Short and long run income elasticity of gambling tax bases: evidence from Italy

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Abstract

In periods of economic recession and budget constraints, it becomes essential for the governments to understand which tax revenues are more likely to guarantee a stable or increasing amount of revenues able to support the provision of main public services without depending too much on variation in Gross Domestic Product (GDP). The aim of this paper is to analyze a particular source of tax revenues in Italy, namely gambling tax revenue split by game type (i.e. Lotto; Lotteries; Entertainment machines), in order to understand how tax bases react to changes in income, providing a measure of short run (variability over the business cycle) and long run (growth) income elasticity of different gambling tax revenues. Results show that gambling activities tend to be impressively reactive to variation in income in the long run, and, on the contrary, not particularly volatile in the short run.

Keywords: dynamic ordinary least squares, error correction models, excise taxation, gambling tax revenue, income elasticity of tax base.

JEL Classification: H21, H27, H60, C10

1. Introduction

Most of western countries are facing dramatic economic problems, mainly caused by the economic recession of current years which has seriously reduced the Gross Domestic Product (GDP) growth levels and increased unemployment and poverty. This fact is rising the efforts of governments to find out additional financial resources to cope with the increasing social costs of economic crisis (e.g. subsidies to workers and firms) and to guarantee the provision of necessary services (e.g. education, health care).

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In addition to this phenomenon, in Europe, countries belonging to the Economic and Monetary Union (EMU) are subjected to strict budget constraints imposed by the Stability and Growth Pact[2] (SGP) which limits the decision possibilities for governments in the field of fiscal policies, reducing the opportunities of resorting to public debt and fiscal deficit as means of financing.

In addition to these two phenomena, several European countries are already subjected to high level of fiscal pressure especially on income and general consumption; this fact makes impracticable a further increase in tax rates. Therefore, governments are trying to find additional financial resources from taxes other than income and sales ones. Among alternative sources of tax revenues, sin taxes (i.e. taxes levied on socially proscribed goods and services, as alcohol, tobacco, candies, soft drinks, fast foods, gambling) are looked with interest by governments as they are usually perceived by the population as "voluntary taxes" due to the fact that they weight only on consumers of sin goods and thus they are more acceptable than taxes on widely consumed goods (Fox, 2010; Clotfelter and Cook, 1991).

In the macro-economic environment, Italy does not make exception, recording impressively low GDP growth level, high level of public debt (almost 130% of GDP in 2012) and dramatically high fiscal pressure (in 2012 fiscal pressure in Italy accounted to 55% for each euro). As a consequence, like others European countries, Italian government started to look for alternative tax revenues and it identified gambling as a possible precious source of resources.

As a result, during the last ten years (2003-2013), Italy experienced a big promotion of gambling activities by means of the government who has the monopoly of the sector. Generally, the strategy of the government was to increase gambling possibilities through the introduction of new types of games subjected to low tax rates in order to boost demand for gambling and to rise tax revenues.

Before 2003, the number of legalized games in Italy was still limited[3]: in addition to the 4 casinos present in Italy (i.e. Venice,Sanremo,Campione d'Italia , Saint-Vincent) popular games included Lotto, a limited number of lotteries, Sport Betting, Superenalotto and Bingo. However, in 2003, Law 269/2003 legalized a new type of gambling activity destined to gain great success: slot machines. The introduction of slot machines represented a great innovation in gambling market as it brought gambling among ordinary people, due to the fact that, after 2003, slot machines can be placed in cafe, tobacco shop, stations and supermarkets without being confined to casinos;

[2] The SGP is represented by a set of rules in terms of fiscal deficit and public debt that should be satisfied for all Member States and that have been established in order to make public finances sustainable over the cycle.

[3] For a short description of the games see Appendix 1.

therefore, gambling consumption became a constant presence in routine life for more and more people.

After 2003, the great expansion of gambling continued, with the progressive legalization of other gambling products: on-line games have been progressively liberalized in the period 2008-2011, several instant lotteries have been introduced in 2009, Video-Lotteries in 2010, Online Poker in 2011.

It is thus evident that, in Italy, the government obtained a huge development of gambling industry through an increase in gambling tax base: this target was pursued through a massive increase in available games and operators in the market and through a simultaneous reduction in tax rates on recently introduced games.

However the huge development of gambling market inflamed the debate on morality of gambling promotion by the government. Indeed, even if gambling is not coercive, the gains in tax revenues are not devoid of social costs: the number of people devoting a significant amount of money in gambling products is increasing with the amount of available public games: thus the issue of problematic gamblers is becoming a more and more serious problem. In addition, many studies showed that gambling tends to be more problematic among poorer individuals who are more fascinated by the hope of a life change (e.g. Clotfelter, 1979; Kitchen and Powells, 1991; Combs et al., 2008 Beckert and Lutter, 2009). All the aforesaid issues gave rise to a debate on the morality of state in the legalization and, above all, promotion of gambling (Smith, 2000); Viti de Marco et al. (1936), already in 1930s, investigated the inconsistent role of the government in gambling market, stating that the state has, at the same time, the duty to fight against the vice from which it can derive a big profit.

Despite the rapid development of gambling market, in Italy the literature on gambling fiscal system is still lacking. To the best of our knowledge only one study (Sarti and Triventi, 2012) focused the attention on Italian gambling fiscal system studying the potential regressivity of gambling taxation; however, no studies have been developed on the specific characteristics of fiscal system spit by game typology.

The aim of this paper is to try to fill this gap, through the study of the evolution of gambling market in Italy, analyzing some characteristics of gambling fiscal system in this context of market development. In particular we will focus the attention on the characteristics of gambling tax revenues in terms of growth and variability over the business cycle, trying to understand if gambling tax revenue represents a significant alternative source of tax revenue for the government and if it is a stable and predictable source of revenue in the short and long run. In order to do so, we will compute some measures of income elasticity of different categories of gambling tax revenues (i.e Lotto, Instant Lotteries, Entertainment Machines) using data of the Italian Ministry of Economy and Finance (MEF) under a short and long run perspective.

The paper is organized in 6 sections; after the introduction, the second section reviews the literature on the topic; the third one analyzes the evolution of gambling market in Italy; the fourth and the fifth provide the method and the empirical results of our modeling. The paper ends with conclusions and policy implications.

2. Literature Background

Traditionally two elements are considered in the evaluation of a tax system: efficiency and equity. However, in addition to the two aforesaid elements, Clotfelter (2005) identifies adequacy and stability as important issues to be considered by practical-minded tax analysts. A tax satisfies adequacy principle if tax revenues collected are relevant with respect of total amount of tax revenues. When considering gambling tax revenue this is a difficult condition to be satisfied as generally gambling revenues represent a definitely small amount of total tax revenues; however, Clotfelter (2005) shows that Italy and Australia make exception as gambling tax revenues, in 1999, accounted to more than 1.5% of total tax revenue (in detail to 2.4% for Italy), and thus they were a relevant source of tax revenue. According to our estimation based on data provided by the Italian Ministry of Economy and Finance (MEF) the percentage of gambling tax revenues (Lotto + Instant Lotteries + Entertainment Machines + Other Games) over the total amount of tax revenues in Italy is increasing over time and, in 2013, it accounted to 2.87% making gambling a more and more important source of revenue for the Italian government.

