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USING SPATIAL DISTRIBUTION OF OUTLETS TO ESTIMATE GAMBLING INCIDENCE[1]

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Abstract

The paper proposes a simple and innovative methodology for measuring the incidence of gambling expenditure in countries for which household survey data is unavailable or unreliable. A first application of this methodology is presented by merging data on the geographical location of gambling outlets, together with residents' socioeconomic and demographic characteristics around that location across all of the 1,600 statistical areas in Israel. It was found that the Israel National Lottery (Lotto) and sports-betting Toto lottery tend to set up significantly more sales points in disadvantaged neighborhoods, after controlling for a standard list of factors such as population size and composition. The Suits Index is calculated based on the spatial estimation results and yields a measure of -0.42, which implies that the implicit tax associated with gambling is highly regressive.

Key words: Incidence, Gambling, Location policy

JEL: H22, H23, H27

1. INTRODUCTION

This work proposes an innovative approach to examine the incidence of gambling expenditure by employing supply side data, but which does not require detailed data on the sales revenue of each gambling outlet. To carry out this methodology, one needs the spatial distribution of gambling sales points and the socioeconomic characteristics of the residents around their location. The geographical unit should be relatively small to avoid the *ecological fallacy* risk (i.e., drawing conclusions about the behavior of individuals based on observations about the actions of groups). Measuring the incidence of gambling expenditure is based on two basic assumptions. One is that the state-run gambling organizations set up their sales outlets mainly based on economic considerations. The institutional background presented below shows that this is a reasonable assumption in Israel. Second, the number of current sales points within the borders of a certain geographical unit reflects economic equilibrium,

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which is a standard assumption in the industrial organizational literature that studies firms' entry into competitive and concentrated markets (Bresnahan and Reiss 1990, 1991).

The sheer availability of gambling outlets brings the supply side into the picture, which has received almost no prior research attention. The many previous studies conducted on the gambling market have almost all focused on understanding gamblers' behavior and the factors that affect the demand for gambling, such as personal and environmental characteristics, and gambling type. This seems to express the natural curiosity of researchers from the fields of economics, sociology, psychology, psychiatry, health and social work to better understand the factors that attract people to gambling.

The typical way of measuring the incidence of gambling expenditures is to use reported behavior based on household surveys. However, gambling expenditures may be severely biased, as individuals may prefer to hide activities that are frowned upon, such as the extent of their gambling. According to a household survey conducted by the Israeli Central Bureau of Statistics, the aggregate reported expenditure on gambling in 2015 was around $25 million (using an exchange rate of 4 New Israel Shekels (NIS)=$1), while the actual expenditure on legal gambling for 2015 was $2.5 billion, based on official financial reports from Lotto (State Lottery) and Toto. Thus, household survey data cannot be used to estimate the incidence of gambling accurately. The Lotto and Toto do not disclose disaggregated data on gambling revenues at the outlet level, and both the Lotto and Toto have refused to provide detailed data for each sales point, stating that such data would violate the privacy of lottery franchisees.

The current paper considers gambling losses as an implicit tax or monopolistic rent, whose incidence requires measurement. This is a reasonable assumption in many countries because the license to operate gambling is legally restricted to state-run organizations such as the State Lottery (Mifal-HaPais/Lotto) and the Israeli Sports Betting Board (Toto) in the context of Israel. The monopolistic structure of the gambling market does not allow (lawful) private firms to reduce or close the gap between the purchase price of a lottery ticket and its expected gain. This rent should also be perceived as an implicit tax because gambling losses are used to finance public activities such as education, culture and sports.

The methodology of measuring the incidence of gambling expenditure suggested in this paper could serve other countries for which household survey data is unreliable and disaggregated sales data by gambling outlet is unavailable. A first use of this methodology is illustrated by examining the spatial distribution of gambling outlets in Israel. It was found that the Lotto and Toto tend to set up significantly more outlets in poor neighborhoods after taking into account a battery of explanatory variables. Using the estimated coefficient, neighborhoods' socioeconomic characteristics and actual revenues, the calculated Suits Index is -0.42, which indicates that gambling is highly regressive.

The world's gambling industry has significantly expanded over the past decades and it seems likely it will continue to grow at significant rates in the future as well, as a result of the possible expansion of Internet gambling (Guillén et al., 2012). This dramatic expansion in the scope of gambling raises the question of whether other parts of the population have

joined the circle of gamblers or if the weak population has simply further expanded its participation. This expansion raises the importance of reexamining the incidence of gambling expenditures, despite the rich existing research.

In the next section, a review of the literature on who gambles and why is presented, which helps to guide the empirical analysis. Section 3 displays the institutional background of the Israeli gambling market, which is then used to estimate the incidence of gambling, and Section 4 outlines the working hypotheses. Section 5 describes the data and the results appear in Section 6. Section 7 presents a summary and discussion of the main findings.

2. LITERATURE REVIEW

a. Participation in gambling

The sheer number of people who participate in gambling fascinates economists because of the hidden riddle reflected in the purchase of a lottery ticket, the cost of which is higher than its expected gain. In the US, it was found that 55–66 percent of the people participate in gambling at least once a year, while 13 percent gamble once a week (Kearney, 2005; Welte et al., 2002). Similar rates were found in Europe (Bekcert and Lutter, 2012) and Israel.[2] The expected gain from participating in common forms of gambling, such as Israel's Lotto or Toto, equals approximately one half of the cost of purchasing a lottery ticket.

This behavior appears odd from the expected utility theory point of view and has led to numerous attempts to answer three main questions: Which people tend to participate in gambling (with an emphasis on identifying problem gambling)? Why do they gamble? and, What encourages or diminishes the desire to gamble? The answers to these questions have important implications regarding the well-known social costs that often accompany gambling such as suicide, deterioration of one's physical and mental health, family dissolution, turning to crime in order to finance gambling, and bankruptcy.

Governments throughout the world have identified the hidden riches that accompany gamblers' willingness to purchase a lottery ticket at double the price of its true value as a source of potential income. The initiative to use gambling as a source of income for the financing of public activities sometimes comes from the central government and at other times emerges from below, as in the case of the Israeli State Lottery, launched by the local authorities. Over time, the perceived benefits of conducting gambling operations as a source of income have overcome the social costs and risks associated with gambling; today more than 100 countries run gambling operations (Guillén et al., 2012).

The high tax rate (around 50 percent) imposed on gamblers makes the question of who tends to participate in gambling even more interesting. Many studies have been dedicated to

[2] A total of 63 percent of Israelis have purchased a lottery ticket at least once in their lives; 10 percent gamble at least once a week according to a Geocartography survey conducted in September 2009 and cited in Agamon (2009).

examining who bears the burden of the implicit tax on gambling. Four surveys, summarizing dozens of research studies conducted in economics and other fields, present broad agreement about gambling as a regressive form of taxation (Clotfelter and Cook, 1991; Miyazaki et al., 1998; Beckert and Lutter, 2009; Perez and Humphreys, 2013). These studies showed that low-earning populations spend a larger share of their income on legal gambling than their more affluent counterparts and, in some studies, even a larger amount of money (Rintoul et al., 2014). This finding on the regressive incidence of gambling exists in different countries, at different periods of time, and in both micro and macro data.

b. Why do the poor gamble more?

How can we explain the tendency of low-income people to spend a larger fraction of their income on gambling? Over the years, various competing and complementary theoretical hypotheses have been suggested to explain why people deviate from the prediction of expected utility theory. While most people with low and high levels of wealth are risk averse, individuals with mid-levels of wealth may exhibit a risk-loving attitude (Friedman and Savage, 1948). For such individuals, a financial investment with a negative net expected value, such as participating in gambling, might be perceived as reasonable. A similar but perhaps more convincing explanation is that low-income people (but not very low) may view gambling as their only foreseeable means of getting rich. Individuals who just manage to provide for their basic needs realistically assume that not many opportunities to get rich in the standard ways are available to them; therefore, they may find it rational to invest a small amount of money in an unfair game (McCaffery, 1994). This hypothesis, which predicts a higher level of gambling participation among the middle and lower classes, has received empirical support in previous studies (e.g., Welte et al., 2002). Instead of treating gambling as a purely financial investment, an alternative approach that explains why poor people tend to spend more on gambling perceives gambling as a consumption good that yields enjoyment. It is easy to show that even a risk-averse individual would choose to gamble if we add the expected joy from participating in the lottery games (Conlisk, 1993).

