A BLACKJACK GAME STRATEGY EVALUATION

Nikola Kaspříková

Abstract

Blackjack is one of the most popular casino games. For an evaluation of a more complicated strategy under conditions which are close to reality, a computer simulation is often used. Many players of casino games try to implement an exit strategy. We present an evaluation of a particular exit strategy, which, when combined with a restriction on bet size, may allow the player to prevent ruining, using a computer simulation. Basic descriptive statistical characteristics of the results are provided. First the rules of the game are introduced and the settings and the basic strategy to be used in the game simulation are recalled. Then we design a particular exit strategy and finally the results of evaluation in the computer simulation are shown and the performance of the strategy which has been used is evaluated using basic descriptive statistical characteristics. The results of 10000 replications of the experiment have been evaluated. The results show a median gain at value 3 and rather moderate values of the 1st and the 3rd quartile. With median number of games at 47, when there could have been at most 100 games without the early stopping rule applied.

Key words: blackjack, simulation, exit strategy

JEL Code: C63, C64

Introduction

Blackjack is one of the most popular casino games. It has been attracting both practitioners and researchers for quite a long time. Many players and many academic papers search for the optimal strategy under various settings. The paper (Baldwin et al., 1956) introduces optimal strategy under specific conditions. Nevertheless for an evaluation of a more complicated strategy under conditions which are close to reality (such as that the cards are not to be drawn from an infinite deck), a computer simulation is often used. There are many computer simulation studies for blackjack available, see e. g. (Nolan and Lang, 2015). The papers in search for the optimum strategy or using computer simulation for the analysis include (VanderGenugten, 1997) and (Yang et al., 2011).

Last but not the least, when browsing the blackjack-related literature, it is obvious that blackjack and other casino games also receive much attention by academic papers in the field of addictive behaviour studies, see (Gainsbury et al., 2017).

Many players of casino games try to implement an exit strategy. Exit strategies are popular not just among the practitioners playing casino games, but are also investigated by investors searching for the optimal investment strategies. Such strategies are discussed in (Cao, 2013) and (Li, 2014). In this paper we design and evaluate a particular exit strategy for the blackjack game, which may, when combined with a restriction on bet size and split or double, also allow the player to prevent ruining. We perform the evaluation using a computer simulation. Basic descriptive statistical characteristics of the results are provided.

The structure of the paper is as follows: first the rules of the game are recalled and the settings and the basic strategy to be used in the game simulation is discussed. Then we design a particular exit strategy and finally the results of evaluation in the computer simulation are shown and the performance of the strategy which has been used is evaluated using basic descriptive statistical characteristics.

1 The game

The blackjack is a popular casino game which given that the player applies a correct strategy brings just a small advantage for the house over the player. The basic information about the game may be easily obtained for example from Wikipedia (Blackjack, 2017). We recall some basic facts about the game here. Blackjack is a sort of a card game. Usually one to eight standard 52-card decks are shuffled. In our simulation we use five decks. A dealer and the players take part in the game. Each player is dealt an initial hand of two cards, which are visible to the players. The dealer receives the first card face up.

The player is to win by creating card totals that turn out to be higher than the dealer's hand but do not exceed 21 (busting, the player loses), or alternatively by allowing the dealer to take additional cards until bust. When it is the player's turn, the player decides to take one of the following actions: "hit", which means taking another card, "stand", which means not taking another card, "double" (doubling the bet, take a card and stop) or "split" (when receiving two identical cards, split them into two hands, giving an additional bet). Number cards count as their original value; the jack, queen, and king count as 10; aces are for or 11, as the player chooses. The dealer has to get cards until the hand busts or reaches the value at least 17. If the dealer busts, all remaining player hands win. If the dealer does not bust, each remaining bet wins if its

hand is higher than the dealer's, and loses otherwise. Wins are paid out at 1:1, or equal to the bet, except for winning blackjacks, which are traditionally paid at 1.5 times the bet.

2 Game strategy

We recall the basic game strategy and the cards counting strategy schemes, which will be then combined with a proposed exit strategy.

1.1 Basic game strategy

The basic game strategy to be used by the player suggests actions of the player based on player's hand and the dealer's face-up card, and is shown in Wikipedia (Blackjack, 2017). Then the player may use some advanced techniques together with the basic strategy, to make the play even more profitable. One of the examples of such improvements is the cards counting.

