

An Empirical Analysis of Gambling Consumption: *National Lottery* in Spain, 1850-2000.

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Most fortunately it happens, that since reason is incapable of dispelling these clouds, nature herself suffices to that purpose, and cures me of this philosophical melancholy and delirium, either by relaxing this bent of mind, or by some avocation, and lively impression of my senses, which obliterate all these chimeras. I dine, I play a game of backgammon, I converse, and am merry with my friends; and when after three or four hours' amusement, I would return to these speculations, they appear so cold, and strained, and ridiculous, that I cannot find in my heart to enter into them any farther.

David Hume, *Treatise of Human Nature*.

Introduction

The Spanish National Lottery is near to celebrating the two hundredth anniversary of the first Modern Spanish Lottery draw in Cadiz in 1812. Since then the factors stimulating the continued and consistent growth of this game have been numerous. In this context, an important factor is the now distant date of July 1st 1849, when provisional lottery sales centres were created in all towns acting as judicial administrative centres, and in any other places where there was sufficient demand. Towards the end of the nineteenth century (1892) the traditional “Christmas Draw” appeared for the first time, and described as such; this draw is now internationally famous. During the twentieth century, there were further innovations: from September 1941 all draws, whether regular or extraordinary, introduced the “reintegro”, or refund of ticket price. The innovation had a favourable effect on sales. Later, from 1966 onwards, prize payment could be made at any lottery sales centre. In June 1985 the National Organism for Lotteries and State Betting was set up, the cornerstone of the organization in charge of managing state lotteries, betting and gaming. Three years afterwards, the international renown of the National Lottery is evident. In October of that year, the first European Draw took place, with the participation of the state lotteries of Belgium, France, Luxembourg, Portugal, Sweden, Switzerland and Turkey. At the same time the First Latin-American Lottery Congress took place in Madrid. In 1992 the first Universal Extraordinary Draw was held in Seville with countries from four continents taking part. Since 2000 the legislation is in place regulating the public entity “State Lotteries and Betting”, which manages all the economic activity relating the gaming economy in Spain.

With these historic antecedents in mind, the main objective of the following paper consists of analysing the determining factors in the consumption of lotteries by way of an estimation of the historic function of gambling in Spanish families between 1850 and 2000.

1. Factors determining per capita spending on National Lottery, 1850-2000.

The first draw for the Modern Lottery took place in Cadiz on March 4th, 1812. This lottery followed the rules for lottery in force in “New Spain” (1769), based on a system of tickets divided into tenth shares, which was the system then used in the Dutch Republic. Previously, a primitive lottery (“*Numbers Lottery*”) operated more or less successfully between the years 1763 and 1862.¹ Almost two hundred years later, Guillén states that Spain spends 1.8% of its GDP on lotteries while only investing 1% of its GDP on R+D. In fact, Spain is the only OECD country which spends more money on lotteries than R+D (*Expansión* (daily economic paper), 17/06/2004). Along similar lines, Garvía points out that from the last quarter of the nineteenth century until the present day, Spain has become the greatest world consumer of lotteries. In fact, in the last 10 years the Spanish have spent an annual average of 1.5% of GDP on lotteries (*El País* (daily newspaper) 08/01/2006). Why? What factors motivate this fascination with gaming among Spanish economic agents?²

Usually it is assumed that spending on games of chance on the part of the economic agents is not rational, since it cannot guarantee part of the expected profit. In principle, there should be other motives to justify spending on gambling. According to Kearney (2002) there are two hypotheses which give an explanation for the demand of the consumer for lotteries. Either it is a response to expected benefits and therefore the consumers maximise their behaviour, or, on the contrary, the consumers seem to be misinformed about the risks and the prizes in lottery games. According to this same author, for the period 1992-8 consumption of lottery games in the United States reduced other consumer expenditure by 38\$ (approximately 2%), with a greater proportional reduction among those North American domestic budgets with lower incomes. Apparently, the demand for lottery products responded positively to the expected value

¹ Cordoncillo Samada, J.M. *Historia de la Real Lotería de Nueva España. (History of the Royal Lottery of New Spain)* Seville, 1962.