Participating in gambling may reflect the desire that exists among all individuals for consumption goods that create a fictitious or dreamlike reality. While more affluent individuals may allow themselves to detach from the daily grind with the aid of expensive fantasy products, like trips to exotic countries or expensive cars, gambling offers an inexpensive fantasy, which even poor people can afford (Cohen, 2001). Apparently, gamblers take pleasure in fantasizing about the possible uses of their potential winnings (Clotfelter and Cook, 1991, p.9). According to certain sociologists, gambling is a window through which one can escape, even if only for a short while, from the depressing daily reality for individuals on the lower rungs of the social ladder (Devereux, 1980).

While the last two above-mentioned approaches suggest a rational explanation for gambling, the third approach focuses on erroneous decisions. Gamblers are inclined to express exaggerated optimism when assessing their chances of winning; in this way, the

perceived expected utility perhaps justifies participating in gambling (Kahneman and Tversky, 1979). Ignoring the true probability of winning is only one of among a series of characteristics that reflect gamblers' difficulty with regard to statistical inference.

Clotfelter and Cook (1993) showed that gamblers in Maryland tended to avoid choosing numbers that had appeared as winning numbers in previous lotteries, despite the fact that the winning numbers are chosen randomly every week. Another example of faulty basic statistical deduction is reflected in the increased sales over a period of several weeks in US lottery outlets that sold a winning ticket, in spite of the fact that the chances of these specific outlets selling another winning ticket are the same as other outlets (Guryan and Kearney, 2008). Low-income people with low education levels are more likely to participate in gambling because they are more inclined to make these types of mistakes in processing statistical information.

Disadvantaged groups might exhibit higher gambling participation rates, regardless of statistical literacy, because of their economic distress, which harms their cognitive performance (Shah et al., 2012; Mani et al., 2013). According to this theory, the concerns that accompany economic hardship consume the necessary mental resources needed to make sensible decisions in all aspects of life. In this way, a vicious cycle of financial distress is created, often leading to decisions that make the situation even worse, such as taking a loan at a high interest rate or spending money on gambling.

The availability of lottery outlets is predicted to fuel gambling, following Sunstein and Thaler (2008), who claim that people's decisions are significantly influenced by the architecture of their decision environment. Gambling availability may appear in different forms such as the location of gambling outlets, the number of gambling outlets in a certain area, opening hours, the variety of gambling types, and the amount of time gambling has been legal. The combination of the impact of financial stress on cognitive performance, together with the environmental influence on individuals' choices and decisions has great potential—more than the approaches presented above—to explain not only the high incidence of gambling among low-income people, but also *problem gambling*, which is more common among the lower income class (St. Pierre et al., 2014).

In the two broad surveys published about the influence of physical availability on the frequency of problem gambling (Vasiliadis et al., 2013; St-Pierre et al., 2014), the role of *supply* was not mentioned. The main discussion rather related to whether availability actually increases demand. Although many studies have shown that the availability of gambling outlets expands the circle of problem gamblers, other studies found no such significant relation. In a study conducted in the US, it was found that people living within a 10-mile radius of a casino have double the chance of becoming problem gamblers, compared to those living at a further distance (Welte et al., 2004). Similar findings were found in New Zealand regarding the effect of distance between place of residence and gambling outlets and problem gambling (Pearce et al., 2008). In contrast, a study based on Quebec residents failed to find

a significant relation between travel distance and the chances of developing a gambling addiction (Sevigny et al., 2008).

An empirical analysis of the effect of physical availability on problem gambling mainly employs geographic distance between place of residence and gambling outlet, without taking into account supply side behavior; this may lead to flawed conclusions. Gambling operators are expected to set up more outlets in underprivileged neighborhoods if residents spend more on gambling, as is revealed by the empirical evidence (Delfabbro, 2002; Welte et al., 2004). In such a case, the correlation between availability (number of outlets) and gambling expenditure might not necessarily reflect a causal relationship. The source of this correlation is the supply side responses to the higher gambling demand associated with neighborhoods' socioeconomic characteristics. In contrast, the empirical connection between availability and gambling expenditure is valid if the gambling suppliers determine the location of gambling outlets in a random manner. However, the assumption of random supply is not in line with the rich body of empirical evidence on the existence of large numbers of gambling outlets in poor neighborhoods (Clotfelter and Cook, 1991; Pearce et al., 2008; Rintoul et al., 2014).

The attempt to explain the lack of empirical consensus regarding the effect of availability on gambling illustrates the weakness stemming from the lack of attention given to supply side response. One of the leading hypotheses proposed for these mixed findings was that the positioning of gambling outlets increases the area's gambling expenditures as a result of the initial exposure. However, this is gradually supposed to stabilize or even decrease because over time the public adapts to gambling and even develops immunity to it (LaPlante and Shaffer, 2007). However, this model, imported from biology, does not account for the expected response of gambling suppliers following changes in demand. Integrating supply side response clearly shows that availability not only has an impact on demand, but is also influenced by demand.

Gambling operators have an increased incentive to establish more gambling outlets in areas where low-income people reside because more gambling outlets (availability) increases the demand of people who are in financial distress. This is true under the condition that gambling operations maximize profit, and are not concerned with social costs. Examining supply side behavior indirectly allows us to determine whether the social cost of gambling is an important consideration, according to the correlation between the number of gambling outlets and neighborhoods' socioeconomic characteristics.

3. INSTITUTIONAL BACKGROUND

The State Lottery ("Mifal HaPais"/Lotto) and the Israeli Sports Betting Board are the only two institutions permitted to sell gambling products in Israel, while private organizations are forbidden to conduct any form of gambling, including the running of casinos. The Lotto was established in 1951, when local council heads, led by Tel Aviv's mayor, realized that gambling could be used as an additional source of funding for establishing hospitals, and

later, schools. The State Lottery operates through a license received from the Minister of Finance, which is renewed every four years. This license specifies, among other things, the games' characteristics such as frequency, types of gambling, scope, and the way in which the Lotto's net gains are divided among different public uses.

For many years, the Ministry of Finance acted as a formal regulator of the gambling market, although no basic regulatory infrastructure existed. In practice, the Lotto is viewed as a source of revenues and the regulatory role is almost completely overlooked. Surprisingly, the Ministry of Finance does not employ any professional staff to carry out these regulatory responsibilities, despite the clear need to regulate the gambling market.

The Israeli Sports Betting Board (Toto) operates under a law passed in 1967, and is the only body that can legally run gambling operations based on the results of sports competitions in Israel and abroad. In contrast to the State Lottery, the Board does not require a renewal of its license every four years, but it does require permission from the Minister of Finance and the Minister of Culture and Sport regarding changes in the forms of sports gambling and the allocation of its net gains. However, this two-headed regulator also lacks any type of professional infrastructure; therefore, regulation of gambling programs is kept to a minimum.

These two public gambling organizations in Israel operate in order to maximize their profits, just as private firms do. The standard practice upon opening a new Sports Betting Board (Toto) outlet clearly presents their top priority. The centrality of economic considerations reflects the true spirit of the organization, as can be seen by this quote: "*The Board's considerations in deciding to open a Toto outlet must be based, first and foremost, on economic considerations*". To clarify this point even further, it is stated, "*In other words, all considerations must be geared towards increasing the Board's revenues*" (taken from Toto protocol).

In 2015, legal gambling revenues in Israel reached a total of NIS 10 billion, divided between the Lotto (70 percent) and the Toto (30 percent), compared to the less than NIS 5 billion earned one decade ago (taken from the State Lottery and the Sports Betting Board's financial reports). This reflects a particularly rapid growth rate, similar to the worldwide gambling market's prosperity (Guillén et al., 2012). The growth of the legal gambling market over the past decade stems from the increased frequency of gambling and lotteries, longer hours of operation, and the expansion of types of gambling offered by the Lotto and Toto. Two such examples are the 500 electronic gambling machines authorized in 2005, and betting on horse races taking place in England and Ireland, which began in 2013. Thus, a rapid growth in gambling revenues occurred, despite the fact that the State Lottery was not granted permission to sell its products via the Internet.

