CRITICAL gambling studies

Commercial Gambling and the Surplus for Society: A Comparative Analysis of European Companies

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Abstract:

Background: Gambling is an important source of public revenue in many countries. Little is known about how this revenue is generated, and how it depends on product portfolios, operating costs, turnover, and the institutional contexts of the industry.
Methods: A comparative analysis of income statements from 30 European gambling companies is reported. Scatter diagrams are used to describe how the surplus depends on volume, operating costs, monopoly status, and the game portfolio measured by aggregate return-to-players (RTP). Company profiles are used to interpret the results.
Hypotheses: Commercialization increases aggregate return to players. This is likely to lower the surplus. Low operating costs of automated and fast games compensate for this loss. Commercial companies produce less surplus than monopolies.
Results: The surplus is a linear function of the total revenue. Excluding three big companies, total volume is positively associated with the average return percentages but not proportionally with operating costs. The difference between monopolistic and market-based companies does not appear to be significant. Detailed descriptive analysis shows that the European gambling market may be facing a situation of supply saturation where further growth of gambling proceeds for good causes can no longer be accomplished.

Keywords: Gambling, industry, revenue, surplus, beneficiaries, costs

Introduction

Gambling is a relevant funding source for public services in many countries. It typically corresponds to approximately two percent of national budgets in Europe (Sulkunen et al., 2019; Egerer, Marionneau & Nikkinen, 2018), equalling in many cases state revenue from tobacco and alcohol products. This revenue comes from a surplus that remains from the total wagers placed by gamblers, after winnings are paid out and other costs, including private profits, are covered. The surplus for public use can be taxed away by states, regions, and communities, or used as direct contributions to civil society organizations (CSOs), charities, and other beneficiaries. In some cases, it is delivered as dividends to public owners. Public revenue is a patent justification of advancing legalised gambling (Egerer, Marionneau & Nikkinen, 2018; Francis & Livingstone, 2020; Nikkinen & Marionneau, 2014).

Revenue from gambling has grown since the 1980s when many states introduced state-operated national lotteries to collect money for sports, culture, youth work, and other good causes, and local clubs were allowed to arrange bingos and other forms of low-stakes gambling to support their activities (Adams, 2007; Clotfelter & Cook, 1990; Bedford, 2019; Kingma, 2004; Livingstone, 2005; Nicoll, 2019; Wardle et al., 2021). State lotteries and charity raffles, with infrequent or low pay-outs, were originally designed to be contributions to good causes as well as sources of excitement, and they are still essential sources of the gambling surplus in European countries. Lotteries and other charity games have a very high house take and low event frequencies. The pay-out rate is usually only about 50 percent of total wagers, or even less (cf. Clotfelter & Cook, 1990). The stakes are mostly small, but the jackpots are high. Spending on these games is often described as "voluntary" taxation (Neary & Taylor, 1998) as well as a source of excitement providing a small chance of winning high jackpots (Ariyabuddhiphongs, 2011). Many companies carry these games as part of their charity image but also due to their popularity and profitability (Clotfelter & Cook, 1990; Marionneau &

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Lähteenmaa, 2020). National betting and lottery companies are often state monopolies or operated by private companies on an exclusive license (Gidluck, 2018).

Commercialization has involved the entry of new for-profit companies to the market but has also diversified the game portfolios of many older companies, adding faster games and offering higher and more frequent pay-outs. The Nordic, British, Czech, Spanish, and French state monopolies are examples of increasingly commercial business models (Nikkinen, Ed., 2020). Commercial, or "big gambling" as Markham and Young (2015) have called it, differs from more traditional lotteries in that event frequencies are high with intervals of only seconds, and returns to players (RTP) are high, often over 90 percent of total wagers. Scratch cards, instant lotteries, remote betting, and electronic gambling machines (EGMs) are examples of such fast, or high-RTP games. Over the past few decades, commercialisation has transformed gambling into what consumers see more as an individualized experience than as an act of solidarity and means to support collective social goals and community needs. Commercial gambling aims at profits to owners and investors, at least when operators are private companies, and creates the public surplus as a side product of its commercial entertainment value rather than as an end in itself. As a policy justification it nevertheless has an important function. Governments and operators advertise the economic benefits of gambling, or the surplus, also from commercial gambling as "free income" or an alternative to taxation (Henricks & Embrick, 2016). Given that high game intensity is related to high risk of gambling problems and their prevalence in a population, the downside of this additional income is the burden it places on public health (Sulkunen et al., 2019, p. 115).

Three factors might reduce the gambling surplus to society[2] from commercial gambling. First, market-based government regulations in many countries, especially in Europe, increase price competition in the market (Sulkunen et al., 2019). Second, increased game intensity changes the activity itself, reducing the element of public revenue collection while increasing the role of individual consumption experiences (cf. Schüll, 2012). Gamblers playing fast games in casinos and arcades, or on online devices, see their spending less as a voluntary donation for "good causes" than as the price paid for the consumption for its own sake, and market competition tends to cut down the operators' margins. Third, the cost structure of the industry changes. While operating costs can be lowered with mass production and electronic distribution, development and maintenance of sophisticated game technology requires intellectual property creation, expensive equipment, and highly skilled labour.

This article presents the results of a study of factors influencing the gambling surplus based on the income statements of 30 European gambling companies in 2017. The analysis focuses on how the surplus depends on volume, return percentages, and operating costs. The analysis suggests that, insofar as increasing game intensity is the way to growth, the European gambling market appears to face a supply saturation.

Economy of the Gambling Surplus

The source of the gambling surplus can be understood in several ways. Neoclassical orthodoxy in economic science assumes that windfall profits are derived from government regulation which generates unearned extra revenue for suppliers and may also cause undesirable consequences for society. For example, neoliberal economist Milton Friedman attributed the undesirable consequences of illicit drug trade to extra profits generated by prohibitive regulations (Friedman & Friedman 1981, pp. 1–29, 193–200).