In addition to adequacy, governments are often interested in the long and short term variability of different tax bases and in how they are affected by variation in income. Indeed, in periods of financial distress, it is important to understand on which resources the government can rely in the short run (cyclical variability of tax revenues) and on which it can rely under a long run perspective (trend growth rate of tax revenues). From a short run perspective, governments are interested in guaranteeing the quality and quantity of public services offered, and, in order to do so, they need a stable amount of tax revenues able to finance properly fundamental public services. On the other side, when focusing on long run purposes, governments aim at maximizing tax revenue growth in order to improve the public services provision and quality.

However, stability of revenue and growth are not always compatible; some authors (e.g. Fox and Campbell, 1984) pointed out that there is a trade-off between tax revenue growth in the long run and stability of tax revenues in the short run, while others (Dye and McGuire, 1991) find that sometimes growth and stability can be directly correlated; indeed in principle, high long term growth can be compatible with

short-term stability (Wolswijk, 2009). As stated by Groves and Kahn (1952) a fair taxation system is one that ensures to the government an approximately constant amount of revenue over a time period and that thus permits to finance major public services without depending too much on the business cycle conditions.

In order to measure the impact of variation in income on gambling tax base a commonly used approach is by the use of two measures (one for the short run and one for the long run) of income elasticity. In particular, more income elastic tax bases are more likely to grow fast in the long term because, as income increases, the tax base would increase more than income (Groves and Kahn, 1952). In addition, high income elastic taxes in the short run would experience fluctuations of tax base over the business cycle, making the tax base, and consequently the tax revenues, unstable and uncertain. Different measures and econometric techniques have been proposed in the literature to estimate the short and long run income elasticity of several tax bases.

The first study in this direction was proposed by Groves and Kahn (1952) who computed a measure of income elasticity for local taxes for several USA states. If we consider a time period between t_0 and t_1, income elasticity of a tax base is defined as the ratio between the percentage change over the period of time in tax yield *T* and the percentage change in income *Y* during the same period of time:

$$\varepsilon = \frac{(T_1 - T_0)/[(T_1 + T_0)/2]}{(Y_1 - Y_0)/[(Y_1 + Y_0)/2]} \quad (1)$$

where the numerator of equation 1 represents the ratio between change in tax yield between t_0 and t_1 and the average tax yields between the two periods, whereas the denominator represents the ratio between change in income between t_0 and t_1 and the average income of the two periods.

Using the value of income elasticity as a benchmark, Groves and Kahn (1952) identified three types of taxes depending on income elasticity value:

1. income elasticity less than one: these taxes are the most stable as an elasticity smaller than unity guarantees that tax bases fluctuate less than income. According to Groves and Kahn (1952) licences, property taxes and pool taxes belong to this category;
2. income elasticity close to one: these taxes vary proportionally with income, meaning that they are roughly unstable. Sales taxes are often considered in this category;

3. income elasticity bigger than one: these taxes vary more than proportionally to income. This means that they are strongly unstable over the business cycle. Corporate net income taxes usually have an income elasticity bigger than one.

Applications to general sales and income tax base

Studies based on the Groves and Kahn (1952) approach have been developed, among the others, by Fox and Campbell (1984), Dye and McGuire (1991), Sobel and Holcombe (1996), Bruce et al. (2006). Many authors focus the analysis on different categories of sales taxes, finding out how income elasticity varies over different goods. Fox and Campbell (1984) analyze the income elasticity of ten taxable sales groups, finding out that differences exist over different groups. The main differences are observed among durable and nondurable goods; in particular durable goods tax base declines during economic recession and boosts in expansion period, while the contrary is true for nondurable goods. Other authors (Dye and McGuire, 1991; Bruce et al., 2006) analyze the elasticity of income taxes in different USA states. Bruce et al., 2006 find out that flat and progressive income tax base tend to be more elastic than sales tax bases, and thus more unstable. However, not all the studies agree on this conclusion; among the others, Fox and Campbell (1984) find out that certain income tax bases can be more stable than sales tax bases. In addition, the authors observe that income tax bases tend to fluctuate less than sales tax bases over the business cycle in the short run. Bruce et al. (2006) perform a similar analysis on short and long run income elasticity of sales tax bases and income tax bases, finding out that, overall, long run income elasticity for personal income tax base is more than double the one for sales taxes.

Research on this topic in Europe are lacking; Wolswijk (2009) proposes a study in this direction applied to three tax categories (i.e. value-added tax, personal income tax and corporate income tax) in the Netherlands. Results show that short run elasticity estimates tend to be different from long run ones, especially when tax bases are below the long run equilibrium. This means that economic agents tend to react slowly to variation in income, as responses are lagged and smaller in the short run. In particular, for what concerns value-added tax (VAT) the author find out a long run elasticity of 0.9, and two short run elasticity estimates (when tax base are respectively below and above the equilibrium) of 0.64 and 1.10. This fact can be explained by a change in consumption habits towards more basic (less taxed) goods during recession, and, conversely, by a shift towards the consumption of more luxurious (and thus taxed) goods during economic expansion. Different conclusions emerge for income tax bases. Personal income tax (PIT) has been found to have a symmetric short run response and to be more reactive in the short run, experiencing a short run elasticity bigger than the

long run one (1.89 versus 1.57); this can be explained by the slowness in employment adjustments. Lastly, corporate income taxes (CIT) tend to be more reactive in the long run, recording a long run elasticity bigger than one (1.07) versus two short run estimates of 0.12 (when tax base is below long run equilibrium) and 0.90 (when tax base is above long run equilibrium).

Applications to gambling tax base

As we already said, the vast majority of studies focusing on income elasticity of tax base focused the analysis on sales and income taxes. However, theoretically, similar approaches can be applied to any types of tax bases, including the gambling tax base. Some previous researches focus the attention on gambling taxation. In particular, the first study in this direction has been proposed by Cargill and Eadington (1978) who analyze the income elasticity of casino gambling revenues in three regions of Nevada, finding out that gross casino gambling revenue is fairly elastic and that the estimates vary across regions from 1.05 to 1.75. A similar study has been performed for Brazil by Babbel and Staking (1983). A more recent research has been proposed by Nichols and Tosun (2008), who analyze the long and short run income elasticity of casino gambling revenues using quarterly data of 11 USA states and observing how gambling revenues differ from other types of tax bases (i.e. sales taxes and income taxes). The authors improve on previous studies: indeed they use quarterly data as in Fox and Campbell (1984) but they extend the analysis to more than one state using a panel dataset. In addition they use actual tax base rather than a proxy for it as in previous researches and they introduced in the model three variables that describe the supply-side of casino gambling industry (i.e. number of slots machines lagged two quarters, number of table games lagged two quarters, seasonal dummies) to take into account the specific characteristics of the sector. Nichols and Tosun (2008) find out that, in the long run, gross casino revenues generally grow faster than other sales tax bases but slower than income tax base. For what concern the short run, their estimates on gambling elasticity are usually lower than estimates for sales and income tax base, meaning that gambling revenues tend to fluctuate less than other tax bases over the business cycle.

3. Gambling in Italy: data and recent development of the market

The development of gambling market

During the last decade in Italy gambling market experienced a dramatic boost: after the liberalization of 2003 which legalized new forms of gambling (i.e. slots machines) the amount of money devoted to gambling significantly increased, leading to an explosion of the market.

