

Gamblers' Habits: Empirical Evidence on the Behavior of Regulars, Newcomers and Dropouts

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Abstract Electronic gambling offers the opportunity to analyze huge and unbiased data sets of automatically recorded actual gambling behavior. This study refers to data on 2,127,887 poker playing identities from the Online Poker Database of the University of Hamburg (OPD-UHH) to analyze three subgroups of gamblers: regulars, newcomers, and dropouts. Their gambling habits over 6 months are analyzed in total, as well as over time. Regulars show a much higher involvement than non-regulars and increase their playing volume slightly over the observation period. Newcomers have a lower involvement than non-newcomers and most of them decrease their playing volume over time. Still, there is a small group of newcomers which increases their playing volume sharply and is, hence, very interesting for the industry as well as for the early prevention of pathological gambling. Dropouts have a higher gambling involvement than newcomers but play less than players who have not stopped stop gambling. Most dropouts also show a decreasing playing volume before dropping out. An analysis of the correlations between different variables of gambling habits shows that most of them reinforce each other, for example: gamblers with a higher total playing time tend to play at more tables simultaneously. Only playing frequency is a moderating variable of gambling involvement.

Keywords Online · Poker · Gambling · Habits · Behavior

Introduction

Electronic gambling opens up a new era of research on gambling behavior as it has become possible to automatically record actual gambling behavior. This procedure allows reliable and objective analyses of huge and unbiased data sets. Pioneering work in this field has been carried out by a series of nine papers from Harvard Medical School. They analyze the gambling behavior of online gamblers for different games with a sample of players from

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the operator bwin (LaBrie et al. 2007, 2008; Broda et al. 2008; LaPlante et al. 2008, 2009; Nelson et al. 2008; Xuan and Shaffer 2009; Braverman and Shaffer 2012; LaBrie and Shaffer 2011). Smith et al. (2009) compare the gambling behavior of poker players before and after big wins and big losses. Fiedler (2012) used the Online Poker Database of the University of Hamburg (OPD-UHH) to analyze the playing habits of 2,127,887 poker playing identities. This paper uses the same sample of poker players from the OPD-UHH to explore the gambling habits over 6 months of three subgroups of poker players: regulars ($n = 228,332$), newcomers ($n = 69,734$) and dropouts ($n = 321,568$). The gambling habits include the number of sessions, session length, total time spent playing, the average number of tables played simultaneously, playing intensity as US\$ rake per hour, and playing volume in US\$ rake per hour over the total observation period. These variables are referred to as the gambling behavior in this paper, and are part of the broader term “gambling habits” which also include playing duration (days played from the first to the last observation) and the relationship between the playing duration and the variables of the playing behavior.

Data and Methods

The source of the data for this study is the Online Poker Database of The University of Hamburg (OPD-UHH). It includes data on 2,127,887 poker identities who played at Pokerstars. Pokerstars is a poker-only online operator¹ and by far the largest one in the market (Fiedler and Wilcke 2012). The data collection was conducted over a period of 6 months from September 10, 2009 to March 11, 2010.² Software was programmed to automatically gather information about every active playing identity shown in the lobbies of the different poker operators. This software scanned each available cash game every 10 min and recorded information for the OPD-UHH. The OPD-UHH was subsequently queried and the playing habit results that were obtained are analyzed here by standard statistical procedures. The data are also analyzed as a dynamic panel to evaluate changes in playing habits over time.

Variables of Gambling Habits in Online Poker

In online poker it is not fully clear what the variables of the playing habits are. For example, what is “total money wagered”—a frequently used variable for gambling analyses. Is it the amount of money a player sits down with at a table, how much he bets during the course of a hand, or how much he bets in every individual bet? The answer is ambiguous as the bets in poker differ a lot in regard to their riskiness and expected value. Fiedler (2012) discusses some of these problems and operationalizes the most sensible variables which can be derived from information in the OPD-UHH. These are the number of sessions played, the average playing time per session, the average number of tables

¹ This is important to note as other operators like for example bwin are mainly sports betting operators and people playing poker there might do so only as their second or third game. People playing at Pokerstars are representative for the group of online poker players, though.

² The period of data collection was extended due to technical problems such as downs of the server, software updates and disconnections.

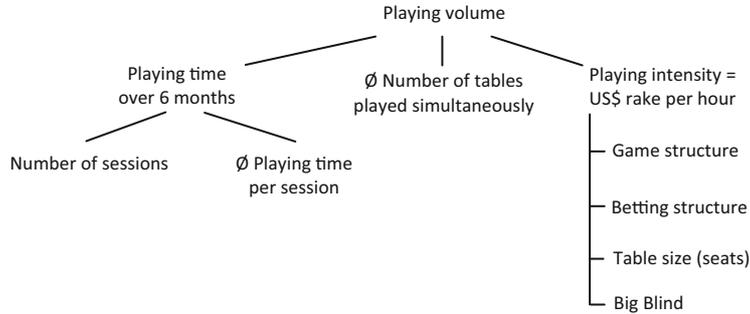


Fig. 1 The different variables of the playing behavior and their relationship

played simultaneously, playing intensity, and the key variable of the playing volume. Their relationship is shown in Fig. 1.

Multiplying the number of sessions with the average time spent per session yields the playing time over 6 months. The average number of tables played simultaneously is a variable unique to online poker and only possible due to the nature of electronic game play, i.e. because players do not have to be physically present at an online poker table they can play multiple tables simultaneously (so called multitabling). The playing intensity is defined as the US\$ rake (fee) a player paid to the operator per hour per table. It depends mainly on the stakes but also on the game and betting structure as well as on the number of players at a table. The higher the rake per hour, the higher the risk a player seeks. Combining all of these variables yields the playing volume. This variable shows the US\$ rake a player paid to the operator during the observation period. The longer a player gambles, the higher the number of tables he plays simultaneously and the more intense the poker variants/betting structure/stakes, the higher is the playing volume. This information on playing behavior can also be related to the playing duration which measures the time from the first to the last observation of a player. This allows the playing frequency as well as the number of sessions per days played or the rake paid per day to be calculated. All variables of gambling behavior and those variables related to the playing duration are defined here as a player's gambling habits. In this paper, the term "gambling involvement" refers to all variables of gambling habits.

