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# Sommario

## Nuove e vecchie sfide per l'Italia che riparte

# Gaming Industry and Pareto Optimality in Italy: A Comprehensive Welfare Analysis

**Alberto Casagrande**[*]
**Marco Spallone**[**]

## Abstract

In 2016 market volumes of the Italian gaming industry reached 95 billions €, including 77 billions € of winnings. Total Government revenues amounted to 10 billions €, growing by 24% with respect to 2015. Given the peculiar characteristics of gaming products and the many issues at stake (consumer protection, employment, international competition, …), the gaming market is subject to public regulation. In order to maximize social welfare, regulation of the gaming market must solve a tight trade-off between government revenues, economic sustainability of providers and utility of consumers. In order to suggest a methodological approach to the solution of such a complex trade-off, we mapped the Italian gaming industry by means of a simplified economic model that includes the main stakeholders, that is consumers (players), producers (licensed providers of gaming services) and benevolent public regulators (State or dedicated public agencies). The main result is that for the social welfare function to be maximized the price of one unit of gaming should be almost four times the price of one unit of consumption. Moreover, we found that an increase of the tax rates on profits does not affect social welfare, while it dramatically changes its composition: Government re-

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venues increase and profits decrease proportionally; since there is no effect on prices, consumers are indifferent. Conversely, an increase of tax rates on sales negatively affects social welfare (in particular, if tax rate on sales is augmented above 70%) since it causes prices to increase and, in turn, purchasing power of consumers to decrease.

**Sintesi -** *L'industria del gioco in Italia: un'analisi di welfare per la definizione dell'Ottimo Paretiano.*

*Nel 2016 i volumi del settore dei giochi in Italia hanno raggiunto i 95 miliardi di euro, di cui 77 miliardi hanno rappresentato le vincite dei giocatori. Il totale delle entrate erariali si è attestato intorno ai 10 miliardi, in crescita del 24% rispetto al 2015. Data la particolare natura del mercato e la complessità delle questioni implicate (la salute dei consumatori, l'occupazione, la competizione internazionale, …) il settore dei giochi è sottoposto a regolazione da parte dello Stato. Per massimizzare il benessere sociale, tale regolazione è chiamata a risolvere un difficile trade-off tra entrate erariali, sostenibilità economica dell'industria e benessere dei consumatori. Per suggerire un approccio metodologico alla soluzione di tale trade-off, abbiamo rappresentato il mercato dei giochi attraverso un modello economico semplificato che include i principali attori, consumatori (giocatori), produttori (concessionari) e regolatori (Stato e agenzie statali). Il risultato principale della nostra analisi è che la massimizzazione del benessere collettivo implica un prezzo per unità di gioco pari a quattro volte il prezzo di un'unità di consumo. Dimostriamo, inoltre, che un aumento della tassazione sui profitti dei concessionari non impatta sul benessere sociale, ma ne altera la composizione: le entrate fiscali aumentano e i profitti diminuiscono, mentre i consumatori rimangono indifferenti. Al contrario, un aumento della tassazione sulle vendite ha un impatto negativo sul benessere sociale poiché provoca un aumento dei prezzi che riduce il potere d'acquisto dei consumatori e, conseguentemente, il loro benessere. Tale effetto negativo è amplificato quando l'aliquota fiscale sulle vendite supera il 70%.*

**JEL Classification:** H19, H31

**Keywords:** Gaming Industry**,** Pareto Optimality, Italy.

**Parole chiave:** Industria del gioco, Ottimo Paretiano, Italia.

## 1. Introduction

The search for Pareto Optimality is the typical objective of economists. In this paper we perform this search focusing on the gaming industry, in particular on the Italian gaming industry.

In the last decade, issues related to the gaming industry became very relevant in Italy because of many intriguing reasons, that is: the gaming industry experienced a recent transition from a fully polarized duopoly (where the Italian State was the unique supplier of legal games, and organized crime was the unique supplier of all illegal gambling activities) to a strongly regulated oligopoly (where a set of large and small private suppliers compete), that has drastically reduced illegal activities; from 2008 to 2016 tax revenues generated from the gaming industry grew from 1 billion € to almost 13 billions €; despite the reduction of illegal activities and the growth of tax revenues, the collateral social effects of gaming (that is, addiction and personal bankruptcies) caused the public opinion to side against gaming, with no distinction between legal and illegal gaming or between addictive and non-addictive gambling products. However, our personal interest for the gaming industry also stems from our recent on-the-field experience.

