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The social value of gambling: surplus estimates by gambling types for France

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Abstract: We estimate the social surplus of gambling in France, by adding three components: consumer surplus, producer surplus and taxation revenue. To estimate consumer surplus, we use the rational benchmark approach, which attributes a loss of welfare (i.e. a negative surplus) to problem gamblers depending on their level of excess spending compared with recreational gamblers. Using data for the year 2019 and considering only legal gambling, we find that the net consumer surplus is negative for the gambling activity as a whole, even though it is positive for three types of gambling: draw lotteries, slot machines and online poker. Offline sports betting is the gambling category generating the lowest amount of consumer surplus. When we add the producer surplus and the taxation revenue to the consumer surplus, we find a strictly positive social surplus of about 3 billion euros for gambling as a whole. However, the net social surplus remains strictly negative for four types of gambling: offline and online sports betting, offline horse racing and table games in land-based casinos. These results can be useful guides to the public policy on gambling.

Keywords: gambling; consumer surplus; rational benchmark; producer surplus; taxation revenue; social welfare

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1. Introduction

Gambling is a leisure activity with a risk of excess. The Diagnostic and Statistical Manual of Mental Disorders (DSM) indeed recognizes gambling as a potential behavioural addiction. Negative impacts of problem gambling include job loss, depression and anxiety, poor health, relationship breakdown, and financial hardship (see e.g. Productivity Commission, 1999). The existence of these damages is a concern for the public authorities in charge of regulating this activity in many countries. If they are to maximize social welfare, they indeed face a trade-off between the benefits derived from the enjoyment of gambling, the profits of gambling companies and the government revenues from taxation, and the costs of problem gambling.

In this article, we provide an analytical framework for estimating the social surplus of gambling. It relies on the addition of three components: consumer surplus, producer surplus and taxation revenue. The most challenging part is estimating the consumer surplus for problem gamblers. We adhere to theories that addictive behaviours are deviations from the framework of perfect rationality (e.g. Gruber and Köszegi, 2001; Bernheim and Rangel, 2004). This implies that we must include 'internalities', i.e. self-imposed costs incorrectly taken into account during the decision-making process, when estimating the consumer surplus.

The value of internalities can be measured by ad hoc studies. Pioneers of such studies were Lesieur and Anderson (1995) in Illinois and Thomson, Gazel and Rickman (1996) in Wisconsin. More ambitious and large-scaled studies were then conducted by Gerstein et al. (1999) in the United States and the Productivity Commission (1999) in Australia. They implemented dedicated surveys to estimate the monetary value of various 'internal costs' attributed to gambling, such as depression, job loss and divorce. More recent pieces of work (e.g. Thorley et al., 2016 for Britain and Fielder, 2016 for Germany) combine various data sources—typically national prevalence surveys and national or international academic publications—to provide cost estimates.

This approach to consumer surplus estimate is rich, but difficult to implement rigorously, as it requires that (i) it is exhaustive, i.e. investigate all possible negative impacts of problem gambling on gamblers' welfare, (ii) it is designed to measure causal effects, and (iii) its results are expressed in monetary terms. Another possible approach, that we adopt in this article, is to measure the consumer surplus of gamblers relying on the rational benchmark approach. It consists of computing a net consumer surplus integrating a welfare loss from excess expenditures. The advantage of this approach is that it requires only a parsimonious set of data.

We describe the analytical framework we use to measure the social surplus in greater detail in section 2. We then apply it to the French gambling sector for the year 2019. We describe the data in section 3. Section 4 shows the estimates, disaggregated by type of gambling. We discuss our results in section 5. In short, we find that the social surplus for the entire gambling sector is positive by about 3 billion euros. However, there are significant differences between gambling types, with about half having a negative social surplus. For these categories, the

producer surplus and taxation revenue are not sufficient to compensate for the negative consumer surplus.

2. Analytical Framework

In our framework, the social surplus (SS) is measured by:

$$SS = CS + PS + TR \quad (1)$$

with CS the consumer surplus, PS the producer surplus and TR the taxation revenue.

