

SETTING THE ODDS OF WINNING THE JACKPOT: ON THE ECONOMICS OF (RE) DESIGNING LOTTERY GAMES

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Abstract: In many jurisdictions, domestic lotto games have experienced a significant decline in sales revenue due to the introduction of new gambling products and the absence of appealing jackpots. To reverse this trend and encourage demand, operators worldwide have conducted major reforms to the design of games. In this paper, we focus on Spain's largest domestic lottery game, which went under major structural changes in 2012 as the operator significantly reduced the odds of winning the jackpot with the aim of producing more frequent and larger rollovers. Our findings here show overall negative results of such reform, as players seem to no longer react to large jackpots, and the declining trend in sales has even worsened. (*JEL* D12, H27, L83)

Keywords: Lotto, demand, game design, intertemporal substitution, change in preferences.

I. INTRODUCTION

As modern lottery games became increasingly established and popular worldwide, economic literature has shown a relentless interest in studying a phenomenon that challenges established economic theories and represents an ever-growing source of extraordinary revenue for governments.

Following the successful experiences of New Jersey (1974) and New York (1978), many jurisdictions worldwide introduced lottery games and established public agencies as the sole provider of lottery products to use profits from gambling as a source of public revenue. Lottery mania—so termed by Kaplan (1990)—spread across the world, and national lottery games

appeared in several countries. However, some decades later, the demand for lottery seems to face a stage of maturity and in some cases even of decline.

In Spain, the most popular domestic lottery game marketed on a regular basis, *La Primitiva*, was introduced in 1985. Although the game has undergone successive reforms and minor changes throughout its history, it was only in late 2012 that a major structural reform took place in an attempt to reverse a prolonged downward trend in sales. Structural reforms were a worldwide practice that were followed by lottery game operators who generally attempt to set games' parameters to maximize revenue. Ever since the game has gained popularity among Spaniards, it was very common for there to be at least one jackpot winner, which made it difficult for the game to produce rollovers and to consequently generate ever-increasing jackpots. *La Primitiva* has also lost market share over the last few years due to the introduction of new gambling products that offer life-changing prizes as well.

Lottery games' parameters include the ticket price—or entry fee—, the odds of winning the jackpot, the prize structure's monetary value, and the payout rate—that is, the fraction of sales returned as prizes—(Gulley, 2018). As economic literature has empirically found evidence that larger jackpots encourage lottery demand, the game operator attempted to create a new scenario that would allow the game to consistently produce ever-larger jackpots, so *La Primitiva's* structural reform mainly focused on reducing the odds of winning the jackpot, so the rollovers would accumulate on a regular basis. However, optimally setting this parameter is not trivial. As discussed in Gulley (2018), if the game is too difficult for a winner to appear, repeated rollovers may drive away lottery players.

In this paper, we focus on assessing whether or not the Spanish lottery operator has been successful at setting the odds of winning the jackpots to maximize revenue, and we evaluate the economic scope of these structural changes. It is structured as follows. We first present a review of relevant literature on the economics of designing lottery games. Then, we provide the background on *La Primitiva*. In the third section, we outline our econometric modeling and

discuss the results of our research, as we finally conclude with some final remarks and counsel to policy-makers.

II. THE ECONOMICS OF (RE) DESIGNING LOTTERY GAMES

As lottery participation represents an apparently irrational behavior, economic literature has shown a keen interest on the matter over the last decades (see Grote and Matheson (2011) and Pérez and Humphreys (2013) for a more detailed review). Friedman and Savage (1948) first established that, for an average consumer with a certain risk aversion, the positive asymmetry in the probability distribution of prizes offsets a lower expected bet value than its own price.

The choice of a lottery game's parameters (design) is a complex task, much like the choice of the entry fee to the game. Some empirical evidence available analyses whether the choices made by lottery operators succeed (or not) in boosting games sales revenue.

In a seminal paper, Clotfelter and Cook (1991) studied the effects of a variation in price and prize structure on this demand, and they found a positive link between sales and both the bet's expected value and the size of the rollover. Many other studies have analyzed how lottery games' parameters are set to accomplish operator's objectives (see Gulley and Scott (1993), Scott and Gulley (1995), Mason et al. (1997), Walker (1998), Farrell et al. (1999), and Forrest et al. (2000), among others). Walker and Young (2001) found evidence that lottery sales positively depend on lottery payouts and their asymmetrical distribution, and negatively on the variance of this distribution.

