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## CRIME AND SPORT PARTICIPATION: AN ECONOMETRIC MODEL WITH SIMULTANEOUS EQUATIONS APPROACH

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**Abstract.** Sport in all societies' leads to a return on social capital. Many politicians use sports-based programs to reduce crime in society because sport plays an important role in the social development of societies. On the other hand, crime causes insecurity in the neighborhood, and when people realize their fear of crime, they reduce their social activities, such as sports participation. Therefore, this study determines the interaction effect between crime and sport participation and we test an econometric model with simultaneous equations approach using the two-stage least squares method (2SLS). We used panel data of all provinces of Iran from 2004 - 2017. The results showed that a significant and negative interaction effect exists between crime and sport participation. Also, the number of coaches, sport facilities, and, sport budget have a significant and positive effect on sport participation. Per capita GDP has a significant and negative effect on crime and per capita GDP<sup>2</sup> × sport participation has a significant and positive effect on crime. Finally, drugs have a significant and positive effect on crime.

**Keywords:** *crime, simultaneous equations, sport participation.*

**Rezumat.** Sportul în toate societățile duce la o rentabilitate a capitalului social. Mulți politicieni folosesc programe bazate pe sport pentru a reduce criminalitatea în societate, deoarece sportul joacă un rol important în dezvoltarea socială a societăților. Pe de altă parte, criminalitatea provoacă insecuritate în cartier și, atunci când oamenii își dau seama de teama lor de criminalitate, își reduc activitățile sociale, cum ar fi participarea la sport. Prin urmare, acest studiu determină efectul de interacțiune dintre criminalitate și participarea la sport și testăm un model econometric cu abordare a ecuațiilor simultane folosind metoda celor mai mici pătrate în două etape (2SLS). Am folosit datele panoului din toate provinciile Iranului din 2004 - 2017. Rezultatele au arătat că există un efect de interacțiune semnificativ și negativ între criminalitate și participarea la sport. De asemenea, numărul de antrenori,

facilitățile sportive și bugetul pentru sport au un efect semnificativ și pozitiv asupra participării la sport. PIB-ul pe cap de locuitor are un efect semnificativ și negativ asupra criminalității, iar PIB-ul pe cap de locuitor "×" participarea la sport are un efect semnificativ și pozitiv asupra criminalității. În cele din urmă, drogurile au un efect semnificativ și pozitiv asupra criminalității.

**Cuvinte cheie:** *criminalitate, ecuații simultane, participare la sport.*

### **Introduction**

The relationship between crime and sport participation is an important issue. Juvenile delinquency is a serious problem in society and causes financial and social expenditures such as establishment of police and justice system, financial and emotional damages to victims, and the effect of criminal behaviour on criminals and their families. Youth crime prevention programs include a vast variety of programs and activities [1]. Sport-based interventions are considered as low-cost and peaceful programs that have positive effects on the development of youths [2]. Generally, evidences address positive effects of physical activities on crime prevention [3]. On the other hand, in some countries such as the United States, fear of being a crime victim is a barrier against sport participation and physical activity [4]. Studies have shown that in addition to direct effects of crime and violence on factors such as access to parks and outdoor recreation, crime has a negative effect on physical activity. Objective presence of crime and mental understanding of insecurity lead to a relationship between crime and low physical activity [5].

Crime is just one of many serious problems within Iran. There is widespread concern in Iran regarding rising crime rates [6] and the effect of criminal policy and crime prevention programs [7]. According to Dousti, Goodarzi [8] government intervention in sport, as well as recreation and leisure, in Iran is increasingly prominent and sophisticated. Sport is increasingly and inextricably linked to a variety of cultural, economic, environmental and political spheres. Iranians participate in a variety of traditional and modern sports, but not all sports are highly organized or well governed. Therefore, Iran is an ideal contact to examine the link between crime and sport participation

It is within this context that this study examines the interaction effect between crime and sport participation in Iran. The study addresses two fundamental questions: (1) Does crime impact sport participation; and, (2) Does sport participation impact crime? This study used simultaneous equations econometric model using the two-stage least squares method (2SLS) to investigate crime and sport participation simultaneously. The study also included a number of control variables. For sport participation, these control variables were the number of coaches, the number of facilities and government funding of sport. For crime, the control variables were per capita GDP and drugs.

