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Is Texas Hold 'Em a Game of Chance? A Legal and Economic Analysis

STEVEN D. LEVITT, THOMAS J. MILES, AND ANDREW M. ROSENFIELD*

In 2006, Congress passed the Unlawful Internet Gambling Enforcement Act (UIGEA), prohibiting the knowing receipt of funds for the purpose of unlawful gambling. The principal consequence of the UIGEA was the shutdown of the burgeoning online poker industry in the United States. Courts determine whether a game is prohibited gambling by asking whether skill or luck is the "dominant factor" in the game. We argue that courts' conception of a dominant factor—whether chance swamps the effect of skill in playing a single hand of poker—is unduly narrow. We develop four alternative tests to distinguish the impact of skill and luck, and we test these predictions against a unique data set of thousands of hands of Texas Hold 'Em poker played for sizable stakes online before the passage of the UIGEA. The results of each test indicate that skill is an important influence in determining outcomes in poker. Our tests provide a better framework for how courts should analyze the importance of skill in games, and our results suggest that courts should reconsider the legal status of poker.

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INTRODUCTION

Imagine an activity in which hundreds of thousands of people participate every year. A high degree of skill is needed to excel at the activity, but most participants do not possess or develop the skill. Rather, most pursue it as a recreation because they find the activity pleasurable. Often, they undertake it with friends or in informal groups. A limited number of participants invest substantial resources to acquire the skill necessary for success at the activity. Some of these individuals aspire to earn professional livelihoods from their participation. However, these investments in human capital are, on average, not profitable. The overwhelming majority of those making these investments fail to become professionals. The very small fraction who succeed as professionals are exceptionally skilled and earn very substantial sums from the activity. These few participants become famous for their extraordinary skill, and a large portion

of their incomes comes from the thousands of amateurs who pay sizable amounts to watch the highly skilled engage in the activity.

Many activities fit this description. Musical performance is an example. Many people sing in church choirs or perform in "garage bands." Large numbers of people take lessons or attend specialized schools to acquire and improve their musical skills. Many try to become opera singers or rock stars, but out of the millions of participants, only a handful become a Joan Sutherland or a Bruce Springsteen. Similarly, many people enjoy participating in community theater, and many thousands of people work, often in Hollywood or New York, as struggling actors. An infinitesimally small number become movie or television stars. Perhaps the best example is sports. Millions of young people play sports in casual games, at schools and universities, or in amateur leagues. Only those with the most extraordinary talents ever play as professionals.

The law regulates each of these activities in various ways, but it generally does not directly prohibit people from participating in the activities. An exception is the activity of poker. The Unlawful Internet Gambling Enforcement Act (UIGEA) prohibits the knowing receipt of funds for the purpose of unlawful internet gambling.[1] Although the UIGEA does not prohibit online gambling, the principal consequence of the UIGEA was the closure of the burgeoning online poker industry.[2] This was so because the UIGEA relies on state law to determine whether a game is illegal gambling. State courts, in turn, have applied the "dominant factor test" to determine whether a game constitutes gambling and is thus prohibited under state antigambling statutes.[3] As its name indicates, the test asks whether chance dominates skill in determining the outcome of a game, and where chance dominates, courts deem the game to be impermissible gambling.[4]

This Article reviews how courts have applied the dominant factor test and argues that their approach has been unduly narrow and unscientific. The name of the legal test suggests an inherently quantitative inquiry: the weighing of two factors. But courts have not taken this intuitive approach. Rather, they insist the test implies a "qualitative" approach, by which they mean that the relevant inquiry is whether chance can override the influence of skill in a single round of play.[5] Where skill does not completely govern the outcome of a single round of

1. Unlawful Internet Gambling Enforcement Act, 31 U.S.C. §§ 5361–5367 (2006).

2. In December 2011, the government obtained its first convictions under the UIGEA, and in the spring of 2011, it obtained indictments against several major online poker sites. Matt Richtel, *U.S. Cracks Down on Online Gambling*, N.Y. TIMES, Apr. 15, 2011, http://www.nytimes.com/2011/04/16/technology/16poker.html; Milton J. Valencia, *Tierney Brother-in-Law To Stay Free Until March Sentencing*, BOS. GLOBE, Dec. 9, 2011, http://bostonglobe.com/metro/2011/12/09/tierney-relative-remain-free-pending-sentencing-for-gambling-conviction/e8QNPtNM4eZXgxPTdlaCFM/story.html.

3. *See, e.g.*, Op. of the Justices, 795 So. 2d 630, 635–36 (Ala. 2001) (equating the "American Rule" to the "dominant factor" test and collecting state court decisions applying it); Morrow v. State, 511 P.2d 127, 129 & n.5 (Alaska 1973) (citing additional cases supporting states' adoption of the dominant factor doctrine).

