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Media Exposure and Individual Choices:

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To what extent individual choices are influenced by media exposure? We try to provide evidence on this issue considering how the sales of lotto tickets are determined by the size of the top prize (the jackpot) compared to the amount of attention that media devote to the game. We use data on the Italian SuperEnalotto (2003- 2010) and estimate tickets sales in relation to the jackpot size and to several measures of lotto media coverage. To take into account that media attention may be affected by the amount of tickets sold we instrument media coverage with the availability of other newsworthy material (sport events and disasters). It emerges that media attention to the game is inversely related to the availability of other news. Two-Stage-Least Squares Estimations show that, given the jackpot size, players spend more on lotto when media attention to the game is higher.

Keywords: Media Influence; Media Exposure, Psychology and Economics, Lottery; Instrumental Variables

JEL classification: D03; D83; D1; D81

1. Introduction

Mass media are believed to be an insidious force in shaping individual beliefs and behaviours. Being exposed to information provided by the media may change individual choices through a number of different channels. Firstly, individuals may deviate from the standard rational behavioural model and may be affected by messages coming from different sources also when those messages do not provide any relevant information. Secondly, in choices that involve complex calculations, individuals may base their decisions on how readily examples of an event can be brought to mind instead of considering the different aspects relevant for a rational decision (Kahneman and Tversky, 1979). Thirdly, news may generate emotions that may have a substantial impact on decision making (Loewenstein and Lerner, 2003).

A number of papers have investigated the effects of the media on political, social and economic outcomes. Some contributions have analyzed the impact of newspapers on politicians' accountability (Besley and Burgess, 2002; Stromberg, 2004), and on voters' behavior (Gentzkow, 2006; Della Vigna and Kaplan, 2007). Other works have focused on the effects of television on social

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behaviors. Chong and La Ferrara (2008) and Jensen and Oster (2007) analyze the effects of the role models portrayed in TV programs on divorce and women's autonomy in Brazil. Paluck (2009) estimates the influence on beliefs and social norms of a radio soap opera providing messages of intergroup tolerance in Rwanda. Dahl and DellaVigna (2005) focus, instead, on the role of movie violence on crime. Finally, a strand of the literature has dealt with the effects that the media produce on some economic variables. Huberman and Regev (2001) examine the impact produced on the stock price of a pharmaceutical company, *EntreMed*, by a number of articles appearing on the press and reporting positive effects of a drug patented by this company for curing a type of cancer. The authors show an increase in the stock price not only when the articles provide new information but also when they do not add anything to information already available to investors. Tetlock (2007) shows that news media content can predict movements in indicators of stock market activity.

In this paper we investigate the effects of the media on consumer behaviour focusing on lottery playing. Given the amount of money people spend in gambling (in 2009 the Italian Government has obtained 8,810 millions of euros from gambling games), we think it is important to try to better understand what drives this type of behaviour.[1]

Lottery playing is clearly inconsistent with expected value maximization and a number of different theories have been proposed to explain the deviation from the standard rational behavioural model. One possible explanation is based on the entertainment value obtained by playing, since by buying a ticket players can experience, in addition to the chance of winning, an excitement and dreams about becoming wealthy. Other reasons for playing are that individuals place disproportionate weights on small probabilities or that they tend to behave as risk lovers when small amounts of money are involved (Kahneman and Tversky, 1979, 2000). Moreover, given the complex calculations needed to grasp the expected value of buying a ticket, individuals may be particularly reactive to messages that provide salient information or that generate emotions. They may take their decisions on the basis of rough heuristics deriving from news instead of considering the true probability of winning.

We focus our attention on *SuperEnalotto*, a very popular Italian State lottery. In this lottery, a series of six numbers is drawn from a pool of 90 numbers. To win the top prize (jackpot) players are required to match all six numbers.[2] When no ticket matches the drawn numbers the top prize is carried over into the next drawing. Because of this mechanism, the jackpot can reach very impressive figures, exceeding sometimes one hundred million of euros.

Since the price of a lotto ticket is not affected by the jackpot, the expected return of playing typically increases when the jackpot increases inducing players to buy more tickets (see, for example, Matheson and Grote, 2004). However, also other factors may be at work. In particular, when the jackpot increases the attention devoted by the media to the game tends to increase too. A large number of articles in the press and on TV news are devoted to what people is dreaming to do with the money

[1] A number of interesting analysis on lottery playing have been recently provided. See for example Kearney (2005) and Guryan and Kearney (2008).
[2] This type of game is known in the Anglo-Saxon countries as "Pick 6 Lottery".

they could win, or reporting of lines at lottery outlets or interviewing past winners. Are players affected by the attention media the devote to the game?