### **Theoretical Background and Relevant Literature**

The beneficial effect of sports and sports participation on society is predictable and obvious. Some specific benefits are usually expected, including: (1) General health through physical activity. (2) Strengthen human capital through the development of knowledge, motivation, skills and readiness for personal endeavor. (3) Active citizenship, social inclusion and integration. In summary, Sports seems to increase individual and social well-being. Sport as a pure economic commodity forms the field of professional sports economics that has been expanding in recent years. In addition, the sports system was interpreted as a sub-foreign

policy. In fact, success in sports has helped most countries, such as the Soviet Union, East Germany, Cuba, and other socialist countries, gain international recognition and prestige [9]. In general, sport has a potential to improve the lives of individuals and communities and it create positive social impacts in society. Academic interest and research has grown into the social impact of sport along with the growing recognition and use of sport as a political tool for achieving broad social outcomes. Recent and historical evidence suggests that sport provides social benefits in terms of improving health, reducing crime, improving education, and increasing mental well-being [10]. Huang and Humphreys found a positive relationship between happiness and sports participation. Both men and women enjoy sports participation and men benefit more. Also, Davies, Taylor [10] In a study on the Social return on investment through sports participation in the UK concluded that for every £1 invested in sports, £1.91 of social benefits are generated. Hoyer, Nicholson [11] Described how sport and its social benefits have increased dramatically around the world and it is evident in the sports policies of various countries, including Australia, New Zealand, and Canada. The Australian Government's policy argues for the importance of sports participation for physical and mental health, and states that sport contributes to confidence and self-esteem and reduces crime rates. Canada's sports policy recognizes the positive effects of sport on individuals and communities.

This policy argues that sport is potentially a powerful factor in social change [10]. These examples show that the importance of sports and sports participation goes beyond its role in physical strength and emphasizes the role of sports in the social development of countries.

Before presenting the main purpose of this research and expressing the background literature, it is important to define the two key terms related to the presented research. These are sports participation and crime. Sport is a broad term that is widely defined. Many sport policymakers in Europe, including the UK Sports Councils of England, Northern Ireland, Wales and Scotland, use the Council of Europe's definition of sport: sport refers to all forms of physical activity that take place through occasional or organized participation, with the aim of expressing or improving physical fitness and mental well-being, building social relationships, or gaining results at competitions at all levels [10]. The definition presented in this paper provides an econometric definition of sports participation and it is defined using the report of the Statistics Center of Iran in this study: Number of organized athletes who have a sports insurance card and regularly (depending on the season of sports) to go to the sports clubs to do sports and their presence in the sport clubs is registered in special offices and usually have a membership card. Information about participation in various sports such as football, basketball, volleyball, wrestling, field running, etc. can be found in the information of the Statistics Center of Iran, and this research uses the sum of the participants of sports. This number is calculated separately for each province of Iran from 2004 to 2017 because this research uses panel data.

Also, numerous definitions of crime and fear of crime have been proposed in various studies. Ferraro and LaGrange [12] Conceptual framework provides an effective starting point for defining fear of crime. They divided fear of crime into "public" and "personal" fears. Public fear focuses on the general perception of the danger of perceiving crime in an area. According to Ferraro and LaGrange, many surveys purport to measure personal fear but instead measure general fear. For example, commonly used questions such as "how safe would you feel walking alone at night in your neighbourhood?" are measures of perceived risk of crime [12] Personal fear of crime is more specific and measures a person's sense of security more clearly.

While there are some variations, it basically describes personal fear as a threat to becoming a victim of crime [13]. Also, Covington and Taylor [14] define fear of crime as an emotional response to the possibility of physical harm in a criminal activity. But, this study provides an econometric definition of crime according to the information of the Statistics Center of Iran and the report of the Iranian police: includes the number of crimes registered in the police force, which causes insecurity in the neighborhood and fear of crime. These crimes include Intentional homicide, unintentional homicide, Accidental deaths, Beaten and injured, Threats, coercion and reluctance, pretending to be stabbed and poisoned, This number is calculated separately for each province of Iran from 2004 to 2017 because this research uses panel data and all variables must be set as data panels.