Herrero Suárez, Henar. *El monopolio de una pasión. Las Reales Loterías en tiempos de Carlos III. (The monopoly of a passion. The Royal Lotteries in times of Charles III)*. Valladolid: Universidad Secretariado de Publicaciones, 1992, p. 12.

² According to Murphy, between 1693 and 1699 English society was quite hooked on lottery. Murphy, Anne L. “Lotteries in the 1690s: investment or gamble?” *Financial History Review*, 12.2 (2005): 227-246.

of the gamble. This suggests that consumers of lottery products are not (were not) misinformed and were moreover completely informed as to their purchasing power.

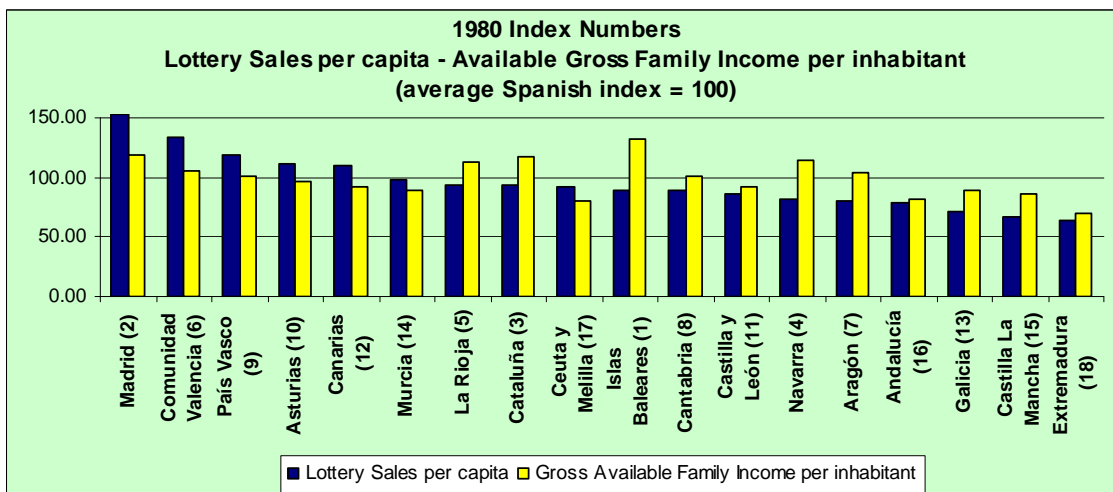
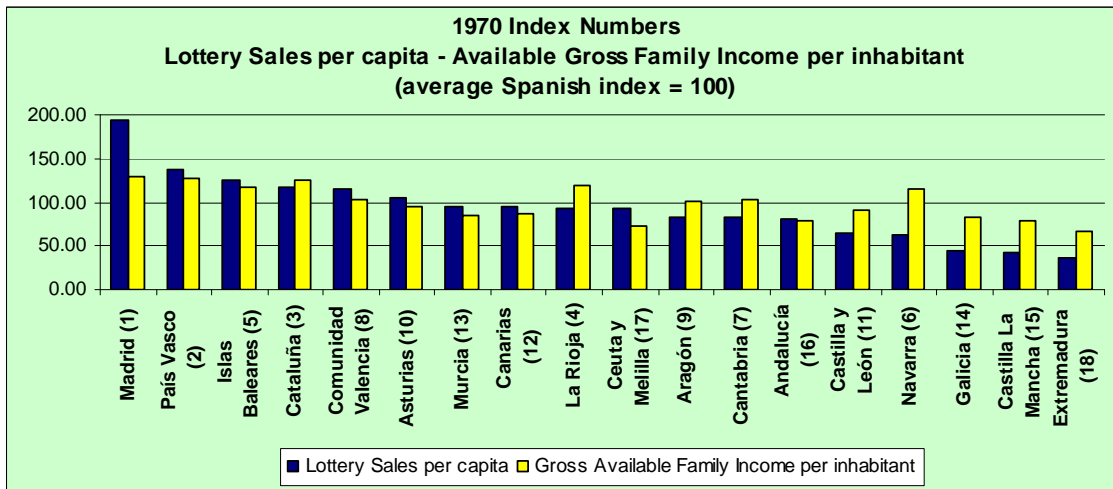
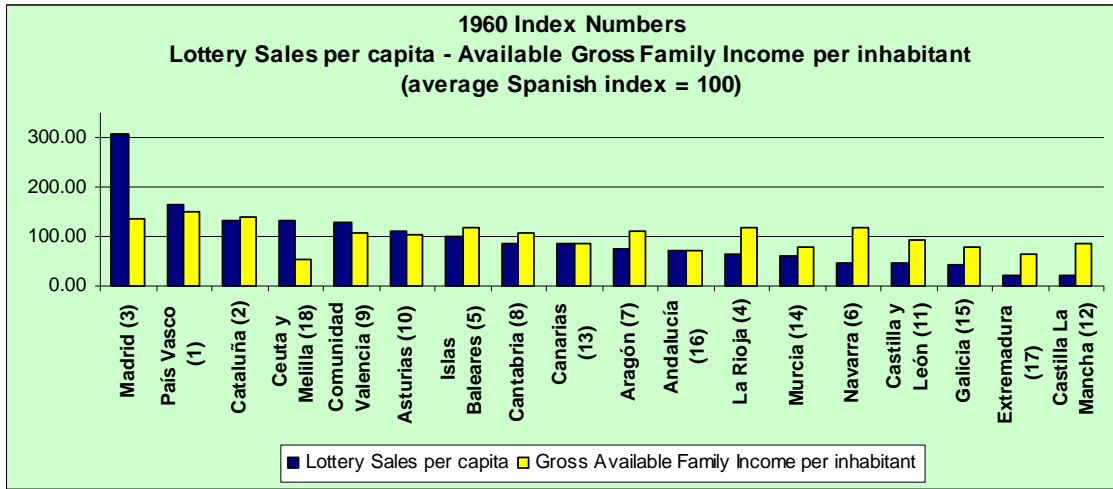
Earlier Clotfelter and Cook (1989, *Selling Hope: State Lotteries in America*) tried to study the determining factors for demand for lottery between 1975 and 1988. In order to do this they estimated a per capita expenditure according to the following variables: age, sex, race, religion, income, working situation (employed or unemployed), place of residence (level of urban development), studies and family status. The conclusions reached suggested that potential lottery consumers were middle-aged males – preferably Hispanic or black – generally Catholics, and employed in jobs calling for a maximum level of studies close to secondary education. Apparently, these authors did not find any consistent association between per capita expenditure on lotteries and income level.

