Automating Online Video Poker for Profit

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1. INTRODUCTION

IN 2004 THE AUTHOR PUBLISHED A PAPER on a win-win situation for both the player and the casino in video poker machines.[1] It was shown that video poker is interesting to analyze due to the changing strategies produced by progressive jackpots. These allow players to have the odds in their favor, while paradoxically allowing the casinos to increase their percentage margin on extra turnover as the jackpot rises. This situation makes progressive jackpots beneficial for both the player and the casino.

The arrival of online casinos in 1996 brought games that you would find at land-based casinos (roulette, blackjack, video poker, etc.) to the computer screens of gamblers all over the world.[2] While the focus in Barnett and Clarke is for the player to obtain a long-term profit from video poker in land-based casinos, a better approach is through online casinos—as this makes automation of systems possible across several computers. For example, if the hourly win rate using one machine is $10/hour, then the same code used to automate one machine could be used on ten machines for an hourly win rate of 10 * $10/hour = $100/hour.

This article analyzes automating online progressive video poker games for profit. This requires the development of computer code to automate the process. The algorithm and implementation of the code will not be addressed in this article, but rather identifying which game could be used as the starting point. For example, a game that is favorable on a regular basis of several days per week on average would appear to be better than a game which is only favorable on several days per year on average. Bankroll management and playing strategies are also analyzed in this article.

2. OUTLINE OF VIDEO POKER

Video poker is based on the traditional card game of draw poker. Each play of the video poker machine results in five cards being displayed on the screen from the number of cards in the pack used for that particular type of game (usually a standard 52-card pack, or 53 if the joker is included as a wild card). The player decides which of these cards to hold by pressing the "hold" button beneath the corresponding cards. The cards that are not held are randomly replaced by cards remaining in the pack. The final five cards are paid according to the payout table for that particular type of game. The pay tables typically follow the same order as traditional draw poker. For example a full house pays more than a flush. Epstein,[3] Croucher,[4] Frome,[5] and Jensen[6] have calculated probabilities and strategies for a range of poker-like games.

Barnett and Clarke[7] analyze a Joker Wild video poker game. The initial cost to play is 1, 2, 3, 4,

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[1] T. J. Barnett and S. R. Clarke, *Optimizing returns in the gaming industry for players and operators of video poker machines* 212–216 (2004). Proceedings of the International Conference on Advances in Computer Entertainment Technology. National University of Singapore.

[2] MARK BALESTRA, HOW TO WIN AT ONLINE GAMBLING (2005).

[3] RICHARD A. EPSTEIN, THE THEORY OF GAMBLING AND STATISTICAL LOGIC (1997).

[4] JOHN S. CROUCHER, THE STATISTICS OF GAMBLING (2002).

[5] LENNY FROME, WINNING STRATEGIES FOR VIDEO POKER (1997).

[6] MARTEN JENSEN, VIDEO POKER FOR THE WINNER (1999).

[7] Barnett and Clarke, *supra* note 1.

TABLE 1. THE PAYOUT AND PROBABILITIES FOR JOKER WILD VIDEO POKER USING OPTIMAL STRATEGY
FOR DIFFERENT HAND TYPES

Hand Name	Payout ($) 1 coin	Payout ($) 10 coins	Probability 1–4 coins	Probability 10 coins	Return (%) 1–4 coins	Return (%) 10 coins
Royal Flush	500	10,000	1 in 38,069	1 in 37,615	1.31	2.66
Joker Royal	500	5,000	1 in 8,870	1 in 8,790	5.64	5.69
5 of a Kind	10	1,000	1 in 10,795	1 in 10,794	0.93	0.93
Straight Flush	50	500	1 in 1,603	1 in 1,607	3.12	3.11
4 of a Kind	27	270	1 in 119	1 in 119	22.74	22.75
Full House	5	50	1 in 65	1 in 65	7.69	7.69
Flush	4	40	1 in 55	1 in 55	7.26	7.27
Straight	3	30	1 in 43	1 in 44	7.02	6.87
3 of a Kind	2	20	0.129	0.129	25.84	25.88
Two Pair	1	10	0.107	0.107	10.71	10.73
Nothing	0	0	0.697	0.698	0.00	0.00
			1	**1**	**92.3**	**93.6**

or 10 coins where 1 coin = $1. The payouts are proportional to the amount bet, with the exception of 10 coins paying extra for obtaining a royal flush. The probability associated with each outcome depends on the strategies of which cards are held for each of the $^{53}C_5$ card combinations (there are 53 cards in a standard deck, with one joker included).