Exposure to crime is a problem because it increases stress and psychological problems [5]. Worldwide, it is estimated that at least 300 million young children less than five years are exposed to violent crime in society [15]. In the Netherlands, almost 34% of offenders in 2014 were less than 25 years old. Assink, van der Put [16] Concluded when young people commit crimes, they are more likely to create persistent pattern of offending. In addition, juvenile delinquency is often associated with other adverse outcomes, including dropout, unemployment, and health and mental health problems. Therefore, the prevention of juvenile delinquency has become an important topic in youth studies. Recently, policymakers for young people have become interested in using sports to prevent crime [1]. Also, among the solutions offered to combat youth delinquency, sports participation was advocated as a factor for social and personal change. While there is disagreement about the value that sport-based activities provide in relation to social concerns. It is widely accepted that sports participation can be used as part of strategies in social environments to bring about positive change in youth and reduce offensive or antisocial behavior [17]. Sport creates a unique environment for the psychosocial growth of youths, because of its ability to engage and or otherwise motivate youth [18]. Sport has fundamental roles in important sociopolitical contexts such as education, community revival, and community safety (crime prevention) [19]. Therefore, policymakers have paid particular attention to low-cost, sport-based crime prevention programs [2]. Therefore, today, governments and local institutions in around the world offer youth sports activities to prevent juvenile delinquency. Various studies have emphasized the importance of reducing crime through sports participation. Brosnan shows that participation in sport was associated with lower rates of crime (particularly violent crime). S. Davis and Menard [20] showed that sports participation has a direct effect on reducing illegal behaviors and reduces illegal behaviors. Also, Caruso [9] in a study showed that (1) there is a strong negative relationship between sports participation and property crime. (2) There is a strong negative association between sports participation and juvenile delinquency. (3) There is a positive relationship between sports participation and violent crime, but this relationship is very weak. Interestingly, there is a complementary effect between crime and education and sports participation. In addition, Spruit, Hoffenaar [1] emphasize the impact of exercise-based intervention to prevent juvenile delinquency.

According to Social Bonds Theory (SBT) (Hiroshi, 1969), sport-based interventions reduce crime because sport creates bonds with society, and people with stronger bonds are less likely to commit crimes. The four major components of SBT are attachment, commitment, belief, and participation – all of which are evident in sport (1). Also, According to Nichols, sport has the potential to reduce youth crime in three main ways: (1) as a distraction or as a surveillance mechanism, (2) as cognitive behavioral therapy; and (3) as 'hook' or a relationship

strategy [17]. Sports participation alone is not enough to reduce crime and combat youth delinquent behaviors, but it can be effective if used as a preventative activity along with other supportive factors [17]. Therefore, Youth sport participation should be encouraged as a method to reduce illegal behaviors and crime [21]. According to these explanations, sports participation can have a positive effect on crime prevention.

On the other hand, Crime and fear of crime have been identified as potential mediators between neighborhood characteristics and mental health and well-being outcomes, as promising places for interventions to improve well-being, and as important dimensions of wellbeing in their own right [4]. Residents who find their neighborhood unsafe may limit their outdoor physical activity, regardless of whether the crime is a serious threat or not. However, neighborhood safety has been frequently reviewed in the public health literature as a potential limitation to physical activity. Also, people who are afraid of crime limit their social and physical activities to avoid places or situations that they think are unsafe. Residents may view crime as a problem, but if the crime does not make them feel insecure or afraid, it is unlikely to limit activity. Physical activity also needs to be considered because perceived safety may only limit outdoor activities in the neighborhood [22]. Numerous studies have been conducted to reduce the physical activity caused by crime and the fear of it. Most of them have mentioned the fear of crime as a factor in reducing physical activity. In a study by Weir, Etelson [23], it was reported that a high level of anxiety of parents about neighborhood safety leads to low level of sport participation of children in poor societies. Some studies have shown that high crime rates reduce physical activity among many adolescents. For example, Gordon-Larsen, McMurray [24] found a link between high crime rates and declining sports participation among middle and high school students. Molnar, Gortmaker [25] argued that crime may restrict physical activity among young people due to a lack of safety while exercising or playing. Stodolska, Shiner [26] Showed that crime prevents young people from visiting parks, and this fear limits sports participation and outdoor recreation. Perceived security in the environment is a modifiable facilitator for children's and adults' sports participation. Crime and fear of crime have always been identified as a potential negative effect on sports participation and physical activity [27]. To reduce fear of crime, people have two types of behaviors. First, they avoid certain places to minimize their exposure to dangerous conditions. Second, they visit places where security measures are promoted. In summary, in communities with low crime level, sport participation is more likely [28]. Existing studies have shown that the recreational behavior of ethnic and racial minorities is significantly limited by their economic and social environments, which are often associated with poverty and poor social status. In particular, participation in outdoor physical activity may be adversely affected. Many factors limit physical activity and outdoor recreation among young people. These include their socio-cultural environment and the characteristics of their neighborhood [26]. According to environmental stress theory, "Chronic exposure to environmental stressors can lead to feelings of tiredness, reduced sense of control over daily routines. Constant exposure to violence and crime may be one of these stressors and reduce people's motivation to engage in behaviors such as sport participation [26]. Experience" and understanding crime can be very subjective. A person whose parked car is broken overnight probably has a different perception of the prevalence of the crime compared to a neighbor who may never have suffered even a minor act of vandalism [13]. According to these explanations, crime causes insecurity in the neighborhood. This creates fear, and this fear reduces people's social activities such as sports participation.