To empirically investigate this issue we use data on the amount of ticket sales and on the jackpot for 1086 *SuperEnalotto* drawings, from 2003 to 2010. Since lotto playing is mainly diffused among low income individuals, we suspect that any possible effect of media exposure on playing is especially driven by TV news. Unfortunately, we do not have information on the content of news appearing on TV and base our analysis on news in the press, relying on the high degree of correlation in the news reported by these two type of media. We build different measures of media coverage based on the number of daily articles devoted to the game by Italian newspapers and on the number of on line articles as resulting from the Google Search engine.

The reverse causality problem that emerges in estimating the effect of media exposure on lotto sales is handled adopting an Instrumental Variable estimation strategy and using the availability of other newsworthy material, that is, disasters and sport events, as instruments for whether the media report news concerning the *SuperEnalotto* game. We expect that, ceteris paribus, news devoted to *SuperEnalotto* are fewer when there are important competing events to be reported by the media. This approach is similar to that adopted by Eisensee and Tromberg (2007) to investigate the influence of mass media on US government responses to natural disasters occurring worldwide.

From TSLS estimates, controlling for the size of the jackpot and a number of other potentially relevant variables, it emerges that players buy a substantially larger amount of lottery tickets when media is devoting more attention to the game. From first stage regressions we find that our instruments negatively affect the attention devoted by the media to the *SuperEnalotto* game.

The paper is organized as follows. In Section 2 we provide some details on the *SuperEnalotto* game and on the data used in the econometric analysis. In Section 3 we present IV estimates of players' response to media attention. Section 4 concludes.

2. Data and Descriptive Statistics

SuperEnalotto is a very popular State lottery in Italy, introduced in 1997. On average, Italians spend in a year about 2 billions euros in lotto tickets. The game consists in matching 6 numbers out of 90. Players matching all of the winning numbers win the jackpot while players matching only some numbers win smaller prizes. The prize pool consists of about 34% of the revenues from ticket sales, while about 54% represent public revenues. Currently, there are three drawings at week (on Tuesday, Thursday and Saturday). In a drawing in which no ticket matches all the drawn numbers, the top prize is carried over into the next drawing and is added to the share from ticket sales. Because of this mechanism jackpots have sometime reached very impressive figures: in about 90 drawings jackpot has been higher than 100 millions euros and the largest jackpot of €177,729,043 was won in 2010.

Our analysis uses data on 1086 consecutive drawings from January 2003 to October 2010.[3] The dataset provides for each drawing the amount of tickets sold and the size of the jackpot. Each play costs €1 and the price has not changed during the period considered.

Table 1 provides some descriptive statistics. On average, the value of tickets sold for each drawing is of 13,768,302 euros. The jackpot has a mean of 37,627,190. The top prize has been won only at 3% of drawings.

The media coverage of the game has been measured using three different indicators. Firstly, we run automatic keyword-based searches of electronic archives, containing all the articles published during the period of interest, for two of the main Italian newspapers (*Corriere della Sera* and *La Stampa*).[4] We define an article as being about the *SuperEnalotto* when in the text of the article it appears the word "*SuperEnalotto*" or "*Jackpot*" and build the variable *Corriere-Stampa News* as the number of articles appeared in the two newspapers in the same day of the drawing (tickets are sold until 8:00 pm) or in the three days before. Secondly, we use the same strategy to build *Press Review News* based on the electronic archive of the Press Review of the Italian Chamber of Deputies.[5] Finally, based on the Google Search Engine (a site that aggregates headlines from on-line news sources), we define a variable *Google News* considering the number of articles related to the *SuperEnalotto*, using the same criteria as above.[6]

The average number of articles in the press, per each *SuperEnalotto* drawing, according to the variable *Corriere-Stampa News* is equal to 1.54, while *Press Review News* has a mean of 2.01. *Google News* takes an average value of 4.73. The three variables measuring media coverage have a high degree of correlation, ranging from 0.30 to 0.50.

Table 1. Descriptive Statistics

Variables	Mean	Std. Dev	Min.	Max.	Obs.
Ticket Sales (in ,000 €)	13768.302	6052.088	7182.115	54219.566	1086
Jackpot (in ,000 €)	37627.19	32694.18	596.2026	152380.3	1086
Corriere-Stampa News	1.536	2.952	0	32.000	1086
Press Review News	2.010	4.763	0	48.000	1086
Google News	4.734	6.965	0	32.000	428
Disasters	3.112	3.076	0	18.000	1086
Sports Events	0.060	0.237	0	1.000	1086
Unemployment (monthly)	7.398	0.832	5.800	8.800	1086
Win in the Past Drawing	0.0331	0.179	0	1	1086

Data are at drawing level.