As for the Spanish case, Forrest et al. (2010) assessed the changes in game design and their effects on *El Gordo de la Primitiva* demand—a former 6/49 lotto game—introduced in 2005. They showed that lottery players reacted positively to the bet's expected value, were risk-averse, and valued large jackpots, no matter how unlikely they were to win. They also found evidence that such changes led to an increase in sales, therefore proposing this case as an example of how to manage lottery games. In fact, this successful experience could have encouraged *La Primitiva*'s

operator to undertake the 2012 reform. On the other hand, Garcia et al. (2013) estimated the price elasticity of the demand for some games operated by the *Sociedad Estatal de Loterías y Apuestas del Estado* (SELAE), the domestic public management of state-owned lotteries. They found that these are operated in the inelastic area of demand and suggested an increase in the bet's effective price—the difference between the bet's entry fee and the expected value of its prize structure—to improve revenue. Unlike Forrest et al. (2010), this recommendation is based on rollover induced estimates and not caused by structural changes in the game.

Forrest and Gulley (2018) also aim to discuss the UK National Lottery's 2013 pricing reform—the operator doubled the price of a ticket—, and found that while the game's revenue did increase in the short term, it immediately resumed to decrease in the long term. On this matter, they attributed any positive effect on revenue in the short term to the operator's ability to make the game produce higher jackpots through a one-off spike in sales, as well as advised the restructuring of the game and prize tiers to encourage demand rather than increasing the entry fee. In fact, as previously discussed, a key decision for a game operator is to set the best game format—an optimal design would maximize the net revenue of the game, as stated by Hartley and Lanot (2003)

Combs and Spry (2019) conclude, when analyzing different redesigns of US Powerball and Mega Millions, that changes designed to generate higher jackpots (e.g. changes in odds of winning the jackpot and minimum jackpot size, among others) significantly impacted both games' sales.

III. BACKGROUND OF THE *LA PRIMITIVA* GAME

La Primitiva is a pari-mutuel lotto game with a fixed payout rate. Monetary value of prizes cannot be determined *ex ante* since they keep growing until the draw is held—this means that lottery players cannot know the jackpot size when placing their bet. Its current entry fee is set to €1. In simple bets, participants have to choose a combination of six numbers out of 49 plus

an additional number out of 10 (this is known as a $6/49 + 1/10$ game in literature). Multiple bets are also allowed by choosing multiple combinations—the more, the higher the price. Two draws are held every week on Thursday and Saturday. If there is no jackpot winner in a draw, its monetary value is added to the jackpot pool of the immediately following one.

Table 1.

La Primitiva's Prize Structure.

Prize Tiers	New Odds	Old Odds	Prize After	Prize Before
Special tier (six matches + refund)	1/139,838,160	—	20%	—
First tier (six matches)	1/13,983,816	1/13,983,816	40%	52%
Second tier (five matches + complementary)	1/2,330,636	1/2,330,636	6%	8%
Third tier (five matches)	1/55,491	1/55,491	13%	16%
Fourth tier (four matches)	1/1,032	1/1,032	21%	24%
Fifth tier (three matches)	1/57	1/57	€8	€8
Refund tier	1/10	1/10	€ Bet	€ Bet

In Table 1, we summarize *La Primitiva's* prize structure. The special category amounts the largest prize for which all six numbers and the refund number—a special ball drawn from a separate drum—must be matched. The remaining decreasing tiers require lower matches as prize are also smaller. If there are no winners for the special and/or first tier, their prize pool would accumulate to the special category of the immediately following draw. If there are no winners for the second and/or third tier, their rollovers increase the prize pool of the third and/or fourth tier of the same draw, respectively. If there are still no winners in all these tiers, their rollovers are added to the special category pool of the next draw.