## Materials and Methods

In this study, we use an econometric model with simultaneous equations approach to investigate the interaction effect between crime and sports participation with the emphasis on economic-sports variables. Therefore, the research panel model is estimated by the two-stage least squares method (2SLS) using Eviews software version 10. In the sections that follow, we first describe the variables and data then, we describe and specify the pattern of simultaneous equations, and finally we describe the analysis and complementary tests.

## Data and Variable Description

In this study, we use panel data to generate 392 observations from all 28 Iranian provinces for the 14 year period 2004 - 2017. The panel data within this study is characterized by a combination of time-series and cross-sectional dimensions, thus eliminating many of the disadvantages of cross-sectional or time series data. Panel data captures a greater amount of social and economic information, controls for potential heteroscedasticity, and significantly avoid biased estimates caused by ignoring variables. Also, the panel data increases the explanatory power of the samples and increases the reliability of the results [29]. The data was collected from several sources: Iranian Statistics Center (ISC), Iranian Ministry of Economy and Finance (IMEF), Iranian Police Force (IPC), Iranian Ministry of Youth and Sport (IMYS), Iranian National Olympic Committee (INOC).

In this study, the crime variable is estimated using the number of crimes in each province includes poison, stabbing, compulsion, and reluctance, threaten, beaten, accidental death, premeditated and unintentional murder. The Sport Participation (SP) variable is estimated using the number of athletes in different sports that regularly participate in the relevant sport and have a sports insurance card.

Crime and sports participation are the main variables of the research. Considering that simultaneous equations are used in this research, the effects of these two main variables should be examined using control variables. Control variables are essential in estimating simultaneous equations. According to the background of previous research as well as the theoretical foundations, control variables were selected for this research. Therefore, effect of Coaches (CO), Sports Budget (SB) and Sports Facilities (SF) as control variables on sport participation is estimated and effect of GDP Per Capita (GPC), GDP Per Capita $\times$  Sports participation (GPCSP) and Drugs (DR) as control variables on Crime is estimated.

Coaches (CO) variable is estimated using number of coaches in different sports who have a coaching certificate in the relevant sport for each province from 2004 to 2017. The coach is a key socializing agent in sport [30]. According to sport psychologists, coaches are one of the most important social incentives to continue sport participation [31].

The Sports Budget (SB) variable is estimated with the government current expenditures for the sports and youth sector in Iran that were calculated in Rials for each province from 2004 to 2017. The effectiveness of government spending at national and regional levels was examined in previous research. Nationally, there is evidence of a significant and positive effect sport-related government expenditure on sport participation [32]. Also, regionally, Humphreys and Ruseski [33] documented that government spending on parks and recreation increases participation in group sports. Recent research investigated the relationship between sport-related government spending and sport participation [34]. Analysis of individual-level and state-level data produced an insignificant effect of government investment in general sports promotion on sport participation. Dallmeyer, Wicker

[34] concluded that a “thorough differentiation between funding size, period, and consistency is necessary whenever evaluating the impact sport-related government spending may have on sport and exercise behavior of the adult population.

Sports Facilities (SF) variable is an estimate of the number of sports facilities including land, field, hall, pool, track, gymnasium for all provinces of Iran separately from 2004 to 2017. Sports policies emphasize the importance of sports infrastructure aimed at increasing community participation and club membership [35]. For example, In England and China, sport facilities are integral to policies seeking to increase sport participation in clubs [36, 37]. Lower levels of participation coincide with their being less sport facilities in an area [38]. Similarly, [39] argued the same based on the distance to indoor sport facilities and the desirability of the neighborhood. Eime, Harvey [40], Cautioned that the impact of facility availability on participation was varied between sports.

Per Capita GDP is used as another variable. Moreover, it is multiplied with sport participation and it makes GDP Per Capita $\times$  Sports participation (GPCSP). There is no consensus in the literature regarding the link between GDP per capita and crime. Some studies have concluded that GDP per capita have a negative effect on crime [41, 42]. Some researchers did not find a significant effect in this regard [43, 44]. Finally, other researchers believe that GDP per capita have a positive effect on crime [45, 46]. When average GDP per capita is high in a certain area, criminals obtain higher advantages. Therefore, criminal cases increase in prosperous areas [47]. This is because when there is personal wealth, there is greater incentive for criminal activity [48]. On the other hand, GDP per capita is considered to be a measure of welfare and this promotes life standards due to better social control and self-regulation and reduces crime [44]. Some studies concluded that GDP per capita is related positively to sport participation and leisure time physical activity [49, 50]. The percentage of people who never participate in sport is significantly related to wealth status of that country. As a result, with increased GDP per capita those who do not participate in sport will participate [51].