Adams and Livingstone (2015) have proposed that extra revenue from gambling, like other forms of consumption that can involve dependency, comes from what they call an addiction surplus. A very small number of problem gamblers (about 2 to 3 percent of the population based on population studies) contribute a very large share (often about 50 percent) of the revenue collected by the industry. Addicted gamblers cannot control their consumption, and this increases the total turnover and contributes significant profits for the industry.

Young and Markham (2017) add two other factors to what they call secondary exploitation through gambling. One is the monopolistic or highly concentrated structure of the industry. Monopoly pricing follows from government restrictions, or from economic barriers to entry, such as high initial investment requirements, patents, or other technological impediments. Support for this hypothesis was provided by Gu (2002) in a comparative study of the casino industries in Nevada and European jurisdictions. The study showed that non-competitive European markets appear to help casinos achieve higher returns to society than those in Nevada.

Another factor suggested by Young and Markham (2017) is that the price of production is divorced from the sale price. For example, a one dollar bet in blackjack takes the same amount of capital investment and labour costs as a 1000 dollar bet. In general, transactions between buyers and sellers in this industry are asymmetrical: players spend money every time they

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[2] It should be observed that the term "gambling surplus" in this article refers to the extra amount of money collected by gambling operators for public use, after payment of winnings and deduction of costs and private profits from the total wager placed by players. It should not be confused with the "consumer surplus" that in marginal utily economics refers to the amount of value derived by consumers who would be willing to pay a higher price for the product than they actually are.

place a bet, whereas sellers pay almost nothing to provide the next run of the game (Sulkunen, 2022).

From the public interest point of view, it is essential to also distinguish between private profits and profits that go to public use. Private profits include dividends to owners as well as investors' share of the company's revenue.

In this paper, we define the surplus as:

$$Sg = Rg - (RTP + C + F) = GGR - (C + F)$$

where Sg = the gambling surplus; Rg = revenue from gambling (comprising of company revenue from wagers, not from other sales); RTP = money returned to players as winnings; GGR = gross gambling revenue = Rg minus RTP; C = operating costs; and F = cost of financing (a residual category consisting of finance costs and private ownership costs).

Dividends paid out to private shareholders, interest paid out to creditors, and profits that remain in the company, are also deductions from the surplus (Sg). They constitute what we call the financial cost (F) in the model. Sharing the total yield between private profits and public surplus is a key gambling policy issue, but F is a complicated variable to measure, and would require a balance sheet analysis of the companies. It will be measured in this article as the residue of the total gambling revenue from which all other costs have been deducted. It varies from <0 (companies making a net loss to owners) to 17% of the GTR for Szerencsejáték (Hungary) and 22% for Sazka (Czech Republic).

From this equation, Sg + F represents the total gross yield of the company after expenses, to be divided between private gain and surplus for public use. Respectively, the cost of financing including private gain (F) equals Rg – (RTP + C + Sg) = GGR – (C + Sg).

The factors introduced above that might increase the total yield, public and private combined, can be expressed as follows: The addiction surplus sets the average sale price higher than it would be otherwise, and also adds to the overall volume of consumption, allowing the industry to draw a revenue above its costs and normal profit. To the extent that governments can extract this extra revenue towards public use (instead of private profit), addiction supports the gambling surplus to society (Sg). This creates a conflict of interest for those public stakeholders who are responsible for preventing addiction and other harms, but who also benefit from them in the form of the surplus. The addiction surplus should appear as low price and income elasticities of gambling demand. Monopoly pricing, whether government imposed or economic, has similar effects, assuming that there is a fixed amount of demand independently of supply. As we know, this is not the case (Sulkunen et al., 2019): supply creates demand. This is why explaining the gambling surplus by market imperfections of supply are not sufficient.

Evidence on price and income elasticities as well as on monopoly pricing is inconclusive. Some studies suggest low income elasticities in the long run (Swiss Institute of Comparative Law, 2006, pp. 1429-1439). One review and time series study in the UK (Frontier Economics, 2014) finds that the commercial growth sectors – EGMs and remote betting – are the most inelastic. These are the games that are most likely to attract problem gamblers; this would support the addiction surplus hypothesis.

Operating costs (C), financial costs (F), and pay-outs (RTP), are inversely related to the surplus. The faster the games, the higher the RTP must be, and the lower the operating costs (C) are, the higher will be the Sg, given the gross gambling revenue GGR. Furthermore, the surplus (Sg) depends on how much of the total yield goes to private shareholders and investors, or remains in the company to improve its financial position (and share value).

Very little research is available on the effects of company size and the cost structure of the supply. Clotfelter and Cook (1990) have compared US lottery operations and found that companies with higher overall sales had lower operating costs. However, questions remain: (1) Is it indeed the case that big companies have more high-RTP game portfolios than small ones, and thus earn a lower average share of gamblers' money? If so, we could expect them to keep their sale prices down to production costs, and to satisfy their owners and investors with private profits. One way of doing this is to keep their Sg as low as they can. (2) The next question is therefore: do big companies, measured by turnover, produce lower levels of surplus to societies relative to their size than small ones? (3) The third question concerns the factor of operating and financial costs. Does the production price of fast games effectively compensate for high pay-outs, and how far can the other cost factors, including private profits, be held in check to support public income from commercial gambling? If commercial gambling offered by big companies produces less surplus per input by gamblers than traditional lotteries, but more harm to public health and population welfare, a substantial justification for its growth collapses.

Data and Method

To measure the gambling surplus to society, as well as the variables on which this surplus depends (listed in the formula above), we collected data from the income statements of 30 gambling operators operating in 18 European countries. We only included companies that publicly reported reliable data on their operations. The income statements of the included companies cover their operations on national gambling markets. Our dataset excludes companies that only give corporate income statements on the total of their operations in several countries, and some smaller companies with inadequate reporting.

