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Working Paper

Working Paper

2009-05

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March 2009

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The demand for Euromillions lottery tickets: an international comparison

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April 2009

We analyze the demand of the Euromillions lottery tickets, a European lotto-like game launched in 2004 and played simultaneously in nine countries with the same rules and the same draws. Using the effective price methodology, we show that price elasticities are very different across countries. Especially, Spain and Portugal exhibit a low price elasticity and high mean sales, meaning a low sensitivity to jackpot increases. On the contrary, Ireland and the United Kingdom exhibit very high long-run elasticities and a large sensitivity to jackpot variations. The interpretations of these results are linked to lower GDP in the two former countries and, for Spain, to the large development of syndication play, and to the bookmaking activities and the highly competitive betting market in Ireland and the UK. Moreover, we show that Spanish and Portuguese players pay a much higher effective price than UK gamblers, meaning that in a certain sense the former subsidize the latter.

Keywords: lottery, gambling, demand estimation, price elasticity

JEL classification: D81, H71

I. Introduction

States and private firms offer a large variety of legalized games of chance, but lotto-like games are among the most popular for at least for two reasons. They are easy to play, players having only to select 5, 6 or 7 numbers in a range varying from 35 to 55, depending on the country and the precise design of the game. They also offer large (and attracting) jackpots, due to the long odds they are based on, and consolation prizes as well. Lottos are also interesting to study because they are based on the pari mutuel principle. A given percentage of sales returns to players, the rest feeding the budget of the organizing state or being used to finance good causes. It implies that prizes depend on the number of tickets played and so does the expected value of a ticket. Especially, when the jackpot increases, sales are boosted but the probability of sharing the jackpot also increases. Consequently, the expected value of a ticket is closely linked to the buying behavior of players.

Euromillions is one such lotto-like game, launched in February 2004 in three european countries, France, Spain and the United Kingdom. In October 2004, six other countries joined in, namely Austria, Belgium, Ireland, Luxemburg, Portugal and Switzerland. Euromillions is characterized by very long odds, since there is only one chance over about 76 millions to win the jackpot. It is probably one of the lotteries with the longest odds throughout the world.

As mentioned by Cook and Clotfelter (1993), "there is a strong tendency for per capita lotto sales to increase with the size of the population base". It may explain why low population countries like Luxemburg or Ireland have been interested in joining the three initial countries. Moreover, enlarging the population base may avoid jackpot fatigue (Matheson and Grote, 2004) which arises when many successive draws bring no winner. The jackpot is then perceived as almost impossible to win and sales may start to decrease.

The probability of getting a winner then diminishes and it can put at stake the survival of the game.

In general, very long odds generate rollovers which have two conflicting effects. On one side, a larger jackpot is offered after a rollover, but, on the other side, this larger prize attracts (apart from the abovementioned jackpot fatigue effect) a greater number of players. As a consequence, the probability of sharing the higher jackpot with other winners increases, then lowering the individual expected jackpot prize.

The demand of lotto tickets is usually estimated as a function of the effective price which is the difference between the cost of a ticket and its expected value. The cost is known and generally stable through time but the expected value varies from draw to draw for at least two reasons. The first one is the possibility of rollovers which increases the expected value and then decreases the effective price. The second reason, not independent from the first, is that the effective price depends on the volume of sales by the role it plays on the probability of a rollover. Estimating a demand function must take into account these two conflicting effects which are highly non linear.

These remarks show that the estimation of the demand of Euromillions tickets is interesting in itself due to the very long odds of the game implying frequent rollovers. For exemple, 67.9% of draws didn't bring any jackpot winner between February 2004 and September 2008 (239 weekly draws). Even if we restrict the period by starting in October 2004 (when the six new countries joined in) the percentage is still 66.66%. Moreover, two sequences of twelve draws in a row without any jackpot winner have been observed during this period.

The other interesting feature of the Euromillions lottery is its international character since it is played in nine countries. Players face the same rules, the same rollovers, but live in diverse environments. The competitor games are different (lottos, instant games, etc.), some countries allow bookmaking activities while others do not, per capita GDP may be quite different from a country to another, and so on.

In this paper, we analyze the demand for tickets in two steps. We start by an aggregate-level study including all the participating countries. The methodology is quite standard and uses the effective price approach. Then, using the effective prices estimated in the first step, we compare the demand functions of the nine countries and show that behaviors are very different across countries. Especially, we show that UK players are much more sensitive to jackpot increases (corresponding to effective price decreases) than players of the eight other countries. On the contrary, in Spain and Portugal, players are less sensitive to jackpot changes. A link with per capita GDP and the level of sales is proposed to explain this maybe counterintuitive result.

The paper is organized as follows. In section 2 we describe the rules of the game and the database used in the empirical analysis. Section 3 deals with the estimation model and section 4 develops the empirical results and their interpretations at the aggregate level. Section 5 provides a country-by-country analysis of sales and price elasticities. Finally, section 6 concludes the paper and proposes some future directions of research.

II. Rules of the game and database

II.1 The rules of the Euromillions lottery

The essential differences between a standard national lotto game and Euromillions are the following. First, numbers are drawn in two different sets. Five numbers are drawn without replacement in the range {1,...,50} and two more numbers are drawn (independently of the first five) in the range {1,9} without replacement. These two numbers are usually called "lucky stars", by reference to the European flag. So players notch seven numbers, five in the first set and two in the second set. Most standard lotto games are based on draws of five or six numbers in a set of 35 to 53 numbers.

The Euromillions lottery offers twelve winning ranks defined in table 1. For example, the notation *n* + *m* means that *n* numbers are correct in the first set and *m* in the second set. The column "%prize" reports the way the prize pool is shared among the winning ranks at the end of the sample period. In fact, these figures were changed twice since the start of the game. The proportion devoted to the first rank was initially 20% of the prize pool. It increased to 22% in August 2004 and reached the current level, 32%, in February 2006. The sharing of the prize pool is not unusual. In most lotto games, the part devoted to the jackpot (rank 1) is generally large, as is the proportion devoted to the low rank prizes. However, the reasons are different. A high jackpot rate makes the game attractive and a high share devoted to low rank prizes avoids too low (and discouraging) gains for these ranks, since the number of the corresponding winners is high.

