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Nationalist sentiment and lottery markets: Evidence from Catalonia

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Abstract: To what extent nationalist sentiments affect economic behaviour is still an open question. In this paper a study of emerging and competing lottery markets in the same jurisdiction (Catalonia, a Spanish region) is conducted to explore the impact of such nationalistic feelings in the demand for gambling. The use of panel data allows controlling for changing economic and demographic conditions at the province level and their potential effect on the analysed lottery markets. The results from a difference-in-difference regression analysis indicate that a statistically significant but limited impact of the introduction of the new lottery exists, suggesting that the observed shift in the existing market demand may respond, beyond mere economic determinants, to behavioural biases (e.g. identification feeling with the new lottery).

Keywords: nationalism; sentiment bias; lottery demand; difference-in-difference regression.

Introduction

How the nationalist sentiments emerging in certain regions affect the economic activity developed in those regions has not been a subject of much discussion in previous literature. Apart from Shankarmahesh (2006), who explores the concept of consumer ethnocentrism, and Morse and Shive (2011), who analyse to what extent the degree of patriotism in a country affects the level of investment in domestic companies, the evidence on this issue is limited.

Notwithstanding, this kind of sentiment bias can have major implications for individuals' economic decisions. Cheah and Phau (2015) identify economic nationalism as a critical component of nationalistic sentiment, influencing cognitions, attitudes, evaluation and purchase intentions. So consumers can develop stereotypical ideologies on the services and goods in a particular region and exhibit some preferences for home country products.

This concept has been explored to some extent in the gambling literature. In particular, Forrest and Simmons (2008) test the betting market for Spanish football for the existence of a sentiment bias, which occurs when bettors exhibit a strong preference for a particular player or team because their beliefs are based on heuristics rather than rational expectations. Consumer's behaviour will then be biased. This may also refer to people over betting on their home and national team (Gandar et al. 2001).

The market for the Christmas draws of lotteries in Spain exhibits a number of features that make it particularly suited for analysing the influence of nationalist sentiment on economic behaviour. Since the eighteenth century, the Spanish government has operated the Christmas draw of the National Lottery (*El Gordo*)¹ in the whole Spain as a monopoly². In addition, the Christmas lottery market in Spain also includes the Epiphany draw (*El Niño*) which dates back some centuries ago too. However, Catalonia, a Spanish region (Figure 1), started to run its own Christmas lottery draw, *La Grossa de Cap d'Any*, in 2013 becoming the first Spanish region to do this.

(INSERT FIGURE 1 AROUND HERE)

Catalonia has a specific identity apart from the other Spanish regions. It is a peripheral community with full ethnic/cultural potential, distinct historic personality and important growth poles and industrial zones (Moreno 2002). This strong character, which is expressed in the fact that it possesses its “own” language (a co-official language alongside Spanish), politically translating into the presence of nationalist parties with a significant degree of success (García-Álvarez and Trillo-Santamaría 2013), has been projected in the raise of a single regional self-identification in the form of a Catalan nationalism.

The launch of the Catalan lottery could be supported by a demand based on the previously mentioned biases in consumer behaviour linked to emerging nationalist sentiments. With this setting in mind, the main goal of this paper is to investigate whether such relationship between lottery consumption (gambling) and nationalist sentiment exists.³ The abovementioned setting provides a natural experiment in which a difference-in-difference identification strategy can be applied. Catalan provinces can be considered as the treatment group and the rest of Spanish provinces as the control group.

Moreover, lotteries themselves are challenging markets to understand and model. Beyond the interest these markets may have in economic analysis – playing the lottery seems to be economically irrational – they can be considered as an alternative method for the government to raise revenue. For a comprehensive, but somewhat dated discussion of lotteries, see Clotfelter and Cook (1989). For an analysis of the factors affecting lottery adoptions, see Alm et al. (1993) or Jackson et al. (1994). A more recent review of the literature could be found in Grote and Matheson (2011) and Pérez and Humphreys (2013).

A number of previous studies have examined the substitution between different lottery games and between lottery and other forms of gambling. Also, research interested in competition

¹ *El Gordo* is the term commonly used by people to refer to both the jackpot and the lottery itself and this is why we use this name in the paper. But there is also a lotto type state-operated game which is called *El Gordo de la Primitiva* and that has nothing to do with the Christmas draw of the Spanish National lottery.

² Governments have authorized lotteries primarily as a means of generating non-tax revenues. These lottery revenues are often earmarked for particular public purposes (good causes) such as education, or, in general, economic development. This use of lotteries as a public finance tool has justified the state regulation of these markets, sometimes operated under a public monopoly organization.

³ Cuadras-Morató and Raya (2016) analyse how the conflict between Catalonia and Spain affected the sales of Catalan sparkling wine (*cava*) in both Catalonia and the rest of Spanish regions. Their results provide evidence of different reactions in different territories.

between jurisdictions in the context of cross-border shopping for state lottery tickets. Tosun and Skidmore (2004) and Knight and Schiff (2012) respectively provide a comprehensive review of this literature. Even though the theoretical discussion suggests that current operator lottery sales are likely to decrease with the introduction of a new lottery operator (Tosun and Skidmore 2004), little empirical research examines competition between lotteries in the same jurisdiction and very little examines rival lottery markets formation in the gambling industry. However, this may pose a serious threat to state lottery sales, clearly deserving deeper analysis.

The novelty here is not just in analysing two competitive/alternative gambling products (like in Grote and Matheson 2006 or in Stover 1990) but in focusing on the dynamics of the lottery market structure when a new competitor offering a homogeneous (similar) lottery product arises. Of course, it would be certainly expected that a new entrant into a market previously dominated by a monopoly would reduce sales for the monopolist. As pointed out by Schaumans and Verboven (2015), there is market expansion as a consequence of a new entry in an industry with homogeneous products, holding prices constant, whenever demand is decreasing in the common price. Here it is also the case that traditional operator lottery sales appear to be influenced by the relative number of lottery players showing a preference bias for the domestically operated game (rival game). Furthermore, an assessment of effect in total market sales is offered as well (i.e. if sales of new competitor outweigh the potential decrease in sales of the traditional operator).

All in all, this study specifically contributes to the literature on the determinants of the demand for lottery by introducing a new focus on the impact of nationalistic feelings in lottery sales (how social behaviour for groups of nationalistic consumers affects the demand for the traditional lottery product) and more broadly to the literature of competitive markets by measuring the degree to which the state-authorized lottery operator sales are affected by the introduction of a new competitor at the regional level.

The remainder of the paper is structured as follows. In Section 2, we provide context for the lottery products we consider. Section 3 describes the data. In Section 4, we build our model. We go on to work with a model where lottery sales in a province are a function of the demographic and socio-economic characteristics of that province. The estimates themselves are presented in Section 5. The final section of the paper derives some conclusions.