Income statements of the included companies are available on company corporate websites. They are required legally from private companies as well as most public monopolies, foundations, charities, and CSOs that act as gambling operators. The income statements follow the International Financial Reporting Standards (IFRS), but this is not sufficient to compare figures across companies. For this reason, we have built a model that we call the *standardised income statement* (SIS), to measure the variables of the formula above.

Each variable in the SIS model sums up several distinct items commonly reported in the original income statements, but not the same way for each company.

Company size can be measured either by the revenue from gambling (Rg), or by the gross gambling revenue (GGR), which is the revenue from gambling minus the sum of winnings paid out to gamblers, in other words the aggregate sum of money that consumers spend on gambling. In this article we use the GGR for volume for the theoretical reason that it measures the actual size of the company turnover disregarding the game portfolio, which will be analysed separately in the analysis below. Technically, for the sake of consistency with the income statements, instead of the GGR we have used their gross *total* revenue (GTR), which includes revenue from other activities, mostly restaurants. The difference is insignificant in all except one company, Loteria Romana, for which we have used the GGR.

To measure *the gambling surplus (Sg),* we added together all company taxes, earmarked contributions to designated causes, regional or local budgets, direct contributions to beneficiaries, and license fees. Contributions to the horse racing sector, as well as to sports, excluding sponsorship and marketing, have been included in the surplus. Taxes on winnings are sometimes charged but these have not been included in this analysis due to unreliable reporting. Svenska Spel, Norsk Tipping, Danske Spil, and Sociedad Estatal Loterías y Apuestas del Estado (SELAE) deliver the surplus as dividends to public shareholders, here included in the surplus. The Spanish Organización Nacional de Ciegos Españoles (ONCE) pays a salary to its vendors (persons with reduced eyesight or other disabilities), costing 639 million EUR in 2017. We also included these costs in the gambling surplus as they can be considered a direct contribution toward the welfare of the blind or vision impaired (Nikkinen, 2020, p. 97).

RTP is a proxy for the company's product portfolio. Companies with high RTP have product portfolios that consist mainly of fast EGM and casino type gambling as well as remote betting, whereas companies with low RTP offerings refer mainly to slow lottery and bingo-type products (Sulkunen et al., 2019).

Some companies do not report their revenue from gambling (Rg), but only their GGR (Veikkaus, Holland Casino, Swisslos, Loterie Romande, and Danske Spil). The estimate of Rg for Veikkaus is taken from Marionneau and Lähteenmaa (2020). The estimate for Holland Casino is based on Dutch gambling authorities' report from 2017: payment percentages of table games are between 95 and 99 per cent, and EGM RTP is over 90 per cent (Kansspelautoriteit, 2017 pp. 66, 83). The other three companies were omitted from the analysis of revenue from gambling (Rg) and RTP.

The variable *operating costs* (C) sums up items on personnel costs, depreciation, material, game licenses, commissions to agents, marketing, and so on, depending on the way these costs are reported in the companies' income statements. Details of the data processing are given in Marionneau et al. (2020), and an overview of the companies and their institutional contexts is reported in Nikkinen (Ed.) (2020), summarized here in Appendix 1.

Institutionally we have divided the companies into market- and monopoly-based structures (dummy variable M). Those operating in a market-based environment were assigned the value 1, others received the value 0. However, the line between monopoly and market structures is not absolute. The monopoly status is itself unclear because in most gambling markets only some types of gambling are under a monopoly, but gamblers usually spend money on many kinds of available games (e.g., Paton & Williams, 2001). The Italian companies included Sisal, Snaitech, Gamenet, and HBG Gaming and are privately owned so we classify them as market-based (M = 1), although they too operate under restrictive licenses (Rolando & Mandolesi, 2020). Camelot in the UK, Premier Lotteries Ireland, and Sazka in Czech Republic are private companies operating on competitive markets but hold government monopolies and are here classified as monopolies. Postcode Lotteries operated by the Dutch private company Novamedia are available in the Netherlands, the UK, some states of Germany, Sweden, and Norway. They are small and charitable operators on exclusive licenses, and not considered market-based here. The Nordic state monopolies Norsk Tipping, Norsk Rikstoto, Svenska Spel, Veikkaus, and the partial state monopoly Danske Spil, also compete with offshore operators. The market shares of the Nordic state monopolies were estimated to hold approximately 85 percent of the gambling market in their respective countries in 2018 (Nikkinen & Marionneau, 2021).

The national population base obviously affects the companies' sales volume, but not in a uniform fashion. Most companies are not the only legal providers within their jurisdiction, and monopoly status can yield a very large revenue even in a small country. For example, the Finnish state monopoly Veikkaus operates with an annual volume of about 12 billion EUR in a country of 5.5 million people, the same volume as Sisal and Snaitech in Italy (60 million), and twice the volume of Svenska Spel in Sweden (9.7 million), and ONCE in Spain (46.5 million). As we are interested in how Sg and the cost elements depend on turnover, we use volumes instead of per capita figures.

Results
The Gambling Surplus

The heterogeneities of production, product portfolios, institutional entry restrictions, and market conditions suggest great variations in the gambling industry's capacity to produce a surplus. The first observation from our data is dramatically depicted in Figure1: the surplus depends in a straightforward manner on one single factor, the volume of sales.

