



An Empirical Study of the Effect of Voluntary Limit-Setting on Gamblers' Loyalty Using Behavioural Tracking Data

Michael Auer¹ · Niklas Hopfgartner¹ · Mark D. Griffiths² 

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Abstract

Online gambling has become increasingly popular over the past decade as has research using behavioural tracking (player account) data. To date, there is no study that has empirically investigated the effects of responsible gambling tools on loyalty. In the present study, the effect of voluntary limit-setting on player loyalty was evaluated over time using tracking data provided by an online gambling operator. More specifically, the authors were given access to an anonymised dataset of 175,818 players who had placed at least one bet or gambled at least once during January 2016 to May 2017 at the online gambling operator *Kindred*. The average age of the players was 31 years, and overall 18,484 of the players were female (10.5%). The dataset comprised a 20% random sample of the total player population of *Kindred*. In each of ten playing intensity groups, the percentage of active players in the first quarter of 2017 was higher in the group of players who had set voluntary money limits in the first quarter of 2016 compared to players that did not (suggesting players that set voluntary spending limits are more loyal compared to those who do not). The implications of these findings are discussed.

Keywords Online gambling · Internet gambling · Responsible gambling · Problem gambling · Behavioural tracking · Limit-setting

✉ Mark D. Griffiths
mark.griffiths@ntu.ac.uk

Michael Auer
m.auer@neccton.com

Niklas Hopfgartner
n.hopfgartner@neccton.com

¹ neccton Gmbh, Davidgasse 5, 7052 Müllendorf, Austria

² International Gaming Research Unit, Psychology Department, Nottingham Trent University, 50 Shakespeare Street, Nottingham NG1 4FQ, UK

Introduction

Over the past decade, online gambling has become increasingly popular. Online gambling is in rapid growth around the world and the global online gambling and betting market was worth \$143.32 billion in 2017 and it is estimated to grow to \$279.8 billion by 2023 with a compound annual growth rate of 11.8% between 2017 and 2023 (Oristep Consulting 2018). A majority of survey data report a higher involvement of men compared to women in both online and offline gambling (see Calado and Griffiths 2016 for a systematic review of all nationally representative gambling studies worldwide). There is evidence that the high accessibility of online gambling and use of electronic means of payment represents an increased risk for some players (Gainsbury et al. 2013; Griffiths et al. 2009; Wardle et al. 2011; Wood and Williams 2011). The preference for this mode might for some gamblers be based on convenience.

Online Gambling and Behavioural Tracking

Most studies in the area of gambling research are carried out via surveys or in laboratory setting with small sample sizes which often comprise students. The use of actual player data, often called behavioural tracking, is a relatively new trend. The vast majority of land-based gambling still happens anonymously. However, there is a direct relationship between player and transaction in online gambling because online gambling requires players to have an account with an operator. The analysis of behavioural tracking data has shown that there can be a large difference between players' self-estimation of gambling intensity and their actual losses (Braverman et al. 2014; Auer and Griffiths 2017). For example, Auer and Griffiths (2017) compared survey responses from 1335 gamblers relating to gambling expenditure with their actual gambling behaviour. The study found that the estimated loss self-reported by gamblers was correlated with actual objective loss but that players with higher losses tended to have more difficulty estimating their gambling expenditure (i.e., players who spent more money gambling also appeared to have more trouble estimating their gambling expenditure accurately). Studies that have compared self-reported and actual data demonstrate that caution should be warranted when using self-report data relating to the amount of money spent gambling in any studies that are totally reliant on self-report data.

Online Gambling, Limit-Setting, and Behavioural Tracking

Voluntary or mandatory limits are a popular responsible gambling (RG) tool offered by many online gambling operators (Bonello and Griffiths 2017). Few operators go so far as to introduce maximum spending limits. However, among those that do include are *win2day* (the Austrian Lottery's online gambling site), *Norsk Tipping* (in Norway) and *Veikkaus* (in Finland). Among a sample from 100,000 online players at *win2day*, Auer and Griffiths (2013) found that deposit limits subsequently decreased gambling expenditure among casino and lottery players, and that time limits decreased gambling expenditure among poker players. More recently, in a real-world experimental study with 4328 players from an European online gambling operator, Ivanova et al. (2019) found that newly registered players were more likely to set voluntary limits if they were actively prompted by the gambling operator to do so. However, players who set voluntary limits without being prompted to do so lost more money gambling than players who did not set limits. Auer et al. (2018b) found that information that reminds players that they had just spend 80% of their personal-set limit decreased monetary

gambling intensity in consecutive months. Among video lottery players in Nova Scotia, a Canadian study by Focal Research (2007) found that RG features (including limit-setting tools) generally reduced the overall levels of gambling expenditure.

