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03:2009 WORKING PAPER

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# **What characterises the expectations of gamblers?**

**By**

**Connie Nielsen**

## **ABSTRACT**

This paper investigates the expectations of gamblers who have a risk attitude towards gambling (problem gamblers) and gamblers without a risk attitude (non-problem gamblers). In a representative survey of the Danish population we have selected all the people who have ever gambled. We classify the gamblers to have a risk attitude towards gambling if they have a positive score according to the NODS screening instrument (see appendix 1). In the questionnaire, some questions are asked to all the gamblers and some questions are asked specifically to the gamblers who have a positive NODS score and thus, a risk attitude towards gambling. Based on the information from the survey there are several ways to carry out some logical tests around the elicited expectations.

An interesting question is how gamblers perceive their chances of winning and the likely gains they can obtain. We investigate whether the gamblers have erroneous thoughts of gambling, their subjective estimates of the return rates of the games, expected gains and motives of consumption and investment for playing. These aspects will help to create a picture of how rational the gamblers are and whether there are significant differences between problem gamblers and non-problem gamblers.

# **What characterises the expectations of gamblers?**

## **INTRODUCTION**

There are many explanations why some people continue to gamble in spite of persistent losses. In this article we will investigate the expectations of gamblers to acquire a more thorough understanding of their underlying beliefs when gambling. We expect that gamblers have a lot of erroneous thoughts or maybe they are just overoptimistic because they generally have a more risky behaviour.

We distinguish between games of chance and games of skill. A game of chance has a random outcome which is independent of previous outcomes whereas it is possible to acquire some information that can build up knowledge if it is a game of skill. For a bookmaker game where you bet on sports, it is quite possible that you have some information about the horses or the football players. In the questionnaire we ask for the following games that can have an inhibited element of skill: The Pools, Oddset, Bookmaker games or poker on the internet. As regards the games of chance, the list includes: The Lotteries, Keno, Instant games, gambling machines, and the Casino. Appendix 2 has a description of all the games. Naturally, any idea of prediction and control over the outcome of a game can only have some chance of justice for games of skill. Still, for games of chance we also find erroneous beliefs where it seems to be difficult to imagine a random sequence of numbers. Of course any presences of erroneous thoughts are symptoms that the gamblers exhibit irrational behaviour.

Gambling behaviour has been difficult to explain within a classical framework of expected utility. In general the classical EU theory can account for the wealth motive for gambling, but if we would like to consider a consumption motive, the EU theory will have to be modified to take account of the fact that the probabilities in any risky prospect can have direct value beyond that included in the expression of expected utility. Friedman and Savage (1948) started showing that a utility function can have a section with increasing marginal utility (i.e. non-concave segments) to explain gambling. To allow for both gambling and insurance at the same time would, however, require both concavity and non-concavity of the utility function. There have been several attempts to show that there can

be violations of the assumptions underlying the EU theory. An overview of theories that have tried to accommodate for inconsistencies with the axioms of EU theory can be seen in Quiggin (1993).

We can distinguish between gambling as consumption and gambling as investment as we have asked the respondents about their motives of gambling. Gambling as consumption corresponds to a utility contribution from the value of entertainment and gambling as investment corresponds to a utility contribution from the value of winning money. In our data we see evidence of a consumption motive and it is also possible to see how it relates to games of skill and games of chance. If we assume that the consumption motive and the gambling motive are separable to the gambler, consumer demand for gambling should depend positively on the expected gain of gambling. We investigate whether the demand for gambling depends on the expected gain. If this is the case and gamblers can distinguish between a consumption motive and an investment motive, this can be regarded as a manifestation of rational expectations.

To be rational gamblers have to be well-informed. On one hand we expect gamblers to be better informed than non-problem gamblers as they have more experiences of gambling and as they have an interest in learning about the games. On the other hand, the fact that they gamble and accordingly, as regards the majority of the games, they will lose more than they gain in the long run on average can result in a priori expectations that problem gamblers are not as well informed about the chances of winning. Testing for rational expectations offers some insight into the behavioural patterns of gamblers. First, we investigate whether gamblers have rational expectations by checking their expectations of the return rate of a game which is the percentage of the total turnover that is eventually paid out to the gamblers after administrative costs, taxes and maybe some beneficent purposes are covered. Second, it turns out that it is possible to be rational and to have overoptimistic expectations of their subjectively expected gains. For this purpose we define a notion of relative luck which we define as the difference between the subjectively expected gain of a game and the subjective estimate of the return of a game.

## **DATA**

In Denmark a screening of gamblers in 2005 among a representative sample of 8153 persons points out 303 persons to be lifetime gamblers (Bonke and Borregaard, 2006). The screening of the gamblers is based on the NODS lifetime screening instrument where NODS (NORC DSM) is a screening tool developed by the National Research Centre at the University of Chicago (see Gerstein et al., 1999 for the validity of NODS). All the persons who have gambled are classified into a group of problem gamblers if they have a NODS1+ score and a group of non-problem gamblers if the NODS score is zero. A follow-up survey was conducted in 2006 that interviewed 183 of the identified NODS1+ persons together with a control group of 270 persons. The control group was drawn to have the same distribution on age, gender and whether there are children living at home or not in the household.

## DO GAMBLERS HAVE RATIONAL EXPECTATIONS?

*Erroneous thoughts* of gambling are quite common and they are a sign of irrational behaviour. In some empirical studies problem gamblers have more unrealistic perceptions of winning chances than non-problem gamblers (Johansson & Götestam, 2004; Joukhador et al., 2004; Ladouceur et al., 2001). Furthermore, a study by Lund (2007) finds that persons who have either 1-2 misconceptions of winning or 3-5 misconceptions of winning are more likely to be at risk gamblers. In a study where perceptions of gamblers are recorded while gambling on a Video Lottery terminal, there are no significant differences between problem and non-problem gamblers on the percentage of erroneous thoughts (Ladouceur, 2004). But, the conviction of erroneous thoughts increased over the duration of play for pathological gamblers whereas the opposite trend was observed for the non-problem gamblers as they decreased their degree of confidence in their erroneous thoughts as the game progressed. We find that the attitudes that gambling can be a way of earning money and that the chance of winning is increasing while playing if they have not won for a long time are significant for problem gamblers as can be seen in Table 1.

Table 1. Misconceptions about winning chances.