1.2 Cards counting

One of the strategy improvements which may bring a significant advantage for the player is the card counting approach.

There are many cards counting techniques, some of them may be easily adopted even by rather inexperienced players, while others are rather complex. The Table 1 shows some of the systems for card counting, as given in (Card counting strategies, 2017). And as mentioned in the Wikipedia (Card counting, 2017), when a complex cards counting strategy is to be applied, it may take quite a long time and sometimes the player may even be inaccurate. In such cases, the more complex strategies may in the end be less productive than a simple strategy. In our simulation, we make use the REKO cards counting strategy scheme, described in more detail in (REKO card counting strategy, 2017). The REKO strategy is one of the rather simple strategies. Based on the resulting count, the single bet size value, which we also limit by maximum value of 10, is chosen.

3 Strategy evaluation results

We design a particular exit strategy to be implemented by the player and we evaluate it using a computer simulation. It is a sort of a stop-loss and stop-profit strategy. The player is to play 100 games until the stopping criterion is met. The player stops if the cumulative gain for the first time reaches at least 30 units. At the same time, the player is to stop if the cumulative loss for the first time reaches at least 30 units.

Tab. 1: Some of the popular card counting strategies

Strategy	1	2	3	4	5	6	7	8	9	10
Canfield Expert	0	0	1	1	1	1	1	0	-1	-1
Canfield Master	0	1	1	2	2	2	1	0	-1	-2
Hi-Lo	-1	1	1	1	1	1	0	0	0	-1
Hi-Opt I	0	0	1	1	1	1	0	0	0	-1
Hi-Opt II	0	1	1	2	2	1	1	0	0	-2
KISS 2	0	0/1	1	1	1	1	0	0	0	-1
KISS 3	-1	0/1	1	1	1	1	1	0	0	-1
K-O	-1	1	1	1	1	1	1	0	0	-1
Mentor	-1	1	2	2	2	2	1	0	-1	-2
Omega II	0	1	1	2	2	2	1	0	-1	-2
Red Seven	-1	1	1	1	1	1	0/1	0	0	-1
REKO	-1	1	1	1	1	1	1	0	0	-1
Revere RAPC	-4	2	3	3	4	3	2	0	-1	-3
Silver Fox	-1	1	1	1	1	1	1	0	-1	-1
UBZ 2	-1	1	2	2	2	2	1	0	0	-2
Uston Adv. Plus Minus	-1	0	1	1	1	1	1	0	0	-1
Uston APC	0	1	2	2	3	2	2	1	-1	-3
Uston SS	-2	2	2	2	3	2	1	0	-1	-2
Wong Halves	-1	.5	1	1	1.5	1	.5	0	-.5	-1
Zen Count	-1	1	1	2	2	2	1	0	0	-2

Source: https://www.qfit.com/cardcounting

The Table 2 shows the basic descriptive summary of the simulation results. 10000 replications of the experiment have been run in the simulation. The results show a median gain at value 3 and rather moderate values of the 1st and the 3rd quartile.

Tab. 2: Basic descriptive summary statistics of gains

1st Quartile	-31.5
Median	3
Mean	0.818
3rd Quartile	31.5

Source: simulation results

To get a more detailed idea about the resulting values of the gains, one can look at the Figure 1, which shows the plot of the probability density estimate of the gains from the game.