Background and setting of lottery games in Spain

The Christmas Draw of the Spanish National Lottery

The Christmas draw of the Spanish National Lottery, so called “*El Gordo*”, could be considered as a unique lottery: “75% of Spaniards play, sharing tickets, and every year at Christmas, 0.3% of the Spanish GDP is at stake.” (Bagues and Esteve-Volart 2016). It takes place every year on December 22 and, with the exception of some multi-state lotto games in the United States (e.g. Powerball and Mega Millions), it is the largest lottery draw in the world, offering in the last edition of 2020 a huge jackpot of 688 million euros⁴.

It is really a national event in Spain, in which society is involved, in terms of individual purchases, syndicate play - group purchase and sharing of lottery tickets -, and distribution of

⁴ This is the total amount of the jackpot prize that would correspond to all the issued tickets of the winning number. It is usually shared by a significant number of lottery winners. For instance, in the 2018 draw, the jackpot winners were spread across six different Spanish cities: *Badajoz, Bilbao, Cuenca, Gernika, Granada and Huesca*.

large volumes of lottery tickets by associations and clubs of various kinds that, with their commissions, get resources to finance their activities the rest of the year. Lines of people waiting to buy a ticket in some “lucky stores” (Guryan and Kearney 2008) are becoming more and more common. It should be noted that tickets may be available each year as early as July.

In Spain the exclusive management of the state-owned games, including the Spanish National Lottery, is the responsibility of SELAE - *Sociedad Estatal Loterías y Apuestas del Estado*. The Christmas draw accounts for 53.6% of all annual sales of the Spanish National Lottery. If all the tickets are sold, the total of the issuance amounts to 3,440 million euros, of which 2,400 million are allocated to prizes (payout rate is about 70 per cent).

The draw is based on tickets which have 5-digit numbers (ranging from 00000 to 99999), just like any regular drawing of the Spanish National Lottery. Due to the enormous popularity of the game, each set of numbers on each of the tickets is sold multiple times; in several so-called “series” (the last 2020 edition of the draw had 172 series for each of the 100,000 tickets). Between series, there is no difference in prize-money. That is, a prize on a 5-digit number is paid on that number in every unit. Therefore, the series number is merely an administrative one. Price of an entire ticket costs 200 euros each “serie”. Because this may be too expensive, the tickets are usually sold as tenths (the price of a tenth is then 20 euros). On a private basis, or through associations and other organizations, it is also possible to buy or be given even smaller portions of one tenth. Usually, the price of those portions is incremented by a supplement that is paid as a donation to the intermediary organization. So many organizations buy tenths, divide them up and sell them as participations to their customers or employees. Anyone holding a participation of a winning ticket will be entitled to the corresponding share of the prize amount.

The jackpot prize amounts to 4 million euros to each “serie” of the winning number (400,000 euros to the tenth), which is equivalent to a return of 20,000 euros of prize for every euro staked. There is also a second prize of 1.25 million euros (125,000 euros to the tenth) and a third prize of 500,000 euros (50,000 to the tenth). In addition, there are many other small prize categories.

The Epiphany Draw of the Spanish National Lottery

The Epiphany draw of the Spanish National Lottery, also popularly known as “*El Niño*”⁵, is one of the two great non-regular draws of the Spanish National Lottery with sales accounting for 13% of National Lottery revenues. In 2021 this draw sales recorded 725 million euros. It takes place every year on January, 6 and the last edition (2021) jackpot prize equalled 2 million euros.

The draw has a different prize structure but a very similar design to that of *El Gordo*. However, only 50 series for each of the 100,000 5-digit numbers are issued. This accounts for 1,000 million euros. The take out rate is 30 per cent, so 700 million euros are offered in different prize tiers. As in the case of the Christmas draw, the price of a tenth is 20 euros.

⁵ The Epiphany draw is known by Spaniards as *El Niño* for two main reasons: historically, its antecedent was a raffle held between 1878 and 1818 to raise funds to build the children's hospital of *Niño Jesús* in Madrid; and, basically, because in Spain the Epiphany is mainly called the Children's Day – it is when children receive their biggest presents in the year. Child is the English word for Spanish *Niño*.

El Niño players are consistently more than 40% of residents in Spain – over 16 million lottery buyers (Cases et al., 2018). Sales come, in part, from reinvesting small prizes (specially the refund-prize⁶) from the Christmas draw. So demand for *El Niño* is strongly linked to the outcome of *El Gordo* draw.

“La Grossa de Cap d’Any”

“La Grossa de Cap d’Any” is a lottery draw held annually since 2013 on Catalonia on December, 31. It is operated by *Loteria de Catalunya*, a public company created in 1986 dependent on the Catalan regional government.

The stated purpose of the introduction of the draw was to increase the public revenue to be devoted to social projects. It is held on a date very close to both the Christmas draw and the Epiphany draw of the Spanish National Lottery. Thus, Catalonia becomes the first Spanish autonomous community operating its own Christmas lottery in a competitive market with the national ones.

There are 100,000 numbers available (00000 to 99999) and 60 tickets of each are sold. Each ticket has a price of 5 euros. The payout rate is 69.6 per cent of revenue, while between 16 per cent and 20 per cent of revenue is allocated to childcare programs. *“La Grossa”* offers various prize categories. Jackpot winners will receive 100,000 euros per ticket, so a return of 20,000 euros per euro gambled. There are other minor prizes, including a second tier prize of 6500 euros per euro, and a third tier prize of 3,000 euros per euro. The prize structure looks very much similar to that of *El Gordo* and, in particular, the gain per euro gambled for the jackpot winners is the same in both lottery draws.

The Setting

The scenario that arises is that of a new lottery product competing in the same market with established draws with a very similar design and almost homogeneous characteristics. In the particular case of *El Gordo* and *La Grossa* and in terms of the jackpot, the same return per euro staked is offered. It should be noted that both are passive lottery games in the sense that players buy a lottery ticket with numbers already printed on it and that the jackpot is predetermined, no matter the sales level. There is a consensus in the previous economic literature, including the Spanish case, that the main determinant of lottery demand is the jackpot (Forrest et al. 2002; García et al., 2013), and here the amount of jackpot per euro gambled is exactly the same for the two previously mentioned lottery products.

Although in the case of *El Niño* the amount of the jackpot prize in terms of ticket price is exactly the half to that of the other two draws, it is expected that its demand also suffers from the introduction of *La Grossa* according to its interrelation with the Christmas draw. Moreover, the date for *La Grossa* draw, placed between the Christmas and the Epiphany draws, may affect somehow the purchase pattern of those lottery players who used to buy *El Niño* tickets by reinvesting *El Gordo* small prizes. In any case, the inclusion of this draw in the analysis may allow to analyse from a global perspective the final outcome of the new lottery product (*La Grossa*) introduction in terms of the total Christmas lottery market sales.

⁶ All lottery tickets that match their last digit with that from the winning number can claim for the refund of the ticket price.