Importantly, consumers are split into two groups: a group of rational consumers and a group of addicted consumers. Hence the global consumer surplus is defined by:

$$CS = RCS + ACS \quad (2)$$

with RCS the surplus of rational consumers and ACS the surplus of addicted consumers. The method used to estimate each of these elements is described below.

The rational consumer surplus

The surplus of rational consumers is measured using the traditional approach to measure consumer surplus, i.e. applying the following formula:

$$RCS = \frac{S}{2|\eta_R^*|} \quad (3)$$

with S, the spending of rational consumers, and η_R^*, the price elasticity of rational demand (see Massin and Miéra, 2020, Appendix A, for the computation details of this equation).

The addicted consumer surplus

The measure of ACS is taken from Massin and Miéra (2020), who propose a revised version of the Productivity Commission's (1999) formula. This approach distinguishes a positive component generated by the 'reasonable' part of expenditures and a negative component generated by the 'excessive' part of expenditures. In Figure 1, P^* represents the equilibrium price, line D_A the demand schedule of addicted consumers for which the optimal consumption is Q_A^*, line D_R the hypothetical demand schedule of rational consumers, which is associated with the optimal consumption Q_R^* and the satiation point Q_R^S. The net consumer surplus is obtained by subtracting area L from area G: $ACS = G - L$.

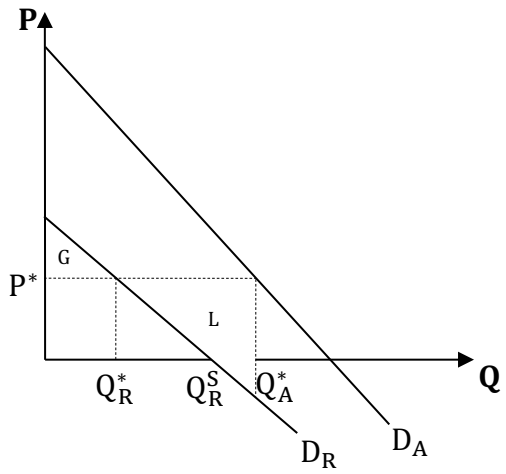

Figure 1. Net consumer surplus using the rational benchmark approach

Massin and Miéra (2020) show that the following formulas are appropriate:

$$G = \frac{R^2}{2R|\eta_R^*|} \tag{4}$$

$$L = \frac{E^2}{2R|\eta_R^*|} \tag{5}$$

$$ACS = \frac{R^2 - E^2}{2R|\eta_R^*|} \tag{6}$$

with $R = P^*Q_R^*$, the rational spending, $E = P^*(Q_A^* - Q_R^*)$, the excess spending, and η_R^*, the price elasticity of the rational demand at equilibrium.

The producer surplus

The textbook microeconomic approach to measuring producer surplus under the assumption of linearity of the supply function is to apply the following formula:

$$PS = \frac{NGR}{2\varepsilon^*} \tag{7}$$

where NGR is the net gambling revenue (i.e. revenue excluding taxes), and ε^* is the price elasticity of supply. The problem with this approach is that there is no estimate of the price elasticity of supply for gambling. It would require both accurate data on the production process of the gambling industry and a robust statistical identification strategy, which are not at our disposal. It is possible to make ad hoc assumptions about the value of this elasticity, but it seems more appropriate to address the notion of producer surplus in an accounting manner. Indeed, the following correspondence can be established between the notion of surplus and the main accounting values:

+ Gamblers' bets
- Winnings redistributed to gamblers
= Gross gambling revenue
- Taxes
= Net gambling revenue
- Variable costs

= Producer surplus
- Fixed costs
= Profit

Provided the necessary accounting data is available, the surplus can thus be estimated by summing the accounting profits and the fixed costs of the operators. This is the approach used by the Allen consulting group (2011) for different categories of gambling in Tasmania. The estimates obtained lead to a gross surplus rate - defined as the surplus in relation to gross gambling revenue - of between 19% and 26% depending on the type of gambling (26% for casinos, 25% for Keno and slot machines, 19% for sport and horse racing betting). In our application to French data, we extend this range to account for structural differences between the gambling sector in the two countries. We apply a range of 15%-30% to the national gross gambling revenue. We thus obtain the amount of the producer surplus for the whole gambling sector. To obtain estimates broken down by gambling type, we account for the large disparities of taxation levels. Hence, we first determine the net surplus rate, by relating the producer surplus to the net gaming revenue at the sector level. We then apply this rate to the net gambling revenue of each gambling type.