Definition of Player Groups and Hypotheses About Their Gambling Behavior

Three subgroups of players are distinguished: regular players, newcomers and dropouts. For this study, regulars are defined as players who were observed in the first 2 weeks and also in the last 4 weeks of the data collection. Newcomers are defined as players who were first observed in week 10. Dropouts are defined twofold (1) as players who were observed in the first 2 weeks but not in the last 4 weeks and (2) as players who dropped out in week 22 of 26 weeks of the data collection and did not play the last 4 weeks. See Fig. 2 for an illustration of the definitions (a continuous line represents that players were played during this time, a dashed line that they might have played, and no line that they did not play).

The defining criteria of the player groups are continuums. And the typical challenge in such situations is to specify the cutoff points. Even in theory, the underlying problems

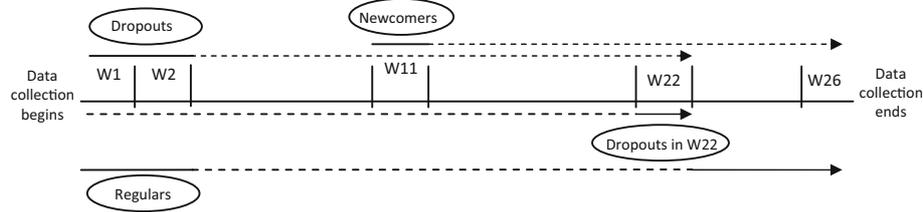


Fig. 2 Regulars, newcomers, and dropouts defined (W = week)

cannot be overcome completely. For example: Someone plays a couple of poker sessions, stops playing and restarts after 5 years. Is this player two times a newcomer or just the first time? The answer depends on the purpose of analysis. The idea behind the group definitions of this paper is the so called consumption capital which was first used to explain excessive and addicted gambling behavior from an economic perspective (Becker and Murphy 1988). In this concept players build up consumption capital when they are playing. The higher the stock of consumption capital the more likely is a player to join the tables again. If a player is not playing, the stock of consumption capital decreases over time. With that idea in mind the definition of player groups is straight forward: regulars are players with a high consumption capital and play during most of the observation time, newcomers are players with no (or very low) consumption capital and join the player pool during the observation time, and dropouts are players who stopped playing despite having built up consumption capital before.

The main challenge, however, is to specify the cutoff points for the groups. Why should a newcomer be defined as someone joining in week 10 and not as someone joining in week 9, week 11 or as someone joining in either of these weeks? The purpose of this paper is to analyze the playing habits of regulars, newcomers and dropouts. Hence, false negatives are not a problem. As long as the sample size is large enough it does not matter if the playing behavior of all newcomers is investigated or just a fraction of them. However, false negatives are a problem as they introduce a bias into the group statistics. Consider, for example, a regular player who was on vacation for a couple of weeks and is therefore wrongly defined as a newcomer. Hence, the objective is to minimize the false positives in the groups. With this objective having the highest priority it still has to be balanced against not having enough data points. For example, a sample of players who joined the player pool in the last week of observation includes less false positive newcomers than the sample of players who joined the player pool in week 10. But it is not sensible to analyze the playing behavior of such a group as the observation period is already over and no playing behavior is left to analyze. Considering all these facts the author decided to define the groups as explained above. Still, there is some subjective component left regarding the cutoff points and, for example, defining the players who joined in week 9 or 11 as newcomers would also have been reasonable.

Gambling behavior is analyzed in total and also per week. The groups of regulars and newcomers are used in both analyses. The two different groups of dropouts are each used once. The dropouts in the analysis of total gambling behavior refer to those seen in the first 2 weeks but not in the last 4 weeks; the dropouts in the analysis of behavior by week refer to the group of players who were seen in week 22 and not thereafter (but maybe before).

By identifying the week they stopped playing, their previous behavior can be analyzed. If it shows significant differences, potential dropouts could be identified in advance.

Hypotheses About Total Playing Behavior

The regular players are supposed to play a lot more often, for longer, and on more tables simultaneously and with a higher intensity in comparison than non-regulars. The newcomers assumedly play less often, for a shorter time, and most often at just one table and with a lower intensity than non-newcomers. This hypothesis arises from the typical career of a gambler who starts with low and infrequent bets which are continually increased in size and number (see e.g. the three phases of a gambler's career: (1) positive beginning, (2) critical habituation, (3) addiction in Meyer and Bachmann 2005, p. 38). The hypotheses on the gambling behavior of dropouts are ambiguous. On the one hand there may be some excessive players in this group who stopped playing because they suffered too great a financial loss. On the other hand there are probably a lot of players in this group who are not very interested in the game and, hence, show a low playing intensity. The latter group is probably much larger and, hence, the dropouts have a smaller playing volume than non-dropouts. Also, dropouts are supposed to have a larger playing volume than newcomers. This leads to the following four hypotheses to be tested with the data (where playing volume also stands for the other variables of playing behavior, please note that all hypotheses are formulated as null-hypotheses):

H₀ Regulars do not show a different playing volume to non-regulars.

H₁ Newcomers do not show a different playing volume to non-newcomers.

H₂ Dropouts do not show a different playing volume to non-dropouts.

H₃ Dropouts do not show a different playing volume to newcomers.