Current gambling regulation in Israel does not limit the number of outlets or their location. The Lotto operates over 2,500 sales points, while the Toto markets its products through 1,500 gambling outlets distributed throughout Israel. Some of the sales points are affiliated with one of the two gambling vendors, while others sell both Lotto and Toto products. Certain sales points sell gambling products alongside other consumer products, including cigarettes

and alcohol, despite the potential harm generated by selling these three products in the same place. The majority of Lotto and Toto franchisees earn a fee of 7 percent of the lottery ticket's face value, while the central distributors (there are 8), who deliver State Lottery products to the sales outlets (franchisees), receive a fee of 1.5 percent of the ticket's face value.

The average loss in the past ten years in lottery gambling is approximately 42 percent, similar to the state-run lottery in North America.[3] Individuals who participate in legal gambling in Israel lost over NIS 4 billion in the past year (2015), and this is before taking the 30 percent income tax imposed on lottery prizes (above a certain threshold) into account.

According to the rules stipulated by the license, the State Lottery (Lotto) allocates 46.25 percent of its net gambling profits to building classrooms and kindergartens in accordance with the Ministry of Finance's directives. In addition, 46.25 percent of the profits are transferred to local authorities according to predetermined criteria, while another 7.5 percent are given to cultural and educational institutions. Toto revenues are currently allocated to sports activities: 51 percent of the profits are invested in building and renovating sports facilities and equipment, 41 percent are transferred to sports associations, 4 percent goes to supporting sports centers, and another 4 percent is divided according to the discretion of the Sports Betting Board.

4. DEVELOPING THEORETICAL HYPOTHESES

The current study focuses on the revealed behavior of the two gambling organizations in Israel in relation to the geographical distribution of gambling outlets. Following the institutional background description, this study assumes that the gambling organizers are driven by economic considerations in deciding on the number of outlets placed in certain geographical areas and their location. Therefore, gambling organizers will choose to set up more sales outlets in geographic locations where they expect high demand in order to maximize their profits. Hence, in determining the locations and number of sales outlets, gambling suppliers respond to the demand factors of each specific area such as income level, population size and composition.

Suppliers are expected to add sales points, as long as the additional revenues are greater than the added costs, under the assumption that maximizing profits is the main driving force.[4] This assumption implies that the existing number of gambling outlets reflect a state of equilibrium; otherwise, there would be a financial incentive to open an additional outlet or to close one.

[3] See North American Association of State and Provincial Lotteries.

[4] It is important to note that this work does not allow us to examine whether the choice of location on the part of gambling operators expresses a response to existing demand or if the availability of gambling outlets encourages the demand even more (supply creates demand).

A neighborhood's socioeconomic characteristics are expected to impact the number of gambling outlets set up in that neighborhood by gambling organizations. A review of the studies on gambling demand presents a strong connection between socioeconomic characteristics and gambling expenditures as a share of income and some studies even find that they spend more in absolute terms. The studies presented above also show a higher incidence of problem gambling in distressed neighborhoods, which provides an important share of the gambling industry's revenue. Maximizing profits implies that the suppliers care about the association between a neighborhood's income and the absolute amount of money spent on gambling (rather than the share of income). Thus, a large number of sales outlets in low-income neighborhoods means that gambling operators expect that these neighborhoods spend more money on gambling. An identical number of sales outlets in weak and strong neighborhoods would also result in regressive incidence because it implies that the amount of gambling expenditure is also identical, meaning a negative correlation between income level and the share of income spent on gambling.

Population size and composition are also important characteristics in gambling demand, which influences the optimal number of lottery outlets. The larger the adult population is, the more extensive the gambling demand will be. This should drive gambling suppliers to set up more sales outlets in areas with more adult citizens. Taking demographic composition into account is important because of the close negative connection existing in Israel between income and family size. The share of population under the age of 18 is expected to impact the desired number of sales points, as it is forbidden in Israel to sell gambling products to children under that age (although the actual initial gambling age may be otherwise).

Populations' gambling demands may also change in accordance with religion. The three major religions display a generally unfriendly attitude toward gambling (Hoffmann, 2000); the prohibition on gambling is very severe in Islam, compared to Judaism and Christianity. While the Koran says that all drinking of wine and gambling is forbidden (Sura 5, verse 90), the Mishna suffices with disqualifying an individual from being a witness if he has participated in gambling activities (Mishna, Sanhedrin, 3:3).

Therefore, Lotto and Toto managers are likely to set up less sales points in areas with Muslim residents compared to areas where the majority of residents are Jewish, and in places where the residents are ultra-Orthodox Jews. According to a survey conducted by Gavriel-Fried (2015), ultra-Orthodox Jews were less likely to gamble compared to secular Jews, which implies that less sales points are likely to be located in ultra-Orthodox neighborhoods.

The Lotto and Toto are expected to set up more sales points in larger areas, in which the distance between residential areas and gambling outlets is an important demand factor, as was found in previous studies. It is important to note that if we find more Lotto and Toto gambling outlets in larger areas (other things being equal), we can conclude that the gambling operators consider distance a central variable in determining gambling demand.

To conclude, the proposed statistical model to be estimated is:

$$Y_i = a + b * SES_i + c * X_i + e_i \quad (1)$$

where the dependent variable, Y_i, represents the number of gambling outlets in geographical area i; SES_i represents the socioeconomic level of geographical area i; X_i expresses the list of demographic, social and geographic characteristics of area i, intended to isolate the effect of socioeconomic status; and e_i denotes the error term.

5. THE DATABASE

The number of outlets in a given geographic location, which serves as a dependent variable, was constructed as follows: In January–February 2016, information on the addresses of 2,446 Lotto outlets was taken from the Lotto Internet website and mobile application. Another 1,332 Toto store addresses were taken from the easy.co.il Internet website (Table 1).[5]

In the current study, a statistical area is the basic geographic unit that may capture a segmented market for gambling. In the 2008 census, the Central Bureau of Statistics divided the country into 1,616 statistical areas, out of which 82 municipalities were not divided into statistical areas. These municipalities, whose populations were under 10,000 residents (except for the Bedouin villages of Hura and Kabul) were defined as a separate statistical area. The Central Bureau of Statistics divides urban municipalities numbering over 10,000 residents into smaller geographical locations: quarters, sub-quarters and statistical areas.[6] In order to allow for a comparison between different estimated models, the empirical analysis is limited only to statistical areas for which there is existing data on all of the variables that appear in this paper. Relatively few observations were removed (35 statistical areas), leaving a remainder of 1,581 observations.

Using GIS (Geographic Information System), the sales outlets were assigned to different statistical areas. The actual number of sales points included in the study is smaller because we were not able to assign 301 of the sales outlets to statistical areas. A total of 302 additional sales points were lacking data on the socioeconomic status and the share of votes for ultra-Orthodox political parties (Table 1). Extensive variance in the number of sales outlets was found, with 615 statistical areas having no sales outlets and 179 areas having five or more sales outlets (Table 1).

A statistical area does not necessarily represent the geographical unit relevant to the local gambling market in the eyes of the gambling operators. Therefore, in the empirical analysis, we will examine the sensitivity of the geographical unit by substituting the statistical area with three alternative geographical units: a sub-quarter, a quarter, and a community. However, the obvious advantage of choosing a small geographic unit is a higher homogeneity

[5] The Toto website does not include its outlets' addresses.

[6] Municipalities whose populations number over 10,000 residents were divided into quarters. *A quarter* covers several sub-quarters that share territorial continuity, and includes 20,000-50,000 inhabitants. *A sub-quarter* includes several statistical areas that share territorial continuity, and usually includes between 5,000-30,000 individuals.

level of population characteristics, which reduces concerns about ecological fallacy inference.

Table 1 (a)

Number of Lotto & Toto selling points

	State lottery	Toto	All
(1) Lotto & Toto selling points	2,446	1,332	3,778
(2) Unable to match point address to statistical area	118	183	301
(3) No data on socioeconomic index	214	75	289
(4) No data on votes for ultra-Orthodox parties	10	3	13
(5) Survey population (5)=(1)-(2)-(3)-(4)	**2,104**	**1,071**	**3,175**

Number of selling points and addresses were extracted during January–February 2016 from state lottery website and from – easy.co.il

Table 1 (b)

The number of statistical areas by number of selling points

	State lottery		**Toto**		**All**	
	Number	(%)	Number	(%)	Number	(%)
No selling point	666	42.1	895	56.6	615	38.9
1	430	27.2	462	29.2	264	16.7
2	235	14.9	148	9.4	241	15.2
3	115	7.3	41	2.6	162	10.3
4	66	4.2	12	0.8	120	7.6
5	20	1.3	12	0.8	63	4
6	10	0.6	5	0.3	38	2.4
7	9	0.6	0	0	18	1.1
8	5	0.3	4	0.3	11	0.7
9	5	0.3	0	0	11	0.7
10 or more	20	1.2	2	0.1	38	2.4
All statistical areas	**1,581**	**100.0**	**1,581**	**100.0**	**1,581**	**100.0**

This sensitivity analysis provides a partial account for the possibility that people gamble outside their own residential area, such as in shopping centers and public transportation stations. In order to examine the robustness of the results, we omit the top percentile of the statistical areas with the largest number of gambling outlets.