Gambling Operators and Corporate Social Responsibility

Previous gambling research has also demonstrated that corporate social responsibility (CSR) is associated with several positive organizational outcomes, including greater financial performance (Lee et al. 2009), increased employee retention and satisfaction (Kim et al. 2017) and increased revisit intentions by patrons (Kim et al. 2017). In addition, Wu et al. (2014) observed that corporate image was a key component in customer satisfaction with gambling operators. To date, there is no study that has empirically investigated the effects of RG tools on loyalty. It has been shown that voluntary limit-setting reduces subsequent play, but in order for operators increase the usage among players it would be helpful to know whether players are more loyal on the long run if they use such tools.

The authors of the present study argue that RG is related to corporate social responsibility (CSR) and many gambling operators merge these two corporate functions. Cha et al. (2016) reported the findings of a study on the effects of CSR-brand fit on service brand loyalty via brand identification in a brand coffee shop industry. The results indicated that CSR-brand fit strengthens both personal and social brand identification, which in turn increases consumers' service brand loyalty. Park et al. (2017) studied the congruency between consumer values and the goals of CSR activities. They found that companies' CSR commitment induces greater satisfaction with and trust in the company and its services, which then ultimately encourages consumers to remain loyal. Kim et al. (2017) found that CSR in gambling operators is associated with an increased intention to visit venues by players. In a survey with customers of a Canadian provincial government-owned gambling operator, Abarbanel et al. (2018) found that perceived adequacy of responsible gambling programs and perceived gaming operator motives are predictive of customer satisfaction.

The Present Study

In the present study, the effect of voluntary limit-setting on gamblers' loyalty using behavioural tracking data was examined. The present authors view voluntary limit-setting as part of the company's CSR strategy. Previous studies have shown that voluntary limit-setting reduces subsequent gambling expenditure. However, in this study, the authors hypothesized that players who chose voluntary limits would be more loyal to the operator over time, compared to players who did not choose voluntary limits. Age and gender differences among those who engaged in voluntary limit-setting were also explored although no specific hypotheses were formulated in relation to these two variables given the lack of previous research.

Method

Participants, Procedure and Statistical Analysis

The authors were given access to an anonymized dataset of 175,818 players (157,110 males [89.3%]; 18,484 females [10.5%]; 224 gender unknown [0.2%]; average age 31 years) who had

placed at least one bet or gambled at least once during January 2016 and May 2017 at the online gambling operator *Kindred*. The dataset comprised a 20% random sample of all active players in the total player population of *Kindred*. *Kindred* offers a variety of online games including sports betting, bingo, slots, table games, live casino, and other games (e.g., keno, scratchcards, videogame-type games). The authors were given information about each individual's voluntary limit-setting behaviour. Players can voluntarily choose daily, weekly and monthly loss as well as deposit limits. The limits can be changed anytime. Limit decreases are effective immediately and limit increases are valid after 7 days. In many cases, the Wilcoxon test was chosen because of the skewed distribution of both bet size and limit in the total sample. The analysis was performed with the open source software The R program (R Core Team 2013).

Results

Age Differences in Voluntary Limit-Setting

Out of 175,818 players, 14,581 players (8.3%) had set a voluntary limit between December 2016 and May 2017. Table 1 shows the median daily bet, average number of playing days, and limit-setting behaviour for each age group. The group of players who are older than 76 years was comparably small and the findings related to this group should be interpreted with caution. Players aged between 29 and 38 years had the highest median daily bet and players younger than 21 years had the lowest median daily bet. Players between 56 and 76 years gambled most frequently. The percentage of players that choose voluntary limits decreased with age. The median daily, weekly, and monthly limits were similar and the median daily limit was smaller than the median daily bet except for players aged between 56 and 76 years. The difference between the median daily bet and the median daily limit decreased with increasing age. All the metrics reported in Table 1 are significantly different across the age categories and reported using chi-square tests at the bottom of the table.