If H_0 – H_2 cannot be rejected it does not necessarily mean that the theory is wrong but that the definitions of the groups were not sensible and that any further hypothesis cannot be tested with this grouping.

In addition, it is reasonable that the different variables of the playing behavior reinforce each other. The reason is as follows: when a player gets more involved this leads to an increase in all variables of the playing behavior. For example, it is supposed that the more sessions are played the higher the playing intensity, or the more tables are played simultaneously, the longer the total playing time. This should be true for all groups of players. These thoughts lead to the following hypothesis:

H₄ The variables of playing behavior do not reinforce each other.

Hypotheses About Playing Behavior by week

The group of regular players played at the beginning and the end of the data collection. These players probably also played before the data collection. Hence, their playing behavior might already be in equilibrium which means that it would not differ over the 26 weeks of the data collection. On the other hand, tolerance and chasing, two key criteria for problematic and pathologic gambling (see e.g. Lesieur 1977; Stinchfield et al. 2007; or Cunningham-Williams et al. 2005), suggest an increase in gambling involvement. Thus, as poker can be addictive for some players, this suggests that the different variables of playing behavior show a slight increase over time.

Newcomers are also assumed to increase their playing behavior in the course of time. The reason is as follows: when they first begin to play they might want to find out how the software works, what the game-flow is like, or to look into the rules of the game. Over time they learn these things and are therefore assumed to play with a higher intensity and—on average—on more tables. Whether this also holds true for the number of sessions and the average session length is, however, ambiguous. Newcomers might increase these variables of gambling behavior after learning the game but newcomers may also play most often and longest initially in order to learn the game. However, the effects of increasing tolerance towards gambling stimuli and the increased desire to chase losses³ seem to be more important, making newcomers more likely to increase their gambling involvement over time.

Building hypotheses about the gambling behavior of dropouts over time is more complex. The group of dropouts probably consists of many players who lose interest in poker and therefore quit. Those players are assumed to play less often and for a shorter time over the course of the observed weeks. Still, it is supposed that these players show increased activity in the last week before they stop playing. The reason is that most players stop playing when their bankroll is empty and they do not want to rebuy. Thus, when they go bust, they stop—and losing everything is most likely when gambling involvement is at its highest. However, there are probably also players in this group who play more and more often and for higher stakes, for example to recoup past losses. Eventually they lose all the money they can afford to or want to, and drop out. These players increase their playing behavior until they ultimately drop out. Since the analysis of the total sample shows that most players only play rarely and for small sums, it can be assumed that the group of players who drop out because they lose interest in poker is larger. This means dropouts decrease their gambling involvement over time but increase it the last week before they stop playing.

These thoughts lead to the following hypotheses (if not otherwise stated, the playing volume also stands for the other variables of playing behavior):

H₅ Playing behavior of regulars does not change over time.

H₆ Playing behavior of newcomers does not change over time.

H₇ Playing behavior of dropouts does not change over time.

Empirical Results

Total Playing Behavior

Table 1 shows the results for the average, median and standard deviation of playing habits for different groups of players and the total sample. The variables of the playing behavior are not normally distributed, as a Kolmogorov–Smirnov–Lillefors test for normality of a random 1 % sample shows (all significant at $p < .001$).⁴ Hence, the hypotheses H_0 to H_3

³ Since poker is a zero sum game among the players where the operator keeps a part of the wagered bets, players are expected to lose more the longer they play. Thus, the longer they play the more losses there are to chase.

⁴ Sessions: K–S = .322, session length: K–S = .117; total playing time: K–S = .350; number of tables: K–S = .382; playing intensity: K–S = .296; playing volume: K–S = .467; betting days: K–S = .186; sessions/day: K–S = .177; playing time/day: K–S = .236; rake/day: K–S = .432.

Table 1 Total gambling habits by group

		Regulars	Non-regulars	Newcomers	Non-newcomers	Dropouts	Non-dropouts	Total sample
	n	228,332	1,899,555	69,734	2,058,153	321,568	1,799,957	2,127,887
Number of Sessions	$\bar{\mu}$	92.44	15.81	16.53	24.29	17.73	25.09	24.03
	Median	59	5.00	5	7.00	7	7.00	7
	σ	99.72	29.96	31.35	49.78	30.58	51.84	49.30
Avg. session length in min.	$\bar{\mu}$	57.90	49.35	49.51	50.30	47.17	50.82	50.27
	Median	50.53	40.94	41.10	42.00	40.00	42.54	42.00
	σ	33.27	38.16	37.72	37.76	35.06	38.21	37.76
Total playing time in h	$\bar{\mu}$	101.21	16.15	17.14	25.55	17.59	26.58	25.28
	Median	49.52	3.77	3.75	4.92	4.43	4.93	4.88
	σ	142.16	39.47	42.32	65.83	40.01	68.62	65.21
AvgTables	$\bar{\mu}$	1.73	1.26	1.24	1.32	1.31	1.31	1.31
	Median	1.13	1.04	1.03	1.05	1.05	1.05	1.05
	σ	1.82	.89	.82	1.05	1.02	1.05	1.04
Avg playing intensity in US\$	$\bar{\mu}$	3.03	2.32	2.30	2.40	2.27	2.42	2.40
	Median	1.50	.81	.80	0.88	.78	.89	.87
	σ	4.03	4.50	4.64	4.45	4.12	4.52	4.46
Total rake in US\$	$\bar{\mu}$	998.29	78.85	73.01	181.05	109.02	189.33	177.51
	Median	92.83	3.50	3.52	4.92	4.04	4.97	4.86
	σ	5,387.68	783.47	610.56	1,964.05	1,017.54	2,056.52	1,934.86
Playing duration in days	$\bar{\mu}$	171.34	41.37	42.67	55.75	52.10	55.56	55.32
	Median	174	17.00	23	27.00	36	25.00	27
	σ	9.25	48.19	43.57	61.29	50.33	62.37	60.83
Sessions per day	$\bar{\mu}$.53	.76	.72	0.74	.66	.75	.74
	Median	.34	.67	.59	0.60	.47	.63	.60
	σ	.55	.67	.65	0.66	.63	.67	.66