Finally, the Drugs (DR) variable is estimated with the number of drugs and psychotropic substances (i.e., heroin, crack, crystal, opium, morphine, cannabis, grass, glass, cocaine, ampoules, and psychedelics pills) that confiscated by police. This variable is estimated also for all provinces of Iran from 2004 - 2017 in kg. There is evidence of a positive correlation between drug abuse or addiction among family members and a person's tendency to engage in criminal behavior [52, 53]. Drug offenses have always been considered as a serious threat to health and security. In addition, drug criminals do other crimes to obtain money [54]. For example, people who use drugs commit crimes by 2.8 to 3.8 times more than those who do not use drugs [55]. The variables used are described in Table 1 below:

Table 1

Variable, Measurement, and Source				
Variable	Measurement	Cross-section	Time-series	Source
Crime	The number of Crimes in each province	All provinces	2004-2017	IPC
Sports Participation (SP)	The number of athletes with a sports insurance card	All provinces	2004-2017	IMYS, INOC, ISC

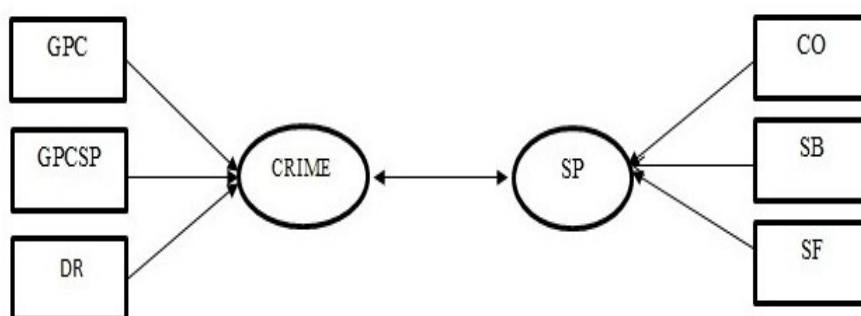
Continuation Table 1

Coaches (CO)	Number of coaches with a sports insurance card and coaching certificate	All provinces	2004-2017	<b>IMYS, INOC</b>
Sports Budget (SB)	government current expenditures for the sports and youth sector	All provinces	2004-2017	<b>IMYS, ISC</b>
Sport Facilities (SF)	number of sports facilities including land, field, hall, pool, track, gymnasium	All provinces	2004-2017	<b>IMYS, ISC</b>
GDP Per Capita (GPC)	Gross domestic product per capita	All provinces	2004-2017	<b>ISC, IMEF</b>
GDP Per Capita × SP (GPCSP)	SP×GDP Per Capita	All provinces	2004-2017	-
Drugs (DR)	number of drugs and psychotropic substances discovered by police (kg)	All provinces	2004-2017	<b>IPC</b>

### Model Specification (Simultaneous Equations Approach)

This study used a simultaneous equations approach to investigate the simultaneous interaction effects of crime and sports participation. This is because our model violates a key assumption related to the exogeneity of the explanatory variable. In our model, an endogenous variable is a function of another endogenous variable. So instead of one equation, there are several equations. Within the simultaneous equations approach, variables are categorized as either endogenous or exogenous. Exogenous variables are not influenced by variables within the model. In contrast, an endogenous variable is influenced by at least one other variable. In this respect, the endogenous variable is dependent on exogenous variables and some endogenous variables, in turn, impact other endogenous variables. So whilst there is a one-way relationship between some endogenous variables and some exogenous variables, there is a two-way relationship between endogenous variables that makes it problematic to classify them as either an independent or dependent variable [56].