Table 1 around here

The second important difference with national lotto games is that Euromillions is played in nine different countries with a unique draw and uniquely determined prizes for all the participating countries. It means that all players face the same takeout rate, the same draws and rollovers and almost the same cost. The cost of a ticket is 2 euros for the Euro-zone, 1.5£ for UK and 3.2 Swiss francs for Switzerland. As tickets and prizes are obviously paid in local currency, we will neglect the evolution of exchange rates in our analysis. Consequently, all amounts considered in the rest of the paper are written in euros. It is the most natural choice because the takeout rate is exactly 50%, therefore the amount devoted to prizes is equal to the number of tickets sold (in the absence of rollovers).

It can be observed, in table 1, that the sum of the percentages (in column %prize) is not 100% but only 94%. It comes from the existence of a "reserve fund" used to feed some jackpots. Usually, when a jackpot has been won, the next week jackpot is a round amount, in general 15 millions[1]. Then, a volume of sales of 46 million tickets would be necessary to feed a 15 million jackpot prize without using the reserve fund and the typical sales level is lower than that.

When a jackpot is not hit (rollover), the next one is fed with the amount that has not been won (32% of the amount of last week prize pool) plus a part of the reserve fund. The anticipated amount of the next jackpot (announced jackpot) is used by the organizers in TV, radio or press ads.

Exceptional events are sometimes proposed to players. In these occasions, a huge jackpot is offered, even if it is not the result of successive rollovers. As we will see later on, it happened twice in our sample period (100 and 130 millions respectively). Obviously, these events necessitate a specific treatment in the demand estimation process.

To sum up, Euromillions is a well-suited lottery to perform international comparisons because many variables are controlled. The takeout rate is constant across countries for a given draw and has been constant through time since the inception of the game. All the participants face the same draws and rollover amounts and, more generally, the same rules. It is not the case in most international comparisons (for example Garrett (2001)) of lottery gambling. Consequently, if differences occur in the demand functions, they cannot come from the design of the game and may be attributed to behavioral or environmental features.

II.2 The data

The database for the Euromillions lottery has been built through the website www.sojah.com which is the French official website related to all the state-sponsored games of chance in France. It not only provides the

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[1] At the beginning of the game, only 3 countries were participating and some jackpots were only 10 millions.

history of draws and individual gains but also all the laws[2] concerning these games. Moreover, for the Euromillions lottery, it also provides the draw-by-draw results of the other participating countries.

We extracted the data for the first 197 draws, starting at the beginning of the game on 02/13/2004 and ending on 11/16/2007. We mentioned in the introduction that six countries joined in after the first 34 draws. Consequently, we decided to start our empirical study in October 2004, giving up not 34 but 35 draws, to avoid the biases induced by the entry day of the six new countries. 162 draws were then considered for the empirical analysis, starting on 10/15/2004.

For the present study, we use the following elements:

- the volume of sales, country by country and at the aggregate level;
- the individual gains for each rank;
- the number of winners for each rank in each participating country;
- the realized jackpot (to be shared among first-ranked winners);
- the percentage of sales devoted to each rank[3].

In fact, 4 countries realize about 80 % of the total volume of sales, France, England, Spain and Portugal. It is interesting to notice that the first three totalize around 150 millions of inhabitants and Portugal only 11 millions, but the mean number of tickets sold in Portugal is comparable to the corresponding figures in France or Spain with a 4 to 6 times lower population and it is twice the volume of sales in the UK.

II.3 Descriptive statistics

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[2] Especially it makes available all the laws about the regulation of the games published in the "Journal Officiel de la République Française”.

[3] It changed only once in our sample period, the part of the jackpot price increasing from 22% to 32%. This change was compensated by a decrease in the portion devoted to the reserve fund, from 16% to 6%.

Table 2 presents descriptive statistics concerning the main variables entering the demand estimation process, namely, the weekly level of sales, the anticipated jackpot (whose calculation is detailed in the next section) and the jackpot as it is provided in the database. In columns 2 and 3, we added the populations of the nine countries and the per capita GDP[4]

Concerning the lottery-related variables, we report the minimum (Min), maximum (Max), mean (μ), standard deviation (σ) and coefficient of variation (μ/σ). As mentioned before, the range of variation of the three variables is large and essentially due to rollovers.

Table 2 around here

Several elements deserve comments in Table 2, especially the situations of Portugal, the United Kingdom and Luxemburg. Portugal is characterized by a high mean-sales level, in particular regarding its population base, and a low coefficient of variation around .38 (the coefficient of Spain is even lower). On the contrary, the United Kingdom is remarkable with a "low" mean sales level (still with respect to the population base) and a very high coefficient of variation.

The two lowest per capita GDP correspond to the two lowest coefficients of variation, namely Spain and Portugal. Knowing that time-variations in sales are essentially due to rollovers and increasing jackpots, one possible interpretation is that players in low GDP countries are less sensitive to jackpot increases. This remark may seem counterintuitive but it is worth to remember that "lowest" jackpots are 15 millions which is already a huge amount for low GDP players. For example, the per capita GDP in Portugal is half the one in Ireland and the mean sales per inhabitant are three times higher in Portugal. This interpretation is consistent with cumulative prospect theory (Kahneman and Tversky, 1979 and Tversky and Kahneman, 1992) in which the valuation of a risky prospect is realized with respect to a reference

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[4] 2006 figures in USD provided by the Conference Board and the Groningen Growth and Development Centre, http://www.conference-board.org/economics/database.cfm

point. The valuation function is concave for gains and convex for losses. Agents characterized by a low reference point (linked to per capita GDP) find little marginal utility in jackpot increases, taking into account that the initial jackpot (if won) leads the "low GDP" winner in a zone with negligible marginal utility.

Figures 1 and 2 show the evolution of sales in Portugal, Spain, UK and Europe as a function of the jackpot in two sequences of twelve draws in a row without jackpot winners. The initial levels of sales, that is sales in the first week without a rollover (15 millions jackpot), have been normalized to 1. It appears clearly that the Spanish and Portuguese curves are below the mean (corresponding to Europe) and the UK curve is far higher, showing a much greater sensitivity to jackpot increases in the UK. One possible interpretation is the highly competitive UK lottery market. For example, there were 680 authorized bookmakers in the UK in 2006, according to the report of the NJPC (National Joint Pitch Council). When the jackpot increases and the effective price decreases, Euromillions becomes more competitive and may attract players who usually bet on other lotteries, on racetrack or other sports through the bookmaker network (Forrest *et al.*, 2008).

Figure 1 around here

Figure 2 around here

Finally, Luxemburg also deserves a special comment. As can be seen on table 2, the per capita GDP is exceptionnally high, about 3 times the Portuguese one and 50% higher than the second highest, Ireland. This figure has to be regarded with prudence because thousand people work in Luxemburg (in banks and insurance companies) without living there. Most often, they come from France, Belgium and Germany. It also means that it is impossible to identify the origin of lottery sales. It is possible that a non negligible part comes from these cross-border employees.