Cases et al. (2018) analysed the purchase of *La Grossa* in Catalonia. They explained that the number of buyers (about 41.5% of residents in Catalonia in 2017) seems to be driven by a feeling of identity affirmation. In particular, more than half claimed they played to *La Grossa* because it seems good that Catalonia has its own lottery. On the other hand, the most usual reasons for not buying *La Grossa* included aversion to gambling activities and the perception of greater prizes in *El Gordo*.

It should be acknowledged that defining a single variable capturing what can be understood as nationalist sentiment is honestly complicated. In the empirical approach here it is understood as a global term encompassing a wide-ranging number of issues, including political conflict, domestic products consumption, and linguistic identity, among others. In fact, although Catalan is, jointly with Spanish, the official language in Catalonia and enjoys widespread use, Spanish has significant presence.⁷

As for the political conflict point of view, it specially raises when elections take place. In particular, the support for secession sharpened after the regional elections of 2015 where a coalition of independence supporters called *Junts pel Sí* (Together for Yes) won a majority of Catalan parliament.

Finally, in the case of *La Grossa* all the profits are fully devoted to finance social programs addressed to elder people, handicapped persons and centers taking care of children. Apart from the previously noted feeling of national identity issue, and the preference Catalan consumers may have for a lottery that is advertised and issued in their own language, this could also contribute to and so be caught by the considered here nationalist sentiment.

All this is what it is identified in the econometric model as a differential Catalan reality when estimating the effect of the introduction of *La Grossa* on sales of *El Gordo* in Catalonia.

Data

We observe data on sales of the Christmas and the Epiphany draws of the Spanish National Lottery for each of the 52 provinces of Spain between 2004 and 2016 (2005 and 2017 for *El Niño*). We have also collected data on sales of *La Grossa* in the four Catalan provinces (*Barcelona, Girona, Lleida* and *Tarragona*). So our baseline data set consist of a balanced panel of 52 provinces observed during 12 years.

(INSERT FIGURE 2 AROUND HERE)

According to SELAE information, the average yearly sales revenue of *El Gordo* is about 2,600 million euros, around 6.5% of the total amount of gambling revenues in Spain. However, the evolution of the number of lottery tickets sold in the Christmas drawn has shown a considerable variability over time. Figure 2 shows *El Gordo* and *El Niño* sales revenue through the considered sample period. Substantial variability in lottery spending can be observed, with sales ranging from 2,867 million euros in 2007 to 2,362 million euros in 2013 in the case of *El Gordo* and from 779 million euros to 604 million euros for *El Niño* in the same time interval. It is clear that the lottery has also suffered the consequences of the financial crisis starting in 2008 with a significant decline between 2007 and 2013.

⁷ According to the last figures from the *Survey on language uses of the population* in Catalonia, Catalan is the usual language for 36.1% of the population and Spanish for 48.6%.

(INSERT FIGURE 3 AROUND HERE)

With respect to the provincial variability of *El Gordo*⁸, Figure 3 plots the average sales per year per capita in each province (including autonomous cities) from 2004 to 2016. The overall average is 60.95 euros, with two provinces (*Lleida* and *Soria*) having a particularly high average (well above 170 euros) - that most likely corresponds to outliers due to the effect of sales made to residents from other provinces.

The evidence from Figure 2 and Figure 3 shows that the dependent variable in our empirical model (sales revenue) has enough variability in both dimensions to allow us to distinguish between temporal and geographical effects.

As for Catalonia, total sales of *El Gordo* in that region account for about 16% of the total sales of the Christmas lottery draw in Spain, although its evolution over time has also experienced some variability, as shown in Figure 4.

(INSERT FIGURE 4 AROUND HERE)

With regard to per capita sales in the four Catalan provinces, apart from the exceptional case of *Lleida*, they were significantly below the national average ranging between 34.75 euros (*Tarragona* in 2013) and 57.72 euros (*Barcelona* in 2007).

As for *La Grossa*, equivalent statistics are reported in Figure 5. Although a certain decline in *La Grossa*'s total sales has been observed since its introduction in 2013, there is a significant variability among the four Catalan provinces. Per capita sales seem to decrease in *Barcelona*, while the rest of the provinces experience (on average) the opposite trend. A special case is *Girona*, where per capita sales of *La Grossa* sharply increased in 2014.

(INSERT FIGURE 5 AROUND HERE)

As mentioned above, the case of *Lleida* deserves a special consideration. In the 2004 draw, all *El Gordo* lottery tickets that won the jackpot were sold in the town of *Sort* (*Lleida*), in just a single outlet (*La Bruixa d'Or*). The total amount of the prize, which reached 390 million euros, was spread over various regions (more than half of the tickets were sold online and the rest were distributed to lottery players in *Mallorca*, *Madrid* and *Jaen*). The previous year, the same outlet had distributed prizes for an amount of 150 million euros. Actually, that lottery outlet in *Sort* is famous for selling the winning tickets of the Christmas lottery jackpot on three occasions in 2003, 2004 and 2007. Thus, it is the one that sells more *El Gordo* lottery tickets in Spain.⁹

In line with Guryan and Kearney (2008) and Baker et al. (2016), who provide evidence that jackpot wins in particular geographical areas have the potential to elevate sales for an extended

⁸ Even though the descriptive analysis here focuses on *El Gordo*, it would be practically applicable to the case of *El Niño*. Corresponding figures are available on request.

⁹ Notice that, besides selling winning tickets several times, the name of the town, *Sort* (Luck), and the name of the outlet, *La Bruixa d'Or* (The Golden Witch), are also contributing to the attractiveness of this place for lottery consumers.

period, the sequence of lottery prizes won for tickets sold in Lleida, undoubtedly has contributed to dramatically boost sales on that Catalan province.

(INSERT FIGURE 6 AROUND HERE)

In fact, when comparing the evolution of *El Gordo* sales in *Lleida* with that of similar Spanish provinces either in per capita income (e.g. *Navarra*) or in population (e.g. *Cáceres*), huge differences are observed (Figure 6). Therefore, this province should deserve special consideration when modelling lottery sales in Spanish provinces.

Model specification

The available information has a panel data structure which allows observing Christmas and Epiphany draws lottery sales at the province level before (2004-2012) and after (2013-2016) the new Catalan lottery game (the treatment) is introduced. The outcome variable is the (log) sales of lottery draw(s) and we will be using different definitions of this variable: only *El Gordo* sales; *El Gordo* plus *La Grossa* sales, the draws which are competing both in terms of the name¹⁰ and the (same) prize structure; or *El Gordo* plus *La Grossa* plus *El Niño*, the three big Christmas draws performed in the short period of less than two weeks, although as mentioned *El Niño* has a different prize structure compared to the other two draws.