In Italy three main measures are used to evaluate gambling market: gross expenditure, net expenditure and tax revenue. The gross expenditure represents the total amount of money that is devoted to gambling, which means the total amount of money bet, whereas the net expenditure is the net amount of money spent in gambling after subtracting the payout (i.e. money that goes back to the consumer through winnings). Thus:

$$Gross\ Expenditure = \sum_k Bet_k \tag{2}$$

$$Net\ Expenditure = \sum_k (Bet_k - Payout_k) \tag{3}$$

It is evident that these two measures, even though highly correlated, provide different information: the first is a measure of the global gambling market, while the latter is a measure of the impact of gambling on households budget. In addition, for the vast majority of games, gross expenditure represents the tax base on which tax rates are applied to get tax revenue.

The amount of tax revenue is a further measure that should be considered when analyzing gambling market from the government point of view as it represents the total amount of economic resources that the government gets from gambling activities. It has been showed that the dynamics of gambling tax revenue is generally different from the dynamics of gambling expenditure due to the different tax systems applied to different games.

Year	Variable	Lotto	Superenalotto	Lottery	Sport Betting	Horse racing	Bingo	Slots and Vlt	Skill Games – Online Poker	Total
2003	**Total**	6,938	2,066	282	1,123	2,974	1,257	367	-	15,007
	% of total	46%	14%	2%	7%	20%	8%	2%	-	100%
	$\%\Delta(t, t-1)$	-	-	-	-	-	-	-	-	-
2004	**Total**	11,689	1,836	594	1,300	2,908	1,542	4,474	-	24,343
	% of total	48%	8%	2%	5%	12%	6%	18%	-	100%
	$\%\Delta(t, t-1)$	+68%	-11%	+111%	+16%	-2%	+23%	+1,119%	-	+62%
2005	**Total**	7,315	1,981	1,546	1,488	2,820	1,553	11,470	-	28,173
	% of total	26%	7%	5%	5%	10%	6%	41%	-	100%
	$\%\Delta(t, t-1)$	-37%	+8%	+160%	+14%	-3%	+1%	+156%	-	+16%
2006	**Total**	6,588	2,000	3,970	2,281	2,912	1,755	15,436	-	34,942
	% of total	19%	6%	11%	7%	8%	5%	44%	-	100%
	$\%\Delta(t, t-1)$	-10%	+1%	+157%	+53%	+3%	+13%	+35%	-	+24%
2007	**Total**	6,177	1,940	7,955	2,591	2,748	1,726	18,827	-	41,964
	% of total	15%	5%	19%	6%	7%	4%	45%	-	100%
	$\%\Delta(t, t-1)$	-6%	-3%	+100%	+14%	-6%	-2%	+22%	-	+20%
2008	**Total**	5,852	2,509	9,274	3,909	2,272	1,636	21,685	242	47,379
	% of total	12%	5%	20%	8%	5%	3%	46%	1%	100%
	$\%\Delta(t, t-1)$	-5%	+29%	+17%	+51%	-17%	-5%	+15%	-	+13%
2009	**Total**	5,664	3,782	9,434	4,026	1,981	1,512	25,525	2,348	54,272
	% of total	10%	7%	17%	7%	4%	3%	47%	4%	100%
	$\%\Delta(t, t-1)$	-3%	+51%	+2%	+3%	-13%	-8%	+18%	+870%	+15%
2010	**Total**	5,231	3,525	9,367	4,396	1,729	1,954	32,000	3,145	61,347
	% of total	9%	6%	15%	7%	3%	3%	52%	5%	100%
	$\%\Delta(t, t-1)$	-8%	-7%	-1%	+9%	-13%	+29%	+25%	+34%	+13%
2011	**Total**	6,800	2,400	10,200	3,910	1,370	1,850	44,900	8,420	79,850
	% of total	9%	3%	13%	5%	2%	2%	56%	11%	100%
	$\%\Delta(t, t-1)$	+30%	-32%	+9%	-11%	-21%	-5%	+40%	+168%	+30%
2012	**Total**	6,215	1,800	9,800	3,980	1,010	1,655	48,700	13,980	87,140
	% of total	7%	2%	11%	5%	1%	2%	56%	16%	100%
	$\%\Delta(t, t-1)$	-9%	-25%	-4%	2%	-26%	-11%	+8%	+66%	+9%
Total	**%Variation (2003-2012)**	-10%	-13%	+3,375%	+254%	-66%	+32%	13,170%	+495%	+481%

Table 1: Gross Expenditure and its variation (2003-2012) split by game

-data in millions of euro- (source: Italian Customs and Monopolies Agency)-

Table 1 and Figure 1 show how gross expenditure evolved during the last ten years: overall, total gross expenditure increased by 481% recording, in 2012, a total amount of gross expenditure of more than 80 billions of euro; this phenomenon was mainly caused by the change in the government attitude towards gambling, namely by the introduction of new games (e.g. slot machines) which boost gambling opportunities during everyday life. If we analyze the evolution of gross expenditure split by game typology we can see that the games more responsible for gambling growth are the most modern ones: in particular slots machines (slots) and video-lotteries (vlts) (which we will referred to as "Entertainment Machines") which have

been legalized respectively in 2003 and 2010 and which experienced an average increase of 72% a year: the gross expenditure connected to entertainment machines (i.e. slots + vlts) became a more and more relevant percentage of total gross expenditure, moving from 2% in 2003to 56% of total gross expenditure in 2012.

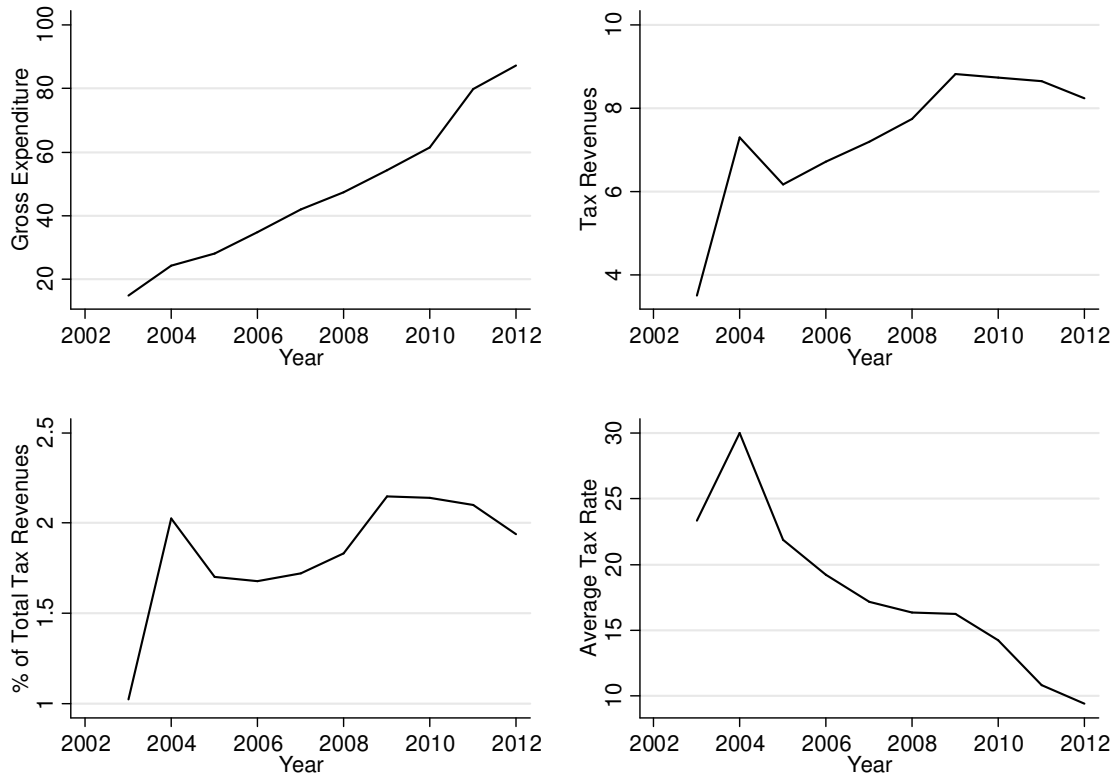

Figure 1: Gross Expenditure (billions of euro) **, Tax Revenues** (billions of euro)**,**
% of Gambling tax on total Tax Revenues, Average Tax Rate
- source: Italian Customs and Monopolies Agency -