III The estimation of the demand for Euromillions tickets

III.1 Model specification

The most common way to estimate sales in lotto-like games relies on the standard economic approach linking demand to price. However, the cost of a ticket is very stable through time and is not a good measure of the price, simply because there is an expected return from a lotto ticket. Consequently, most papers estimate demand through its link to the effective price, defined as the cost of the ticket minus its expected gross return (Gulley and Scott (1993), Scott and Gulley (1995), Walker (1998), Farrell *et al.* (1999), Forrest *et al.* (2001), Forrest *et al.* (2002), Wang *et al.* (2006) among others).

The two main factors determining the effective price are the expected volume of sales and possible rollovers which increase the jackpot and decrease the price. Obviously, other factors may influence demand, like income or demographic considerations but, on the short run, these elements cannot justify the variations observed on figure 3. This figure shows the draw-by-draw evolution of ticket sales for the Euromillions lottery between October, 15, 2004 and November, 16, 2007 (162 draws). Huge variations are observed, either progressively in a few weeks, when several rollovers occur in a row, or suddenly, when an exceptional jackpot is offered. It is the case in two occasions corresponding to draws 122 (02/09/2007) and 155 (09/28/2007) on figure 3 (the corresponding points are circled). In the first case the exceptional jackpot is 100 millions and it is 130 millions in the other case.

Figure 3 around here

The time-series of sales is typical for a lotto-like game (see for example Farrell *et al.*, 1999, Gulley and Scott, 1993, Purfield and Waldron, 1999 or Beenstock and Haitovsky, 2001). Successive rollovers generate large increases in sales and the curve is convex on the subsets of dates corresponding to such a sequence of rollovers (see figures 1 and 2 as examples of this phenomenon). Apart from the rollover effect, we also observe a positive trend on sales because the sample starts a few months after the inception of the game. The number of tickets sold starts from 20 millions and slowly increases to 40 millions

Figure 4 shows, on the same period, the evolution of the jackpot. It appears clearly that the peaks in sales correspond to large increases in jackpots due to rollovers or to the two exceptional events (also circled on figure 4). In fact, the correlation between the two variables on our estimation period is 0.89.

Figure 4 around here

But the increase in sales due to rollovers implicitly lowers the probability of a rollover in the next draw. Consequently, it is rather intuitive that the amount of the rollover is an essential determinant of the effective price; moreover, there is no takeout rate on the rollover amount.

The pari mutuel feature of lotto games make the estimation of demand interesting in itself because demand depends on the effective price which itself depends on demand (ticket sales). The problem is usually solved in a two-stage procedure. First, demand is estimated as a function of variables like the announced jackpot, a possible trend in sales, and some dummy variables related to exceptional events like superdraws (draws with an exceptional jackpot not coming from successive rollovers) or changes in the design of the game. This first estimation is used to calculate an effective price which is then injected in the second stage of the estimation procedure.

As mentioned before, the effective price is the difference between the cost of a ticket and its expected value. The expected value for draw *t* is written as:

$$AV_t = p \times JA_t \times ES_t + K_t \tag{1}$$

where *p* is the probability of winning the jackpot, JA_t is the amount of the date-*t* jackpot, ES_t is the portion of the jackpot a given winner will keep and K_t is the expected value of smaller prizes. We neglect the fact that rollovers may happen at lower ranks and we assume that K_t is equal to .62 euro, the part of gains devoted to ranks 2 to 12. Nevertheless, we have to mention that a rollover at rank 2 happens 7 times on the 162 draws of our estimation period, essentially in the beginning. But when a draw brings no winner at rank 2, the gains are reported on the following rank of the same draw. Consequently our simplifying assumption is innocuous.

Another exception deserves to be noticed. From November 2005 to February 2006, 12 draws in a row didn't bring any jackpot winner. The jackpot finally reached 183 millions and 3 winners shared it. After this sequence, the organizers decided, probably to avoid jackpot fatigue, that in case of 12 rollovers in a row, the jackpot would be shared by second-rank winners. It happened once, on November, 17, 2006.

Cook and Clotfelter (1990) remarked that the Poisson distribution is adequate to model the probability of getting a winning ticket. It allows to write AV_t as follows:

$$AV_t = \frac{1}{Q_t}\Big[\big[R_{t-1} + c(1-\tau)\beta_t Q_t\big]\big(1-e^{-pQ_t}\big) + c(1-\tau)\alpha_t Q_t\Big] \tag{2}$$

c is the cost of the ticket, τ is the takeout rate, Q_t is the number of tickets sold by date *t*, R_{t-1} is the cumulated rollover from previous drawings, β_t is the share of the prize pool devoted to the jackpot and α_t is the share devoted to smaller prizes (see table 1). On the period of our empirical study, α_t is constant equal to 62%. It is worth to notice that β_t rose from 22% to 32% of the prize pool in February 2006. However, the difference of 10 % was not taken on the share of smaller prizes (α_t) but on the Reserve Fund which was fed by 16% of the prize pool before the change and 6% after. Consequently, $\alpha_t + \beta_t < 1$.

As mentioned before, Q_t is not known in equation 2. The first stage of the process estimates Q_t with variables already known before date t. If we denote by I_t the information possessed at date *t*, the first-stage is devoted to the estimation of $Q_t^* = E\left[Q_t \left| I_{t-1}\right.\right]$.

Our model is close to the one proposed by Forrest *et al.* (2002). We use the following general formulation:

$$Q_t^* = f\left(CONSTANT, TREND_t, Q_{t-1}, JA_t, EVENT_t, HALO_t, SHARE_t\right) \tag{3}$$

where *EVENT* is a dummy variable taking into account the 2 exceptional jackpots in the database. *TREND* is simply the number of the draw to take into account a possible trend in sales. *SHARE* is a variable taking into account the change in the percentage devoted to the jackpot during our sample period. It takes two values, respectively 22% and 32% and is then equivalent to a dummy variable. Finally, *HALO* is a dummy variable aimed at taking into account a possible halo effect. It is sometimes observed that after a large jackpot has been won, sales remain important on the next draw (Farrell *et al.*, 1999, Grote and Matheson, 2007). In other words, there is a lag in the sales adjustment to the new jackpot level.

