Is the Lottery Product an Inferior Good in Higher Income Countries?

Maria João Kaizeler (Corresponding Author)

SOCIUS - Research Centre in Economic Sociology and the Sociology of Organizations, Lisbon, Portugal

Rua Quinta do Paizinho, 22, Lisboa, Portugal

Tel: 351-21-471-5224 E-mail: mkaizeler@gmail.com

Horácio C. Faustino

ISEG, Technical University of Lisbon and SOCIUS - Research Centre in Economic Sociology and the Sociology of Organizations, Lisbon, Portugal

Rua Miguel Lúpi, 20, Lisboa, Portugal

Tel: 351-21-392-5902 E-mail: faustino@iseg.utl.pt

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Abstract

Do the populations of low per-capita income countries participate with a stronger desire to win and spend relatively more money on lottery products? Is such a desire to buy lottery products constant, or does it decrease when the country reaches a higher per-capita income class? To answer these questions, this paper uses econometric models with significant explanatory variables. The results confirm the hypothesis that the lower income-class countries spend more than the higher income-class countries. However, the results do not confirm the hypothesis that lottery products may be considered an inferior good in countries belonging to the higher per-capita income class. The results also show that for all countries, there is an inverted U relationship between per-capita sales and per-capita GDP and up to a specific value, the per-capita lottery sales decrease as per-capita GDP increases, becoming an inferior good as a result.

Keywords: Elasticity of demand, Income class, Gambling, Inferior good.

1. Introduction

The Friedman-Savage (1948) utility function, elaborated upon expected utility theory, argues that utility in a specific segment of wealth is increasing. The dream of upward mobility into a higher socio-economic class is the explanation that the Friedman-Savage utility function puts forward to account for gambling and the purchase of lottery products.

Wisman (2006) considers that the poor have limited options for recreation and the State, through the State lotteries, takes advantage of the poor. In this sense, revenues from lotteries would be a regressive tax.

Gambling has become a popular, legal activity among poor and rich people throughout the world. People are found to play lottery games in more than half of the world's countries. For example, in the United Kingdom, more than half of the adult population plays the lottery every week (see Sproston, 2002). Despite this, there have been few econometric cross-country or panel data studies on this phenomenon.

Garrett pioneered the estimation of the income elasticity of demand for lottery products by income class, using a cross-country regression on the year 1997 and concluding that "the elasticity of demand for lottery ticket purchases is different both across continents and income classes." (Garrett 2001, 224) The main purpose of the present paper is to deepen the study of Garrett and answer the question whether lottery products are an inferior good when we consider different income-class countries. Using regression analysis, this paper tests some theoretical hypotheses, namely, the hypothesis that per-capita lottery sales vary among income classes and the hypothesis that the income elasticity of demand for lottery products varies across income-class countries. The underlying theoretical explanation is that lottery products may be considered an inferior good in countries having the highest levels of per-capita GDP (an inferior good being defined as one for which purchases decrease as income increases). When income increases, the income elasticity of demand for this good becomes negative and lottery sales decrease.

The paper also tests the hypothesis that lottery sales increase together with increases in per-capita GDP up to a point, and then decrease. In this case, when we consider the income as a continuous variable, there is an inverted U relationship between per-capita sales and per-capita GDP and up to a specific per capita income people will spend a declining percentage of their income on gambling as their income increase.

As there are other determinants of the expenditure on lottery products, the paper introduces in the regression analysis other explanatory factors, such as education and the male-female ratio.

To test the hypotheses that are formulated, the paper uses data for 80 countries in the year 2004.

The paper is organised as follows. In the second section, the literature is reviewed. The third section presents and describes the formal hypotheses. The fourth section presents the econometric model and explains the empirical findings. The final section considers the study's implications and presents our concluding remarks.

2. Review of the Theoretical Literature and Empirical Studies

Friedman and Savage considered that a possible interpretation for the typical shape of a utility curve – two convex segments, corresponding to qualitatively different socio-economic levels, and one concave segment corresponding to the transition between the two levels – is as follows: "increases in income that raise the relative position of the consumer unit in its own class, but do not shift the unit out of its class, yield diminishing marginal utility, while increases that shift it into a new class, that give it a new social and economic status, yield increasing marginal utility" (Friedman and Savage, 1948: 298). The dream of moving up into a higher class may explain gambling and why low income-earners participate with a stronger desire to win.