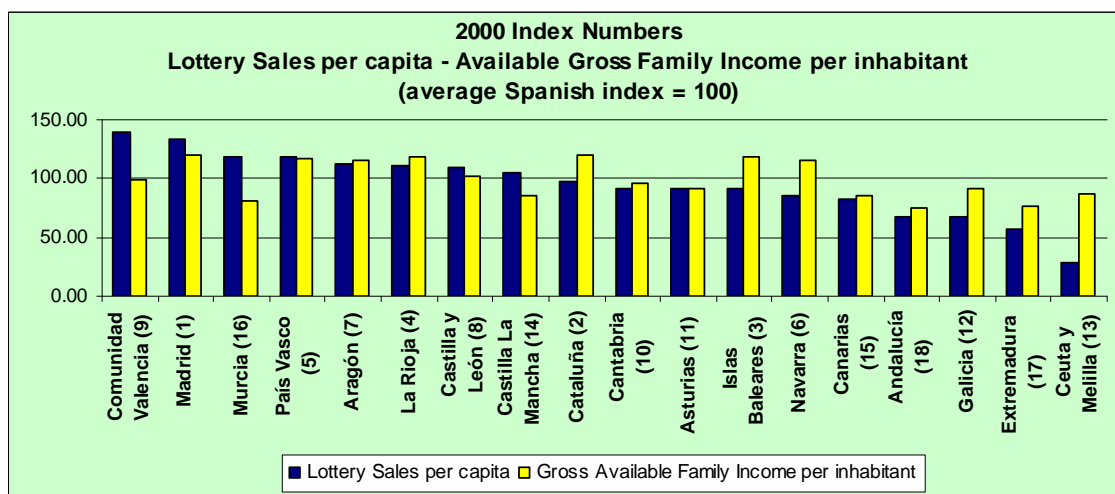
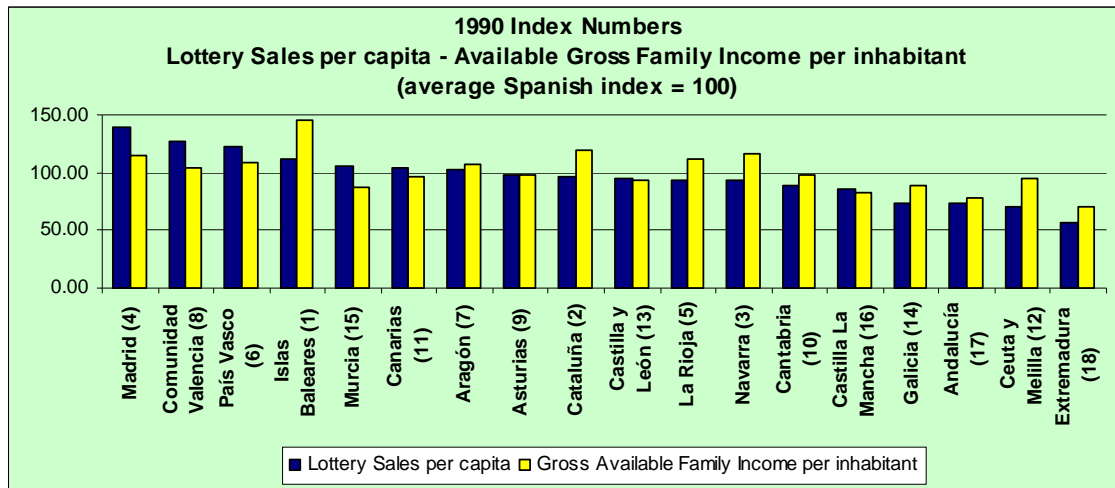
For the Spanish case, there are the pioneering works of Garvía (2005, *Azar y organización. Historia económica de las loterías españolas y europeas [Chance and organisation. Economic history of the Spanish and European lotteries]*) who tries to explain why and when Spain became the greatest consumer of lotteries. His main hypothesis is based on the concept of purchase in company: the participation of different economic agents who are somehow tied by the bonds of friendship or relationship stimulates spending on games of chance. Thus, for example, in Spain practically half the population shares lottery and this figure comes close to 90% as the Christmas draw approaches, whereas in the United States and Spain this percentage does not reach 30%. In the same way this custom of swapping shares in lottery tickets, based on close interpersonal ties, would imply a certain degree of high confidence in the lottery sales centres.