As previously stated, we use a difference-in-differences model with the following specification for the different estimations based on the alternative definitions of the dependent variable (lottery sales):¹¹

$$\ln Y_{it} = X'_{it}\beta + \sum_{s=2005}^{2016} \tau_s DT_{s,t} + \alpha_i + \sum_{k=B,G,(L),T} \theta_k \sum_{s=2013}^{2016} P_{k,i} DT_{s,t} + u_{it} \quad (1)$$

where Y_{it} is the outcome variable (lottery sales) for province i in period t ; α_i is the individual (provincial) effect; $DT_{s,t}$ is a dummy variable equal to 1 when $s=t$ and 0 otherwise, capturing the time effect; $P_{k,i}$ is a dummy for the k -th Catalan province equal to 1 when $k=i$ and 0 otherwise ($B = Barcelona$, $G = Girona$, $L = Lleida$, $T = Tarragona$); X_{it} is a vector of covariates which could affect the outcome variable but which are not affected by the treatment, although they could be associated with belonging to the treatment or the control group; and u_{it} is the error term. Notice that the parameters of interest, measuring differential the effect of the introduction of *La Grossa* in the sales in Catalonia compared to the other Spanish provinces, are θ_k , i.e. the coefficients of the interactions terms between the dummies for each of the Catalan provinces and the dummy defined for the period 2013-2016 after the introduction of *La Grossa* in Catalonia.

We include two covariates in the final specification: the provincial GDP and the population, to control for income effects and the size of the market, respectively. These are changing

¹⁰ Both “*Gordo*” and “*Grossa*” words mean “fat” but the first one is male in Spanish and the second one female in Catalan.

¹¹ Notice that this a particular case of a model which provides a rationale for the use of synthetic control methods in comparative case studies (Abadie et al. 2010) where the effect of the unobserved individual effects is constant through time.

economic and demographic conditions among provinces. Sales revenue and provincial GDP were deflated by the provincial consumer price index to transform them in real terms. Consequently, these two variables are measured in euros of 2016.

Basic descriptive statistics of the variables used in the estimation of the demand equations are reported in Table 1. Information is presented by distinguishing between the treatment (Catalan provinces) and the control (non Catalan Spanish provinces) groups and between the pre- (2004-2012) and post-treatment (2013-2016) periods.

From descriptive statistics in Table 1 some informative evidence can be derived. There are some clear elements of comparison between Catalan and non Catalan provinces in Spain in terms of the analysed variables. First, when considering the whole period (2004-2016), for the non Catalan provinces there are 3.19 million euros of lottery sales per one thousand euros of GDP in real terms. This figure reduces to 2.65 in Catalan provinces and is even smaller when excluding *Lleida* (2.36). Expenditure on lottery seems to be less responsive to income in Catalan provinces and this is more evident when excluding *Lleida* because of the large proportion of lottery sales in *Lleida* made from other provinces, as mentioned above. Second, *El Gordo* sales are 3.68 times *El Niño* sales in non Catalan provinces, but this gap is more relevant in Catalan provinces (4.53 times) even when excluding *Lleida*, whose sales are more concentrated in *El Gordo* (4.32 times). Third, population has increased in both groups of provinces between the pre- and post- period after the introduction of *La Grossa*, not showing very remarkable differences. Fourth, the GDP per capita is substantially greater in Catalan provinces (29.08 thousand €) than in the rest of Spanish provinces (23.33 thousand €), i.e. about 25% higher. There is also a significant decrease in the GDP per capita before and after 2013 (around 9% decrease) for both groups of provinces.

(INSERT TABLE 1 AROUND HERE)

Table 1 also provides enough information to obtain a preliminary estimate of the effect of the introduction of *La Grossa* in the total Christmas lottery sales of the treatment (Catalan provinces) and the control group (rest of Spanish provinces) by using the simple difference-in-differences estimator. The average lottery sales per capita in Catalonia are reduced by 16.94 € after the introduction of *La Grossa*, whereas this reduction is just 12.70 € in the non Catalan provinces, meaning that the effect in the treatment group is negative, although not statistically significant. However, this basic approach does not take into account three relevant aspects. First, unobserved provincial effects are not the same within the Catalan provinces and, similarly, within the non Catalan provinces, as implicitly assumed in the previous exercise. Second, by using the averages in both periods we are not taking into account the non-stationary behaviour of the series in the analysis. Third, there are significant differences in terms of GDP and population between the provinces of the treatment and the control groups. Fourth, the province of *Lleida* is included in the calculation of the previous figures. The first three points are behind the justification for the specification in Equation (1), where time-invariant provincial effects, a flexible specification for the time effects and the two covariates we mentioned are included in the final specification. Not taking into account the previous considerations would have reduced the model to be estimated to:

$$\ln Y_{it} = \beta_0 + \gamma C_i + \delta DPost_t + \theta(C_i * DPost_t) + u_{it} \quad (2)$$

where C_i is a dummy variable equal to 1 for a Catalan province and 0 otherwise; $DPost_t$ is a dummy variable equal to 1 if $t = 2013$ to 2016 , and 0 otherwise; and θ is the parameter of

interest measuring the effect of the introduction of *La Grossa* in total Christmas lottery sales in Catalonia.

Results

The different specifications of the proposed model are estimated by using the within-group estimator which allows to control for the correlation of the unobserved effects at the province level and the explanatory variables. Using a Hausman's test we reject the null hypothesis of no correlation between the individual effects and the explanatory variables. Results for three models, which differ in terms of the definition of the dependent variable, are displayed in Table 2, where the parameters of interest are those of the interaction terms between the dummy capturing the period after the introduction of *La Grossa* (2013-2016) and the dummies for the Catalan provinces.

In the first column we report the estimation results of the specification in equation (1), where the dependent variable is the log of the *El Gordo* sales. According to these results the introduction of *La Grossa* has led to a significant displacement of the Spanish lottery market in Barcelona and Girona, but not in Tarragona. The estimated fall in *El Gordo* sales is 11.3% and 8.6% in the first two provinces, respectively, but the fall in Tarragona (5.8%) is only significant at 10%. This overall fall can be explained by Catalan customers switched from one product to the other because simply playing *La Grossa* they can win the same prize-per-euro as in *El Gordo*. But also because they feel more identified with the Catalan lottery and therefore their behaviour as consumers is driven, beyond the expected return per euro staked - which is exactly the same for both products - by some kind of nationalist sentiment bias. When including *Lleida*, the decrease in *El Gordo* sales in this province is even more important compared to that in the other Catalan provinces (see Figure 3 as illustrative), which can be explained by a much more significant drop in lottery purchases made in *Lleida* from other Spanish provinces. A possible explanation (among others) for this last result could be attributed to the fact that the effect of the 2008 financial crisis was affecting more the purchase of lottery tickets made outside the province. As we mentioned, the high level of sales in *Lleida* is explained by the amount of lottery tickets bought by players from other provinces because of the historical success of this province in previous draws. This is because of this outlier situation that we are not including *Lleida* in the estimates reported in Table 2.