The presence of Q_{t-1} in equation 3 doesn't mean that we focus on the time-series properties of sales. In fact, the role of this variable is to take into account the fact that small prize winners on a given draw often reinvest their gains in the purchase of tickets for the next draw. Therefore, Q_{t-1} could be replaced by a "small gain" variable, say the amount of gains at ranks 11 and 12. However, this amount is strictly proportional to Q_{t-1} since the percentage of the prize pool devoted to these ranks is constant since the inception of the game. It also explains why, in the next section, we will use OLS to estimate equation 4 hereafter (see Walker and Young, 2001).

III.2 The first-stage equation

To estimate AV_t, we first perform the following regression (Model I):

$$\begin{aligned} Q_t^* &= a_0 + a_1 t + a_2 Q_{t-1} + a_3 JA_t + a_4 JA_t^2 \\ &+ a_5 EVENT_t + a_6 HALO_t + a_7 SHARE_t + \varepsilon_t \end{aligned} \tag{4}$$

The introduction of the variable "jackpot squared" is justified by the convex relationship between sales and jackpot amount usually observed (Forrest *et al.*, 2002, Wang *et al.* 2006). Beenstock and Haitowsky (2001) used log-sales and log-prizes in their regression but nevertheless introduced the square of the logarithm of the jackpot amount in their regression.

To estimate the coefficients, we need the announced jackpot JA_t. But the one reported in the database is either the announced jackpot, when there is no winner, or the realized jackpot where there are one or several winners. In the latter case, it may be different of the jackpot really announced before the draw. Therefore, we cannot directly use these figures in the estimation since they are not always known before the draw. We have to estimate the anticipated date-t jackpot with variables in the information set I_{t-1}.

If there are some winners at *t* - 1, we can keep the jackpot provided in the database for date *t*. It is usually a rounded amount, typically 15 millions. When there is a rollover, we assume that sales are expected to be the same as in the preceding draw and we take into account the percentage devoted to the reserve fund to feed the new jackpot. It is an approximation because the organizer uses this fund in a strategic way. More precisely, when the jackpot is "low", all the amount devoted to the fund in a given draw is added to the next jackpot. But after several rollovers, only a part (unknown before the draw) of the fund is added to the next jackpot. It implies that our estimation is very precise for low and mean jackpots but is a little bit optimistic for high ones, even if our estimation of sales is conservative. Figure 5 illustrates this point for a sequence of 12 draws in a row without winners. It compares the jackpot provided in the database (the dashed line *JR*) with our calculations (the bold line *JA*).

Figure 5 around here

The variable *HALO* is defined in the following way. When the draw t - 1 brings some winners and the corresponding jackpot includes rollovers of preceding draws, *HALO* = 1. In the other cases, *HALO* = 0. To take into account the difference between the two exceptional jackpots, *EVENT* takes the value of the announced jackpot for the two dates corresponding to the exceptional jackpots and 0 elsewhere.

After having estimated the coefficients in equation 4, we reintroduce the estimated values Q_t^* in equation 2 to calculate the anticipated value of the game AV_t. The effective price is then equal to $P_t = c - AV_t$ with c = 2 €.

III.3 The second-stage equation

The second stage of the estimation process links sales to the effective price obtained in the first-stage by means of the equation:

$$\ln(Q_t) = \beta_0 + \beta_1 t + \beta_2 \ln(Q_{t-1}) + \beta_3 \ln(P_t) + \beta_4 LEVENT_t + \varepsilon_t \qquad (5)$$

This formulation using logarithms for lagged sales, exceptional jackpots and prices allows to directly interpret β_3 as the short-run price elasticity of ticket sales. The long-run price elasticity is represented by $\beta_3/(1-\beta_2)$. Equation 5 is comparable to the one used by Forrest *et al.* (2002) and Wang *et al.* (2006), apart from the fact that we do not need to distinguish between Wednesday and Saturday draws since there is only one Euromillions weekly draw. Here *LEVENT* is the logarithm of *EVENT* when *EVENT* is strictly positive and 0 elsewhere.

IV. Empirical results at the aggregate level

IV.1 First-stage estimation

Equation 4 contains Q_{t-1}, therefore the estimation is performed on 161 draws starting on 10/22/2004. Table 3 summarizes the results. Not to deal with too large numbers, the variable, JA_t^2 has been divided by 10^8.

Table 3 around here

Six out of eight coefficients are significant at the 0.1% level. The only two unsignificant coefficients correspond to the variables *SHARE* and *HALO*. It is in fact not surprising. The date-*t* announced jackpot includes the part devoted to the reserve fund at date t - 1. Moreover, the change from 22% to 32% of the jackpot share was operated by diminishing the reserve fund. Consequently, the modification of *SHARE* is already included in JA_t. Concerning the variable *HALO*, Grote and Matheson (2007) remark that the halo effect corresponds to successive draws with decreasing sales and increasing jackpots. It appears only 5 times in our sample period, explaining that the halo effect is not large enough for the coefficient of *HALO* to be significant.

The adjusted R^2 is equal to 0.966 and the *F*-statistic is 640.75, the two being obviously largely significant.

IV.2 Second-stage estimation

As presented in the preceding section, the equation estimated in the second-stage is:

$$\ln(Q_t) = \beta_0 + \beta_1 t + \beta_2 \ln(Q_{t-1}) + \beta_3 \ln(P_t) + \beta_4 LEVENT_t + \varepsilon_t \qquad (6)$$

In this equation, the values of *LEVENT* are either 0 or $\ln(JA_t)$ for the two exceptional jackpots, to take into account the difference between the amount of these two jackpots. The results appear in table 4. All the coefficicents are highly significant and we are first going to focus on the short-run price elasticity which is equal to -0.609 with a *t*-value of -28.637. The significance of this coefficient clearly indicates a downward sloping demand curve as it was expected. *Ceteris paribus*, a decrease of 1% of the effective price generates an increase of 0.611% of sales. However, the usual caveat *ceteris paribus* is restrictive because a decrease of 1% in the effective price on a given draw has long-term effects (since lagged sales enter equation 5 with a highly significant coefficient). Consequently, the long-run price elasticity has to be measured by $\beta_3/(1-\beta_2)$. It is then equal to -0.896. This result is in line with the one obtained by Forrest and McHale (2007) in their analysis of the competition between the Euromillions lottery and the UK lotto. The maximization of sales by the organizer implies a long-run elasticity of -1. At a first glance, we could say that the level of sales is not maximized and that the effective price could be increased. We have to be prudent when referring to such an interpretation for two reasons. The first is obvious and concerns rollovers. Variations in the effective price essentially come from rollovers and it is not clear if a permanent increase in the effective price (by means of a takeout rate increase for example) would generate a decrease in sales corresponding to the long-run elasticity provided by the model. The second reason is more subtile. The long-run elasticity provided by the model concerns aggregate (European) data and is obtained by regressing the logarithm of global sales on the logarithm of the effective price. However, the big picture can hide large disparities across countries. Figures 1 and 2, shown in section 2, were signals of the maybe important behavioral differences across countries.