WinPoker is a commercial product available from the Web at < www.zamzone.com >, which calculates (by complete enumeration) the number of all possible resultant hands, and hence the expected return value, for each of the $2^5 = 32$ hold combinations. The highest expected value (EV) is the best way to play that hand. Similar calculations and strategies can be obtained from various other online sites, such as VP Genius.[8] A pay table for the winning hands, their contribution to the total return, and their probabilities for Joker Wild are shown in Table 1. From this game, 70% of the time the player will not receive any return. The most likely winning hand is three of a kind, which occurs 13% of the time, even though its payout is twice as much as two pair. Similar anomalies occur with joker royal and five of a kind. Three of a kind generates the highest contribution to the total return, by contributing 26%, and a royal flush, although not the lowest, contributes only 1.31% for 1–4 coins and 2.66% for 10 coins. For this situation, WinPoker calculated a return with perfect strategy of 92.3% for 1 coin and 93.6% for 10 coins, and corresponding variances of $44.04 and $6428.29.

In progressive video poker a group of machines are connected to a common jackpot pool that continues to grow until someone gets a specific outcome (such as a royal flush). When this occurs, the jackpot is reset to its minimum value. The initial cost is fixed, although a specific condition is often required, such as playing maximum coins. For example, 10 coins, or $10 per play, would be required for the Joker Wild game above. Since the payout for obtaining a royal flush changes with the jackpot meter, the probability associated with each outcome (assuming an optimal strategy) will change as the jackpot meter increases, consequently increasing the probability of hitting a royal flush.[9] WinPoker calculated that a jackpot of at least $33,700 is needed for Joker Wild to be favorable and potentially make a long-term profit for the player. Clearly, there are added complexities in analyzing progressive video poker games (dependency of trials) compared to non-progressive video poker games (independent trials).

Finally, some games have a multi-hand feature that allow up to a possible 100 hands. Just as in single-hand video poker, you choose which of the five cards to hold from the base hand, and this is copied to each of the remaining hands played. When you're ready to draw new cards, click the Deal button. For each hand you play, a random set of replacement cards is drawn for each successive hand.

3. ONLINE VIDEO POKER GAMES

3.1 Software providers

Most online casinos use independent software providers to establish which games are available

[8] < http://www.vpgenius.com >.
[9] Barnett and Clarke, *supra* note 1.

AUTOMATING ONLINE VIDEO POKER FOR PROFIT 17

TABLE 2. GENERAL INFORMATION FOR A RANGE OF ONLINE PROGRESSIVE VIDEO POKER GAMES

Game	Software	Hands	Amount Bet	Return at minimum jackpot	Jackpot at break-even	Probability jackpot at break-even
Jackpot Poker (25c)	Boss Media	1	$1.25	95.4828%	$3,098	1 in 31,817
Jackpot Poker (50c)	Boss Media	1	$2.50	95.4828%	$6,196	1 in 31,817
Jackpot Poker ($1)	Boss Media	1	$5	95.4828%	$12,392	1 in 31,817
Jackpot Poker ($5)	Boss Media	1	$25	95.4828%	$61,960	1 in 31,817
MegaJacks	PlayTech	1	$1.25	98.3735%	$1,220	1 in 35,939
Jacks or Better 10-play	PlayTech	10	$12.50	96.1472%	$17,296	1 in 31,942
Super Jackpot Bonus (25c)	Cryptologic	1	$1.25	98.3164%	$1,830	1 in 36,481
Super Jackpot Bonus ($1)	Cryptologic	1	$5	98.3164%	$7,320	1 in 36,481
Super Jackpot (25c)	Cryptologic	1	$1.25	97.2984%	$2,167	1 in 32,573
Super Jackpot ($1)	Cryptologic	1	$5	97.2984%	$8,666	1 in 32,573
Jackpot Deuces	Microgaming	1	$5	94.3421%	$39,617	1 in 109,516
Super Jax	Microgaming	1	$5	92.7916%	$52,417	1 in 109,510
Jacks or Better (G)	Gamesys	1	$2.50	96.1472%	$28,230	1 in 116,079

to the player for their own casino. VP Genius outlines many progressive jackpot video poker games with the corresponding software provider. This is represented in Table 2, along with the number of hands, amount bet, return to player at the minimum jackpot level, jackpot at break-even and the probability of hitting a jackpot at break-even. There are six software providers offering progressive video poker games, consisting of:

Boss Media: offers four games of a progressive Jacks or Better game where the jackpot is won with any royal flush. Players need to form a minimum poker hand of two jacks in order to win. Any cards lower than this will not be considered a winning combination and the player will lose his or her bet. The cost to play each game is in proportion to the payouts, and therefore all four games give the same return to player at the minimum jackpot level.

PlayTech: offers two quite different games. MegaJacks is similar to Jackpot Poker (25c), as both games require $1.25 as the initial cost and the same type of winning outcomes. However, MegaJacks give returns of $31.25, $11.25, and $7.50 for a four of a kind, full house, and flush, respectively. In comparison, Jackpot Poker (25c) gives returns of $25, $8.75, and $6.25 for a four of a kind, full house, and flush respectively. Consequently MegaJacks gives a higher return to players at the minimum jackpot level. Jacks or Better 10-play requires multiple hands, where 10 games are played. The initial cost is $12.50. Only the base hand qualifies for the jackpot, such that if you get a royal flush on the base hand then the remaining

nine hands are always paid $3,200, and if you get a royal flush on one of the remaining hands, then only that particular hand is paid $3,200.

Cryptologic: offers four games where the same jackpot is used for Super Jackpot (25c) and Super Jackpot Bonus (25c), and the same jackpot is used for Super Jackpot ($1) and Super Jackpot Bonus ($1). In Super Jackpot Bonus, discards are returned to the deck before new cards are drawn and bonus payouts are made if any or all of those cards are dealt back into your hands. Also 1, 3, 5, or 10 hands can be played on all four games, with the jackpot being awarded if a royal flush is obtained on the base and any remaining hands.

Microgaming: offers two games of Jackpot Deuces and SupaJax. To win the jackpot in Jackpot Deuces, the player needs to get a royal flush in diamonds. In SupaJax, a 53-card deck is used, where the extra card is the SupaJax card. To win the jackpot, the player must get four jacks with the SupaJax card.

Gamesys: the progressive game is based on Jacks or Better, and to win the jackpot you need to get a royal flush in spades.

Each software provider above services many casinos with the same progressive jackpot game. Therefore a player could have an account with 10 casinos that utilize the same game, and this is very useful for automating a system across several computers.

3.2 Characteristics

To compare different video poker games requires a set of characteristics. The following will be used

TABLE 3. FOUR CHARACTERISTICS FOR COMPARING A RANGE OF ONLINE PROGRESSIVE VIDEO POKER GAMES

Game	Probability reaching break-even	Burn rate	Probability jackpot in 40,000 trials	Expected loss without a jackpot
Jackpot Poker (25c)	9.79%	7.79%	71.6%	$9,256.99
Jackpot Poker (50c)	9.79%	7.79%	71.6%	$18,513.97
Jackpot Poker ($1)	9.79%	7.79%	71.6%	$37,027.95
Jackpot Poker ($5)	9.79%	7.79%	71.6%	$185,139.74
MegaJacks	36.42%	2.72%	67.1%	$3,649.10
Jacks or Better 10-play	12.99%	6.59%	71.4%	$78,726.98
Super Jackpot Bonus (25c)	27.82%	4.01%	66.6%	$5,461.57
Super Jackpot Bonus ($1.25)	27.82%	4.01%	66.6%	$21,846.30
Super Jackpot (25c)	23.86%	5.32%	70.7%	$6,471.66
Super Jackpot ($1.25)	23.86%	5.32%	70.7%	$25,886.63
Jackpot Deuces	4.24%	7.23%	30.6%	$118,217.08
Super Jax	2.08%	9.57%	30.6%	$156,413.58
Jacks or Better (G)	1.09%	4.86%	29.1%	$42,061.53

T3 ▶ and represented in Table 3 for each game given in Table 2:

Probability reaching break-even—each play of the game results in a proportion of the initial cost contributed to the jackpot pool, which continues to grow until someone hits a specific outcome (such as a royal flush). When this occurs, the jackpot is reset to its minimum value. Barnett and Clarke[10] calculated the proportion of time the jackpot reaches a certain level for different amounts of money added to the jackpot pool for the Joker Wild game outlined in Section 2. Online casinos or online software providers do not readily give the proportion of money contributed to the jackpot pool, for their progressive video poker games. We will assume that 2% of the initial cost is contributed to the jackpot pool and calculate the proportion of time the jackpot reaches a break-even game.

