rates during the tournament (Campaniello, 2013).Various are the factors, such as heightened population density, an influx of visitors, and shifts in social dynamics, which might have the potential to influence crime rates when the

World Cup is held. Nonetheless, the relationship between hosting the event and crime is even more intricate, and its outcomes might vary based on contextual elements, including pre-existing crime levels, the effectiveness of security measures, and the socio-economic conditions prevailing in the host country or cities. It is noteworthy that each host country implements diverse strategies and measures to ensure safety and security throughout the World Cup. These initiatives encompass bolstered law enforcement, heightened surveillance, and proactive steps to prevent and deter criminal activities.

Hence, given that major events like the World Cup may definitively have implications for cities on their respective level of crime, it is worth considering whether nations should take into account the potential ex-post criminality numbers before proposing to host the World Cup. As a result, this paper will address the following research questions: Did the 2006 FIFA World Cup in Germany have an impact on the level of crime in the selected venues? Is the effect on crime rates homogeneous for all cities or does it depend on the characteristics of each city?

To answer those questions the ex-post consequences of the 2006 FIFA World Cup in Germany on the venues' crime rate will be analyzed in order to determine empirically to what extent major events impact the rate of criminality. The hypothesis to be tested is whether the World Cup in Germany, and hence Mega Events, had a positive impact on crime rates in the chosen locations.

This research presents a novel investigation into the impact of the World Cup in Germany on the level of criminality in cities. To the best of the knowledge, this study represents the first comprehensive examination of the relationship between the World Cup and crime in Germany. Additionally, this paper seeks to explore a possible heterogeneity of the effect of the World Cup on crime rates in German cities of over the period 2003-2006 by employing a panel data approach. It is important to notice that this research provides evidence on the relationship between mega events and crime using the 2006 FIFA World cup in a developed country, Germany for instance, as a case study. As such, the impact of major sporting events on crime rates might vary depending on the socio-economic and cultural characteristics of the hosting countries.

To conduct this research, cities that hosted the 2006 World Cup between June 9th and July 9th will be examined, comparing the number of crimes in those cities (our treatment set) to those in locations that did not host the event (our control group).

In the first part of the research, a two-way fixed effects model, which has been discovered to be the most utilized approach in situations of sporting events with more than one treatment unit (Feddersen et al., 2008; Campaniello, 2008; Hagn, 2009; Feddersen et al., 2012; Feddersen et al., 2013), will be used to examine the impact of the World Cup in 2006 on crime rates in German cities. Indeed, in crime analysis, the two-way fixed effects model allows for the separation of the unique impact of the World Cup while adjusting for other factors that may influence crime rates. By including fixed effects for both cities and time periods, the model enables to control for time-invariant characteristics of different cities as well as time-varying factors that affect all cities similarly.

Moreover, the two-way fixed effects model is a better choice than synthetic control methodology for analyzing the hypothesis since: (1) it accounts for unobserved heterogeneity and (2) it does not imply the creation of a synthetic control group which would invalidate the entire study, given that in this research a control group is already present. After controlling for time and city fixed effects and other characteristics often linked with crime, the resulting difference between the locations studied can be interpreted as the World Cup's causal influence on local crime rates. Additionally, to consider the variability in panels' standard errors and tackle the presence of serial autocorrelation, a Prais-Winsten regression has been integrated into the analysis to enhance the accuracy of the estimations. Moreover, a matching methodology, together with the two-way fixed effects, is implemented as a way of improving the comparison between treated and untreated cities.

Whereas, in the second part, potential heterogeneities in the effect of the 2006 World cup on local crime will be addressed by considering two impactful variables: (1) the old East and West Germany division, which embeds the different socio-economic contexts of the analysed cities and, (2) population density, which captures the difference of crime occurrences between cities with higher and lower population density. As Twinam (2017) discovered, cities that are more densely populated tend to have higher crime rates

compared to those that are less populated. In this part, the hypothesis is that cities in East Germany and with high population density will experience a higher effect compared to those being part of the respective opposite groups.

In point of fact, despite the widespread belief that major sporting events may lead to increased criminal activity; our results suggest otherwise. These findings contribute to the growing body of evidence that challenges common perceptions, emphasizing the importance of employing robust methodologies to uncover the true causal impact of major events on local crime dynamics.

The paper is structured as follows: Section 2 will provide a comprehensive background on the assessment of mega-events, particularly the World Cup. Next, Section 3 will describe the empirical strategy and the data, outlining the chosen variables and specifications, as well as the strategy used for estimating the parameters of interest and testing the hypothesis. Section 4 describes and discusses the results. Finally, Section 5 will examine possible policy implications of the results while also acknowledging the study's limitations and suggesting possible improvements for future research.

2. Background of the Study

The FIFA World Cup is a globally renowned sporting event that draws billions of viewers every four years. Although it is often recognized for its ability to bring together individuals from different countries and backgrounds, there is still a lot of debate surrounding its impact on society, particularly when it comes to crime rates. Researchers have conducted numerous studies to understand the relationship between the World Cup and various forms of criminal activity, such as violent crime, property crime, and domestic violence. While some studies suggest that the World Cup is associated with an increase in crime rates, particularly in host countries, others argue that this relationship is not significant or is even negative.

The literature review in section 2.1 will first provide an overview of existing research on the factors that contribute to crime rates and then it will go in-depth in the relationship between major sport events such as the World Cup and crime by analysing and synthesizing findings of previous studies. By doing so, the aim is to shed light on the factors that contribute to the World Cup's potential impact on crime rates and

provide insight into the potential social consequences of hosting such a significant international sporting event. Next, section 2.2 frames the study in the context of criminality in Germany and the characteristics of the 2006 World Cup.

2. 1 Literature Review

Crime is a thoroughly studied socio-economic topic, often linked with exogenous shocks to society. When looking for possible factors that contribute to the overall crime rates, natural disasters emerge as a determinant frequently studied as it is a significant external shock capable of influencing the levels of criminal activity (Frailing et al., 2007; Roy, 2010; Leitner et al., 2011). Natural disasters, such as hurricanes, earthquakes, floods, and wildfires, possess immense power and can cause extensive devastation, profoundly impacting the social, economic, and environmental aspects of affected communities. Beyond the immediate physical damage they inflict, these catastrophic events have far-reaching consequences. Contrary to intuition, a substantial body of evidence suggests that natural disasters can have a profound effect on crime rates in affected areas. Numerous studies have demonstrated a positive correlation between natural disasters and crimes related to property, violence, burglary, and theft (Frailing et al., 2007; Roy, 2010; Leitner et al., 2011). However, it is important to note that an emerging body of literature presents an alternative perspective, indicating a negative impact of natural disasters on crime rates. For instance, Garcia Hombrados (2020) explored the case of the 2010 earthquake in Chile and found that crime rates actually decreased in response to the natural disaster. Similarly, Zahran et al. (2009) discovered that natural disasters in Florida tended to reduce property and violent crimes.

Not comparable to natural disasters, another kind of exogenous shocks is growing importance in the literature: Mega Events. Large sporting events like the football ones are, indeed, likely to influence various criminal behaviors, including robbery and burglary (Campaniello, 2008). For instance, Yu et al. (2016) supported the "hot spot theory" by studying basketball events sponsored by the Memphis Grizzlies and the University of Memphis Tigers. They found that crime rates tend to increase in areas with larger crowds due to increased opportunities for crime. Supporting those findings, Marie (2016) conducted an

experimental analysis of football matches in London and discovered that they influenced crime through three channels: crowd concentration, self-incapacity, and police displacement. Moreover, according to Barker et al. (2002), crime is a spatial phenomenon that is subject to dislocation, and it tends to cluster in areas with a higher concentration of tourism amenities and attractions but less concentrated security, as it was the case during the America's Cup 2000 in Auckland.

Another type of mega-event, the Olympic Games, has garnered more attention in the literature in terms of any possible link to crime. Indeed, as Andresen and Tong (2012) pointed out, the Olympic Games in Vancouver in 2010 had a non-significant effect on crime, owing to an increase in security personnel that mitigated any potential negative effect. It was also stated that the media played a factor in the impression of crime during the 2012 Olympic Games in London. Indeed, respondents, particularly those residing in Commonwealth nations, indicated an increase in the possibility that London will face a rise in crime (Schroeder et al., 2014).

Several factors may contribute to the occurrence of crime because of Mega Events like the World Cup, but three of them have been found to be the most influential: tourism, employment, and population density.

First, the most extensively researched factor is tourism which has been proved to cause an increase in the number of potential victims in the region. Indeed, numerous studies have shown that tourism has a positive impact on burglary, larceny, and robbery crimes and no relation to crimes against people such as murder, rape, and assault (Allen, 1999; Barker et al., 2002; Biagi & Detotto, 2012; Yu et al., 2016; Montolio & Planells, 2016; Recher et al., 2020). For this reason, it appears that the vast majority of studies conducted in this field focus on the relationship between crime and tourism.

Second, the relationship between employment and crime is complicated and multifaceted. Research has consistently shown that unemployment is a key predictor of crime, as jobless individuals are more likely to engage in criminal activity due to financial hardship and social marginalization. Additionally, unemployed

individuals may have more free time to commit crimes and may lack the positive role models and social support networks that come with employment. Entorf (2000) found that unemployed young people in Germany were more likely to commit crimes. Similarly, a substantial body of research has shown that crime has become part of the unemployment problem (Good et al., 1986; Freeman, 1991; Hagan, 1993). However, the World Cup and other major athletic events generate many employment opportunities. For example, it was shown that the 2006 World Cup in Germany produced around 60,000 employments. As such, from this analysis a big event such as the World cup is expected to reduce criminality given the increase in employments rates in the regions where the event is held.

Third, the impact of the World Cup on crime may be influenced by population density. As a matter of facts, the amount of people living in a specific region, referred as "population density", can significantly affect crime rates, social cohesion, and economic development. Highly populated areas such as metropolitan centers may have a higher incidence of criminal activity, while less populated regions like rural villages may experience social exclusion and isolation. According to Glaeser and Sacerdote (1999), population density is a double-edged sword that boosts cities' production on the one hand. On the other side, it raises the level of crime.

