



LIQUID AND GRIT

Slots Design Report

Competitive research and data insights for slots designers

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INTRODUCTION



Dear Slots Designers,

The famous Spanish artist, Salvador Dali, stated, “At the age of six I wanted to be a cook. At seven I wanted to be Napoleon. And my ambition has been growing steadily ever since.”

In 1895, the first slot machine was created with reels of horseshoes, diamonds, spades, hearts, and a Liberty Bell. Land-based machines evolved to classic, video, and now premium. At the inception of social casino, companies emulated and licensed land-based machines.

Today, social casino is a leader and genesis of new mechanics for all markets due to the numerous machines released, ability to test, and competition.

It is not hard to imagine real-money versions of Slotomania’s *Farm Fortune*, Big Fish Casino’s *Gummy Drop*, and Huuuge Casino’s *God of Sky* played at the Aria, Caesars Palace, and Bellagio.

Social casino is still quite young, but our ambitions for growth continue strong.

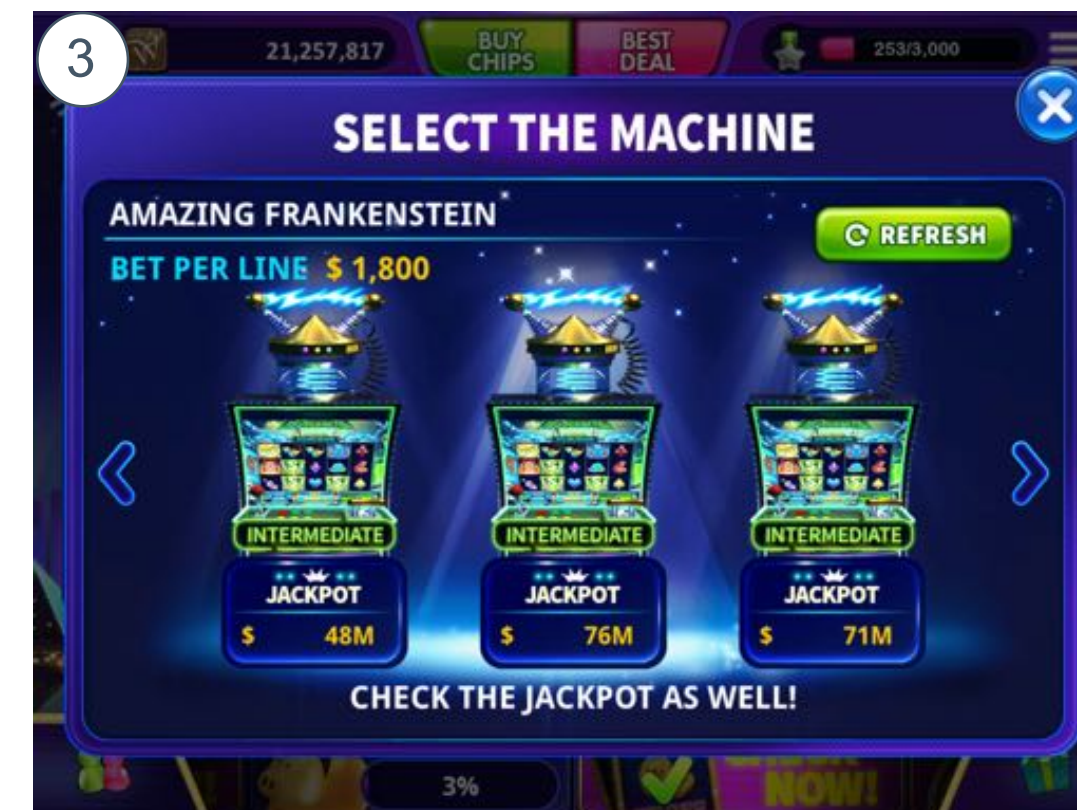
Brett Nowak
Editor-in-Chief

NEW INNOVATIONS

NEW INNOVATIONS I

Go beyond four reel sets. Entertain players during downloads. Offer multiple machines

- **Explore multiple reel sets:** Take inspiration from CLUE Bingo, which offers players up to 12 bingo cards (image 1).
- **Allow play during downloads:** In DoubleU Casino, players may download a machine while playing other games. Players check a box to download all machines (image 2).
- **Give players more control with machine choices:** Upon machine-entry in DoubleU Casino, players pick one of 12 machines. Each machine has a different progressive jackpot. Once a machine is selected, players then choose a bet amount (image 3).
- **Add purchasable bonus wheel spins:** After a spin in Bingo Blitz's *Rockin' Rooster*, players may purchase additional spins for \$4.99. There is also a collection mechanic added to the bonus wheel to incentivize repeat purchases (image 4).
- **Add progressive jackpot numbers to out-of-coins dialogues:** When players run out of coins in House of Fun's *The Crown of India*, the out-of-coins dialogue displays all five progressive jackpots (image 5).
- **Display a win ladder in the bonus game to market high potential payouts:** In Pharaoh's Way's *Animal King*, the bonus game lets players try to advance along a win tower by guessing higher or lower (image 6). This mechanic is successful because it showcases a potentially high win that appears to be achievable.



NEW INNOVATIONS II

Expand bonus wheel capabilities. Improve pay tables. Add rewards along progression mechanics

- **Explore bonus wheels that reward reel sets, sticky wilds, and free spins:** In House of Fun's *Cashtonium*, the bonus wheel pays out a different number of reel sets and stacked wild combinations (images 1 and 2).
- **Improve the pay table explanations:** In NetEnt's *Starburst*, a reel set displays a GIF of the winning combination (image 3).
- **Reward free spins along a progression mechanic:** In DoubleU Casino's *Amazing Frankenstein*, players receive two free spins at the 6th, 9th, and 12th step and three free spins at the 15th (image 4).
- **Only land one symbol during free spins:** In the *Lightning Free Spin Bonus* in Jackpot Party's *Kronos: Father of Zeus*, the Zeus symbol is the only symbol and sticks during each spin (image 5).
- **Add two sets of progressive jackpots:** In House of Fun's *Double Rapid Fire*, players may hit any of the nine progressive jackpots on *Rapid Fire* or *Rapid Ice* (image 6).
- **Consider adding customer support in the pay table:** In Pharoah's Way, players may contact customer support in the pay table.



MARKET WATCH

Covering 2/1/17 - 2/28/17

TRENDS: TOP 30 GROSSING GAMES

New reels trends: 3 x 3 (8%) and diamond-shaped (6%). Popular February themes: Classic (12%) and IP (12%). Up MoM: more IP (10% to 12%). New mechanic: Respins (3%)



REELS		THEMES		MECHANICS*		IP	
3 x 5	33%	Classic	12%	Stacked symbols	12%	GoldFish	Battleship
4 x 5	25%	IP	12%	Progressive jackpots	11%	Wizard of Oz	Please Knock!
2 x 3	8%	Mythology	9%	Pick'em bonus	6%	Wonka Slots	So Shines A Good Deed
3 x 3	8%	Animal	4%	Multipliers	5%	Wizard of Oz	Welcome To Emerald City
Diamond-shaped	6%	Asian	4%	Respins	3%		

*24% of machines had free spins and 4% of machines had jackpot(s) but this was omitted from the summary

TRENDS: FEATURED GAMES

4 x 5 (47%) became the most popular reel set (last month was 3 x 5 at 38%). Stacked symbols (10%) and added wilds (4%) remain popular MoM. IP releases in Hot Shot Casino, Quick Hit Slots, and Hit It Rich



REELS		THEMES		MECHANICS*		IP	
4 x 5	47%	IP	24%	Progressive jackpots	16%	Hot Shot Casino	Star Trek II: The Wrath of Khan
3 x 5	24%	Mythology	18%	Stacked symbols	10%	Quick Hit Slots	Playboy: Don't Stop The Party
4 x 6	12%	Classic	12%	Pick'em bonus	7%	Quick Hit Slots	Monopoly: Big Money Reel
2 x 3, 3 x 6, and 3, 4, 4, 4, 3	1 machine each	Egyptian, Holiday, Ocean, and SciFi	1 machine each	Added wilds	4%	Hit It Rich	I Love Lucy: Grape Stomp

Featured games include: DoubleDown Casino, Heart of Vegas, House of Fun, Slotomania, Hit It Rich, Caesars Slots, Quick Hit Slots, and Hot Shot Casino
*25% of machines had free spins as a mechanic but this was omitted from the summary

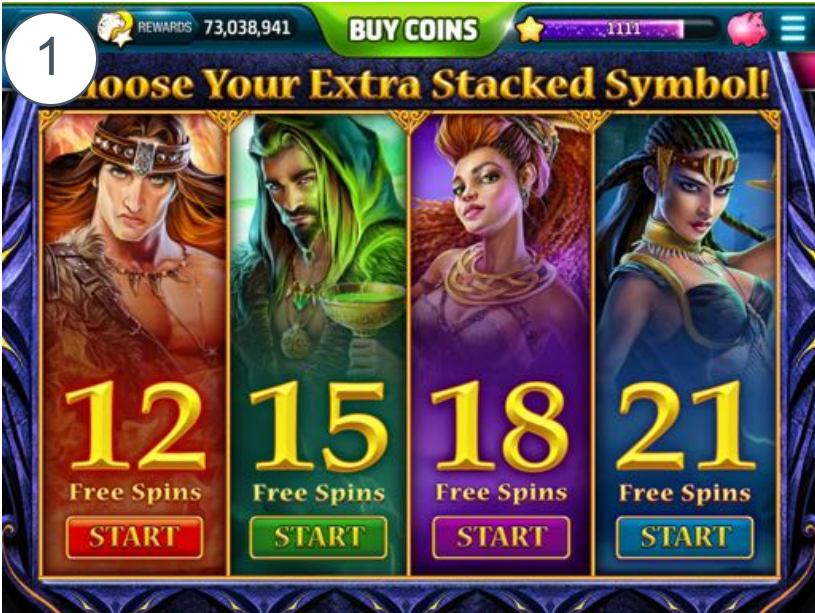
DETAILS: FEATURED GAMES

GAME	MACHINE	REELS	LINES	THEME	TYPE	NOTABLE FEATURES
DoubleDown Casino	<i>Pink Diamond: Free Game</i>	2 x 3	25	Classic	Classic	Classic style machine with full reel multiplier symbols and free games (see Deep Dives for details)
Heart of Vegas	<i>Pure Gold</i>	3 x 5	<i>Reel Power</i>	Other	Core Video	Jackpots won when three or more chip symbols land in a horizontal row during a non-bonus spin (image 1)
House of Fun	<i>The Crown of India</i>	3 x 5	243 ways	Other	Core Video	<u>Reskin of <i>Glorious Egypt</i> and <i>Golden Sirens</i></u> . Choose your bet mechanic with active gold symbols (see Deep Dives for details)
	<i>Cashtonium</i>	4 x 5	50	Science Fiction	Core Video	<i>Cashtonium Wheel Feature</i> ; a spin on a bonus wheel that awards different number of reel sets and full reel wilds (image 2)
	<i>Double Rapid Fire: Fire and Ice</i>	3 x 6	25	Classic	Core Video	<i>Rapid Fire</i> and <i>Rapid Ice</i> progressive jackpots are triggered by five or more <i>Rapid</i> symbols. Three or more bonus symbols trigger the bonus wheels that award free spins or a progressive jackpot prize (image 3)
	<i>Suits of Fortune</i>	4 x 5	40	Other	Core Video	Fill the meter within the time limit by collecting wild cards to win a progressive jackpot bonus game (image 4)