Figure 1. Gambling surplus (Sg) per sales volume (GTR) of 30 European companies in million EUR (conversion based on the currency rate of first of January 2017) (r = 0.99). The companies marked with triangles are classified as market based.
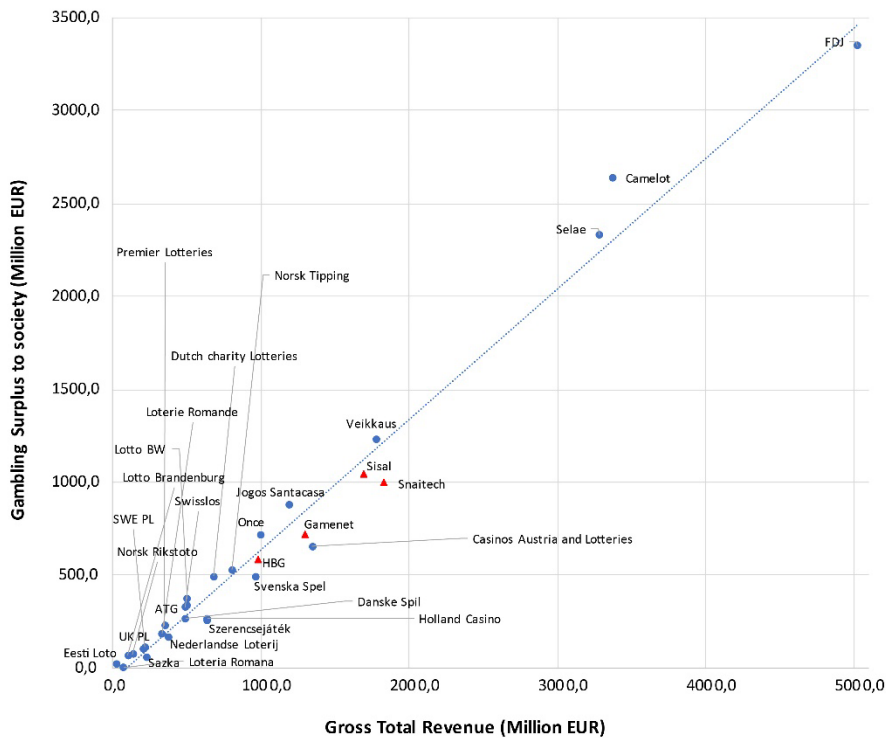
The surplus Sg follows the GTR closely for all companies included in this analysis (Sg = 0,702 × GTR, with r = 0.99). One added million EUR of the GTR increases the Sg by 0.7 million EUR.

The surplus ranges from about 40 percent of the GTR for the Hungarian Szerencsjáték, Holland Casino and Nederlandsje Loterij, to over 70 percent for ONCE and SELAE in Spain, and Jogos Santacasa in Portugal. Veikkaus (Finland), Norsk Tipping and Swedish ATG allocate about 66 percent of their GTR to public use; while Danske Spil (Denmark), Svenska Spel (Sweden) and Norsk Rikstoto (Norway) deliver about 50 percent. The Czech private lotto monopoly Sazka appears to deliver only 25 percent of its GTR toward public use.

To confirm the result in Figure 1, logarithmic regression models predicting Sg were estimated with the volume (log GTR) alone (MODEL 1) and with RTP, C and M as independents (MODEL 2) in Table 1.

The full model is log Sg = β0 + β1(log GTR) + β2(log RTP) + β3 (log C) + β4 (M) + ε.

Table 1. Logarithmic regression models predicting the gambling surplus (log Sg) in 30 European companies. Standardized coefficients.

	β_1(log GTR)	β_2(log RTP)	β_3(log C)	β_4(M)	Adjusted R^2	sd ε
MODEL 1	0.943	excluded	excluded	excluded	0.886	0.2295
MODEL 2	1.904	0.005 (n.s.)	-1.007	-0.85 (n.s.)	0.954	0.1469

Logarithms of 10 are used for the quantitative variables to reduce the outlier effects, and standardized coefficients for the independent variables are presented to assure comparability between them.

As is already apparent from Figure 1 above, the volume alone predicts the surplus well, with β_1 (log GTR) = 0.943 and adjusted R^2 = 0.886. Operating costs C add to the power of the model, but only slightly. The effects of market-based variable M and RTP are not significant ($p<0.05$).

The answer to question (2) above is thus negative: in the whole sample of companies the Sg is positively correlated with the company turnover as measured by GTR. The fit is not essentially improved by adding C, RTP and M as predictors.

However, different and partly opposite factors may be found underlying the linear relationship between volume (GTR) and the surplus to society (Sg). These are related to the operating costs (C) and return to players (RTP). Next, we ask how they are related to the surplus, to answer research questions (1) and (3): Is it indeed the case that big companies have more high-RTP game selections, and can this be compensated for by low operating costs?

Portfolio Effect

As explained in the section "The gambling surplus" above, the operators' selection of games can be expected to influence the amount of surplus they produce. We call this *the portfolio effect,* here measured by the RTP as described above. A high pay-out rate might appear generous toward players and less generous toward beneficiaries of the surplus, but it must be kept in mind that the game portfolios offered by companies are not motivated by generosity but profit-seeking by faster games.

Leaving aside the biggest companies operating in big countries SELAE (Spain), Camelot (UK), and FDJ (France) for a moment, there is a relationship between volume and RTP, as shown in Figure 2.