(INSERT TABLE 2 AROUND HERE)

In any case the observed shift in the demand for *El Gordo* in the mentioned Catalan provinces can be considered "relatively small" because *El Gordo* sales level is maintained quite well by determinants such as the perception of a greater jackpot in *El Gordo* (even though the gain per euro played is the same for both draws, the amount of the jackpot in absolute terms is 400,000 euros in *El Gordo* when it is 100,000 euros in *La Grossa*), and even because traditions and the relevance of syndicated play (Garvía 2007).

In order to disentangle whether the reason behind the effect of the introduction of *La Grossa* is just the result of a substitute entering to the market or the consequence of a national sentiment bias, we reestimate the model in Equation (1) by defining the dependent variable as the log of the sales of *El Gordo* plus the sales of *La Grossa* since both draws are very close in time and can be considered as perfect substitutes in terms of the offered prize-per-euro. Results in the second column show that in this case the introduction of *La Grossa* seems to lead to a

significant positive effect on sales in the case of Girona compared to what happens in the other non Catalan Spanish provinces¹². Sales seem to be multiplied by a factor of 1.303 ($e^{0.265}$).

As an additional check, we reestimate the same model but redefining the dependent variable as the log of the total sales for all the examined Christmas draws (*El Gordo*, *La Grossa* and *El Niño*), given that the three draws are performed in just 15 days and that even *La Grossa* draw just takes place in between the other two. As shown in the third column in Table 2, even when considering the sales of *El Niño*, there is still that positive effect on total sales linked to the introduction of *La Grossa* in the case of *Girona*, but not for the other two Catalan provinces.

Despite the fact that these results are limited to a single Catalan province, they could be supporting the argument of nationalist sentiment having an influence on lottery sales to the extent that *Girona* is the province with a major presence of Catalan national political parties in both the Spanish general and the Catalan regional elections. In particular, in the two elections after the introduction of *La Grossa*, *Girona* was the province with the highest proportion of votes for parties in favour of Catalan independence (48.5% in the Spanish general elections in 2015 and 64.6% in the Catalan regional elections in 2015, which compare with 31.1% and 47.7% for all the Catalan provinces, respectively).¹³

Although we aim to assess the effects of the introduction of *La Grossa* in the Catalan lottery market, we also comment on the results of the control variables included in all model specifications in Table 2. Since the model we are estimating corresponds to a demand equation, we included, as previously mentioned, a proxy for the income at the province level (GDP) and a variable capturing the size of the market (population), both having geographical and time variation. However, since both *La Grossa* and *El Gordo* have the same prize structure and there is no price variability between regions, no price variable is included in the specification. The expected time variability (in real terms) is captured by the time dummies.

The results for all the considered specifications show a positive and significant effect for the income variable, with an elasticity clearly below one (i.e., the Christmas lottery is a normal good, although the demand is not very sensitive to changes in income). In addition, the estimated income elasticities show, as the literature consistently finds since the seminal work of Clotfelter and Cook (1990) (see, among many others, Combs and Spry, 2019; Gandullia and Leporatti, 2019; Han et al., 2017), that sales revenue increase less than proportionately with income (GDP), which makes *El Gordo*, *La Grossa* and *El Niño*, as an implicit tax, regressive.

With respect to the population variable, a negative effect is obtained. We do not reject the null hypothesis of the GDP per capita being the relevant variable. It must be pointed out that, although population has variability in both dimensions (provinces and time), part of the geographical variability of the population is also captured by the fixed province-effects.

Our model specifications also include categorical variables for year to account for changes in the economic environment and other time-effects. The estimate coefficients clearly reflect the

¹² It must be pointed out that these results hold if we use a linear, instead of a log linear, specification for the demand equation.

¹³ These figures correspond to the votes obtained by the coalitions *Esquerra Republicana de Catalunya-Catalunya Sí*, and *Democràcia i Llibertat* in the Spanish general elections and by the coalitions *Junts pel Sí* and *Candidatura d'Unitat Popular* in the Catalan regional elections.

impact of economic cycle (particularly the 2008 financial crisis) on lottery sales, it does not matter the definition of the dependent variable, as it was pointed out above (Figure 2).

Conclusions

A number of studies have examined the substitution between different lottery games and between lottery and other forms of gambling. Little research examines competition between lotteries in the same jurisdiction and very little examines rival lottery markets formation in the gambling industry.

In this paper, a difference-in-difference approach is used to examine competition between lottery agencies in the same jurisdiction. The focus here is on a new operator offering a similar lottery product and the goal is to analyse whether the introduction of that new operator in the market has significant effects on both sales of the traditional operator and total market sales. In particular, it aims to measure the impact of introducing a new regional lottery (*La Grossa*) in the Catalan lottery market and, specifically, to test whether a displacement effect exists in terms of sales of the Spanish National Lottery for the Christmas draw by estimating an empirical model of lottery sales by province, using fixed effects and province-year characteristics (population, income). An evaluation of the effect in total market sales is additionally offered to test whether sales of *La Grossa* exceed (or not) the potential decrease in sales of the Spanish lottery.

In terms of competition between lottery agencies, the empirical findings show that the introduction of the Catalan Christmas lottery draw caused a relatively small negative impact on sales of the traditional Spanish Christmas lottery draw in Catalonia. In particular, *El Gordo* sales revenue in the Catalan provinces experienced a decrease, in particular in Barcelona and Girona, since *La Grossa* started to operate. This limited drop in sales is conditioned by the relevance of *El Gordo* demand determinants such as the perception of a greater jackpot, traditions and syndicated play.

The fact that the shift in the demand for *El Gordo* responds to something more than mere socio-economic factors may be related to behavioural biases linked to nationalist sentiments and likely caused by linguistic identity, political conflict, domestic products consumption, among other issues related to a differential Catalan reality. This argument is particularly reinforced by *Girona* – the Catalan province in which nationalist parties achieved the most political success in last elections – where a positive significant effect found in terms of total market sales when *La Grossa* was introduced. Nationalist sentiment does not seem to increase the whole market in all the Catalan provinces, but "simply" causes consumers to switch from one product to another.

Notwithstanding, the conceptual term of nationalism sentiment may itself deserve a further discussion. Here it is identified in the econometric model by the interaction terms between *La Grossa* introduction indicator and the Catalan provinces dummy variables. But maybe there could be alternative approaches to measure what can be really classified as a nationalist sentiment effect. Anyway, why national sentiments seem to drive so differently the demand for lottery across different regions deserves deeper attention in future research. It may also be of interest to extend this analysis (whether nationalist sentiment influences economic behaviour) to other markets.

For the Catalan lottery operator (*Loteria de Catalunya*) this finding should be exploited in their media campaigns so even more lottery players can be attracted to the Catalan product and boost their sales. In terms of SELAE, this result must be interpreted with caution and, in any case, can serve as a warning that other Spanish provinces may follow Catalonia in introducing their own lotteries in the Spanish gambling market. In any case, this paper leads to a better understanding of the dynamic and macro-behaviour of one of the most popular lottery markets in the European gambling industry. The findings here are relevant as they address questions about the regional dimension of lottery markets, regarding the sustainability of the state model and, even, the welfare implications of state-lottery financed public expenditures, which remains an important policy issue for state government finance.