The first national prevalence survey was conducted in the United States, the objective being to identify individuals with gambling-related problems (Kallick et al., 1979). This survey found that 68 percent of adults reported having gambled at some time in their lives and 61 percent declared that they had gambled during the previous 12 months. The report on this survey contains a wealth of information on gambling participation and on the characteristics of people who engage in different forms of gambling. Among the findings obtained, there were indications that males, residents of large cities, Catholics, Jews and younger adults had relatively high levels of participation. More recent prevalence surveys have reached similar conclusions with regard to the demographic characteristics of consumers of gaming products (see Abbot et al., 2004).

Clotfelter and Cook considered that lotteries are played mainly by the poor. These authors did not find any consistent relationship between the estimated per-capita expenditure on lotteries and the average income level when using data for Maryland and Massachusetts. The only exception found was for lotto games with comparatively large jackpots, for which expenditures tended to rise with income (Clotfelter and Cook, 1989).

Certain studies have found that low income households spend a greater proportion of their income on state lotteries than do middle- or high-income households (Clotfelter et al., 1999; Kearney, 2005). Income has been identified as one of the most important factors explaining the demand for lottery products. According to several authors, the idea of desperation has been put forward (the "desperation" hypothesis of gambling) in order to establish an antagonistic relation between wealth and gambling. The less people have, the higher are their aspirations to attain better conditions, gambling on lotteries in desperate search of a solution when they cannot find another way to resolve their financial stress. Accordingly, the purchase of lottery tickets is motivated by a wish to escape poverty (see, for example, Friedman and Savage, 1948; Blalock, Just and Simon, 2007).

Some studies have sought to find a possible correlation between lottery purchasing behaviour and demographic characteristics, such as age, gender, race, religion, income and educational attainment, but with little consensus achieved among the authors. Chalmers and Willoughby (2006) examine gender-specific factors which might be related to adolescent gambling behaviour and conclude that there are consistent gender differences observed. Welte et al. (2007), using a tobit regression analysis, study the relationship between the type of gambling and gambling problems by age and gender. Lam, using a logistic regression analysis, investigates the effect of religiosity on gambling participation and concludes that "religiosity, and frequency of religious participation in particular, can have a significant influence on one's level of gambling participation" (Lam 2006, 316). However, except in the case of lotteries, his study did not find any relationship between the importance of faith for the gambler and the frequency of gambling participation. With regard to lotteries and faith, different authors have reached different conclusions (see, Lam, 2006; Diaz, 2000).

Although much research has been done on lotteries using cross-sectional studies, there has been little investigation into income elasticity of demand for lottery products, considering different income-class countries. A good exception is Garrett's (2001) paper.

3. Hypotheses

This paper discusses the following explanatory hypotheses for lottery product demand:

3.1 H1: The relation between per-capita lottery sales and per-capita GDP is an inverted U.

We expect that lottery sales increase together with increases in GDP, up to a point where a country has reached a level at which the GDP is high enough and lottery sales (or expenses on the part of consumers) become an inferior good and as a result, start to decrease. In order to analyse this relation and to discover what that GDP maximum level might be, we include the variable (PCGDP)2

3.2 H2: Per-capita lottery sales vary among income classes

We created four dummy variables in order to have four categories of per-capita income:

Class 1 =1 if per-capita GDP is lower than 4,614 US$ and zero otherwise;

Class 2 =1 if per-capita GDP is between 4,615 US$ and 11,654 US$ and zero otherwise;

Class 3 =1 if per-capita GDP is between 11,655 US$ and 28,079 US$ and zero otherwise;

Class 4 =1 if per-capita GDP is higher than 28,080 US$ and zero otherwise.

We do not include Class 4 in the model in order to avoid collinearity (Class 4 is the base group).

3.3 H3: The income elasticity of demand for lottery products varies across income-class countries

In order to test this hypothesis, the paper considers an equal distribution of four quartiles (with each quartile containing twenty countries). Based on Garrett's findings, we believe that this distribution is sufficient to obtain significant results, because despite the aggregation, it is possible to test whether the income elasticity of demand for lottery products varies across income classes and whether the sign of this elasticity changes or not.

The dummies are then interacted with country GDP, giving us the 4 variables to be included in the model: Class1*PCGDP, Class2*PCGDP, Class3*PCGDP and Class4*PCGDP. If we include PCGDP as an explanatory variable, we should exclude Class4*PCGDP to avoid collinearity.

3.4 H4: The higher the level of education, the smaller will be the per-capita lottery sales.

The studies of scholars such as Coups, Haddock and Webley (1998), Ghent and Grant (2007) and Giacopassi, Nichols and Stitt (2006) have revealed the existence of an inverse relationship between education and lottery consumption.