Gender Differences in Voluntary Limit-Setting

Out of the 18,884 female players, 1736 (9.5%) had voluntarily set a limit during December 2016 and May 2017. Out of the 157,110 male players, 12,832 (8.2%) had voluntarily set a limit during December 2016 and May 2017. The percentage of females setting a voluntary limit was significantly higher than males ($z = 5.43$, $p < 0.001$). Players had the option to set daily, weekly and/or monthly deposit limits. For female players, the median daily limit was €27 and for male players it was €36. Analysis was also carried out comparing the players' average limits with average spend on gambling. If (on average) the limits set are much higher than gambling expenditure, this means that players are choosing limits that are too high and if (on average) limits set are in the same range of their normal gambling expenditure then this means that players are choosing more responsible limits. Findings showed that the limits set were on average lower than the respective median daily bet for both female players (€70) and male players (€40). Figure 1 displays the log transformed daily bet for males and females for age categories. The transformation is necessary in order to properly display the distribution. Results indicated that females had a higher median daily bet than males in each age category.

The difference between male players and female players' daily limit was significant with males setting much higher daily limits ($\chi^2 = 5.51$, $df = 2$, $p = 0.019$). The Wilcoxon test also

Table 1 Playing intensity and voluntary limit-setting across age groups

Age group (years)	N	Daily bet (median €)	No. of playing days (mean)	Players with limit	Daily limit (median €)	Weekly limit (median €)	Monthly limit (median €)
18–21	32,721	33	18	2889 (8.8%)	23	23	27
22–28	58,613	50	19	5080 (8.7%)	37	36	45
29–38	46,236	59	22	3890 (8.4%)	40	45	49
39–55	31,083	48	27	2235 (7.2%)	45	45	47
56–76	6978	41	35	481 (6.9%)	43	44	45
>76	187	34	34	6 (3.2%)	20	1143	71
	175,818	$\chi^2 = 1685$, df = 5, $p < 0.001$	$\chi^2 = 786$, df = 5, $p < 0.001$	$\chi^2 = 90$, df = 5, $p < 0.001$	$\chi^2 = 50$, df = 5, $p < 0.001$	$\chi^2 = 214$, df = 5, $p < 0.001$	$\chi^2 = 243$, df = 5, $p < 0.001$

demonstrated a significant difference between the median daily deposit limit and the median daily bet ($W = 303,230,000$; $p < 0.0001$). The median deposit limit was significantly lower than the median daily bet. The weekly median deposit limit for female players was €32 and for male players was €38. The monthly median deposit limit was €45 both for female players and male players. Both weekly median deposit limit ($W = 383,610,000$; $p < 0.0001$) and monthly median deposit limit ($W = 658,530,000$; $p < 0.0001$) were significantly different from the median daily bet with the median daily bet being higher. However, it should be noted that the bet is not completely comparable to the deposit limit. The deposit limit is the amount of money that a player transfers whereas the bet contains all the reinvested wins and is naturally higher. A player could generate a large bet with a low deposit if there are frequent wins.