On the other side, expenditure in games that have been introduced earlier (i.e. Lotto, Superenalotto) remained quite constant during the last 10 years and became a less relevant percentage of total gross expenditure; gross expenditure in Lotto moved from 46% of total expenditure in 2003 to 7% in 2012; in addition, expenditure in horse related games declined (-66%). The expenditure in lottery tickets increased thanks to the great increase in instantaneous lottery tickets available. Also online skills games and online poker, which have been legalized respectively in 2008 and 2011 experienced a great expansion, with a total increase of 495% in only 5 years.

The main reason for the government to promote gambling is economic: tax revenues deriving from gambling guarantee to the government a precious source of funds that can be used to finance several public needs.

Table 2 and Figure 1 show some figures on gambling tax revenue evolution. Tax revenues increased significantly during the time period (2003-2012) moving from 3,5 billions of euro in 2003 to more than 8 billions in 2012 (+135%). If we split the analysis by game type we can see (Table 2) that a big part of the increase in tax revenues derives from lotteries, slots and video-lotteries. However, the increase in tax revenues is much lower than the increase in gross gambling expenditure (overall, +135% tax revenues versus +481% of gross expenditure), and total tax revenues experience a reduction after 2010.

This phenomenon can be explained analyzing the gambling tax system (Giuricin, 2013). In Italy the gambling taxation system is not homogeneous as different games have different tax systems and tax rates (Table 3); for some games (i.e. Lotto and Instant lotteries) tax revenues are derived from the differential between the total amount of money bet by gamblers and the money returned to players as winning. For all the other games the tax base is represented by gross expenditure; however, as it is showed by Table 3, tax rates applied to different games vary significantly. In particular recently introduced games tend to have lower average rates than older games: video-lotteries have particularly low tax rates (i.e. 4.00 %), while for slots machines tax rates for tax payers decrease if total gross expenditure is higher than the one obtained the previous year leading to an incentive for tax payers to boost demand. On the other hand, older games tend to be subject to higher tax rates; for example Superenalotto is subject to particularly high tax rates, namely 53.62 %.

This phenomenon of decrease in tax rates applied to gambling is a consequence of the change in the government attitude towards gambling. Fiasco (2011), a sociologist specialized in research on gambling in Italy at the National anti-Usury Council, identifies different steps in governments behaviour on gambling regulation. During the period 1992-2002 the government was focused on maximizing tax revenues (the so-called period of `generate tax revenues`): therefore the government tried to find the equilibrium between taxation level and demand. On the contrary, after 2003, the main aim of the government became to increase market value (the so-called period of `generate market value`) and thus to decrease tax rates in order to boost the demand for gambling. For this reason, new games have been subjected to lower tax rates, in order to incentivize demand that increases tax revenues. As a consequence, the total amount of tax revenues collected increased in absolute numbers, but the percentage revenues for each euro decreased.

Year	Variable	Lotto	Superenalotto	Lottery	Sport Betting	Horse racing	Bingo	Slots and Vlt	Skill Games – Online Poker	Total
2003	**Total**	1,565	1,100	114	297	144	251	33	-	3,504
	% of total	45%	31%	3%	8%	4%	7%	1%	-	100%
	$\%\Delta(t, t-1)$	-	-	-	-	-	-	-	-	
2004	**Total**	4,919	976	219	222	141	308	513	-	7,298
	% of total	67%	13%	3%	3%	2%	4%	7%	-	100%
	$\%\Delta(t, t-1)$	+214%	-11%	+92%	-25%	-2%	+23%	+1,455%	-	+108%
2005	**Total**	2,425	1,054	426	290	137	311	1,514	-	6,157
	% of total	39%	17%	7%	5%	2%	5%	25%	-	100%
	$\%\Delta(t, t-1)$	-51%	+8%	+95%	+31%	-3%	+1%	+195%	-	-16%
2006	**Total**	1,959	1,013	891	291	141	351	2,072	-	6,718
	% of total	29%	15%	13%	4%	2%	5%	31%	-	100%
	$\%\Delta(t, t-1)$	-19%	-4%	+109%	+0%	+3%	+13%	+37%	-	+9%
2007	**Total**	1,747	962	1,526	230	134	345	2,250	-	7,194
	% of total	24%	13%	21%	3%	2%	5%	31%	-	1
	$\%\Delta(t, t-1)$	-11%	-5%	+71%	-21%	-5%	-2%	+9%	-	+7%
2008	**Total**	1,565	1,235	1,659	249	110	327	2,594	7	7,746
	% of total	20%	16%	21%	3%	1%	4%	33%	0%	100%
	$\%\Delta(t, t-1)$	-10%	+28%	+9%	+8%	-18%	-5%	+15%	-	+8%
2009	**Total**	1,591	1,736	1,663	218	97	270	3,165	70	8,810
	% of total	18%	20%	19%	2%	1%	3%	36%	1%	100%
	$\%\Delta(t, t-1)$	+2%	+41%	+0%	-12%	-12%	-17%	+22%	+900%	+14%
2010	**Total**	1,250	1,578	1,545	213	83	214	3,756	94	8,733
	% of total	14%	18%	18%	2%	1%	2%	43%	1%	100%
	$\%\Delta(t, t-1)$	-21%	-9%	-7%	-2%	-14%	-21%	+19%	+34%	-1%
2011	**Total**	1,737	1,081	1,330	184	66	231	3,916	103	8,648
	% of total	20%	13%	15%	2%	1%	3%	45%	1%	100%
	$\%\Delta(t, t-1)$	+39%	-31%	-14%	-14%	-20%	+8%	+4%	+10%	-1%
2012	**Total**	1,134	810	1,590	177	48	206	4,154	108	8,227
	% of total	14%	10%	19%	2%	1%	3%	50%	1%	100%
	$\%\Delta(t, t-1)$	-35%	-25%	+20%	-4%	-27%	-11%	+6%	+5%	-5%
Total	$\%\Delta$ $(\mathbf{2012}, \mathbf{2003})$	-28%	-26%	+1,295%	-40%	-67%	-18%	+12,488%	+1,443%	+135%

Table 2: Tax Revenue and its variation (2003-2012)

-Data in millions of euro (source: Italian Customs and Monopolies Agency)-

Game	Tax Base	Tax Rates
Lotto	-	Differential
Superenalotto	Gross Expenditure	53.62%
Lottery	-	Differential
Sport Betting	Gross Expenditure	From 2.00% to 33.84%
Horse racing	Gross Expenditure	From 6.00% to 15.70%
Bingo	Gross Expenditure	11%
Slot - VLT	Gross Expenditure	From 4.00% to 13.00 %

Table 3: Tax base and tax rates by game (source: Chamber of Deputies, 2012)

Therefore, average tax rate is significantly changing due to the introduction of new, less taxed, high-demanded games (Figure 1). In detail, average tax rate[4] decreased over time moving between 2003 and 2013 from 23% to 9%. Among games, lotteries experienced a significant negative trend in the evolution of rates: tax rates moved from 40% in 2003 to 16 % in 2012. Even more intense is the drop in average rate connected to sport betting: it decreases by 83 % in ten years.