Table 1 continued

		Regulars	Non-regulars	Newcomers	Non-newcomers	Dropouts	Non-dropouts	Total sample
Time per day in min.	$\bar{\mu}$	34.58	39.20	36.63	38.77	32.10	39.95	38.70
	Median	17.35	20.00	19.50	20.00	15.70	20.00	20.00
	σ	47.55	54.29	50.79	53.71	46.76	54.73	53.62
Rake per day in US\$	$\bar{\mu}$	5.63	2.10	1.83	2.50	2.12	2.55	2.48
	Median	.54	.25	.23	.28	.19	.29	.27
	σ	29.97	11.16	9.38	14.59	12.72	14.74	14.45

regarding the total playing behavior were tested with non-parametric tests. For comparison reasons Table 1 also shows the results of the total sample. On average 24.03 sessions (median 7 sessions) were played over the course of 6 months, each lasting 50.27 min (median 40 min) on average for a total average playing time of 25.28 h (median 4.88 h).⁵ The average playing duration (time between first and last session) is 55.32 days (median 27 days) and the average number of sessions per day 0.74 (median 0.60 sessions). Excessive multitableting is rare as people were observed to play at 1.31 tables at the same time (median 1.05 tables). On average the players paid US\$ 2.4 per hour (median US\$.87) for a total average rake paid of US\$ 177.51 (median US\$ 4.86).

Table 2 depicts the results of Mann–Whitney-Tests for different subsamples, which test whether player groups come from the same basic population or not. Regulars and non-regulars do not have the same population. This affects all variables of the playing behavior ($p < .001$). Thus, hypothesis H_0 can be rejected: regulars play more often (92.44 session vs. 15.81 on average), for longer (101 h compared to 16 h), on more tables simultaneously and with a higher intensity in comparison to non-regulars, which results in a much higher total playing volume (US\$998 on average vs. US\$79). This means that the group definition of regulars can be used for the other hypotheses. The results also allow to reject H_1 with $p < .001$ for all variables. The playing behavior of newcomers is considerably lower than that of non-newcomers. This still holds true when taking into account that, by definition, newcomers have not played the first 9 weeks of the observation and therefore have a shorter period where they could accumulate playing volume. This is demonstrated by the rake per day which is US\$1.83 for newcomers and US\$2.50 for non-newcomers. Hence, also the group definition of newcomers can be used to test the other hypotheses.

Hypothesis H_2 (dropouts do not show a different gambling involvement to non-dropouts) can also be rejected for all variables of playing behavior except for the average number of tables played simultaneously with $p < .001$. The number of tables played is not significant ($p > .05$), meaning that both groups have the same population and H_2 cannot be rejected for this variable. In all other variables, dropouts have a lower playing involvement than non-dropouts, e.g. playing volume is US\$109 compared to US\$189 for non-dropouts. The results for hypothesis H_3 are ambiguous. The Mann–Whitney-Test shows that for all variables, the two groups do not have the same population ($p < .001$). Dropouts have a higher total playing time than newcomers (17.59 vs. 17.14 h) because they play more sessions even though they play shorter sessions on average. They also play slightly more tables at the same time (1.31 on average compared to 1.24). Playing intensity of newcomers and dropouts is nearly identical (US\$2.27 per hour vs. US\$ 2.30 per hour on average and US\$0.78 vs. US\$0.80 for the median). Still, playing volume is much higher with US\$109 for dropouts compared to US\$73 for newcomers. When considering that dropouts have, by definition, not played the last 4 weeks of the observation period, this finding still holds true as the rake per day value shows (US\$2.12 vs. US\$1.83). So overall, H_3 can be rejected and the definition of dropouts can be used to test the other hypotheses.

Nonparametric Spearman correlations allow testing H_4 that states that the variables of playing behavior do not reinforce each other. The correlations were calculated for all variables of the three groups' gambling habits and must be nonparametric because the variables are not normally distributed (see footnote 2). All correlations can be found in

⁵ The average total playing time is less than the product of the sessions and the average session length. This indicates that people with more sessions tend to play longer; note that numerator for the average total playing time is the total number of players while it is the total number of sessions for the average session lengths.

Table 2 Results of the Mann–Whitney-tests for the different groups

		Sessions	Session length	Playing time	Tables	Playing intensity	Playing volume	Days	Sessions/day	Playing time/day	Rake/day
Regulars versus non-regulars	M-W-U	5.1E+10	1.7E+11	6.2E+10	1.3E+11	1.7E+11	7.4E+10	1.4E+09	1.7E+11	2.1E+11	1.8E+11
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Newcomers versus non-newcomers	M-W-U	6.6E+10	7.1E+10	6.6E+10	6.8E+10	6.9E+10	6.7E+10	6.5E+10	7.1E+10	7.0E+10	6.8E+10
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Dropouts versus non-dropouts	M-W-U	2.9E+11	2.8E+11	2.9E+11	3.0E+11	2.8E+11	2.8E+11	2.9E+11	2.6E+11	2.6E+11	2.6E+11
	p	<.001	<.001	<.001	.719	<.001	<.001	<.001	<.001	<.001	<.001
Newcomers versus dropouts	M-W-U	1.1E+10	1.1E+10	1.1E+10	1.1E+10	1.1E+10	1.1E+10	1.0E+10	1.1E+10	1.1E+10	1.1E+10
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001

