STATISTICAL ANALYSIS OF LONG TERM BETTING PHENOMENON: JOURNEY GAME TO ADDICTION

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Abstract

For the past few years there was significant increase of the social problems connected to sports betting, which represents a big challenge to Croatian society and health care system. This problem demands interdisciplinary approaches which includes cooperation of experts and scientists from different Fields such as medicine, sociology, psychology, math and statistics. Random phenomena are a subject of study by mathematical statistics. In this paper we made a statistical model for large game series in sports betting. It is shown that possibility for winning in that type of series is almost negligible for betters. Analyses that are exposed in this paper shatter the illusion of quick money from sports betting. Therefore, the mathematical knowledge of sports betting should be included in the general education of society through specialized workshops on betting and gambling, for their effective prevention. We think that some results of this study would be useful to include in the treatment of addiction rehabilitation groups of pathological gambling addicts in order to reduce their will for gambling as possible source of quick income. This would certainly contribute to the correction of perception and expectation in conducting psychotherapy with problematic gamblers.

Key words*: gambling, sport, addiction, psychology of sport, limit theorems*

Introduction

There are various forms of gambling organized all around the Globe, from Canada and the United States to Australia and Japan, as well as the European Union. Gambling industry, which includes lottery, bingo, electronic gambling machines, a variety of scratch games, horse and dog races, Casinos and betting shops carried out a very powerful and effective advertising campaigns. Popularization of the lottery games attracts a growing number of players which are lured by possibility of quick and easy profit. Statistics shows that about 6% of GDP in most countries consists of income from various lottery games (Zuckerman i Prostran, 2009), which is an enormous number. Recently for these reasons, the number of regular gamblers as well as the problematic gamblers (Karouzos, 2001) with all the social, psychological, health (Rayli et al., 2002), social (Walker and Barnett, 2003), ethical and morally harmful effects. Studies show that people whom tend to inordinately gambling often have problems with law (Yeoman and Griffiths, 1996). Engrained gamblers mostly fall into the financial and material problems (Nixon et al. 2002). Gambling is also a negative religious phenomenon as an alternative to transcendental experiences (Kozjak, 2008). Appearance of the sports betting negatively manifests itself on the sporting events and professional sport and undermines its deepest roots causing frequent adjustment of sports results. These phenomena causes a loss of confidence in sport at all its levels.

The Republic of Croatia recognized the problem of the increasing occurrence of various forms of gambling addiction. For the past ten years the number of companies that have concessions for games of chance (Zoričić at al., 2009). The number of betting shops for all kinds of games of chance rapidly increased. According to data from the Ministry of Finance (http://www.banka.hr/10.05.2013) Croatian citizens in 2011 paid 4.69 billion kuna, which is incredibly 1,093 kuna per capita. The amount of payment in sport betting shops in 2012 was another major record of five billion kuna and growing trend. It is estimated that in Croatia a few years ago were more than 400,000 citizens whom bets regularly, of which over 100,000 have gambling issues. This problem was particularly conspicuous in adolescents where gambling is often associated with other forms f risky behavior (Dodig and Ricijaš, 2011, Dodig et al. 2015). The emergence of gambling addiction is present in faculty student population (Zuckerman and Extended, 2009, Dodig et al. 2014). It wasdeterminated that almost 50% of faculty students have experience of sports betting and this group mainly consisted of young men. Faculty students who became gambling addicts neglect their faculty obligations and their various gambling becomes a major preoccupation and puts aside all other personal interests they had.

Psychologists have studied what causes the phenomenon of addiction to sport betting and other forms of gambling. Clinical researches have shown

that people who gambles often have a delusion of confidence and situation control (Langer, 1975, Burger, 1991), and that make their transition to inordinate and pathological gambling (Towfig et al, 2012). It is determinated that in the majority of cases with problematic and pathological gamblers lead to the phenomenon of pathological optimism (Zarevski, 1990). Pathological optimism is a kind of psychological illusion under which the gambler becomes convinced that he will win at the game (Clotfelter and Cook, 1993). One of the psychologically created illusions is based on the fact that gamblers very often loose by only one wrong pair on the ticket, which creates a feeling that they did not have enough luck. It is determinated that in the present case is not about luck than on mathematical law, the binomial distribution (Budmir and Jelaska, 2013).