Furthermore, Mega Events like the World Cup can have different effects on transforming cities. Large expenditures are necessary and the majority of which are focused at improving public transit systems. However, some investments are also intended at reclaiming specific regions and neighbourhoods. For example, according to Garcia-Lopez (2012), Barcelona is a proof of urban evolution as a result of a Mega Event. Another example is the one offered by He et al. (2020), who used the Boao Forum for Asia as a case study. They discovered that the Mega Event hosted in the Boao accelerated urban growth in regions most impacted by the forum. These findings suggests that Mega Events do not only have economic benefits but also do contribute to the transformation of urban landscapes.

As a results, when cities host world cups or other significant events, they frequently spend in rehabilitating and rejuvenating districts to accommodate the flood of tourists. These activities may have a favourable influence on the area's crime rate. Deterrents to potential criminals include increased monitoring, enhanced security measures, and a visible police presence. Furthermore, an enhanced physical environment, such as greater lighting and public places, can make the neighbourhood more pleasant and deter criminal conduct. These events' economic prospects, along with community involvement activities, can help to reduce crime rates by providing employment, developing social cohesiveness, and encouraging communal responsibility among citizens (Campaniello, 2008; Garcia-Lopez, 2012).

2. 2 Context: Crime in Germany and the World Cup

Germany has a peculiar history with crime which is connected to the fall of the Berlin Wall. As a matter of fact, the social and economic changes that followed the reunification of East and West Germany initially increased crime for a variety of reasons. First, the growth in organized crime as criminal groups from East and West Germany began to integrate and extend their activities (von Lampe, 2002). Second, the dissolution of East Germany's official security apparatus, the Stasi, left a power vacuum, which criminal groups exploited (Augustine, 2004). Third, cultural and linguistic disparities between East and West Germans also caused tensions and misunderstandings that escalated to confrontation (Molnar, 2021).

As a result, crime rate in Germany increased by 211% from 1990 and 1995[1]. More precisely, as Wolfgang Schinz, the criminal police director of western Berlin, revealed in 1991 in an interview with the Chicago Tribune[2], robberies, stealing, and pickpocketing increased in 1990 compared to the pre-Berlin wall breakdown. Schinz contended that the migration of individuals from the former East Germany to the wealthier West Germany increased crime rates in the West. Furthermore, East Germany's economic transition from a planned to a market economy resulted in high levels of unemployment, poverty, and social

[1] https://www.macrotrends.net/countries/DEU/germany/crime-rate-statistics
[2] https://www.chicagotribune.com/news/ct-xpm-1991-07-07-0103170487-story.html

dislocation, thus increasing property crime, such as theft and burglary (Dornbusch et al., 1992; Hall et al., 1994).

Lastly, and unfortunately, the fall of the Berlin Wall also gave rise to a new generation known as the "Children of the Wall" (Chevalier et al., 2013) who, born in former East Germany between 1991 and 1993, were at least 50% more likely to become criminals as adults.

By examining crime rates in Germany during the time span of interest, from 2003 to 2006, discernible trends and patterns can be uncovered. Broadly, the overall crime rate experienced a gradual decrease over this period following the trends established by the fall of the Berlin wall (Bundeskriminalamt, 2023).

More specifically, during the period of analysis, property crime rates demonstrated a noticeable decline signalling a positive trend in terms of theft, burglary, and other related offenses. This reduction can be attributed to multiple factors such as enhanced security measures, technological advancements, and community policing efforts. Contrarily, rates of violent crime remained relatively stable during this timeframe. A trend which is attributable to the intricate socio-economic factors and regional disparities present within Germany at the time. On the other hand, white-collar crime, including fraud and embezzlement, witnessed a slight increase during those three years which can be linked to improved reporting mechanisms and an increased awareness surrounding financial illicit activities. Nonetheless, even if overall crime rates declined, specific crime categories and target areas needed heightened attention in terms of law enforcement and prevention strategies (Reinke, 2009).

In this framework, it is worth exploring how a mega event such as the 2006 FIFA World Cup might have had an impact on security measures and crime rates. Specially, because such events are critical for the consistent distribution of new surveillance and security technology and, as Eick (2011) said "even selling sausages became a security concern during the 2006 World Cup". Additionally, the 2006 FIFA World Cup took place in the aftermath of the 2001's 9/11 attacks, which had significantly impacted global security

measures. As a result, the tournament saw the implementation of extensive security measures to ensure the safety of participants, spectators, and host cities. Indeed, massive upgrades were made to security people, electronics, and software in order to detect everything from a t-shirt to dangerous bombs and explosives. Germany collaborated closely with international security agencies and law enforcement bodies to share intelligence and coordinate security efforts. Interpol, EUROPOL, and other relevant organizations worked alongside German authorities to identify potential threats, exchange information, and facilitate the smooth operation of security measures during the tournament. Furthermore, security measures and apparatus did not originate just in Germany. NATO supplied aerial monitoring with two AWACS planes, and armed personnel were stationed throughout the host cities. It should be emphasized that during the 2006 World Cup, 200 data banks with over 18 million data files were supplemented with electronic background checks for the hundreds of thousands of persons seeking to work at the World Cup (Averesch, 2009). Moreover, the 2006 FIFA World Cup came shortly after the 2001 terrorist attacks which affected security measures everywhere creating a chain reaction.

It is important to note that the 2006 World Cup did not affect all the regions in Germany, instead it impacted only some specific cities where the games took place. Thus, for the purposes of this research, crime rates in the host cities will be compared to those in cities that did not host the event. To have a clearer understanding a map of the cities that held football matches are depicted in Figure 1, picturing in blue treated cities – those that hosted the event – and in grey the non-treated ones – control group.

Given the large investments necessary, cities with a stadium capacity which, at the time, met the standards had a better chance of being selected as the venue's location. For this reason, the names of the stadiums and their capacities are given and summarized in Table 1.

Figure 1: Host Cities vs no-Host Cities

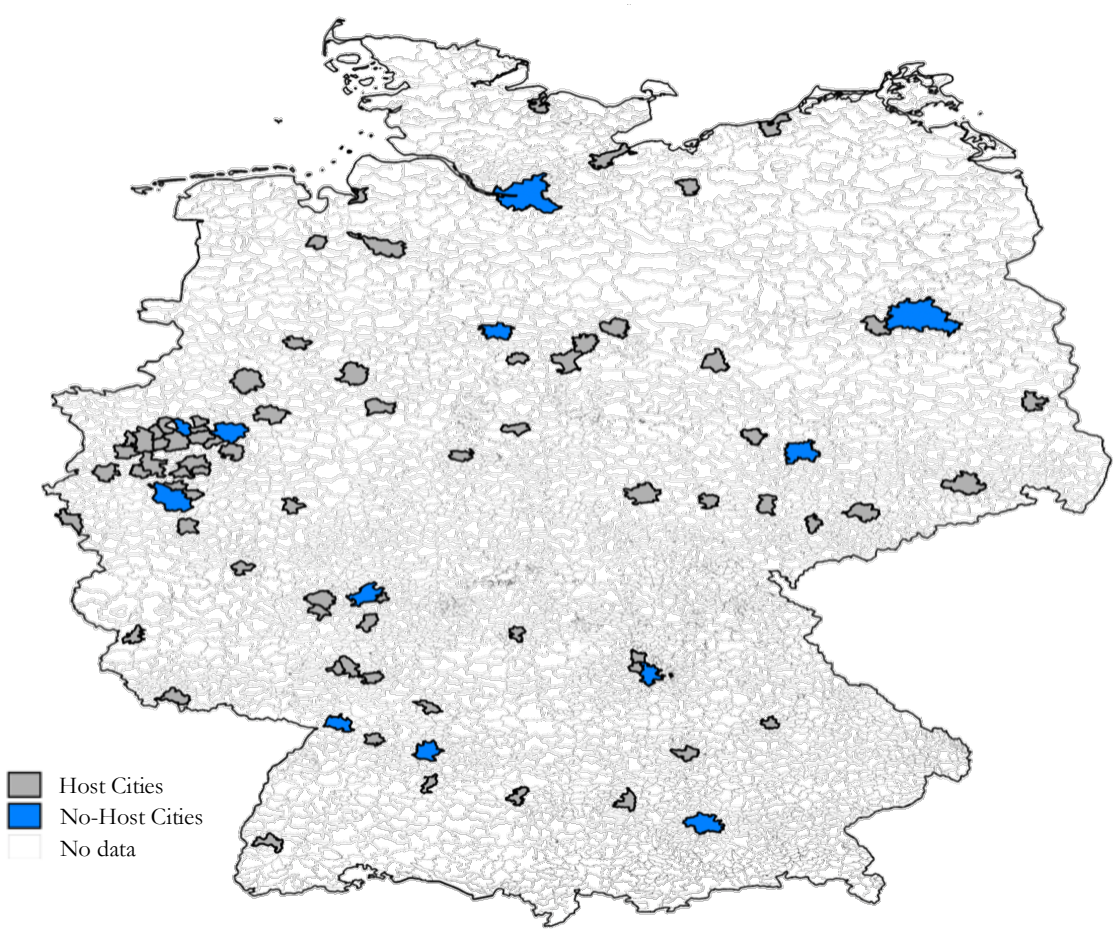


Table 1: 2006 FIFA World Cup's Venues

Location (City)	Name	Capacity
Berlin	"Olympiastadion"	72,000
Munich	"Allianz Arena"	66,000
Dortmund	"Westfalenstadion"	65,000
Stuttgart	"Gottlieb-Daimler Stadion"	52,000
Gelsenkirchen	"Arena AufSchalke"	52,000
Hamburg	"Volksparkstadion"	50,000
Frankfurt	"Commerzbank-Arena"	48,000
Kaiserlslautern	"Fritz-Walter-Stadion"	46,000
Cologne	"RheinEnergiestadion"	45,000
Hanover	"Niedersachensenstadion"	43,000
Leipzig	"Zentralstadion"	43,000
Nuremberg	"Max-Morlock-Stadion"	41,000

3. Empirical Strategy and Data

3.1 Theoretical Background

The basic premise of the crime economic model is that individuals maximize their anticipated utility, thus their decision to engage or not engage in criminal activities is rational and is influenced by the perceptions of costs and benefits of illegal behaviour (Becker, 1968; Ehrlich, 1973). The model is based on economists' standard choice analysis, and it posits that a person commits an offense if the predicted benefit to him surpasses the utility he could gain by utilizing his time and other resources on other activities (Becker, 1968).

The rational choice model states that the decision to participate in illegal conduct is influenced by the amount of the expected benefit (both financial and psychological) from doing the crime in comparison to the expected penalty. The individual conducts the unlawful act if the expected utility exceeds the expected consequence. Indeed, we may conceive crime as any other economic activity since all individuals, whether criminals, victims, or law enforcement officers, respond to incentives, both good and negative, and they logically seek their greatest benefit.