Tables 4, 5, 6 in the Appendix. The most noteworthy results are the following: (1) all correlations among the variables of playing behavior in all groups are positive at $p < .01$ with the exception of playing intensity and session length by newcomers. Hence, H_4 can be rejected which supports the view that the variables reinforce each other. (2) Although positive, the correlations of playing intensity are rather weak compared to the correlations among the other variables. This means that players who tend to play often or for longer only play for slightly higher stakes or more risky poker variants. (3) Playing duration in days, from the first to the last observation of a player, is positively correlated with all variables of newcomer and dropout playing behavior. It correlates strongest with the number of sessions, total playing time and playing volume which is partly due to the definition of these variables. The correlation with session length and playing intensity is weaker but still positive (0.24 and 0.16 for newcomers and 0.23 and 0.24 for dropouts). These results suggest that the longer the duration from the first to the last playing day, the higher the gambling involvement. Please note that all correlations regarding playing duration in days are meaningless for regulars since they have, by definition, a playing duration of (nearly) the whole observation period. (4) Playing frequency (sessions per day) is weakly but negatively correlated with all variables of the playing behavior, except session length for newcomers and dropouts, which is weakly positively correlated. This means that playing frequency works as a moderating variable towards gambling involvement. (5) Playing volume per playing duration or rake/day also correlates positively with all variables of the gambling behavior. This further supports the view that the more a player gambles, the higher his involvement. Hence, that gambling involvement reinforces itself, which means that, for example, a player who plays for longer or more often is more likely to play at more tables simultaneously (and vice versa).

Given the knowledge that regulars have a far greater gambling involvement than non-regulars while dropouts and newcomers show a lower involvement, it is interesting to see how much the contribution of each group to the total playing volume differs. Table 3 depicts the absolute and relative number of players in each group and how much playing volume they generated. While accounting for only 11 % of the players, regulars' share of the total playing volume is 60 %. In contrast, the share of playing volume of dropouts and especially newcomers is lower than their share of the total player pool.

Playing Behavior by Week

Analyzing the playing behavior by week enables trend observation over time. Figure 3 shows the average playing volume per week over time for regulars, dropouts and newcomers. The level effect found in the analysis of total playing volume is obvious here too: regulars have a much higher playing volume per week than newcomers or dropouts. Figure 3 also gives a first impression of the average playing volume trends. As theorized

Table 3 Absolute and relative total playing volume per group

Sample	Number of players	Share of players (%)	Playing volume in US\$	Share of playing volume (%)
Regulars	228,332	10.73	227,940,442	60.35
Dropouts	327,930	15.41	36,933,685	9.78
Newcomers	69,734	3.28	5,091,308	1.35
Total Sample	2,127,887	100.00	377,714,269	100.00

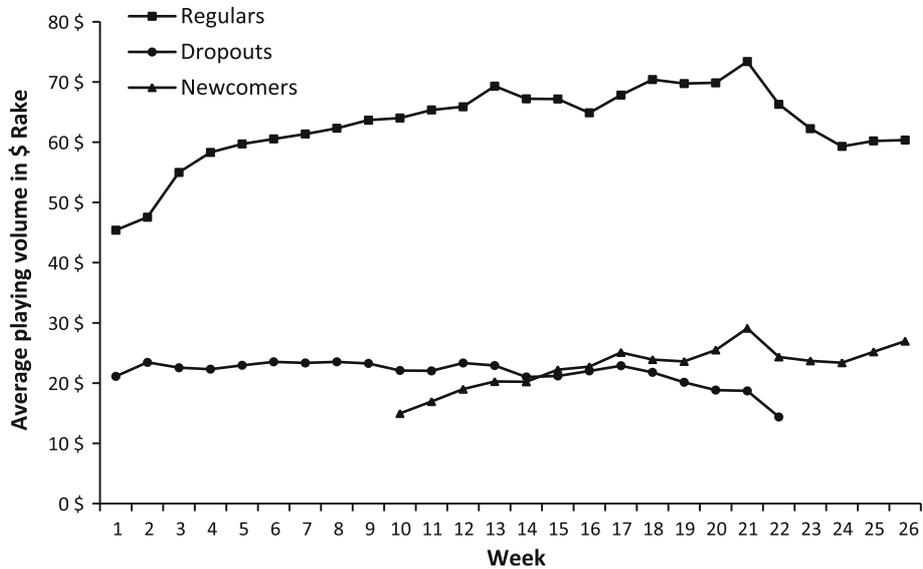


Fig. 3 Average playing volume of regulars, dropouts, and newcomers over time

above, newcomers and regulars tend to increase their playing volume over time while dropouts, as expected, decrease their playing volume overall. However, instead of the expected increase in playing volume in the last week before dropping out, there is a decrease. Surprisingly, there is a sharp increase in the playing volume of regulars and dropouts in week 21. If this was seen in week 16 (the week including the Christmas holidays), it may be explicable. But as week 21 is the week from January 28 to February 3, 2010 the author has no explanation for this increase.

Analyzing the average playing volume per week is sufficient to reject H_5 which states that the playing volume of regulars does not increase over time. However, it is not sufficient to confirm or reject the hypotheses H_6 and H_7 . The reason is that not every newcomer or dropout has played for week of the observation period and the average values may therefore be biased. Regulars, instead, are defined by a beginning and end point. This is different for newcomers and dropouts. Both groups have only one observation point which defines them (week 10 for newcomers, week 22 for dropouts). Thus, the group of newcomers shrinks over time as players stop playing, whereas the group of dropouts grows in the number of players until week 22. Both groups are therefore diluted. For example, there are 68,893 newcomers in week 10. By week 20, only 11,755 of these players (17 %) were still active. Figure 4 shows the player retention of newcomers. Thus, the increase in average playing volume per player in the newcomer group could be due to two things: (1) players increase their playing volume or (2) players with a low playing volume dropped out of the group which, in turn, increases the average value of the still active players. As for the group of dropouts, the decreased average playing volume of the group may be indeed the result of lower playing volume by the players, or it is due to players with a small playing volume joining the group before the cut-off period in week 22. An analysis of the data in a simple time series model as a dynamic panel helps to distinguish between these two effects.