La Primitiva redesign could be considered unique and different from other lottery games redesign in Spain and other countries. The change in format as described in Table 1 reduced the odds of winning the jackpot ten times. Such a huge decline in the odds of winning (accomplished by adding the special ball for the refund number to the six winning balls before the change in game design) is maybe one of the largest single reductions in the odds of winning the jackpot that has occurred worldwide. As for comparison, in 2015, the UK National Lottery was redesigned from 6/49 to 6/59 reducing the probability of winning the jackpot by more than three times. Even in Spain, the 2005 redesign of *El Gordo de la Primitiva* that lengthened the odds from approximately 1:14m to 1:32m (Forrest et al., 2010) (this is less than a three times increase in the difficulty of winning the game's jackpot) was very far from the reduction in the odds of winning *La Primitiva*'s jackpot. Regarding multistate lottery games, in US, major reforms of Powerball in 2013 and Mega Millions in 2015 reduced the odds of winning the jackpot-from 1/175223509 to 1/292201338 (over 1.6 times), and from 1/175711536 to 1/258890850 (almost 1.5 times), respectively, among other changes such as increasing the entry price and the guarantee jackpot size (Combs and Spry, 2019). The European EuroMillions also reduced the probability of winning the jackpot - from 1/117000000 to 1/140000000 (close to 1.2 times) - in successive reforms during the 2010 decade.

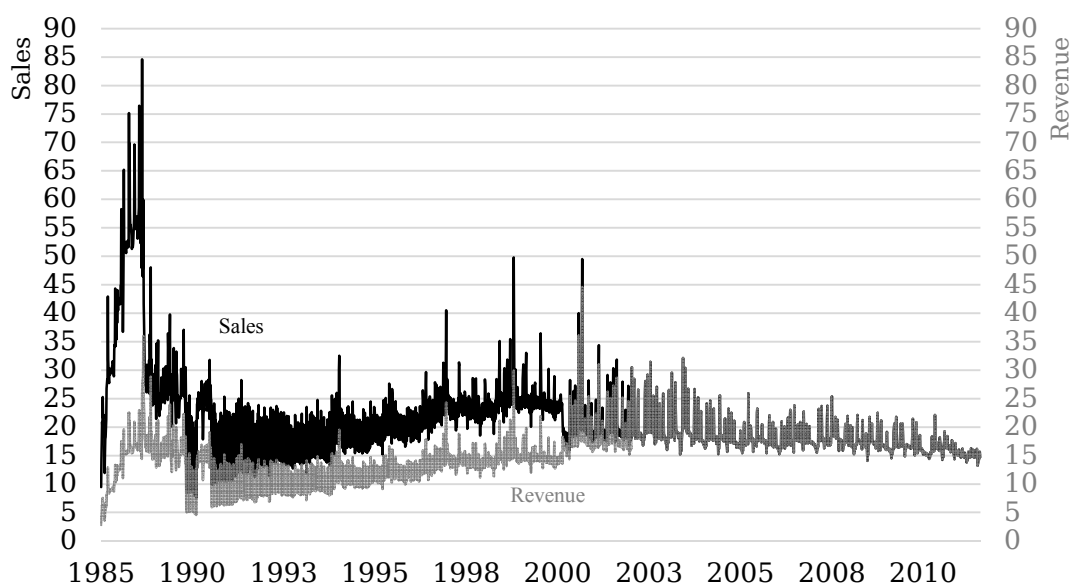
Prizes below €2,500 are tax-free and can be claimed directly from any lottery outlet. However, since January 2013 and for the purpose of “consolidating public finances and encouraging economic activity,” prizes over that amount are subject to a special tax of 20 percent on the exceeding amount and must be claimed in banks.

As the game has steadily lost popularity over the years, the entry fee has increased several times to account for it. Earlier studies on *La Primitiva* such as García et al. (2013) observed “a price elasticity lower than 1, which indicates that it is operated in the inelastic area of its demand.” Therefore, it is expected that its demand will decrease less than proportionally to the increase in price, and thus revenue will increase.

In Figure 1, we show tickets sold and revenue in a draw-by-draw basis from 1985 through 2011—note that both series perfectly overlap from 2002 on as the entry fee was set to €1. We distinguish two clearly different periods in sales and revenue: while they both steadily increased from the early 1990s through late 2000, they started to decline from early 2001 on. Right before the first period, we observe a noticeable drop in both series due to a price increase, as well as the introduction of the second weekly draw—way less popular than the first—, and a new lottery game, the *Bonoloto* in 1988—cheaper and more likely to win. We may find some explanations for these periods on papers such as Mikesell (1987), who defined the hope of winning a prize as a fundamental feature of gambling, and Clotfelter and Cook (1989), who established lottery players as hope buyers: this way, lottery participation rises, regardless of an increase in price, because of the hope of winning, but begins to decline as participants’ despair appears. Large jackpots were still being produced on a regular basis, but sales were decreasing as it was quite common for there to be at least one jackpot winner

Figure 1.