Taxation revenue

TR requires no computation. The data collected can be used directly.

3. Data

To apply the analytical framework described in the previous section, we have collected data pertaining to gambling in France for the year 2019. All data (except the price elasticity of demand) were provided by the French Monitoring Centre for Gambling (FMCG), combining three different primary sources of data: data provided by the gambling operators (gross gambling revenue), data provided by public institutions (taxation revenue) and data from the French Health Barometer 2019 (prevalence of problem gambling and share of spending of problem gamblers).

We use the gross gambling revenue (GGR) as a measure of spending. It is defined as the difference between the amount wagered and the amount paid out in winnings. To determine the spending of recreational gamblers (S), the rational spending of problem gamblers (R) and the excess spending of problem gamblers (E), we combine this data with data on prevalence and spending of problem gamblers provided by the French Health Barometer.

The Health Barometer is a national survey carried out by Santé publique France, the French national public health agency (Soullier et al., 2021). Data on gambling patterns were collected in 2014 for the first time and in 2019 for the second time. In this study we use data from the 2019 survey. A representative sample of 10,352 persons aged 18 to 85 years was interviewed using a computer-assisted telephone interviewing (CATI) system from January 2019 to June 2019. To assess the severity of gambling problems, the overall score on the Problem Gambling Severity Index (PGSI), a quantitative sub-section of the Canadian Problem Gambling Index, was used (Ferris & Wynne, 2001). It consists of 9 items with answers reported on a 4-point

Likert scale ('never'; 'sometimes'; 'most of the time'; 'almost always'). Respondents were categorized as non-problem gamblers (PGSI score = 0); low-risk gamblers (score = 1–2); moderate-risk gamblers (score = 3–7); and problem gamblers (score = 8+). In the following, we group the two first and the two last categories. We thus have a group of non-problem, or 'rational', gamblers with a score <3 and a group of problem, or 'addicted', gamblers with a score ≥3. This choice is justified by the work of Currie et al. (2009) and further discussed in section 5. The share of problem gamblers is noted α.

The participants were also asked to report their spending on each gambling activity either per occasion or on a weekly, monthly, or annual basis by answering to the question (translated from French): "How much money do you usually spend per session when you play these games? We want to know the amount of money you take out of your pockets when you gamble. This does not include money that you won." [1] Total spending was calculated on an annual basis for each gambling type and was then used to derive the share of total spending attributable to problem gamblers, noted β. The share of rational (r) and excess (e) spending by problem gamblers is derived from the following formulas:

$$r = \left(\frac{1-\beta}{1-\alpha}\right)\alpha \tag{8}$$

$$e = \beta - r \tag{9}$$

Regarding the price elasticity of demand, we use intervals constructed using two sources: a meta-analysis of international estimates by Gallet (2015) and estimates based on French data provided by the French lottery operator (Française des jeux) - see the Appendix for details. The price elasticity of demand of recreational gamblers is needed to measure the net consumer surplus. Such data are however not available. Available elasticities apply to the aggregate demand of all gamblers. Nevertheless, it is likely that the price elasticity of demand of recreational gamblers is included in the wide range used for the price elasticity of aggregate demand.

Table 1 summarizes the primary data we use in this study, as well as their sources. The list of gambling types reported refers only to gambling that is authorized in France. Lottery games are operated offline under the monopoly of the Française des Jeux (FDJ). Offline sports betting is also operated by the FDJ, while offline horse racing betting is operated by the Pari Mutuel Urbain (PMU). Slot machines and tables game are authorized only in land-based casinos. Online gambling is open to competition for three types of games: sports and horse racing betting and poker. All other games are prohibited online. Note that for casinos the breakdown of taxation revenue between slot machines and table games is not available. We assume that the distribution of taxes between these two categories is identical to the distribution of gross gambling revenue, i.e. that the tax rate is homogeneous.