In this paper, we map the Italian gaming industry by means of a simplified economic model that includes the main stakeholders, that is consumers (players), producers (licensed providers of gaming services) and benevolent public regulators (State or dedicated public agencies): consumers (who are heterogeneous in terms of their attitude toward gaming) maximize their utility by allocating their income between consumption goods and gaming, producers maximize their profits by choosing the amount of gaming to supply, and regulators set the price of gaming to maximize social welfare. The maximization of the social welfare function implies the solution of a trade-off between all welfare components, that is tax revenues, utility and profits.

Making such trade-off explicit is a key step forward in the search for a

proper balance between economic and social objectives. In our opinion, this should also provide the (Italian) Government with the right methodology to face such complex issues.

We calibrate the model on the Italian gaming sector and we solve numerically for the optimal price of gaming (under a set of assumptions over the gaming market structure). Then, we perform a sensitivity analysis of our main results by letting the main parameters (tax incidence, income distribution, heterogeneity) vary.

The main result is that for the social welfare function to be maximized the price of one unit of gaming should be almost four times the price of one unit of consumption.

Moreover, an increase of the attitude toward gaming of consumers does not alter significantly the magnitude of the welfare function; however, the amount of welfare experienced by consumers diminishes, while profits increase together with Government revenues. An increase of the tax rates on profits does not affect social welfare, while it dramatically changes its composition: Government revenues increase and profits decrease proportionally; since there is no effect on prices, consumers are indifferent.

Finally, an increase of tax rates on sales causes profits to decrease and Government revenues to increase; however, given that tax on sales affect prices and, in turn, the purchasing power of consumers, social welfare is diminishing if tax rate on sales is augmented above 70%.

Three sections follow this introduction. Section 2 provides a brief description of the gaming industry in Italy as it is. In section 3, the economic model is setup and equilibria are characterized. Section 4 describes our calibration of the model and the numerical results. In Section 5 a sensitivity analysis over the main parameters of the calibration is provided. Finally, the sixth section concludes.

## 2. A brief description of the Italian gaming market

In 2006 the Italian Government had to liberalize the gaming market in order to be compliant with European regulation.

Since 2006 the Italian gaming industry grew rapidly mainly for three reasons:

- A larger supply of gaming products, ranging from traditional lotto games to sport betting and entertainment machines.
- The migration of consumers from illegal gaming (widespread all over the country before 2006) to legal one.
- The development of online gaming.

In 2016 market volumes, including 77 billions € of winnings, reached 95 billions €. So, total expenditure of consumers amounted to almost 18 billions €. In 2015, market volumes were 88 billions €, and expenditure of consumers was about 17.5 billions €. While volumes increased by 7 billion €, expenditure stayed almost constant.

Slot machines make more than half of total volumes, while lotteries account for about 15% of total volumes and sport bets for about 10%. Volumes of online casino games are substantially increasing up to almost 20% of volumes.

Total Government revenues were 10 billions € in 2016, while they were only 8 billions € in 2015. In 2016 profits for gaming providers reached 8.5 billions €. So, overall, Government revenues grew by 24% with respect to 2015, and amounted to almost 55% of profits.

Market consists of few large players (either Italian or foreigner) that supply any type of gaming product and many small players whose portfolio is restricted to few products. Gaming products are supplied both on land and online. Lottomatica and Sisal are exclusively licensed to supply Lotto (in-

cluding instantaneous lotteries, so called Gratta e Vinci) and Superenalotto respectively.

While news seem to be good in terms of Government revenues and market competition, the growth of the gaming market raises crucial social issues: since on average Italian adults spent 365 € per capita in 2016, many claim that gaming distorts consumption choices and induces addiction, causing severe negative externalities. Actually, data on addicted consumers (that is, number, average expenditure, age, sex, …) are not available, but addiction is perceived as very pervasive.

So, given this situation, the solution of the trade-off between Government revenues, profits, and welfare of consumers is an urgent and compelling task.

## 3. The model

We represent the Italian gaming industry by means of a simplified economic model, as described below.