	Problem gambler	Non- problem gambler	Tests	Problem gambler N	Non- problem gambler N
Believe somewhat or completely that you can earn money by gambling	52.3	39.4	$\chi^2$ trend test of the difference between problem gamblers and non-problem gamblers: p value = 0.0014	178	251
Believe somewhat or completely that the chance of winning is increasing while gambling if there has been no wins.	18.4	15.0	$\chi^2$ trend test of the difference between problem gamblers and non-problem gamblers: p value = 0.12	179	246

Problem gamblers seem to have more unrealistic expectations about gambling because it is significant that they are more likely to expect to earn money by gambling. This holds for certain as long as we regard games of chance. Skills might, however, improve the chances of winning.<sup>1</sup> The old perception that the gambler will lose on all games on average has been questioned a little recently as there are few examples of some poker players who seem to do a living from their poker playing. If it is possible to build up some skills to be better at predicting the outcome of a game then these skills can be of importance when the gambler has information on the sport teams that play the matches on the pools coupon or the horses that run in a horse race. The majority of games can though be characterised as games of pure chance where it is not possible to predict the outcome. If this is the case, the problem gamblers exhibit irrational behaviour when they expect to win from their gambling. Furthermore, there is independence between the individual outcomes and it will also be irrational for problem gamblers if they believe that the chance of winning is increasing while they are playing if there have not been any winnings for a time. This situation is often referred to as the gambler's fallacy. For instance the outcome of six when throwing a dice does not affect the chance of receiving six next time the dice will be thrown unless somebody has cheated with the shape of the dice. This type of mistake can be more common than we think. (Ladouceur, 2004) provides an example where most people will tend to choose a lottery ticket with numbers 7,13,22,43,41,47 in stead of a lottery ticket with numbers in a sequence 1,2,3,4,5,6 because they think it is more likely that the first combination comes out.

As the distinction between games of chance and games of skill is important when we want to evaluate whether gamblers possess erroneous thoughts, we need to have a look at the gamblers who have replied to our questionnaire. Table 2 provides some information on what problem gamblers and non-problem gamblers have played and what their favourite games are.

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<sup>1</sup> Thinking about these types of games only makes it hard to find a game where pure skill is the sole blessing to the outcome and where there is no chance at all (maybe chess).



Table 2: List of the most popular games among gamblers and non-problem gamblers.

	Ever gambled		Favourite game <sup>1)</sup>	
	N = 270 NodsN = 0	N = 183 NodsN > 0	N = 141 NodsN = 0	N = 132 NodsN > 0
	Per cent			
Games of pure chance				
Number games	84	85	65	39
Instant games	79	89	9	5
Games with an element of skill				
The Pools	48	69	1	5
Oddset	26	53	9	20
Foreign Bookmakergames	10	33	1	8
Card games	30	66	6	14

Note 1: The percentages in the columns would add up to 100 per cent if all the games in the questionnaire were presented in the Table. The games left out are Bingo, horce race, gambling machines, roulette and games of dice.

In Table 1, non-problem gamblers have almost tried the games of pure chance as often as the problem gamblers, but when it comes to games with an element of skill, the proportion of problem gamblers who have tried to play a game ever is much higher. When the gamblers report their favourite game, it is also clear that the games of pure chance are more popular among the non-problem gamblers as almost 3 out of 4 persons report them as their favourite game. Accordingly, games with an element of skill are relatively more popular among problem gamblers.

From the favourite game in Table 2 we can identify the gamblers who prefer a game of skill. We can use this variable to control for when we want to judge how skills can affect the replies by gamblers regarding misconceptions of gambling. First in Table 3, we define a logistic regression where we explain the problem gamblers by explanatory variables of misconceptions and risk attitudes. Then, we control for the gamblers who prefer a game of skill.

Table 3: Are misconceptions and other risk attitudes explanatory factors of being a problem gambler?

Logistic regression	Exclusive skills		Inclusive skills	
	Odds ratio	P >  z	Odds ratio	P >  z
<b>Misconceptions</b>				
Believe you can earn money by gambling	1.587	0.024	1.337	0.180
Believe the chance of winning is increasing while gambling if no wins have come out.	1.130	0.659	1.289	0.373
<b>Risk attitudes</b>				
Chooses gambling when offered a fair bet	2.262	0.000	2.268	0.000
Picks the game with a maximum gain and a minimum likelihood	1.170	0.527	1.241	0.402
Chooses to gamble if offered a game where you can win 10 times the stake	3.104	0.000	2.428	0.006
<b>Skills</b>			4.679	0.000
Log likelihood ratio: Pr > Chi <sup>2</sup>		0.000		0.000
N = 453				

As the question of believing you can earn money by gambling becomes insignificant when we correct for skills, it can not be completely out of the question that gamblers believe they can earn some money by gambling because they possess certain skills. Even if gamblers possess skills it is though still quite unrealistic that they can control the outcome of a game. Therefore, this is not to contradict earlier results that it is a good idea to educate gamblers about winning chances (Delfabbro, 2004; Lund, 2007). If we leave out the risk attitudes, it does not seem to affect the parameters of the questions regarding misconceptions. The risk attitudes here can be in line with the NODS questions, which are also an expression of a risky behaviour. Risk preferences are usually not directly observed and are usually referred to as unobserved heterogeneity. However, we have been able to indirectly track down some knowledge about unobserved characteristics of persons through the questionnaire. There are 45 per cent of the problem gamblers who prefer to gamble which is significantly different from the 25 per cent non-problem gamblers who prefer to gamble (Chi<sup>2</sup> test with a p value < 0.00001). The problem gamblers are also significantly different from the non-problem gamblers as regards the question of playing or not if they can win 10 times the money they put at stake (Chi<sup>2</sup> test with a p value < 0.0003). The problem gamblers and non-problem gamblers do not, however, look very different for the question where they have to choose between three different games. The first game has a 20 per cent chance of winning 5,000 DKK, the second game a 10 per cent chance of winning 10,000 DKK and the last game a 1 per cent chance of winning 100,000. In this case 60 per cent of the problem gamblers and 63 per cent of the non-problem gamblers pick the game with a maximum gain and a minimum likelihood and the Chi<sup>2</sup> test between problem gamblers and non-problem gamblers is not significant at the 0.12 significance level. This is probably the reason why this variable becomes insignificant in explaining the likelihood of being a problem gambler in Table 3. The fact that the distributions of problem gamblers and non-problem gamblers do not look that different for this question reflects that problem gamblers do not have a strong tendency to choose the most risky game just for the sake of taking on more risk.