References

- Abadie, A., Diamond, A., and Hainmueller, J. (2010). Synthetic control methods for comparative case studies: Estimating the effect of California's tobacco control program. *Journal of the American Statistical Association*, 105, 493-505.
- Alm, J., McKee, M., and Skidmore, M. (1993). Fiscal Pressure, Tax Competition, and the Introduction of State Lotteries. *National Tax Journal*, 46, 463-76.
- Bagues, M., and Esteve-Volart, B. (2016). Politicians' Luck of the Draw: Evidence from the Spanish Christmas Lottery. *Journal of Political Economy*, 124, 1269-1294.
- Baker, R., Forrest, D., and Pérez, L. (2016). The compatriot win effect on national sales of a multicountry lottery. *Journal of the Royal Statistical Society: Series C (Applied Statistics)*, 65, 603-618.
- Cases, J., Gómez-Yañez, J., Gusano, G., and Lalanda, C. (2018) "IX Informe Percepción social sobre el Juego de azar en España 2018, IPOLGOB-UC3M." Universidad Carlos III. Madrid.
- Cheah, I., and Phau, I. (2015). Conceptualising consumer economic nationalistic tendencies: scale development and validation. *The International Review of Retail, Distribution and Consumer Research*, 25, 313-331.
- Clotfelter, C., and Cook, P. (1989). *Selling hope: State lotteries in America*. Harvard University Press.
- Clotfelter, C., and Cook, P. (1990). On the economics of state lotteries. *Journal of Economic Perspectives*, 4, 105-119.
- Combs, K., and Spry, J. (2019). The effects of lotto game changes and large jackpots on income elasticities and sales. *Contemporary Economic Policy*, 37, 261-273.
- Cuadras-Morató, X., and Raya, J. (2016). Boycott or *Buycott*?: Internal Politics and Consumer Choices. *B.E. Journal of Economic Analysis & Policy*, 16, 185-218.
- Forrest, D., and Simmons, R. (2008). Sentiment in the betting market on Spanish football. *Applied Economics*, 40, 119-126.

- Forrest, D., Simmons, R., and Chesters, N. (2002). Buying a dream: Alternative models of demand for lotto. *Economic Inquiry*, 40, 485-496.
- Gandar, J., Zuber, R., and Lamb, R. (2001). The home field advantage revisited: a search for the bias in other sports betting markets. *Journal of Economics and Business*, 53, 439-453.
- Gandullia, L., & Leporatti, L. (2019). Distributional effects of gambling taxes: empirical evidence from Italy. *The Journal of Economic Inequality*, 17, 565-590.
- García, J., Pérez, L. and Rodríguez, P. (2013). La (inelástica) demanda de juegos lotto. *Revista de Economía Aplicada*, 21, 91-113.
- García-Álvarez, J., and Trillo-Santamaría, J. (2013). Between regional spaces and spaces of regionalism: cross-border region building in the Spanish ‘state of the autonomies’. *Regional Studies*, 47, 104-115.
- Garvía, R. (2007). Syndication, institutionalization, and lottery play. *American Journal of Sociology*, 113, 603-652.
- Grote, K., and Matheson, V. (2006). Dueling Jackpots: Are Competing Lotto Games Complements or Substitutes?. *Atlantic Economic Journal*, 34, 85-100.
- Grote, K., and Matheson, V. (2011). The Economics of Lotteries: A Survey of the Literature (No. 1109). College of the Holy Cross, Department of Economics.
- Guryan, J., and Kearney, M. (2008). Gambling at lucky stores: Empirical evidence from state lottery sales. *American Economic Review*, 98, 458-73.
- Han, K. C., Lee, S., Suk, D. Y., & Sung, H. M. (2017). Jackpot rollover and lottery regressivity. *Journal of Gambling Business & Economics*, 11, 7-26.
- Jackson, J., Saurman, D., and Shughart II, W. (1994). Instant winners: Legal change in transition and the diffusion of state lotteries. *Public Choice*, 80, 245-263.
- Knight, B., and Schiff, N. (2012). Spatial competition and cross-border shopping: Evidence from state lotteries. *American Economic Journal: Economic Policy*, 4, 199-229.
- Moreno, L. (2002). Decentralization in Spain. *Regional Studies*, 36, 399-408.
- Morse, A., and Shive, S. (2011). Patriotism in your portfolio. *Journal of Financial Markets*, 14, 411-440.
- Perez, L., and Humphreys, B. (2013). The ‘who and why’ of lottery: empirical highlights from the seminal economic literature. *Journal of Economic Surveys*, 27, 915-940.
- Schaumans, C. and Verboven, F. (2015). Entry and competition in differentiated products markets. *Review of Economics and Statistics*, 97, 195-209.
- Shankarmahesh, M. (2006). Consumer ethnocentrism: An integrative review of its antecedents and consequences. *International Marketing Review*, 23, 146-172.

Stover, M. (1990). Contiguous state lotteries: substitutes or complements?. *Journal of Policy Analysis and Management*, 9, 565-568.

Tosun, M., and Skidmore, M. (2004). Interstate competition and state lottery revenues. *National Tax Journal*, 57, 163-178.