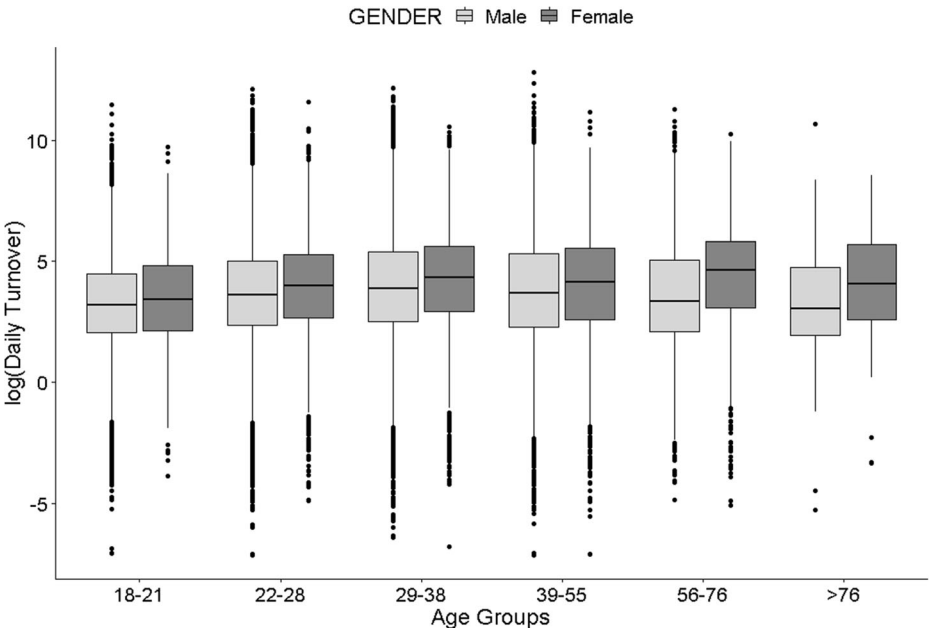


Fig. 1 Distribution of log transformed daily bet for gender and age categories

However, if a player does not win frequently, the bet could equal more or less the deposited amount (and depends on chance).

In order to test whether age and gender correlated independently with daily bet a robust multivariate analysis of variance with the *raov* package in R was performed (Kloke and McKean 2012). The analysis demonstrated that gender ($F = 86.71$, $df = 1$, $p < 0.001$), age ($F = 118.9$, $df = 4$, $p < 0.001$) and the interaction ($F = 28$, $df = 5$, $p < 0.001$) of the two variables were significant with respect to daily bet.

Loyalty and Voluntary Money Limit-Setting

In order to provide further insight concerning the effect of voluntary money limit-setting, the following research design was chosen. First, all players who played at least one game during the first quarter of 2016 (January to March 2016) were selected. The selected players were then categorized into ten equally sized groups according to their bet size between January and March 2016. In each group, players were then divided into those who had voluntarily chosen a limit in the first quarter of 2016 and those who did not. Table 2 reports the size of the ten groups, the range of bets, and the number of players who had set voluntary limits in each group. Out of the 165,622 players that placed bets in the first quarter of 2016, 8.3% had set voluntary limits and there was a positive correlation between gambling intensity and those who had voluntarily set money limits. Among players who bet less than €4 during the period of analysis, 2.6% of players had voluntarily set a limit. Among players who bet more than €239 in the period of analysis, 14.9% set a limit. Table 3 reports the difference in gender and age for each of the ten gambling intensity groups. None of the ten groups are significantly different with respect to gender. Groups 1–7 were significantly different with respect to age. Apart from Groups 8–10, players who set limits were younger compared to players who did not set limits.

In order to determine whether the setting of a voluntary money limit had an impact on future playing behaviour, the number of players who were still active in the first quarter of 2017 was evaluated for each gambling intensity group. The first quarter of 2017 was completely independent of the previous time period (first quarter of 2016) and the resulting difference between players who had voluntarily set a money limit and those who did not can most likely be attributed to the limit-setting behaviour 1 year before. This is a so called “predictive” approach in which a future time period’s behaviour is correlated with a previous

Table 2 Equally sized groups based on bet size and number of players who set voluntary limits in the first quarter of 2016

Intensity group	<i>N</i>	Min bet (€)	Max bet (€)	Players who had set monetary limits
1	16,576	0	4	429 (2.6%)
2	16,549	5	8	389 (2.4%)
3	16,562	9	14	583 (3.5%)
4	16,563	15	22	711 (4.3%)
5	16,561	23	39	1182 (7.1%)
6	16,563	40	69	1549 (9.4%)
7	16,562	70	122	1765 (10.7%)
8	16,562	123	239	2162 (13.1%)
9	16,562	240	596	2475 (14.9%)
10	16,562	597	364,022	2470 (14.9%)
165,622				13,715 (8.3%)

Table 3 Gender and age distribution for players who set voluntary limits in the first quarter of 2016 and players who did not set voluntary limits in the first quarter of 2016