The socioeconomic status is taken from the Central Bureau of Statistics that is calculated for every *statistical area* based on a series of 16 variables in 2008, the last year for which there are available data.[7] As a result, a time gap is created between the dependent variable

[7] The variables list included in the socioeconomic status is comprised of 5 variables for **standard of living** (average monthly income per standard individual, average car used by household members aged 18+, average number of rooms per person in a household, average number of bathrooms per person in a household, percentage of households with computer and Internet connection); 5 **employment and retirement** variables (percentage of working wage earners aged 15+, percentage of women aged 25–

measured in 2016 and the main explanatory variable calculated for 2008. The risk of measurement errors, as a result of this time gap, is reduced because of the high persistence over time characterizing the socioeconomic index (Central Bureau of Statistics Report 2013, Figure 3a). The socioeconomic index follows a normal distribution with an average of 0 and a variance of 1, ranging between -2.95 and 3.14 (Table 2).

Population size and composition were also taken from Central Bureau of Statistics data. The average population in a statistical area was close to 4,000 people, out of which 11 percent, on average, were aged 65 and above and more than 30 percent were aged 17 and below (Table 2). The data on population size and composition are also available for the year 2014. The results show almost no change when we use population size for the most recent year (2014), but this information is not presented in the empirical analysis because of space limitations.

An area was categorized as belonging to a specific religion (one of the four main religions in Israel: Jews, Muslims, Christians and Druze) if half or more of its residents in the year 2008 were of the same religion. A total of 86 percent of the areas were defined as Jewish, 11 percent of the areas had a Muslim majority, 1.7 percent were comprised of Druze and 1.3 percent were designated Christian (Table 2). The Jewish population was divided into two groups: ultra-Orthodox Jews and all other Jews. An area was defined as ultra-Orthodox if half or more of the residents voted for the main ultra-Orthodox political party (United Torah Judaism) in recent general elections, held on January 25, 2015. Ninety-four percent of Israeli Jews are not ultra-Orthodox; the rest are considered ultra-Orthodox according to the above definition (Table 2). The empirical analysis employs an alternative definition according to which, a statistical area has been classified as ultra-Orthodox if half or more of its residents vote for one of the two ultra-Orthodox political parties (United Torah Judaism and Shas).

The average land area of a statistical area is 1.5 square kilometers (Table 2). The great majority of the statistical areas are residential areas; only 7 percent are public spaces; 4 percent of the areas are defined as open; and there is one industrial area out of the almost 1,600 areas included in this study (Table 2).

54 who are not part of the civilian work force, percentage of working wage earners earning more than double the average income, percentage of working wage earners earning less than minimum wage, percentage of people receiving income support, percentage of people receiving an income supplement in old age; 3 **demographic** variables (median age, dependency ratio, and average number of persons per household); and 3 **education** variables (average years of study of persons aged 25–54, percentage of persons aged 25–54 with BA degrees, percentage of persons in academic or managerial positions).

Table 2

Descriptive statistics at a statistical area level

Variable	Number of observations	Mean & SD	Minimum	Maximum
Number of state lottery selling points in a statistical area	1,581	1.3 (2.121)	0	22
Number of Toto selling points in a statistical area	1,581	0.7 (1.075)	0	10
Number of state lottery and Toto selling points in a statistical area	1,581	2.0 (3.049)	0	32
Income per equivalent person (ln)	1,550	8.4 (0.484)	6.642	10.05
Income per equivalent person (NIS)	1,550	5,222 (2,550)	766.3	23,097
Socioeconomic index	1,581	0.0223 (0.987)	-2.952	3.145
Population size (ln)	1,581	8.2 (0.339)	6.230	9.690
Population size	1,581	3,932 (1,443)	509	16,160
Aged 65 or older (%)	1,581	11.0 (6.490)	0	39
Aged 18-64 (%)	1,581	58.9 (7.883)	29	88
Aged 17 or younger (%)	1,581	30.2 (11.539)	5	71
Non ultra-Orthodox Jews (%)	1,581	80.6 (39.57)	0	100
Ultra-Orthodox Jews (%)	1,581	5.0 (21.79)	0	100
Christians (%)	1,581	1.3 (11.45)	0	100
Muslims (%)	1,581	11.4 (31.77)	0	100
Druze (%)	1,581	1.7 (12.96)	0	100
Size of area (Square meters, ln)	1,581	13.2 (1.205)	10.76	18.75
Size of area (Square kilometers)	1,581	1.561 (5.589)	0.0473	138.6
Residential area (%)	1,581	99.2 (8.682)	0	100
Industrial area (%)	1,581	0.1 (2.515)	0	100
Natural area (%)	1,581	0.3 (5.025)	0	100
Public use area (%)	1,581	0.4 (6.641)	0	100

6. THE RESULTS

The baseline OLS regression following the model presented in Section 4 for lottery gambling outlets appears in Table 3. It is clear that the socioeconomic status has a significant and negative influence on the number of lottery gambling outlets, after controlling for a list of standard variables, such as population size and composition. Table 3 shows that the socioeconomic status coefficient is severely biased if the standard list of control variables is not included (Column 1, Table 3). The results are similar when using income per equivalent person instead of socioeconomic cluster. State lottery locates more gambling outlets in areas with lower income, which is not surprising in light of the positive correlation between socioeconomic cluster and income per equivalent person (Column 4, Table 3). The level of education, as measured by the share of population (age 25-54) with university degree, has an insignificant impact on the number of lottery outlets beyond the effect of income.

The number of gambling outlets expands with population size, and narrows with the share of the young population (age 17 and under), which is in line with our theoretical prediction. The Lotto does not tend to set up either more or less gambling outlets in areas with a larger share of older people (age 65 and over), compared to areas with a younger adult population between the ages of 18–64 (Column 3, Table 3). This result is consistent with previous studies as well as a survey on attitudes towards gambling conducted in Israel (Gavriel-Fried, 2015).

As expected, the number of Lotto outlets, in areas where most residents are Jews, is significantly higher than in areas where most residents are Muslims (or Christians). Surprisingly, the coefficient for areas where most residents are ultra-Orthodox Jews is higher than the coefficient for areas in which the majority of residents are not ultra-Orthodox Jews. This finding is also in contrast with the attitudes survey about gambling, conducted among the Jewish population in Israel (Gavriel-Fried, 2015). Note that the number of lottery outlets in areas with a Muslim majority might nevertheless be high because of their high poverty rate (Dahan and Endeweld, 2019)

Predictably, the State Lottery sets up more gambling outlets in larger areas, implying that its managers believe the distance between places of residence and gambling outlets has an impact on gambling demand. In addition, there are significantly more gambling outlets in public and industrial areas than in residential areas. However, these results are not very meaningful, since there are only 7 public areas, 4 open areas, and one industrial area out of the almost 1,600 areas included in this study.

The main results and, in particular, the finding that the State Lottery sets up more sales outlets in economic disadvantaged areas compared to wealthy areas remain almost unchanged if we omit all of the statistical areas without Lotto gambling outlets from the empirical analysis (Columns 6-7, Table 3). It is important to note that the same picture emerges even when not controlling for the other variables.