On the other hand, the supply of crime is determined by a variety of factors, including potential criminals' lack of legitimate employment possibilities, the amount of arrest and penalization, changes in the demand for crime, geographic locations, and time period. Assume, for example, that a person is risk averse and willing to conduct a crime. To put it another way, the individual will forecast the expected benefits, say E(b), that are greater or equal to the probability of not being caught, say (1-pc), times the expected return, say E(r), minus all the possible costs that a criminal activity requires, say E(c), minus the expected wages that the individual could have earned by legal activities, say E(w), minus the expected punishment for the illegal activity times the probability of being caught, say E(p)*pc (Fajnzylber et al., 2002). To summarize, the assumption of the economic model is the following:

$$E(b) \geq [(1 - pc) \times E(r)] - E(c) - E(w) - [E(p) \times pc]$$

The economic model assumption above is applied for the case of the 2006 World Cup, and it is especially consistent with the study when considering the possible changes in the variables present in the equation. Indeed, the expected probability of being caught E(pc), expected returns E(r), expected costs E(w), expected wages E(w) and expected punishment E(p) might actually vary because of (1) differences between cities depending on local features and characteristics of the population and, (2) the 2006 World Cup. Especially concerning the effect that the World Cup in Germany might have had on E(b), it is worth noting the impact on pc and E(p) due to enhanced or decreased security measures or the number of police officers in the host cities; E(r) if considering wealthy tourists as potential victims for example; E(w) given the increased employment rates in the different event's venues.

The assumption of spillover effects is a second condition that must be considered. Indeed, these effects are well recognized as the consequences of seemingly unconnected events in one location on the economies of other locations. These consequences are crucial in determining the true impact of the treatment on the economy of the host city (Kim et al., 2020). Given the World Cup's features, such as the flood of tourists, greater security measures, and increased police presence, which were likely more prominent within certain host cities, these consequences are unlikely to occur. In fact, it was discovered that during the FIFA World Cup in Italy in 1990, neighbouring provinces did not exhibit a substantial spillover impact (SUTVA assumption), validating the hypothesis of the absence of spillover effects in the case of Germany in 2006 (Campaniello, 2013).

Starting with these theoretical considerations, the research will design and estimate a model with the number of crimes as the outcome variable and a variety of economic and social aspects as controls.

3.2 Empirical Model & Methodology

The 2006 FIFA World Cup in Germany provides a unique opportunity to investigate the potential relationship between major sporting events, particularly those held in developed economies, and crime rates in hosting cities. To do so, the number of reported infractions at the city level is employed as the

outcome variable, following the empirical application of the theoretical model mentioned above. To be clear, "crime" is defined as the number of offenses recorded to law enforcement, which cannot be compared to the number of offenders: a person may have committed many reported crimes, but his arrest is only recorded once.

For the purpose of this research, crimes that might potentially rise during a mega-event are assessed: the World Cup produces overall excitement and greater chances for aggregation since it draws people from within and from other countries, making the city more chaotic and attractive for potential criminals who want to engage in criminal activities unnoticed.

While it is often speculated that such events may lead to an increase in local crime, this research goes beyond mere correlation between the two and employs a rigorous methodology to identify an actual causal effect. In this context, the employed methodology seeks to isolate the specific impact of the 2006 World Cup on local crime rates by implementing a robust estimation strategy, encompassing a two-way fixed effects methodology and propensity score matching. Following this thorough approach, it is possible to obtain valuable insights into the complex dynamics between major sporting events and crime, ultimately contributing to a better understanding of the social consequences associated with hosting such events.

In addition, to examine the overall impact of the 2006 World Cup on local crime rates, this study also investigates the heterogeneity of the effect across different host cities. As such, potential variations in the impact of the World Cup on crime rates among the host cities are uncovered, thus recognizing that the relationship between major sporting events and crime can vary across contexts. Precisely, it can be explored whether certain cities experienced different effects compared to others by taking into consideration city-specific characteristics, such as population density and the old division of West and East Germany. By analysing heterogeneity, a nuanced understanding of the complexities surrounding the relationship between the World Cup and crime is provided, finally shedding light on the contextual factors that might mediate or moderate the observed effects.

Detailed information on the methodology implemented will be given in the next paragraphs.

First, a panel data set is compiled, which includes data from 84 German cities with more than 100,000 people between 2003 and 2006. The cities are built in accordance with the OECD's (2012) definition of functional urban regions, which encompasses the economic and functional extent of cities based on everyday people's movements.

In the first part of the research, a panel type database ranging from 2003 and 2006 is exploited to investigate if there was any change in crime rates due to a city's decision to host the World Football Cup in 2006. Using the data on the German urban areas highlighted in the previous section, the study uses this equation:

$$c_{jit} = \beta_0 + \beta_1 Host_{it} + \beta_2 X_{it} + T_t + \mu_i + e_{jit} \quad (1)$$

where c_{jit} is the crime rate of type j in city i at time t; $Host_{it}$ is a dummy variable which identifies the treated cities i.e. the cities that hosted the 2006 World Cup; X_{it} is the set of control variables of city i at time t; T_t are the Year fixed effects; μ_i are the city i fixed effects and, finally, e_{ji} is the error term for crime j and city i in year t. To be clear, the dummy variable for the host city ($Host_{it}$), whose coefficient the research is interested in, is defined as:

$$Host_{it} \begin{cases} = 1 \; if \; City_i \; hosted \; the \; World \; Cup \; and \; Year = 2006 \\ = 0 \; otherwise \end{cases}$$

The null hypothesis that nothing has changed in the host city's crime disparity due to the Mega Event implies $\beta_1 = 0$. Instead, the alternative, $\beta_1 \neq 0$, identifies with the change of crime rates in cities as a result of hosting the World Football Cup.

Using equation (1), the effect of the treatment is estimated by means of a pooled OLS and a Two-Way Fixed Effects (TWFE). The Pooled OLS regression technique is applied to merge data from diverse groups or units neglecting individual-specific effects, and assuming homogeneous coefficients across all the analysed groups. The Fixed Effects methodology enables the estimation of variations within groups and controls for unobservable differences among individuals. In addition, due to the likely non-specificity of the error term, a robust clustered estimation by city of TWFE is used.

Moreover, to correct the estimations for heteroskedastic panels' standard errors and serial autocorrelation of type AR(1), results from a Prais-Winsten regression are also included. Specifically, the Prais-Winsten method involves estimating the correlation between the error at t and t_{-1} and then using this estimate to transform the outcome and predictor variables in such a way that the correlation is removed from the error when a linear regression model is fitted to the transformed data. The key assumption behind the method is that the error follows a first-order autoregressive process which is quite reasonable using yearly data. The method is an example of feasible generalized least squares and, as such, produces estimates with the same asymptotic distribution as the maximum likelihood estimator (Bottomley et al., 2023).

Lastly, to ensure the validity of the findings, a propensity score matching methodology is employed to maximize similarity of cities in treatment and control groups before the treatment. In detail, propensity score matching is a statistical technique that helps address potential biases in observational studies by creating a balanced comparison group. By estimating the likelihood of being a host city based on observable characteristics, like socio-economic factors, each host city can be matched with non-host cities that have similar characteristics. As a result, this method allows to isolate the effect of hosting the World Cup on the crime rate, reducing the influence of confounding factors.

In depth, characteristics used in the matching procedure include: the stadium capacities and, the distance from the nearest airport, as factors that were considered to select the venues and population. The regression used to estimate the propensity scores is a probit model and the matching algorithm is a nearest-neighbor without replacement.

Moving on, the second part of the research aims to analyze a possible heterogeneity of the effect of the treatment. Indeed, when examining the effects of the 2006 World Cup on crime rates in hosting cities, it is important to explore potential heterogeneities to unveil underlying factors that may have influenced the outcomes. For this reason, two variables are defined to explore the presence of a heterogeneous effect of the treatment:

$$East\ Germany_{it} \begin{cases} = 1\ if\ City_i\ was\ in\ East\ Germany\ in\ 1945 \\ = 0\ otherwise \end{cases}$$

$$High\ Pop\ Density_{i06} \begin{cases} = 1\ if\ City_i\ has\ a\ value\ of\ Population\ Density > average\ Population\ Density \\ = 0\ otherwise \end{cases}$$

The first variable, representing the old East and West Germany division, takes into account the historical and socio-economic contexts of German cities, which can significantly differ between the two regions. The division between East and West Germany during the Cold War had lasting effects on infrastructure, economy, and social dynamics. Cities in East Germany faced challenges such as a lagging economy, high unemployment rates, and limited resources, while those in West Germany generally enjoyed more prosperous conditions. Thus, the division provides a relevant and meaningful distinction when analyzing the effects of the World Cup on crime rates. Taking into consideration the economic model explained in the previous section, criminals present in East Germany might have had higher expected benefits E(b) compared to those present in the West given a lower probability of being caught (pc) induced by social-economic distress and insecurity. Thus, accounting for this variable allows us to investigate if cities in the two regions experienced different patterns in criminal activities during the tournament, indicating whether the historical legacy influenced the outcomes.

The second variable, population density, offers another crucial dimension to consider in addition to the East-West division. As a matter of fact, cities with higher population densities tend to have more vibrant and bustling urban environments, with increased social interactions and potential anonymity. Such conditions can shape the occurrence and nature of criminal activities. By including a population density variable that distinguishes cities with densities above the mean of hosting cities interacted with the treatment, it is possible to discern if areas with more densely populated urban centers experienced unique patterns in crime rates during the World Cup.

Taking these variables into account enables to clarify the diverse characteristics and dynamics of the hosting cities, allowing to explore potential disparities in crime rates. Accounting for the historical division of East and West Germany and population density while analysing the effects of the World Cup uncovers the potential presence of heterogeneous outcomes.
With that said, a TWFE accounting for serial autocorrelation AR(1) through the Prais-Winsten regression for the unmatched and matched samples are used to identify possible heterogeneities of the effect of the treatment. As such, two are the utilized equations:

$$c_{jit} = \beta_0 + \beta_1 Host_{it} + \beta_2 EastGermany_{it} + \beta_3 Host_{it} \times EastGermany_{it} + \beta_4 X_{it} + T_t + \mu_i + e_{jit} \quad (2)$$

where the dummy variable for the effect of being part of East Germany in 1945 and being selected as a venue in 2006 ($Host_{it} \times EastGermany_{it}$) is defined as:

$$Host_{it} \times EastGermany_{it} \begin{cases} = 1 \; if \; Treatment = 1 \; ; Year = 2006 \; ; East \; Germany = 1 \\ = 0 \; otherwise \end{cases}$$

And it isolates the effect that the World Cup in 2006 in Germany had on cities that were part of the former East Germany against the former West Germany.