Bets Sold (Millions) and Revenue (Million EUR) (1985-2011).

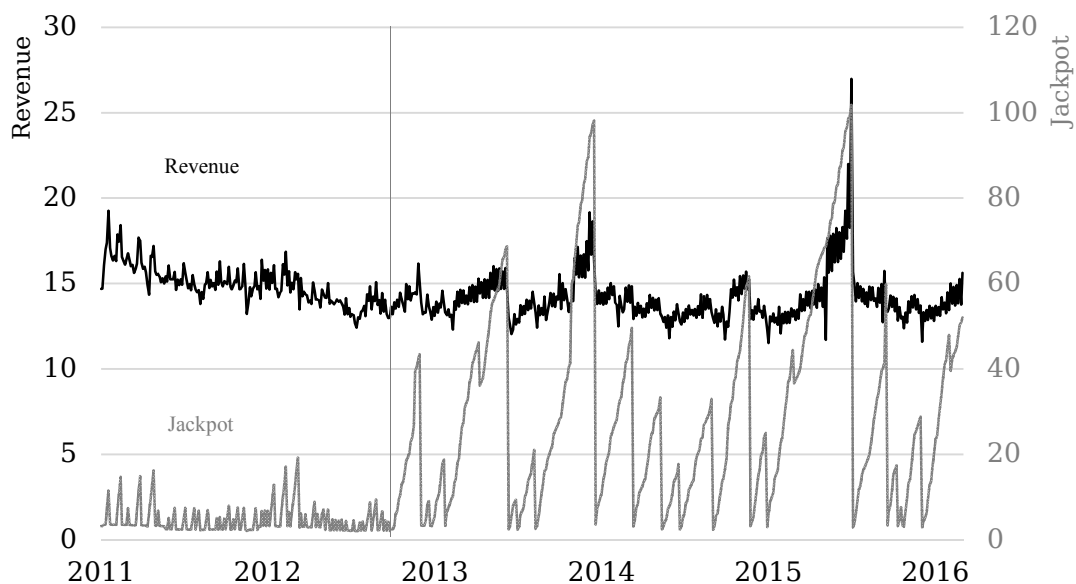


Source: SELAE.

The—relatively—high odds of winning the jackpot rendered the game unable to produce extraordinary jackpots that would encourage participation. Therefore, the operator saw fit to reduce those odds in a major structural reform of the game that became effective on November 8, 2012. Its design changed from its former 6/49 format to the current 6/49 + 1/10, so the odds of winning the jackpot is now ten times lower. In general, the operator tailored the game regulation to enable it to deliver big jackpots. As a result of the redesign of the game, the average length of the draw cycle hugely increased to almost 17 draws (with 57 being the maximum). Previously, there was at least one jackpot winner in almost every draw.

Figure 2.

Revenue and Jackpots Size (2011-2016, Million EUR).



Source: SELAE.

In Figure 2, we plot *La Primitiva*'s revenue and jackpots from 2011 through mid 2016—the vertical line marks the introduction of the new game structure. As a result of this major reform, the jackpot generating pattern is now entirely different. Since it is now much more unlikely that there will be a jackpot winner, it is also much more likely that rollovers will accumulate in consecutive draws without winners. Thus, there is more variation now in jackpot size, as they are significantly much larger than before. Prior to the reform, the average jackpot was €4.04 million ($\sigma = 2,511,091$), whereas after the changes, it was €26.5 million ($\sigma = 21,992,110$). In absolute terms, the highest jackpot before 2012 was €28.8 million in 2001, whereas the highest jackpot after this date was €101.8 million in 2015.