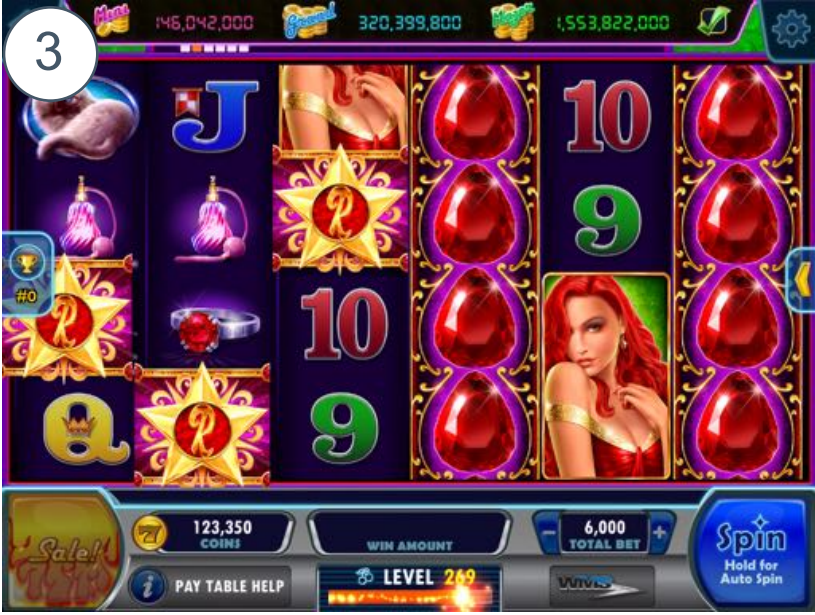
DETAILS: FEATURED GAMES

GAME	MACHINE	REELS	LINES	THEME	TYPE	NOTABLE FEATURES
Slotomania	<i>Heroes of Cimmeria</i>	4 x 5	50	Mythology	Core Video	Scatter symbols on reels 1, 3, and 5 trigger a u-pick the free spins bonus; players choose what symbol to be extra-stacked and the number of free spins (image 1)
	<i>Precious Stone</i>	4 x 6	80	Mythology	Core Video	<u>Reskin of <i>Despicable Wolf</i></u> . Includes a collection mechanic to trigger a pick'em bonus, and free spin that includes a locking wild when a special bonus symbol is included in the triggering spin (see Deep Dives for details)
Caesars Slots	<i>Princess Goldie</i>	3, 4, 4, 4, 3	40	Ocean	Core Video	<u>Reskin of <i>Wild Skulls</i></u> . Fill meter mechanic during base game to trigger a pick'em bonus with multipliers of x3, x5, win all, and pick again (image 2)
	<i>Golden Gaze</i>	3 x 5	243 ways	Mythology	Premium	<u>Reskin of <i>Gold for Greece</i></u> . Free spins are with 3125 ways to win and up to 50 free spins. Pick'em bonus to win a progressive jackpot prize (image 3)
Hit It Rich	<i>Stupid Cupid</i>	4 x 5	40	Holiday	Core Video	During free spins, a full reel wild can land with a x2 multiplier (image 4)
	<i>I Love Lucy: Grape Stomp</i>	3 x 5	30	IP	Premium	During free spins, full reel wilds may trigger and remain for one spin



DETAILS: FEATURED GAMES

GAME	MACHINE	REELS	LINES	THEME	TYPE	NOTABLE FEATURES
Quick Hit Slots	<i>Playboy: Don't Stop The Party</i>	4 x 5	40	IP	Premium	<i>Don't Stop The Party Bonus</i> awards free spins with multipliers; one spin is awarded from each 3 x 3 reel displayed in up to four reels (image 1)
	<i>Monopoly: Big Money Reel</i>	4 x 5	20	IP	Premium	<i>Big Money Reel Spin Bonus</i> is a wheel that awards credit prizes, the <i>Utilities Bonus</i> , or the <i>Go Free Spins Bonus</i> . The <i>Go Free Spins Bonus</i> has a pick'em before every free spin. The <i>Utilities Bonus</i> has players pick a hand to reveal 'Spin,' 'Collect,' and 'Collect x2' (image 2)
Hot Shot Casino	<i>Star Trek II: The Wrath of Khan</i>	4 x 5	50	IP	Premium	<i>Warp Speed</i> feature is played on expanded 6 x 5 reel. If symbols match on reels 1 and 5 on the new top and bottom rows, then the symbols between convert (see Deep Dives for details)
	<i>Ruby Star</i>	4 x 6	80	Other	Core Video	On each spin of the base game, wild stacks will randomly appear on two reels. During free spins, wild stacks that hit in the base game will remain locked for the remainder of the bonus spin (image 3)
	<i>Super Rise of Ra</i>	4 x 5	40	Egyptian	Core Video	During the base game, any portion of a tower symbol that appears on a reel triggers the <i>Radiating Wilds</i> . This converts all symbols to the left and right of the tower to wilds (image 4)

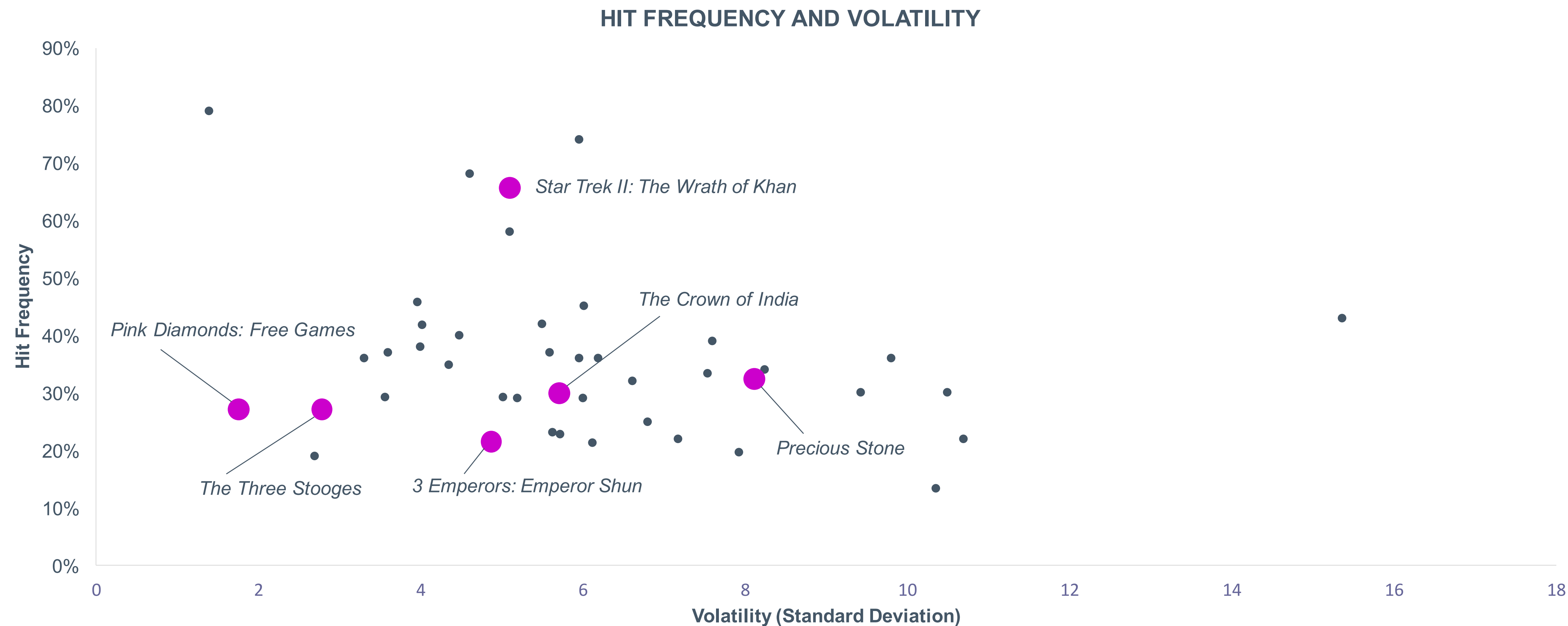


DEEP DIVES

- *Precious Stone* – Slotomania
- *The Three Stooges* – Hit It Rich
- *The Crown of India* – House of Fun
- *3 Emperors: Emperor Shun* – FaFaFa Real Casino
- *Star Trek II: The Wrath of Khan* – Hot Shot Casino
- *Pink Diamonds: Free Games* – DoubleDown Casino

HIT FREQUENCY AND VOLATILITY

FaFaFa Real Casino's *3 Emperors: Emperor Shun* had a jackpot hit x111K the initial bet amount. Hot Shot Casino's *Star Trek II: The Wrath of Khan* has a high hit frequency. All other machines examined have moderately low hit frequencies, comparatively