Table 4 around here

It is the reason why, in the next section, we reestimate equation 5 country by country.

V. International comparison

To reveal behavioral peculiarities in Euromillions gambling, equation 5 is estimated nine times, considering national sales levels as the dependent variables. It is important to notice that the effective price is the same in all countries because all players face the same conditions before a given draw (in terms of jackpot and winning probabilities) but the time series Q_t are different from a country to another. Consequently, coefficients β_2 and β_3 may vary depending on the behavior of national players. The essential results are reported in table 5. The model performs well in all countries and almost all the coefficients have the same significance level than in the aggregate analysis. The two exceptions are the coefficients of EVENT in Portugal and the United Kingdom which are significant at the 5% and 1% levels respectively, instead of 0.1% in the aggregate model.

Table 5 around here

There are large differences in coefficients β_2 and β_3 across countries. The influence of lagged sales is much more pronounced in Ireland and the UK and lead to high long-run elasticities (in absolute value). The comparison between UK and Spain is especially interesting. UK players have strong reactions to jackpot increases, leading to a high short-run elasticity. Due to the difference between coefficients of Q_{t-1} for the two countries, the difference between long-run elasticities is even higher. However, as explained in a stimulating paper by Garvia (2007), Spain is a specific case due to the development of syndication play. This development is due to historical reasons that may be traced back to the nineteenth century[5] and to the existence of the Christmas lottery which is a really important event in Spain. For this special lottery, 90 % of gamblers are syndicate players. Garvia shows that syndicates have become a common habit in Spain. Obviously, it is then not surprising that Spanish players are less sensitive to changes in the jackpot level since it is easier to always play the same amount for the members of a syndicate, especially if there are many members.

These national peculiarities show that the interpretation of long-run elasticity at the aggregate level can lead to questionable conclusions about the optimal level of the ticket price or of the takeout rate. It is simply due to the fact that $\ln\left(\sum_{k=1}^{9} Q_t^k\right)$ is not equal to $\sum_{k=1}^{9} \ln\left(Q_t^k\right)$ where Q_t^k stands for sales in country *k* at draw *t*. For example, consider a draw in which sales reach their mean level (of the three-year period under consideration) in each country, and assume the price has been increased by 1% through a change in the takeout rate. The short-run change in sales would be a decrease of 0.579%, according to the national elasticities, but 0.611% if we consider the aggregate coefficient. Using long-run elasticities, the decrease would be 0.93% with national elasticities but only 0.9% when using the coefficient obtained with aggregate data.

To conclude this empirical analysis, we illustrate the effect of the differences in elasticities by calculating the mean effective price paid by players in each country over the sample period. As UK players are highly sensitive to a jackpot increase, we can expect that they are “late comers” in the game. In other words, they start to play heavily at high jackpot levels when the effective price is low. Table 6 illustrates this point. We observe that the mean effective price paid by UK players is only 0.785 € (or the

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[5] The abolition of the Spanish lotto in 1861 and the reform of the *Loteria Nacional* increased the cost of gambling, then provoking the take off of syndicates among the working classes. It then became a usual social practice among all social categories.

equivalent in Sterling pounds) when the corresponding price paid by Spanish players is 0.928 €, that is more than 15% higher.

The third and fourth columns show the mean share of gains and tickets and the fifth is the ratio gains/tickets. We could expect that UK players generate a better return since they pay a lower mean effective price. It is in fact not the case on our sample period; the ratio is 0.992 for Spain and only 0.978 for the UK. It is not so surprising because the relationship between the realized number of jackpot winners and the number of tickets is non linear. The linearity only prevails for expectations. As the number of jackpot winners is in general very low, large differences appear between realized and expected numbers of winners. This phenomenon is also illustrated by the fact that low population countries exhibit extreme ratios, only depending on the presence of jackpot winners. For example, the ratio of Ireland is extremely high (1.53) only because an Irish woman was the only winner of a 115 million jackpot.

Table 6 around here

Perhaps we could conclude by a joke saying that UK players are more rational (or opportunistic)…but less lucky than Spanish players?

VI. Concluding remarks

The Euromillions lottery is especially well-suited for international comparisons at the European level since players in nine countries play the same game, face common rules and identical rollovers. However, players live in different national environments and may react differently to variations in the effective price of the lottery ticket. In our global analysis, we have shown that the very long odds of the game lead to frequent rollovers inducing huge variations in prices. The long-run price elasticity is -0.9, that is greater than -1, the level which maximizes the revenues of the lottery. The short-run elasticity is close to -0.6. These synthetic figures hide large dissimilarities across countries. More precisely, short-run elasticities are very low in Spain and Portugal, compared to the United Kingdom. It may be interpreted by referring to the regressivity of lotteries. In fact, Spain and Portugal have the smallest GDP of the nine countries and this could explain the lower sensitivity to rollovers. Moreover, the mean per capita sales in Portugal is incredibly high, compared to the ones in the other countries; it can also explain why Portuguese players cannot afford much higher bets when the jackpot increases. The other interesting countries are Ireland and the United Kingdom which exhibit very high long-run elasticities. Irish and UK players live in a highly competitive environment concerning the supply of lotteries and other games of chance. It is then not surprising to observe a low mean sales level coupled with a high sensitivity to jackpot increases. We have also shown that UK players pay a lower effective price by being "late comers" in the game.

Future research can be developed in several directions. At the country level, a study of whether national and multistate games are substitute or complements would deserve developments in the spirit of Forrest and McHale (2007) who already analyzed this question for the UK market. At the aggregate level, an interesting problem is the question of "free-riding". If national and multistate games are complements, one can ask if it is not interesting for a given country to benefit from the Euromillions jackpot feeding by other countries and simultaneously to propose a national game with a design close to the one of the Euromillions lottery. It is the strategy recently adopted in France by La Française des Jeux, the French state-owned sponsor of lotteries, who has abandoned the lotto game to propose a "new lotto" with rules resembling those of the Euromillions lottery.

References

Beenstock, M. and Haitovsky, Y. (2001), Lottomania and other Anomalies in the Market for Lotto, *Journal of Economic Psychology*, 22, 721-744.