Although the new jackpots are unquestionably larger, they do not appear to stimulate the demand—at least not in a sustained fashion. Massive jackpots have certainly encouraged participation—e.g., the spikes in sales in late 2013 and mid 2015—but smaller jackpots, although still considerably larger than pre-reform jackpots, now lead to even lower sales. While revenues do occasionally spike, this is mainly due to an extraordinary, one-off jackpot that encourages participation. When a jackpot winner finally appears, sales immediately drop as the new jackpot is insufficient to encourage participation. Therefore, the reform has apparently failed to reverse the downward trend in sales, as they have continued to drop consistently through 2015.

IV. ECONOMETRIC MODELLING

Since pricing doesn't seem to be a decisive factor for lottery demand (the economic literature has shown that lottery demand is not driven by its price, but by the game's prize structure) it is difficult to use the game's entry fee as a predictor of lottery sales (the entry fee to games has usually remained constant over time and across many different gambling markets around the world). However, Gulley and Scott (1993) observed that the jackpot size for a particular draw—determined by the game's prize structure and the rollover accumulation pattern—produced significant variations in the expected value of the bet that would eventually

explain the changes in sales, and accordingly suggested to use the effective price as an explaining variable rather than the entry fee. Later on, Forrest et al. (2002) empirically proved that gamblers basically react to the jackpot size, and considered this as the main determinant of lottery demand. They even observed that, from time to time, the jackpot grows so much that the expected value of the bet becomes positive. All things considered, our paper uses a standardized econometric modelling in which the jackpot size is included as the main explaining variable for *La Primitiva*'s demand.

In line with Forrest et al. (2010) and Forrest and Gulley (2018), we estimate the following linear demand specification:

$$Bets_t = f(Bets_{t-1}, Bets_{t-2}, Jackpot_t, NewRegime, Trend, w_t) \quad (1)$$

where $Bets_t$ is the gross sales volume in draw t , and $Bets_{t-1}$ and $Bets_{t-2}$ refer to the two immediately preceding draws explaining the habit or inertia effects of playing the lottery (e.g. $Bets_{t-2}$ for Saturday refers for the tickets sold on the same day of the previous week when $Bets_{t-1}$ is that for the prior Thursday). $Jackpot_t$ is the jackpot size for draw t , which also accounts for the special tax of 20 percent for prizes that exceed €2,500 (see equations 2 and 3). $NewRegime$ is a dummy variable that takes value 1 for the draws held after the introduction of the changes in the game design. And finally, $Trend$ is a linear trend to control for the existence of a saturation or maturation effect, as well as changes in consumers' preferences on lottery demand.

Equations 2 and 3 explain how the jackpot size for each draw is calculated according to the game regulation. For draws prior to January 2013, the prizes were tax-free—therefore, the jackpot winner received the full money value of the jackpot (equation 2a). However, from this date onwards, a special tax of 20 percent on prizes that exceed €2,500 was introduced (equation 2b). Accordingly, the empirical analysis here will refer to a single jackpot, but note that it is calculated in two different ways depending on when the draw occurred. Of course, the mere effect

of the introduction of this tax on lottery demand would be an interesting exercise in its own right. Unfortunately, it is so close in time that it would be very difficult to isolate its impact from the one of the game's new structure.

$$A = ([r * Bets_t] - [8 * p * Bets_t]) * j + Rollover_t \quad (2a)$$

$$B = ([A - 2,500] * 0.2) \quad (2b)$$

$$Jackpot = \begin{cases} A, & t < 2013 \\ B, & t \geq 2013 \end{cases} \quad (3)$$

where r is the payout rate. 8 is the flat prize (€8) for the fifth prize tier. p is the probability of matching three of the six numbers. j is the percentage of the prize pool allocated to the jackpot. 2,500 is the tax-free amount of the jackpot pool. Lastly, 0.2 is the 20 percent tax on the exceeding prize amount.

Therefore, the following specification is estimated:

$$\begin{aligned} \log(Bets_t) = & \beta_0 + \beta_1 \log(Bets_{t-1}) + \beta_2 \log(Bets_{t-2}) + \beta_3 \log(Jackpot_t) + \\ & \beta_4 NewRegime + \beta_5 Trend + \beta_6 (NewRegime * \log[Jackpot_t]) + \\ & \beta_7 (NewRegime * \log[Bets_{t-1}]) + \beta_8 (NewRegime * \log[Bets_{t-2}]) + \\ & \beta_9 (NewRegime * Trend) + w_t \end{aligned} \quad (4)$$

Since it is unlikely that the dummy variable *NewRegime* alone can explain the response of lottery players to the structural changes, we also included several interactions with other relevant variables in the model specification: $NewRegime * \log(Jackpot_t)$ will attempt to capture the changes in the slope of the demand function, while $NewRegime * \log(Bets_{t-1})$, $NewRegime *$

$\log(Bets_{t-2})$ and $NewRegime * Trend$ will show further changes that may have occurred as a result of the new regulation.