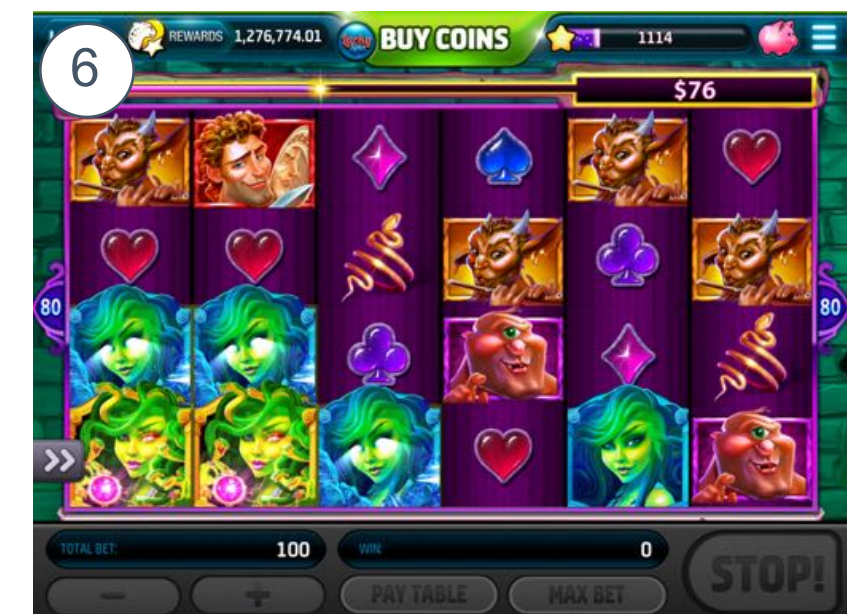
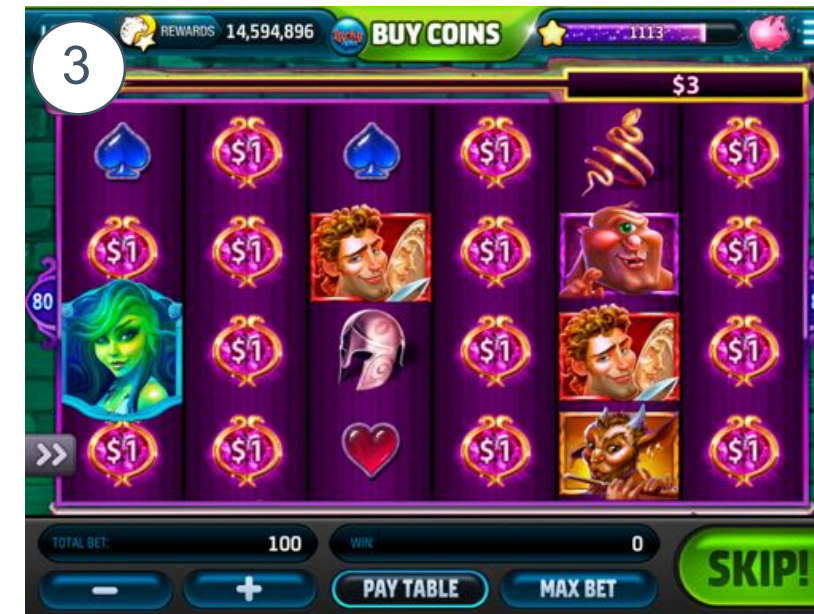


Jackpots are payouts equal to or greater than 1,000x the bet
Gray dots in the graph represent other machines examined in past reports

PRECIOUS STONE

Slotomania's *Precious Stone*, a reskin of *Despicable Wolf*, offers a collection mechanic for a pick'em bonus and up to 100 free spins with locking wilds

- *Precious Stone* was released in conjunction with a *SlotoQuest*. It may also be played independently through the lobby card (image 1).
- Fill meter and information about the collection mechanic appear above a 4 x 6 reel set (image 2).
- Players collect gems during play to fill the meter. When the meter fills, it triggers the *Precious Jackpot Bonus*. Increasing the bet amount ups the value of the gems appearing on the reels (image 3).
- When the meter fills, players choose from ten gems. Each gem contains a multiplier and some gems contain both a multiplier and a 'Keep Picking' bonus (image 4).
- The bonus round ends when only a multiplier is revealed. The award for the bonus round is the *Precious Bonus* multiplied by all multipliers chosen (image 5).
- In the base game, free spins are triggered when five or more bonus symbols appear on consecutive reels. Any golden bonus symbols that are part of the trigger become wild and remain locked until all free spins are complete (image 6).
- Up to 100 additional free spins may be won. Five free spins are awarded for the first five symbols. Each additional triggered bonus symbol awards five more free spins (image 7).
- The 'You Win' dialogue displays the winnings, spins, and an option to share free coins with friends (image 8).

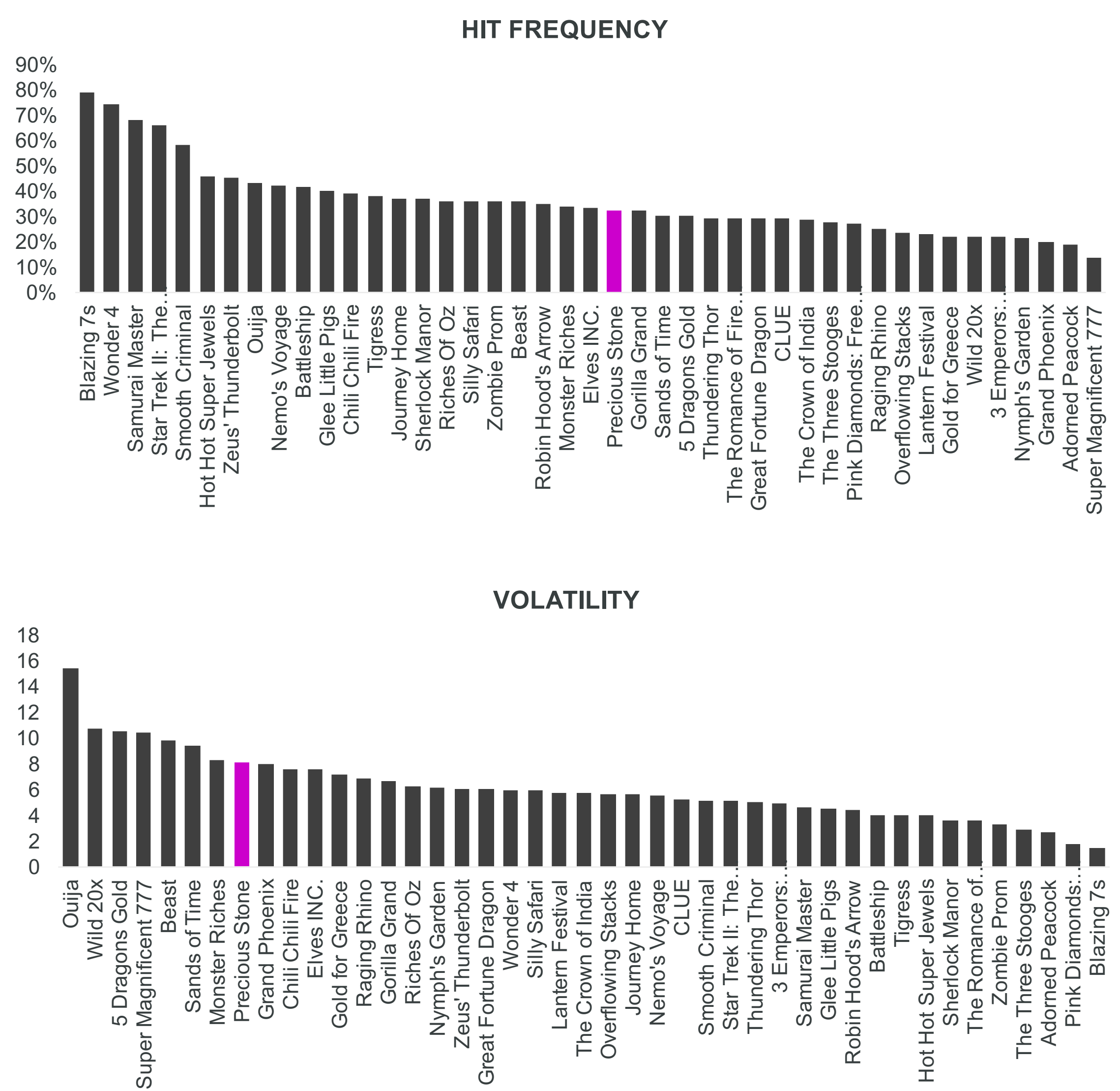


Precious Stone Stats

Slotomania’s *Precious Stone* has an average hit frequency and low volatility. Bonus games hit 1 in 92 spins

Game play ^I	
Hit frequency	32%
Volatility	8.1
Spins until a bonus	92
Distribution of RTP as % of total RTP ^{II}	
Base game	60%
Bonus game	40%
RTP range ^{III}	
Minimum range	61%
Median	74%
Maximum range	88%

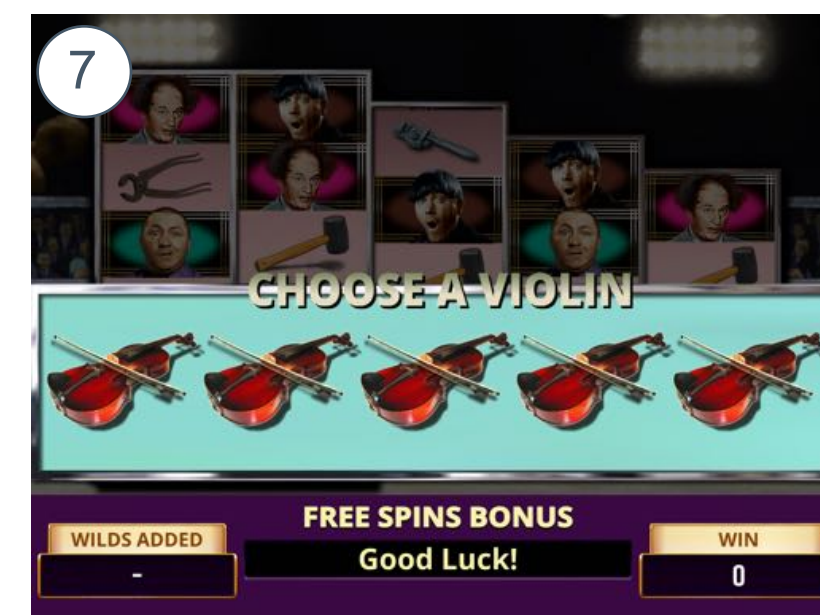
^I Volatility is based on the standard deviation of the 10,000 payouts from this machine
^{II} The distribution of RTP equals the RTP of the base or bonus game over the total RTP
^{III} RTP range is 90% confidence with 10K spins. More info on this process is in the Appendix



THE THREE STOOGES

Hit It Rich's *The Three Stooges*, a reskin of *The Real Housewives of Atlanta*, offers a respin feature with locking symbols, a pick'em bonus, and a pick'em feature with *Free Spins Bonus*