Clotfelter, C. T and Cook, P. J. (1990), On the Economics of State Lotteries, *Journal of Economic Perspectives*, 4(4), 105-119

Cook, P.J. and Clotfelter, C. T., (1993), The Peculiar Scales Economies of Lotto, *American Economic Review*, 83(3), 634-643.

Farrell, L., Morgenroth, E. and Walker, I., (1999), A time-series Analysis of UK Lottery Sales: Long and Short Run Price Elasticities, *Oxford Bulletin of Economics and Statistics*, 61, 513-526.

Forrest, D., Gulley, D. and Simmons, R., (2001), Elasticity of Demand for UK National Lottery Tickets, *National Tax Journal*, 53, 853-863.

Forrest, D., Gulley, D. and Simmons, R., (2008), The Relationship between Betting and Lottery Play, *Economic Inquiry*, forthcoming, DOI: 10.1111/j.1465-7295.2008.00123.x.

Forrest, D. and McHale, I., (2007), The Relationship Between a National and a Multistate Lotto Game, The *Journal of Gambling Business and Economics*, 1(3), 207-216.

Forrest, D., Simmons, R. and N. Chesters, (2002), Buying a Dream: Alternative Models of Demand for Lotto, *Economic Inquiry*, 40(3), 485-496.

Garrett, T. A., (2001), An International Comparison and Analysis of Lotteries and the Distribution of Lottery Expenditures, *International Review of Applied Economics*, 15 (2), 213-227.

Garvia, R. (2007), Syndication, Institutionalization, and Lottery Play, *American Journal of Sociology*, 113 (3), 603-652.

Grote, K. and Matheson, V., (2007), Examining the `Halo Effect' in Lotto Games, *Applied Economic Letters*, 14 (4-6), 307-310.

Gulley, D. O. and and Scott, F. A., (1993), The Demand for Wagering on State-Operated Lotto Games, *National Tax Journal*, 45(1), 13-22.

Kahneman, D. and Tversky A., (1979), Prospect Theory: An Analysis of Decision Under Risk, *Econometrica*, 47, 263-291.

Matheson, V.A. and Grote, K.R., (2004), Lotto fever: do lottery players act rationally around large jackpots?, *Economics Letters*, 83, 233-237.

NJPC (National Joint Pitch Council), (2006), Annual report and accounts 2005, available at http://www.njpc-ltd.co.uk/data/documents/60-NJPC_05_6.pdf.

Purfield, C. and Waldron, P., (1999), Gambling on Lotto Numbers: Testing for substitutability or Complementarity Using Semi-Weekly Turnover Data, *Oxford Bulletin of Economics and Statistics*, 61(4), 527-544.

Scott, F.A. and Gulley, D.O., (1995), Rationality and Efficiency in Lotto Markets, *Economic Inquiry*, 33(2), 175-188.

Tversky, A. and Kahneman D. (1992) Advances in prospect theory: cumulative representation of uncertainty, *Journal of Risk and Uncertainty*, 12, 297-323.

Walker, I., (1998), The Economic Analysis of Lotteries, *Economic Policy*, 13(27), 359-392.

Walker, Y. and Young, J. (2001), An Economist's Guide to Lottery Design, The Economic Journal, 111, 700-722.

Wang J. H.., Tzengb, L. Y.and Tienc J., (2006), Willingness to pay and the demand for lotto, Applied Economics, 38, 1207-1216.

Rank	Nums+ Stars	%prize	Pgain	Rank	Nums+ Stars	%prize	Pgain
1	5+2	32%	1.31×10^{-8}	7	3+2	1%	1.3×10^{-4}
2	5+1	7.4%	1.83×10^{-7}	8	3+1	5.1%	1.82×10^{-3}
3	5	2.1%	2.75×10^{-7}	9	2+2	4.4%	1.86×10^{-3}
4	4+2	1.5%	2.95×10^{-6}	10	3	4.7%	2.73×10^{-3}
5	4+1	1%	4.13×10^{-5}	11	1+2	10.1%	9.8×10^{-3}
6	4	0.7%	6.19×10^{-5}	12	2+1	24%	2.63×10^{-2}

Table 1: Winning ranks, sharing of the pool prize and probabilities of gain

			Weekly sales					
Country	Pop	GDP	Min	Max	□□	□/pop	□ □	□ □□□
Europe	208.07	32771	18.89	139.5	39.99	0.19	18.94	0.47
Austria	8.193	35877	0.57	7.27	1.66	0.20	0.92	0.55
Belgium	10.379	35122	0.94	10.74	2.63	0.25	1.42	0.54
France	61.731	33307	5.02	33.01	10.07	0.16	4.97	0.49
Ireland	4.062	43341	0.18	3.967	0.99	0.24	0.62	0.63
Luxembourg	0.474	66729	0.08	0.82	0.21	0.44	0.10	0.49
Portugal	10.606	22134	3.69	30.17	9.44	0.89	3.61	0.38
Spain	44.491	28106	5.08	18.19	7.74	0.17	2.05	0.27
Switzerland	7.524	37847	0.67	8.45	2.04	0.27	1.07	0.52
UK	60.609	35085	0.99	35.26	5.21	0.09	5.08	0.98
JA			10	196.79	41.5		35.8	0.86
JR			10	183.57	39.66		33.57	0.85

Table 2: Descriptive statistics for population (Pop), per capita GDP (GDP), weekly sales, jackpot announced (JA) and jackpot realized (JR). For these three variables, the statistics are the minimum, the maximum, the mean, the standard deviation and the coefficient of variation. The data are in millions except the coefficient of variation (without unit) and the per capita GDP (in 2006 USD)