There are three economic agents:

1. The Social Planner, *(S)*.
2. One monopolistic producer, (*M*).
3. *N* consumers, which we divide into four types, according to income (**P**oor versus **W**ealthy) and attitude toward gaming (**Add**icted versus **Non-Add**icted). Utility functions for the four types have the following notation: $U_{P,Add}(\circ)$(Poor and Addicted), $U_{W,Add}(\circ)$ (Wealthy and Addicted), $U_{P,NoAdd}(\circ)$ (Poor and Non-Addicted), $U_{W,NoAdd}(\circ)$ (Wealthy and Non-Addicted).

We assume that the supplier of gaming products is a monopolist: this is an approximation of the current situation in Italy, where many firms (some large, some small) interact in a monopolistic competitive environment. We deal

with a monopolist because we do not want to focus on strategic interaction among firms; moreover, we want to take into account (extra) profits to gather insights about market sustainability. We may think of the monopolist as being a firm operating on a single market segment in the short run.

As for the composition of the population of heterogeneous players, we assume that the number of addicted players, both amongst the wealthy and the poor, is fixed, and that any price or income change would not affect such number.

Each player can choose to allocate her income, $R_i$, over gaming ($G$) and consumption ($C$), in order to maximize her utility given the price vector $P = (p_G, p_C)$. Preferences are different across the population because of addiction (Addicted versus Non Addicted), while budget constraints vary across the population because of different incomes (Poor versus Wealthy).

From utility maximization, each player $i$ derives her demand functions for gaming and consumption, whose arguments are the price vector and the available income:

$$\begin{cases} q_{iG}^d = f_i^G(P, R_i) \\ q_{iC}^d = f_i^C(P, R_i) \end{cases}, for\ i = [(P, Add), (W, Add), (P, NoAdd), (W, NoAdd)].$$

The monopolist will choose the amount of gaming to supply ($q_G^S$) in order to maximize profits, that depend on the price of gaming ($p_G$) and on the production costs ($C_M$), and on the tax rate on sales $t_S$:

$$\Pi_M = (1 - t_S) p_G q_G^S - C_M(q_G^S).$$

Finally, we have to define the social welfare function, that is the objective function of the social planner: it is a non-trivial exercise that – as we already stressed out – we believe has not been completely spelled out in the gaming environment, at least for the Italian case.

Focusing on the gaming industry, the social planner pursues three main objectives:

1. High tax revenues (to be redistributed on the basis of political choices that we do not model);
2. High profits (in order to keep firms in business);
3. High utility (that implies consumers enjoying both consumption and gaming, but avoiding addiction to gaming, especially amongst the poor consumers).

Then, the social welfare function, (*SW*), to be maximized includes three arguments, that is tax revenues, profits, and utility:

$$SW = w_1[t_\Pi \Pi + t_S(p_G q_G)] + w_2 \Pi_M + (1 - w_1 - w_2) \sum_{i=1}^{N} u_i$$

where $N$ is the total number of consumers (regardless of the type); $w_1$, $w_2$, and $w_3 = 1 - w_1 - w_2$ are the weights of the three arguments of the social welfare function, taxes, profits, and utility respectively; $t_\Pi$ and $t_S$ are the tax rates on profits and sales respectively; $q_G$ is the amount of gaming traded in equilibrium.

Consistently with the actual decision of the Italian policy makers, we allow the social planner to maximize *SW* by choosing the optimal price of gaming. In other words, assuming that the price of consumption, $p_C$, is defined on a perfectly competitive market, the objective of the social planner is to choose $p_G$ in order to maximize *SW*.

By normalizing the price of consumption to 1 ($p_C = 1$), choosing $p_G$ implies choosing the relative price of gaming with respect to consumption. In equilibrium, $p_G$ is such that SW is maximized, consumption demand equals consumption supply (because of perfect competition) and gaming demand equals gaming supply.

## 4. Calibration and numerical results

In order to compute the equilibrium price, we need to define both the demand and the supply side of the economy. Moreover, we have to calibrate the model on the Italian case in terms of tax incidence, income distribution, and heterogeneity of preferences toward gaming.