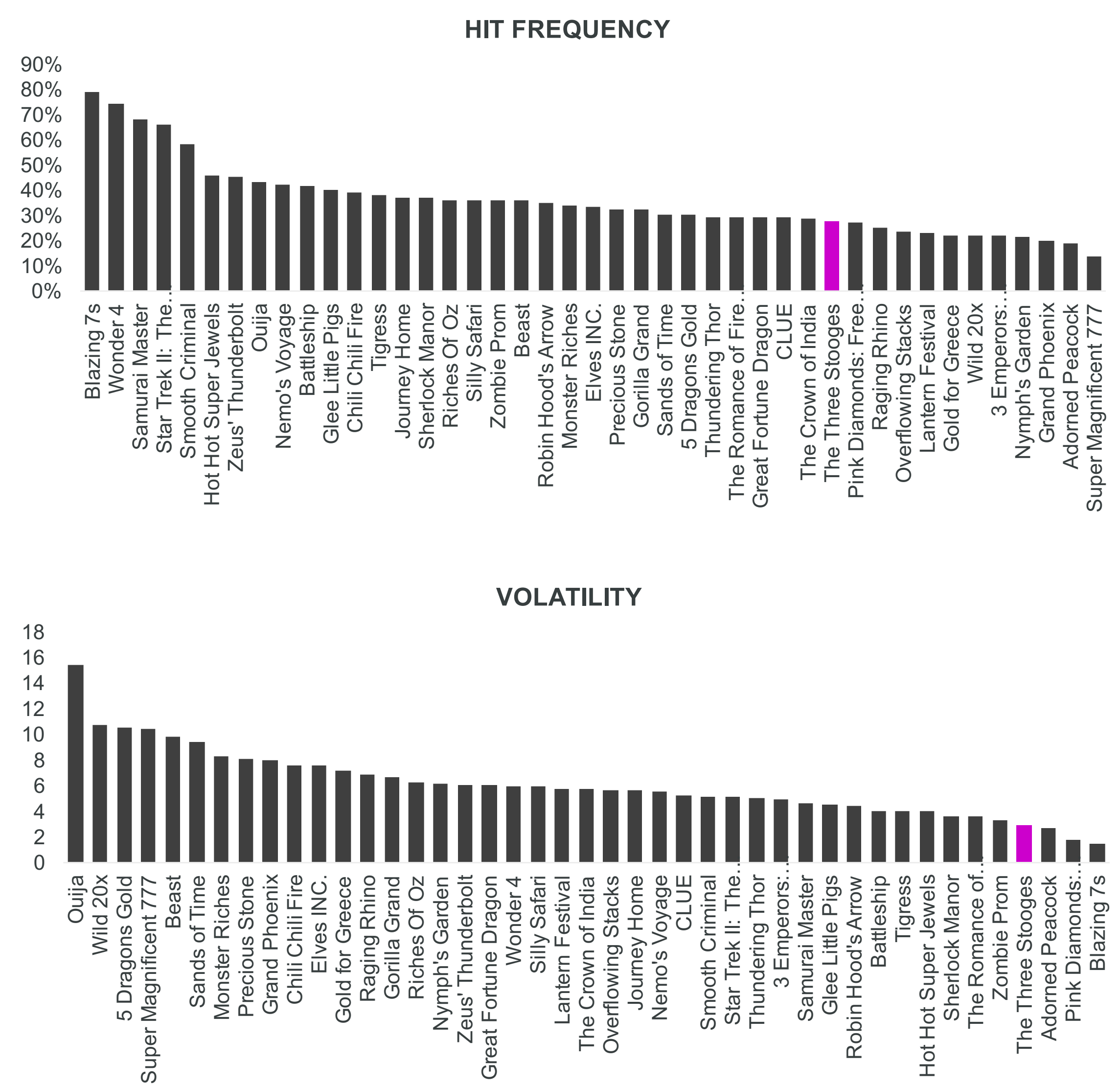
- Bet dialogue highlights qualifying bets and a *Jackpot Guarantee* (image 1).
- *The Three Stooges* is a 3, 4, 5, 6, 6 reel set. Additional full reel wilds may be added during any spin (image 2).
- A respin feature triggers when the *Three Stooges* symbol lands anywhere on reel 5 (image 3).
- Players are awarded three respins with a randomly chosen locking symbol displayed above the reels (image 4).
- A pick'em bonus is triggered when bonus symbols land on reels 1, 3 and 5. The pick'em bonus has two steps; the first step is, 'Choose a Pie' (image 5).
- The second pick'em bonus is 12 pies that offer credit awards or one of the *Three Stooges* symbols. Finding all *Three Stooges* awards the bonus credits displayed at the top of the page (image 6).
- The *Free Spins Bonus* is triggered when bonus symbols land on reels 1 and 3 and a *Free Spins* symbol appears on reel 5.
- When triggered, five violins appear containing wilds (image 7).
- The *Free Spins Bonus* is played on flipped reels with the number of additional wilds added from the pick'em portion of the bonus (image 8).
- The *Free Spins Bonus* continues by awarding another violin choice and another spin until a 'Last Spin' is revealed.



THE THREE STOOGES STATS

Hit It Rich's *The Three Stooges* has a low hit frequency and low volatility. Bonus games hit 1 in 49 spins

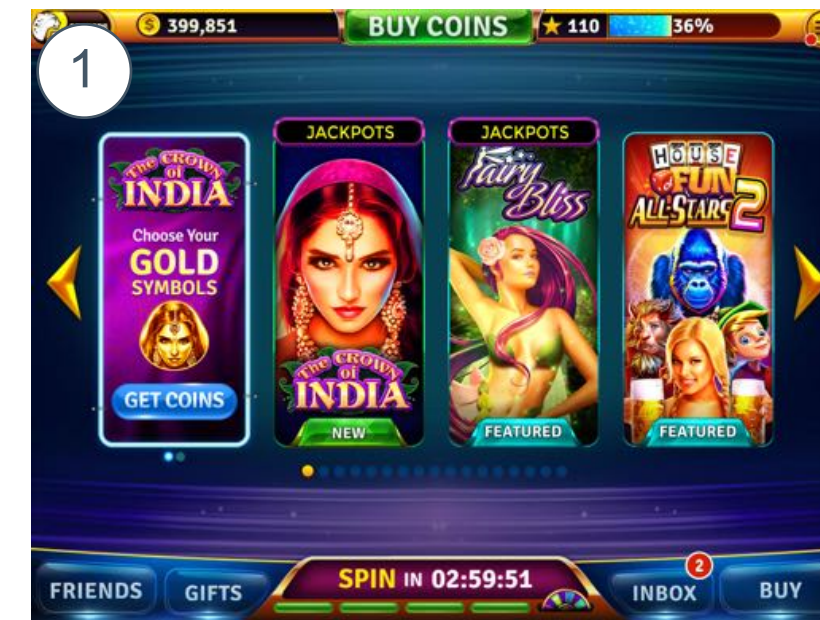
Game play	
Hit frequency	28%
Volatility	2.8
Spins until a bonus	49
Distribution of RTP as % of total RTP	
Base game	69%
Bonus game	31%
RTP range	
Minimum range	75%
Median	79%
Maximum range	84%



THE CROWN OF INDIA

House of Fun's *The Crown of India* is a recent reskin of *Golden Sirens* and offers gold symbols, free spins, and a jackpot pick'em game

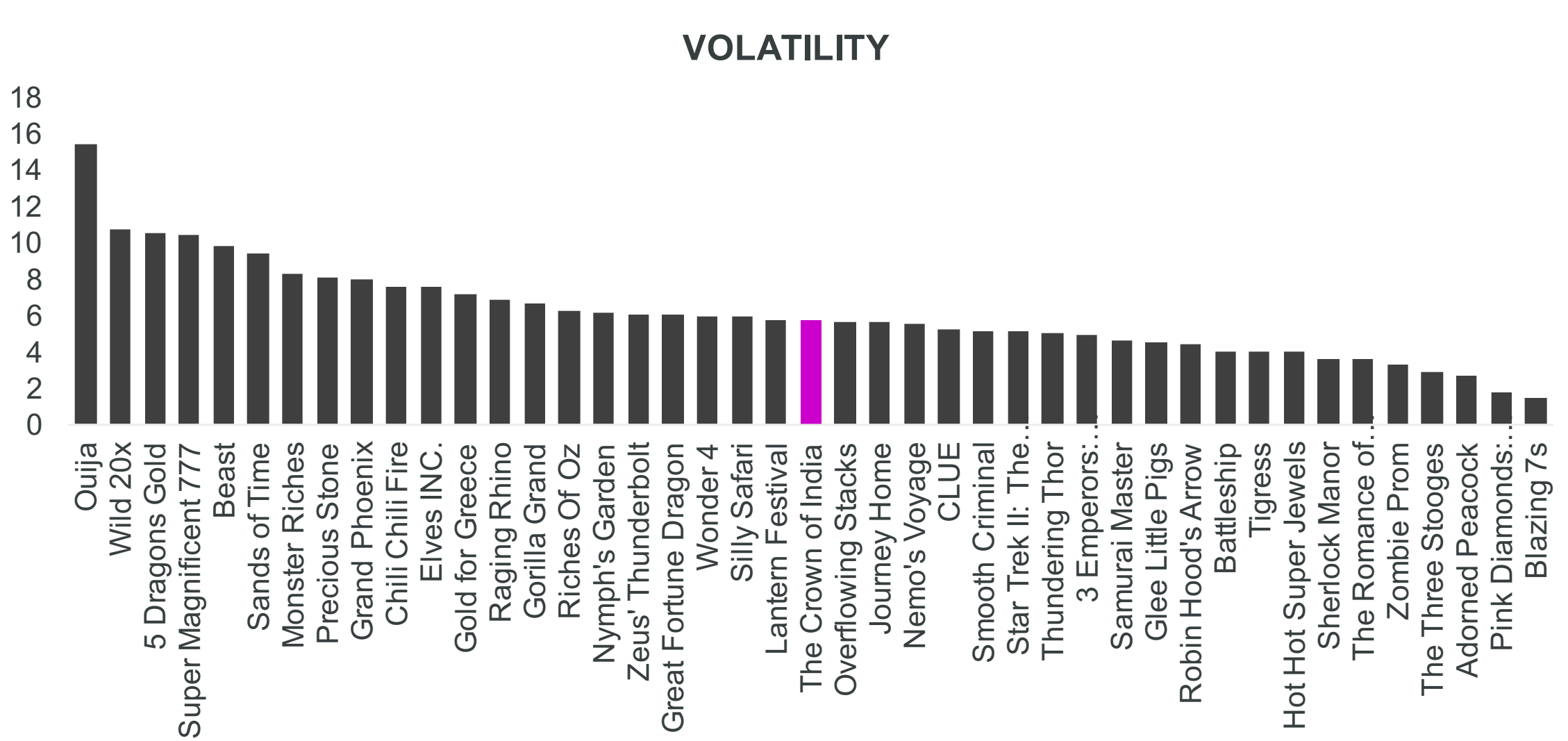
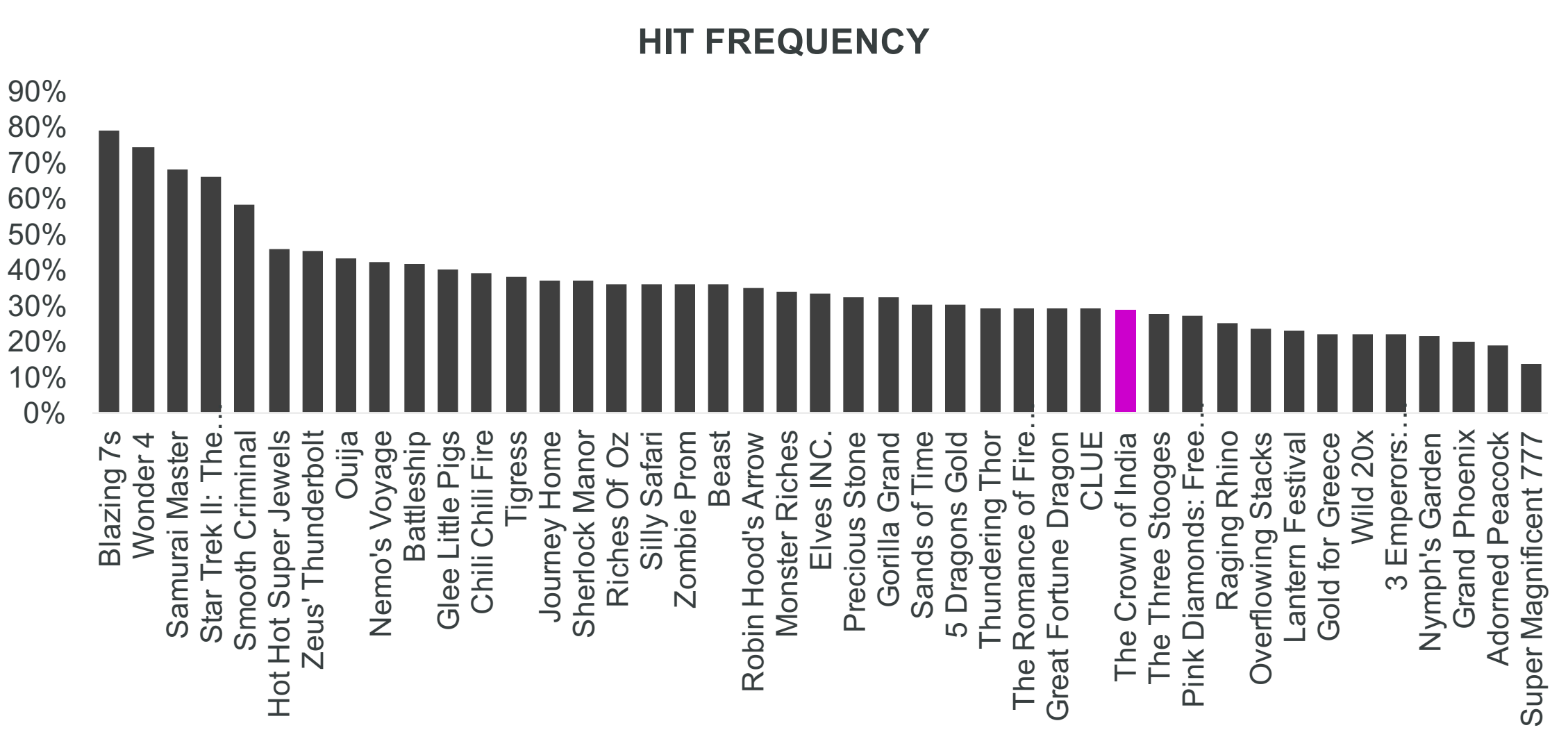
- At app-entry, *The Crown of India*'s lobby card is displayed with the text, "Choose Your Gold Symbols" (image 1).
- A 'Choose Your Bet' screen displays the number of playable gold symbols and the corresponding bet amounts (image 2).
- *The Crown of India* is a 3 x 5 reel set with five progressive jackpots at the top and active gold symbols at the bottom (image 3).
- Three or more bonus and/or wild symbols that start on reel 1 and land on consecutive reels, trigger 8 to 15 free games (image 4).
- Players are notified at the end of the free games with a dialogue that displays the total credits won (image 5).
- Any time during play, wild symbols that appear only on reels 2, 3, and 4 may trigger a *Jackpot Feature* (image 6).
- When the *Jackpot Feature* is triggered, a box containing 12 gems, the jackpots, and instructions to pick an icon appear on the screen. In this example, the bet amount did not qualify for the *Mega Jackpot*, so the *Mega Jackpot* and the corresponding icons were greyed out (image 7).
- Matching three gems wins the corresponding jackpot prize. Players are notified with a jackpot award dialogue box (image 8).