Figure 2. Return to players in percent of revenue from gambling (RTP%), per gross total revenue (GTR) in million EUR (r = 0.62). Outliers SELAE, Camelot, and FDJ are excluded.
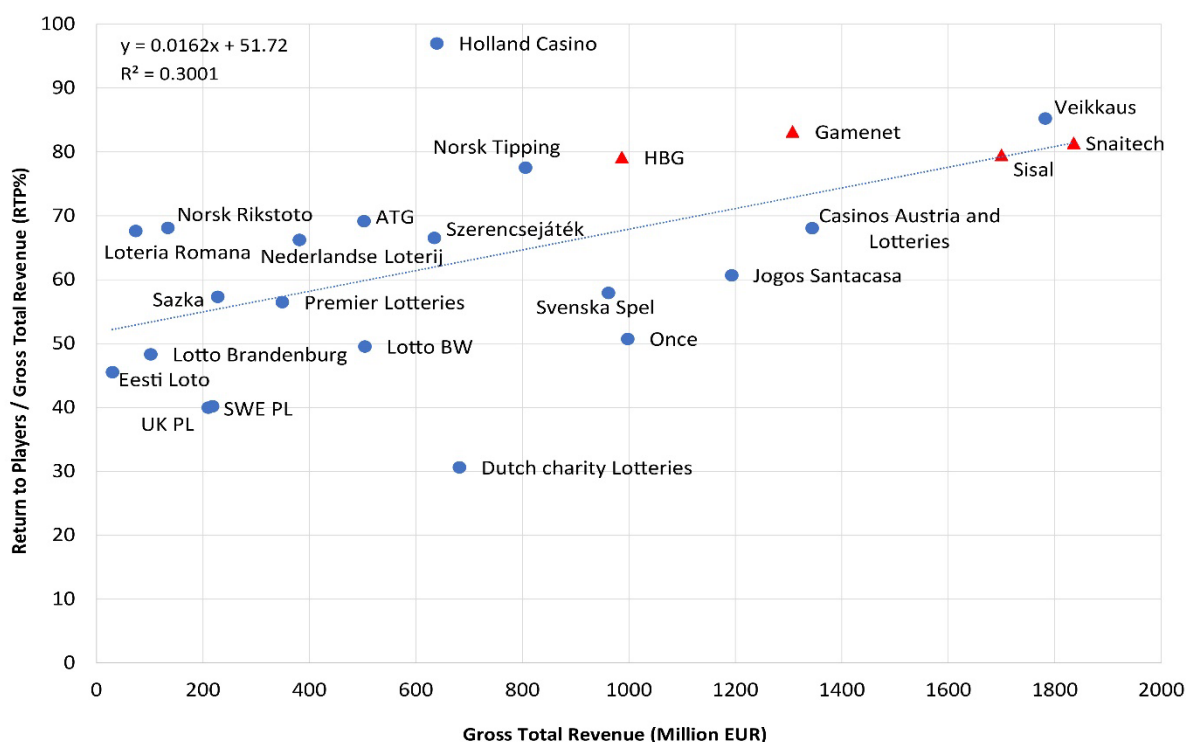

Figure 2 shows that excluding the large outliers as well as the companies for which we have no estimate for RTP, big companies have high RTP percentages. Companies that have high turnover also have a high volume of high-RTP products (fast games) in their portfolio. This result is paradoxical: the more operators spend on winnings the more surplus they also produce.

The answer to research question (1) is therefore positive. It is indeed the case that big companies appear to have high-RTP portfolios, except for the outliers. On average, high volume compensates for high expenses on winnings. Nine companies with an RTP over 60 percent have a GTR over 1,000 million EUR. Apart from the market-based Italian companies, these are national lottery and betting monopolies that have become diversified and increased the aggregated RTP of their game portfolios. For example, FDJ's RTP was 59% in 2000 (Trucy, 2002), and 67% in 2017 (FDJ, 2017). Veikkaus had an overall RTP of 85.2% in 2017, its first year as state monopoly on all gambling, with 54 percent of its GTR coming from high-RTP products, such as EGMs. The Norwegian state monopoly has a high aggregate pay-out rate (77.6%) from the popularity of similarly high-RTP online sports betting (Marionneau & Lähteenmaa, 2020). The market-based Italian companies included in this analysis have RTP ratios ranging from 79.5% (HBG) to 83.2% (Gamenet), derived largely from high-RTP operations, mainly EGMs.

Why is this the case? Companies with lottery-heavy portfolios have low return percentages. These include Eesti Loto (45.5%), the German State lotteries that have RTPs below 50%, and ONCE (50.8%). Camelot (56.9%), and the Irish state monopoly Premier Lotteries (56.3%), both owned by the Ontario Teachers' Pension Plan (OTTP), are also close to the 50-percent mark (National Lotteries Ireland, 2018; OTPP, 2018). The Holding Nationale Doelen Loterijen (which includes three Dutch charity lotteries: Bank Giro, the Dutch Postcode Lottery and Vrienden Loterij, referred to as "Dutch charity lotteries") has an RTP as low as 30% of their aggregated Rg. The Post Code Lotteries in Sweden and the UK have return percentages of about 40%.

The outliers are national lottery monopolies in big countries. SELAE in Spain focuses today on online gambling and has an RTP of 64%. FDJ in France offers lotto tickets (34.2% of the GTR), but also high-risk (Vila, 2018) scratch cards (49.2%), and offline sports betting (16.6%). It has a medium level RTP of 67%. Camelot, the British national lotto monopoly, has the lowest RTP of 57% among the giants. However, this is still moderately high, based on its current combination of traditional lotteries, scratch cards, and instant lotteries.

The state-owned Holland Casino, with 14 establishments in the country, is an outlier in the opposite direction. It is likely to have a high RTP (up to 97% estimated from figures published in a report of the Dutch Gambling Authority, Kansspelautoriteit (2017)),

but also high operating costs. The other casino company, Casino Austria, has a moderately high RTP of 68.1%.

Operating Costs

The RTP percentage rising with the volume of turnout implies that high volume means high costs in pay-outs to gamblers (excluding the outliers). This can be offset by economies of scale: gamblers spend more money, and operating costs per gross total revenue C/GTR (C%) can be lowered when the volume of turnout increases. This happens when digital technology of high-RTP products replaces mechanical machines and staff-operated draws and equipment.

Figure 3 shows how operating costs C in percent of GTR relate to total volume GTR. Here a linear relationship can be observed only when the giants are included in the analysis. The relationship is weak, and for the rest of the companies there is no correlation at all. The outliers Camelot, FDJ, and SELAE, have operating costs at or below 30; in the smaller companies it varies for reasons not directly related to their sales volume.