On the other hand, the false feelings of the optimism and confidence that appears to gamblers is based on the experience of the occasional wins. This phenomenon is especially characteristic for sports betting because they have a great addictive power. The betting shops provide quite frequent sports betting services, live betting, betting on more than one events at the same time, a fast internet betting that allows gambling twenty-four hours per day. Thus the players develops an addiction to sports betting much faster than from conventional betting such as Bingo or Lottery because there are much longer interval between payments. It is very important to notice that according to laws of the statistics there is a possibility of the winning ticket with high amount of money if you play a lot of tickets. Periodically winning make an false certainty that it is possible to win log term at betting shops. With this study it is mathematically proven wrong – long term winning is almost impossible. Statistical model of long term betting shows that gambler who bets often at betting shops losses more the more he bets.

STATISTICAL MODEL OF THE LONG TERM BETTING

Analysis of one betting ticket In this chapter we are observing one tipical betting ticket as an example how a lot of gamblers play ther own pairs. Pairs on this ticket are chosen from Super-Sport betting shop 15.05.2016. (Table 1).

Pair	Coefficient 1	Coefficient X	Coefficient 2
SS Lazio-AC Fiorentina	1,90	3,20	3,80
Benfica Lis.-Nacional Fun.	1,35	4,50	9,00
Chelsea-Leicester	2,80	3,00	2,40

Table 1. Selection from Super-Sport betting shop on the 15.05.2016.

In order to convert the coefficients in the corresponding probabilities we have caluclated index of winning for every pair (Budimir and Jelaska, 2013):

$$i_{d_1} = \frac{1}{1{,}90} + \frac{1}{3{,}20} + \frac{1}{3{,}80} = 1.101973684$$

$$i_{d_2} = \frac{1}{1{,}35} + \frac{1}{4{,}50} + \frac{1}{9{,}00} = 1.074074074$$

$$i_{d_1} = \frac{1}{2{,}80} + \frac{1}{3{,}00} + \frac{1}{2{,}40} = 1.107142857$$

Based on index values of profit it is evident in all three cases that for one paid money unit, betting shop makes approximately 1.11 money units.

Possibilities of played events in order are:

$$p_1(1) = \frac{1}{koeficijent(1)} \cdot \frac{1}{i_{d_1}} = \frac{1}{1.90} \cdot \frac{1}{1.101973684} = 0.47761194 = 47.76\%$$

$$p_2(1) = \frac{1}{koeficijent(1)} \cdot \frac{1}{i_{d_2}} = \frac{1}{1.35} \cdot \frac{1}{1.074074074} = 0.689655172 = 68.97\%$$

$$p_3(2) = \frac{1}{koeficijent(2)} \cdot \frac{1}{i_{d_3}} = \frac{1}{2.40} \cdot \frac{1}{1.107142857} = 0.376344086 = 37.63\%$$

Because the events are independant, possibility that played betting thicket is winnig one:

$$p = p_1(1) \cdot p_2(1) \cdot p_3(2) = 0.3755 \cdot 0.6897 \cdot 0.3763 = 0.097455 = 9.74\%$$

In case of scoring all pairs and taking into account the handling charge of 5%, with payment of ten kunas, the profit of this betting ticket is:

$$N = 10 \cdot 1.90 \cdot 1.35 \cdot 2.40 = 61.56$$

Profit of this betting ticket can be shown as ranom variable:

$$N\sim\begin{pmatrix}61.56 & -10\\ 0.0974 & 0.9026\end{pmatrix}$$

Expected profit is:

$$EN = 61.56\cdot 0.0974 - 10\cdot 0.9026 = -3.03$$

Variance of the random variable N is:

$$\begin{aligned}VarN &= E[N^2] - [EN]^2\\ &= 61.56^2\cdot 0.0974 + (-10)^2\cdot 0.9026\\ &\quad - (-3.03)^2 = 450.19\end{aligned}$$

The statistical model of large series of games

In the idealized case it can be assumed that gambler makes similar tickets as the one form Table 1. Using mathematical formula, played ticket *i* is random variable N_i which has identical distribution as radnom variable *N*.