According to Wooldridge [57, 58] simultaneous equation approach with panel data requires an accurate model. In this study, sport participation and crime are the two endogenous variables that are central to our model. These variables interact with each other as well as with the relevant exogenous variables. The conceptual model is portrayed in Figure 1 below:



**Figure 1.** Conceptual model of crime and sport participation.



This model can also be understood as two equations. In Equation 1, Sports Participation is a function of Crime, Coaches (CO), Sports Budget (SB), and Sport Facilities (SF). In Equation 2, Crime is a function of Sport participation (SP), Per Capita GDP (GPC), GDP Per Capita× Sport participation (GPCSP) and Drug (DR):

$$\text{Equation 1: } SP_{it} = \beta_0 + \beta_1 \text{ CRIME}_{it} + \beta_2 \text{ CO}_{it} + \beta_3 \text{ SB}_{it} + \beta_4 \text{ SF}_{it} + \varepsilon_{it0}$$

$$\text{Equation 2: } \text{CRIME}_{it} = \delta_0 + \delta_1 \text{ SP}_{it} + \delta_2 \text{ GPC}_{it} + \delta_3 \text{ GPCSP}_{it} + \delta_4 \text{ DR}_{it} + \varepsilon_{it1}$$

### Analysis and Complementary Tests

This section describes the estimation method of crime and sport participation equations. These equations are estimated with the simultaneous equations approach and 2SLS method. Many studies have used the simultaneous equation approach, but none have investigated the links between crime and sport participation. When using the simultaneous equations approach, the ordinary least squares (OLS) method is not suitable. OLS estimators are biased and contradict structural coefficients due to the so-called concurrency bias of equations. The methods of 2SLS and three-stage least squares (3SLS) can overcome these issues. The main difference between 2SLS and 3SLS is that 2SLS is a single-equation method and 3SLS is a system procedure [59]. Given that our hypotheses are estimated using single equations, we used 2SLS but we present the OLS results for comparison purposes. Before simultaneous equations model estimation, complementary tests included unit root test to check data reliability, F-Lamer test to distinguish between pooled or panel model, and Hussman test to determine the utility of a fixed or random-effects model are necessary.

First of all, according to the importance of reliable data, reliability is examined. Levin, Lin [60] showed that in panel data, the use of a single root test to combined data is more valid relative to use it separately for every cross-section. Therefore, we used Levin, Lin, and Chu's method to investigate the reliability of research variables. In estimating panel data, pooled or panel data are investigated. In other words, it should be specified that in the regression relationship, interactions of the cross-section are different, or all interactions are similar. All sections have similar y-intercepts (pooling data) or a different y-intercept should be considered for each section (panel data). For this purpose, the F-Lamer test is used [61]. Now, F-test statistic is estimated according to the following relation and F-value should be computed in Eviews:

$$F_{(nt - n - k)} = \frac{(SSR_R - SSR_{UR})}{\frac{SSR_{UR}}{(nt - n - k)}} \quad (1)$$

In this formula, n is the number of sections and provinces, t is time period, and k is the number of explanatory variables. If the estimated F-value is larger than the F-value, H0 is rejected and the effects of the group are accepted and different y-intercepts considered in the estimation. As a result, it is possible to use a panel method for estimation. Finally, to distinguish between the uses of a fixed-effects or random-effects model, the Hausman test was also used [57].

### Results

The descriptive statistics of research variables are presented (Table 2).

Table 2

Descriptive Statistics of Research Variables					
Variables	Mean	Median	Standard deviation	Max.	Min.
Crime	5898.13	2798	10798.02	119265	14
Sports Participation (SP)	88513.71	57664	87341.97	566235	10453
Coaches (CO)	6483.26	4669.5	7455.48	63887	303
Sports Budget (SB)	43435.34	24289	73794.86	960251	140
Sport Facilities (SF)	432.67	254	653.88	4477	40
GDP Per Capita (GPC)	88667.76	67198	81713.05	481100	6832
GPC×SP (GPCSP)	1.01E+10	3.96E+09	2.26E+10	2.20E+11	1.05E+08
Drug (DR)	18576.68	3618	32106.42	185652	148

To investigate reliability of variables for combined data, Levin, Lin and Chu's test was used. The results showed that probability of all variables is less than .05, therefore  $H_0$  is rejected. The results of the reliability test are presented in Table 3.

Table 3

#### Results of Levin, Lin and Chu's Test to Investigate Variable Reliability

Variables	Statistic	Prob.**
Crime	-5.30	0.0000
Sports Participation (SP)	-9.33	0.0000
Coaches (CO)	-4.06	0.0000
Sports Budget (SB)	-13.70	0.0000
Sport Facilities (SF)	-5.65	0.0000
GDP Per Capita (GPC)	-14.05	0.0000
GPC×SP (GPCSP)	-21.10	0.0000
Drug (DR)	-6.74	0.0000

Table 4

#### Summary of F-Lamer and Hausman test results

Test	Equations	Statistics	Df	Prob.	Result
F-Lamer	Equation 1	22.23	27.347	0.0000	Estimation by panel
	Equation 2	8.75	27.347	0.0000	Estimation by panel
Hausman	Equation 1	26.74	4	0.0000	Estimates with fixed effects
	Equation 2	28.45	4	0.0000	Estimates with fixed effects

To determine whether we have panel data or pooled data, the F-Lamer test showed that the significance level in both research equations is less than 0.05. Therefore, in this study, panel model is used. In the next step, Hausman test is used to determine fixed or random effects model. In both equations, the significance levels were less than 0.05, Therefore, we elected to use a fixed effects model.