Burn rate—the burn rate is the expected percentage of money lost to the player each play of the game without hitting the jackpot. Since the chance of hitting the jackpot decreases as the jackpot increases, the burn rate is taken at break-even. From Table 3, MegaJacks has the lowest burn rate at 2.72%.

Probability jackpot in 40,000 trials—this is the probability of hitting a jackpot in 40,000 trials.

Expected loss without a jackpot—this is the expected amount of money lost without a hitting a jackpot, given that the probability of hitting the jackpot over a number of trials is 95%.

A game that is favorable on a regular basis of several days per week on average would appear to be better than a game which is only favorable on several days per year on average. The rate at which a game is played is not constant, but rather highly dependent on the return to player. For example, from observation, the rate at which the jackpot increases when the game is favorable will be greater than the rate at which the jackpot increases when the game is unfavorable to the player. The probability of a game reaching break-even can be used as a guide as to which games are more likely to be favorable to the player as a proportion of days in a year. From Table 3, MegaJacks has the highest probability of reaching break-even, at 36.42%, followed by Super Jackpot Bonus at 27.82%. Obtaining a long-term profit in progressive video poker requires hitting jackpots. The bankroll will decrease in between hitting jackpots, and losing an entire bankroll is still very possible, even though the game is favorable. The burn rate, the probability of a hitting a jackpot in a number of trials, and the expected loss without hitting a jackpot can be used as a guide as to whether to play a particular game, and—more importantly—which game should be used as the starting game for automating a system. Out of all the games represented in Table 3, MegaJacks has the highest probability of reaching break-even, the lowest burn rate, and the lowest expected loss without hitting a jackpot. Also, the probability of hitting a jackpot in a number of trials for MegaJacks is relatively high in comparison to the other games. Therefore, there is indication that MegaJacks could be used as the starting game for automating an online system for profit. Section 4 will give a detailed

[10]Barnett and Clarke, *supra* note 1.

TABLE 4. THE PAYOUT, PROBABILITIES, AND RETURN
FOR EACH HAND TYPE FOR MEGAJACKS, GIVEN 100%
TOTAL RETURN TO THE PLAYER

Hand	Payoff	Probability	Return
Royal Flush	$1,220	0.0028%	2.7157%
Straight Flush	$50	0.0111%	0.5564%
Four of a Kind	$25	0.2355%	5.8878%
Full House	$9	1.1485%	10.3367%
Flush	$6	1.1122%	6.6729%
Straight	$4	1.1308%	4.5234%
Three of a Kind	$3	7.4165%	22.2495%
Two Pair	$2	12.8919%	25.7839%
Jacks or Better	$1	21.2737%	21.2737%
Nothing	$0	54.7769%	0%
		100%	100%

analysis of MegaJacks, which could be used in bankroll management in determining the size of the jackpot to start playing the game.

4. MEGAJACKS

T4▶ Table 4 represents the payouts, probabilities, and return for each hand type for MegaJacks, given a T5▶ 100% total return. Table 5 represents the return to player at different jackpot levels with the corresponding probability of reaching a specified jackpot T6▶ level. Table 6 represents the probability of hitting a jackpot in a number of trials and the corresponding expected amount lost without hitting a jackpot. The current jackpot meter for progressive video poker games can be obtained online through various sites, such as Slot Charts[11] and Awesome Jackpots.[12]

4.1 Playing Strategies

As mentioned in Section 2, playing strategies can be obtained using software such as WinPoker or online sites as VP Genius. However, the strategies

TABLE 5. RETURN TO PLAYER AT DIFFERENT JACKPOT
LEVELS, WITH THE CORRESPONDING PROBABILITY
OF REACHING A SPECIFIED JACKPOT LEVEL FOR MEGAJACKS