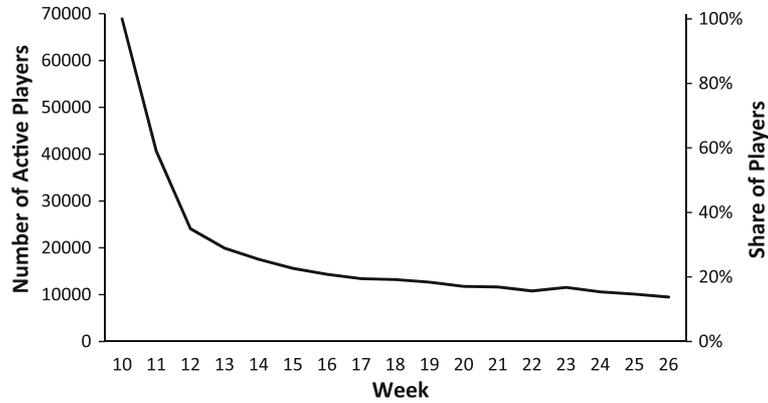


Fig. 4 Player retention of newcomers

To determine the reason for an increased average playing volume of newcomers and the decreased average playing volume of dropouts, the relative playing volume per player and its absolute changes over time are analyzed. The absolute changes is the difference of the playing volume of a player in a given week compared to the playing volume in the base period which is week 10 for newcomers and week 22 for dropouts. They show how much more or less playing volume a player has in the other weeks in absolute US\$ terms. In formal terms:

$$\Delta\varphi_{it} = \varphi_{it} - \varphi_{i10}$$

$$\Delta\omega_{jt} = \omega_{jt} - \omega_{j22}$$

where φ the playing volume of newcomer i in week t and, correspondingly, ω the playing volume of dropout j in week t . $\Delta\varphi$ and $\Delta\omega$ denote the absolute change of the change in playing volume of the respective player in week t compared to week 10 for newcomers and week 22 for dropouts. The relative playing volume, Φ_{it} and Ω_j , also refer to week 10 for newcomers and week 22 for dropouts. It is calculated by dividing the absolute change of the playing volume in a period by the playing volume in the base period. This procedure can be formalized as follows:

$$\Phi_{it} = \frac{\varphi_{it} - \varphi_{i10}}{\varphi_{i10}} = \frac{\Delta\varphi_{it}}{\varphi_{i10}}$$

$$\Omega_{jt} = \frac{\omega_{jt} - \omega_{j22}}{\omega_{j22}} = \frac{\Delta\omega_{jt}}{\omega_{j22}}$$

The relative playing volume and the absolute changes were only calculated if a player played in a given week. Figures 5 and 6 show the average results for the groups of newcomers and dropouts and the results for the 25th percentile, Median, 75th percentile, and 90th percentile.⁶ It can be seen that the majority of newcomers show a decreased relative playing volume over time. The 25th percentile also has a strongly decreased

⁶ Note that the percentile players of the relative playing volume are not identical to those of the average playing volume.

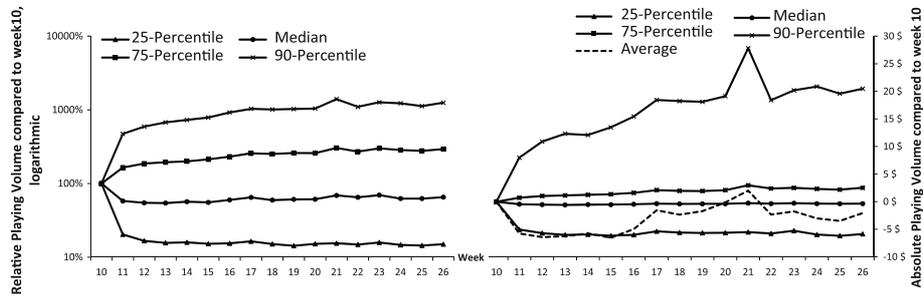


Fig. 5 Relative, Φ , and absolute change, $\Delta\phi$, in newcomer playing volume per week

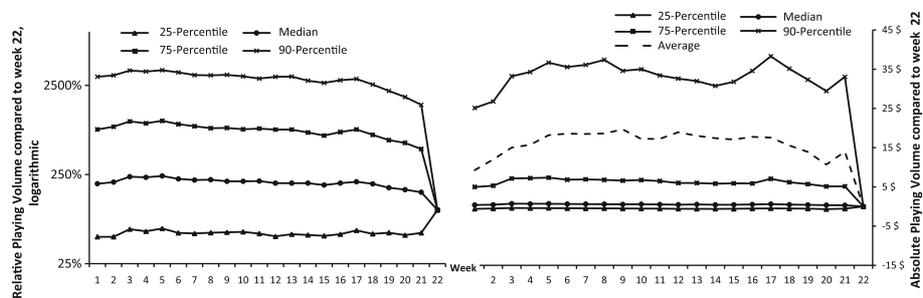


Fig. 6 Relative, Ω , and absolute change, $\Delta\omega$, in dropout playing volume per week