Table 1. Descriptive statistics

	2004-2016	(A) 2004-2012	(B) 2013-2016	(B)/(A) %
	Whole sample	Before <i>La Grossa</i>	After <i>La Grossa</i>	
<i>All Spanish provinces</i>				
<i>El Gordo</i> sales (million €)	2802.99	2933.06	2510.35	-14.41
<i>El Niño</i> sales (million €)	742.21	789.68	635.39	-19.54
<i>La Grossa</i> sales (million €)	9.60	0.00	31.20	
Total lottery sales (million €)	3554.80	3722.74	3176.93	-14.66
Ratio <i>El Gordo/El Niño</i> sales	3.79	3.72	3.95	
GDP (thousand million €)	1112.02	1135.56	1095.04	-3.57
Population (millions)	45.89	45.63	46.48	1.86
GDP pc (thousand €)	24.25	24.90	22.78	-8.51
Total lottery sales/GDP	3.19	3.28	3.00	
Total lottery sales pc (€)	77.61	81.72	68.35	-16.36
<i>Non Catalan Spanish provinces</i>				
<i>El Gordo</i> sales (million €)	2346.81	2441.40	2133.97	-12.59
<i>El Niño</i> sales (million €)	640.99	678.99	555.70	-18.16
<i>La Grossa</i> sales (million €)	0.00	0.00	0.00	
Total lottery sales (million €)	2987.80	3120.39	2689.47	-13.81
Ratio <i>El Gordo/El Niño</i> sales	3.68	3.60	3.84	
GDP (thousand million €)	898.83	917.41	857.02	-6.58
Population (millions)	38.56	38.33	39.07	1.93
GDP pc (thousand €)	23.33	23.94	21.94	-8.35
Total lottery sales/GDP	3.32	3.40	3.14	
Total lottery sales pc (€)	77.64	81.54	68.84	-15.58
<i>Catalan provinces</i>				
<i>El Gordo</i> sales (million €)	456.18	491.65	376.38	-23.45
<i>El Niño</i> sales (million €)	101.21	110.69	79.89	-27.83
<i>La Grossa</i> sales (million €)	9.60	0.00	31.20	
Total lottery sales (million €)	566.99	602.34	487.46	-19.07
Ratio <i>El Gordo/El Niño</i> sales	4.53	4.45	4.71	
GDP (thousand million €)	213.19	218.16	202.02	-7.40
Population (millions)	7.34	7.30	7.42	1.64
GDP pc (thousand €)	29.08	29.90	27.24	-8.90
Total lottery sales/GDP	2.65	2.76	2.41	
Total lottery sales pc (€)	77.47	82.68	65.74	-20.49
<i>Catalan provinces excluding Lleida</i>				
<i>El Gordo</i> sales (million €)	377.08	402.22	320.52	-20.31
<i>El Niño</i> sales (million €)	87.87	95.51	70.67	-26.01
<i>La Grossa</i> sales (million €)	9.10	0.00	29.57	
Total lottery sales (million €)	474.05	497.73	420.76	-15.46
Ratio <i>El Gordo/El Niño</i> sales	4.32	4.22	4.54	
GDP (thousand million €)	200.95	205.76	190.11	-7.61
Population (millions)	6.91	6.88	6.99	1.60
GDP pc (thousand €)	29.10	29.93	27.21	-9.09
Total lottery sales/GDP	2.36	2.42	2.22	
Total lottery sales pc (€)	68.74	72.52	60.23	-16.95

Note: All economic variables are in real terms (base year 2016).

Source: Data on lottery figures come from SELAE and *Loteries de Catalunya*. Information on GDP and population was obtained from the Spanish Statistical Office (INE).

Table 2. Estimates of the lottery sales revenue models (dependent variable in logs)

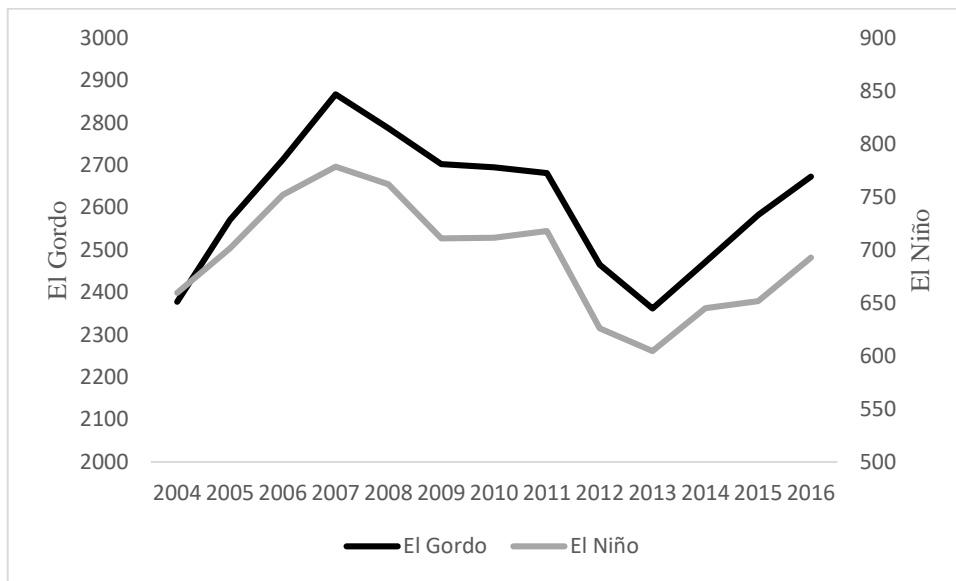
	<i>El Gordo</i>	<i>El Gordo La Grossa</i>	<i>El Gordo La Grossa El Niño</i>
Population (log)	-0.277**	-0.287**	-0.333**
GDP (log)	0.260**	0.265**	0.321**
Year (Ref. = 2004)			
2005	0.038**	0.038**	0.029**
2006	0.051**	0.051**	0.045**
2007	0.083**	0.083**	0.071**
2008	0.029*	0.029	0.022
2009	0.026*	0.027	0.010
2010	0.009	0.009	-0.006
2011	-0.014	-0.013	-0.021
2012	-0.098**	-0.097**	-0.113**
2013	-0.138**	-0.140**	-0.152**
2014	-0.089**	-0.077**	-0.088**
2015	-0.049**	-0.052**	-0.068**
2016	-0.013	-0.017	-0.044**
Interaction terms ^a			
(2013-2016)* <i>Barcelona</i>	-0.123**	-0.063	-0.075*
(2013-2016)* <i>Girona</i>	-0.091**	0.197**	0.152**
(2013-2016)* <i>Tarragona</i>	-0.052	0.017	0.002
Constant	2.664**	2.644**	2.732****
R ² within	0.734	0.672	0.723
Number of obs.	663	663	663
Provinces	51	51	51
Time periods	13	13	13

Notes: ^a (2013-2016) is a dummy for the period after the introduction of *La Grossa*. *Barcelona*, *Girona* and *Tarragona* are the dummies for each Catalan province.* Significance at 5%; ** significance at 1%.

Figure 1. Map of Spain, noting Catalan provinces.

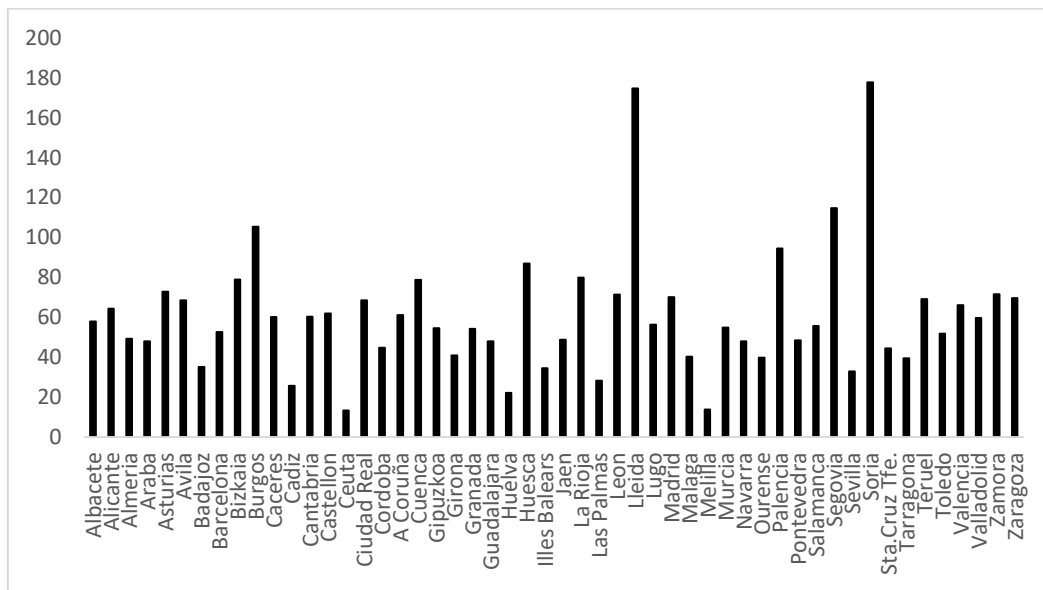


Figure 2. *El Gordo* and *El Niño* sales (in million euros)