Another logical test of rational expectations is to check *whether gamblers expect the return rate of a game to be less than 100 per cent?* The return rate of a game is the percentage of the total turnover that is eventually paid out to the gamblers again after the administrative costs and maybe some beneficent purposes are covered. Of course this return rate has got to be less than 100 per cent and we check in the data whether everybody is aware that the return of each game must be less than 100

per cent. The result is very satisfactory as no one expects the return rate to be greater than 100 per cent. We will come back to this as it seems to be in contrast with the fact that there are gamblers who have individual gains greater than 100 per cent.

We can also test *whether the subjective returns of the gamblers correspond to the objective returns (audited by the Game Authority)*. Table 4 lists the average subjective estimates of the returns per game provided by gamblers with and without a risk attitude as well as the audited returns by the Game Authority (Spillemyndigheden).

Table 4: Expected and Audited Return Rates

	Problem Gamblers <sup>1)</sup> (Std.dev.)	Non-problem gamblers <sup>1)</sup> (Std.dev.)	Audited return to player percentages	T-test (Problem gamblers vs. non-problem gamblers <sup>1)</sup> )	N (Number of problem gamblers / number of non-problem gamblers <sup>1)</sup> )
The Pools	44 (22)	40 (25)	45	n.s. <sup>2)</sup>	55/54
Oddset	56 (24)	49 (27)	71-72	n.s. <sup>2)</sup>	48/29
Bookmaker	60 (32)	45 (27)	92	0,0414	38/30
Lotteries	45 (24)	39 (23)	45	n.s. <sup>2)</sup>	54/44
Keno	48 (27)	41 (27)	60	n.s. <sup>2)</sup>	23/20
Instant Games	43 (24)	41 (25)	50-60	n.s. <sup>2)</sup>	44/31
Gambling Machines	52 (31)	54 (33)	82	n.s. <sup>2)</sup>	41/35
Casino	57 (37)	38 (32)	90-98	0,0245	40/30
Poker on the Internet	65 (32)	47 (30)	95-98	0,0542	27/21

Note 1: Problem gamblers have at least replied yes to one of the NODS questions (i.e. NODS > 0) listed in Appendix 1 whereas non-problem gamblers (NODS = 0) do not associate themselves with any of the questions.

Note 2: T-test n.s. for p-values > 0.10. Unpaired, unequal variances.

In Table 4, the gamblers with a risk attitude have higher expectations of the return of a game than the gamblers without a risk attitude. Furthermore, it implies that the gamblers with a risk attitude have expectations that are closer to the audited percentages. As regards the Pools and lotteries, the average expectations of the gamblers with a risk attitude attain the level of the audited returns. For most of the games, the average expectations between problem gamblers and non-problem gamblers are not significantly different. The games that exhibit a significant difference between the two groups are bookmaker games, Casino and poker on the Internet. Indeed, we expect that these games are distinguished by the need of making a greater effort to understand the rules of the games as each

of the games can be categorized as a game of skill. The expected returns of problem gamblers are on average closer to the audited returns, indicating that problem gamblers on average are more informed than gamblers without a risk attitude.

In Table 5 we group the differences between the expected returns and the audited return into three categories. The average of the expected values is close to the audited return if its value is between a maximum of 10 per cent beyond the audited return. If the average of the expected values is either 10 percent higher or lower than the audited return, the expected returns are in the upper and lower end of the distribution respectively.

Table 5: The distribution of the difference between the expected returns of the gamblers and the audited returns divided on gamblers with and without a risk attitude towards gambling.

	< -10 pct.	+/- 10 pct.	> 10 pct.	Total	Fischer's exact test	Don't Know	$\chi^2$
The Pools							
G w/risk <sup>1)</sup>	21	7	27	55		126	
G w-o/risk <sup>2)</sup>	30	1	23	54	0.032	215	0.004
Oddset							
G w/risk <sup>1)</sup>	28	7	13	48		133	
G w-o/risk <sup>2)</sup>	19	5	5	29	n.s. <sup>3)</sup>	240	< 0.001
Bookmaker games							
G w/risk <sup>1)</sup>	26	12	0	38		142	
G w-o/risk <sup>2)</sup>	28	2	0	30	0.011	239	0.001
Lotteries							
G w/risk <sup>1)</sup>	20	7	27	54		127	
G w-o/risk <sup>2)</sup>	26	1	17	44	0.056	225	< 0.001
Keno							
G w/risk <sup>1)</sup>	13	2	8	23		158	
G w-o/risk <sup>2)</sup>	14	1	5	20	n.s. <sup>3)</sup>	248	0.070
Instant games							
G w/risk <sup>1)</sup>	24	11	9	44		137	
G w-o/risk <sup>2)</sup>	16	8	7	31	n.s. <sup>3)</sup>	238	0.02
Gambling machines							
G w/risk <sup>1)</sup>	26	15	0	41		140	
G w-o/risk <sup>2)</sup>	19	16	0	35	n.s. <sup>3)</sup>	234	0.002
Casino							
G w/risk <sup>1)</sup>	25	15	0	40		141	
G w-o/risk <sup>2)</sup>	25	5	0	30	0.049	239	0.001
Poker on the Internet							
G w/risk <sup>1)</sup>	19	8	0	27		154	
G w-o/risk <sup>2)</sup>	19	2	0	21	0.088	248	0.013

1) G w/risk are gamblers with a risk attitude towards gambling (i.e. a NODS score > 0).

2) G w-o/risk are gamblers without a risk attitude towards gambling (i.e. a NODS score = 0).

3) Not significant at the 0.1 level.

Table 5 displays expected returns of individual game for problem gamblers and non-problem gamblers in relation to the audited returns. Among the 55 gamblers who have stated the return of the pools, there are 7 who predict the actual value within a 10 percent bracket (i.e. 10 percent lower or 10 percent higher than the actual return of that particular game). For almost all the types of games, there is a higher fraction of problem gamblers than non-problem gamblers who predict correctly. This is, however, not the case for gambling machines where there is a larger fraction of non-problem gamblers who predict correctly. From Fisher's Exact test we can see that the difference is though not significant. At a 10 per cent level there is a significant difference for the following games: the pools, bookmaker games, lotteries, Casino or poker on the Internet. If we further include the 'don't know' replies, the problem gamblers know the return of the stakes better than the non-problem gamblers for all the games except for the gambling machines where the non-problem gamblers have most predictions that are correct. This can be seen by the significance level of the  $\chi^2$  test static in Table 5 stating the difference between how many problem gamblers versus non-problem gamblers who answered the question right, wrong or don't know.