THE CROWN OF INDIA STATS

House of Fun’s *The Crown of India* has a low hit frequency and moderate volatility. Bonus games hit 1 in 88 spins

Game play	
Hit frequency	29%
Volatility	5.7
Spins until a bonus	88
Distribution of RTP as % of total RTP	
Base game	60%
Bonus game	40%
RTP range	
Minimum range	81%
Median	91%
Maximum range	100%



3 EMPERORS

FaFaFa Real Casino's *3 Emperors: Emperor Shun* features reveal doors with credit and jackpot prizes, respins after each win, and up to 50 free games

- A bet dialogue box appears upon machine selection (image 1).
- *3 Emperors: Emperor Shun* has a 4 x 5 reel set with three levels of jackpots (image 2).
- Every win triggers the respin feature. During the respin, symbols that contain a win clear, and either new symbols cascade into place or a reveal door appears (image 3).
- The respin feature will continue until no further wins appear, or the tenth respin awards the *Max Respin Jackpot* (image 4).
- During respin, reveal doors may appear in place of new symbols (image 5).
- The reveal doors award random credit bonuses from x5 to x100 the bet amount. After the reveal doors, the respin feature is triggered for new symbols to appear (image 6).
- Reveal doors may also contain a *Revealed Jackpot*. The *Revealed Jackpot* payout is based on the number of reels from the original winning combination (image 7).
- The free games feature is triggered when bonus symbols appear on reels 2, 3, and 4. Players are awarded 12 to 50 free games randomly. The respin feature is active during the free games feature (image 8).

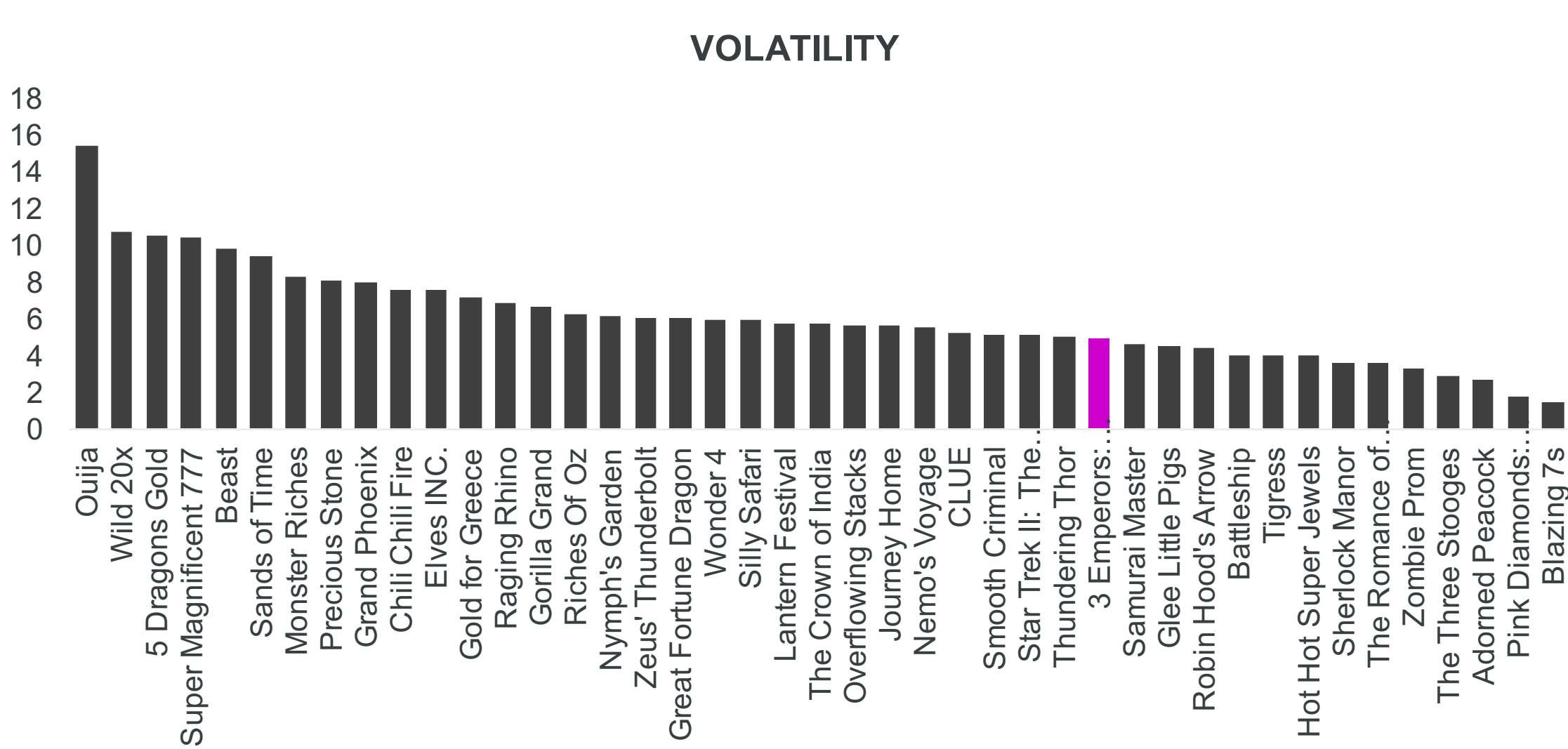
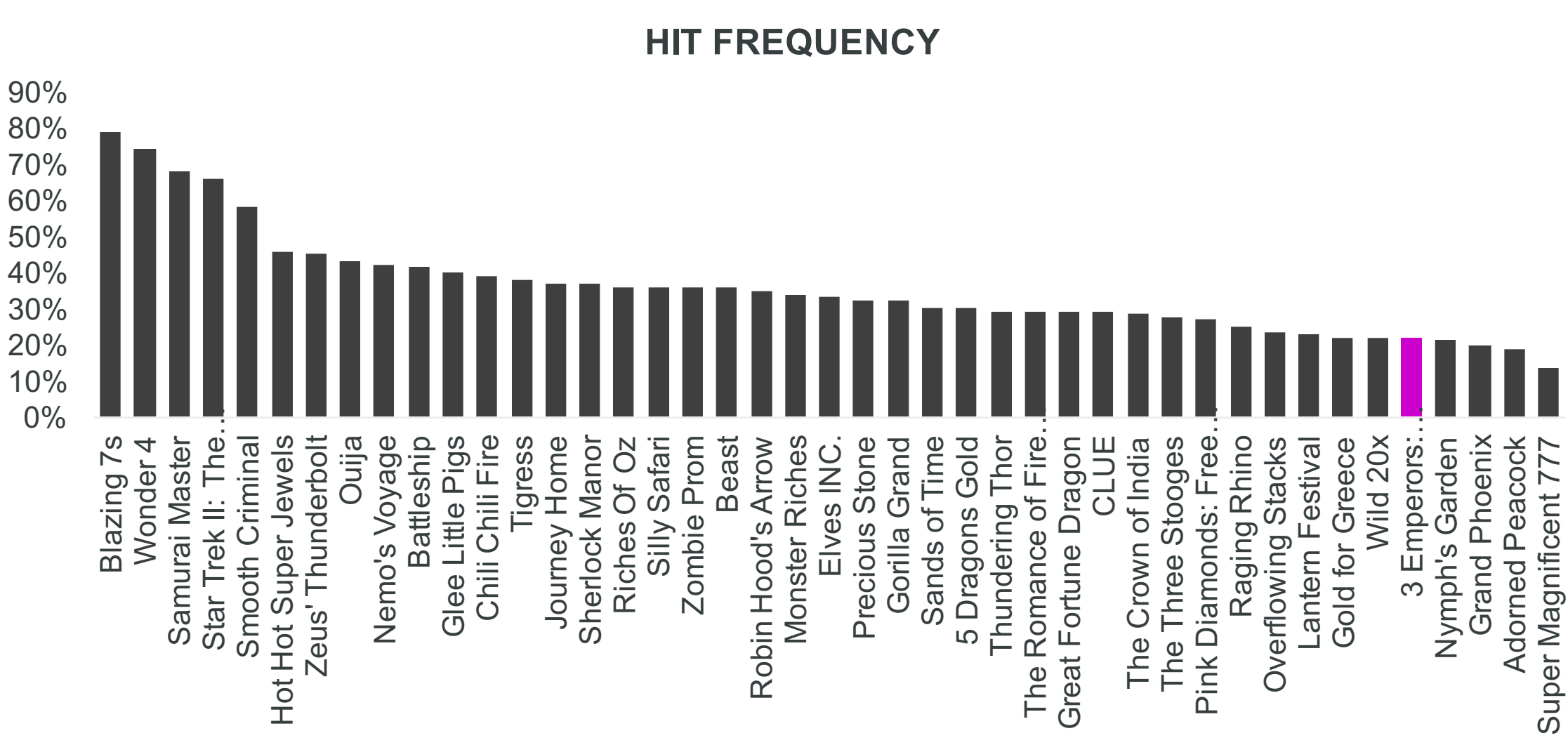