Table 3

State lottery location policy

Dependent variable: The number of state lottery selling points in a statistical area

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All statistical areas					Areas with selling points	
Income per equivalent person (ln)				**-1.189*** ** (0.139)	**-1.008*** ** (0.253)		
Socioeconomic index	0.050 (0.040)	**-0.372*** ** (0.057)	**-0.540*** ** (0.064)			**-0.241*** ** (0.071)	**-0.564*** ** (0.088)
Population size (ln)		**1.003*** ** (0.158)	**0.858*** ** (0.150)	**0.948*** ** (0.169)	**0.955*** ** (0.169)		**0.875*** ** (0.231)
Aged 65 or older (%)		**0.030** ** (0.015)	0.024 (0.015)	0.013 (0.015)	0.016 (0.016)		0.019 (0.021)
Aged 17 or younger (%)		**-0.062*** ** (0.008)	**-0.065*** ** (0.009)	**-0.069*** ** (0.009)	**-0.067*** ** (0.010)		**-0.083*** ** (0.015)
Non-ultra-Orthodox Jews			**0.866*** ** (0.203)	**0.966*** ** (0.214)	**0.931*** ** (0.215)		**1.088*** ** (0.257)
Ultra-Orthodox Jews			**1.251*** ** (0.297)	**1.223*** ** (0.303)	**1.209*** ** (0.302)		**2.287*** ** (0.505)
Muslims			-0.235 (0.231)	-0.232 (0.240)	-0.235 (0.237)		1.034 (0.691)
Druze			-0.392 (0.251)	-0.320 (0.263)	-0.320 (0.261)		-0.012 (0.382)
Size of area (ln)			**0.223*** ** (0.051)	**0.216*** ** (0.053)	**0.214*** ** (0.053)		**0.279*** ** (0.076)
Industrial area			**6.588*** ** (0.115)	**6.681*** ** (0.128)	**6.718*** ** (0.134)		**5.901*** ** (0.157)
Natural area			-0.927 (0.596)	-0.860 (0.585)	-0.856 (0.583)		**-0.625** * (0.357)
Public use area			**5.221** ** (2.178)	**5.213** ** (2.175)	**5.208** ** (2.176)		**4.248** ** (2.156)
Share of university degree among ages 25-54 (%)					-0.005 (0.005)		
Constant	**1.330*** ** (0.053)	**-5.375*** ** (1.328)	**-7.722*** ** (1.383)	1.825 (1.675)	0.359 (2.489)		**-7.637*** ** (2.135)
Observations	1,581	1,581	1,581	1,550	1,549	915	915
Selling points	2,104	2,104	2,104	2,073	2,068	2,104	2,104
Adjusted R^2	0.000	0.115	0.174	0.179	0.180	0.007	0.125

Omitted group: Population composition (ages 18-64), religion (Christians), area type (residential).
Robust standard errors are in parentheses ,*** p<0.01, ** p<0.05, * p<0.1

Table 4 presents the estimation results, but this time for Toto outlets only. The number of Toto gambling outlets significantly increases in accordance with residents' decreasing socioeconomic status, after controlling for population size and composition. As before, the results show the importance of the list of control variables in order to obtain an unbiased

coefficient for socioeconomic status. An increase of one standard deviation in socioeconomic status is accompanied by a decrease of 0.54 in the number of Lotto outlets, compared to less than half of this decrease (0.24) for Toto outlets. In other words, the Lotto runs a more aggressive policy in regard to setting up gambling outlets in distressed areas, compared to the Sports Betting Board.

Table 4

Toto location policy

Dependent variable: The number of Toto selling points in a statistical area

	(1)	(2)	(3)	(4)	(5)	(6)
	All statistical areas				Areas with selling points	
Income per equivalent person (ln)				**-0.526*** ** (0.069)		
Socioeconomic index	**0.065*** ** (0.022)	**-0.158*** ** (0.027)	**-0.239*** ** (0.032)		**-0.140*** ** (0.048)	**-0.223*** ** (0.049)
Population size (ln)		**0.567*** ** (0.080)	**0.537*** ** (0.080)	**0.565*** ** (0.090)		**0.452*** ** (0.153)
Aged 65 or older (%)		**0.004** (0.007)	0.008 (0.007)	0.004 (0.007)		-0.004 (0.011)
Aged 17 or younger (%)		**-0.035*** ** (0.004)	**-0.034*** ** (0.004)	**-0.035*** ** (0.005)		**-0.041*** ** (0.009)
Non-ultra-Orthodox Jews (%)			**0.340*** (0.198)	**0.389*** (0.211)		-0.105 (0.257)
Ultra-Orthodox Jews (%)			0.267 (0.219)	0.251 (0.230)		0.605 (0.521)
Muslims (%)			-0.193 (0.203)	-0.187 (0.215)		0.229 (0.418)
Druze (%)			-0.308 (0.215)	-0.279 (0.228)		**-0.765** ** (0.322)
Size of area (ln)			**0.094*** ** (0.024)	**0.093*** ** (0.025)		**0.124*** ** (0.042)
Industrial area			**2.330*** ** (0.056)	**2.360*** ** (0.064)		**1.650*** ** (0.101)
Natural area			**-0.704** ** (0.291)	**-0.682** ** (0.292)		**-0.560*** ** (0.187)
Public use area	**0.676*** ** (0.027)		**1.880*** ** (0.613)	**1.872*** ** (0.604)		1.035 (0.629)
Constant		**-3.562*** ** (0.700)	**-4.297*** ** (0.724)	-0.046 (0.893)	**1.585*** ** (0.046)	**-2.572** ** (1.239)
Observations	1,581	1,581	1,581	1,550	686	686
Selling points	1,071	1,071	1,071	1,060	1,071	1,071
Adjusted R^2	0.003	0.140	0.165	0.168	0.008	0.071

Omitted group: Population composition (ages 18-64), religion (Christians), area type (residential).
Robust standard errors are in parentheses ,*** p<0.01, ** p<0.05, * p<0.1

As predicted, the sign of socioeconomic status coefficient is the same when the dependent variable is the combined number of both Lotto and Toto outlets (Table 5). A higher socioeconomic status by one standard deviation implies a decrease of 0.78 in the number of gambling outlets (Lotto and Toto). Many of the gambling outlets sell both Lotto and Toto products; therefore, this examination should also be perceived as an analysis of the supply of various types of gambling.

As can be seen, the general picture remains the same when replacing *socioeconomic status* with *income*. The Lotto and Toto operate more sales points in areas where low-income people reside. According to the coefficient estimated in Table 5 (Column 4), a decrease in the average monthly income level of an area's residents by NIS 2,900, which is a little more than one standard deviation, will result in the opening of one additional gambling outlet. These estimation results show that both gambling organizations choose to position more sales points in poor areas because they apparently believe that low-income people spend a larger amount of money on gambling, compared to high-income people. In other words, the degree of regressive incidence, evident from the many sales outlets in distressed neighborhoods, is relatively high. This is an important finding given the high income inequality observed in Israel (Dahan, 2017).

A nonlinear estimation of the effect of socioeconomic status on the combined number of Lotto and Toto gambling outlets appears in Table 6. The statistical areas were divided into 10 equal deciles according to socioeconomic status. As can be observed in Table 6, the size of the estimated coefficients decreases as the socioeconomic status goes up. This result is true for both Lotto and Toto outlets when controlling for a list of explanatory variables, such as religion and population size. The number of Lotto and Toto gambling outlets in the lowest decile is 2.5 times larger than in the top decile. The influence of the other variables, as implied by the estimated coefficients, remains the same in the case of a non-linear specification. The number of outlets is larger among populations with more adults (18+), larger area size, and in areas with a Jewish majority.

The regression results and aggregate data on gambling sales revenues, as well as the number of sales points, can be used to illustrate the incidence of gambling expenditure. In 2015, the average revenues per sales point were NIS 2.5 million per year (calculated by dividing the aggregate revenue of Lotto and Toto by the total number of sales points). The average gamblers' loss in 2015 was NIS 1 million per sales point, after taking into account the 58 percent payout rate. To calculate the fraction of income that each statistical area spends on gambling we first multiply the estimated socioeconomic coefficient for each decile by the average loss, which equals NIS 1 million (Table 6, Column 6) and then divide it by the total income of the residents living in a particular statistical area. This should be seen as an illustration, given that the regression coefficients represent the predicted number of sales points in each socioeconomic decile, all other variables being constant.