relative playing volume over time. The reason is probably that there are gamblers who, for example, start playing at high limits and then reduce their playing volume. However, there also seem to be many players who start out with a very low playing volume and then increase it manifold as the curves of the 75th and 90th percentile show. The trend over time in absolute terms shows interesting differences. For example, the median absolute changes are nearly zero, which is striking as the median relative trend is a decline. The reason is a level effect: most newcomers have such a low playing volume when they start playing that a reduction is barely noticeable in absolute terms. While the 75th percentile shows a sharp increase in relative terms it is only moderate in absolute terms. The 90th percentile player, however, also has a sharp absolute increase in playing volume. The average absolute change in playing volume first shows a sharp decrease, then increases to close to the level of week 10 in week 16 and peaks in week 21, which is slightly higher than playing volume in week 10 before it is followed by a decline. It seems to be primarily impacted by a few players with major changes in their playing volume. This is mostly a small group of players who show an exorbitant increase in playing volume. It is very interesting that the major changes in playing volume occur from week 10 to week 11. This is especially true for the relative playing volume. The reason may be that new players first have to try out which is the best poker variant, table size, betting structure, and limit for them to play. They investigate this during the first of their playing weeks and then adjust to it. The changes in the following weeks are all relatively minor. Thus, the hypothesis H_6 that states that newcomers do not change their playing volume over time can only partly be rejected. Most players reduce their playing volume and the total group shows—contrary to the reasoning

in Sect. 4.2—a decline in the playing volume. A few players, however, increase their playing volume sharply.

The playing volume of dropouts before they stop playing is higher in relative terms. This is especially true for the 90th and 75th percentile. The median playing volume for most weeks is also more than twice as high as in the last playing week. Still, there are also players showing a much larger playing volume in week 22 relative to the weeks before, as the curve of the 25th percentile shows. In absolute terms, most dropouts do not change their playing volume much before dropping out as the curves for the 25th percentile and the median show. Also, the playing volume of the 75th percentile is mostly only US\$5 more than the previous week. However, as the 90th percentile shows, there are some players who played much more in the weeks before they dropout. As with the newcomers, this group also strongly affects the average changes which show a decline before week 22. Although showing a very minor declining trend in the weeks before the dropout, the playing volume only shows a sharp decline from the week before the dropout to the last week. Therefore, hypothesis H_7 which states that dropouts do not change their playing behavior over time cannot be rejected for the majority of the players, with the exception of the last week itself. The sharp decline in playing volume in the last week is contrary to the reasoning in 4.2, which expects to see an increase of playing volume before the dropout. Only 35 % of the players show an increase in their playing volume before they stop playing—and it is also only minor in comparison to the decrease in the volume of most players.

Discussion

As expected, regulars show a much higher gambling involvement than non-regulars. While regulars account for only 11 % of the total sample, they create 60 % of total playing volume. This shows that playing volume is not uniformly distributed but heavily concentrated. An analysis of the total sample even showed that 1 % of the gamblers account for 60 % of the total playing volume (Fiedler 2012). Hence, the group of the regular players includes many but not all of the most involved players. Another finding was, as expected, that newcomers and dropouts have a lower gambling involvement than the rest of the sample while it is even lower for newcomers. The low playing intensity of newcomers is consistent with the typical career of a gambler who starts with a low gambling involvement and increases it over time (Meyer and Bachmann, 2005). The low playing involvement of dropouts can be explained by a domination of this group by players who stopped playing because they lost interest in the game and, hence, are less likely to have a greater than average interest beforehand.

The analysis of the correlations among the different variables of the gambling behavior shows that they reinforce each other in all groups (with the exception of playing intensity and session length newcomers). An analysis of the gambling behavior in connection with playing duration yielded the interesting finding that playing frequency (sessions per day) is negatively correlated to all variables of the playing behavior (except session length). This means that the higher the playing frequency of a player, the more likely he is to stop gambling, and that playing very often in a short period of time reduces overall gambling involvement. This finding may be counterintuitive when it comes to pathological gambling. But it is reasonable for recreational players who have a given limit for their expenses

and stop when it is reached (they reach it faster when they play more frequently). It can be concluded that the only moderator for gambling involvement is playing frequency, while all other playing habits reinforce each other (with the exception of playing duration and US\$ rake per day).

The analysis of the playing behavior over time shows that regulars slightly increase their playing involvement over time which is consistent with the typical path of a gambler's career. Inconsistent with this reasoning is that most newcomers decrease their playing volume over time. A reasonable explanation for this finding is that many newcomers underestimate the expenses of poker—especially as they not only pay a fee to the operator but are also “rookies” and lose money to their more skilled opponents—as well as beginning on too high stakes. After becoming aware of these costs, they adapt by playing for lower stakes or less risky poker variants or betting structures. This reasoning is also supported by the fact that most of the decrease happens in the second playing week. Still, there is a group of newcomers which is small but not to be neglected that increases their playing volume sharply. These are the players who are potentially at risk of developing detrimental gambling habits. While this group is very important for the industry to generate a long sustained cash flow, it is also a group vulnerable to gambling problems. This shows that early prevention of problem gambling and the monetary interest of the industry are diametrically opposed.

The vast majority of dropouts decreased their playing volume in the weeks before they stopped playing. Those dropouts who increased their volume did so only in relative terms while the absolute increase is rather small. This finding can be explained by group domination by players who simply lose interest in the game and stop playing. Still, it is remarkable that most of the decreased playing volume occurs from the week before last to the last playing week. This is somewhat counterintuitive as it could be reasoned that players stop playing when their bankroll is empty and that this is most likely to happen when gambling involvement is highest. However, dropouts seem to anticipate that and decrease their playing volume beforehand, maybe to delay going bust. Hence, a sharply decreased playing volume might be a good indicator for a potential dropout of a player.