Based on the expected returns of the games, it is possible to conduct a more formal test of rational expectations to see *if the subjective estimates correspond to the audited figures*. The question is whether gamblers have unbiased estimates of the return of a game. Usually, there are two tenets which make up the hypothesis of rational expectations (Forrest et. al., 2000). First, the expectations of forecast errors are zero. Second, forecast errors should also be uncorrelated with any available information (the orthogonality property).

$$R_{gi} = \alpha_i + \beta_i R_g^{audited} + v_i + \varepsilon_{ig}$$

In the regression, the dependent variable  $R_{gi}$  is the return of game  $g$  subjectively estimated by individual  $i$  and the explanatory variable  $R_g^{audited}$  is the audited return of game  $g$ . The error term consists of an individual specific term,  $v_i$  (it differs between units, but, its value is constant for any particular gambler) and  $\varepsilon_{ig}$  (the usual residual with mean zero, uncorrelated with itself, uncorrelated with the audited return, and homoskedastic). If the hypothesis  $H_0: \{\alpha_i = 0; \beta_i = 1\}$  can not be rejected, the expectations are unbiased. As some of the gamblers only report one game, we pool all the individual regressions to have the same intercept and the same slope in Table 6.

Table 6 Fixed effect panel data estimation with common intercept and slope for problem gamblers and non-problem gamblers respectively

	Constant	Audited return	Prob > F	$\sigma_u^2$	$\sigma_e^2$
Non-Problem gamblers (N = 71)	45.6 (13.4)	-0.03 (-0.6)	0.5485	26.1	15.1
Problem gamblers (N = 79)	35.1 (12.9)	0.25 (6.6)	0.0000	24.9	13.3

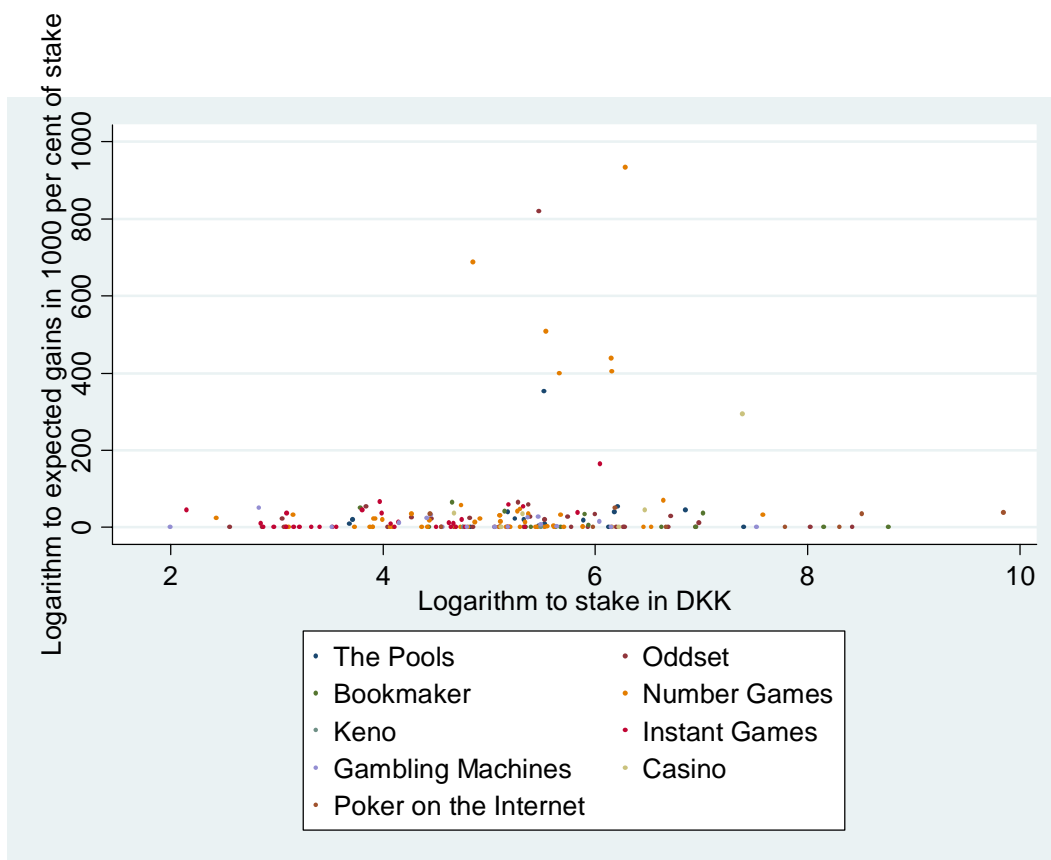
Note: t-values in parentheses.

For the non-problem gamblers, the pooled estimation is not significant and the audited returns can not explain the subjectively expected returns by the gamblers. Going from the pooled regression of the non-problem gamblers to the problem gamblers, the pooled regression becomes significant as the audited return gets significant. The constant decreases a little, but it is still significant and much higher than zero. The parameter value of the audited returns gets positive, but it is less than one. For the problem gamblers, both the variance of the individual specific error term and the variance of the usual error term decrease a little. From these regressions we can conclude that problem gamblers seem to be more well-informed about the conditions under which gambling takes place.

Besides the question whether gamblers believe they can earn money by gambling, we also ask the problem gamblers more precisely how much they expect to win during a month on the games they are playing and how much money they spend on the separate games both exclusive and inclusive expected gains from the money put at stake. Combining the two questions makes it clear *whether gamblers expect to get a net gain or a net loss from their gambling*. We define the *expected gain* of gambling as the difference between the gross gain (the amount paid to them as prizes irrespective of how much money they have put at stake) subtracted by the money put at stake. In the questionnaire, 146 gamblers out of the 183 gamblers with a risk attitude towards gambling have reported how much they spend on each of the games (see Appendix 3 for an overview of the stakes exclusive the prizes they win).

To see the relation between expected gains and the money put at stake, Figure 1 plots the expected gains against the stakes by game in DKK. At 100 per cent the gambler will be even of the expenses he/she has had on the game in question. Note that a gambler has more than one dot in Figure 1 if he/she plays several games. There are 96 gamblers out of the 183 gamblers with a risk attitude who report their expected gains of the games they play where some of them play several games up to a

maximum of seven, which is reported by one gambler. In total the 96 gamblers play 191 games corresponding to two games each on average.