[1] This way of defining gambling spending (which does not remove winnings from bets) is different from that of the gross gambling revenue (which removes winnings from bets). This is not a problem for our approach, since we perform the calculations by gambling types, within which the rates of return are identical for all gamblers.

	Gross gambling revenue (GRR) (in million €)	**Taxation revenue (TR) (in million €)**	**% of problem gamblers (α)**	**% of spending by problem gamblers (β)**	**% of rational spending by problem gamblers (r)**	**% of excess spending by problem gamblers (e)**	**Price elasticity of demand (η_R^*)**
Source	Gambling operators (collected by the FMCG)	Ministry of Finance, Ministry of the Interior, Online Gambling Regulatory Authority (collected by the FMCG)	French Health Barometer (processed by the FMCG)	French Health Barometer (processed by the FMCG)	French Health Barometer (processed by the authors)	French Health Barometer (processed by the authors)	Gallet (2015) and the French lottery operator
Lottery games	4 695	3 168					
Draw lotteries	2 285	1 656	2.2	9.3	2.0	7.3	-1.10 ; -0.50
Scratch cards	2 410	1 512	4.2	26.6	3.2	23.4	-1.30 ; -0.90
Offline betting	2 557	854					
Sports	779	289	19.7	77.7	5.5	72.2	-1.50 ; -1.10
Horse racing	1 779	565	10.9	46.7	6.5	40.2	-1.20 ; -0.80
Land-based casinos	2 418	1 330					
Slot machines	2 027	1 115	12.6	25.3	10.8	14.5	-0.90 ; -0.50
Table games	391	215	9.0	48.0	5.1	42.9	-0.90 ; -0.50
Online gambling	1 424	711					
Sports betting	880	479	15.7	58.7	7.7	51.0	-1.60 ; -1.00
Horse racing betting	271	146	19.3	45.4	13.1	32.3	-1.30 ; -0.70
Poker	273	86	22.3	41.0	16.9	24.1	-1.30 ; -0.70
All gambling	11 095	6 063					

Table 1. Primary data and sources (year 2019; except the price elasticity of demand)

4. Estimates

Table 2 provides estimates for the consumer surplus. The estimates for recreational gamblers are obviously strictly positive. For the whole gambling sector, the surplus amounts to about 4 billion euros, lottery games and slot machines providing the most important part. The estimates for problem gamblers have two components: a positive part (G) and a negative part (L). The positive part is relatively small: about 400 million euros. The negative part is much more substantial: about 10 billion euros. Offline sports betting is the greatest contributor to this loss of welfare, followed by offline horse racing and scratch cards. Following these results, the net surplus of problem gamblers is negative for gambling as a whole and for all gambling types. Considering the surplus of all gamblers, the estimate is negative by about 5 billion euros for the gambling sector as a whole. However, three gambling categories exhibit a positive amount: draw lotteries, slot machines and online poker.

Type of gambling	Spending of recreational gamblers (S)	Rational spending of problem gamblers (R)	Excess spending of problem gamblers (E)	Recreational gambler surplus (RCS)	Welfare gain associated with rational spending of problem gamblers (G)	Welfare loss associated with excess spending of problem gamblers (L)	Problem gambler surplus (ACS)	Overall gambler surplus (CS)
Lottery games								
Draw lotteries	2 072	47	166	942 ; 2 072	21 ; 47	268 ; 590	-247 ; -544	695 ; 1529
Scratch cards	1 769	78	564	680 ; 983	30 ; 43	1 575 ; 2 275	-1 545 ; -2 232	-865 ; -1 249
Offline betting								
Sports	174	43	562	58 ; 79	14 ; 19	2 475 ; 3 374	-2 460 ; -3 355	-2 403 ; -3 276
Horse racing	948	116	715	395 ; 593	48 ; 72	1 835 ; 2 752	-1 787 ; -2 680	-1 392 ; -2 087
Land-based casinos								
Slot machines	1 514	218	295	841 ; 1 514	121 ; 218	221 ; 397	-100 ; -179	742 ; 1 335
Table games	203	20	168	113 ; 203	11 ; 20	776 ; 1 397	-765 ; -1 377	-652 ; -1 174
Online gambling								
Sports betting	363	68	449	114 ; 182	21 ; 34	930 ; 1 488	-909 ; -1 455	-796 ; -1 273
Horse racing betting	148	35	88	57 ; 106	14 ; 25	83 ; 155	-70 ; -130	-13 ; -24
Poker	161	46	66	62 ; 115	18 ; 33	36 ; 67	-18 ; -34	44 ; 81
All gambling	7 353	670	3 071	3 262 ; 5 847	299 ; 512	8 199 ; 12 497	-7 901 ; -11 985	-4 639 ; -6 138