This is a control variable. By including the variable Education (EI), an attempt is made to infer the influence of education in the demand for lottery products. We assume that the higher a country's level of education is, the less misinformed consumers are, hence, the less will they gamble. Therefore, we expect a negative relation between the education index and lottery sales (see Coups, Haddock and Webley, 1998; Ghent and Grant, 2007).

3.5 H5: The higher the male-to-female ratio, the higher the per-capita lottery sales.

There are some factors that intensify gambling behaviour in men. Men are likely to be less risk-averse, in addition to being more susceptible to over-confidence (see Chalmers and Willoughby, 2006). Consequently, we expect a positive relationship between the gender ratio and lottery sales. Ghent and Grant (2007) using a maximum likelihood estimation, found a positive relationship between the male-female ratio and sales of lotto tickets.

4. Empirical Results and Data Source

The dependent variable consists of the total sales that aggregates the seven categories of games tracked in La Fleur's almanac, namely, lotto, numbers, keno, toto, draw, instant and others (e.g., bingo), converted to U.S. currency. The La Fleur almanac is a complete reference source on the worldwide lottery. All information is gathered directly from government sources.

The explanatory variables were obtained from world data bases. These include: World Bank data, which provided information on GDP and population; the U.S. Census Bureau International Data Base, which yielded information on the age and gender distribution of a country's population; the UN Human Development Report, which provided information concerning the educational levels of the countries considered.

4.1 General Econometric Model

$$Yi = \beta_0 + \beta_1 Xi + \varepsilon i$$

Where Yi stands for PCS15 (per-capita sales over 15 years) in normal values or in logs, X is a vector of explanatory variables in normal values or in natural logs and εi is a random disturbance assumed to be normal, independent and identically distributed (IID) with E (εi) =0 and Var (εi) = σ2 > 0 . It is assumed that the explanatory variables are exogenous. The explanatory variables are the variables considered in the theoretical hypotheses: PCGDP, Class 1, Class 2, Class 3, PCGDP*Class1, PCGDP*Class2, PCGDP*Class3, EI and GenderRatio.

4.2 Regression Results

In Table 1, we specified four regression equations. In all regressions, we are particularly interested in knowing whether the lottery product may be considered an inferior good for all countries or not.

Table 1 displays the OLS estimation results, using the robust bias correction as suggested by Davidson and Makinnon (1993).

In equation 1, all the explanatory variables are statistically significant. The variables Education Index (EI) and gender ratio are statistically significant with the expected sign. The effect of changes in levels of education on lottery sales is negative, which is as expected. The increase of 1% in the Education Index (EI) diminishes per-capita lottery sales by approximately 140 US$. In this regression, the EI appeared significant at 5%. The increase of 1% in a country's male-to-female ratio implies an increase in per-capita lottery sales of 308 US$. The gender ratio is significant at 10%. The results also show that an increase of 1 US$ in per-capita GDP will lead to an increase of 0.018 US$ in the per-capita lottery sales. However, as we specified a quadratic function and the coefficient of $PCGDP^2$ is negative and significant, this result confirms the hypothesis that the relation between these two variables is an inverted U. The correlation between per-capita sales and per-capita GDP is positive up to a specific annual value of PCGDP but, after this level, the correlation becomes negative. This leads us to conclude that the changes in income have a positive effect on lottery sales in all income-class countries, but this effect is decreasing. Considering all countries, the results suggest that the lottery product becomes an inferior good for people having a high per-capita GDP, regardless of whether or not they live in different income –class countries.

We may conjecture that the consumers in high income-class countries spend a declining percentage of their income on lotteries when their income increases. This can be confirmed by means of the elasticity concept. When the income elasticity becomes negative, it can be said that the good is an inferior good for these countries. This is performed in equations 3 and 4. As these two equations give the same results (see Schwartz information criteria and the RESET test), we will analyse only equation 4. The difference between equation 3 and 4 is the introduction of PCGDP in equation 3, excluding the variable PCGDP*Class4 (base group) for collinearity reasons. The difference between equation 2 and 3 is the logaritmic form for the dependent variable and the explanatory variables related to income classes. The RESET test suggests that we should use the model with logaritmic variables (equation 3 instead of equation 2).