Data on gambling in Italy

One of the main limits of developing analysis on gambling in Italy is the lack of easily available data on the topic. Different subjects are responsible for the collection and processing of data on gambling. The main data source is the Italian Customs and Monopolies Agency which is the administration created to deal with the responsibility of ruling state monopolies. In addition to Italian Customs and Monopolies Agency other institutions provide data on gambling: specialized news agencies (e.g. Agipronews, Agicos, Agimeg, Agicops), gambling authorities, organizations dealing with pathological gambling, Italian Ministry of Economy and Finance (MEF), Italian Institute of Statistics (ISTAT), Italian Anti-Drug Department (DPA) and the National Research Council (CNR).

For what concern data useful for our analysis, we are mainly interested in data on gambling tax revenues and tax bases. In Italy data on gambling tax revenue can be directly obtained from the Italian Ministry of Economy and Finance (MEF) website which reports, both by cash and competence criteria, the amount of tax revenues derived from Lotto, lotteries and entertainment machines (i.e. slots machines and video-lotteries) at a monthly level for the period 1990-2014. In addition to this dataset, a monthly report is published by the Court of Auditors which permits to obtain annual tax revenues from 1995 to 2013 well detailed by game typology. The longest time series of tax revenues can be obtained by ISTAT which reports the total amount of indirect tax collected by the government split by tax category. Tax categories include four game typologies (i.e. Casino, Lotto and lotteries, sport betting, horse racing, skill games and other bets) for the last 23 years (1990-2012).

On the other side, a proxy for tax base can be obtained by the Italian Customs and Monopolies Agency which provides, on request, data on gross expenditure at a monthly level for the last years and by game typology (i.e. Entertainment machines, Bingo, Horse racing, sport betting, lotteries, Lotto, Superenalotto, skill games).

In this paper we will use data on tax revenues provided by the MEF aggregated at a quarterly level: the dataset reports, the inflows in several types of taxes using cash

[4] Average tax rate has been computed as the ratio between the total amount of tax revenues and Gross Expenditure

(1990-2001) and competence (2002-2014) criteria. Previous studies (e.g. Fox and Campbell, 1984) showed that using quarterly data instead of yearly data brings some benefits as it permits to have more degrees of freedom. However, as gambling tax revenues can be influenced by government decisions on fiscal system (e.g. change in tax rates, increase in the number of licences, promotion of gambling), some control variables connected to the market should be included.

Tax	Time period considered	Number of observations	Mean per quarter	Standard deviation	Variable
Lotto	1990q1-2013q4	96	1.49 billions	1.36e+09	Tax Revenue
Instant Lotteries	2005q2-2013q4	35	1.77 billions	6.98e+08	Tax Base
Entertainment Machines	2004q2-2013q4	39	5.94 billions	3.02e+09	Tax Base

Table 4: Some descriptives of the variables

We consider three categories of gambling activities: lotto, instant lotteries, entertainment machines[5] (Table 4), which represent, in 2012, respectively the 14%, 19% and 50% of total amount of gambling tax revenues. Due to the lack of available data we are not able to use tax bases for all game types. In particular, tax revenues have been considered as a good proxy for tax base for Lotto as revenues for the government on these game derived from the difference between money spent and money given back as winning.

We instead use entertainment machines and instant lotteries tax bases computing them as the ratio between tax revenue and average tax rate for each year[6]: we believe that considering tax base rather than tax revenue is particularly important for these categories of gambling activities due to the important legislative reforms that impact on Instant Lotteries and Entertainment machines during the last years; in addition, due to the great expansion of instant lotteries after 2003 we select as period of analysis for this game only data related to the last decade.

Figure 2 shows the evolution of gambling and GDP time series over the period considered. The three gambling series experienced different trends: while lotto revenues recorded only a minor growth over the 23 year-period considered, entertainment machines tax base boomed impressively during the last ten years; on the other side, instant lottery tax base experienced a high growth level during the period (2005-2008), while stabilizing in the following years (2008-2013).

[5] Entertainment machines include slot machines (slots) and video-lotteries (vlts) revenues.

[6] Average tax rates have been computed as the ratio between the total amount of tax revenues and Gross Expenditure for each year (source of data: Italian Customs and Monopolies Agency)

As measures of income we used three different quarterly variables: market prices GDP, GDP per capita, available disposal income[7]. Results do not differ significantly; therefore we will present the ones obtained through the use of aggregate GDP.

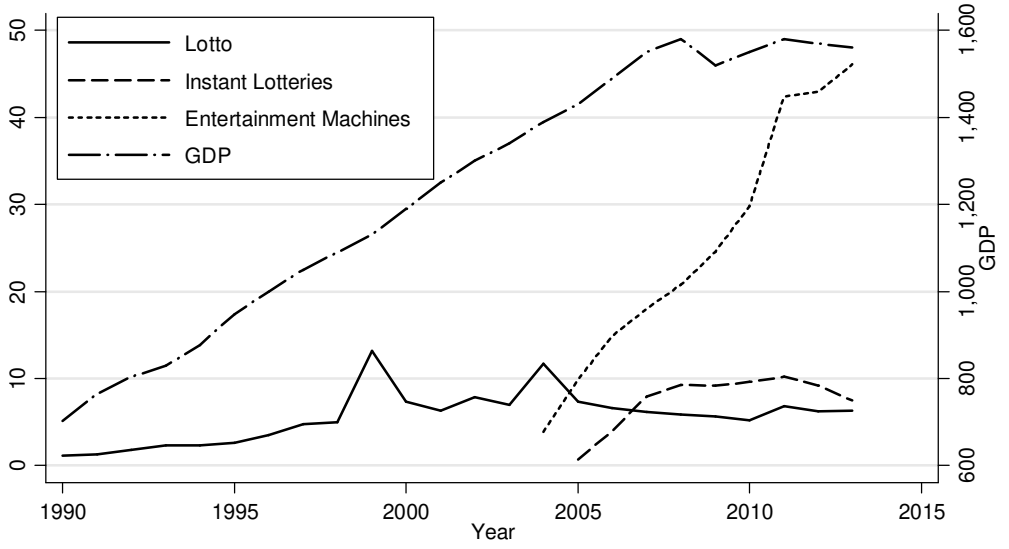

Figure 2: Yearly gambling time series considered in our models

-data expressed in billions of euro (source: MEF- Eurostat)-

All variables have been converted in constant euro using the GDP deflator and their natural logs are used in the regressions.