The logarithmic transformation of the economic variables reduces data dispersion and allows a direct interpretation of the estimated coefficients as elasticities.

The data used in our paper was provided by SELAE for the 1985-2016 period. However, since the current gambling scenario is quite different from the scenario in the 1990s, and in line with Forrest and Gulley (2018), we considered only the data for the draws held between February 5, 2004 and June 30, 2016, both included. This leads to 1,294 observations. It should be noted that the latest major lotto game to be introduced in the Spanish gambling market, *Euromillions*, started to operate in 2004.

As noted by DeBoer (1990) and Forrest and Gulley (2018), among other authors, demand may differ according to the day of the week a particular draw is held on. Therefore, we performed separate regressions for the Thursday and Saturday draws of *La Primitiva*.

In addition, the explaining variable here depends directly on the number of tickets sold. As explained earlier, *La Primitiva* is a pari-mutuel lottery game in which both the jackpot size for a particular draw and the probability of at least a jackpot winner to appear are determined by sales. Because of this, endogeneity matters. A standardised solution in the economic literature is to use a two-stage method. Thus, following Gulley and Scott (1993), we propose the rollover size in draw t and its square as instruments for the first stage. These are found to be valid instruments, as they meet the conditions of exogeneity and relevance (namely, $E(\varepsilon_j * z_j) = 0$ and $cov(x_j, z_j) \neq 0$, respectively). The first stage's econometric specification is $Jackpot_t = f(Rollover_t, Rollover_t^2, w_t)$. We included the jackpot variable in real terms and logarithms, and we considered the special tax applied from 2013 onwards as well. Both instruments are in levels instead of logarithms in order to preserve the observations without rollovers.

Table 2 presents some key statistics of the main economic variables for the time period considered (February 2004 through June 2016).

Table 2.

Summary Statistics (EUR).

Variable	Mean	Std. dev.	CV	Min.	Max.
Jackpot					
Before	4,770,169.24	3,903,540.84	2.63	1,997,150.28	26,406,785.01
After	29,582,133.99	23,741,868.17	1.08	2,374,284.2	101,859,326.6
Revenue					
Before	17,615,489.86	2,615,557.98	1.77	12,413,286	32,149,920
After	14,085,032.17	1,436,569.68	3.15	11,510,535	26,982,383
Rollover					
Before	1,288,273.707	2,981,298.63	2.79	0	22,834,399.88
After	23,896,778.54	21,799,861.58	1.18	0	96,797,896.49

Source: SELAE.**V. RESULTS**

We present our estimates in Table 3, and we elaborate the results that we found below.

The Thursday and Saturday columns show the estimates for the draws held on those days. The dummy variable's negative coefficient shows that the new game structure has negatively affected its sales for the Thursday draws, while its positive coefficient shows the opposite for the Saturday draws. However, this is not enough evidence that players are opposed to or supportive of the new regime, as the resulting demand curves would be a combination of a shift and a change on its slope. As the major structural reform was mainly based on the jackpot size as a claim to encourage lottery playing, its interaction with dummy would be a key asset to measure its effects

on sales. In fact, although jackpots do seem to encourage lottery demand—as expected, both coefficient signs are positive—, their interactions with the dummy are negative. Therefore, while the game’s demand curve for both days has indeed shifted to the right, it is now more inelastic—that is, it now needs an ever-larger jackpot increase to reach the same sales level. Admittedly, the reform has succeeded in producing bigger jackpots, as shown in Figure 2, but these no longer drive demand in the same way as before, since players have now become less sensitive to them. Thus, the reform will probably fail in its attempt to reverse the downward trend in sales in a steady, consistent way.

Table 3.

Estimates (Dependent variable is the (log) number of tickets sold).