Neither is there determining proof about the influence of personal wealth. According to Palazuelos (2000) when comparing the gross domestic product per inhabitant and spending per inhabitant on National Lottery between 1995 and 1998, it is not always the autonomous regions with lowest income which devote less of that income to purchasing lottery. For example, in 1995, the Balearics, with the highest income per inhabitant were below average with regard to spending on gambling. However, regions with income levels below average – Castilla y León, Murcia and

Castilla La Mancha – had consumption levels above the average. This data can be clearly appreciated in table 1 where index numbers have been placed in relation for Sales of National Lottery per capita and Available Gross Family Income per inhabitant between 1960 and 2000, with the relative position of each autonomous region for available gross family income in brackets. Historically it can be seen that the greatest consumption of National Lottery lies in two of the autonomous regions with highest available gross family income: Madrid and the Basque Country. However, from 1980 onwards it is the Valencian Autonomous Region and Murcia – both with very low available gross family income – which are at the top alongside the Madrid Autonomous Region. Also of particular note is the progressive rise of two regions – Castilla y León and Castilla La Mancha – with available gross family income relatively lower than average, with high rates of emigration and very low population density. Likewise, the lowest consumption figures for National Lottery are historically in Andalusia, Extremadura and Galicia, and since 1980 the autonomous cities of Ceuta and Melilla.

Table 1
 Relation between per capita National Lottery Sales and
 Gross Available Family Income per inhabitant, 1960-2000
 (In index numbers. Mean index for Spain = 100)





Note: The position occupied by each Autonomous Region for available gross family income per inhabitant is given in brackets.