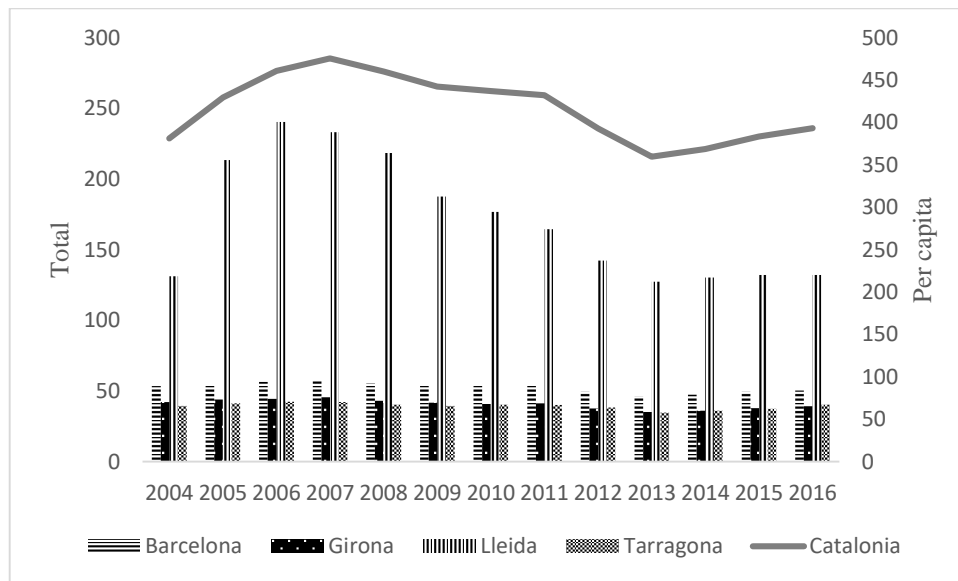
Source: Own elaboration from data provided by SELAE

Figure 3. *El Gordo* (per capita) sales (in euros) by province



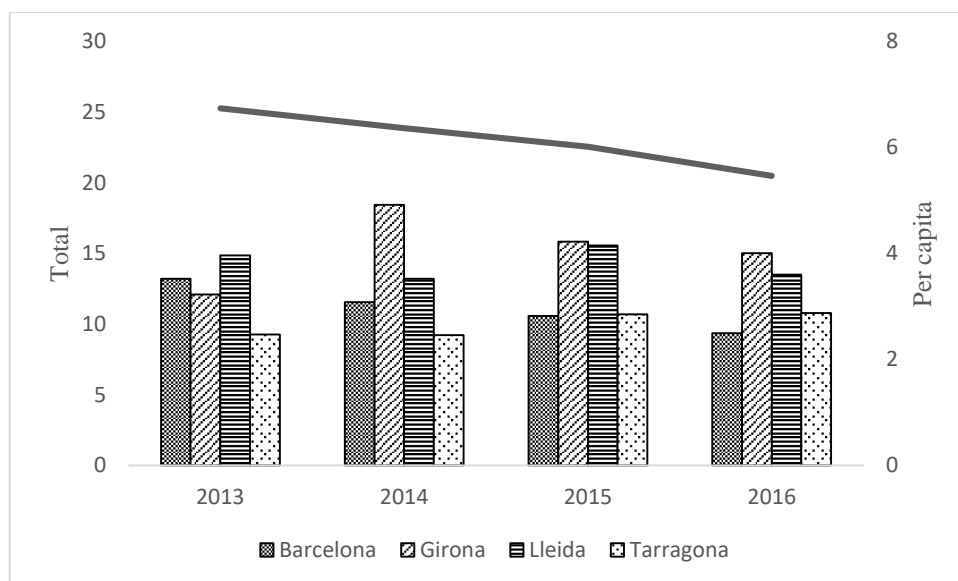
Source: Own elaboration from data provided by SELAE

Figure 4. *El Gordo* sales (in million euros) in Catalonia and (per capita) sales (in euros) by Catalan provinces



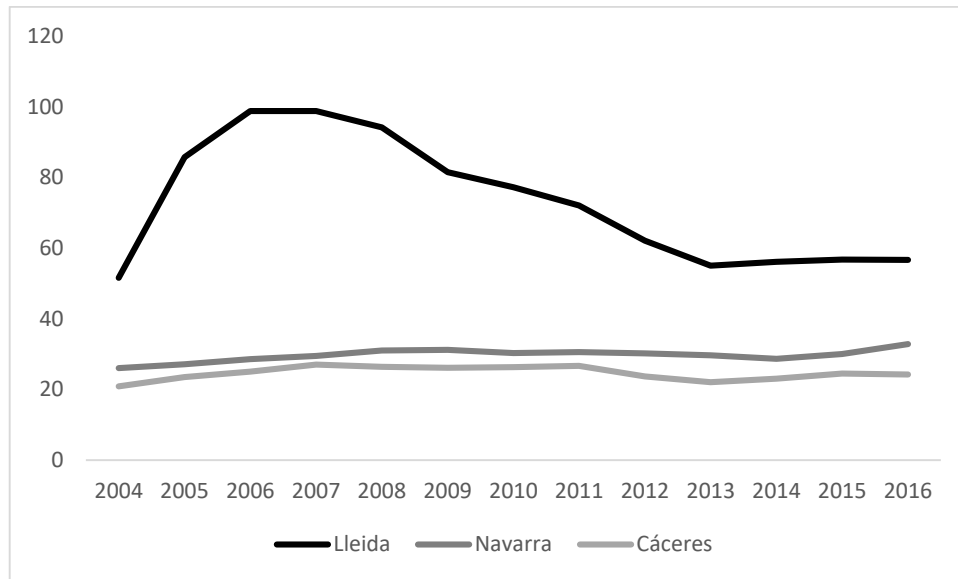
Source: Own elaboration from data provided by SELAE

Figure 5. *La Grossa* sales (in million euros) in Catalonia and (per capita) sales (in euros) by Catalan provinces



Source: Own elaboration from data provided by *Loteries de Catalunya*

Figure 6. *El Gordo* sales (in million euros) in *Lleida*, *Navarra* and *Cáceres*



Source: Own elaboration from data provided by SELAE