Jackpot	Return to player	Probability of reaching a jackpot level
$1,220	100.0000%	36.42%
$2,000	101.8635%	15.29%
$5,000	109.4248%	0.54%
$10,000	123.0732%	1 in 48,157
$20,000	152.0209%	1 in 12,575,570

TABLE 6. THE PROBABILITY OF HITTING A JACKPOT
IN A NUMBER OF TRIALS AND THE CORRESPONDING
EXPECTED AMOUNT LOST WITHOUT HITTING
A JACKPOT FOR MEGAJACKS

Trials	Probability	Expected lost without a jackpot
40,000	67.1%	$1357.85
80,000	89.2%	$2715.70
100,000	93.8%	$3394.63
120,000	96.5%	$4073.55

may change as the jackpot meter continues to grow.[13] Consider the hand JH, QH, KH, KS, KC. As given in Table 7, when the jackpot is $1,220 ◀T7 (100% return to player,) holding the KH, KS, KC gives an expected return of 4.3025 units, compared to holding the JH, QH, KH, which gives an expected return of 3.8511 units. In comparison, when the jackpot reaches $5,000 (109.42% return to player), holding the KH, KS, KC gives an expected return of 4.3025 units, compared to holding the JH, QH, KH, which gives an expected return of 4.4052 units.

4.2 Kelly criterion

Barnett[14] analyzed casino games to identity when games are favorable to the player and could possibly generate a long-term profit. Analyses were given for both the classical Kelly (two outcomes) and the Kelly criterion when multiple outcomes exist (more than two). The Kelly criterion when multiple outcomes exist was applied to favorable video poker machines. In the case of non-progressive machines, an optimal betting fraction was obtained for maximizing the long-term growth of the player's bankroll. In the case of progressive machines, the minimum jackpot size was obtained as an entry trigger to avoid over-betting, based on the player's bankroll. Table 8 represents the minimum bankroll ◀T8 size requirement for different jackpot levels in MegaJacks, such that a player would not be over betting under the Kelly criterion.

Another common problem that often arises in gambling is obtaining the probability of losing one's entire bankroll given a favorable game. A recursive solution (which assumes independent trials)

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[11] <http://www.slotcharts.com>.

[12] <http://www.awesomejackpots.com>.

[13] Barnett and Clarke, *supra* note 1.

[14] Tristan Barnett, *How much to bet on video poker*. 24 CHANCE, May 2011, at ◀AU1

TABLE 7. THE NUMBER OF ALL POSSIBLE RESULTANT HANDS FOR TWO HOLD COMBINATIONS
FROM THE HAND JH, QH, KH, KS, KC

Return $1,220	Return $5,000	Hold	Total	N	J+	2P	3K	S	F	FH	4K	SF	RF
4.3025	4.3025	__KKK	1081	0	0	0	969	0	0	66	46	0	0
3.8511	4.4052	JQK__	1081	699	286	15	6	30	43	0	0	1	1

TABLE 8. KELLY CRITERION ANALYSIS FOR MEGAJACKS

Jackpot	Return	Bankroll
$1,300	100.18%	$22,166
$1,500	100.65%	$7,383
$2,000	101.86%	$3,534
$2,500	103.09%	$2,689
$3,000	104.34%	$2,318

was derived by Evgeny Sorokin and posted on Arnold Snyder's Blackjack Forum Online.[15] This derivation could also be used as a guide to determine the jackpot size for playing the particular video poker game.

5. CONCLUSIONS

The arrival of online casinos in 1996 brought games that you would find at land-based casinos to the computer screens of gamblers all over the world. A major benefit in online casinos is in the automation of systems across several computers for favorable games, as this has the potential to make a significant amount of profit. This article applied this concept to online progressive video poker games. By establishing a set of characteristics to compare different games, analyses were carried out to identify which game should be the starting point for building an automated system. There are further incentives in online gambling through bonuses, cash backs, and affiliate income which should be explored if profiting from online gambling is going to be a long term business.

Whilst the legal implications of automating online systems have not been addressed in this article, the reader may be interested in this dispute on a player winning $46,000 through online video poker at Easy Street Sports casino: <http://wizardofodds.com/casinos/easy-street-sports.html>.

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[15] <http://www.blackjackforumonline.com/content/VPRoR.htm>.

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