Source: Own preparation on the basis of Alcaide (2003, *Evolución económica de las Regiones y Provincias Españolas en el siglo XX*, (Economic Evolution of the Spanish Regions and Provinces in the twentieth century), pages 428-433) and from the Reports of the State Lotteries and Gaming organisation.

This would imply the existence of a series of “irrational” factors involved in greater spending on Lotteries. For example, according to Palazuelos there could be emotional factors. To be more specific, let’s take the example of the “Fallas” festival in Valencia or the “Festival of Moors and Christians” in Murcia, which are usually financed by shares in lottery tickets which are sold throughout the year. Nor should the importance of past prizes be ignored. In this context, the city of Lleida saw important growth in sales in 1996 after the jackpot prize (“El Gordo”) was won by a ticket sold there for the early January “Niño” draw, and there were similar cases in Soria (1997) and Granada (1998). There are even so-called popular beliefs and traditions. In 1997 there was significant growth in Badajoz and Melilla when income levels per inhabitant were not exactly high and there were no precedents of prizes. However, the fact is that

during that year there had been natural disasters in those places, which increased the consumption of lottery. Another variable which is per se extremely important is the traditional Christmas draw.³ Finally, we should not forget the important of the role played by the older economic agents in games of chance, who are in general more tolerant of the gambling culture (ABC daily newspaper: 07/07/1998).⁴

On the basis of these premises, the correct influence of all these aspects and or characteristics can only be made by means of the specification of an econometric model which includes the influence of each one of them. The econometric estimation of the historic factors in the consumption of National Lottery begins by taking all the variables in logarithms in order to avoid problems of heterocedasticity. To go into more detail, a translogarithmic function is used which develops a second order Taylor series around the point $\ln y = 0$,

$$\ln y \approx B_0 + \sum_{i=1}^m \left(\frac{\partial \ln X}{\partial \ln a_i} \right) \ln a_i + \frac{1}{2} \sum_{i=1}^m \sum_{j=1}^m \left(\frac{\partial^2 \ln X}{\partial \ln a_i \partial \ln a_j} \right) \ln a_i \ln a_j$$

where all the derivatives are evaluated at the expansion point. If we identify these derivatives as coefficients impose the symmetry of the cross (“a”) derivatives, then the function for Y will be as follows:

$$\ln y = B_0 + B_1 \ln a_1 + L + B_m \ln a_m + \delta_{11} \left(\frac{1}{2} \ln^2 a_1 \right) + \delta_{12} \ln a_1 \ln a_2 + \delta_{22} \left(\frac{1}{2} \ln^2 a_2 \right) + L + \delta_{mm} \left(\frac{1}{2} \ln^2 a_m \right) \quad [1]$$

If δ_{ij} equals zero, everything is reduced to a Cobb-Douglas function with a constant unitary substitution elasticity. This Cobb-Douglas function consists of a simple double-logarithmic transformation of all the variables used, with the exception, obviously, of the fictitious variables which may have been used.

Despite this, it is quite likely that the dependent variable may not grow at a constant rate over time. Supposing a model of quadratic tendency, such that the

³ Palazuelos, César (2000): “La Lotería. Historia y Cifras de la Ilusión Compartida” (The Lottery. History and Numbers of a Shared Dream. *Cuadernos de Información Económica*, nº 154, pp. 149-156.

⁴ REIS (1989). *Datos de Opinión. (Data of Opinion)* Separata number. 45. Madrid: CIS.

tendential component is a concave or convex curve, depending on the sign of the parameters.

$$\ln y_t = \beta_0 + \beta_1 \ln a_{1t} + \beta_2 (\ln a_{1t})^2 + \dots + \beta_m \ln a_{mt} + \varepsilon_t, \text{ siendo } t = 1, 2, \dots, T \quad [2]$$

If $\beta_2 > 0$, it implies a convex tendency. In other words, as time passes, the growth rate of the exogenous variable increases by a greater proportion. By contrast, if $\beta_2 < 0$ implies a concave tendency (the growth rate of the variable decreases as time passes). Adopting this supposition also affects the calculation of the elasticities, which would no longer be constant. To be more exact, by supposing a model of quadratic tendency, the elasticity of a_{1t} , all else being equal, would turn out thus:

$$y = \exp(\beta_0 + \beta_1 \ln a_{1t} + \beta_2 (\ln a_{1t})^2)$$

$$\frac{\partial y}{\partial a_{1t}} = y \left[\frac{1}{a_{1t}} + 2(\ln a_{1t}) \frac{1}{a_{1t}} \right]$$

$$\frac{\partial y}{\partial a_{1t}} \frac{a_{1t}}{y} = \beta_1 + 2\beta_2 \ln a_{1t} \quad [3]$$