Furthermore, the second equation is:

$$c_{jit} = \beta_0 + \beta_1 Host_{it} + \beta_2 HighPopDen_{i06} + \beta_3 Host_{it} \times HighPopDen_{i06} + \beta_4 X_{it} + T_t + \mu_i + e_{jit} \quad (3)$$

where the dummy variable for the effect of having a population density higher than the mean of the final venues in 2006 and being selected as a venue in 2006 ($Host_{it} \times HighPopDen_{i06}$) is defined as:

$$Host_{it} \times HighPopDen_{i06} \begin{cases} = 1 \; if \; Host = 1 \; ; HighPopDen_{i06} = 1 \\ = 0 \; otherwise \end{cases}$$

And it isolates the effect that the World Cup in 2006 in Germany had on cities that had a population density higher than the average and were selected as a final venue.

Lastly, as conducted in the first part, a propensity score matching methodology is proposed aiming to capture the unobserved heterogeneity prior to the implementation of the treatment.

3.3 Data and Variables

The data on crime come from the "Bundeskriminalamt," or Federal Criminal Police Office, which publishes municipal-level figures annually. To be precise, the outcome variables account for crime in general, as well as burglary and robbery. Individually, burglary is defined as illegal entry (trespass) onto another person's property with the intent of committing a criminal offense on the victim's property. In the case of Germany

cities' streets were bustling with activity, millions of fans were attending matches and engaging in public viewing events, making it much more difficult for would-be burglars to operate undetected.

Robbery, on the other hand, is the crime of stealing or attempting to steal anything valuable via the use of force, the threat of force, or terror. In this situation, events such as the World Cup frequently draw a large number of fans and visitors, some of whom may be unfamiliar with the local region and ignorant of possible hazards. Opportunistic criminals may perpetrate crime or robbery by taking advantage of crowded areas, distracted persons, or the general festive environment.

Regarding the variable of interest, a dummy variable named "Host" is selected that takes the value of 1 in 2006 if the city was finally picked as a venue of the World Cup. According to the abovementioned actions put in place by, among the others, the German government, a decrease of criminality should be expected due to the event.

The economic variables that will be introduced as controls include "Number of Companies," which is used as a measure of urban areas' prosperity, and "Persons Unemployed" (source: Eurostat Database - Cities). Rationally, the opportunity cost of incarceration, which is the principal expense of crime, is proportional to the work possibilities lost. A positive coefficient is predicted because the fewer the number of jobless persons, the higher the cost of a particular prison term to an individual.

In terms of socioeconomic variables, "Total nights spent in tourist accommodation establishments" is used to measure tourist flows (source: Eurostat Database - Cities); population density, calculated as the ratio of population in cities to land area (source: Eurostat Database - Cities and Destatis - Statistisches Bundesamt) and a Dependency Index is presented as a demographic indicator.

Furthermore, light will be shed on the intriguing finding of Twinam (2017). He discovered that when residential population density increased, crime decreased. As a result, a proxy for residential population density is presented, with "Population living in a private household" serving as a surrogate for residential population and the respective land area for each city (source: Eurostat Database - Cities and Destatis - Statistisches Bundesamt). Finally, an educational measure is implemented: "Persons aged 25-64 with ISCED

level 5, 6, 7, or 8 as the highest level of education" is picked, a variable that moulds the number of persons with a higher degree (source: Eurostat Database - Cities).

The characteristics used in the propensity score matching methodology, such as Population and Stadium Capacity are publicly available on Wikipedia, whereas the data on the shortest distance from the biggest airport is gathered from Google Maps.

From the initial pool of 84 cities, the cities of Schwerin, Witten, Wolfsburg and Zwickau are removed from the sample due to a lack of observations. These changes yielded to a total of 320 observations divided into 4 years and 80 cities (including the 12 treated cities).

The natural logarithm of the outcomes and controls is used in order to normalize their distribution.

4. Empirical Results

4.1 Descriptive Statistics

To have a comprehensive understanding of the variables considered in the analysis, the descriptive statistics of the outcomes and control variables employed in the two-ways fixed effects model explained above is provided. Specifically, Table 2 illustrates the descriptive statistics of the three outcomes, whereas Table 3 captures the descriptive statistics of the control variables and those used in the propensity score matching. Moreover, a visual framework is provided in Figures 2 to 4, depicting the maps of the three outcome variables in 2006, whereas Figures 5 to 7 illustrate the changes over the four-year timespan of the analysis. It is worth noting that from figures 5 to 7 a significant change in crime rates does not seem to figure and the two groups appear to follow parallel trends in the years before 2006.

Table 2: Dependent Variables Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Logarithm of Crime Rate	320	-2.258	.239	-2.925	-1.695
Logarithm of Burglary Rate	320	-6.361	.557	-7.881	-5.108
Logarithm of Robbery Rate	320	-6.963	.489	-8.366	-5.909

Table 3: Independent Variables Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Logarithm of Total Nights Spent in Tourist Accommodation	320	13.026	1.142	10.642	16.582
Logarithm of Persons Unemployed	320	9.452	.822	8.071	12.745
Logarithm of Persons Aged 25-64 with ISCED level 5,6,7,8 as the Highest Level of Education	320	10.393	.914	8.909	13.465
Logarithm of Number of All Companies	320	8.988	.806	7.542	11.919
Logarithm of Residential Population Density	320	7.353	.403	6.148	8.236
Logarithm of Dependency Index	320	-1.192	.121	-1.504	-.92
Logarithm of Stadium Capacity	320	9.845	.754	7.601	11.307
Logarithm of Distance from the Closest Biggest Airport	320	4.384	.906	2.079	5.606
East Germany	320	.142	.35	0	1
High Population Density	320	.062	.242	0	1