As exogenous determinants of the *SuperEnalotto* media coverage we use the availability of other newsworthy material. Specifically, we use data on disasters (earthquakes, floods, storms,

[3] Data are available on the SuperEnalotto official website:
http://giochinumerici.sisal.it/portal/page/portal/SitoGioco/superenalotto

[4] We have excluded "*La Repubblica*", since the free archive of this newspaper provides data only starting from 2008.

[5] This Press Review includes all the articles published on the front page of the 8 main Italian newspapers. In addition, it includes about 200 articles per day on political, economic and social events.

[6] Unfortunately, Google News is available only starting from the 1st January 2008.

epidemics, fires, industrial accidents, etc.) occurring worldwide and on some important sport events (Soccer World Cup, Soccer European Cup, Summer and Winter Olympic Games) taking place during the period under consideration.

To identify disasters we follow Eisensee and Stromberg (2007), using data from the Emergency Disaster Database provided by the Center for Research on the Epidemiology of Disasters. We restrict our attention to a sub-sample of disasters. In detail we consider: all the disasters taking place in Italy; disasters taking place in European countries or USA when more than 10 people are killed; disasters taking place in other areas of the world when the number of killed people is higher than 100. This leaves us with a total of 500 disasters taking place in the period 2003-2010. Since disasters appear in the news (TV and Press) not only in the day in which they occur, but also in a number of days following the events, to build our variable *Disasters* we consider as relevant a span of 7 days. This variable takes values ranging from 0 to 18 with a mean of 3.11.

As regards sports events, we define a dummy *Sports Events* taking value of one for all the dates in which has taken place one of these events: Soccer World Cup (in 2006 and 2010), Soccer European Cup (in 2004 and 2008), Summer Olympic Games (in 2004 and 2008) and Winter Olympic Games (in 2006 and 2010).

3. Instrumental Variable Estimates of Players Reactions to Media Coverage

The relation between lotto ticket sales and media coverage is modeled as follows:

$$\ln(Ticket\ Sales_t) = \beta_0 + \beta_1 Media\ Coverage_t + \beta_2 \ln(Jackpot_t) + \beta_3 X_t + \varepsilon_t \qquad [1]$$

where the dependent variable, $\ln(Ticket\ Sales_t)$, is the log of the amount in euros of tickets sold at drawing *t*, $Media\ Coverage_t$ is the attention devoted by the media to the *SuperEnalotto* (measured using, alternatively, *Corriere-Stampa News, Press Review News,* and *Google News*); $\ln(Jackpot_t)$ is the size (in log) of the jackpot at drawing *t*; X_t is a vector of control variables including the monthly rate of unemployment, a dummy if the drawing is on *Saturday*, a dummy *Past Win* taking value of one if at the previous drawing the jackpot was won, a dummy equal to 1 for the last week of the month aimed at catching liquidity constraints by players, dummies for months of the year and yearly dummies; ε_t is an error term.

We explicitly consider that *Media Coverage* is not exogenous and is determined as follows:

$$Media\ Coverage_t = \phi_0 + \phi_1 \ln(Ticket\ Sales_t) + \phi_2 \ln(Jackpot_t) + \phi_3 Disasters + \phi_4 SportsEvents + \phi_3 X_t + v_t \qquad [2]$$

As described in equations [1] and [2] media attention may affect the amount of ticket sales, but at the same time a large volume of sales may induce the media to devote more attention to the

game. Given the positive influence of ticket sales on media coverage ($\phi_1 > 0$), we expect that OLS estimates of β_1 in equation [1] are upward biased. On the other hand, measurement errors may lead to a downward bias of OLS coefficients.

To handle problems arising from reverse causality, we undertake an Instrumental Variable estimation strategy using as an instrument for *Media Coverage* the variable *Disasters* and the dummy *Sports Events*. These variables are arguably not correlated with the error term in equation [1].

Results from Two-Stage-Least-Squares (TSLS) are shown in Table 2. Standard errors are corrected for heteroskedasticity and autocorrelation up to 8 lags. Panel B shows results from First Stage regressions. The instrumental variables strongly determine our three measures of media coverage and the *F*-statistic for the test of whether the instruments' coefficients are jointly equal to zero is in all specifications near or above the threshold value suggested by Staiger and Stock (1997). Since the model is overidentified, we are able to test the exogeneity of our instruments with the overidentifying restrictions test. The value of χ_1^2 in the three specifications is very small reassuring us about the validity of our IV strategy.