Therefore, the elasticity of the tendential variable will be given by the expression [3]. The method of estimation proposed is that of minimal squares, counting the “t” statistics and the standard errors by the White method, robust to heterocedasticity. Under these premises, the provincial sales per capita of National Lottery have been considered as the dependent variable. There is, however, a problem or additional limitation when including the explicative variables given that we are looking at cross section data. For example, there is no data about the percentage of the population which would indicate “how many adult males resident in municipalities of more than one hundred thousand inhabitants with a specific level of income” buy National Lottery. Be that as it may, the explicative variables included are as follows:

Expectations of prize:

Apparently, the decision to play or not to play can be influenced by the winnings which may previously have been received. In the same way what is known as the “gambler’s fallacy” would be highlighted: the probability that a

prize should be given twice in a short period of time is low. To see what influence these expectations have on provincial sales per capita in 1859, the first prizes won by lottery consumers in 1858 are counted in.

Per capita income:

According to neoclassical economics, the consumption of lotteries is irrational given that it means buying an asset of negative usefulness. However, the relation between purchasing power, wealth or income and spending on gambling is not evident. The reasons may be many: disinformation about the risks and the prizes in lottery games, expectations about future winnings, addiction to gambling, the effects of purchasing in company, etc. To measure if consumers are fully informed about their income capacity and National Lottery consumption capacity, as an explicative variable, per capita income has been included. In 1860 this is measured by means of the industrial and commercial subsidy, and the Basque Provinces and Navarre are not counted in. From 1960 on, the GDP data at market prices with constant 1995 prices is used, as collected in Alcaide (2003). Likewise it is taken that per capita income does not remain constant with the passing of time, hence the introduction of a quadratic tendency.

Age:

Sometimes, most of the specialized literature considers that the older economic agents are more tolerant with the gambling culture. To measure the importance of this fact, from 1960 onwards the percentage of population over the age of 65 is included.

Education and Training of Human Capital:

With the inclusion of this variable, an attempt is being made to deduce the influence of the level of studies on purchasing National Lottery. This variable has been collected in percentage terms. In 1860, in the face of the absence of specific statistical data, the number of students signed on in the so-called

secondary teaching institutes has been taken. Between 1960 and 2000 the estimation for Human Capital (1964-2004) carried out by Mas, Pérez, Uriel, Serrano and Soler. On this basis the following categories of educational levels in the active population have been considered:

- **Primary Studies.** Included are those economic agents who have not completed compulsory secondary education (ESO), Basic General Education (EGB) or their equivalents. Likewise those agents who have not studied at all and/or who are illiterate.
- **Mid-level Studies.** This level includes the “Elementary Baccalaureate” and other first cycle studies: EGB, compulsory secondary education, Higher Baccalaureate, Professional Training, first and second grade, and other unclassifiable studies. In general terms, this population group has successfully completed between eight and twelve years of education.
- **University Qualifications.** This comprises the economic agents who have a minimum of a three-year (ordinary) degree or have completed three years of a longer degree course.

Degree of Urban Development:

To measure the impact of urban development and of the network of National Lottery sales centres, two variables have been considered. Until 1960 the number of Lottery Sales Centres existing in each province. From this decade on, the choice has been to include the demographic density.

Personal Satisfaction:

This calls for studying the influence of the socio-economic background of the economic agents, and for this, the number of emigrants per province (in percentage terms) has been taken as the variable.

Religiousness in the society:

According to Clotfelter and Cook (1989) Catholic societies are more given to the consumption of lotteries than Protestant ones. To check the behaviour of this variable in 1860 the number of regulars outside the cloister is used (in percentage terms). In 1960 the number of priests, seminarians and members of religious orders of the Spanish dioceses in 1959 (expressed also in percentage terms).