3 EMPERORS STATS

FaFaFa Real Casino’s *3 Emperors: Emperor Shun* has a low hit frequency and moderate volatility. Bonus games hit 1 in 156 spins

Game play	
Hit frequency	22%
Volatility	4.9
Spins until a bonus	156
Distribution of RTP as % of total RTP	
Base game	74%
Bonus game	26%
RTP range	
Minimum range	81%
Median	89%
Maximum range	97%
Jackpots¹	
Number of jackpots	1
Multiple of bet	110.8K

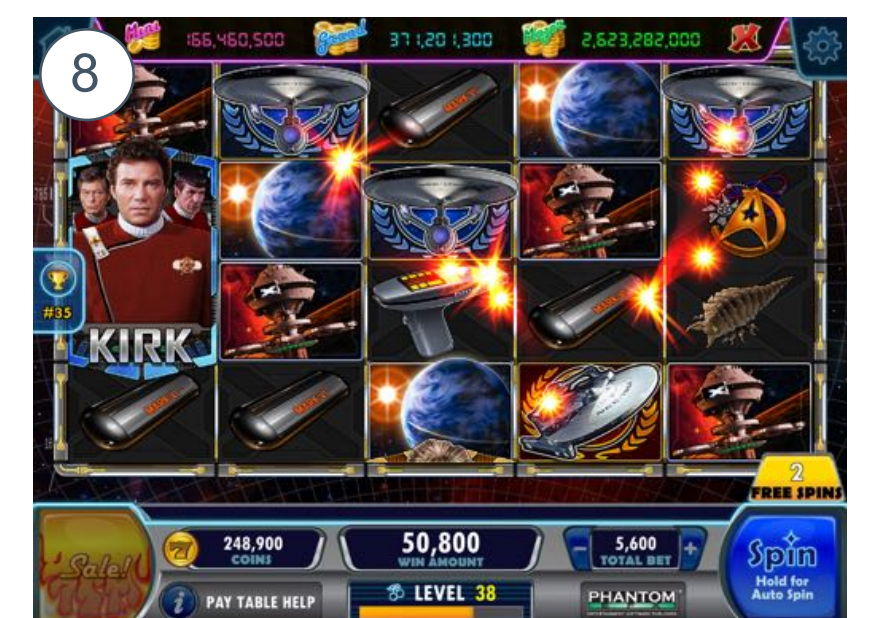
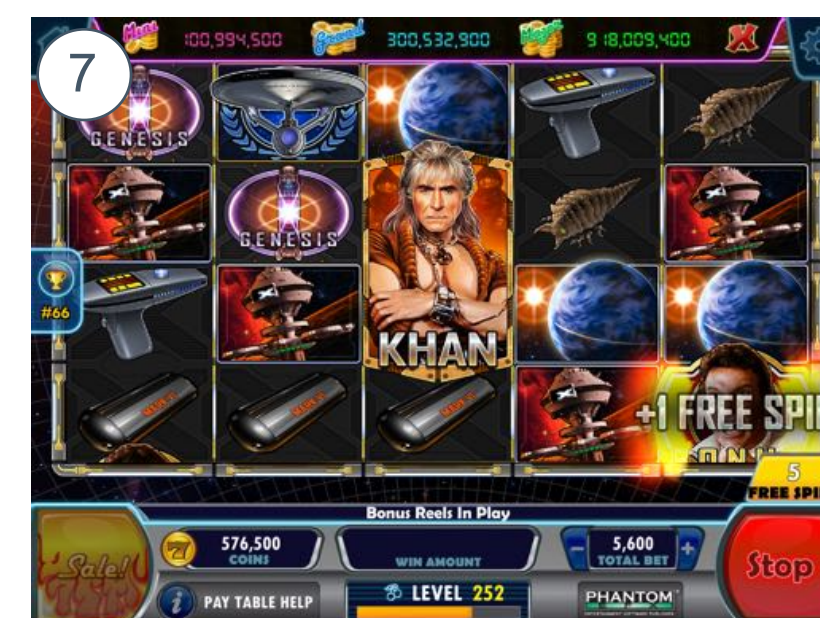
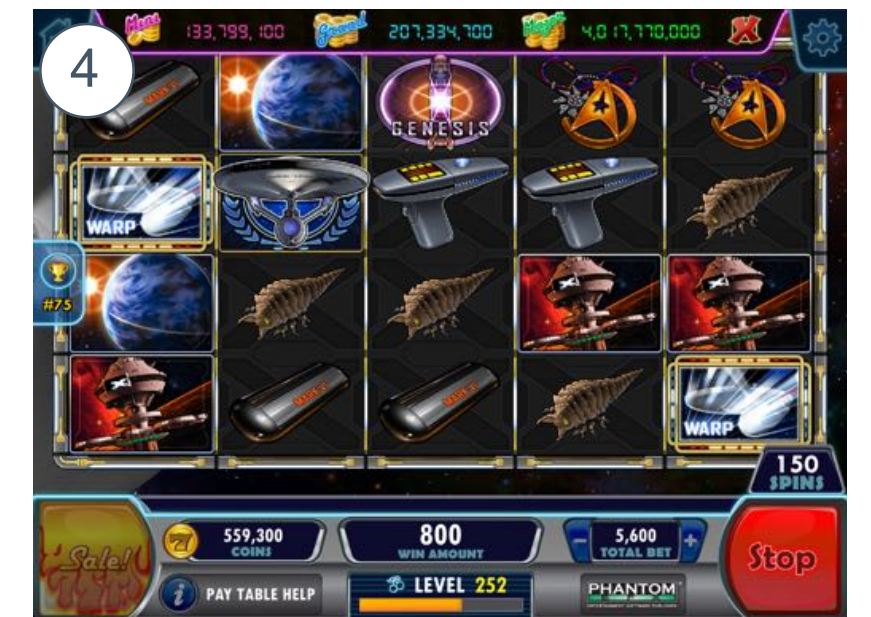
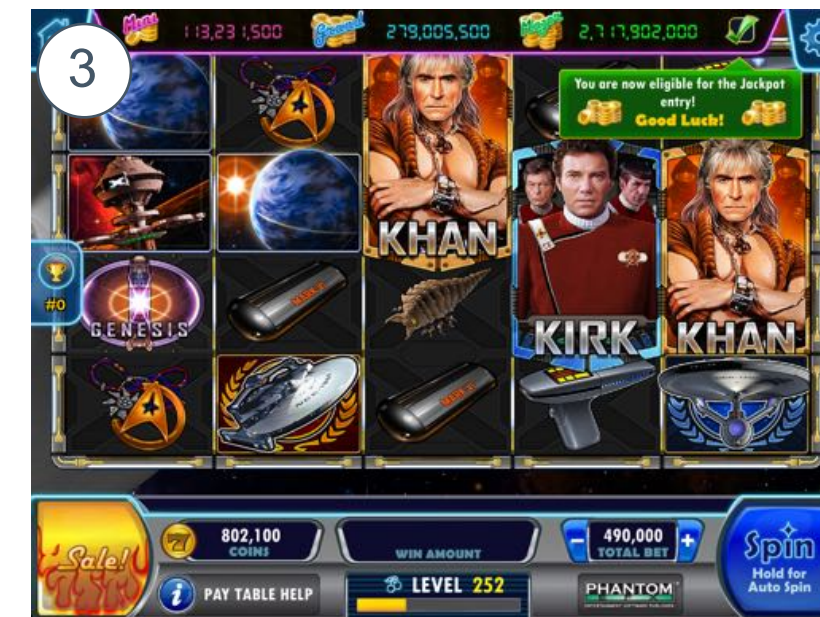
¹ Jackpots are payouts equal to or larger than 1,000x the bet. Jackpot results are not significant



STAR TREK II

Hot Shot Casino's *Star Trek II* introduces a non-free spin feature with additional rows, a conversion mechanic, and free spins with a battle mode