Figure 2: Germany's Crime Rate in 2006 in the cities of the study

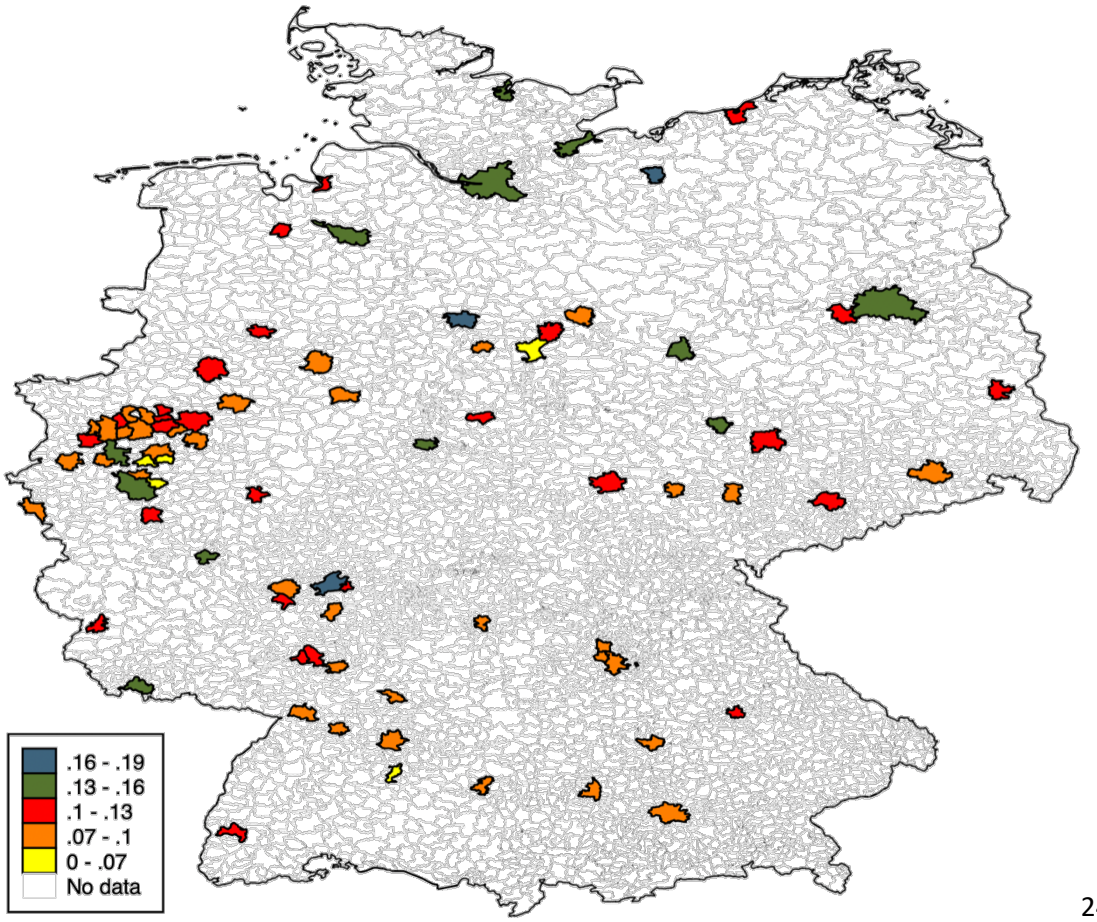


Figure 3: Germany's Burglary Rate in 2006 in the cities of the study

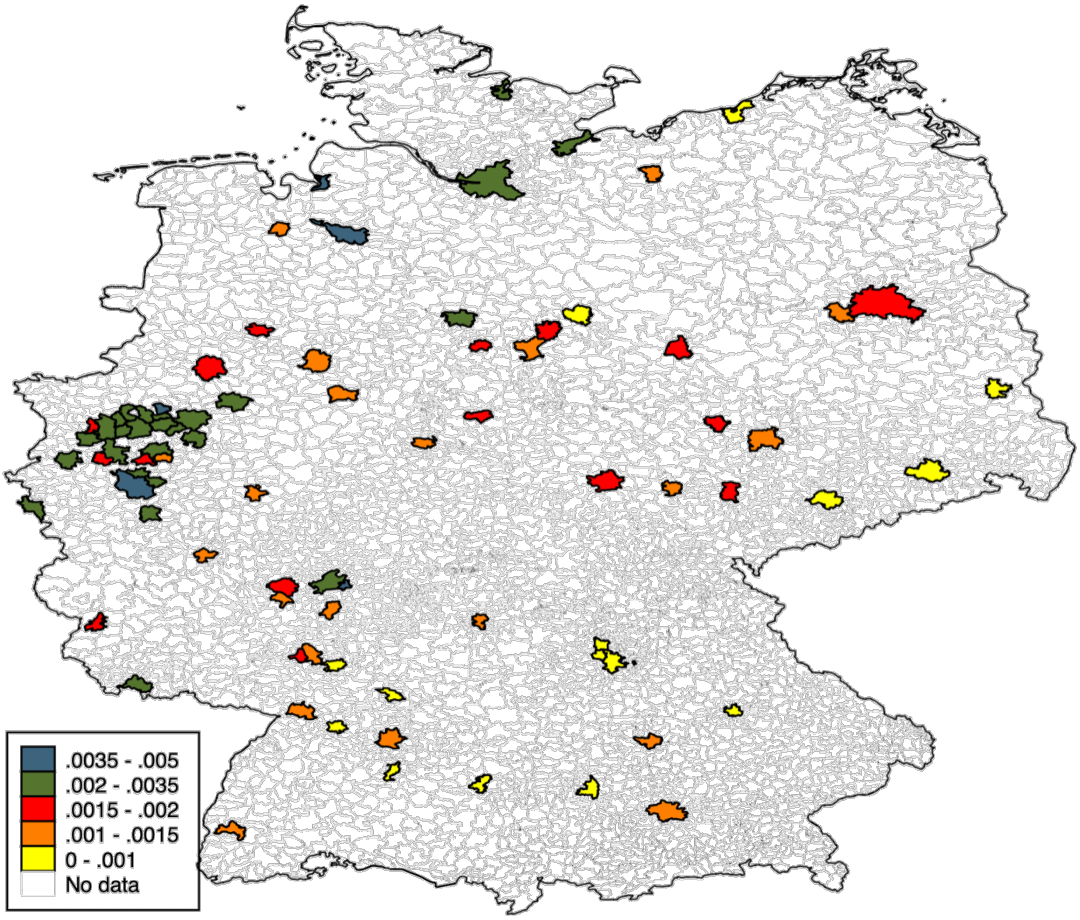


Figure 4: Germany's Robbery Rate in 2006 in the cities of the study

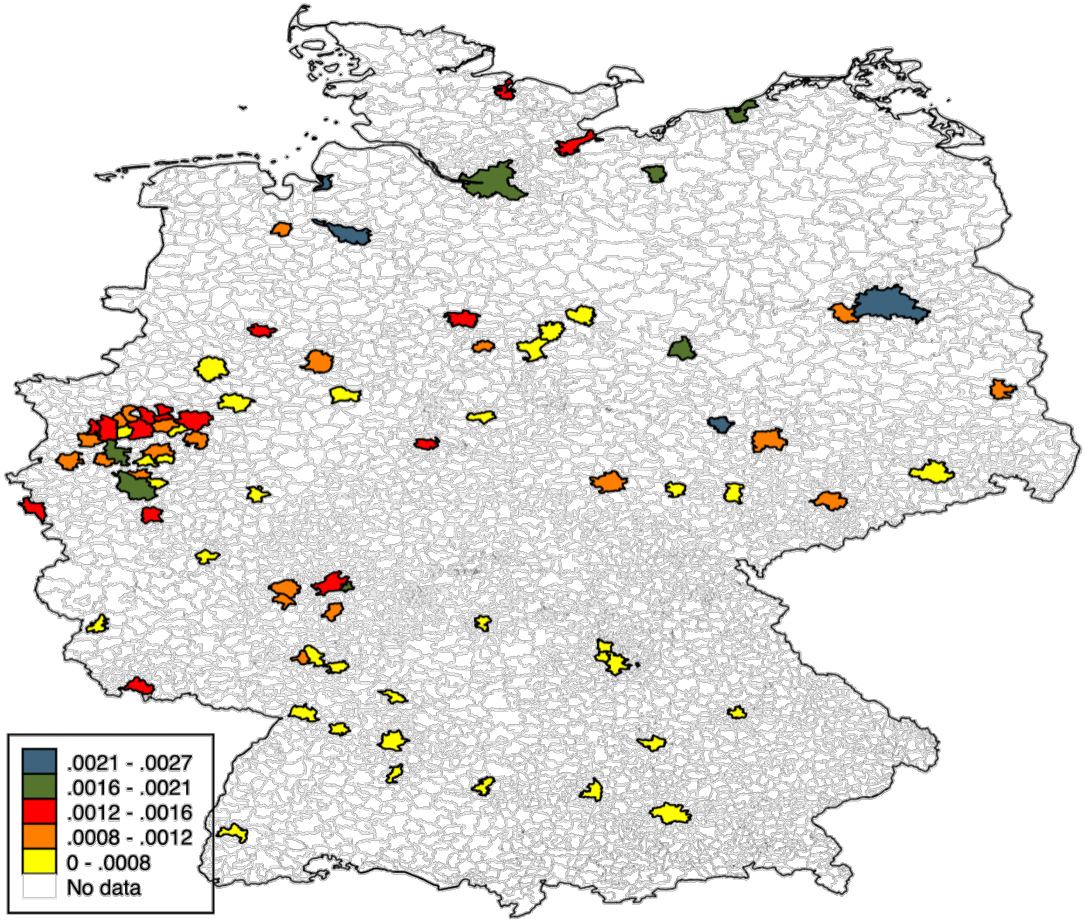


Figure 5: Trend of Crime Rate 2003-2006

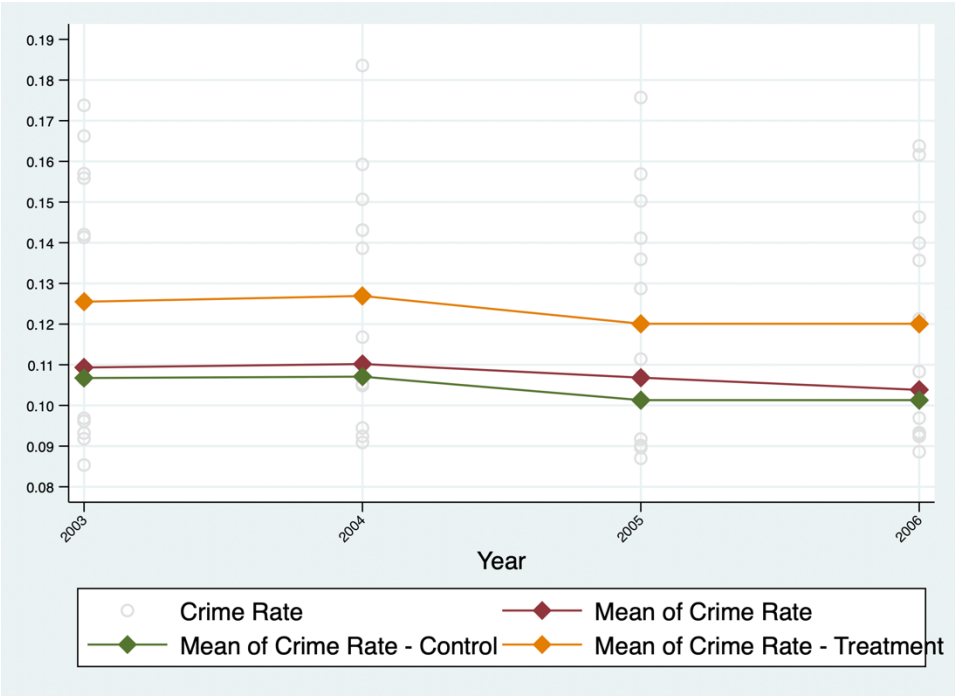


Figure 6: Trend of Burglary Rate 2003-2006

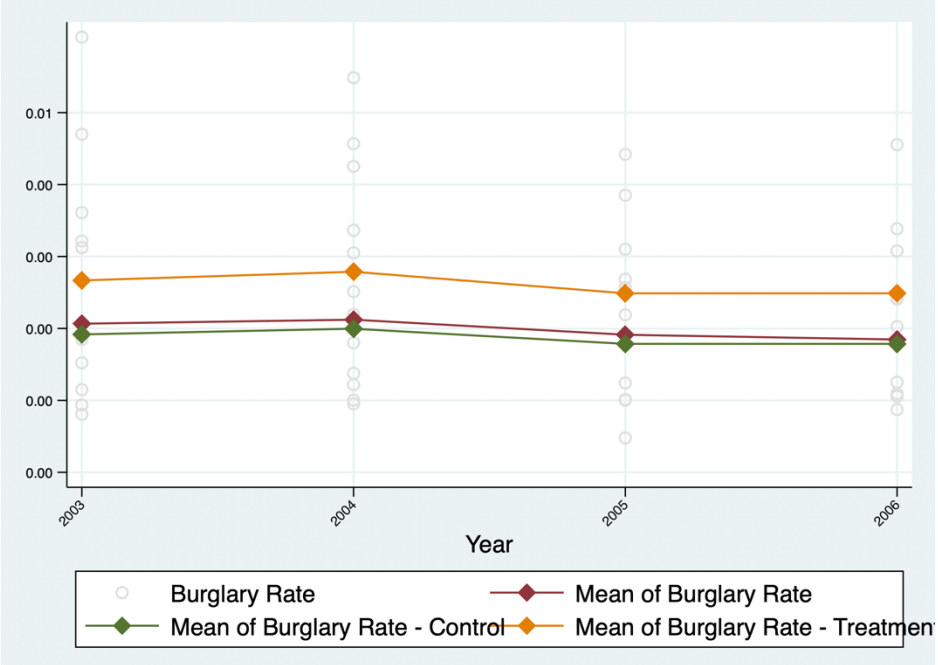
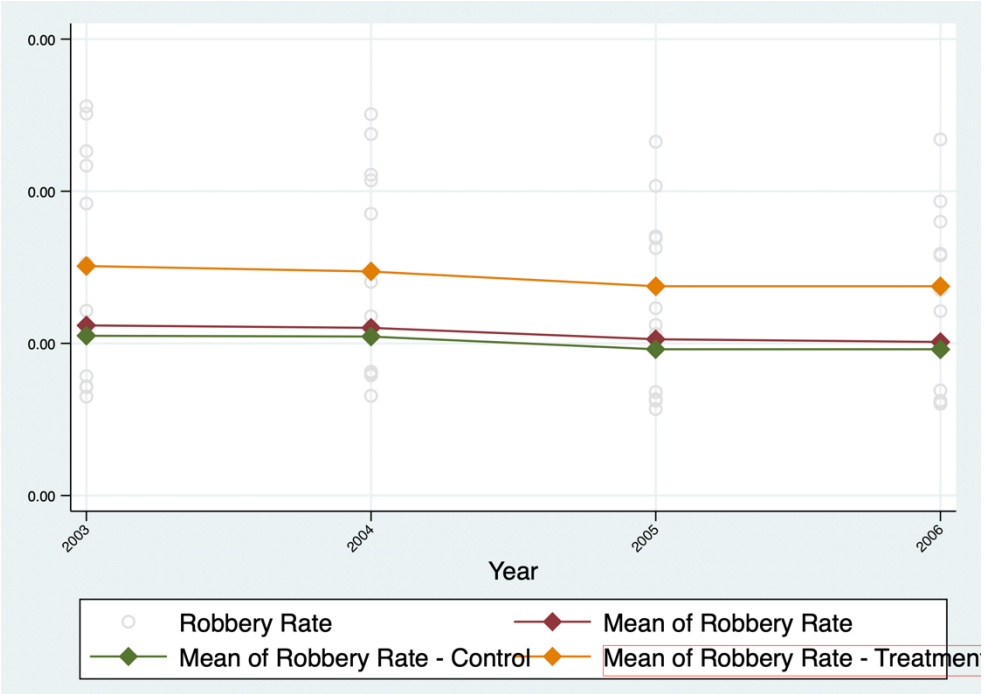