Tab. 3: Basic descriptive summary statistics of the number of games

1st Quartile	24
Median	47
Mean	52.6
3rd Quartile	84

Source: simulation results

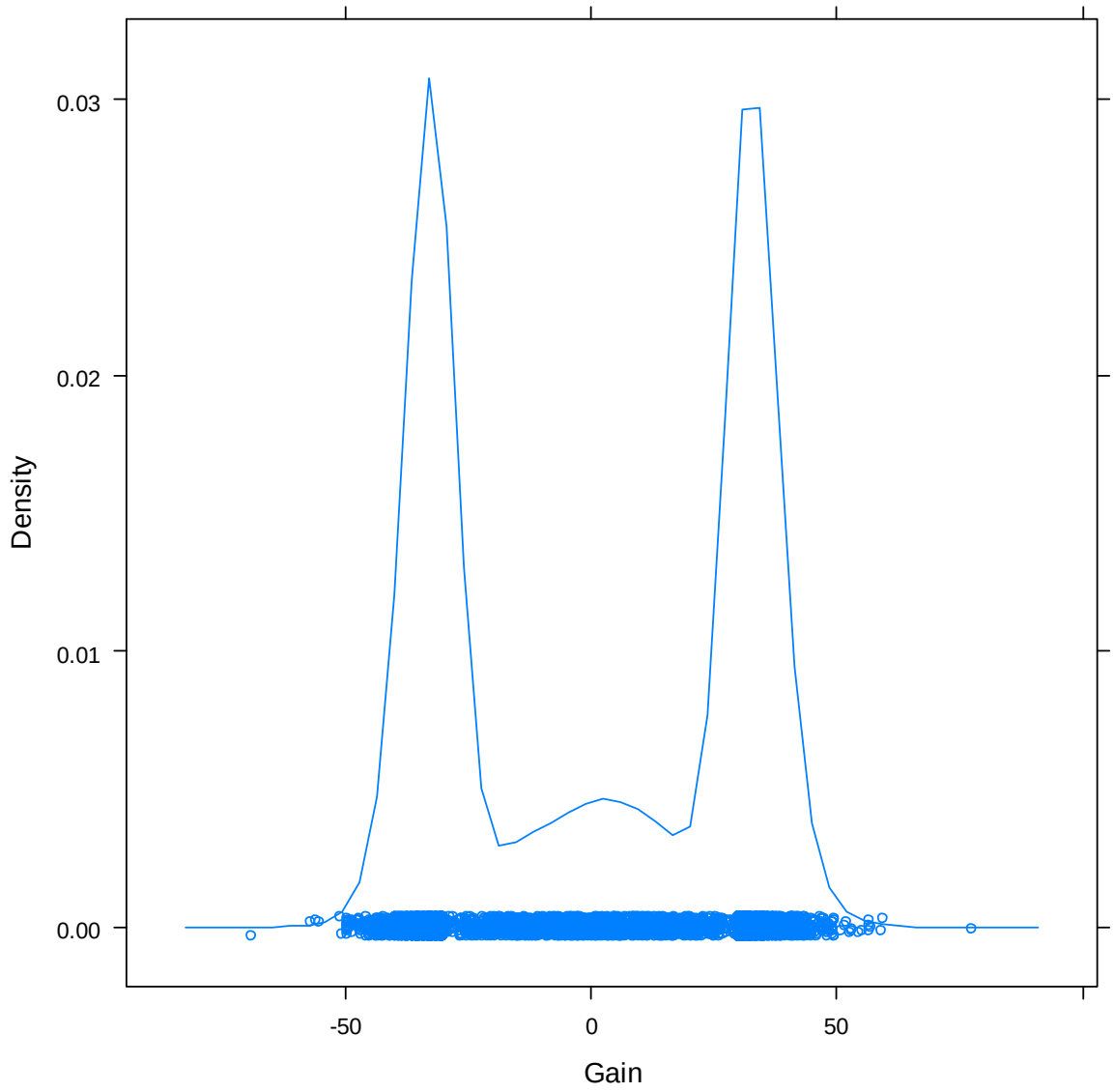
It is also interesting to look at the resulting number of games played. The number of games (up to 100) is most often just 100, that is the early stopping rule does not apply, then another peak in the probability density estimate plot is at around 20 games, that is the stop loss or the stop profit rule applies after around just 20 games. The median value of the number of games is 47. The Table 3 shows the descriptive statistics values for the number of games.

Conclusion

A particular exit strategy to be implemented by the blackjack player has been designed and it has been evaluated using a computer simulation. It is a sort of a stop-loss and stop-profit strategy. The player is to play 100 games until the stopping criterion is met. The player stops if the cumulative gain for the first time reaches at least 30 units. At the same time, the player is to stop if the cumulative loss for the first time reaches at least 30 units. This strategy would allow

preventing the player from ruining if accompanied by the rules to limit the bet size and splits and doubles. The computer simulation allows a quick and convenient evaluation of the strategy.

Fig. 1: Probability density estimate of the gain values



Source: simulation results

The results of 10000 replications of the experiment have been evaluated. The results show a median gain at value 3 and rather moderate values of the 1st and the 3rd quartile. With median number of games at 47.

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Contact

Nikola Kaspříková

University of Economics in Prague, Department of Mathematics

Nám. W. Churchilla 4, 130 67 Praha

nb33@tulipany.cz