Table 5
State lottery and Toto location policy
Dependent variable: The combined number of state lottery & Toto selling points in a statistical area

	(1)	(2)	(3)	(4)	(5)	(6)
	All statistical areas				Areas with selling points	
Income per equivalent person (ln)				**-1.713*** ** (0.197)		
Socioeconomic index	**0.115*** (0.059)	**-0.527*** ** (0.081)	**-0.777*** ** (0.090)		**-0.210** ** (0.100)	**-0.707*** ** (0.118)
Population size (ln)		**1.610*** ** (0.228)	**1.395*** ** (0.219)	**1.516*** ** (0.247)		**1.501*** ** (0.326)
Aged 65 or older (%)		**0.040*** (0.020)	0.032 (0.020)	0.017 (0.021)		0.022 (0.028)
Aged 17 or younger (%)		**-0.097*** ** (0.011)	**-0.099*** ** (0.012)	**-0.104*** ** (0.013)		**-0.118*** ** (0.020)
Non-ultra-Orthodox Jews (%)			**1.201*** ** (0.372)	**1.352*** ** **(0.396)**		**1.229** ** (0.499)
Ultra-Orthodox Jews (%)			**1.509*** ** (0.473)	**1.466*** ** (0.490)		**2.346*** ** (0.766)
Muslims (%)			-0.435 (0.402)	-0.425 (0.423)		0.940 (0.916)
Druze (%)			**-0.702*** (0.422)	-0.601 (0.447)		-0.589 (0.637)
Size of area (ln)			**0.312*** ** (0.070)	**0.305*** ** (0.073)		**0.327*** ** (0.100)
Industrial area			**8.913*** ** (0.164)	**9.042*** ** (0.182)		**8.141*** ** (0.213)
Natural area			**-1.627** ** (0.825)	**-1.538*** (0.815)		-1.061 (0.793)
Public use area			**7.104*** ** (2.719)	**7.088*** ** (2.707)		**5.990** ** (2.746)
Constant	**2.006*** ** (0.077)	**-8.713*** ** (1.894)	**-11.955*** ** (1.984)	1.806 (2.398)	**3.313*** ** (0.111)	**-11.627*** ** (2.966)
Observations	1,581	1,581	1,581	1,550	966	966
Selling points	3,175	3,175	3,175	3,133	3,175	3,175
Adjusted R^2	0.001	0.131	0.187	0.191	0.002	0.125

Omitted group: Population composition (ages 18-64), religion (Christians), area type (residential).
Robust standard errors are in parentheses ,*** p<0.01, ** p<0.05, * p<0.1

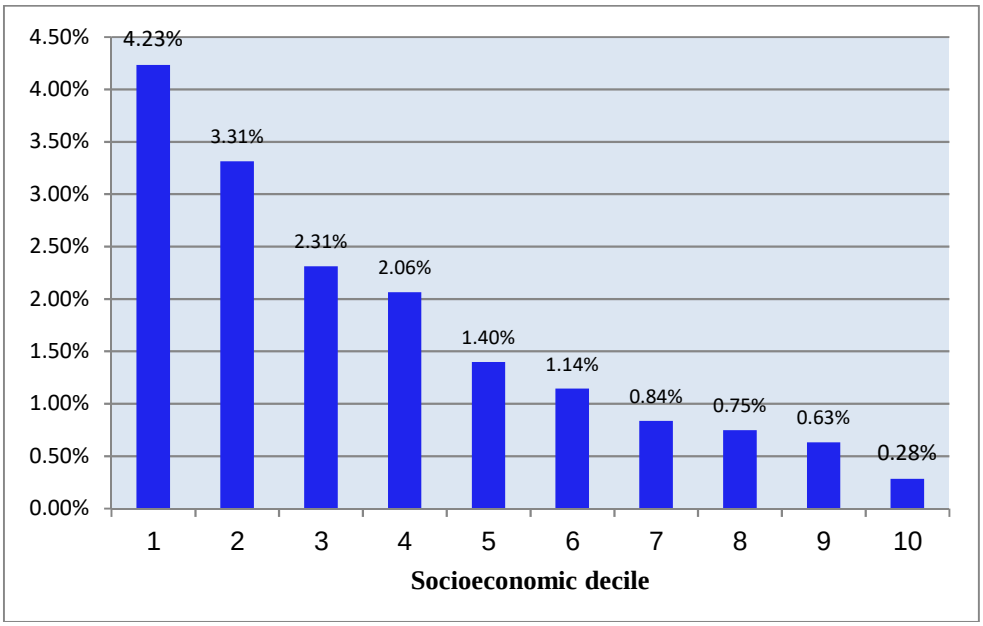
Table 6
State lottery and Toto location policy/nonlinear estimation
Dependent variable: The number of state lottery & Toto selling points in a statistical area

	(1)	(2)	(3)	(4)	(5)	(6)
	State lottery		Toto		State lottery & Toto	
Bottom decile	**-0.376*** **	**1.767*** **	**-0.330*** **	**0.687*** **	**-0.706*** **	**2.454*** **
	(0.113)	(0.259)	(0.061)	(0.122)	(0.160)	(0.362)
Decile 2	0.152	**1.676*** **	-0.006	**0.703*** **	0.146	**2.379*** **
	(0.177)	(0.264)	(0.097)	(0.132)	(0.261)	(0.377)
Decile 3	**0.962*** **	**1.393*** **	**0.380*** **	**0.579*** **	**1.342*** **	**1.972*** **
	(0.200)	(0.198)	(0.104)	(0.107)	(0.286)	(0.285)
Decile 4	**1.278*** **	**1.353*** **	**0.614*** **	**0.658*** **	**1.892*** **	**2.011*** **
	(0.261)	(0.233)	(0.124)	(0.116)	(0.369)	(0.331)
Decile 5	**0.842*** **	**0.918*** **	**0.475*** **	**0.505*** **	**1.316*** **	**1.423*** **
	(0.215)`	(0.212)	(0.121)	(0.118)	(0.326)	(0.318)
Decile 6	**0.741*** **	**0.812*** **	**0.361*** **	**0.387*** **	**1.101*** **	**1.199*** **
	(0.202)	(0.195)	(0.096)	(0.093)	(0.278)	(0.267)
Decile 7	**0.525*** **	**0.534*** **	**0.310*** **	**0.303*** **	**0.835*** **	**0.838*** **
	(0.162)	(0.159)	(0.090)	(0.090)	(0.236)	(0.232)
Decile 8	**0.608*** **	**0.577*** **	**0.316*** **	**0.299*** **	**0.924*** **	**0.876*** **
	(0.150)	(0.145)	(0.092)	(0.086)	(0.226)	(0.215)
Decile 9	**0.608*** **	**0.609*** **	**0.291*** **	**0.284*** **	**0.899*** **	**0.892*** **
	(0.189)	(0.189)	(0.107)	(0.106)	(0.281)	(0.280)
Population size (ln)		**0.895*** **		**0.550*** **		**1.445*** **
		(0.151)		(0.081)		(0.222)
Aged 65 or older (%)		0.023		0.008		0.031
		(0.014)		(0.007)		(0.020)
Aged 17 or younger (%)		**-0.064*** **		**-0.031*** **		**-0.095*** **
		(0.009)		(0.005)		(0.013)
Non-ultra-Orthodox Jews (%)		**0.887*** **		0.318		**1.205*** **
		(0.220)		(0.202)		(0.389)
Ultra-Orthodox Jews (%)		**1.241*** **		0.268		**1.510*** **
		(0.303)		(0.221)		(0.480)
Muslims (%)		-0.251		-0.163		-0.414
		(0.271)		(0.211)		(0.444)
Druze (%)		-0.433		-0.284		-0.717
		(0.286)		(0.224)		(0.462)
Size of area (ln)		**0.208*** **		**0.086*** **		**0.294*** **
		(0.051)		(0.024)		(0.070)
Industrial area		**6.776*** **		**2.379*** **		**9.155*** **
		(0.182)		(0.094)		(0.257)
Natural area		-0.807		**-0.684** **		**-1.491***
		(0.604)		(0.285)		(0.824)
Public use area		**5.134** **		**1.855*** **		**6.989** **
		(2.186)		(0.620)		(2.735)
Constant	**0.797*** **	**-8.842*** **	**0.437*** **	**-4.826*** **	**1.234*** **	**-13.668*** **
	(0.080)	(1.381)	(0.053)	(0.730)	(0.124)	(2.004)
Observations	1,581	1,581	1,581	1,581	1,581	1,581
Selling points	2,104	2,104	1,071	1,071	3,175	3,175
Adjusted R^2	0.042	0.172	0.054	0.162	0.051	0.184

Notes: Omitted group: Socioeconomic decile (upper decile), population composition (ages 18-64), religion (Christians), area type (residential). Robust standard errors are in parentheses ,*** p<0.01, ** p<0.05, * p<0.1

Using the abovementioned calculation, Figure 1 shows that the share of gambling expenditure decreases steeply as we go up on the socioeconomic ladder. This simulated gambling spending by socioeconomic status also enables calculating the extent of the gambling expenditure regressive incidence according to the Suits Index, which is widely used in the literature on gambling. Using this methodology, the Suits Index for gambling expenditure is -0.42, which is highly regressive.[8]

Figure 1
The Estimated Share of Income Spent on Gambling, by Socioeconomic Decile



Lotto and Toto may consider a larger geographical unit, such as a sub-quarter that includes several statistical areas (between 5,000 and 30,000 residents), as the relevant local market for gambling. Table 7 illustrates the effect of socioeconomic status on the number of gambling outlets at the sub-quarter level. The Lotto and Toto set up significantly larger numbers of sales points in sub-quarters belonging to the lowest decile, compared to the highest decile. Generally, the higher one goes on the decile ladder, the more the number of gambling outlets decrease, which is similar to the findings obtained based on statistical areas.