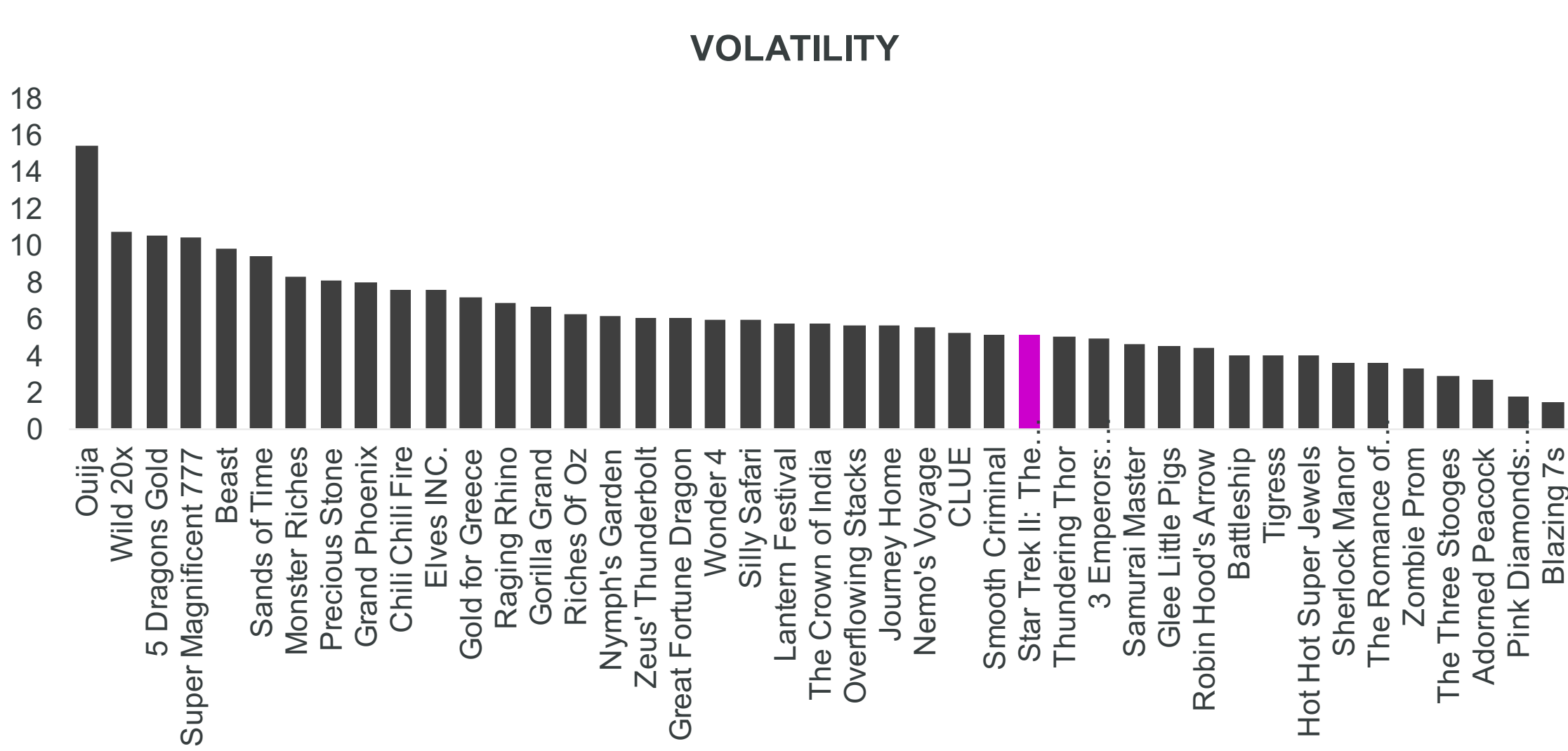
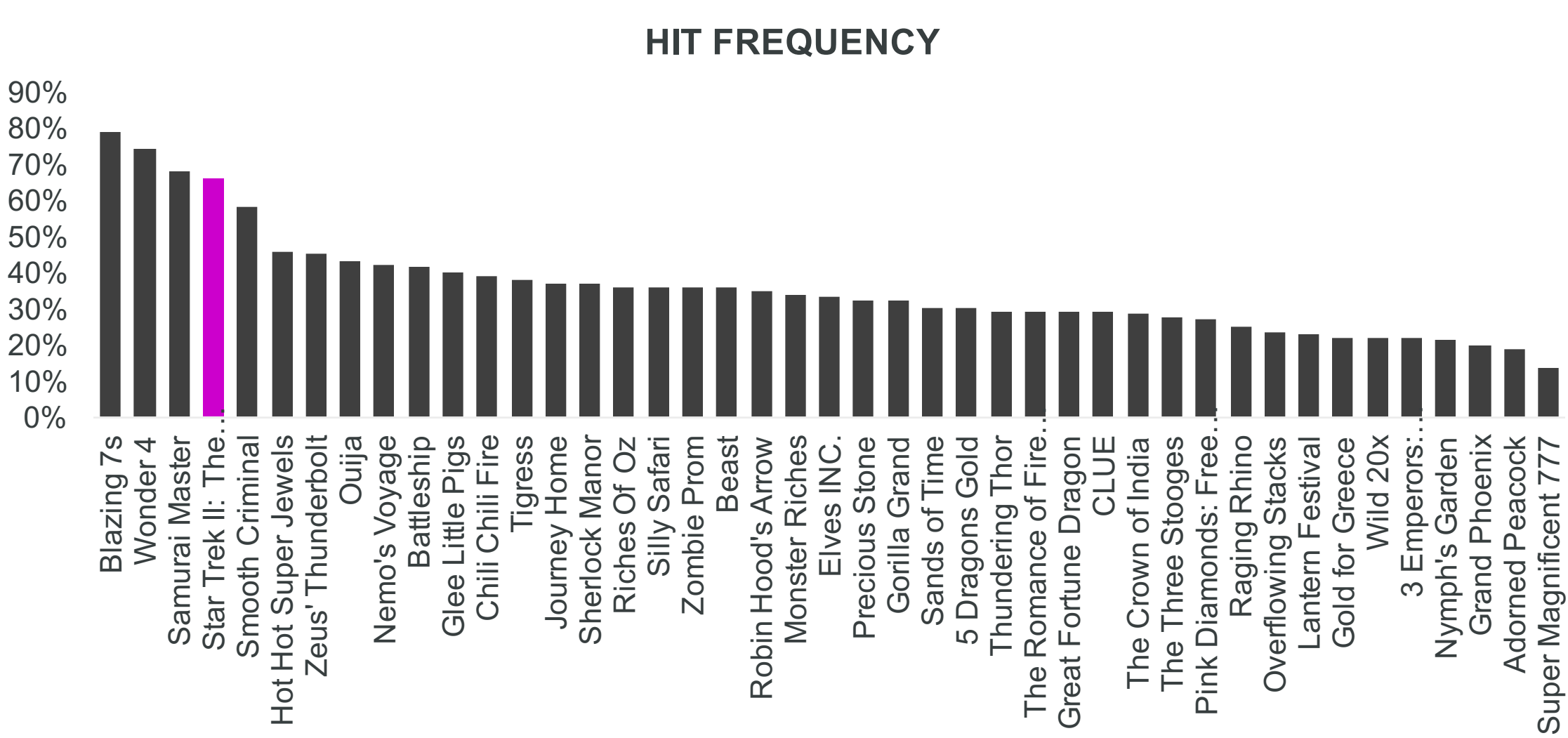
- *Star Trek II: The Wrath of Khan* app-entry dialogue (image 1).
- Bet dialogue based on machine selection (image 2).
- A notice appears next to the jackpots when a qualifying bet is selected (image 3).
- During the base game, *Warp* symbols that land on reels 1 and 5 trigger the *Warp Speed* (image 4).
- The *Warp Speed* awards players five spins and an extra row is added to the top and bottom of the reel set. Matching any two symbols between to match (image 5).
- When three bonus symbols land on reels 1, 3, and 5, the *Free Spins Bonus Round* triggers (image 6).
- Players are awarded five free spins and may earn additional spins when bonus symbols land on reels 1, 3, or 5 (image 7).
- When the *Enterprise* or *Reliant* symbols land on the reels during free spins, they engage in battle and add additional wilds to the reels (image 8).



STAR TREK II STATS

Hot Shot Casino’s *Star Trek II* has a high hit frequency and moderately low volatility.
Bonus games hit 1 in 36 spins

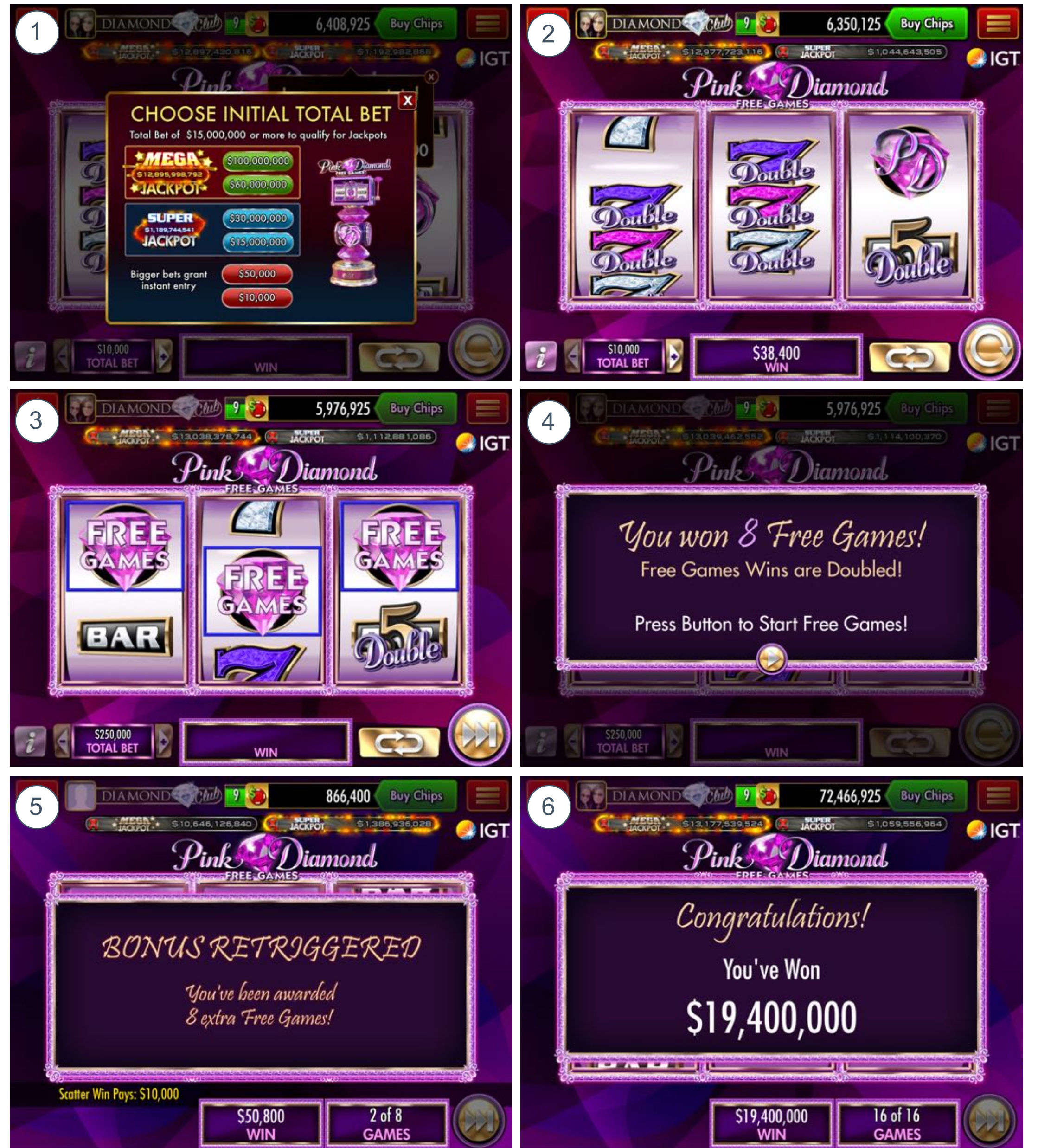
Game play	
Hit frequency	66%
Volatility	5.1
Spins until a bonus	36
Distribution of RTP as % of total RTP	
Base game	56%
Bonus game	44%
RTP range	
Minimum range	78%
Median	86%
Maximum range	94%