4. Econometric specification

To empirically compute the income elasticity of tax bases, most of the early studies use a simple double logarithm regression of the form (Groves and Kahn, 1952):

$$\ln(T_t) = \alpha_0 + \alpha_1 \ln(Y_t) + u_t \qquad (4)$$

where T_t represents the tax yield during the period t and Y_t represents the income level during the period t. Due to the logarithm specification, α_1 provides a measure of the income elasticity of a tax yield.

The main limitation of such an analysis lays in the fact that this model does not make a distinction between short run and long run: in particular, according to these early studies, α_1 provides, at the same time, the potential long term growth and the short run variability over the business cycle. As already noticed by Sobel and Holcombe (1996) this is not always the case as two taxes can share the same growth pattern

[7] The data source of all income measures is Eurostat

while varying differently over the business cycle. In addition, from a methodological point of view, the estimates computed using equation 4 are asymptomatically biased with inconsistent standard errors. To solve these problems, we decide to follow an approach already used by other authors in similar contexts (e.g. Sobel and Holcombe, 1996; Bruce et al., 2006; Nichols and Tosun, 2008). In particular Sobel and Holcombe (1996), using USA data covering the period 1951-1991 on different types of tax bases, analyze precisely the principal econometric limitations affecting earlier studies (e.g. Groves and Kahn, 1952) and propose some solutions. First of all, in order to produce unbiased estimates of coefficients tax and income variables should be stationary. A variable following a stationary process is one that tend to return to a certain mean value over time. This means that, if a variable has a decreasing or increasing trend it cannot be stationary and thus traditional regression techniques cannot be applied. Most macroeconomic time series are not stationary; however, when converted in first differences they become stationary; if this is the case, the series are defined as co-integrated, which means integrated of same order. With co-integrated series, econometric models estimate the long and short run estimates following the Engle-Granger two step procedure (1987).

The first step of this approach is the testing for variables stationarity and therefore for their level of cointegration. In general, to determine if a variable is stationary, the Augmented Dickey-Fuller test (See Dickey and Fuller, 1979) is performed: a significant *t-statistic* indicates that the variable is stationary, while an insignificant *t-statistic* indicates that the variable is non-stationary. Several studies confirm that taxes and income variables tend to be non stationary (e.g. Sobel and Holcombe, 1996; Bruce et al., 2006; Nichols and Tosun, 2008). If this is the case, some corrections should be used on the estimation technique: first of all it is necessary to divide the analysis in short run estimation and long run estimation. Indeed, an estimation of income elasticity of tax base based on equation 4 would not take into account short run fluctuations around the trend, and it thus provides only an estimation for the long time period. In order to correct for the non stationarity of the variables it is necessary to transform the variables into stationary ones; this can be done either adjusting for a constant trend or transforming the variables into the first difference form. The second approach has been shown to be more effective in this context (e.g. Sobel and Holcombe, 1996; Bruce et al., 2006; Nichols and Tosun, 2008).

This means that equation 4 for the short run elasticity, in presence of non stationary variables becomes:

$$\Delta \ln(T_t) = \alpha_0 + \alpha_1 \Delta \ln(Y_t) + u_t \qquad (5)$$

where T_t represents the tax yield during the period t and Y_t the income level during the period t. In equation 5 all the variables are expressed in first difference form denoted by Δ. In this case, the coefficient α_1 represents the short run income elasticity of tax base and it measures the percentage change in tax base provoked by a one percent change in income. A coefficient bigger than one indicates a tax base that moves more than income over the business cycle while a coefficient lower than one indicates an opposite situation. This measure is independent of the long run elasticity and it just provides a measure of how tax base fluctuates up and down due to the business cycle adjusting immediately to income variation.

The problem of non stationarity of the variables has consequences also on long run estimation as it brings to biased estimations of long run elasticity with inconsistent standard errors. The bias in estimation derives from the fact that estimated error terms tend to be correlated, leading to a problem of serial auto-correlation of the error term. To solve this problem, Stock and Watson (1993) propose the use of a dynamic ordinary least squares (DOLS) which consists in the inclusion in the model of a proper number (usually five) of leads and lags of the change in the independent variable:

$$\ln(T_t) = \beta_0 + \beta_1 \ln(Y_t) + \sum_{g=-j}^{j} \beta_2 \Delta(Y_{t+g}) + \varphi_t \qquad (6)$$

The number of leads and lags to be included is usually selected looking at the Bayesian Information Criterion (BIC). This procedure removes coefficient bias and corrects for serial autocorrelation by using Newey-West correction for the standard error (Newey and West, 1986).

Sobel and Holcombe (1996) identify one last problem that can affect short run elasticity estimation in this contest. Under a short run perspective, in any period tax bases can be above or below the long run equilibrium value. According to the authors, two non stationary variables that have a long run relationship with another one tend to move back together when they deviate too much from each other. This means that, in any time period, two short run movements coexist: on one side tax base react to income variation, while on the other side tax base adjust to converge to the long run equilibrium value. This phenomenon is usually called error correction and it contributes to make short run estimation biased. To solve the problem, an Error Correction Model (ECM) can be built through the inclusion of another variable in equation 6: the additional variable shows how far was the variable from the long run equilibrium values in the previous period. The ECM permits thus to capture both the aforesaid short run movements. The ECM equation is obtained using a two step

procedure. First of all, model of equation 4 is estimated and the connected residuals are computed. Than the lagged once residuals are inserted as an independent variable in model in order to obtain an unbiased short run income elasticity estimation using:

$$\ln(T_t) - \ln(T_{t-1}) = \alpha_0 + \alpha_1(\ln(Y_t - \ln(Y_{t-1})) + \alpha_2\mu_{t-1} + \upsilon_t \quad (7)$$

where μ_{t-1} represents the disequilibrium between short and long run elasticity value. In equation 7 the parameter α_1 captures the short run income elasticity of tax base, while α_2 measures the size of adjustment of tax base to its long run equilibrium value: it provides a measure of the percentage of disequilibrium that is corrected in every time period.

Some authors (e.g. Bruce et al., 2006) believe that a more appropriate approach should consider an asymmetric response of tax base to income variation depending on the position with respect to long run equilibrium value. To allow for an asymmetric reaction, Bruce et al. (2006) propose to insert in equation 7 a dummy variable D_t that assumes value 0 if the short run tax base is below its long run equilibrium and value 1 if the contrary is true.

$$\Delta T_t = \alpha_0 + \alpha_1 \Delta Y_t + \alpha_2\mu_{t-1} + \theta_1(D_t * \Delta Y_t) + \theta_2(D_t * \mu_{t-1}) + \upsilon_t \quad (8)$$

where ΔT_t and ΔY_t represents respectively the difference between the logarithm of tax base and income at time t and the corresponding value at time $t-1$. In equation 8 short run elasticity and the adjustment parameters are estimated separately depending on the position respect to long run equilibrium: in particular, α_1 and θ_1 represent the short run income elasticity when tax base is respectively below and above the long run equilibrium. If θ_1 is statistically different from zero this means that the upward adjustment when tax base is below equilibrium is different from the downward adjustment when tax base is above equilibrium. In addition, α_2 and θ_2 represent the size and speed of adjustment to the long run equilibrium when tax base is respectively below and above long run equilibrium value.

5. Results

Table 6 shows long run estimates of income elasticity while Table 7-8 shows short run elasticity estimates.