Note: the intervals for the surplus estimates come from the intervals used for the price elasticity.

Table 2. Consumer surplus estimates (in million €; year 2019)

Tables 3 and 4 are related to the estimates of the producer surplus. In Table 4, we apply a range of 15%-30% of gross surplus rate to the national gross gambling revenue and thus obtain a producer surplus of about 2.5 billion euros. Considering taxation revenue, this implies a net surplus rate comprised between 33% and 66%. We apply these rates to each gambling type in Table 5. We obtain that offline horse racing betting provides the largest amount of producer surplus, while online horse racing betting provides the lowest amount. When we compute the gross surplus rate (by dividing the producer surplus by the gross gambling revenue), we find that offline horse racing betting and online poker have the highest rates while draw lotteries have the lowest rate.

Gross surplus rate (source: Allen consulting group, 2011)	15% ; 30%
Gross gambling revenue	11 095
Producer surplus	1 664 ; 3 329
Taxation revenue	6 063
Net gambling revenue	5 032
Net surplus rate	33% ; 66%

Table 3. Calibration of the producer surplus using data at the sector level (in million €; year 2019)

Type of gambling	**Net gambling revenue (NGR)** (computed as $GGR - TR$ from Table 1)	**Producer surplus (PS)** (applying a net surplus rate between 33% and 66%)	**Gross surplus rate** (PS/GGR)
Lottery games			
Draw lotteries	629	208 ; 416	0,09 ; 0,18
Scratch cards	898	297 ; 594	0,12 ; 0,25
Offline betting			
Sports	490	162 ; 324	0,21 ; 0,42
Horse racing	1 214	401 ; 803	0,23 ; 0,45
Land-based casinos			
Slot machines	912	302 ; 604	0,15 ; 0,30
Table games	176	58 ; 116	0,15 ; 0,30
Online gambling			
Sports betting	401	133 ; 265	0,15 ; 0,30
Horse racing betting	125	41 ; 83	0,15 ; 0,31
Poker	187	62 ; 124	0,23 ; 0,45
All gambling	5 032	1 664 ; 3 328	0,15 ; 0,30

Table 4. Producer surplus estimates (in million €; year 2019)

Table 5 summarizes estimates of consumer and producer surplus, and adds the taxation revenue to obtain the social surplus. We find that the social surplus is positive when all types of

gambling are considered together. The amount is about 3 billion euros. Five gambling types out of nine have a positive social surplus, with draw lotteries and slot machines showing the largest amounts. Four gambling types out of nine have a negative social surplus. For these games, the producer surplus and the taxation revenue are not sufficient to compensate for the negative consumer surplus. Offline sports betting exhibits the largest negative amount.

Type of gambling	Consumer surplus (CS)	Producer surplus (PS)	Taxation revenue (TR)	Social surplus (SS)
Lottery games				
Draw lotteries	695 ; 1 529	208 ; 416	1 656	2 559 ; 3 601
Scratch cards	-865 ; -1 249	297 ; 594	1 512	944 ; 857
Offline betting				
Sports	-2 403 ; -3 276	162 ; 324	289	-1 952 ; -2 663
Horse racing	-1 392 ; -2 087	401 ; 803	565	-425 ; -720
Land-based casinos				
Slot machines	742 ; 1 335	302 ; 604	1 115	2 158 ; 3 054
Table games	-652 ; -1 174	58 ; 116	215	-379 ; -842
Online gambling				
Sports betting	-796 ; -1 273	133 ; 265	479	-184 ; -529
Horse racing betting	-13 ; -24	41 ; 83	146	174 ; 205
Poker	44 ; 81	62 ; 124	86	192 ; 291
All gambling	-4 639 ; -6 138	1 664 ; 3 328	6 063	3 088 ; 3 256