Note: Three outliers have been deleted in order to make the figure more clear. The two of them regard poker on the internet where there is quoted expected gains of 10.000 and 20.000 per cent. The last observation is an expected gain of 2.000.000 per cent on instant game.

Figure 1: Logarithm to expected gain in per cent of stake versus logarithm to stake in Danish DKK.

A lot of the dots are close to zero in Figure 1. Some of these dots indicate that there are gamblers who put a lot of money at stake without expecting to win anything. Contrary to this, some gamblers have very high expectations to the outcome of the games they are playing though their stakes are well below 1000 DK, particularly for lotteries. For most of the games, the gamblers do not expect to win more than they put at stake on the game. For about half of the reported games (96 out of 191), the gambler does not expect to win anything and you can argue that they play to consume. The gamblers, who expect to win a little but not more than they put at stake on their game, expect to get some compensation for their expenses on gambling. These gamblers, who do not expect a full compensation in expected gains for the money put at stake, may consider the remaining amount as a payment for the consumption value of gambling. The gamblers who expect to win more than they



spend on gambling might perceive their gambling as an investment. In Figure 1, there are 50 games out of 191 where the gambler can regard their playing as an investment.

If we divide all the expectations of gains according to games of skill or games of chance, we find again that the expected gains are higher for games of skill. For games of skill 33 per cent expect gains that are greater than 100 per cent and for games of chance 22 per cent expect this. This confirms what we saw in Table 3 that there is a tendency to expect higher gains of gambling if it is a game of skill. In total there are 26 per cent of the gamblers who expect to win more than they spend on gambling and thus, they may consider their gambling as an investment. To see whether there is an investment motive for gambling, we regress the stakes of the gamblers on the expected gains in Table 7.

Table 7: A simple regression of stake versus expected gain:  $\log(S_i) = \gamma_g + \beta \log(EG_i)$

	Constant	Expected Gain	N	R <sup>2</sup>
Games of pure chance				
Number games	4.2 (12.2)	0.11 (3.1)	22	0.32
Instant games	4.2 (8.0)	0.06 (0.8)	13	0.06
Gambling machines	1.5 (1.9)	0.61 (5.0)	6	0.86
Casino/roulette	4.2 (6.6)	0.21 (2.8)	6	0.67
Games with an element of skill				
The Pools	5.1 (6.0)	0.08 (0.8)	10	0.07
Oddset	3.6 (4.9)	0.29 (2.9)	20	0.31
Foreign bookmaker games	1.5 (0.7)	0.84 (2.2)	8	0.45
Poker on the Internet	0.1 (0.1)	0.96 (4.9)	9	0.78

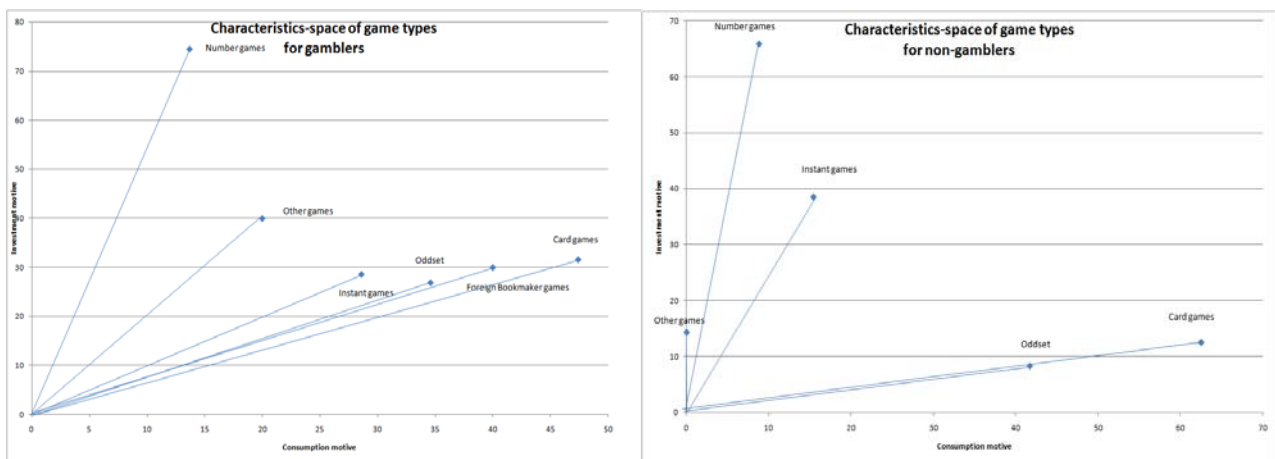
Note: The parentheses include t-values.

The dependent variable of each game in Table 7 is the money put at stake exclusive prizes and the independent variable is the expected gain. For most games the gamblers' subjective expectations of their gains seem to explain how much gamblers on average put at stake significantly. The fact that all the coefficients of the expected gains lie in the interval (0;1) gives an indication that gamblers

are informed evaluators of gambles and that they are fully rational (Kearney, 2004). Had there been more observations we might have been able to interpret the price of the gamble (one minus expected gain) as the entertainment value from participating in a gamble. The fact that gamblers lose on average in the long run can be rational if there is a consumption value of gambling. If the market price of a game equals the gambler's reserved price of a game, the consumption value equals one minus the return rate of the game where the return rate can be approximated by the elasticity of the stake for a change in the expected gain. The gambler's reserved price of gambling can though be higher than the market price implying a higher consumption value than one minus the return rate.

We have more evidence of gambling as consumption as we have both asked whether the gamblers have a consumption motive or an investment motive for gambling. Figure 2 depicts the consumption motive and the investment motive of the favourite game for gamblers and non-gamblers.

Figure 2: Proportion of gamblers who have a consumption motive or an investment motive of their favourite game.



Non-problem gamblers have higher investment motives than problem gamblers when it comes to games of chance such as number games and instant games. It is likely that a lot of people who find themselves in bad living conditions can dream they can climb the social ladder by winning a gamble. When it comes to games where there is an element of skill, problem gamblers have stronger investment motives.