Intensity group	% Female players without limit (%)	% Female players with limit (%)	Average age players without limit	Average age players with limit	Z test gender	<i>p</i> value gender	<i>U</i> test age	<i>p</i> value age
1	10.2	10.5	32.1	29.6	0.01	0.92	3,063,817	<0.001
2	8.5	6.2	31.0	27.9	2.39	0.12	2,646,509	<0.001
3	8.6	7.4	31.3	29.1	0.96	0.33	4,177,902	<0.001
4	9.9	7.5	31.4	29.4	4.46	0.04	5,111,908	<0.001
5	10.8	10.2	31.0	29.6	0.32	0.57	8,327,344	<0.001
6	11.8	10.3	31.0	30.1	2.71	0.10	11,151,272	0.008
7	13.0	12.4	31.6	30.6	0.56	0.45	12,368,662	<0.001
8	13.8	13.1	31.9	31.5	0.76	0.38	15,098,638	0.024
9	14.5	15.3	32.8	32.8	1.18	0.28	17,324,067	0.624
10	14.1	13.4	34.2	34.1	0.70	0.40	17,135,100	0.220

time period's behaviour. Table 4 reports the numbers of active players in the first quarter of 2017. A total of 41% of players from intensity Group 1 who did not set a money limit in the first quarter of 2016 were still active in the first quarter of 2017. The respective percentage of active players in 2017 for players who had set a money limit in intensity Group 1 in 2016 was 44.8%. A total of 45.8% of players from game intensity Group 10 who did not set a money limit in the first quarter of 2016 were still active in the first quarter of 2017. The respective percentage for players who had set a voluntary money limit in intensity Group 10 was 58.6%. The last column in Table 4 (labelled 'difference') reports the difference between players who had set a voluntary money limit in the first quarter of 2016 and the ones who did not with respect to activity in the first quarter of 2017. The number of active players in every intensity group was higher in the first quarter of 2017 if the player had set a voluntary money limit in the first quarter in 2016. This difference also increased with gambling intensity.

A logistic regression was computed in order to determine the relationship between activity in the first quarter of 2017 and gender, age, as well as limit-setting in the first quarter of 2016 (Table 5). The effects of age as well as gender were significant. For a player with a specific age, the odds of still being an active gambler in the first quarter of 2017 was 1.01 higher

Table 4 Number of players still actively gambling in the first quarter of 2017 based on whether they had or had not set a voluntary money limit in the first quarter of 2016

Intensity group	Active players who had not set voluntary money limit	Active players who had set a voluntary money limit	Difference (%)
1	6620 (41%)	192 (44.8%)	3.8
2	7450 (46.1%)	221 (56.8%)	10.7
3	7318 (45.8%)	322 (55.2%)	9.4
4	7086 (44.7%)	419 (58.9%)	14.2
5	7428 (48.3%)	721 (61%)	12.7
6	7042 (46.9%)	940 (60.7%)	13.8
7	6984 (47.2%)	1147 (65%)	17.8
8	6912 (48%)	1418 (65.6%)	17.6
9	6874 (48.8%)	1527 (61.7%)	12.9
10	6454 (45.8%)	1447 (58.6%)	12.8
	70,169 (46.2%)	8355 (60.9%)	14.7

Table 5 Logistic regression predicting gambling activity in the first quarter of 2017 based on age, gender and voluntary limit-setting in the first quarter of 2016

	Estimate	Odds ratio	Std. error	z test	p value
(Intercept)	- 0.983589	0.37	0.047344	- 20.775	< 0.001
Age	0.013025	1.01	0.001211	10.759	< 0.001
Gender	0.778089	2.18	0.050214	15.495	< 0.001
Has limit	1.073014	2.92	0.165433	6.486	< 0.001
Age*gender	- 0.009925	0.99	0.001312	- 7.563	< 0.001
Age*has limit	- 0.005722	0.99	0.004098	- 1.396	0.163
Gender*has limit	- 0.567925	0.57	0.176849	- 3.211	0.001
Age*gender*has limit	0.007711	1.01	0.004541	1.698	0.089

compared to a player 1 year younger. The gender odds ratio (OR) showed that the odds for males still being an active gambler in the first quarter of 2017 was 2.18 times higher than for women. For players who set voluntary limits in the first quarter of 2016, the odds of still being an active gambler in 2017 was 2.92 times higher. The interaction between gender and voluntary limit-setting was also significant. The area under the curve (AUC) index was 54% and the Hosmer-Lemesbow test reported a significant value ($\chi^2 = 130.07$; $df = 8$, $p < 0.0001$). However, a significant Hosmer-Lemesbow test indicates a poor model fit (Hosmer and Lemesbow 1980). Safari et al. (2016) define an AUC value between 0.7 and 0.8 as fair in terms of accuracy which was not indicated in the present study.