Variable	Thursday	Saturday
<i>Constant</i>	11.668 ***	0.9876 **
<i>NewRegime</i>	-8.755 ***	5.299 ***
<i>(log)Bets_{t-1}</i>	0.088	0.8433 ***
<i>(log)Bets_{t-2}</i>	0.128 *	0.043 **
<i>NewRegime * (log)Bets_{t-1}</i>	0.384 ***	-0.435 ***
<i>NewRegime * (log)Bets_{t-2}</i>	0.1845 *	0.1493 **
<i>(log)Jackpot_t</i>	0.101 ***	0.0601 ***
<i>NewRegime * (log)Jackpot_t</i>	-0.0616 ***	-0.0385 ***
<i>Trend</i>	-0.0002 ***	-0.00004 ***
<i>NewRegime * Trend</i>	0.0002 ***	-0.00004 *
<i>Adjusted R²</i>	0.8472	0.9541
<i>N</i>	648	646

Note: * Significance at 10%; ** significance at 5%; *** significance at 1%.

One way to explain these results is that the reform has made it so difficult for a winner to appear that it is very likely that there will be no winners and that an even bigger jackpot will be offered in the next draw. Jackpots are unquestionably bigger, but they are no longer a strong enough claim, as players now know how unlikely it is to win them. Having to match 7 numbers under the new design may be too difficult to accept psychologically. In this regard, there may be an intertemporal substitution in lottery play towards the next draws by players who, aware of the unlikelihood that a jackpot winner will appear, are waiting for the jackpot to be significantly larger to participate. This would explain in part why, while jackpots are now larger, there is not a clear, significant increase in demand as shown in previous literature. We also identify in these results the Clotfelter and Cook (1989) proposition discussed earlier by which lottery players are “hope buyers” whose disappointment with the game appears as they do not win prizes, eventually stopping playing (see Figure 3). It may be as well that players are just bored with (or less excited by) of *La Primitiva* because of its long-established presence in the domestic gambling market and sales continue to fall due to its own inertia.

Either way, the negative trend in sales is quite evident in both cases given the estimated coefficients. Although the new game regulation seems to have slightly slowed down the downward trend for the Thursday draw, it seems to have worsened it for the Saturday draw. However, we still identify a weak habit—or inertia—effect on *La Primitiva* players as shown by the positive lagged variable coefficients. We can think of a couple of reasons to explain this. The straightforward one is that the lower odds of winning the jackpot have strongly discouraged participation. Secondly, consumers' preferences are likely to have changed due to the emerging—and growing—supply of alternative digital lottery games and online gambling websites. On this matter, players may find traditional lottery games less attractive and may now prefer digital, online games, as they usually offer entertainment—e.g., playing online roulette or slots produces entertainment for players by having to actively participate—and a more immediate outcome. This is certainly an opportunity for further research.

Table 4 presents the jackpot elasticities. Overall, the effect of the jackpot size on *La Primitiva* sales appears to be positive, as found in Garcia et al. (2013). However, after the change in game design, elasticities have sharply reduced. As discussed earlier, the demand curve now seems to be more inelastic in terms of the jackpots, and sales are more insensitive to them; accordingly, they will not respond in the same way as before from a certain size of the jackpot pool. This is sometimes referred in the literature to as “jackpot fatigue” or the idea that a given size of jackpot becomes less and less effective over time in attracting sales (Beenstock and Haitovsky, 2001).

Table 4.