OLS estimators are biased and contradictory from structural coefficients due to the so-called concurrency bias of equations that it is inconsistent or insignificant or estimation difficulty in coefficient estimation. For the purposes of comparison and transparency, the OLS results are presented in Table 5.

Table 5

Model Estimation Using OLS Method					
Dependent variable	Independent variables	Coefficient	Std. Error	t-Statistic	Prob.
Sports participation	CRIME	-0.15	0.31	-0.49	0.61
	Coaches (CO)	3.84	0.47	8.16	0.0000
	Sports Budget (SB)	0.15	0.03	4.29	0.0000
	Sport Facilities (SF)	81.78	4.89	16.69	0.0000
Crime	Sports participation (SP)	0.007	0.01	0.62	0.53
	GDP Per Capita (GPC)	-0.006	0.006	-1.02	0.30
	GPC×SP (GPCSP)	3.10E-07	2.98E-08	10.39	0.0000
	Drug (DR)	0.03	0.01	2.03	0.04

The results of the 2SLS estimation are presented in Table 6 below.

Table 6

Model Estimation Using 2SLS Method					
Dependent variable	Independent variables	Coefficient	Std. Error	t-Statistic	Prob.
Sports participation (SP)	CRIME	-2.16	0.74	-2.91	0.003
	Coaches (CO)	4.60	0.59	7.70	0.0000
	Sports Budget (SB)	0.11	0.04	2.84	0.004
	Sport Facilities (SF)	105.29	7.99	13.17	0.0000
Crime	Sports participation (SP)	-0.11	0.02	-4.95	0.0000
	GDP Per Capita (GPC)	-0.01	0.008	-2.33	0.02
	GPC×SP (GPCSP)	5.13E-07	4.54E-08	11.30	0.0000
	Drug (DR)	0.05	0.02	2.05	0.04

The results of 2SLS estimation indicate the significant and negative effect of crime on sport participation ( $\beta = -2.16$ , Prob: 0.003) and a significant and negative effect of sport participation on crime ( $\beta = -0.11$ , Prob: 0.0000). Therefore, there is a significant and negative interactional effect between sport participation and crime. The negative effect of crime on sport participation (-2.16) is larger than the negative effect of sport participation on crime (-0.11). This means that with increased crime, sport participation decreases and with increased sport participation, crime decreases. More specifically, for every 1 unit increase in crime, sports participation decreases by -2.16. And for every 1 unit increase in sports participation, crime decreases by -0.11.

In the sport participation equation, Coaches (CO), Sports Budget (SB) and Sport Facilities (SF) all have a significant and positive effect on sport participation ( $\beta = 4.60$ , Prob: 0.0000,  $\beta = 0.11$ , Prob: 0.004,  $\beta = 105.29$ , Prob: 0.0000). This means that with increase in these variables, sport participation increases.

In the crime equation, there is a significant and negative effect of Per Capita GDP on crime ( $\beta = -0.01$ , Prob: 0.02). However, the coefficient for Per Capita GDP $\times$ SP (GPCSP) and Drugs are significant and positive crime ( $\beta = 5.13E-07$ , Prob: 0.0000,  $\beta = 0.05$ , Prob: 0.04).

### Discussion

The objective of this study was to investigate the interaction effect of crime and sport participation with an emphasis on sport-economics variables. For this purpose, the simultaneous equations econometric approach with the 2SLS method was used to estimate research equations. The findings show interesting and new results.

Hypothesis 1 was supported. There was a significant, negative interaction effect between sport participation and crime. The negative effect of crime on sport participation (-2.16) is larger than the negative effect of sport participation on crime (-0.11). The finding that increased sport participation decreases crime is consistent with previous studies that determined a negative association between sport participation and property crime and juvenile crime [9] juvenile delinquency [1] and some illegal behaviors [20]. As for the effect of sport on reduced crime and illegal behavior, disagreements exist. Some writers and policymakers suggest that youth sports participation should be considered as illegal behaviors reduction [21]. But other researchers conclude that sport participation increases violent and illegal behaviors [62]. Sport participation reduces many youth anomalies like reduced drug abuse and delinquency [62]. And for this purpose, sport-based crime prevention programs are administered widely by governments and local entities around the world [1]. On the other hand, sport participation provides conditions for illegal behaviors and involvement as a social activity [62].