In equation 4, the results show that different income classes behave differently. The dummy class variables are statistically significant (Class 1 is significant at 10.8% only). Regarding the income-class variables, only PCGDP*Class2 and PCGDP*Class3 are significant. The results show that for the second income class, changes in income (1%) lead to a change in the demand for lottery products of 3.71% and for the third income class, the changes of 1% in per-capita GDP increases the per-capita lottery sales by 2.99%. The F test confirms that these two coefficients are not equal. The tendency is decreasing, but the results for the fourth income class are not statistically significant. So, the results do not provide statistical evidence that income elasticity increases up to a certain income-class and decreases in the other income-classes, becoming negative. The coefficient of the variable PCGDP*Class 4 is negative, but the variable is insignificant. These results do not confirm Garrett's (2001) findings, since we did not find a negative and significant coefficient for the highest income-class countries. Therefore, the results of this paper do not confirm the hypothesis that lottery products may be considered an inferior good in countries having the highest level of per-capita GDP. Consistent with our expectation, the coefficient on gender ratio is positive and significant. The increase of 1% in a country's male-to-female ratio implies an increase in per-capita lottery sales of 11.62%.

5. Concluding Remarks

This study has fulfilled the stated objectives and the results confirm the hypothesis that lottery sales vary across income classes. Another interesting result is that in the first regression equation and for all countries, the changes in a country's income always produce a positive, but decreasing effect on lottery sales. These results also suggest that there may be an income cut-off point, beyond which gambling may decrease. In other words, there may be a point at which lottery sales reach their maximum and then start to decrease. The paper tests this hypothesis and finds an inverted U relationship between per-capita sales and per-capita GDP. Unlike Garrett, our study has not found a negative elasticity for the highest income-class countries. Hence, this paper cannot conclude that lottery products may be considered an inferior good in countries having the highest levels of per-capita GDP.

Other interesting results were obtained from both equations. The results show that countries in which the percentage of males is higher than that of females reveal higher lottery sales. In the first equation, the higher the education index, the fewer lottery products are sold. It is important to stress that this study is a cross-sectional study, in which the lack of a panel data and more qualitative information limits the conclusions and the generalisation of results. A panel data set, having both a cross-sectional and a time series dimension, would allow the sample size to be increased. In addition to the use of a panel data, there are other econometric methods that are somewhat more advanced. This study has incorporated a number of factors that affect lottery ticket-buying behaviour. Nevertheless, numerous issues remain beyond the scope of the present study, yet still merit investigation. For example, this paper does not consider the presence of substitute gambling products and does not control for the effects of price changes in these differentiated goods, ceteris paribus, on the demand for lottery products. If we introduce a new parameter to be estimated - the elasticity of substitution between lottery products and other gambling products - the elasticity of demand for lottery may be affected. However, since the market is characterised by product differentiation we feel that this shortcoming does not affect significantly the elasticity of demand for lottery products.

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Table 1. The Regression Equations (Dependent Variable: PCS15)

	1	2	3	4
PCGDP*Class1		0,0013	0,533	0,53
		(0.66)	(0,69)	(0,70)
PCGDP*Class2		0,0051	3,71	3,71
		(1,34)	(2,25)**	(2,29)**
PCGDP*Class3		0,0318	2,98	2,99
		(3,42)***	(2,56)***	(4,54)***
PCGDP*Class4				-0,14
				(-0,40)
Class 1		-273,9	-9,6	-11,04
		(-4,83)***	(-1,62)	(-1.63)
Class 2		-279,9	-36.4	-37,88
		(-4,31)***	(-2,41)**	(-2,48)**
Class 3		-664,8	-29,98	-31,5
		(-4,18)***	(-3,58)***	(-4.32)***
GenderRatio	308,76	220,1	11,16	11,62
	(1,95)*	(1,14)	(3,96)***	(3,97)***
EI	-140,29			
	(-2,07)**			
PCGDP	0,018	-0,00085	3,9e-07	
	(4,40)***	(-0,66)	(0,01)	
PCGDP²	-1,94e07			
	(-2,41)**			
Constant	-267,13	68,84	5,65	-4,21
	(-1,56)	(0,31)	(-1,95)	(-0,93)
B.I.C.	978,78	979,53	269,4	269,4
RESET(p-values)	0,029	0,000	0,948	0,946
N	80	80	80	80
Adjusted R2	0,5215		0,8091	0,8091

Notes: t-statistics (heterokedasticity corrected) are in parentheses. (Breusch-Pagan/Cook-Weisberg test for heteroskedasticity)

* ,**, ***significant at 10% ,5%; and 1% level, respectively.

In Regressions 3 and 4, the dependent variable and the explanatory variables related to income classes and PCGDP are in natural logarithmic form, in order to estimate the elasticities.

The table includes also the p-values of the RESET specification test(under the null that the model has no omitted variables/good specification) together with the Schwartz information criteria, BIC (when the numerical values of the dependent variable are identical, the model with the lower BIC is preferred).