Table 1
 Estimated equation for lottery consumption, 1860-2000
 Dependent variable in logarithms: provincial sales per capita
 (t-student values in brackets)

Explanatory variables	1860	1960	1970	1980	1990	2000
Expectations of prize	5.0872 (4.804)	n.a.	n.a.	n.a.	n.a.	n.a.
Per capita income	0.1751 (0.316)	9.6684 (0.994)	22.9498 (1.478)	51.0924 (3.082)	40.0053 (2.776)	79.2957 (2.361)
Per capita income ^2	-0.0703 (-0.217)	-0.8046 (-0.945)	-1.9308 (-1.488)	-4.1852 (-3.077)	-3.2007 (-2.774)	-6.2553 (-2.368)
Population => 65 years old	n.a.	-0.9543 (-2.759)	0.0957 (0.257)	0.0008 (0.003)	-0.2118 (-0.908)	0.1615 (0.553)
Education and Training of Human Capital:	0.4478 (2.502)					
• Primary Education	n.a.	-0.2446 (-0.605)	-1.2416 (-3.415)	-0.4855 (-1.636)	-0.1842 (-0.810)	0.0279 (0.155)
• Secondary Education	n.a.	0.7668 (2.618)	0.7166 (3.759)	0.2195 (1.265)	0.5304 (2.449)	0.6027 (1.684)
• University degree	n.a.	-0.0288 (-0.059)	-0.0012 (-0.004)	0.0746 (0.370)	0.2318 (1.607)	0.5499 (2.466)
Urban development:						
• N° of lottery sales centres	0.4545 (2.495)	0.3983 (4.424)	n.a.	n.a.	n.a.	n.a.
• Demographic density	n.a.	n.a.	0.1937 (2.656)	0.1142 (1.868)	-0.0102 (-0.231)	-0.0378 (-0.615)
Personal satisfaction: % emigration	0.1885 (3.960)	0.0240 (0.545)	n.a.	n.a.	n.a.	n.a.
Degree of religiousness	0.1542 (1.238)	-0.0688 (-0.729)	n.a.	n.a.	n.a.	n.a.
Constant	5.0872 (4.804)	-26.3315 (-0.943)	-64.3396 (-1.385)	-152.004 (-3.011)	-121.061 (-2.695)	-248.478 (-2.333)
R ² Determination Ratio	0.8374	0.8737	0.8106	0.5792	0.5376	0.3984
Observations	45	50	50	50	50	50
F Statistic	27.2288	30.7523	25.6717	8.2591	6.9764	3.9730
Probability > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0021

Note: The variables significant to 95% are shown in bold type.

The estimated data in figure 1 are quite significant. In the first place, it can be seen that expectations of a prize were particularly influential in 1860. Although it is true that statistically it is possible for there to be a degree of very high correlation between per capita sales and winnings made by consumers, which could put the results in doubt.

In per capita income – measured through the GDP at market prices – one can see a concave quadratic tendency. In other words, as per capita income rises, National Lottery sales increase up to the point of a certain GDP threshold (or per capita income if family units are being considered) when they begin to decrease. Statistically this variable is significant until 1980. Likewise the provinces with the lowest GDP per capita are those which greatest positive elasticity. This means that if the GDP varied by 1 per cent, sales of National Lottery would increase much more in these provinces than in provinces with a higher per capita income. To sum up, everything points to the fact that consumers were and are fully informed about their income capacity and their National Lottery consumption capacity.

It would not seem that the oldest economic agents are particularly given to spending more on National Lottery. With regard to the relation between the training of the human capital and provincial National Lottery sales per capita it can be seen – both in 1860 and in the period 1960-90 – that highest rates of consumption are to be found among those with mid-level qualifications. Since the 1990s it appears that the higher levels of qualification are more and more active in buying National Lottery. This causal correlation is extremely important because normally those with mid- and higher levels of qualifications in the active population are associated with a greater income from salary.

Urban development seems to have had an important role prior to the full integration of the Spanish economy in the European Union. Since 1980 the demographic density is not relevant to explain spending on National Lottery. Likewise emigration is only a significant phenomenon in the nineteenth century, while religious beliefs hardly influence the consumption of Lotteries.

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