We have seen signs of rational behaviour among the problem gamblers. There is though one thing that can seem to be contradictive and inconsistent. As we have checked that all the gamblers are aware that the return rates of the individual games are well below 100 per cent, the gamblers who expect to win more must consider themselves as having more luck attached to them than other people. Actually, we can define a more precise term denoted *relative luck* by the difference between the expected gain of a game and the subjective estimate of the return of a game. The gambler should be informed given the subjective estimate of the return rate of a game that this is what an average gambler can expect to win from a certain game. If the gambler expects to win more than his/her subjective estimate of the return rate dictates, this can be regarded as a measure of how much more lucky than an average gambler, the gambler considers himself/herself to be. Table 8 shows the measure of subjectively estimated relative luck as the difference between gamblers' expected gain and their estimate of the return rate of a game for 44 gamblers.

Table 8: Subjectively expected gains in surplus of the subjectively expected return rates of the games for 44 gamblers.

	The Pools	Oddset	Bookmaker	Numbers Games	Instant	Gambling Machines	Casino/roulet	Poker on the Internet	N
< 0	5	7	6	15	5	4			42
< 100 per cent		3	2	1	3	1	3	2	15
> 100 and < 300 per cent	1	2		1		2	2	1	9
> 300 per cent	2	2		4	1	1			10
Median	-29%	2,5%	-55%	-36%	-20%	-14%	90%	77%	
Mean	8195%	138%	-42%	50369%	222214%	130%	114%	102%	
N	8	14	8	21	9	8	5	3	76

Table 8 shows that gamblers reported expected losses of the gambling for 42 games and expected gains for 34 games. For 25 per cent of the reported games, the gamblers considered themselves to be relatively lucky. It is of interest to know whether they really consider themselves as being relatively lucky or whether it is part of the culture that you have to express confidence in winning. Maybe there is a spill-over effect from sports games where the competing gamblers have to go out and show confidence. If they consider themselves as being relatively lucky, it can be a factor that explains their gambling as well as skills of games. There might be some adverse selection of persons who gamble if this is the case. Unless, the gamblers are rational about their relative luck to the average gambler, the expected gains can be considered as being inconsistent.

We would like to investigate the relation between persons who report relative luck and whether they are a problem gambler or not. However, it is only problem gamblers who have got the question of expected gains. But, the odds of a risk lover among the problem gamblers are 2.5 times the odds of a risk lover among non-problem gamblers. Due to the correlation between being a problem gambler and a risk lover, we can investigate the relation between relative luck and being a risk lover in Table 9.

Table 9: Risk attitude and relative luck of problem gamblers.

	Risk lovers	Risk averse	Risk neutral	Total
Relative luck	31 (26.18)	19 (23.30)	0 (0.52)	50
No relative luck	69 (73.82)	70 (65.70)	2 (1.48)	141
Total	100	89	2	191

Note: Expected values in the contingency table if risk lovers, risk averse and risk neutral persons were equally distributed among persons who report relative luck and those who do not.

In Table 9, the proportion of gamblers who consider themselves as being relatively lucky is 31 per cent among the risk lovers and 21 per cent among the risk averse gamblers. If a person reports relative luck, it is more likely that the person is a risk lover as the percentage would have been 26 per cent if the persons with relative luck were equally divided on risk lovers and risk averse persons. We can reject the hypothesis that gamblers with and without relative luck have the same distribution, with a  $\chi^2(2)$  of 2,99 at the significance level of 0.10, but not at 0.05. Therefore, we expect that people who consider themselves as being relatively lucky will be more likely to become problem gamblers.

## SUMMARY

This paper has investigated the expectations of problem gamblers and non-problem gamblers where the first group has at least one positive NODS question and the other group does not have any positive replies to the NODS questions. We find evidence of the misconception of believing that you can earn money by gambling as the variable is significant in a logistic regression to explain the dependent variable of being a problem gambler. However, the variable becomes insignificant if we

correct for skills. Furthermore, this misconception is more predominant among problem gamblers than among non-problem gamblers. The other misconception of believing the chance of winning is increasing while gambling if no wins have come out is not significant to explain being a problem gambler. At the 15 per cent significance level it is more common to have this misconception among problem gamblers than among non-problem gamblers.

All the gamblers in the questionnaire have subjective expectations of the return rates that are well below 100 per cent. Generally, the problem gamblers are better at predicting the correct audited return rates than the non-problem gamblers. A more formal test of rational expectations where the subjective estimates are regressed on the audited returns also shows that problem gamblers have predictions that are more in accordance with rational expectations than the non-problem gamblers.

Some gamblers expect to win more than they put at stake, other gamblers expect to win a little but not a full compensation of the money put at stake, and still some expect to win more than they put at stake. There seems to be a tendency to expect a higher gain of gambling if it is a game of skill, but especially some few gamblers of number games have very high expected gains. For number games, gambling machines, Casino, Oddset, foreign bookmaker games and poker on the Internet, the gamblers' subjective expectations of their gains seem to explain how much gamblers on average put at stake significantly. All the coefficients to the expected gains lie in the interval (0;1) indicating both an investment motive and a consumption motive for gambling. Asking the respondents directly about their motives of gambling also shows that both motives are present for many gamblers. On one hand non-problem gamblers have higher investment motives than problem gamblers when it comes to games of chance such as number games and instant games. On the other hand problem gamblers have stronger investment motives when it comes to games of skill.

Finally, we define a term of relative luck for problem gamblers by the difference between the expected gain of a game and the subjective estimate of the return of a game. If the gambler expects to win more than his/her subjective estimate of the return rate dictates, this can be regarded as a measure of how much more lucky than an average gambler, the gambler considers himself/herself to be. For 25 per cent of the expected gains for games, the gamblers consider themselves to be relatively lucky. If a person indirectly reports relative luck, it is more likely that this person is a risk lover and consequently also a problem gambler.



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Appendix 1: Questions in the NODS screening for gambling problems.