The ecological fallacy is revealed in all its severity using regressions at the quarter level and, even more so, at the municipality level, seemingly indicating that there is no relation between socioeconomic status and the number of sales outlets. This most likely stems from

[8] Beckert and Lutter (2009) show that the highest reported Suits Index in various studies is -0.44.

Table 7

State lottery and Toto location policy: larger geographical units

Dependent variable: The number of state lottery & Toto selling points

	(1)	(2)	(3)	(4)	(5)	(6)
	Sub-quarter	Quarter	Municipality			
Bottom decile	-0.828	**7.111*** **	4.161	**34.187** **	**-6.579** **	7.654
	(1.061)	(1.607)	(10.708)	(13.832)	(2.550)	(10.755)
Decile 2	**4.586*** **	**6.571*** **	0.661	**17.212*** **	**-6.055** **	15.216
	(1.473)	(1.454)	(5.700)	(6.395)	(2.564)	(9.205)
Decile 3	**4.276** **	**6.206*** **	3.714	**16.743*** **	**-5.305** **	**14.515***
	(1.926)	(1.789)	(7.605)	(5.271)	(2.606)	(8.078)
Decile 4	**5.966*** **	**5.864*** **	0.786	**14.441** **	2.395	3.061
	(2.199)	(2.052)	(5.779)	(5.597)	(3.841)	(7.261)
Decile 5	**3.034** **	**4.198*** **	14.000	**23.314*** **	20.395	12.720
	(1.429)	(1.306)	(9.798)	(6.469)	(13.005)	(8.614)
Decile 6	**4.552** **	**5.277** **	1.536	**17.781** **	**21.145*** **	3.799
	(2.017)	(2.055)	(7.188)	(7.161)	(7.619)	(7.185)
Decile 7	**3.000** **	**3.354*** **	-0.464	**14.948*** **	**27.645*** **	8.162
	(1.297)	(1.254)	(5.806)	(5.245)	(10.554)	(8.048)
Decile 8	**4.931*** **	**4.676*** **	-5.214	**8.694***	**26.245** **	8.956
	(1.448)	(1.230)	(5.230)	(5.015)	(12.150)	(8.915)
Decile 9	1.897	**1.958***	11.857	**18.539** **	26.345	14.817
	(1.157)	(1.043)	(11.512)	(9.109)	(19.291)	(12.992)
Population size (ln)		**5.278*** **		**20.903*** **		**20.773*** **
		(1.238)		(6.000)		(4.392)
Aged 65 or older (%)		0.123		0.442		1.268
		(0.129)		(0.593)		(0.917)
Aged 19 or younger (%)		**-0.334*** **		**-0.864***		-0.557
		(0.093)		(0.500)		(0.726)
Non-ultra-Orthodox Jews (%)		1.347		-16.819		-3.522
		(3.632)		(11.191)		(7.361)
Ultra-Orthodox Jews (%)		2.245		**-19.359***		-1.261
		(3.943)		(11.406)		(16.176)
Muslims (%)		0.096				-7.048
		(4.538)				(8.569)
Druze (%)		0.796				-2.469
		(0.572)				(10.456)
Size of area (ln)				3.220		**4.013***
				(3.032)		(2.289)
Industrial area		0.984		-12.215		
		(1.456)		(9.306)		
Natural area		**-6.675** **		-13.421		
		(2.622)		(8.467)		
Public use area		**7.734***		**15.403***		
		(4.445)		(7.880)		
Constant	**5.241*** **	**-50.951*** **	**19.714*** **	**-226.690*** **	**8.105*** **	**-242.802*** **
	(0.775)	(13.474)	(4.899)	(61.871)	(2.521)	(50.295)
Observations	290	290	76	76	198	198
Outlets	2,431	2,431	1,717	1,717	3,736	3,736
Adjusted R^2	0.049	0.209	-0.015	0.446	0.067	0.511

Notes: Omitted group: Socioeconomic decile (upper decile), population composition (ages 18-64), religion (Christians), area type (residential). Robust standard errors are in parentheses ,*** p<0.01, ** p<0.05, * p<0.1.
Please note that there are no sub-quarters classified as Druze and there are no quarters classified as Druze & Muslim. The regressions for larger geographical units were estimated using different age range due to data limitations.

the fact that the municipalities' socioeconomic level does not match the number of statistical areas ranked as poor economic areas. This outcome further reinforces the choice of using the smallest geographical unit (statistical area) to examine whether gambling operators set up more gambling outlets in distressed neighborhoods.

Table 8 deals with the risk of omitted variables. The negative coefficient of socioeconomic status may reflect an omitted economic incentive to locate shopping centers in economically weaker areas, due to low land costs. In order to address this concern, we ran a placebo test employing the number of Super-Pharm drugstores per statistical area, for all the statistical areas in five main cities in Israel (Jerusalem, Tel Aviv, Haifa, Beer Sheva and Rishon LeZion).[9] Super-Pharm is a well-known pharmacy chain in Israel located in almost every shopping center. An identical regression was estimated for the number of Super-Pharm sales points for all statistical areas to assess the mentioned potential bias. Estimating an identical regression, Table 8 shows that the number of Super-Pharm stores is unrelated to socioeconomic status, which is in contrast to the number of Lotto and Toto outlets.

To further address the risk of omitted variables, the statistical areas with the largest number of gambling outlets (the top percentile) were excluded from the empirical analysis. The results remain almost the same and, in particular, the socioeconomic coefficient continues to be negative and significant.[10] The socioeconomic coefficient also continues to be negative and significant when excluding popular Israeli tourist cities (such as Jerusalem, Eilat and Tiberias).[11]

In order to illustrate the supply side policy regarding more addictive forms of gambling that seem more likely to lead to problem gambling, such as electronic gambling machines and "Keno", the sample has been restricted to gambling outlets that sell such products. The regressions presented in Table 9 show that the Lotto has a significant tendency to set up more sales outlets offering dangerous forms of gambling in weaker economic areas.

7. SUMMARY AND DISCUSSION OF THE FINDINGS

This article proposes an innovative and relatively simple methodology for measuring the incidence of gambling expenditure for countries that do not have available or reliable household expenditure surveys. All that is required is the geographical location of each sales outlet, and this data item is available in every country. The necessary complementary information required is the socioeconomic profile of the residents of the smallest geographical unit. To illustrate the proposed methodology, this research merged two information sources in order to estimate the incidence of gambling expenditures in Israel.

[9] Super-Pharm store addresses were taken from the easy.co.il website in January–February 2016; addresses were then assigned to statistical areas using the same method used for Lotto and Toto outlets.

[10] The results will be provided upon request.

[11] The results will be provided upon request.