Discussion

The present study is the first to empirically investigate the effect of voluntary limit-setting on gamblers' loyalty using behavioural tracking data. The main finding supported the hypothesis that those who set voluntary limits would be more loyal to the gambling operator over time (in this case, a 1-year period). Overall, the present study found that relatively few gamblers set voluntary limits. More specifically, out of the 175,818 players, 8.3% choose a limit between January 2016 and May 2017 ($n = 14,581$). This is higher than the study by Nelson et al. (2008) who reported that out of 47,134 players who subscribed to *bwin.com* in February 2005, 1.2% utilized the voluntary limit-setting feature ($n = 567$). The increased percentage of players using the voluntary money setting feature in the present study may purely be because such RG features are now more embedded in modern online gambling websites and/or are more advertised to players within-site than they were 10 years ago. The percentage of 8.3% of players setting a voluntary limit in the present study was similar to that to the recent study by Ivanova et al. (2019) who found that 6.5% of newly registered players set a voluntary limit 90 days after registration without actively being prompted by the operator to do so.

In each of the ten playing intensity groups in the present study, the percentage of active players in the first quarter of 2017 was higher in the group of players who had set voluntary money limits in the first quarter of 2016 compared to players that did not. The smallest difference between players who had and who had not set money limits was found in the lowest playing intensity group. The present study also found that 8.8% of players aged between 18 and 21 years chose a voluntary money limit compared to 6.9% of players aged between 56 and 76 years. Based on these findings, the study demonstrates that the percentage of players who voluntarily set a money limit decreases with age. This may be because older people are less likely to bet riskily with their money and who feel more in

control of their gambling expenditure compared to younger players. However, it should be noted that there was no clear positive or negative trend visible overall with respect to gambling intensity.

Previous studies have demonstrated that the use of voluntary spending limits decrease near-future gambling intensity (Auer and Griffiths 2013). However, no previous empirical study has ever provided empirically based insight into the long-term business effects of voluntary limit-setting. The results of the present study suggest that gamblers who use voluntary limit-setting features remain more loyal to the gambling operator compared to those who do not set such limits. From a business perspective, the implication is that gambling operators should try to get their players to utilize limit-setting features because it may increase long-term customer retention (and therefore ‘lifetime customer value’) while simultaneously providing protection against over-spending for their clientele.

These findings are in a context of limit-setting appearing to become an increasingly common RG practise in online gambling. For instance, Bonello and Griffiths (2017) reviewed the social responsibility practices comprising 50 of world’s most well-known online gambling sites. They reported that 45 sites (90%) offered players the opportunity to voluntarily set monetary spending limits. Marionneau and Järvinen-Tassopoulos (2017) reviewed consumer protection among all 18 licensed online operators in France and all 18 of the operators offered monetary betting limits as well as deposit limits. Calvosa (2017) reviewed ten regulated online gambling sites in Italy and reported that all ten had the mandatory requirement for players to choose a monetary deposit limit before they could play.

Apart from players aged between 56 and 76 years, the median daily limit in the present study was always smaller than the median daily bet in all age groups. This means that limits are generally set in a realistic range of the actual gambling behaviour. This supports previous findings which report that the majority of players think that voluntary spending limits are a useful RG feature (International Gaming Research Unit 2007; Griffiths et al. 2009; Auer et al. 2018a). Voluntary money limits are not useful if the limits chosen are much higher than the actual gambling habits because they will not help the player to control excessive gambling. In order to examine the effect of voluntary limit-setting on loyalty, the present study utilized a predictive research design. Players were categorized into equal groups according to gambling intensity over a single-time period (January–March 2016) and then their behaviour was observed during a future time period (January–March 2017). The difference between the players starting point (first quarter of 2016) is the fact that they did or did not have a voluntary limit in the previous time period. A similar approach was chosen by Coussement and De Bock (2013) during which they predicted future inactivity on an online gambling site based on past behaviour.