1. Have there ever been periods lasting two weeks or longer when you spent a lot of time thinking about your gambling experiences or planning out future gambling ventures or bets?
2. Have there ever been periods lasting two weeks or longer when you spent a lot of time thinking about ways of getting money to gamble with?
3. Have there ever been periods when you needed to gamble with increasing amounts of money or with larger bets than before in order to get the same feeling of excitement?
4. Have you ever tried to stop, cut down, or control your gambling?
5. On one or more of the times when you tried to stop, cut down, or control your gambling, were you restless or irritable?
6. Have you ever tried but not succeeded in stopping, cutting down, or controlling your gambling? (Has this happened three or more times?)
7. Have you ever gambled as a way to escape from personal problems?
8. Have you ever gambled to relieve uncomfortable feelings such as guilt, anxiety, helplessness, or depression?
9. Has there ever been a period when, if you lost money gambling one day, you would return another day to get even?
10. Have you ever lied to family members, friends, or others about how much you gamble or how much money you lost on gambling? (Has this happened three or more times?)
11. Have you ever written a bad check or taken something that didn't belong to you from family members or anyone else in order to pay for your gambling?
12. Has your gambling ever caused serious or repeated problems in your relationships with any of your family members or friends?
13. Has your gambling caused you any problems at work, such as missing a job or had problems at work or the loss of an important job or career chance?
14. Has your gambling ever caused you to lose a job, have trouble with your job, or miss out on an important job or career opportunity?
15. Have you ever needed to ask family members or anyone else to loan you money or otherwise bail you out of a desperate money situation that was largely caused by your gambling?



## ***Appendix 2: A list of the types of games in the questionnaire.***

In this appendix we list some explanations to the different types of games that we have asked for in the questionnaire. In preparing the explanations we have been inspired by the Wikipedia.

### *The Pools*

For approximately 40 years from 1949, tipping was the only game offered publicly in Denmark by Danske Spil (previously Dansk Tipstjeneste A/S). In 1988, however, the law was changed to make it possible to offer other types of games. The first pools coupon had 12 football matches. Today Danske Spil offers Tips 12 and Tips 13. It is possible to play The Pools at a dealer or on the Internet (danskespil.dk).

### *Oddset*

Oddset consists of betting games on outcomes of sport events and other events. Oddset is offered by Danske Spil. It is possible to play Oddset at the dealer or on the Internet (danskespil.dk).

### *Bookmaker games*

These games are also betting games on outcomes of sport events and other events where Danish players can play at the games offered by foreign suppliers on the Internet.

### *Lotteries*

Lotto was the first new type of game that was allowed publicly after The Pools. Lotto became available for the Danish population in October 1989. It is possible to buy Lotto coupons at a dealer or on the Internet site of Danske Spil. The category of Lotteries can also include other types of lotteries offered by private suppliers who have been allowed to this by the Danish authorities.

### *Keno*

Keno is a game where you have to have correct numbers on your Keno ticket. Danske Spil launched the game in 2004. It is possible to buy Keno tickets at the dealer or on the Internet (danskespil.dk).

### *Instant games*

An instant game is also called a scratchcard, a scratch off, scratch ticket, scratcher, scratchie, scratch-it, scratch game or scratch-and-win. An instant game is a small token, usually made of cardboard, where one or more areas contain concealed information: they are covered by a substance that cannot be seen through, but can be scratched off. The category of instant games consists of different types of games like Christmas calendars, lotteries or a simple scratchcard where you can check whether you have won immediately. It is possible to buy instant games at a dealer or on the Internet.

### *Gambling machines*

A gambling machine is also called a slot machine (American), fruit machine (British), or poker machine (Australian). A gambling machine has three or more reels which spin when a button is pushed. Gambling machines are also known as one-armed bandits because they were originally operated by a lever on the side of the machine (the one arm) instead of a button on the front panel, and because of their ability to leave the gamer penniless. Many modern machines still have a legacy lever in addition to the button. Gambling machines can be situated in many places like casinos, pintable arcades, ferries, restaurants et cetera. It is also possible to play on gambling machines on the Internet.

### *Casino*

A casino is a facility that houses and accommodates certain types of gambling activities. Casinos are most commonly built near or combined with hotels, restaurants, retail shopping, cruise ships and other tourist attractions. There are many types of games that are generally offered in a casino setting like for instance Roulette, Black Jack and Poker.

### *Poker on the Internet*

Poker is a family of card games. Poker games differ in how the cards are dealt, how hands may be formed, whether the high or low hand wins the pot in a showdown (in some games, the pot is split between the high and low hands), limits on bets and how many rounds of betting are allowed. In most modern poker games, the first round of betting begins with some form of forced bet. The action then proceeds to the left. Each player in turn must either match the maximum previous bet or fold, losing all further interest in the hand. A player who matches a bet may also raise, increasing the bet. The betting round ends when all players have either matched the last bet or folded. If all but one player fold on any round, the remaining player collects the pot without showing his hand. If more than one player remains in contention after the final betting round, the hands are shown and the winning hand takes the pot.

Many poker players feel that this betting system distinguishes poker from gambling games. With the minor exception of initial forced bets, money is only placed into the pot voluntarily by a player who, at least in theory, rationally believes the bet has positive expected value. Thus while the outcome of any particular hand is determined mostly by chance, the long-run expectations of the players are determined mostly by their actions chosen based on probability and psychology.

*Appendix 3: A complete list of the money put at stake by the gamblers who have a risk attitude towards gambling (i.e. NODS > 0)*

Gambling Portfolio of 146 out of 183 screened gamblers who replied to these questions.

G:	Pool	Oddset	Bookmaker	Number Games	Keno	Instant Games	Gambling Machines	Casino	Poker on the Internet	Other games	Total	# games
1.	.	2500	.	.	.	.	.	.	.	40000	42500	2
2.	.	10	.	.	.	.	.	1000	20000	.	21010	3
3.	.	1000	.	250	.	.	.	.	10000	.	11250	3
4.	500	4000	4000	.	.	.	.	.	.	.	8500	3
5.	.	500	200	.	.	50	.	250	5000	1000	7000	6
6.	300	300	.	2000	200	500	2000	1500	.	.	6800	7
7.	.	.	1000	.	.	50	.	.	5000	.	6050	3
8.	.	.	5000	.	.	.	.	.	.	.	5000	1
9.	.	3000	1000	500	.	.	.	.	500	.	5000	4
10.	.	.	.	12	.	.	.	.	3000	.	3012	2
11.	.	1000	1000	.	.	.	.	.	500	.	2500	3
12.	1500	500	.	.	.	.	.	.	150	.	2150	3
13.	.	500	300	150	.	200	200	750	.	.	2100	6
14.	100	300	600	200	.	.	.	.	.	800	2000	5
15.	400	300	300	300	.	.	.	300	300	.	1900	6
16.	.	.	300	200	.	.	50	500	800	.	1850	5
17.	.	1000	.	200	.	.	100	.	500	.	1800	4
18.	.	.	150	350	.	20	200	.	.	1000	1720	5
19.	800	.	.	800	.	.	.	.	.	.	1600	2
20.	1500	.	.	.	.	.	.	.	.	.	1500	1
21.	.	.	.	150	.	200	500	.	.	500	1350	4
22.	200	.	.	300	.	.	.	.	.	800	1300	3
23.	.	500	.	300	.	50	200	.	.	200	1250	5
24.	.	.	.	200	.	400	300	200	.	.	1100	4
25.	100	1000	.	.	.	.	.	.	.	.	1100	2
26.	350	200	.	150	.	.	.	.	350	.	1050	4
27.	.	.	.	800	200	.	.	.	.	.	1000	2
28.	500	.	.	.	.	.	.	.	500	.	1000	2
29.	.	.	.	.	.	.	.	.	1000	.	1000	1
30.	150	.	.	150	.	150	500	.	.	.	950	4
31.	100	150	.	200	.	.	.	500	.	.	950	4
32.	.	.	.	.	.	100	.	.	.	800	900	2
33.	.	200	200	.	.	.	200	200	.	.	800	4
34.	.	.	750	.	.	.	.	.	.	.	750	1
35.	.	100	400	200	.	5	.	.	.	.	705	4
36.	40	300	.	120	.	.	.	.	.	200	660	4
37.	200	.	.	50	100	200	100	.	.	.	650	5
38.	300	200	.	40	.	60	40	.	.	.	640	5