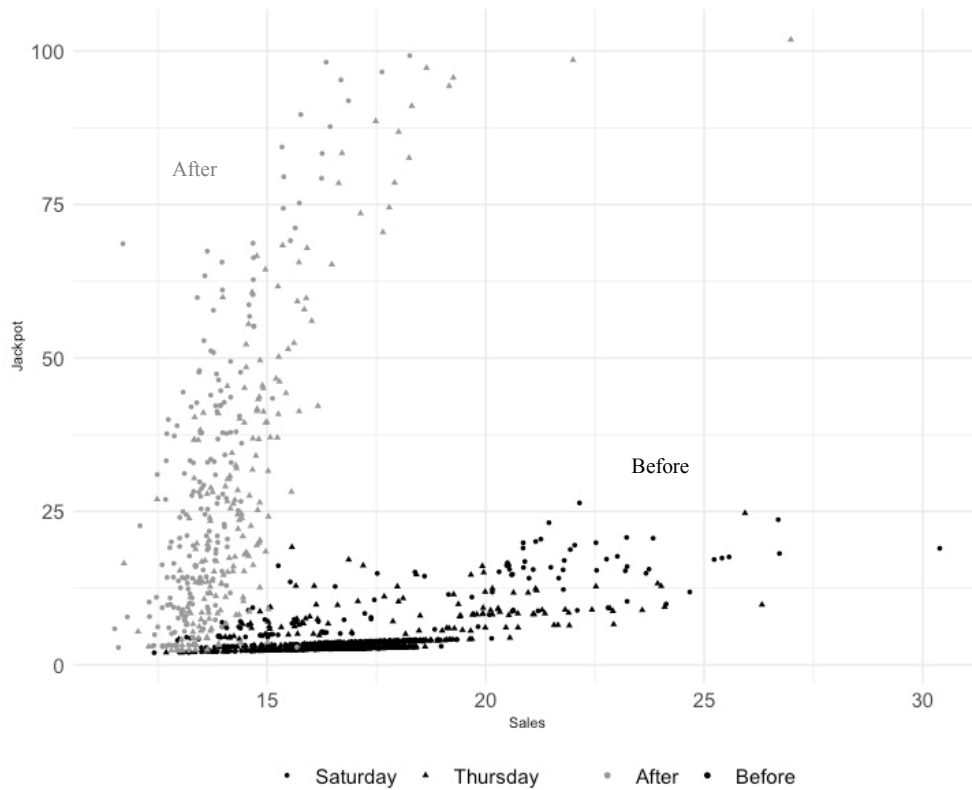
Jackpot elasticities.

Elasticities	All Draws	Thursday	Saturday
<i>NewRegime</i> = 0	0.104	0.101	0.0601
<i>NewRegime</i> = 1	0.036	0.0394	0.0216

In any case, the structural reform cannot be said to have had a direct, positive impact on sales and therefore revenue. The demand curve has slightly shifted to the right and has become much more inelastic, while the sales trend seems to continue to decline. While jackpots are indeed bigger, players no longer perceive them as a strong enough incentive to play as the new game structure has greatly reduced the odds of winning them. As shown in Figure 3 and the estimates, bigger jackpots no longer translate into higher sales but rather the opposite: it is quite common for the same jackpot size to currently produce lower sales than before the reform.

Figure 3.

La Primitiva Jackpot and Sales (Before and After, Million EUR).



Source: SELAE.

VI. CONCLUDING REMARKS

Following the great success of similar lottery products in other jurisdictions worldwide, the 6/49 lottery game *La Primitiva* was introduced in the Spanish gambling market in 1985 and quickly became the most popular regular lottery game ever marketed in Spain. However, as occurred with many other domestic lottery games, due to both the introduction of new products that also offer life-changing prizes and its incapacity to generate large jackpots to stimulate demand, the game showed a long decreasing trend of sales in recent times. Over a decade after a progressive fall in revenue, the game operator introduced in 2012 a major structural reform that aimed to create a new regulatory scenario that would allow the game to produce bigger jackpots

that would serve as a strong enough stimulus for players to remain engaged. The changes focused mainly on making the game more difficult to win by reducing the odds of winning the jackpot.

As the economic literature has shown in successive theoretical and empirical studies, the price of a bet of a lottery game is not the decisive factor of its demand—as opposed to most goods and services—but the jackpot size. For this reason, we used it as the main variable in our attempt to explain *La Primitiva* sales and therefore revenue.

In our empirical exercise, we found that these structural changes in game design—e.g., lengthening the odds—have not succeeded in reversing the long decreasing trend in sales and revenue. While the changes have indeed succeeded in producing larger jackpots than before the reform, these no longer translate into higher sales, as lottery players seem to have become desensitized to the jackpot size because of the lower odds of winning it. However, consumers' preferences are likely to have changed and worsened the situation. Due to an increasing supply of alternative digital, online lottery and other gambling products, consumers may no longer perceive traditional lottery products as attractive as it once was. Either way, the reform seems to have worsened the decline in sales as well. Thus, should these results persist over time, the operator will have to undertake new reforms to ensure the continuity of the game. As an implication of this analysis, lottery operators must be cautious in introducing new changes in game design that make jackpots even more difficult to win.

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