As we explained in paragraph 4, in order to applied the just described econometric techniques, the first problem to be analyzed is on the stationarity of the variables. Table 4 reports the results of the Augmented Dickey-Fuller test (Dickey and Fuller,

1979): a significant value of the statistic indicates that the variable is stationary. Results show that Lotto seems to be stationarity in level while all the other variables are not stationarity in their regular form. However, if we consider variables in their difference form we see that all variables are stationarity, suggesting that they are integrated of order one. Therefore, for Lotto category we will analyze results of traditional models, while we will deal with non stationarity related issues for Entertainment Machines and Instant Lotteries tax base.

Variable	Test for stationarity in level	Test for difference stationarity
Lotto	-8.914 (***)	-16.697 (***)
Instant Lotteries	-2.831	-5.969 (***)
Entertaiment Machines	- 1.627	-12.405 (***)
GDP	-2.067	-10.326 (***)

Table 5: Augmented Dickey Fuller (ADF) Stationarity Test

(* p<0.05; ** p<0.01; *** p<0.001)

In order to account for the great market expansion of gambling market we decide to include some control variables in the models following Nichols and Tosun (2008) approach. Omitting supply-driven changes may lead to omitted variables bias since gambling revenues can depend on factors other than income (e.g. number of licences or machines). Among game categories that we selected we can divide games in two main groups: the first one composed by Lotto which represents the most mature gambling market: indeed, Lotto has been first introduced in Italy long time ago: already during the XIX century Lotto was popular in several cities of Italy. Unlikely other types of games, during the last decades, Lotto has not experienced huge incentives and legislative reforms by the government and thus it has not been involved in the great expansion of the market. On the other side, Entertainment Machines (which include slots machines and video-lotteries) and Instant Lotteries represent two recently introduced booming markets, highly promoted by the government through the introduction of more and more slots machines, licences and lottery tickets. These distinctions among games, make us select different controls variables to take into account the single peculiarities of the markets. In particular we include in all the regressions seasonal dummies to account for potential seasonal variations; in addition we include some variables specific for each market: to take into account the expansion of Entertainment machines and Instant Lotteries market we include a variable reporting the number of workers employed in Arts, Entertainment, Recreation sector (Eurostat Nace Classification = R) as a measure of the development of gambling

market[8]. When running regression on Entertainment machine we also include a dummy variable that has value one after 2010, which is the year of legalization of a new type of innovative and successful entertainment machine (i.e. Videolottery). On the other side, when running models on instant lotteries we include a variable that records the total number of instant lottery tickets introduced each year as a measure of the increase in the available instant lottery tickets. We do not include these control variables for Lotto category due to the fact that this sector was less involved in the great expansion of the market and in the huge increase in licences, number of machines and available lottery tickets; however, for what concerns Lotto regressions, we include a variables recording the total number of monthly lotto extractions (which move from 4 in 1990 to 12 in 2013).

	OLS			OLS with control variables			DOLS with control variables		
LONG RUN ELASTICITY	**Coeff**	**Std Error**	**P value**	**Coeff**	**Std Error**	**P value**	**Coeff**	**Std Error**	**P value**
Lotto	5.02	0.76	0.00	5.88	1.53	0.00	7.10	2.03	0.00
Instant Lotteries	-3.31	3.94	0.41	15.07	3.59	0.00	24.20	6.50	0.00
Entertaiment Machines	-8.30	4.03	0.05	6.03	2.60	0.03	9.97	7.12	0.17

Table 6: Long run income elasticity estimates.

Table 6 reports the results of the models: the β coefficients indicate how fast a tax base revenue grows with respect to income under a long run perspective. We can see from table 6 that coefficients are significant and bigger than one for Lotto, meaning that tax revenues tend to grow more rapidly than income for this game. Results are confirmed when including control variables and when correcting for serial correlation using DOLS with Newey-West standard errors. For what concern Instant Lotteries and Entertainment Machines tax bases, results seem to be less stable: from estimations with control variables it is evident that both game types tend to grow much faster than income in the long run, recording particularly high coefficients of income elasticity. Generally the coefficients connected to these two games categories are bigger than the ones for Lotto: this fact can be a consequence of the different level of growth among mature Lotto market and more innovative slots and lotteries markets. These coefficients are also much higher than the coefficients traditionally obtained for sales and income taxes (Sobel and Holcombe, 1996, Bruce et al. ,2006) suggesting that gambling tax bases seem to grow more than other forms of tax bases in the long run

[8] Unluckily more suitable control variables (i.e. number of slots machines or licences) are still not available for all the time series considered.

adapting to income variations. Therefore, policy makers can consider gambling tax base a particularly important source of revenue in the long run as it is expected to increase impressively adapting to GDP variation.

For what concerns short run estimates, due to the non stationarity of some of the variables considered, variables should be transformed in their stationary form (first differences); thus the basic model for short run elasticity is estimated using equation 5. Johansen (1988) test for cointegration reveals a cointegrating relationship between income and tax base variables. Therefore we run three error correction models (equation 7) comparing the results with the ones obtained using more traditional models (equation 5). ECM provides two different coefficients of interest: the first is the estimation of the short run elasticity, while the second is the adjustment coefficient to long run equilibrium. Indeed, the change in bases in the short run can be provoked by two effects: the change in income and the adjustment to long run equilibrium. Short run elasticity measures the cyclical component of tax base variability: a coefficient bigger than one indicate a variable that fluctuates more than income over the business cycle. From results we see Lotto tends to move faster than income, while instant lotteries seem to be countercyclical, having a negative reaction to increase in income in the short run and therefore rising during recession and dropping in periods of economic booms. The other tax bases estimates turn out to be not significantly different from zero; this suggests that, immediate reaction of gambling revenue towards variation in income do not seem to be important for Entertainment Machines.

The second coefficient estimated by ECM is the adjustment parameter which represents the percentage of last period's deviation from equilibrium that is corrected in each period; we see that Lotto and Entertainment machines revenues tend to have a high adjustment parameters, meaning that in each quarter respectively the 81% and the 51% of deviation from long run equilibrium is corrected.

SHORT RUN ELASTICITY	BASIC MODEL			BASIC MODEL with control variables			ECM with control variables					
	Coeff	Std Error	P value	Coeff	Std Error	P value	Coeff	Std Error	P value	Adj to LR	Std Error	P value
Lotto	14.19	5.60	0.01	-5.47	7.41	0.46	18.10	4.78	0.00	-0.81	0.13	0.00
Instant Lotteries	-8.07	4.58	0.09	4.64	4.29	0.30	-7.97	4.50	0.09	-0.23	0.16	0.09
Entertaiment Machines	4.74	4.74	0.32	2.90	6.43	0.65	5.64	4.31	0.20	-0.51	0.17	0.00

Table 7: Short run income elasticity coefficients.