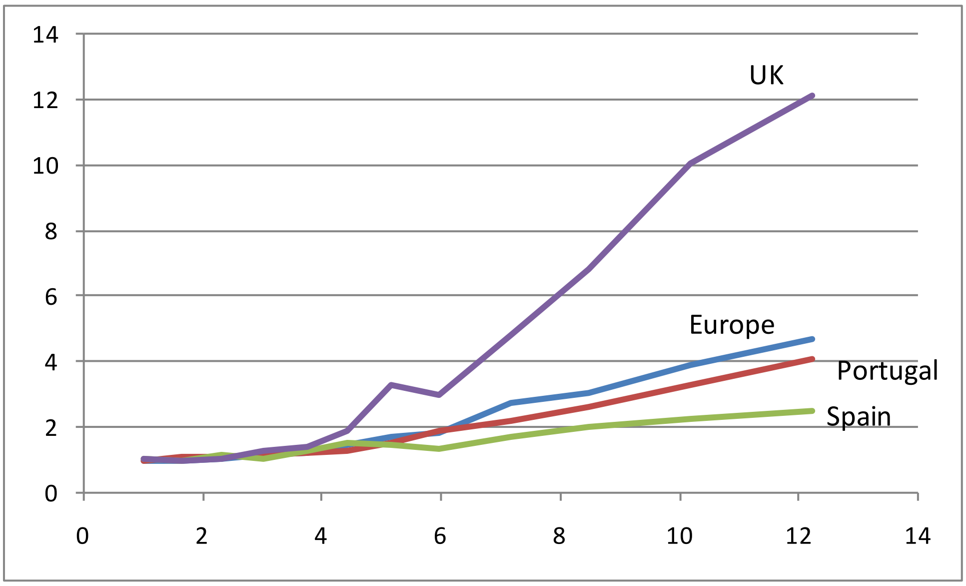

Figure 1: Normalized sales as a function of the jackpot in a sequence of 12 draws (11/18/2005 to 02/03/2006) without jackpot winners in Portugal, Spain, UK and Europe.

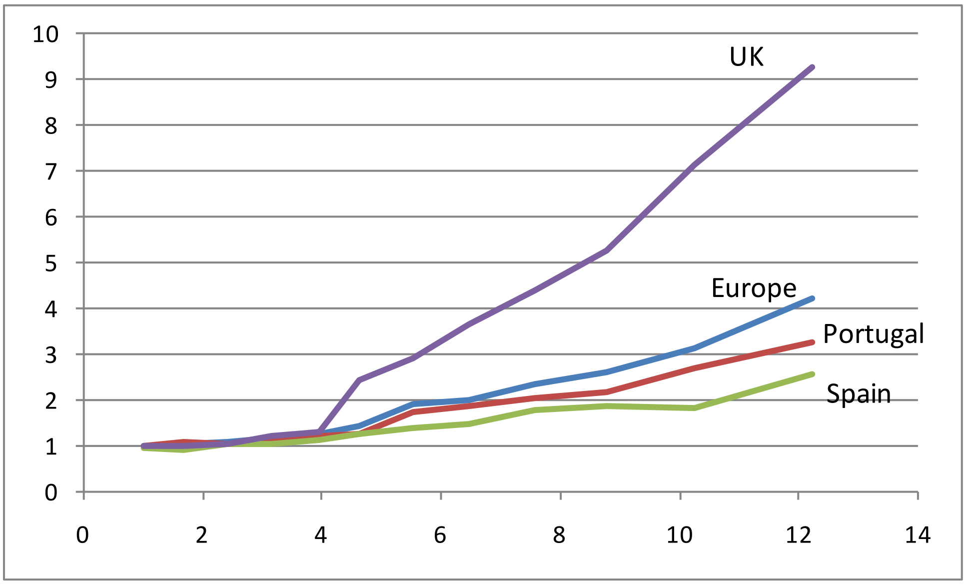

Figure 2: Normalized sales as a function of the jackpot in a sequence of 12 draws (09/01/2006 to 11/17/2006) without jackpot winners in Portugal, Spain, UK and Europe.

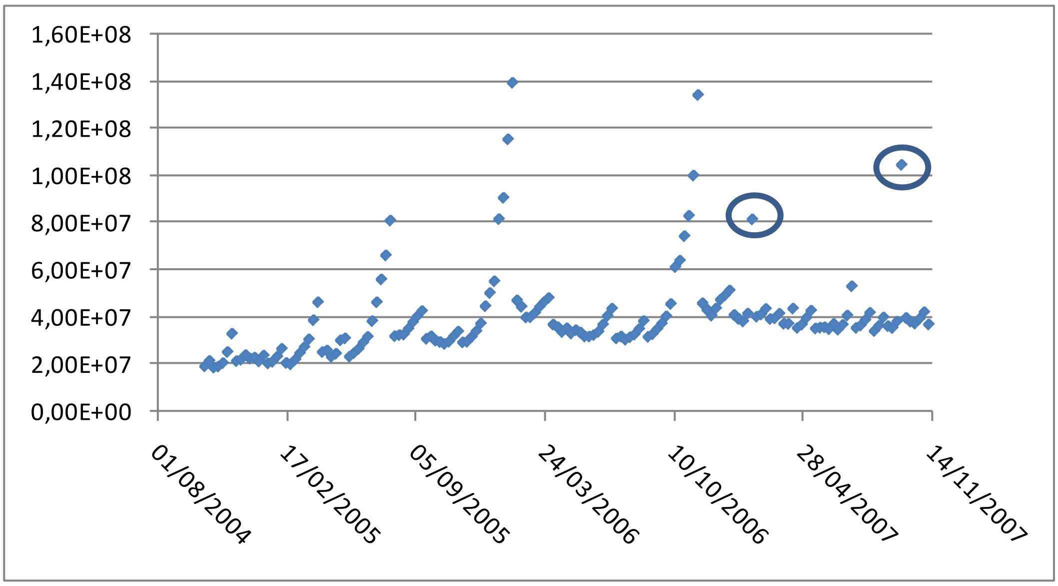

Figure 3: Evolution of sales through time (in number of tickets)

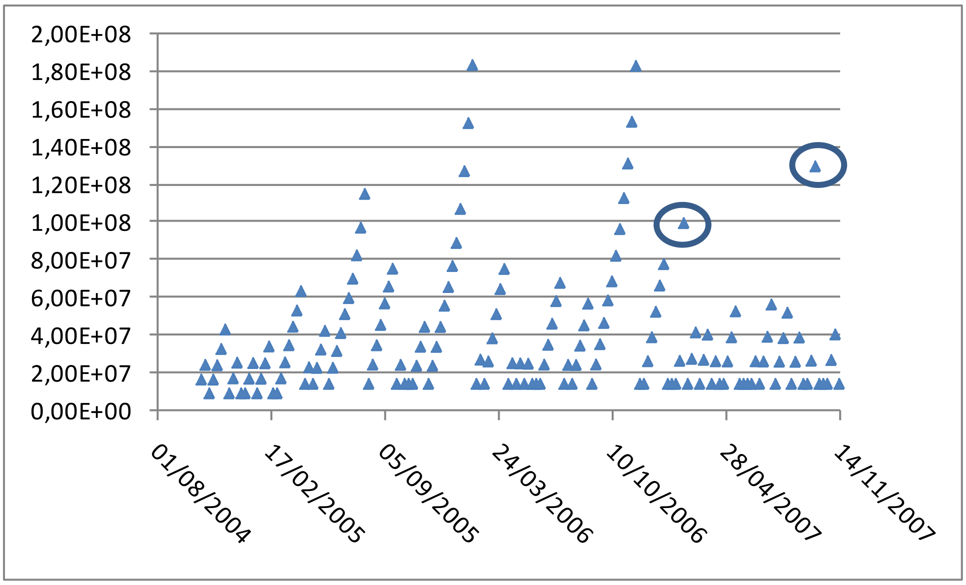

Figure 4: Evolution of jackpot through time (in euros)