According to the law of the big numbers, the relative requency of profit in large series of such tickets converges to 9.7% (convergence in probability and convergence almost certainly):

$$\frac{N_1 + N_2 + \cdots + N_n}{n} \to 0.097 = 9.7\% \approx 10\%$$

It means that profit comes to every 10th played ticket. That type of profit sometimes happens to every gambler whom plays often (in average every 10th played ticket).

Below we present a statistical model of long-term bets which includes series of tickets that are similar to observed ticket.Therefore, we observe an series of the random variables $N_i, i = 1,\dots,n$ as equally distributed as random variable *N*:

$$N_i\sim\begin{pmatrix}61.56 & -10\\ 0.0974 & 0.9026\end{pmatrix}$$

In series of *n* days total profit and losings of gambler who plays this series can be shown as random variable:

$$S_n = \sum_{i=1}^{n} N_i$$

Considering that the conditions of the Lindenberg-Feller central limit theorem are filled, the standardized form of the sum converges to distribution of the normal unit distribution:

$$\frac{S_n - ES_n}{s_n} \to N(0,1)$$

where is

$$s_n^2 = \sum_{i=1}^{n} VarN_i$$

because of the independance of the variables $N_i, i = 1,\dots,n$ expectancy is

$$ES_n = \sum_{i=1}^{n} EN_i = -3.03n$$

while the sum of the variances is equal

$$s_n^2 = \sum_{i=1}^{n} VarN_i = 450.19n$$

according to

$$\frac{S_n - ES_n}{s_n} = \frac{S_n + 3.03n}{\sqrt{450.19n}}$$

it is aproximately a normal unity distribution.

The possibility that gambler profits after he play a big series of *n* tickets $(n \geq 30)$ is

$$\begin{aligned}p_n &= P(S_n > 0) = 1 - P(S_n \leq 0) = (standardization) =\\ &= 1 - P\left(\frac{S_n - ES_n}{s_n} \leq \frac{0 - ES_n}{s_n}\right) = \left|\frac{S_n - ES_n}{s_n}\sim N(0,1)\right.\\ &= 1 - \Phi\left(\frac{-ES_n}{s_n}\right) = 1 - \Phi\left(\frac{3.03n}{\sqrt{450.19n}}\right) = 1 - \Phi\left(0.143\sqrt{n}\right)\end{aligned}$$

Based on the previous formbula we made a Table 2 which consists of possibilities that gambler will profit after one mont, six months, one year, two years and five years of the continious betting:

Table 2. Probability that the sum of profits and losings of the played described type tickets would be positive after large series (in days) of games

No of days	Probability
$n = 30$	$0.216774 = 21.68\%$
$n = 180$	$0.02752 = 2.752\%$
$n = 365$	$0.00315 = 0.315\%$
$n = 730$	$0.00006 = 0.006\%$
$n = 1095$	$0.000001 = 0.0001\%$

From Table 2 we can see that possibility of the total sum of profits and losings would be positive, decreases with increase of the played tickets. After a month of everyday played tickets (n=30) probability that sum of profits and losings would be positive is 21.68%. That means that after one month of continuous betting in average every 5th gambler will be in profit. After six months (n=180) this probability falls on the 2.752%, and after a year (n=365) on 0.315%. Probability that gambler will be in profit after two years of everyday gambling (number of ticket is n=750) is 0.006%. This is less possibility than asteroid Apofis who will pass by the Earth in 2036, hits the ground. Astronomers calculated that probability is 0.004%. According to this result we can expect that in average 6 gamblers of 100,000 of them will be in profit after two years of everyday betting, apropos after series of n=750 tickets. If we observe a series of three years of everyday betting n=1095 tickets, probability that gambler will be in profit is 0.0001%. In average we can expect that only 1 gambler of 1,000,000 of them will be at total profit after that long series of gambling. That probability is eight times lower than one ticket of Loto 6/45 brings the whole combo and it is 0.0008%. Further we increase index n, probability of profit in large series of betting converges to 0. According to that, there are no „realistic chance" that gambler who Betts on large series will be in profit in relation to betting shops.