Figure 3. Operating costs in percent of gross total revenue (C%), per gross total revenue (GTR) in million EUR (r = -0.36).
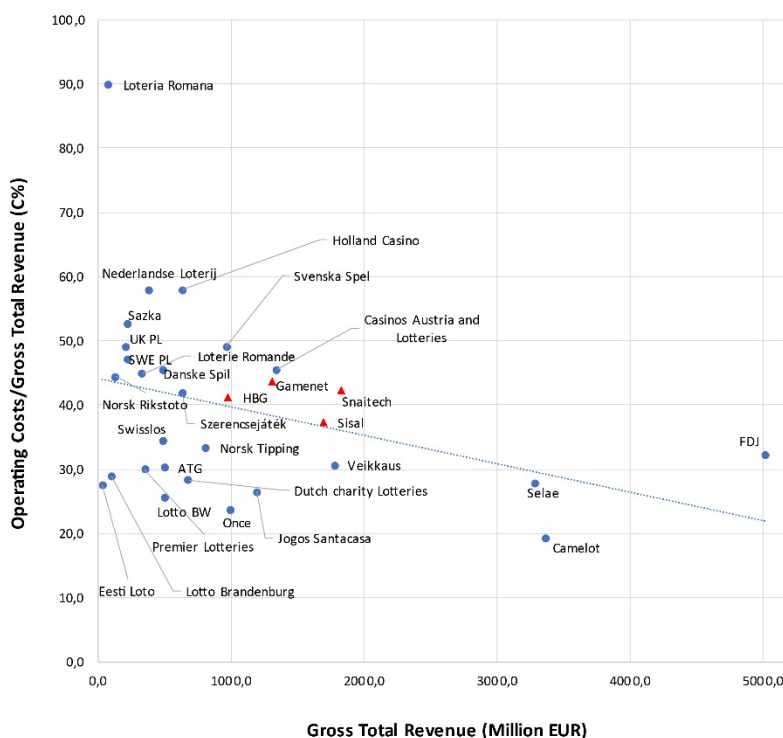
The big companies Camelot, SELAE, and FDJ have low or moderate RTP percentages but low unit costs because of their out-sourced distribution network and high volume. On the other hand, many of the smaller operators have the same cost level. On the other hand, the Italian companies offer high-RTP games (mainly EGMs) with high return rates but have high distribution costs because they pay high commissions to agents: from 15% (Sisal) to over one third of their GTR (32% for Snaitech and Gamenet, 35% for HBG). These items represent a great part of their total operating costs (Rolando & Mandolesi, 2020, pp. 53-67). Svenska Spel had significant marketing expenses in 2017 (Nikkinen & Marionneau, 2021). Casino operators in Austria and Holland draw their revenue mostly from high-RTP electronic gambling machines (EGMs), and government concession fee for casinos and lotteries is lower than EGM operations, which lowers their surplus (Nikkinen Ed., 2020).

Supply Saturation

The analysis above (Figure 2) suggests that (excluding the outliers SELAE, Camelot, and FDJ), the size of gambling companies might be positively related to the proportion of high-RTP games in their portfolio. Big companies do produce a surplus to society proportional to their sales volume (Figure 1), but we still need to answer the question about how much this

depends on low operation costs due to high-RTP portfolios, and on other factors. To answer this question, Figure 4 addresses the relationship between unit costs and RTP percentage to see how unit costs are related to the companies' game portfolio.

Figure 4. Operating unit costs (C%), by return to players (RTP%) in percent of gross total in three groups of companies (solid dots around a solid regression line, square dots around a dotted regression line, and hollow dots omitted from both regressions)
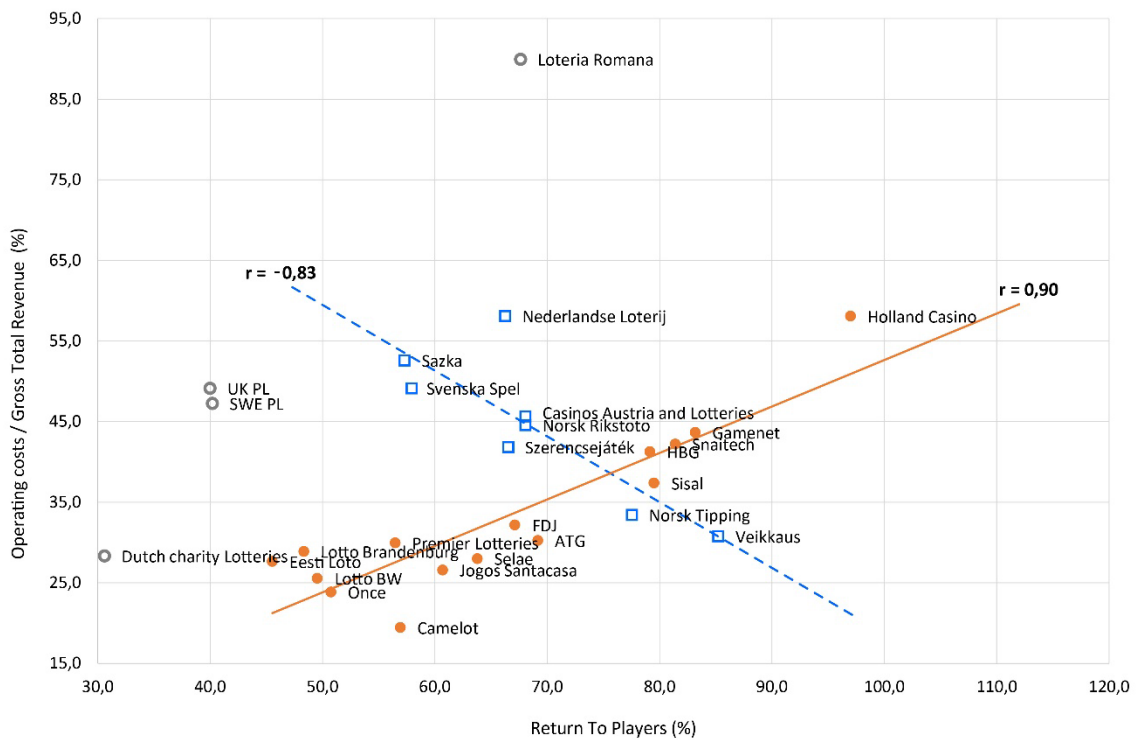
At first sight, there is no pattern in Figure 4: the companies (companies without information on their RTP are excluded) are scattered randomly around the graph (r = 0.17). Looking at the figure more closely, however, we can distinguish two different groups of companies. First, the Nordic monopolies: Veikkaus, Norsk Tipping, Norsk Rikstoto, and Svenska Spel, as well as Nederlandse Loterij, Szerencsjáték (Hungary), Casinos Austria and Lotteries, and Sazka (Czech Republic), fall on a dotted declining line associating higher RTP percentages and lower unit costs. These are marked with squares in Figure 4. Originally these operators offered a limited selection of slow games within strictly regulated regimes but gradually added fast, digital games to their portfolios (reflecting a shift from the so-called "alibi model" to the "risk model" of gambling provision (see Kingma, 2004). The Finnish and Norwegian monopolies Veikkaus and Norsk Tipping have compensated for high pay-outs by low operating costs. Notably Veikkaus has a high RTP percentage and low unit costs, enabling it to produce a generous surplus to society (Nikkinen & Marionneau, 2021). This group suggests that in some circumstances high-RTP