Limitations

There are three limitations to this study. (1) Poker players can easily play on multiple sites and, somewhat less likely, on the same site with multiple user names. This data set cannot take this fact into consideration and, as a consequence, every observed nickname at each site is interpreted separately. Thus, players with multiple accounts are interpreted as multiple players. This is a problem inherent to all analyses of actual playing behavior: they are always partial analyses as gambling behavior at different locations or games is not recorded. Underestimation is the result. (2) The OPD-UHH only contains data on poker cash games. Any playing volume from tournaments was not taken into account of the analyses. According to PokerScout, the revenue of a poker site consists approximately of 70 % cash games and 30 % poker tournaments.⁷ Hence, the results of this study underestimate the gambling involvement of all but exclusive cash game players. (3) The most important limitation is that cash flows between the players were not observed.

⁷ See www.pokerscout.com.

Thus, it cannot be determined whether a player is winning or losing. However, this is important information which would help to give a clearer insight into high volume play. It was shown for example, that players who play more often lose less (LaPlante et al. 2009) and even win (Fiedler and Rock 2009). However, this could not be investigated in this particular case study.

Conclusion

This paper investigated the playing habits of three subgroups of poker players: regulars, newcomers and dropouts. Playing habits were broken down into the number of sessions, session length, total time spent playing, average number of tables played simultaneously, playing intensity as US\$ rake per hour, and playing volume in US\$ rake per hour over the total observation period of 6 months. These variables are referred to as the gambling behavior which, connected with the playing duration (days from first to last observation of a player), yield the gambling habits. Poker players' gambling habits were analyzed in total and as a dynamic panel over time. It was found that regulars have a much higher involvement than non-regulars. They account for 11 % of the players but for 60 % of playing volume and tend to slightly increase their playing volume over time. Newcomers show a lower level of involvement than non-newcomers. Most of them decrease their playing volume over time while there is a small group of newcomers for which increases it sharply. These players are the most important group of players for the industry as well as for early prevention of pathological gambling alike. While these players are at high risk of eventually developing detrimental gambling habits, the industry can find a sustained and growing cash flow in these players. The existence of this group underlines the opposing interests of the industry and prevention of gambling addiction: the industry relies on this group of newcomers to eventually become regular players which is exactly what they are not supposed to become from the prevention perspective.

Dropouts have a higher gambling involvement than newcomers but play less than players who have not stopped gambling. Most dropouts also show a decreasing playing volume over time and the decrease is largest from the week before last to the last playing week. An analysis of the correlations between the gambling habits showed that most of them reinforce each other. For example, the higher the total playing time of a player, the higher the average number of tables played simultaneously. However, the playing frequency in sessions per day is negatively correlated to the variables of the playing behavior of Newcomers and Dropouts; it works as a moderator of gambling involvement for these groups (but not for regular players). This leads to the somewhat counterintuitive conclusion that the more often most someone gambles the lower his gambling involvement. The reason could be that losing money quickly prevents most people from playing more.

Measurement Appendix

See Tables 4, 5, and 6.

Table 4 Nonparametric spearman correlations among the variables of regulars' gambling habits (n = 228,332)

	Sessions	Session length	Playing time	Tables	Playing intensity	Playing volume	Playing duration	Sessions/day	Time/day	US\$ rake/day
Sessions	–	.317**	.929**	.363**	.074**	.684**	.518**	.999**	.925**	.677**
Session length		–	.627**	.449**	.080**	.538**	.169**	.317**	.632**	.539**
Playing time			–	.465**	.090**	.763**	.483**	.928**	.999**	.758**
Tables				–	.104**	.524**	.181**	.363**	.467**	.525**
Playing intensity					–	.658**	.031**	.074**	.091**	.663**
Playing volume						–	.351**	.684**	.763**	1.000**
Playing duration							–	.483**	.453**	.330**
Sessions/day								–	.926**	.678**
Time/day									–	.759**
Rake/day										–

Please note that all correlations regarding the playing duration in days are meaningless for the regulars since they have by definition a playing duration of (nearly) the whole observation period

** Correlation significant at $p < .01$

Table 5 Nonparametric spearman correlations among the variables of newcomers' gambling habits (n = 69,734)

	Sessions	Session length	Playing time	Tables	Playing intensity	Playing volume	Playing duration	Sessions/day	Time/day	US\$ rake/day
Sessions	–	.353**	.926**	.533**	.126**	.765**	.819**	–.218**	.099**	.211**
Session length		–	.663**	.419**	–.002	.520**	.238**	.021**	.595**	.454**
Playing time			–	.587**	.098**	.812**	.729**	–.143**	.324**	.356**
Tables				–	.096**	.553**	.414**	–.068**	.217**	.321**
Playing intensity					–	.632**	.156**	–.120**	–.112**	.663**
Playing volume						–	.637**	–.169**	.208**	.673**
Playing duration							–	–.646**	–.325**	–.083**
Sessions/day								–	.766**	.445**
Time/day									–	.628**
Rake/day										–

** Correlation significant at $p < .01$

Table 6 Nonparametric Spearman correlations among the Variables of Dropouts' Gambling Habits (n = 321,568)

	Sessions	Session length	Playing time	Tables	Playing intensity	Playing volume	Playing duration	Sessions/day	Time/day	US\$ rake/day
Sessions	–	.375**	.935**	.524**	.234**	.791**	.763**	–.157**	.145**	.321**
Session length		–	.666**	.444**	.075**	.544**	.225**	.038**	.582**	.503**
Playing time			–	.584**	.215**	.835**	.683**	–.092**	.343**	.453**
Tables				–	.165**	.568**	.372**	–.034**	.245**	.392**
Playing intensity					–	.692**	.243**	–.136**	–.078**	.678**
Playing volume						–	.621**	–.145**	.224**	.720**
Playing duration							–	–.666**	–.365**	–.038**
Sessions/day								–	.792**	.433**
Time/day									–	.639**
Rake/day										–

** Correlation significant at $p < .01$

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