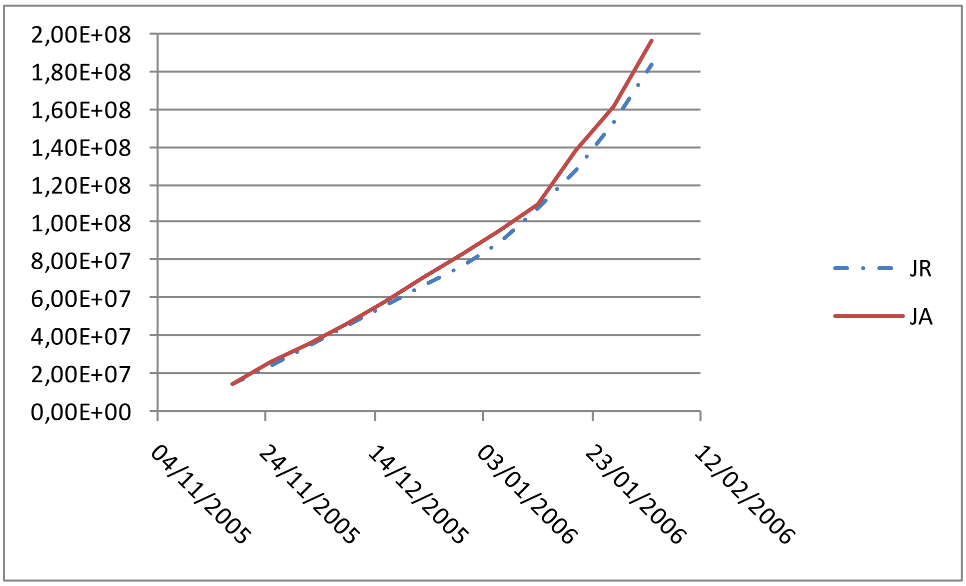

Figure 5: Realized and estimated jackpot in a sequence of draws without jackpot winners

	a	Standard deviation	*t - value*
CONSTANT	16393936***	1127672	14.36
t	73492***	12141	6.053
Q_{t-1}	0.167***	0.02	8.353
JA_t	0.103***	0.027	3.745
$(JA_t)^2$	0.202***	0.016	12.26
SHARE	509240	1100762	0.463
EVENT	0.17 ***	0.025	6.882
HALO	937832	833559	1.125
R^2=0.966	*F* = 640.75		
Note: 0.1% significance level is denoted ***			

Table 3

Model I: Weekly sales is the dependent variable with 7 independent variables

	β	Standard deviation	*t - value*
CONSTANT	11.621***	0.423	27.47
t	0.002***	0.000167	13.043
$\ln(Q_{t-1})$	0.32***	0.025	12.95
Price	-0.609***	0.021	-28.61
LEVENT	0.022***	0.003	6.69
$R^2=0.949$	F=745.5		
Note: 0.1% significance level is denoted ***			

Table 4

Model II: Estimation of the demand function for weekly sales. Independent variables are the effective price, the lagged sales, the trend and a dummy variable representing exceptional jackpots.

	CONSTANT	*t*	Q_{t-1}	$\ln(P_t)$	*EVENT*	*F*	*R^2*	*LRE*
Europe	11.621*** (27.47)	0.002*** (13.04)	0.32*** (12.95)	-0.609*** (28.61)	0.022*** (6.69)	745	.949	-0.9
Austria	10.552*** (18.91)	0.004*** (11.43)	0.231*** (5.69)	-0.649*** (17.51)	0.03*** (4.82)	247	.86	-0.85
Belgium	9.377*** (18.37)	0.004*** (13.12)	0.334*** (9.21)	-0.569*** (18.2)	0.023*** (4.69)	477	.923	-0.85
France	11.152*** (19.42)	0.002*** (6.79)	0.293*** (8.06)	-0.642*** (18.88)	0.029*** (5.52)	287	.878	-0.91
Ireland	4.27*** (10.16)	0.003*** (6.81)	0.665*** (20.12)	-0.483*** (11.63)	0.026*** (3.87)	591	.937	-1.44
Luxemburg	8.68*** (16.92)	0.002*** (5.78)	0.271*** (6.30)	-0.610*** (15.41)	0.033*** (4.83)	143	.782	-0.84
Portugal	9.407*** (17.06)	0.001*** (5.80)	0.404*** (11.59)	-0.486*** (18.05)	0.010* (2.47)	297	.882	-0.82
Spain	12.477*** (19.39)	0.001*** (6.97)	0.204*** (4.96)	-0.390*** (17.24)	0.022*** (6.00)	183	.820	-0.49
Switzerland	10.375*** (17.81)	0.003*** (8.71)	0.261*** (6.31)	-0.637*** (16.45)	0.031*** (4.72)	193	.829	-0.86
UK	7.125*** (16.73)	0.004*** (9.45)	0.507*** (17.24)	-0.865*** (18.43)	0.020** (2.86)	608	.939	-1.76

Table 5: Country-by-country analysis of weekly sales. Long-run elasticity (LRE) in the last column

Country	Mean Price	Gains	Tickets	Gain/tickets
Austria	0.88419395	0.0296465	0.04161489	0.71240124
Belgium	0.89074091	0.07867898	0.06584925	1.19483502
France	0.8759637	0.25980331	0.25177135	1.03190179
Ireland	0.87640837	0.0379131	0.02480384	1.52851748
Luxemburg	0.88582046	0.00284818	0.00524138	0.54340173
Portugal	0.90093353	0.21553208	0.2360346	0.91313763
Spain	0.92821258	0.19155787	0.19312543	0.99188321
Switzerland	0.88340697	0.05648929	0.05117978	1.10374231
UK	0.78548469	0.12753068	0.13037947	0.97815002

Table 6: Mean effective prices paid by players in each country, shares of gains and expenses in each country

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