Figure 7: Trend of Robbery Rate 2003-2006



4. 2 Baseline Results

Without controlling for observable and unobservable, the study presents positive and statistically significant results for the crime rate as a whole. Subsequently, when adding Year Fixed Effects both crime and robbery rates become positive and statistically significant. Despite that, the results of the fixed effects and Prais-Winsten regressions for the outcome variables Crime, Burglary and Robbery lead to a non-significant effect of the World Cup hosted in Germany in 2006 on any of the typologies of crime (Table 4-6).

These findings may initially seem counterintuitive, considering the massive influx of tourists and the heightened excitement and festivities surrounding such a major sporting event. However, it is important to interpret these non-significant results with caution and explore potential explanations.

One possible reason for the lack of a significant relationship could be that the World Cup itself, despite its magnitude, did not directly influence the crime rates in the host cities. Crime rates are complex phenomena influenced by a multitude of factors, including social and economic conditions, law enforcement efforts,

and community dynamics. It is possible that any potential effects of the World Cup on crime rates were overshadowed by these underlying factors, rendering the impact of the event statistically non-significant.

Additionally, it is worth considering the implementation of extensive security measures and increased police presence during major international events like the World Cup. The heightened security measures may have effectively deterred potential criminal activities and maintained a sense of safety and order in the host cities, neutralizing any potential negative impact that the event might have had on crime rates.

As to the effect of the socioeconomic controls, they agree with that reported in the literature, *Logarithm of Persons Unemployed* represents the cost opportunity of being involved in the criminal market and a negative coefficient was expected. Indeed, it affects negatively all the crimes taken into consideration. This is not surprising, given that a substantial body of research has shown that crime has become part of the unemployment problem (Good et al., 1986; Freeman, 1991; Hagan, 1993).

Logarithm of Total Nights Spent in Tourist Accommodation, although only significant in the case of Robbery, presents a positive sign, that is, it positively affects crime. Again, this is consistent with the literature, given that Mega Events like the World Cup create the perfect environment for the connection of demand and supply of crime.

Logarithm of Persons Aged 25-64 with ISCED level 5,6,7,8 as the Highest Level of Education shows a negative and statistically significant coefficient in the three specifications. This is consistent with the hypothesis, given that population that had access to a higher level of education is more likely to access the legal job market and, therefore, the higher the share of population highly educated, the lower the crime rate.

The validity of the methodology implemented depends on the parallel trend assumption of the outcome variable for the treatment and the control group during the pre-treatment periods (Arkhangelsky et al., 2021). In other words, the parallel trends assumption suggests that, in the absence of the policy, the average crime rate for the treated cities would have followed the same trend as the average crime rate for the control cities. This means that any differences in crime rates between the treated and control groups after the policy

implementation can be attributed to the policy itself, rather than pre-existing differences in trends. Violations of the parallel trend assumption can lead to biased estimates of the treatment effect. If the treatment group was already experiencing a different trend in the outcome variable prior to the intervention, it becomes difficult to disentangle the effect of the treatment from the pre-existing trend. In such cases, the estimated treatment effect may be confounded or contaminated by other factors (de Chaisemartin et al., 2020; Arkhangelsky et al., 2021).

Table 4: Logarithm of Crime Rate

Methodology	**Pooled OLS with Robust Std. Err.**	**Pooled OLS with Robust Std. Err.**	**Fixed Effects Regression**	**Fixed Effects Regression**	**Prais-Winsten Regression**
Host	.118 (.066) *	.173 (.071) **	.012 (.025)	.021 (.026)	-.008 (.033)
Logarithm of Total Nights Spent in Tourist Accommodation	-	-	-	.103 (.133)	.017 (.036)
Logarithm of Persons Unemployed	-	-	-	-.030 (.080)	.137 (.036) ***
Logarithm of Number of All Companies	-	-	-	-.049 (.073)	-.142 (.054) ***
Logarithm of Persons Aged 25-64 with ISCED level 5,6,7,8 as the Highest Level of Education	-	-	-	.207 (.355)	-.040 (.066)
Logarithm of Residential Population Density	-	-	-	.943 (1.001)	.178 (.046)
Logarithm of Dependency Index	-	-	-	3.480 (1.645) **	-.774 (.122) ***
Intercept	-2.262 (.014) ***	-2.318 (.027) ***	-2.294 (.008) ***	-7.970 (8.648)	-5.119 (.335) ***
Year Fixed Effects	NO	YES	YES	YES	YES
City fixed Effects	NO	NO	YES	YES	YES
Joint Sig. Test	3.15 *	2.20 **	7.99 ***	1.73	169.66 ***
R-Squared	0.008	0.03	0.11	0.35	0.99
Number of Observations	320	320	320	320	320
Number of Groups	-	-	80	80	80

Standard Errors clustered by City in parenthesis

**** p<.01, ** p<.05, * p<.1*

Table 5: Logarithm of Burglary Rate

Methodology	Pooled OLS with Robust Std. Err.	Pooled OLS with Robust Std. Err.	Fixed Effects Regression	Fixed Effects Regression	Prais-Winsten Regression
Host	.059 (.153)	.153 (.165)	-.06 (.073)	.009 (.124)	-.003 (.110)
Logarithm of Total Nights Spent in Tourist Accommodation	-	-	-	.587 (.432)	-.016 (.058)
Logarithm of Persons Unemployed	-	-	-	-.486 (.430)	.392 (.110) ***
Logarithm of Number of All Companies	-	-	-	-.079 (.162)	.417 (.166) **
Logarithm of Persons Aged 25-64 with ISCED level 5,6,7,8 as the Highest Level of Education	-	-	-	-1.162 (1.181)	-.680 (.170) ***
Logarithm of Residential Population Density	-	-	-	-7.383 (3.259) **	.205 (.119) *
Logarithm of Dependency Index	-	-	-	2.106 (1.859)	-.899 (.529) *
Intercept	-6.363 (.032) ***	-6.312 (.045) ***	-6.312 (.016) ***	60.026 (25.078) **	-
Year Fixed Effects	NO	YES	YES	YES	YES
City Fixed Effects	NO	NO	YES	YES	YES
Joint Sig. Test	0.15	1.17	7.32	3.05 ***	88256.25 ***
R-Squared	0.004	0.01	0.08	0.15	0.99
Number of Observations	320	320	320	320	320
Number of Groups	-	-	80	80	80

Standard Errors clustered by City in parenthesis

**** p<.01, ** p<.05, * p<.1*

Table 6: Logarithm of Robbery Rate

Methodology	Pooled OLS with Robust Std. Err.	Pooled OLS with Robust Std. Err.	Fixed Effects Regression	Fixed Effects Regression	Prais-Winsten Regression
Host	.202 (.140)	.298 (.150) **	-.021 (.050)	.093 (.04) **	-.029 (.071)
Logarithm of Total Nights Spent in Tourist Accommodation	-	-	-	-.211 (.488)	.170 (.040) ***
Logarithm of Persons Unemployed	-	-	-	.167 (.295)	.649 (.048) ***
Logarithm of Number of All Companies	-	-	-	-.164 (.155)	-.311 (.098) ***
Logarithm of Persons Aged 25-64 with ISCED level 5,6,7,8 as the Highest Level of Education	-	-	-	-.663 (.614)	-.336 (.071) ***
Logarithm of Residential Population Density	-	-	-	-5.926 (3.693)	.127 (.065) *
Logarithm of Dependency Index	-	-	-	1.554 (2.079)	-.534 (.187) ***
Intercept	-6.971 (.028) ***	-7.067 (.061) ***	-7.019 (.017) ***	47.919 (26.798) *	-10.582 (.457) ***
Year Fixed Effects	NO	YES	YES	YES	YES
City Fixed Effects	NO	NO	YES	YES	YES
Joint Sig. Test	2.10	1.62	8.42 ***	1.69	444.78 ***
R-Squared	0.006	0.02	0.12	0.17	0.99
Number of Observations	320	320	320	320	320
Number of Groups	-	-	80	80	80

Standard Errors clustered by City in parenthesis

**** p<.01, ** p<.05, * p<.1*

4. 3. Matched Groups

To ensure the validity of the findings, a propensity score matching methodology combined with the TWFE model is employed as a robustness check.

Prior to implementing propensity score matching, the analysis relied solely on observed data, which posed a challenge due to inherent imbalances and potential confounding factors that could influence the estimates of the World Cup's impact on crime rates.

By incorporating propensity score matching, the paper takes a crucial step in addressing these challenges. This methodology enabled it to construct a well-matched comparison group, ensuring that the host cities and non-host cities shared similar characteristics.

This rigorous approach significantly reduced selection bias and provided with a more accurate estimation of the causal effect of the World Cup on crime rates in host cities. The propensity score matching technique allowed the research to isolate the specific impact of hosting the World Cup, disentangling it from other factors that could have affected crime rates during the pre-tournament period.