As for the demand side of the economy, we choose to represent preferences by means of a quasi-linear demand function because this specification allows for both corner and internal solutions:

$$U_i = C + \alpha_j G - G^2$$
$$for\ i = 1, ..., N\ and\ j = (Add, NoAdd)$$

where $\alpha_j$ is the attitude of consumers toward gaming, hence $\alpha_{Add} > \alpha_{NoAdd}$. In our calibration, $\alpha_{Add} = 8$ and $\alpha_{NoAdd} = 6$.[1]

So, given the price of gaming, $p_G$, each consumer chooses to consume an optimal amount of gaming, that is:

$$G_i^* = \frac{\alpha_j - p_G}{2}.$$

The optimal amount does not depend on income, while the actual consumption of gaming does. In fact, $G_i^*$ is the maximum amount of gaming that, given $p_G$ and $\alpha_j$, consumers are willing to have: if their income allows them to consume a smaller amount than $G_i^*$, they will only consume gaming (corner solution); if their income allows them to consume a larger amount than $G_i^*$, they will allocate the residual income on consumption (internal solution).

1 This calibration was chosen to match reality in terms of expenditure composition. In other words, in equilibrium the ratio between consumption and gaming expenditure resembles the actual average composition.

As for the composition of the population, we refer to the few available surveys on gaming addiction, which suggest that almost 2% of Italian adult population is addicted. Moreover, we define as rich those consumers whose income belongs to the highest quartile of the Italian income distribution (that we normalize to 80) and as poor those consumers whose income belongs to the lowest quartile (that we normalize to 10).

We end up with the following percentage composition of the population:
- Poor and Addicted: 2.2%;
- Poor and Non-Addicted: 77.8%;
- Rich and Addicted: 0.3%;
- Rich and Non-Addicted: 19.7%.

As for the supply side, we assume that the cost function of the monopolist ($TC$) is the following:

$$TC = \frac{q_G^{\beta}}{\beta};$$

thus, implying that the marginal cost of the monopolist (MC) is:

$$MC = q_G^{\beta-1}.$$

We assume that $\beta$ is equal to 3 in order to deal with convex marginal costs.

So, the monopolist chooses to produce the quantity of gaming such that marginal cost is equal to marginal revenue. In our specification, this implies that:

$$q_G^S = [\, p_G(1-\tau)\,]^{\frac{1}{\beta-1}}$$

where $\tau$ is the tax rate on sales, that we assume to be equal to 9%. Moreover,

we assume that the tax rate on profits is equal to 32%.

As for the social planner, given the objective function described in the previous section, we assume that the weights on tax revenues, profit and utility are 0.3, 0.3, and 0.4 respectively.[2]

Results are represented in Figure 1: the optimal price of gaming is an internal solution. More precisely, given our calibration, it is about 3.8, that is almost four times the price of a unit of consumption.

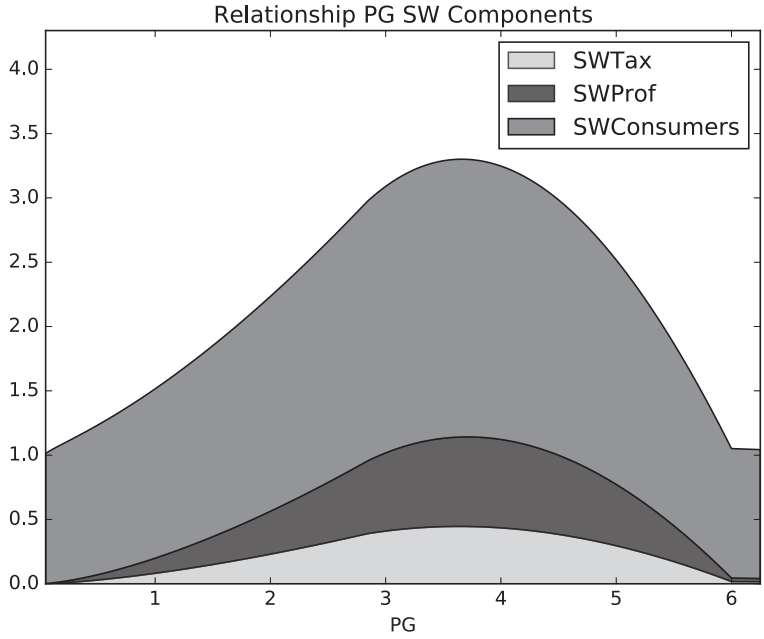
Given the utility function chosen to represent preferences, for any vector of prices consumers are willing to purchase an optimal amount of gaming, that does not depend on income: if their income does not allow them to purchase the optimal amount of gaming, they will only purchase the amount of gaming that they can afford; otherwise, they will allocate the residual income on consumption. However, it could also be the case that consumers cannot purchase the optimal amount of gaming because the monopolist is not willing to supply that amount if the current price is too low, that is if marginal revenue is below marginal cost.