Table 2. TSLS estimates. SuperEnalotto Ticket Sales and Media Coverage

	(1)	(2)	(3)
Panel A: Two Stage Least Squares			
Corriere-Stampa News	0.122***		
	(0.025)		
Press Review News		0.079***	
		(0.015)	
Google News			0.089***
			(0.015)
Ln(Jackpot)	0.100***	0.086***	0.001
	(0.016)	(0.014)	(0.053)
Past Win	-0.129	-0.125	-0.389*
	(0.128)	(0.121)	(0.216)
Unemployment	0.0443	0.055*	0.146
	(0.034)	(0.026)	(0.106)
Saturday	0.248***	0.221***	0.229***
	(0.019)	(0.017)	(0.035)
Last week of the month	-0.022	-0.052*	0.001
	(0.021)	(0.022)	(0.039)
Observations	1086	1086	428
Panel B: First Stage for Media Coverage			
Disasters	-0.117***	-0.162***	-0.315***
	(0.0308)	(0.0512)	(0.122)
Sports Events	-0.691**	-1.736***	-2.768***
	(0.262)	(0.440)	(0.953)
R-squared	0.178	0.282	0.372
First-Stage F-statistics	9.447	11.683	8.077
p-value	0.000	0.000	0.000
Test of overidentifying restrictions χ_1^2	1.405	0.041	0.076
p-value	0.236	0.839	0.782

Notes: The dependent variable is ln(*Ticket Sales*$_t$). In each regression we control for monthly and yearly dummies. Standard errors, corrected for heteroskedasticity and autocorrelation up to 8 lags (Newey-West hac), are reported in parentheses. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

Panel A presents TSLS estimates. We find a significant increase in tickets sold when media attention is higher. As it is possible to see in column (1), in which we measure the attention received by the *SuperEnalotto* using the variable *Corriere-Stampa News*, the effects of media coverage is positive and highly statistically significant (*t*-stat=4.80). One more article increases by 12% the *SuperEnalotto* revenues. In column (2) we measure the extent of media coverage using the variable *Press Review News*. Results show that the amount of tickets sold increases by 7.9% when an additional article is published on the Press. [7] Very similar results are obtained in column (3) using the index *Google News* (because of the limited availability of Google News, these estimates use only the years 2008-2010)[8].

As far as other variables are concerned, it emerges that ticket sales are strongly affected by the size of the jackpot: an increase of 10 percent rises ticket sales by 1.1-1.3 percentage points. The number of tickets sold increases on Saturday. Sales are higher during periods of higher unemployment, while they reduce during the last week of the month suggesting that financial constraints may be relevant in affecting players behavior.

To check the robustness of our results and be reassured about problems related to weak instruments we undertake two different strategies. First, we have estimated the model with the two instruments using the Limited Information Maximum Likelihood (LIML) estimator, which should reduce the bias characterizing overidentified TSLS. Results are shown in the first row of Table 3 and are quite similar to those obtained using TSLS. Secondly, following Angrist and Pischke (2009), we pick our best instrument and run regressions using exclusively *Disasters*, since just identified IV is median unbiased. The estimated coefficients on media coverage (reported in the second part of the Table), are in line with those shown in Table 2, and the F-statistics are satisfactory.

Table 3. LIML estimates and TSLS estimates with a single instrument.

	(1)	(2)	(3)
	LIML Estimates		
Media Coverage (LIML)	0.132***	0.079***	0.093***
	(0.031)	(0.015)	(0.015)
	TSLS using a single instrument		
Media Coverage	0.105***	0.0765***	0.0868***
	(0.025)	(0.022)	(0.019)
First-Stage F-statistics	14.257	9.695	8.126
p-value	0.000	0.002	0.000

Notes: Media Coverage is measured using *Corriere-Stampa News* in (1), *Press Review News* in (2) and *Google News* in (3).

[7] As a robustness check we have also transformed the variable *Disasters* in a categorical variable taking four different values for the four quartiles of the distribution. Results remain substantially the same.

[8] In an alternative specifications, instead of using ln($TicketSales_i$) and ln($Jackpot_i$), we use $TicketSales_i$ and $Jackpot_i$ obtaining very similar results.

4. Concluding Remarks

Articles appearing on the press or on TV reporting on lotto winners, on what people are planning to do in case of a win or on the numbers more frequently chosen by players typically do not provide any relevant information that may affect the decision to play the lottery. However, recent researches in behavioral economics suggest that individuals may deviate from the standard model and change their decisions when exposed to messages that grasp their attention, provoke emotions or provide simple heuristics.

To investigate the issue of media influence we have used data on the Italian *SuperEnalotto* and estimated tickets sales in relation to different measures of media coverage. Reverse causality problems have been handled considering as instruments for the attention devoted by the media to the game the occurrence of disasters worldwide and popular sport events, which claim for space in newspapers.

We find that players are affected not only by the size of the jackpot but also by media exposure. Ceteris paribus, an increase in the number of articles devoted to the game produces a substantial increase in ticket sales.

This finding can be due to a number of psychological factors, such as limited attention, emotional behavior, social conformism. Data at hand does not allow us to uncover the psychological mechanisms beyond the effect emerging from our analysis, which needs to be investigated in future researches.

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