Table 5. Social surplus estimates (in million €; year 2019)

5. Discussion

Gambling is an almost universally regulated economic activity, although the form and intensity of the regulation varies over time and space (Chambers, 2017). Public authorities need indicators to optimize this regulation. The share of revenue derived from problem gamblers has been reported as a useful indicator in the literature. For instance, Fiedler et al. (2019) state: "The share of revenue derived from problem gamblers can be an important indicator of whether a game is beneficial or harmful to society. Games are deemed less beneficial when the share of revenue derived from problem gamblers is largest. The logic is that spending by non-problem gamblers entails a consumer surplus in the form of enjoyment. By contrast, excess spending from problem gamblers, who have lost control over their gambling behavior, creates social costs in the form of productivity losses, treatment costs, and reductions in quality of life." We agree with this view and extend it by converting this indicator into a measure of consumer surplus and adding to it a measure of producer surplus and of taxation revenue. Our goal is to provide a comprehensive measure of social well-being in the gambling sector, based on limited data requirements.

Our approach has some limitations. First, for a fully comprehensive approach we would need to include public expenditures and externalities in the social surplus equation. Public expenditures would include costs of regulation, prevention and health treatment (to the extent that these are covered by a public system, which is the case in France). We lack data on these different items. Externalities refer to costs that gamblers impose to other people without financial compensation. Possible examples are the reduced productivity that a problem gambler could impose to his or her employer, or the violence suffered by a victim of a robbery perpetrated by a gambler seeking to illegally finance his or her gambling activity. It is also established that problem gamblers impose substantial harms on their families (Li et al., 2017). Again, we lack data on these items to include them in our estimates. Since lacking data relate only to costs, our results should be seen as a high estimate, which could only be revised downwards with additional data.

Second, our approach to estimate the consumer surplus may raise some questions. It relies on a binary conception of gambling behavior (non-problem/problem) while it is widely accepted that gambling-related problems exist on a continuum (Toce-Gerstein et al., 2003; Slutske, 2007). The definition of a threshold is nevertheless unavoidable from a practical point of view and also makes sense from a clinical and public health point of view. Currie et al. (2009) validate the use of having a PGSI score ≥ 3 as a threshold of gambling-related harm that has applicability in population health research. Focusing on harms affecting the individual and his or her family, these authors indeed show that this criterion reliably differentiates non-problem gamblers from problem gamblers. The use of a PGSI score ≥ 3 as a threshold leads us to classify a 'reasonable' fraction of gamblers as problem gamblers (between 2% and 22% depending on the gambling type). Changing the threshold, e.g. by defining problem gambling using a PGSI score ≥ 8, would have two types of effects on the consumer surplus estimates. One the one hand, moderate-risk gamblers (with a PGSI score = 3–7) would now be treated as 'rational', and their loss of welfare would become a gain of welfare. This would increase the consumer surplus. On the other hand, the representative problem gambler would become a pathological gambler with much more excess spending than in our estimates where his or her characteristics are mitigated by the presence of moderate-risk gamblers. Because of the non-linearity of the loss measure (L), this would reduce the consumer surplus. We would thus have two effects acting in opposite directions. The overall effect is uncertain. We are not able to perform the analysis that would remove the uncertainty because the samples of gamblers with a PGSI score ≥ 8 are too small for some gambling types to provide reliable spending estimates.

Another question that our approach to consumer surplus may raise regards what is included in the 'internalities'. Contrary to other studies, such as Gernstein et al. (1999) and Productivity Commission (1999), our estimates do not rely on a list of harms. This can be seen both as a limitation—it lacks an explicit tangible basis and does not allow for an assessment of the relative importance of each type of harm—and an advantage—there is no need to establish a list of causal harms, which is a very difficult task.