Actually, what drives the result depicted in Figure 1 is the interaction between demand and supply of gaming: in particular, when price of gaming is below the optimal level, demand for gaming cannot be fully satisfied by the monopolist. In other words, when price is too low, supply is the short side of the gaming market and consumers are not allowed to allocate their wealth according to their notional demands. As price increases, the monopolist supplies more gaming and consumers purchase more gaming: that is why amount of gaming in equilibrium increases with the price of gaming. Obviously, when price is above the optimal level, demand is the short side of the market since consumers choose to substitute gaming with consumption (and the equilibrium amount of gaming decreases).

2 In order to make utility comparable with the magnitude of both tax revenues and profit, the sum of consumer utilities is discounted by a 0.1 factor.

As for tax revenues, they are directly correlated with the amount of gaming that is actually purchased by consumers: in particular, they increase when both profit and sales increase.

Figure 1 **Optimal price of gaming (PG) and social welfare (SW)**



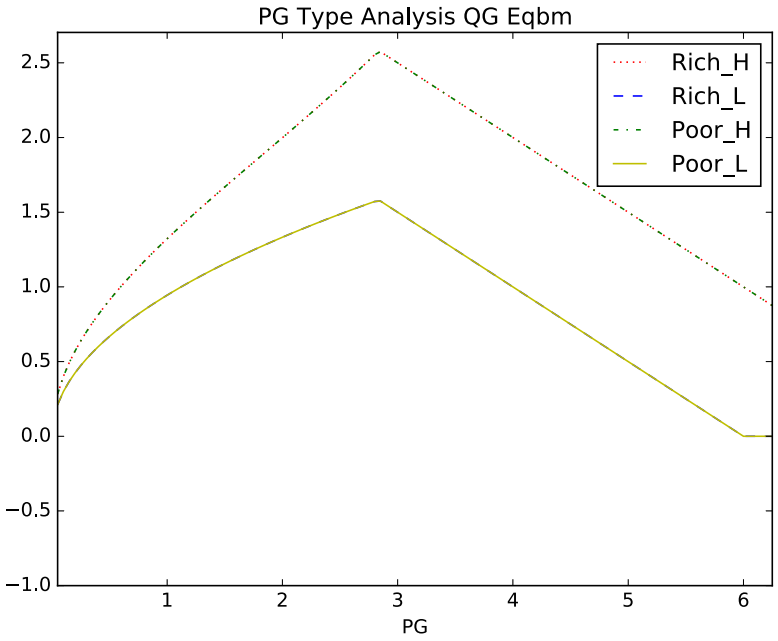

The same equilibrium result can be viewed in terms of the amount of gaming (Figure 2) and consumption (Figure 3) purchased by the four types of consumers.

In Figure 2, the amount of gaming is represented for all types of consumers. However, since the optimal amount of gaming does not depend on income (because of quasi-linear preferences), plots of poor and rich consumers overlap: the two lines in Figure 2 represent the amount of gaming purchased by either addicted or non-addicted consumers, regardless of their income.