Majority of the population who betts regularly are doing it for the money. Problematic gamblers live in world of illusions that in the end profit is possible. Determinated results deny false optimism and confidence of the gamblers and shows that it is justified on the lack of informations. Also, exact mathematically prove that gamblers who hope to profit of the betting occurs semblance of self-confidence and control of the situation. In reality they have no control of situation because they have no insight of the mathematical aparatus which can calculate chances of winning in large series. Thus, the gamblers are not conscious how low are their chances of being in profit after long term betting. Excessive optimism which occurs in addicts hope that he will earn money by betting is completely irrational.

Conclusion

The analysis provided in this study indicates on positive probability of profit only in individual cases. On the analyzed ticket which was offered 15.05.2016 has probability of profit of 9.7% which is approximately 10%. That kind of profit was experienced by every gambler. According to law of the big numbers, gambler can be in profit in average every 10th ticket.

However, analysis of the statistical model for large series and played tickets and it is proven gamble has almost no chance in achieving long term profit. The probability that the gambler will be in profit decreases with increasing number of payed tickets. Probability of profit by increasing number of payed tickets converges very quickly to 0. With this acknowledgments we have completely broke assurance of the gamblers that they can make a strategy with whom they would be in long term profit.

Therefore it would be very useful that we implement mathematical and statistical aspect of betting in the education of the prevention and prevention of the betting addiction. Allegation of the mathematical results which are determinated in this study would be useful in theraphy of the pathological gamblers, to decrease their interest for betting.

We have shown only the small part of the results and the efforts that scientists have put into their research to improve the quality of life and the effectiveness of medicine. Sometimes the motivation of their research was to prevent the disease and sometimes to intervene after, unfortunately, the disease have already taken place.

The Guardians' article by Christine Evans-Pughe from 2008 (How supercomputers enhance our understanding of genes) states that "it takes all night on an 18-processor computer to simulate one second of a complete beating heart". Although it takes a tremendous funding to even start the simulation of the processes in human physiology, it certainly pays back. The benefits are far-reaching and it has been recognized, we can see it in the amount of GDP spent for the health care we mentioned in the beginning. If the development of mathematical models and new methods is only a byproduct of such a research, so be it. Scientists always search for a funding for their research, but interdisciplinary cooperation combined with the technology transfer and benefit to the global community is a way to go.

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STATISTIČKA ANALIZA FENOMENA DUGOROČNOG KLAĐENJA: PUTOVANJE OD IGRE DO OVISNOSTI

Sažetak

Posljednjih nekoliko godina došlo je do značajnog povećanja socijalnih problema vezanih uz sportsko klađenje, što predstavlja veliki izazov hrvatskom društvu i zdravstvenom sustavu. Ovaj problem zahtijeva interdisciplinarni pristup koji uključuje suradnju stručnjaka i znanstvenika iz različitih područja kao što su medicina, sociologija, psihologija, matematika i statistika. Slučajni su fenomen predmet studija matematičkim statistikama. U ovom smo radu napravili statistički model za seriju velikih igara u sportskim kladionicama. Pokazano je da je mogućnost za pobjedu u tom tipu serije gotovo zanemariva za igrače. Analize koje su izložene u ovom radu razbijaju iluziju brzog novca od sportsko klađenja. Stoga, matematičko znanje o sportskim klađenjima treba uključiti u opće obrazovanje društva kroz specijalizirane radionice o klađenju i kockanju za njihovu učinkovitu prevenciju. Smatramo da bi neki rezultati ove studije bili korisni za uključivanje u liječenje ovisnih skupina za patološke ovisnike o kockanju kako bi se smanjila njihova volja za kockanjem kao mogući izvor brzog dohotka. To bi svakako doprinijelo ispravljanju percepcije i očekivanja u obavljanju psihoterapije s problematičnim kockarima.

Ključne riječi: *kockanje, sport, ovisnost, psihologija sporta, granične teoreme.*

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