One last potential problem affecting short run estimated concern the possible presence of an asymmetric response depending of the position with respect to long run equilibrium. Indeed, in each quarters tax base can be either above (period of economic wellbeing) or under (period of economic recession) the long run equilibrium. To analyze this issue, as suggested by Bruce et al. (2006) we run an asymmetric ECM (equation 8). Table 8 reports the results: both two income elasticity and adjustments parameters have been computed depending on the current position with respect to long run equilibrium elasticity. The short run elasticity measures when tax base is below long run equilibrium tend to be not statistically different from zero; however short run income elasticity coefficient when tax base in above equilibrium is significant for Lotto: this suggest that there is an asymmetric reaction to income variation depending on the position with respect to equilibrium for this category of game. In particular, Lotto tend to be more reactive when tax base is above long run equilibrium: this suggests that Lotto tax revenues respond slowly to an increase in income when they are below long run level, meaning that during recession periods they react slowly to signs of recovery. On the contrary Lotto revenues tend to be more reactive when above long run equilibrium, which means in period of economic wellbeing. On the other side differences in short run coefficients are not statistically significant for Entertainment Machines. The adjustments parameters varies across games and they are generally significant when below the equilibrium: however, the adjustment coefficients when above equilibrium are not significant: this suggests that there are not important differences between speed of adjustment depending on the position with respect to long run equilibrium.

ASYMMETRIC SHORT RUN ELASTICITY	Short run elasticity						Adjustment to Equilibrium					
	ECM below Long Run equilibrium			ECM above LR equilibrium			ECM below LR equilibrium			ECM above LR equilibrium		
	Coeff	Std Error	P value	Coeff	Std Error	P value	Coeff	Std Error	P value	Coeff	Std Error	P value
Lotto	6.84	6.52	0.30	21.18	10.28	0.04	-0.90	0.28	0.00	0.18	0.48	0.71
Instant Lotteries	-5.32	6.27	0.40	-6.11	9.66	0.53	-0.66	0.44	0.30	0.77	0.73	0.30
Entertaiment Machines	2.94	5.61	0.60	6.16	10.08	0.55	-0.72	0.27	0.01	0.76	0.62	0.23

Table 8: Asymmetric short run income elasticity coefficients.

6. Conclusions

This paper examined Italian gambling fiscal system, trying to understand the evolution of tax revenues during recent years and some characteristics of the system.

The analysis of gambling gross expenditure suggests that gambling in Italy is a booming market, recording impressively high rate of growth, especially in recently introduced games. In addition, when looking at tax revenues, the descriptive analysis shows that the progressive decrease in tax rates applied to new games is leading to an increasing demand but also to a decreasing tax revenue for each euro bet.

The analysis of the long and short run elasticity of different types of gambling products revenues, help us in the understanding of the comparative dynamics of different gambling tax bases. To the best of our knowledge this is the first study on the characteristics of gambling fiscal system spit by game types.

From a policy maker point of view long run estimates provide an indication of long run revenue growth, while short run coefficients represent the cyclical variability of tax base over the business cycle. Results show that long and short run estimates may significantly deviate from each other.

Long run elasticity estimates suggest that gambling activities (e.g. Lotto, Instant Lotteries, Entertainment machines) tend to have particularly high (and bigger than one) income elasticity measures in the long run: this means that gambling tax bases are expected to grow significantly more than income under a long run perspective; this phenomenon is particularly relevant for recently introduced games, rather than for Lotto which represents a more mature market. In particular instant lotteries revenues seem to be the most reactive to GDP variation, recording a particularly high coefficient. If we compare these estimates with the ones obtained on traditional tax bases (sales and income tax base) (Bruce et al., 2006) we see that gambling revenues tend to record much bigger income elasticity in the long run, suggesting to policy makers that these tax bases are expected to react impressively (and more the general sales and income tax bases) to change in GDP. This means that, in the long run, if the policy towards gambling promotion will not be modified, gambling will guarantee an increasing amount of tax revenues, becoming a more and more relevant category of state inflows. However, it is important to notice that, due to the huge increase in gambling supply during the last years, income elasticity estimates can be partially over-estimated as some control variables (e.g. number of slot machines) are not still available.

Results of short run estimates are less easy to interpret. When considering results of the symmetric model, generally short run estimates are lower than long run ones suggesting the presence of cautious and lagged responses of economic agents to income variation. Lotto revenues make exception as they record a significant and high short elasticity, meaning that Lotto revenues are the most volatile in the short run. On the other side, instant lotteries seem to be countercyclical, having a (slightly) significant negative income elasticity. This can be an important results: indeed, policy

maker struggling with problems of budget constraint can identify instant lotteries tax base at the same time as a long run ever-growing tax base and as a countercyclical instrument in the short run. Entertainment machines does not record significant elasticity coefficients, suggesting that this gambling tax base is not highly reactive to variation in income in the short run. For what concerns adjustment to equilibrium, Lotto and Entertainment machines are the ones experiencing higher coefficients, and thus adjusting faster to the long run equilibrium.

When allowing for an asymmetric response and adjustment depending on the position with respect to the long run equilibrium, results suggest that immediate responses to change in income tend to be higher when tax base is above long run equilibrium; Instant lotteries revenues experience a negative (but not significant) short run elasticity, suggesting the countercyclical nature of this type of game. Adjustments to long run equilibrium tend to be higher (but most of them not significant), in absolute values, for instant lotteries and entertainment machines tax base, suggesting that these gambling products adjust faster to the long run equilibrium. For what concerns Lotto revenues, the adjustment to equilibrium seem to be faster when the tax base is below long run equilibrium, that is in period of economic depression: this can be an useful indication for policy makers who struggle to refill state coffers during periods of financial downturn. However, most of the coefficients in asymmetric models turn out to be not significant, and thus the use of this model is not fully justified.

Results of our models show that gambling tax base-revenues have some characteristics appreciated by policy makers: in particular they tend to grow in the long run adapting to GDP level; in addition instant lotteries revenues seem to move countercyclical to the business cycle in the short run. This may lead policy makers to incentivize gambling as a possible alternative source of revenue for the government. However, this paper ignores ethical and moral issues: in particular the fact that, if we exclude casino, most of gamblers belong to the most economical disadvantaged categories of consumers, leading to a potential and highly discussed in the literature regressivity of this form of taxation (e.g. Clotfelter, 1979; Kitchen and Powells, 1991; Combs et al., 2008 Beckert and Lutter, 2009). In addition, pathological gambling has been officially recognised as a pathology already in 1980 by the American Psychiatric Association and it has been classified inside the Diagnostic and Statistical Manual of Mental Disorders: therefore the promotion of gambling is not devoid of social and economic costs (Walker and Barnett, 1999).

The analysis proposed can be improved getting some additional datasets on gambling market: in particular, a sufficient long time series of data on real tax bases can be obtained on request from the Italian Customs and Monopolies Agency; this will permit us to use real data on gambling tax bases rather than proxies for tax bases.

Some additional data on gambling market (e.g. number of slots machines for each year) can also help in the correct specification of the model.

Appendix 1

Game	Short Description
Lotto	Foresee a combination of numbers among 1 and 90.
Superenalotto	Foresee a combination of 6 numbers among 1 and 90.
Lottery	Buying instant (immediate extraction) or deferred (later extraction) lottery tickets.
Sport Betting	Foresee the outcome of sport events.
Horse racing	Foresee the outcome of horse races.
Bingo	Tombola based on the extraction among 90 numbers
Slot Machines	Entertainment machines where the aim is to match symbols on mechanical reels that spin and stop to reveal one or several symbols, Maximum bet for each game = 1euro; Maximum winning = 100 euro
VideoLotteries	Entertainment machines where the aim is to match symbols on mechanical reels that spin and stop to reveal one or several symbols Maximum bet for each game = 10euro; Maximum winning = 5.000 euro
Skill Games	Games in which ability is more relevant than luck (e.g. Bridge, poker, Chess)

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