products can be a cheap way of collecting money from gamblers. However, even they will likely face problems, as costs cannot be lowered indefinitely, and there is a limit to how high the aggregate RTP can become. Possibilities for further growth are already saturated for some of these operators, unless the market base can be essentially extended through integration with the global online industry.

The second group of companies, marked with solid dots in Figure 4, around the solid rising regression line includes the large Camelot, SELAE, and FDJ, the four Italian companies, ONCE (Spain), Jogos Santacasa (Portugal), and Holland Casino. These companies operate in big countries with populations of 10 million (Portugal) or more.

Eesti Loto, Premier Lotteries of Ireland, and the Swedish horse betting company ATG also belong to this group. They have low unit costs, mainly because of their distribution channels through kiosks and, increasingly, online. ATG transfers the funds for upholding racetracks in Sweden before government tax. This could be counted as a cost item, but in our analysis, it is included in the surplus Sg. These companies can diversify their

product portfolios to gain volume, but this is likely to incur additional costs from investments, distribution, and marketing.

The companies in the second group, to the left of the Italian market-based companies, offer lottery games and scratch cards through agents (tobacco shops and kiosks). They have a strong philanthropic image, and they produce a substantial surplus (Figure 1 above), because the population base of their market area is big. Similarly, Jogos Santacasa of Portugal has low operating costs with its C% at 26.6 percent. Classic lottery games (Lotaria Nacional) today represent only 2.1 percent of its revenue, while instant lottery games, scratch cards and pool betting (high-RTP games but cheap to operate) represent respectively 49.1 percent and 32.2 percent of the Portuguese provider's total wagers (Jogos Santa Casa, 2017).

The four Italian companies are commercial and work in a competitive environment. Over 30% of their GGR comes from high-RTP games, and consequently their RTP% is high, but their distribution costs are also high because of substantial commissions to agents offering availability of EGMs in their premises, mostly bars and game rooms (Rolando & Mandolesi, 2020). They contribute to the Sg in proportion to their size (Figure 1 above) through heavy taxation (Marionneau et al. forthcoming), but they may have already passed the point where further game intensity is profitable to society, unless they can substantially reduce their distribution costs by moving online. The growth of the Italian market has been accompanied by a loss in the surplus since 2009 (Rolando & Scavarda, 2018). These companies are also heavily indebted to financial institutions (Rolando et al., 2020).

Holland Casino has high unit costs although its RTP percentage is quite high, due to the high cost of casino services (personnel costs are 35 per cent of their GTR).

Like the first group of companies, the second group (companies operating in France, Italy, Spain, UK, and Portugal) represent a pattern of lower to higher RTP products, but are now associated with rising rather than lowering cost levels. The French FDJ is an example of an historical change. A government report from 2016 (Cour des Comptes, 2016) observed that while the Sg increased from 2011 to 2015 by only +0.26 %, the turnover increased by 10.9 %. Its portfolio diversity and high-RTP products have increased, but so have production costs. The French example shows that transition from charity gambling with slow games to faster games offered by commercial gambling businesses may be challenging, not only as a public health risk (Vila, 2018) but also from the point of view of collecting public revenue.

The rest of the companies in Figure 4, marked with rings, represent Loteria Romana (Romania), and the postcode lotteries in the Netherlands, UK, Sweden, and Norway. The latter are small charitable operators that sell monthly lottery subscriptions to inhabitants in a postcode area. These are special cases, which were omitted from the two groups discussed above. They deserve a detailed analysis elsewhere.

The second group of companies are also facing a saturation of their growth opportunities. Some of them may still add high-RTP products to their portfolios, but doing so requires new expensive technology and other additional costs to compensate for the expenditure on winnings. Distribution appears to be the most challenging cost element when high-RTP games are offered through digital platforms. While moving online will offer solutions to many companies, this solution may prove to be a problem for public health, as well as for the public interest in collecting the surplus.

Private Gain and Public Benefit

The results indicate that growth involves high-RTP games, usually combined with privatization or outsourcing the operation of government monopolies to commercial companies aiming at profit. Volume, measured as revenue from gamblers (Rg), can compensate for the essentially higher expenses of pay-outs to winners, and in some circumstances lower operation costs can have the same effect. On the other hand, growth and associated commercialization can also involve higher financial or private profit collected by shareholders as dividends and increasing share value, and by investors as interest paid out on loans.