The relevance of income emerges from Figure 3, where the level of con-

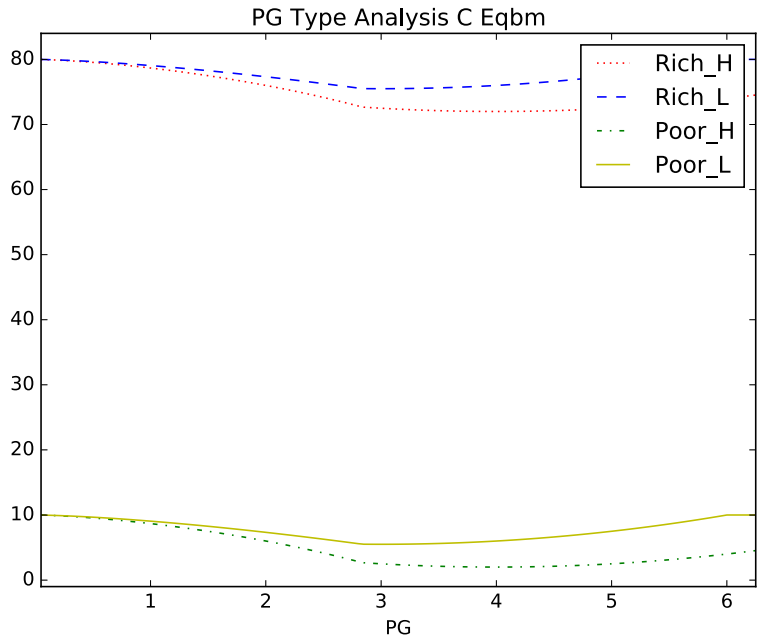
sumption (which is residual with respect to the amount of gaming) depends on the level of income: as it is obvious, richer consumers demand more consumption given the same amount of gaming.

Figure 2 **Equilibrium amount of gaming vs price of gaming (PG)**




Since consumption is residual, it follows an opposite path with respect to gaming: when purchased gaming increases (driven by the demand-supply dynamics mentioned above), consumption decreases and viceversa.

Figure 3 **Equilibrium amount of consumption vs price of gaming (PG)**




## 5. Sensitivity analysis

Few exercises over the results mentioned above provide deeper insights about the properties of the equilibrium.

It is worth emphasizing that the results of the following sensitivity analysis should be interpreted more qualitatively (increase or decrease) than quantitatively (magnitude of either the increase or the decrease): in fact, utility of consumers was arbitrarily scaled down to make proper comparisons with the other components of social welfare (namely, Government revenues and profits) and all results are affected by this parametrization. In other words, a different choice about the scale of utilities may induce different quantitative results.

Among the many parameters over which it is possible to perform a sensitivity analysis, we decided to restrict our attention to policy parameters, namely tax rates.

In Figure 4, social welfare is plotted against tax rates on profit. Since both profit and Government revenues enter the social welfare function with the same weight, an increase of the tax rates does not affect social welfare, while it dramatically changes its composition: Government revenues increase and profits decrease proportionally. Since there is no effect on prices, consumers are indifferent.

In Figure 5, instead, social welfare is plotted against tax rates on sales: as before, profit decreases and Government revenues increase. However, given that tax on sales affect prices and, in turn, the purchasing power of consumers, social welfare is diminishing if tax rate on sales is augmented above 70%.