Third, we must admit that our producer surplus estimate is rather crude. Few studies estimating the producer surplus in the gambling sector are available in the literature. Allen consulting

group (2011) provides an approach that has the advantage of being simple to apply to our data. We can also observe that our calibration step (Table 3) leads to plausible values when the surplus measure is converted into the share of variable costs in the net gambling revenue (34% to 67%) and into the price elasticity of supply (0.76 to 1.51). We are thus confident that the real value of the producer surplus is within the proposed range.

Our results can be compared with the results of existing studies, especially those of the Productivity Commission (1999; 2010), which uses the most similar approach. Two important differences in methods should nevertheless be mentioned. First, our formula to compute the loss of welfare is slightly different from that used by the Productivity Commission since it was shown that the latter is biased and likely to significantly underestimate welfare loss (Massin and Miéra, 2020). Second, the Productivity Commission simultaneously includes in its overall impact estimate a measure of welfare loss related to consumer surplus calculation and a measure of the costs of problem gambling, containing a significant part of internalities, from an ad hoc study. We believe that this approach is inappropriate as it leads to a double counting of internalities.

With these differences in mind, the Productivity Commission's estimates of the social net impact of gambling in Australia amount to a range of minus 1 billion dollars to 4 billion dollars for the year 1997-98 (Productivity Commission, 1999) and a range of 2 billion dollars to 11 billion dollars for the year 2008-09 (Productivity Commission, 2010). As in our estimate, the gambling sector is therefore assumed to bring a net benefit to society. This is not the case of Fiedler (2016), who finds a net cost ranging from 3 to 10 billion euros for Germany. For other types of addictive goods in France, Kopp and Fenoglio (2011) also report net cost estimates: 8 billion euros for alcohol, 14 billion euros for tobacco and 1 billion euros for illicit drugs.

If we turn to the results by type of gambling, we find that draw lotteries and slot machines are the most socially beneficial games in France. This result for draw lotteries can be explained by the fact that it is a widespread game (one with the largest gross gambling revenue - see Table 1), with the lowest prevalence of problem gambler (2.2%) and the lowest share of spending by problem gamblers (9.3%). This result for slot machines could seem surprising since it is proven that high-frequency slot machines have a strong addictive potential (James et al., 2016). The harm impact of slot machines at the population level is however influenced by their accessibility. When they are allowed outside casinos, slot machines are shown to have a high share of spending derived from problem gamblers (e.g. 76% in Quebec according to Fiedler et al., 2019) and to generate very large problem gambling costs (e.g. more than 75% of all problem gambling costs in Australia according to the Productivity Commission, 2010). Our results are much more favorable to slot machines, probably because they are only allowed inside casinos in France. Sports betting is the most socially detrimental type of gambling according to our results, especially offline. This is explained by a relatively large share of problem gamblers (19.7%) and the largest share of spending attributable to problem gamblers (77.7%). The large costs incurred are not compensated by benefits from the producer surplus or the taxation revenue since the gross gambling revenue is limited.

In conclusion, the approach we develop in this article provides fairly complete estimates of the social welfare induced by gambling from relatively few data. It can therefore easily be applied in other countries, or replicated over time for monitoring purposes. We hope that it will be a useful guide for regulators of the gambling sector.

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Appendix

Type of gambling	International meta-analysis (Gallet, 2015)	Estimates provided by the French lottery operator	Ranges used
Lottery games			
Draw lotteries	-1,07 ; -1,11	-0,50	-0,50 ; -1,10
Scratch cards	n/a	-1,10	-0,90 ; -1,30
Offline betting			
Sports	n/a	-1,30	-1,10 ; -1,50
Horse racing	-1,01 ; -1,02	-0,90	-0,80 ; -1,20
Land-based casinos			
Slot machines	-0,68 ; -0,76	n/a	-0,50 ; -0,90
Table games	-0,68 ; -0,76	n/a	-0,50 ; -0,90
Online gambling			
Sports betting	n/a	-1,00	-1,00 ; -1,60
Horse racing betting	n/a	-1,00	-0,70 ; -1,30
Poker	n/a	-1,00	-0,70 ; -1,30

Table A.1. Price elasticity of demand by gambling type