Table 8
State lottery, Toto and Super-Pharm location policy in the 5 biggest cities
Dependent variable: The number of state lottery, Toto and Super-Pharm outlets in a statistical area

	(1)	(2)	(3)	(4)	(5)	(6)
	State lottery		Toto		Super-Pharm	
Bottom decile	**0.915****	**3.271*****	0.157	**1.254*****	-0.072	0.079
	(0.418)	(0.702)	(0.161)	(0.233)	(0.051)	(0.073)
Decile 2	**1.429*****	**2.215*****	**0.762*****	**1.080*****	0.000	0.063
	(0.445)	(0.525)	(0.209)	(0.234)	(0.065)	(0.075)
Decile 3	**1.619*****	**2.154*****	**1.000*****	**1.238*****	0.048	0.081
	(0.602)	(0.636)	(0.295)	(0.303)	(0.071)	(0.075)
Decile 4	**0.619****	**1.190*****	**0.357****	**0.538*****	-0.024	0.011
	(0.245)	(0.318)	(0.145)	(0.158)	(0.061)	(0.068)
Decile 5	**1.405****	**1.897*****	**0.452*****	**0.597*****	0.048	0.070
	(0.565)	(0.679)	(0.172)	(0.190)	(0.079)	(0.091)
Decile 6	**0.799****	**1.135*****	**0.552*****	**0.643*****	-0.002	-0.003
	(0.338)	(0.386)	(0.181)	(0.185)	(0.064)	(0.069)
Decile 7	**1.008*****	**1.179*****	**0.529*****	**0.538*****	0.068	0.067
	(0.315)	(0.341)	(0.159)	(0.157)	(0.073)	(0.077)
Decile 8	**1.040****	**1.105****	**0.592****	**0.580****	**0.173***	**0.165***
	(0.492)	(0.504)	(0.245)	(0.241)	(0.097)	(0.099)
Decile 9	**0.548****	**0.559****	**0.357*****	**0.373****	0.095	0.096
	(0.251)	(0.266)	(0.136)	(0.146)	(0.077)	(0.079)
Population size (ln)		0.440		**0.465*****		0.077
		(0.282)		(0.145)		(0.049)
Aged 65 or older (%)		0.010		-0.002		-0.001
		(0.030)		(0.012)		(0.005)
Aged 17 or younger (%)		**-0.091*****		**-0.040*****		**-0.007****
		(0.018)		(0.009)		(0.003)
Non-ultra-Orthodox Jews (%)		-0.043		-0.576		0.064
		(0.413)		(0.526)		(0.045)
Ultra-Orthodox Jews (%)		0.550		-0.590		**0.156****
		(0.628)		(0.550)		(0.062)
Muslims (%)		0.513		-0.365		-0.051
		(1.592)		(0.842)		(0.062)
Druze (%)		--		--		--
Size of area (ln)		**0.560*****		**0.263*****		**0.044***
		(0.197)		(0.085)		(0.025)
Industrial area		**6.181*****		**2.144*****		**0.918*****
		(0.446)		(0.199)		(0.056)
Natural area		**-4.503*****		**-1.870*****		**-0.334*****
		(1.082)		(0.427)		(0.128)
Public use area		0.786		0.698		0.204
		(0.664)		(0.594)		(0.206)
Constant	**0.643****	**-8.405*****	**0.262*****	**-5.477*****	**0.095****	**-0.998****
	(0.140)	(3.085)	(0.069)	(1.515)	(0.046)	(0.487)
Observations	422	422	422	422	422	422
outlets	667	667	311	311	54	54
Adjusted R^2	0.012	0.113	0.035	0.149	0.013	0.044

Notes: Omitted group: Socioeconomic decile (upper decile), population composition (ages 18-64), religion (Christians), area type (residential). In the 5 biggest cities there are no statistical areas classified as Druze. Robust standard errors are in parentheses ,*** p<0.01, ** p<0.05, * p<0.1.

Table 9
State lottery location policy: EGM and Keno
Dependent variable: The number of EGM and Keno selling points in a statistical area

	(1)	(2)	(3)	(4)	(5)	(6)
	All statistical areas				Areas with selling points	
Income per equivalent person (ln)				**-0.131*** ** (0.023)		
Socioeconomic index	-0.007 (0.007)	**-0.052*** ** (0.009)	**-0.063*** ** (0.011)		**-0.051** ** (0.024)	**-0.089** ** (0.035)
Population size (ln)		**0.089*** ** (0.027)	**0.095*** ** (0.027)	**0.111*** ** (0.030)		0.117 (0.089)
Aged 65 or older (%)		0.002 (0.002)	0.001 (0.002)	0.000 (0.002)		0.009 (0.006)
Aged 17 or younger (%)		**-0.007*** ** (0.001)	**-0.006*** ** (0.001)	**-0.007*** ** (0.002)		-0.004 (0.005)
Non-ultra-Orthodox Jews (%)			**0.145*** ** (0.019)	**0.149*** ** (0.020)		**0.258*** (0.152)
Ultra-Orthodox Jews (%)			**0.130*** ** (0.039)	**0.118*** ** (0.040)		0.152 (0.193)
Muslims (%)			**0.067*** ** (0.024)	**0.060** ** (0.024)		0.252 (0.165)
Druze (%)			0.043 (0.036)	0.046 (0.037)		
Size of area (ln)			-0.008 (0.008)	-0.009 (0.008)		0.003 (0.030)
Industrial area			**-0.086*** ** (0.017)	**-0.073*** ** (0.020)		
Natural area			0.162 (0.233)	0.172 (0.232)		-0.020 (0.147)
Public use area			0.118 (0.167)	0.120 (0.167)		-0.157 (0.108)
Constant	**0.118*** ** (0.009)	**-0.428** * (0.224)	**-0.507** ** (0.240)	0.500 (0.306)	**1.126*** ** (0.028)	-0.150 (0.893)
Observations	1,581	1,581	1,581	1,550	166	166
Selling points	187	187	187	184	187	187
Adjusted R^2	0.000	0.038	0.040	0.041	0.005	0.000

Omitted group: Population composition (ages 18-64), religion (Christians), area type (residential).
Robust standard errors are in parentheses ,*** p<0.01, ** p<0.05, * p<0.1

Lotto and Toto gambling outlets' addresses were assigned to 1,600 statistical areas in Israel, for which data is available regarding the residents' economic, social and demographic profiles.

Using this unique database, we estimated the impact of socioeconomic status on the number of Lotto and Toto sales outlets. Lotto and Toto managers have a stronger inclination to set up more sales outlets in poor socioeconomic than in wealthier areas. The large number of sales outlets in weak areas is a finding that persists after a series of sensitivity analyses. Socioeconomic status is consistently negative, regardless of whether we limit the sample to only Lotto sales points, only Toto sales points, or sales points where both types of gambling products are sold.

The policy to set up more sales points in weak areas also remains consistently significant when using a non-linear estimation. It was found that both of the legal gambling organizations in Israel tend to set up more sales points in disadvantaged areas; this result remained almost unchanged when central areas, such as shopping centers and tourist areas, were excluded. Moreover, the geographic distribution of Lotto and Toto sales outlets compared to those of Super-Pharm drugstores is significantly different. In particular, Super-Pharm does not set up more stores in poor areas, unlike the Lotto and Toto policy. This reduces the concern that the main finding is driven by the potential incentive to locate shopping centers in weak areas.

The estimation results imply that both gambling organizations choose to set up more sales outlets in low-income areas, as they believe that the local population spends a higher amount of money on gambling than individuals from high-income areas do. In other words, the level of regressivity, evident from the large number of sales outlets in distressed areas, is especially severe. The implicit regressive incidence is bigger than what would have been the case if poor households spent a larger share of their income compared to high-income households.

This approach to examining gambling incidence assumes there is no regulatory limitation on the number of sales points, and that the current number of sales points reflects a steady state equilibrium, resulting from legal gambling organizers operating mainly according to economic considerations in positioning sales outlets. This work shows that both of these assumptions seem reasonable for the Israeli gambling market.

The present study reveals that this methodology must be based on relatively small geographical units. A severe bias was found in measuring the incidence of gambling expenditure in a spatial analysis based on large geographical units, due to the ecological fallacy. The effect of socioeconomic status on the number of gambling outlets is biased upward when employing a larger geographic unit such as a municipality. In other words, using a relatively small statistical area is necessary to uncover the true effect of socioeconomic status on the spatial distribution of gambling outlets.

Researching the actual behavior of gambling operators has important implications for public policy because regulators have a direct impact on the supply side. The large number of gambling outlets in distressed areas clearly shows that the main consideration motivating

legal gambling operators, regarding their choice of where to set up gambling outlets, is profit—at the expense of vulnerable populations. This work implies that gambling organizers are not restrained by the negative consequences to vulnerable groups when choosing where to set up their gambling outlets, even though they exist under a public umbrella.

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