We have calculated a measure F that sums up the (private) profits in this wide sense, as the residue from the revenue from gambling (Rg) when all other costs have been deducted, including also the amount of money that remains in the company as part of its assets. This measure, in percent of the GTR (F%) is not systematically related to aggregate RTP percentage which measures their game portfolio, and roughly also the degree of their commercialization. The Nordic monopolies keep a very small amount of their profits in the company, but Eesti Loto, also a state monopoly, saves up to 10 percent of its earnings as company assets. Private monopolies Sazka, and Szerencsejatek deliver to owners approximately the same amount of their earnings as they do to public use, whereas the privately owned Italian companies stay well under 5 percent. Increasing aggregate RTP may involve increasing costs of financing and become another cost factor that aggravates the supply saturation of gambling, but to confirm this requires detailed comparative case studies.

Conclusion

The research reported in this article on 30 European gambling operators, gives a partial answer to the question "Where does the gambling surplus come from?" We have shown that gambling surplus to society depends strongly on the total company turnout, although big operators tend to have high expenses from winnings. Event frequencies of only seconds boost the quantity of bets to the extent that a house take of a game can be as low as five percent or even less, and still

produce a surplus. In general, high-RTP games drive up excess profits, but only if the volume of the turnout is sufficient to compensate for high pay-outs.

In some circumstances, high volume associated with high RTP also involves low operation costs per turnover. This is the case in the Nordic monopolies compared to other operators in small states (10 million inhabitants or less). Inversely, in big European countries (Italy, France, Spain, UK), operators with high-RTP game portfolios have higher operation costs than those with revenues from large margins of slow games and inexpensive distribution outlets. Electronic high-RTP games require equipment, sophisticated game technology, and a more expensive retail network in land-based venues than lottery tickets and scratch cards. Investments on them tend to increase the financial and private profit (or cost), which often is kept in the company to grow its financial assets and share value. Some companies operating in smaller European countries likely face a similar situation.

This suggests that further growth of high-RTP games will face rising operation costs in the European gambling industry. Beyond a certain limit, high volume no longer compensates for high RTP costs. The analysis suggests that, insofar as increasing game intensity is the way to growth, the European gambling market might face a supply saturation, and public income from the industry - one of the key justifications of commercial gambling - may be collapsing. A radical reduction of distribution costs will be necessary to sustain the "free income" justification of the industry. This can only be attained through online product innovation in the face of competition from offshore operators.

This leads to a straightforward conclusion from the point of view of regulation. More money from gambling to public bursaries and good causes requires more spending. Spending and the surplus grow with faster and more harmful gambling products, not with the games that governments have traditionally offered to collect free income for good causes or the public bursary. Growth comes with high risks and increasing harm and, conversely, less gambling-related harm means less money. There are very limited opportunities to avoid this issue by redirecting gambling consumption back to low-RTP games. More money means more gambling and more harmful games, but after a certain point, more gambling and harms does not mean more money.

Limitations

The current study is an analysis of 30 European companies that mainly operate in national markets. Gambling companies operating in several countries do not always break down their annual reporting per country but only provide aggregated corporate figures. The data are cross-sectional and do not chart market trends over time. Longitudinal analyses of income statements are needed to specify the type of supply saturation that different types of companies appear to

be experiencing. A detailed study of private profit from gambling requires an analysis of balance sheets in addition to income statements.

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Appendix 1

The table provides summary information on the 30 gambling operators in operation during 2017 included in the analysis. Companies are arranged in decreasing order of gross total revenue for 2017, and data are provided on the country of operation and the Sg (total gambling surplus and operating costs in percentage of gross total revenue and the RTP (return to players) as a percentage of total revenue (R).

Companies	Country	RTP (percent of total revenue)	GTR (M€)	Cost (percent of GTR)	Sg (percent of GTR)
FDJ	France	67.1	5,022.0	32.2	66.7
Camelot	United Kingdom	56.9	3372.7	19.4	78.3
Selae	Spain	63.8	3284.0	28.0	71.0
Snaitech	Italy	81.4	1835.8	42.2	54.1
Veikkaus	Finland	85.2*	1781.8	30.7	68.9
Sisal	Italy	79.5	1700.0	37.4	61.2
Casinos Austria and Lotteries	Austria	68.1	1344.2	45.6	48.8
Gamenet	Italy	83.2	1308.0	43.7	55.0
Jogos Santacasa	Portugal	60.7	1193.0	26.6	73.4
Once	Spain	50.8	998.0	23.8	71.4
HBG	Italy	79.1	987.0	41.2	58.6
Svenska Spel	Sweden	57.9	961.7	49.1	50.7
Norsk Tipping	Norway	77.6	805.7	33.4	65.9
Dutch charity Lotteries	The Netherlands	30.6	681.6	28.3	72.6
Holland Casino	The Netherlands	97*	639.2	58.1	42.0
Szerencsejáték	Hungary	66.5	634.4	41.8	40.7
Lotto Baden-Wurttemberg	Germany	49.5	504.4	25.5	73.8
ATG	Sweden	69.2	502.6	30.2	67.8
Danske Spil	Denmark	N/A	494.4	45.5	54.3
Swisslos	Switzerland	N/A	489.9	34.6	67.1
Nederlandse Loterij	The Netherlands	66.3	381.4	58.1	43.5
Premier Lotteries	Ireland	56.5	349.1	29.9	65.1
Loterie Romande	Switzerland	N/A	334.1	44.8	55.4
Sazka	Czech Republic	57.3	227.7	52.6	25.3
Swedish Postcode Lottery	Sweden	40.2	217.8	47.2	52.4
People's Postcode Lottery	United Kingdom	40.0	209.9	49.1	50.9
Norsk Rikstoto	Norway	68.1	134.1	44.5	55.3
Lotto Brandenburg	Germany	48.3	101.6	28.9	68.4
Loteria Romana	Romania	67.6	74.1	89.9	4.2
Eesti Loto	Estonia	45.5	29.9	27.6	62.7

* Our estimates

Sources: Annual reports 2017 of all operators included in the table