Figure 4 **Social welfare (SW) components and tax rate on profits (TAO_P)**

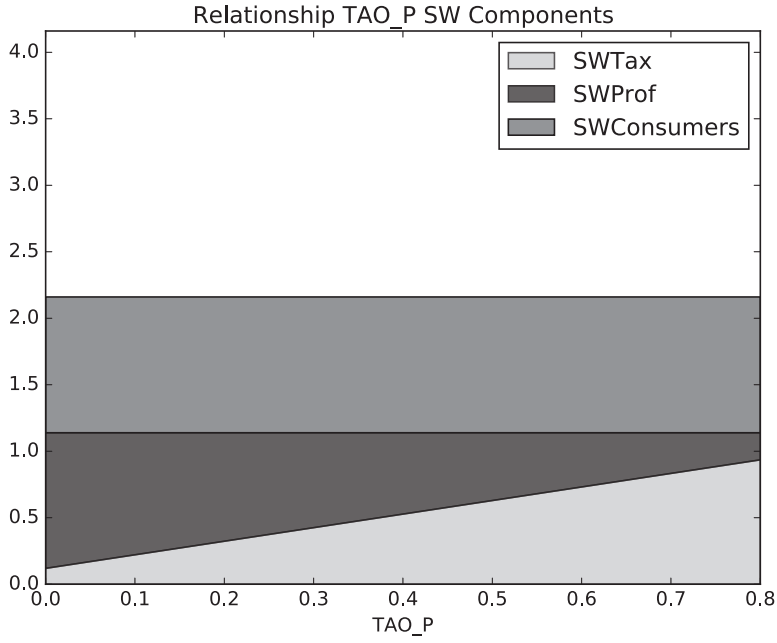
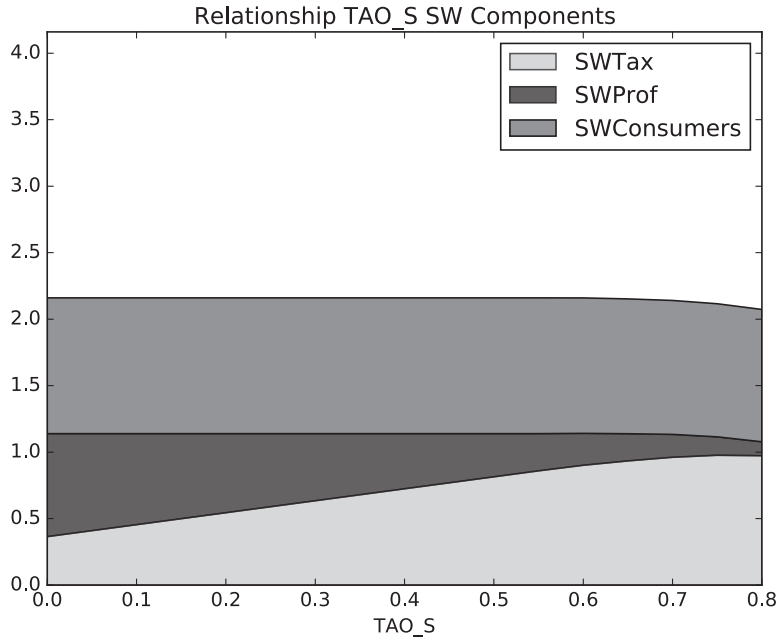
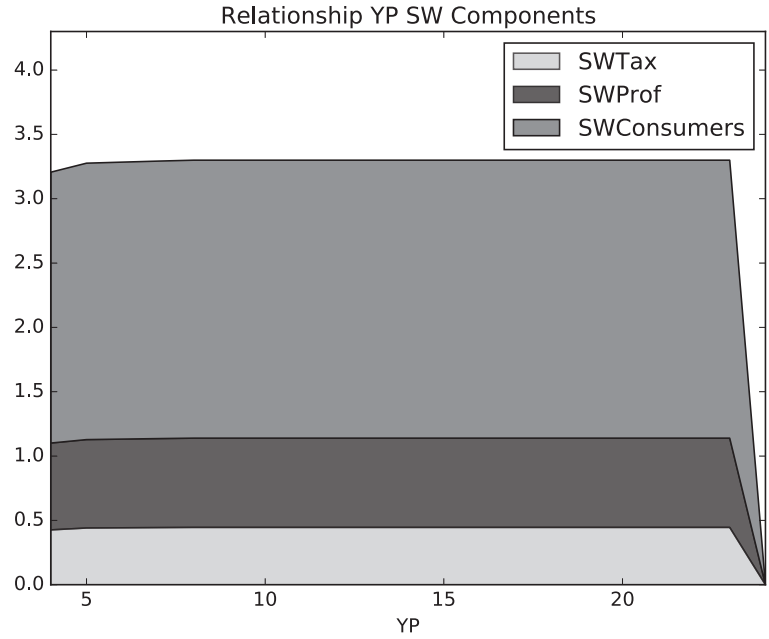


Figure 5 **Social welfare (SW) components and tax rate on sales (TAO_S)**




Generally speaking, policy makers may redistribute income from rich consumers to poor ones by means of targeted fiscal interventions. Redistributive policies may have an impact on the gaming industry, too. In Figure 6, social welfare is plotted against the income of poor consumers, whose growth is compensated by an equivalent decrease of the income of rich consumers to perform a consistent analysis. An increase of the income of poor consumers causes social welfare to grow until the decrease of the income of rich consumers overcompensates such increase.

Figure 6 **Social welfare (SW) components and income of poors (YP)**




## 6. Concluding remarks

Regulation of the gaming market implies the solution of a tight trade-off between government revenues, economic sustainability of providers, and welfare of consumers.

The definition of welfare of consumers is controversial: consumers are better off if gaming is affordable (that is, if prices are low enough); however, since they allocate their income between gaming and consumption, low prices may distort their choices toward gaming, triggering addiction. Especially in Italy, gaming addiction is perceived as a severe social issue, even if reliable data about the number of addicted consumers are not currently available.