In the present study, none of the ten intensity groups were significantly different with respect to gender. However, the first seven intensity groups were significantly different with respect to age. Players who set voluntary limits were younger compared to players who did not set limits. This is in line with the aforementioned finding that the percentage of players aged 18 to 21 years who chose limits was higher compared to players aged between 56 and 76 years.

A logistic regression with the activity in the first quarter of 2017 as the binary dependent variable and age, gender, and setting a voluntary limit (yes/no) as the independent variables found that all three variables are significant. More specifically, being older, being male, and the setting of a voluntary limit in the first quarter of 2016 were positively correlated with still being an active gambler in the first quarter of 2017. The interaction between gender and age as well as the interaction between gender and the setting of a voluntary limit in the first quarter of 2016 were also significant in predicting being an active gambler in the first quarter in 2017. This indicates that there are non-linear relationships between those variables with respect to the gambling activity in the first quarter of 2017. However, the model quality is poor as reported by the area under the curve (AUC) which was 54% and the significant

Hosmer-Lemesbow statistic ($\chi^2 = 130.07$, $df = 8$, $p < 0.0001$). However, this does not impact the finding that voluntary limit-setting is correlated with loyalty over a 1-year period. It cannot be expected that limit-setting, age, and gender alone are sufficient in fully explaining gambling activity 1 year later.

On the assumption that voluntary limit-setting should be part of a gaming operator's CSR strategy, the results appear to underline the fact that CSR has a positive effect on business outcomes. Other studies underline this hypothesis, although they were based on survey data. In a study of 596 casino customers in South Korea, Kim et al. (2017) found that philanthropic CSR had a significant and direct effect on behavioural intentions. In a survey of Canadian casino customers, Abarbanel et al. (2018) also found that corporate social responsibility, and in particular, a commitment to responsible gambling programs, were closely related to customer satisfaction with gambling operators.

The extent to which voluntary limits are used strongly depends on a gaming operator's overall RG strategy. Some companies require all players to choose a limit, and/or have maximum loss limits whereas other operators offer limit-setting as an entirely voluntary tool (Auer et al. 2018a). The authors believe that the present study's result is an important argument for player protection because it demonstrates that voluntary limit-setting does not increase players' inactivity. On the contrary, it increases retention. This is not contradictory to the goals of voluntary limit-setting, assuming that voluntary limit-setting aims to reduce expenditure and not stop gambling completely. The present authors envisage that this finding will encourage more operators to introduce voluntary limit-setting options and actively advertise them to their players.

The present study is not without its limitations. The study was not an experiment because it is impossible to control a 'voluntary' behaviour. A control group in which players are told to choose a limit would contradict the voluntary aspect of such responsible gaming tools. The variables examined were limited and many different influences such as playing on other sites, winning or losing experiences, and available income can all impact on future gambling behaviour. The present study was also conducted with players from one online gambling operator although contrary to many other empirical behavioural tracking studies, the players came from seven different countries (Belgium, Denmark, Netherlands, Norway, Romania, Sweden and the UK). The evaluation of voluntary limit-setting on future loyalty was only assessed during one specific time period which could have been potentially effected by factors unknown to the authors. In order to understand the relationship between voluntary limits and loyalty in more detail, further studies with data from other operators have to be carried out.

Compliance with Ethical Standards

Conflict of Interest The first and second author's company (neccton Ltd) received funding from *Kindred Gaming* for this study. The third author was sub-contracted by neccton Ltd. The third author has received funding for a number of research projects in the area of gambling education for young people, social responsibility in gambling and gambling treatment from *Gamble Aware* (formerly the *Responsibility in Gambling Trust*), a charitable body which funds its research program based on donations from the gambling industry. The third author also receives funding from *Norsk Tipping* (the gambling operator owned by the Norwegian Government). The first and third authors undertake consultancy for various gaming companies in the area of social responsibility in gambling.

Ethical Approval All procedures performed in this study involving human participants were in accordance with the ethical standards of University's Research Ethics Board and with the 1975 Helsinki declaration.

Informed Consent Informed consent was obtained from all participants.

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