39.		100		50		300				150				600	4
40.						600								600	1
41.		500				100								600	2
42.						500		100						600	2
43.	150	150				200		100						600	4
44.								20		50	500			570	3
45.	500					50								550	2
46.				100		400		25						525	3
47.		500												500	1
48.						500								500	1
49.						200		100				200		500	3
50.												500		500	1
51.						200		100		200				500	3
52.										500				500	1
53.				100		200					200			500	3
54.						490								490	1
55.						200		120					165	485	3
56.		400				80								480	2
57.		100				50							300	450	3
58.						400		50						450	2
59.				200		240								440	2
60.						200	200	30						430	3
61.						400		20						420	2
62.	200	200												400	2
63.	200					200								400	2
64.						300						100		400	2
65.	200	200												400	2
66.		400												400	1
67.						250		150						400	2
68.						400								400	1
69.						400								400	1
70.						400								400	1
71.		50				200		30				100		380	4
72.	75	75				200		30						380	4
73.		200		100		30		30						360	4
74.		50						100			100	100		350	4
75.						50						300		350	2
76.						50		100					200	350	3
77.				20		200		100						320	3
78.		300												300	1
79.	50	100		100								50		300	4
80.		50		250										300	2
81.						300								300	1
82.		250				50								300	2
83.	200							25				50		275	3
84.		200										50		250	2
85.		20				200		30						250	3
86.						150							100	250	2

87.	.	.	.	.	50	.	100	100	.	250	3
88.	.	.	.	250	.	.	.	.	.	250	1
89.	.	.	.	200	.	.	.	.	50	250	2
90.	.	.	.	240	.	.	.	.	.	240	1
91.	.	.	.	200	.	25	.	.	.	225	2
92.	.	.	.	70	.	50	100	.	.	220	3
93.	.	.	.	100	.	20	100	.	.	220	3
94.	.	.	.	210	.	.	.	.	.	210	1
95.	.	.	.	200	.	.	.	.	.	200	1
96.	.	.	.	200	.	.	.	.	.	200	1
97.	.	.	.	200	.	.	.	.	.	200	1
98.	.	.	.	200	.	.	.	.	.	200	1
99.	.	.	.	200	.	.	.	.	.	200	1
100.	.	.	.	150	.	25	.	.	.	175	2
101.	.	.	.	120	.	40	.	.	.	160	2
102.	100	50	.	.	.	.	.	.	.	150	2
103.	.	.	.	100	.	50	.	.	.	150	2
104.	.	.	.	150	.	.	.	.	.	150	1
105.	.	.	.	.	.	.	.	50	100	150	2
106.	.	150	.	.	.	.	.	.	.	150	1
107.	.	.	.	144	.	.	.	.	.	144	1
108.	100	.	.	40	.	.	.	.	.	140	2
109.	.	.	.	.	.	10	20	100	.	130	3
110.	.	.	.	.	.	20	8	.	100	128	3
111.	.	.	.	80	.	40	.	.	.	120	2
112.	.	.	.	90	.	30	.	.	.	120	2
113.	50	20	.	50	.	.	.	.	.	120	3
114.	.	.	.	10	.	50	.	.	50	110	3
115.	.	.	.	80	.	25	.	.	.	105	2
116.	.	.	.	.	.	.	.	100	.	100	1
117.	.	.	.	.	.	.	100	.	.	100	1
118.	.	.	.	100	.	.	.	.	.	100	1
119.	.	.	100	.	.	.	.	.	.	100	1
120.	.	.	.	100	.	.	.	.	.	100	1
121.	.	.	.	.	.	.	.	.	100	100	1
122.	.	.	.	.	.	.	.	.	100	100	1
123.	.	.	.	100	.	.	.	.	.	100	1
124.	.	.	.	70	.	25	.	.	.	95	2
125.	.	.	.	.	.	.	.	.	90	90	1
126.	.	.	.	.	.	.	.	.	75	75	1
127.	.	75	.	.	.	.	.	.	.	75	1
128.	.	75	.	.	.	.	.	.	.	75	1
129.	.	.	.	.	.	50	.	.	.	50	1
130.	.	.	.	50	.	.	.	.	.	50	1
131.	.	.	.	25	.	25	.	.	.	50	2
132.	.	.	.	50	.	.	.	.	.	50	1
133.	.	.	.	45	.	.	.	.	.	45	1
134.	.	.	.	.	.	40	.	.	.	40	1

135.	.	.	.	40	.	.	.	.	.	40	1
136.	.	.	.	40	.	.	.	.	.	40	1
137.	.	.	.	40	.	.	.	.	.	40	1
138.	.	.	.	.	.	35	.	.	.	35	1
139.	.	.	.	35	.	.	.	.	.	35	1
140.	.	.	.	.	.	30	.	.	.	30	1
141.	.	.	.	25	.	.	.	.	.	25	1
142.	.	.	.	20	.	.	.	.	.	20	1
143.	.	.	.	20	.	.	.	.	.	20	1
144.	.	.	.	.	.	.	.	20	.	20	1
145.	.	.	.	20	.	.	.	.	.	20	1
146.	.	20	.	.	.	.	.	.	.	20	1