The results of the fixed effects and Prais-Winsten regressions for the outcome variables lead to a non-significant effect of the World Cup hosted in Germany in 2006 on every typology of crime (Table 7-9). This is consistent with the results showed in the previous section, together with the interpretation of the control variables in line with the one of the literature.

Table 7: Logarithm of Crime Rate

Methodology	**Fixed Effects Regression**	**Prais-Winsten Regression**
Host	-.0318 (.021)	-.008 (.030)
Logarithm of Total Nights Spent in Tourist Accommodation	.119 (.082)	.092 (.051) **
Logarithm of Persons Unemployed	-.031 (.075)	.206 (.052) ***
Logarithm of Number of All Companies	.098 (.039) **	-.088 (.065)
Logarithm of Persons Aged 25-64 with ISCED level 5,6,7,8 as the Highest Level of Education	-.041 (.112)	-.067 (.083)
Logarithm of Residential Population Density	-.124 (.185)	-.107 (.115) ***
Logarithm of Dependency Index	-.107 (.372)	-1.008 (.282) ***
Intercept	-3.206 (1.117) ***	-4.324 (.844) ***
Year Fixed Effects	YES	YES
Joint Sig. Test	57.78 ***	438.51 ***
R-Squared	0.31	0.99
Number of Observations	96	96
Number of Groups	24	24

Standard Errors clustered by City in parenthesis

**** p<.01, ** p<.05, * p<.1*

Table 8: Logarithm of Burglary Rate

Methodology	Fixed Effects Regression	Prais-Winsten Regression
Host	-.164 (.138)	.132 (.134)
Logarithm of Total Nights Spent in Tourist Accommodation	2.627 (1.794)	-.133 (.205)
Logarithm of Persons Unemployed	-2.169 (1.262) *	.737 (.341) **
Logarithm of Number of All Companies	.202 (.408)	.956 (.372) ***
Logarithm of Persons Aged 25-64 with ISCED level 5,6,7,8 as the Highest Level of Education	2.845 (2.063)	-1.274 (.506) **
Logarithm of Residential Population Density	-13.147 (6.639) *	-.634 (.495)
Logarithm of Dependency Index	-3.407 (9.913)	-3.372 (1.385) **
Intercept	40.574 (53.609)	-6.487 (3.00) **
Year Fixed Effects	YES	YES
Joint Sig. Test	4.40 ***	40.27 ***
R-Squared	0.45	0.99
Number of Observations	96	96
Number of Groups	24	24

Standard Errors clustered by City in parenthesis

**** p<.01, ** p<.05, * p<.1*

Table 9: Logarithm of Robbery Rate

Methodology	Fixed Effects Regression	Prais-Winsten Regression
Host	.018 (.054)	-.088 (.077)
Logarithm of Total Nights Spent in Tourist Accommodation	-.989 (.964)	.559 (.182) ***
Logarithm of Persons Unemployed	-.538 (.229) **	.769 (.168) ***
Logarithm of Number of All Companies	-.301 (.194)	.455 (.191) **
Logarithm of Persons Aged 25-64 with ISCED level 5,6,7,8 as the Highest Level of Education	-.131 (1.098)	-1.443 (.318) ***
Logarithm of Residential Population Density	-4.273 (2.454) *	-.656 (.249) ***
Logarithm of Dependency Index	1.343 (1.970)	-1.340 (.610) **
Intercept	51.225 (23.553) **	-7.459 (1.362) ***
Year Fixed Effects	YES	YES
Joint Sig. Test	6.06 ***	130.14 ***
R-Squared	0.43	0.99
Number of Observations	96	96
Number of Groups	24	24

Standard Errors clustered by City in parenthesis

**** p<.01, ** p<.05, * p<.1*

4. 4 Heterogeneous Effect

In the previous section, every city in 2006 was considered equally treated. However, it might also be the case that the effect of the treatment was not homogenous among the final venues. For this purpose, this section aims to discover possible heterogeneities in the effect of the treatment using the 1945 division of Germany and the average population density of the treated cities.

4. 4. 1 East and West Germany

The analysis of crime rates during the 2006 World Cup in Germany reveals intriguing heterogeneity in the effects between East and West Germany. The historical division of the country into East and West, prior to the collapse of the Berlin Wall, created distinct socio-economic and cultural landscapes that might have influenced crime patterns during the World Cup (Blokland and Vief, 2021). In this case, the coefficients of interests must be interpreted together: in other words, the variable "Host" represents the effect of the treatment in Host cities, whereas the coefficient associated to "Host x East Germany" represents the effect of the treatment on eastern cities. The negative although non-significant results for crime as a whole and burglary suggest that the event did not have a widespread impact across Germany. However, the statistically significant positive effects observed for robbery indicate a differentiated response. That is, the event had a negligible effect in venues in Eastern Germany (Tables 10-11-12).

In other words, cities that hosted the World Cup in 2006 in Germany that were part of East Germany were more likely to record robbery cases than those that were part of West Germany. More specifically, being a city of East Germany and hosting the world cup would have an impact that is 18,5% higher than cities of West Germany that hosted the world cup on the robbery rate.

One possible explanation for this heterogeneity is the underlying socio-economic factors. East Germany, having undergone significant social and economic changes after reunification, might have experienced higher levels of poverty, unemployment, or social unrest compared to West Germany. Such conditions can contribute to increased crime rates, especially for crimes like robbery that often stem from financial

desperation or social dislocation (Rueschemeyer, 1993). Consequently, the World Cup's impact could have exacerbated existing vulnerabilities in East Germany, resulting in the observed positive and statistically significant effects for robbery.

Moreover, disparities in policing and security resources could have played a role. West Germany, with its more established infrastructure and resources, may have been better equipped to handle the increased security demands associated with the World Cup. The presence of additional law enforcement personnel, surveillance systems, and security measures could have acted as deterrents for criminal activities, including robbery. In contrast, East Germany, facing socio-economic challenges, might have had comparatively fewer resources and weaker security measures, making it more susceptible to increased robbery rates during the event.

Cultural and social dynamics may also have influenced the heterogeneity observed. Differences in community cohesion, social norms, and the presence of organized criminal networks between East and West Germany can shape criminal behavior (Kury & Smartt 2001). Variations in these factors might have influenced the prevalence and modus operandi of criminals during the World Cup, leading to different impacts on crime rates.

Table 10: Logarithm of Crime Rate

Methodology	**Fixed Effects Regression**	**Prais-Winsten Regression**	**Fixed Effects Regression**	**Prais-Winsten Regression**
Host	.041 (.029)	-.012 (.036)	-.056 (.036)	-.046 (.037)
East Germany	-	.124 (.076) *	-	.210 (.122) *
Host x East Germany	-.088 (.028) ***	-.025 (.052)	-.028 (.029)	-.016 (.057)
Intercept	-8.086 (8.720)	-4.948 (.350) ***	9.740 (7.263)	-4.567 (.830) ***
Controls	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Joint Sig. Test	5.23 **	306.55 ***	23.02 ***	250.70 ***
Matching	NO	NO	YES	YES
R-Squared	0.37	0.99	0.45	0.99
Number of Observations	320	320	96	96
Number of Groups	80	80	24	24

Standard Errors clustered by City in parenthesis

**** p<.01, ** p<.05, * p<.1*

Table 11: Logarithm of Burglary Rate

Methodology	Fixed Effects Regression	Prais-Winsten Regression	Fixed Effects Regression	Prais-Winsten Regression
Host	.018 (.161)	-.003 (.148)	-.290 (.196)	.059 (.115)
East Germany	-	-.648 (.090) ***	-	-1.153 (.293) ***
Host x East Germany	-.111 (.175)	-.077 (.168)	.024 (.257)	.435 (.318)
Intercept	58.80 (24.995) **	-8.862 (1.257) ***	46.131 (53.645)	-6.437 (3.04) **
Controls	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Joint Sig. Test	3.78 *	424.41 ***	10.43 **	111.03 ***
Matching	NO	NO	YES	YES
R-Squared	0.15	0.99	0.51	0.99
Number of Observations	320	320	96	96
Number of Groups	80	80	24	24

Standard Errors clustered by City in parenthesis

**** p<.01, ** p<.05, * p<.1*

Table 12: Logarithm of Robbery Rate

Methodology	Fixed Effects Regression	Prais-Winsten Regression	Fixed Effects Regression	Prais-Winsten Regression
Host	.109 (.046) **	-.024 (.079)	-.079 (.074)	-.124 (.081)
East Germany	-	-.178 (.094) *	-	-.220 (.175)
Host x East Germany	-.066 (.045)	-.181 (.181)	-.198 (.084) **	.141 (.063) **
Intercept	47.752 (27.12) *	-10.354 (.609) ***	49.495 (21.27) **	-6.595 (2.52) ***
Controls	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Joint Sig. Test	2.44	400.73 ***	13.17 ***	137.22 ***
Matching	NO	NO	YES	YES
R-Squared	0.14	0.99	0.51	0.99
Number of Observations	320	320	96	96
Number of Groups	80	80	24	24

Standard Errors clustered by City in parenthesis

**** p<.01, ** p<.05, * p<.1*

Standard Errors in parenthesis
**** p<.01, ** p<.05, * p<.1*

4. 4. 2 Population Density

The analysis of crime rates during the World Cup held in Germany in 2006 revealed compelling insights into the effects of the tournament on different types of crimes across the 80 cities included in the study. The findings demonstrate a statistically significant coefficient of overall crime rate during the period of the World Cup, meaning that having a population density above the average decreases the overall crime rate by 35% with respect to those cities with a population density belove the average (Table 13). Supposing that cities with higher density had access to higher resources, the combination of increased surveillance, crowd dynamics, and the preventive actions taken by law enforcement agencies likely acted as deterrents, making it more challenging for criminals to carry out offenses (Clarke, 1995).

However, the analysis revealed large negative but statistically insignificant results for robbery and burglary rates during the World Cup (Table 14-15). This suggests that the factors influencing the two differ from those affecting overall crime. The primary focus of security efforts during the World Cup was on maintaining public order, preventing terrorism, and ensuring the safety of large crowds rather than specifically targeting spontaneous crimes like robbery and burglary (Parent & Ruetsch, 2020). As a result, the impact on robbery and burglary rates remained statistically insignificant, indicating a lack of substantial change during the tournament.