With increased crime, sport participation decreases. This result is consistent with studies by Rees-Punia, D.Hathaway [63] and Miles and Panton [64] They introduced perception of crime and security as barriers to achieve sufficient levels of physical activities. This belief exists that crime may influence sport participation and this effect is different in various fields [63]. Crime may not influence physical activity behavior, unless threat or fear is perceived [65]. Initial prevention can reduce crime. Innovative approaches like built environment to reduce crime [66] increased Social capital [67] and crime prevention organizations [68] to overcome political challenges to prevent crime are available [69].

The second research finding showed coaches have a significant and positive effect on sport participation. This is consistent with the researches of Barnett, Smoll [70] and Sarrazin, Vallerand [71] They concluded that a positive and skillful coach can increase sport participation.

The third hypothesis was also supported. Government sport budget has a significant and positive effect on sport participation. Swierzy, Wicker [72] Concluded how human, financial, and structural resources of sport clubs influence volunteer participation in sports clubs. Also, Widdop, King [73] concluded that budget limitations at local levels lead to reduced costs for optional services such as sports development and community recreation. Therefore, authorities and policymakers should be considered budgets for sport every year and prevent its reduction.

In the context of Hypothesis 4, the results show that sport facilities have a significant and positive effect on sport participation. This means that development of sport facilities leads to increased sport participation. This finding is consistent with Wicker, Hallmann [74] Who showed that sport facilities like swimming pools and sport grounds are very important

for sport participation? In Germany, evidence shows that people who have sport spaces in their neighborhood are more likely to engage in sport participation [74].

The fifth hypothesis showed that GDP per capita has a negative effect on crime. However, these effects are weak. This means that with increased GDP per capita, crime decreases. This finding is consistent with the study of Khan, Ahmed [75] who found that short-term increases in GDP per capita were associated with decreased crime levels. However, the crime rate in a long-term period increases. Indeed, on the one hand, with increased GDP per capita and economic growth, income increases. Higher-income means that more profits are obtained by criminals. Accordingly, affluent areas, due to the opportunities that offer, attract more criminals. On the other hand, Low GDP per capita leads to poverty and causes crime. Poverty has a positive effect on crime [75].

In the context of Hypothesis 6, we found that sport participation×GDP per capita has a significant and positive effect on crime. However, this effect is weak. Ruseski and Maresova [49] used GDP to investigate the effect of economic conditions on sport participation. Should sport participation capacities are used for economic development and this is followed by crime reduction. Finally, the study showed that the quantity of drugs confiscated by police is associated with an increase in criminal activities. This finding is consistent with studies of Fazel, Wolf [52] and Luthar, Anton [53]. They concluded that there is a positive correlation between drug abuse and a person's tendency to engage in criminal behavior. Compared to other major crimes, the illegal use of drugs increases criminal activities such as violence, fraud, and theft [54].

### **Conclusions**

The objective of this study was to investigate the interaction effect of crime and sport participation as simultaneous equations approach. The findings of this study showed that increased crime leads to decreased sport participation and increased sport participation leads to decreased crime.

As pointed out, views on increased participation to reduce crime are contradictory. Some researchers believe that sport participation, due to its educational, social, and cultural features, reduces crime. Others believe that sport participation is a social activity leading to crime. It should be noted that this does not mean that sport participation is eliminated to reduce crime, but that the solution is both increased participation in the community and reduced crime and employ security and safety measures in sport settings as well use suitable education and social measures to reduce crime rate and increase sport opportunities.

In this context, one solution can be sport-based programs to reduce crime in the society. Therefore, according to the research findings, experienced coaches should be employed in sports clubs. These sport clubs need a suitable budget to increase participation. Moreover, expenditures related to clubs should be lowered for public and athletes and private sectors and budget allocation and take suitable measures to build sports facilities, so that sports clubs and participants can use them easily.

But before these measures and implementing sport-based programs, crime reduction programs should be administered to create a space where these programs are effective. To design crime prevention solutions, measures used by other countries can be modeled such as environmental design, social empowerment, increasing volunteer organizations to prevent crime, and modern approaches and policies. Also, the findings of this study should be used to reduce crime. For this purpose, by designing drug identification system and prevention of

drug use and trafficking, short-term and long-term related-drug crimes can be reduced. Also, increasing GDP per capita in the country should be taken.

In sum, crime and sport participation have an interactional effect and many factors influence them. Therefore, these cases should be taken into consideration carefully to prevent crime and create a suitable context for sport participation.

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