In order to suggest a methodological approach to the solution of such a complex trade-off, we mapped the Italian gaming industry by means of a simplified economic model that includes the main stakeholders, that is consumers (players), producers (licensed providers of gaming services) and benevolent public regulators (State or dedicated public agencies): consumers (who are heterogeneous in terms of their attitude toward gaming) maximize their utility by allocating their income between consumption goods and gaming, producers maximize their profits by choosing the amount of gaming to supply, and regulators set the price of gaming to maximize social welfare. The maximization of the social welfare function implies the solution of a trade-off between all welfare components, that is tax revenues, utility and profits.

We think that our results are relevant both qualitatively and quantitatively. From a methodological standpoint, we were able to derive equilibrium results and to perform an informative sensitivity analysis of such results. As for numerical results, we concluded that, given our calibration, for the social welfare function to be maximized the price of one unit of gaming should be almost four times the price of one unit of consumption.

It must be pointed out that utility of consumers was arbitrarily scaled down to make proper comparisons with the other components of social welfare (namely, Government revenues and profits) and all results are affected by this parametrization. Nonetheless, the main qualitative results of our sensitivity analysis are very informative:

- An increase of the tax rates on profits does not affect social welfare, while it dramatically changes its composition: Government revenues increase and profits decrease proportionally; since there is no effect on prices, consumers are indifferent.
- An increase of tax rates on sales causes profits to decrease and Government revenues to increase; however, given that tax on sales affect prices and, in turn, the purchasing power of consumers, social welfare is diminishing if tax rate on sales is augmented above 70%.

Our analysis is part of a broader research project. Next steps include the enlargement of our model to diversify our results over types of games and market structures.

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ECONOMIA ITALIANA

## Call for Papers di Economia Italiana

# Immigrazione ed emigrazione: quali effetti sull'Italia e sull'Europa?

In occasione del convegno che si terrà a Roma il 24 maggio 2018, la Rivista Economia Italiana ha deciso di aprire una call for papers dedicata agli effetti economici dell'immigrazione e dell'emigrazione in Italia e in Europa.

Le sessioni saranno anticipate da un articolo a invito di Hillel Rapoport (Paris School of Economics).

I contributi da sottoporre per la conferenza potranno focalizzarsi sui seguenti temi (lista non esaustiva):

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ECONOMIA ITALIANA 2017/1–2–3

# Nuove e vecchie sfide per l'Italia che riparte

Il 2017 si chiude con incoraggianti segnali di ripresa dell'economia italiana. Per consolidare il rilancio occorre tuttavia proseguire nel cammino delle riforme strutturali. Questo numero presenta alcune riflessioni sul ruolo della politica fiscale, sfatando il "mito" di una spesa pubblica capace di ridurre da sola il rapporto debito/Pil attraverso effetti straordinariamente positivi sulla crescita, ma riconoscendo anche che, in periodi di grave recessione, cure troppo drastiche possono produrre l'avvitamento della crescita e il conseguente rimbalzo del rapporto debito/Pil. Seguono interessanti contributi su diversi altri temi importanti, sia per un'evoluzione di servizi (assicurazioni) che rafforzi le capacità delle piccole imprese di affrontare eventi avversi, sia su alcuni settori (gioco e tabacchi) la cui regolazione ha rilevanti implicazioni sia in termini sociali e per la salute dei cittadini, sia di adeguato contributo al gettito fiscale. Infine, una rubrica è dedicata ad uno degli interventi di maggiore rilevanza strategica dell'ultimo Governo, che mira esplicitamente a una profonda trasformazione dell'industria italiana: *Industria 4.0* vuole essere il primo contributo di una nuova serie di approfondimenti attuali su queste ed altre sfide.

ECONOMIA ITALIANA nasce nel 1979 per approfondire e allargare il dibattito sui nodi strutturali e i problemi dell'economia italiana, anche al fine di elaborare adeguate proposte strategiche e di *policy*. L'Editrice Minerva Bancaria si impegna a riprendere questa sfida e a fare di Economia Italiana il più vivace e aperto strumento di dialogo e riflessione tra accademici, *policy makers* ed esponenti di rilievo dei diversi settori produttivi del Paese.

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