Table 13: Logarithm of Crime Rate

Methodology	**Fixed Effects Regression**	**Prais-Winsten Regression**	**Fixed Effects Regression**	**Prais-Winsten Regression**
Host	.027 (.030)	.029 (.025)	-.012 (.028)	.084 (.031) ***
High Population Density	-.015 (.247)	.003 (.024)	.108 (.017) ***	.344 (.215)
Host x High Population Density	.009 (.043)	-.107 (.066)	-.088 (.033) **	-.522 (.226) **
Intercept	-2.125 (3.479)	-3.817 (.219) ***	-1.31 (6.16)	-4.012 (.235) ***
Controls	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Joint Sig. Test	2.11 **	114.45 ***	32.51 ***	150.76 ***
Matching Methodology	NO	NO	YES	YES
R-Squared	0.30	0.99	0.45	0.99
Number of Observations	320	320	96	96
Number of Groups	80	80	24	24

Standard Errors in parenthesis

**** p<.01, ** p<.05, * p<.1*

Table 14: Logarithm of Burglary Rate

Methodology	Fixed Effects Regression	Prais-Winsten Regression	Fixed Effects Regression	Prais-Winsten Regression
Host	-.035 (.129)	.067 (.091)	-.117 (.184)	.187 (.167)
High Population Density	.082 (.101)	.033 (.081)	.349 (.111) ***	.794 (.599)
Host x High Population Density	.207 (.247)	-.377 (.229)	.008 (.158)	-1.151 (.654)
Intercept	21.518 (14.857)	-	-37.90 (34.46)	-7.272 (.857) ***
Controls	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Joint Sig. Test	1.56	126.06 ***	5.79 **	84.41 ***
Matching Methodology	NO	NO	YES	YES
R-Squared	0.14	0.99	0.58	0.99
Number of Observations	320	320	96	96
Number of Groups	80	80	24	24

Standard Errors in parenthesis

**** p<.01, ** p<.05, * p<.1*

Table 15: Logarithm of Robbery Rate

Methodology	Fixed Effects Regression	Prais-Winsten Regression	Fixed Effects Regression	Prais-Winsten Regression
Host	.131 (.042) ***	.007 (.044)	.071 (.063)	.035 (.075)
High Population Density	.056 (.064)	-.024 (.053)	.008 (.070)	.615 (.581)
Host x High Population Density	-.086 (.077)	-.148 (.135)	-.007 (.079)	-.856 (.585)
Intercept	8.307 (10.059)	-	27.09 (20.99)	-
Controls	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Joint Sig. Test	2.29 **	135.08 ***	9.22 **	168.09 ***
Matching Methodology	NO	NO	YES	YES
R-Squared	0.15	0.99	0.50	0.99
Number of Observations	320	320	96	96
Number of Groups	80	80	24	24

Standard Errors in parenthesis

**** p<.01, ** p<.05, * p<.1*

5. Conclusion

This study examined the impact of the 2006 FIFA World Cup in Germany on crime rates in the cities that hosted the event. Through the application of a rigorous two-way fixed effects methodology and the correction of serial autocorrelation, the initial analysis did not find any significant results for the overall crime rate, robbery, or burglary. These findings were further reinforced by the combination of a propensity score matching methodology with the Two-Way Fixed Effects, which confirmed the lack of a significant effect of the World Cup on crime rates.

The non-significant results obtained in this study could be attributed to several factors. it is possible that the 2006 World Cup did not have a substantial impact on crime rates in the German cities that hosted the event. While large-scale sporting events are often associated with increased crime due to factors like increased population and heightened emotions, it is plausible that the robust security measures and efficient law enforcement deployed during the 2006 World Cup effectively deterred criminal activities. It is also worth considering that the impact of the World Cup on crime rates may have been transient and limited to the event duration, warranting further investigation into the long-term effects.

Nevertheless, recognizing the potential for heterogeneity in the treatment effect, the analysis delved deeper to explore different dimensions. Considering the historical division between East and West Germany, the study revealed a statistically significant although negligible positive relationship between the World Cup and robbery rates in cities located in East Germany. This finding suggests that the event may have had a more pronounced impact on robbery in that particular region, while no significant effects were observed for burglary or the overall crime rate.

Moreover, the study examined population density as a variable of interest in investigating the heterogeneity of the treatment effect. Surprisingly, the analysis demonstrated a negative and statistically significant relationship between the World Cup and both the overall crime rate in cities characterized by higher population density. These results indicate that the presence of the World Cup may have actually contributed

to a decrease in crime rates in densely populated areas during the event. However, large negative but no significant effects were found for robbery and burglary concerning population density.

These findings underscore the complex and multifaceted nature of the impact of major sporting events on crime rates. While the initial analysis did not uncover significant results, further exploration revealed distinct patterns of heterogeneity. The influence of the World Cup on crime rates varied depending on factors such as regional divisions and population density.

The implications of this research are relevant for policymakers and law enforcement agencies involved in the planning and management of large-scale sporting events. The findings suggest that a one-size-fits-all approach may not be effective in addressing the potential challenges posed by such events. Instead, targeted measures that consider the specific characteristics of different cities and their population density may be necessary to mitigate any potential increases in crime rates.

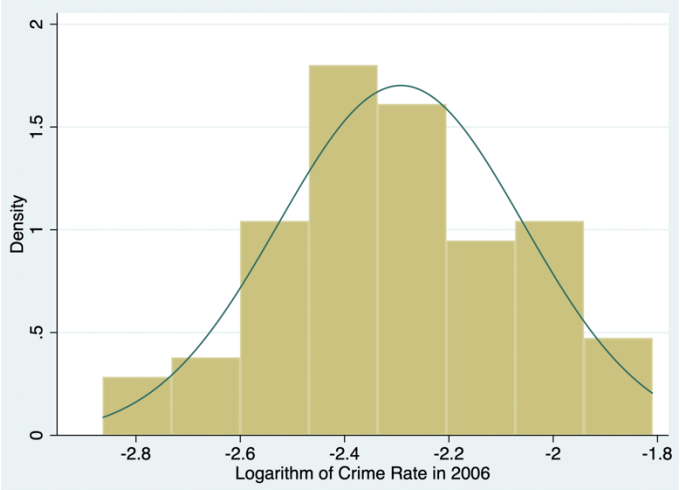
Aside from the results mentioned above, multiple limitations must be acknowledged. First and foremost, the matching methodology could be improved. It is clear that plenty of city characteristics are taken into consideration when selecting cities to host the FIFA World Cup. As a result, investigating and including other possible sources of selection might help in the creation of a good match. Furthermore, future research should delve deeper into the underlying processes by which the World Cup increased crime rates. Exploring monthly or even weekly data might provide unexpected outcomes.

Understanding the long-term effects and sustainability of crime reduction associated with major sporting events is pivot in the decision on whether to host or not such an event. While the research highlights the direct impact of the World Cup on crime, it is only by analyzing the long-term effects that policymakers can make informed decisions and implement targeted interventions to address any potential fluctuations in crime rates. Hence, future research should aim to disentangle the possible long-term effects that Mega Events have on hosting cities.

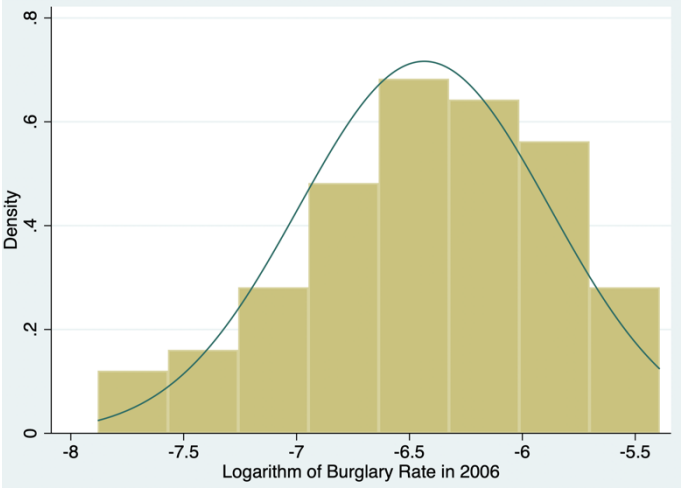
Finally, further investigation for possible spillovers of criminals to other cities due to less surveillance must be done to satisfy the SUTVA assumption.

Appendix 1

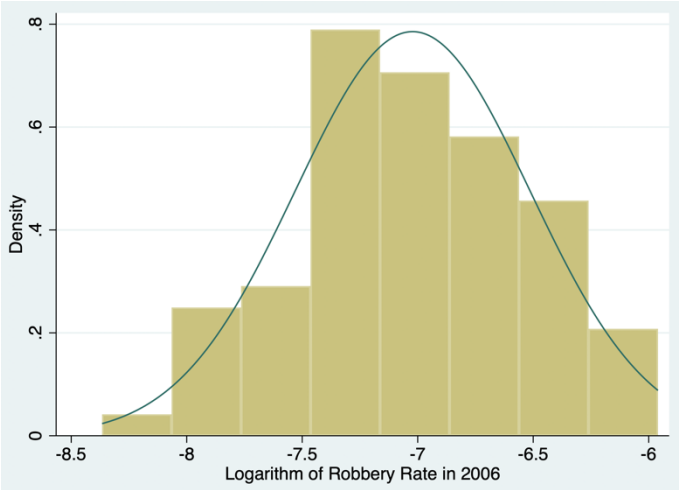
A1: Histogram of Logarithm of Crime Rate in 2006



A2: Histogram of Logarithm of Burglary Rate in 2006



A3: Histogram of Logarithm of Robbery Rate in 2006



A4: Woolridge test for autocorrelation in panel data – Logarithm of Crime Rate

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
       F(  1,       79) =       1.423
                 Prob > F =       0.3224
```

A5: Woolridge test for autocorrelation in panel data – Logarithm of Burglary Rate

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
       F(  1,       79) =       0.367
                 Prob > F =       0.5462
```

A5: Woolridge test for autocorrelation in panel data – Logarithm of Robbery Rate

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
       F(  1,       79) =       1.313
                 Prob > F =       0.2552
```

A6: Probit Regression – Propensity Score Matching

	Probit Regression
Logarithm Distance from nearest biggest airport	.008 (0.001) **
Logarithm of Stadium Capacity	4.482 (1.931) **
Logarithm of Population	2.14e-06 (1.01e-06) **
Constant	-49.784 (20.762) ***
LR chi2	53.02 ***
R2	0.78

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