PINK DIAMONDS

DoubleDown Casino's *Pink Diamonds: Free Games* is a classic-style machine that offers free games, full reel symbols, and multiplier symbols

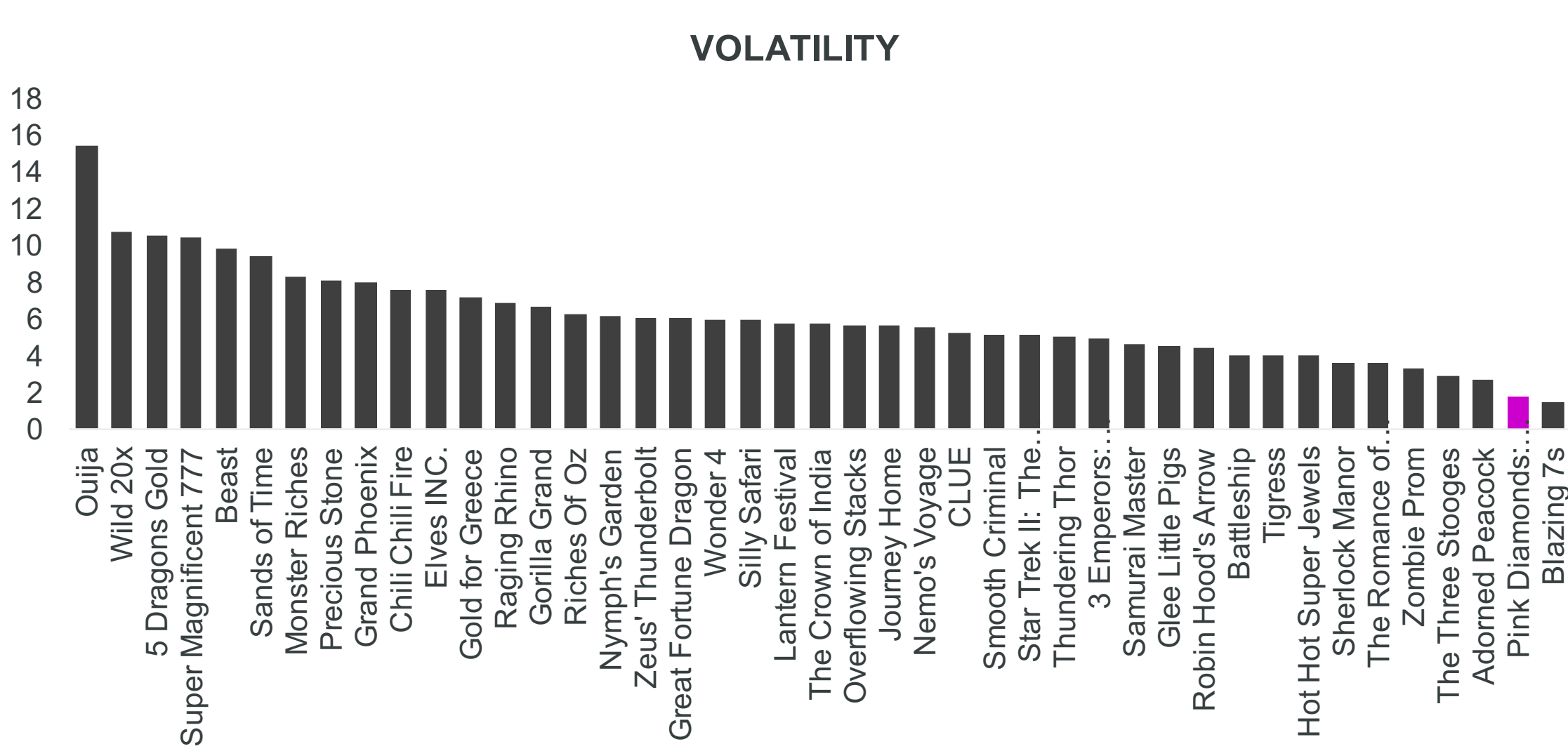
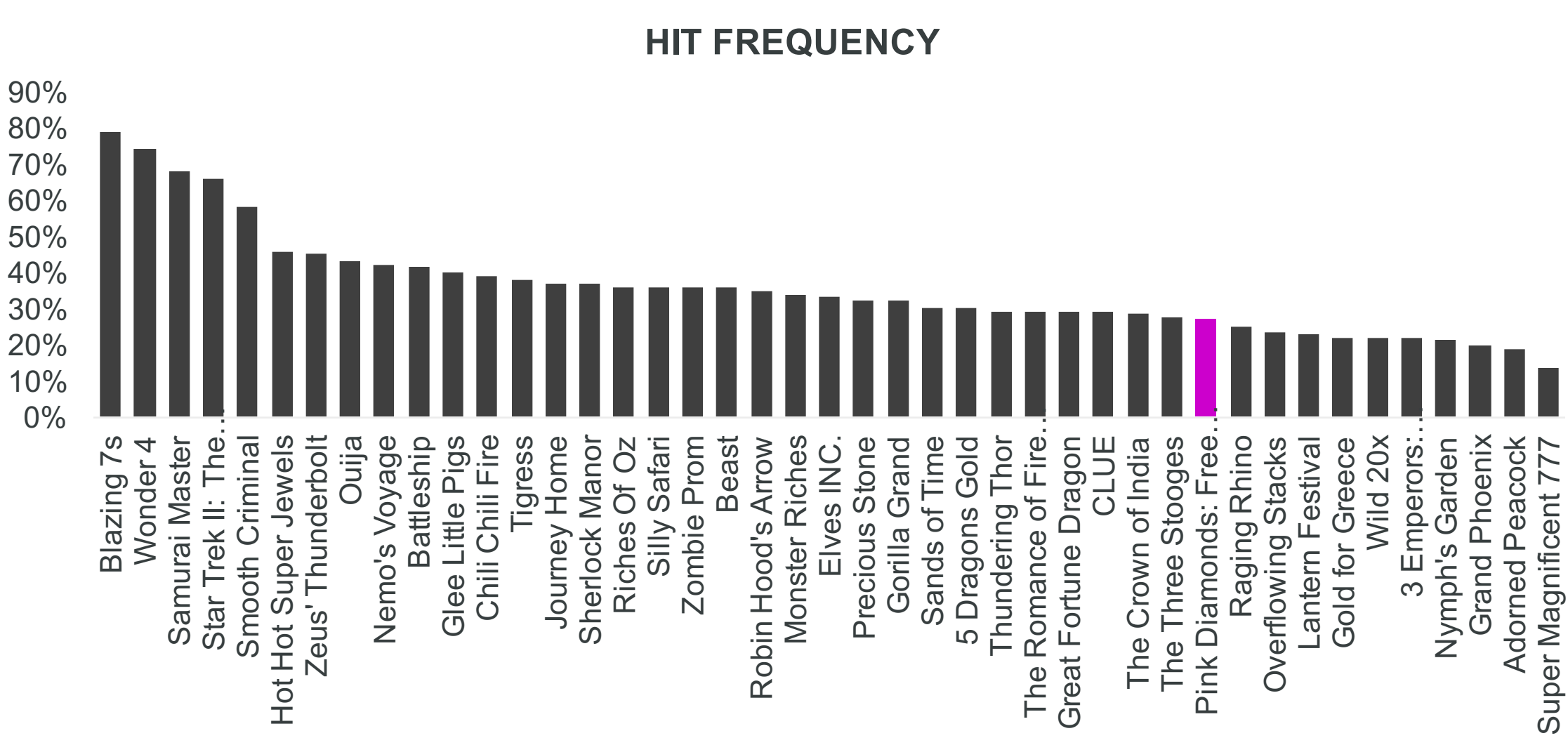
- At machine-entry, a 'Choose Initial Total Bet' dialogue appears, displaying the *Super* and *Mega Progressive Jackpots* (image 1).
- *Pink Diamonds: Free Games* is a 2 x 3 classic machine that offers 25 lines, full reel stacked symbols, and double multipliers (image 2).
- To trigger free games, three *Pink Diamond* bonus symbols must hit (image 3).
- Players receive eight free games (image 4).
- If three more bonus symbols hit, players are awarded eight more free games (image 5).
- Total win dialogue (image 6).



PINK DIAMONDS STATS

DoubleDown’s *Pink Diamonds: Free Games* has a low hit frequency and low volatility.
Bonus games hit 1 in 175 spins

Game play	
Hit frequency	27%
Volatility	1.7
Spins until a bonus	175
Distribution of RTP as % of total RTP	
Base game	76%
Bonus game	24%
RTP range	
Minimum range	29%
Median	32%
Maximum range	35%



APPENDIX

DATA COLLECTION PROCESS

Machine observations are from 10,000 spins and an RMG accepted statistical process to determine 90% confidence levels of a machine's RTP. Recommendations, information and data comes from market research, app intelligence tools and deep analysis of the games

Machine information

- The RTP range is found using a sample of 10,000 spins, which is approximately 20 hours of play.
- To find the RTP range with 90% confidence, the median payout of the 10K spin \pm (standard error) \times (z-score for 90% confidence) is calculated.
- The standard error is (standard deviation) $/ \sqrt{\text{sample size}}$ and the z-score for 90% confidence is 1.65.
- For example, the median payout for *Zombie Prom* after 10K spins was 103% with a standard deviation of 3.3.
- The standard error is $3.3 / (\sqrt{10,000})$, which equals 3.3%
- The RTP range for *Zombie Prom* is then 103% \pm (1.65 \times 3.3%).
- Based on this sample, the result is a 90% confidence that the real RTP of *Zombie Prom* falls between 97% and 109%.

Market research

- Each game is reviewed daily for updates, regardless of whether the game has been updated through the App Store.
- Transaction information comes from the iOS App Store's In-App Purchases tab. These transactions are ranked based on the number of transactions.
- Las Vegas player insights come from online sources, such as the Las Vegas Convention and Visitors Authority and the UNLV Center for Gaming Research.
- Progressive jackpot information comes from online research, specifically from wizardofodds.
- Trending revenue, downloads and package-rank data come from Priori Data, a Liquid and Grit partner.

Those who do not want to imitate anything, produce nothing

– Salvador Dali

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