4. *See Op. of the Justices*, 795 So. 2d at 635–36.

5. *See, e.g.*, Minges v. City of Birmingham, 36 So. 2d 93, 96 (Ala. 1948); State *ex rel.* Tyson v. Ted's Game Enters., 893 So. 2d 355, 374 (Ala. Civ. App. 2002); Commonwealth v. Plissner, 4 N.E.2d 241,

play, courts have concluded—erroneously—that luck must be the dominant factor and thus classified the game as illegal gambling.

This qualitative version of the test suffers from a number of conceptual flaws. It overlooks that for many games, the influence of skill emerges only after many rounds of play, and the standard practice is that participants play many rounds in a single sitting. Moreover, the game is interesting to play in part because a player who is not the most skilled may win a particular round. However, courts that take the qualitative approach regularly discount the importance of mathematical skill and completely ignore the skill of bluffing.

These conceptual missteps lead to erroneous legal conclusions. Occasionally, applications of the qualitative version of the dominant factor test are indeterminate. Different courts sometimes reach conflicting conclusions about the legal status of the same game. Most often, however, applications of the qualitative version of the dominant factor test lead to unduly restrictive conclusions about games that involve significant amounts of skill. The qualitative version of the test is so expansive that it cannot meaningfully distinguish between casino games and widely accepted business practices, such as underwriting insurance, selling annuities, or writing derivatives contracts. The almost unfailingly restrictive conclusions that result from the dominant factor test are increasingly incongruous in light of the growing availability of casino games, many of them government sponsored.

In this Article, we propose four alternative tests that courts could employ to assess the role of skill in a game. To establish a benchmark, we imagine a hypothetical game of pure chance and identify four properties of it that a game involving skill would *not* possess. These properties are: (1) all players have the same expected payoffs; (2) payoffs do not vary systematically with the observable characteristics of players; (3) payoffs do not correlate with the actions a player takes during the game; and (4) a player's past success (or failure) does not predict his future likelihood of success (or failure). When a game lacks one or more of these properties, it is evidence that a player's skill influences the outcome of the game.

This Article tests these four predictions against unique data from poker games played for real stakes on an online poker website between May 2006 and May 2007, a period before the UIGEA became effective. The sample consists of more than twelve million hands of no-limit Texas Hold 'Em played by 2,775 players, each of whom played at least 250 hands. The sample is by far the most comprehensive data set of actual poker play ever examined.

The data resoundingly reject each of the four tests for the hypothesis that no-limit Texas Hold 'Em is a game of pure luck. The results show that expected payoffs vary widely across players. The two player characteristics observable in the data—the number of tables played simultaneously and the stakes of the

244 (Mass. 1936); State *ex inf.* McKittrick v. Globe-Democrat Publ'g Co., 110 S.W.2d 705, 717 (Mo. 1937) (en banc); Sherwood & Roberts-Yakima, Inc. v. Leach, 409 P.2d 160, 163 (Wash. 1965).

game—correlate with a player's payoffs. In addition, the estimates indicate that the actions a player takes affect his expected payoff. A player who plays more hands to completion (rather than folding early) and who bets more liberally accrues more losses. Also, a player's success is serially correlated. The returns a player earned from games in the first half of the sample strongly correlate with the returns earned in the second half of the sample. The results from each of the four tests are consistent with the presence of skill in poker. Moreover, we assess the relative importance of skill and chance in poker. The results show that one important facet of luck—which hole cards a player is dealt—contributes little to the overall distribution of player returns. Instead, it is the differences in player returns after the hole cards are dealt that account for nearly all the dispersion in player returns. The empirical evidence suggests that skill is the primary factor determining the distribution of player returns in no-limit Texas Hold 'Em.

The Article proceeds as follows. Part I describes the UIGEA and how it relies on state classifications of games as gambling. Part II reviews courts' applications of the dominant factor test and gives particular attention to decisions discussing or involving poker. It also points out the conceptual flaws in the approach courts have taken and identifies the courts' underlying policy concern. Part III develops four tests that can be used to distinguish games of skill from games of pure luck, and Part IV presents the results for these tests from the data of online poker.

I. THE UNLAWFUL INTERNET GAMBLING ENFORCEMENT ACT

The UIGEA prohibits a "person engaged in the business of betting or wagering" from knowingly accepting most forms of payment "in connection with the participation of another person in unlawful Internet gambling."[6] Although the title of the Act suggests that it makes gambling on the Internet criminal, it does not directly ban gambling (or the placing of bets or wagers) on websites. Nor does it seek to punish players who gamble on the Internet. Rather, it bans the knowing acceptance by certain people of certain kinds of payments connected to internet gambling.[7] The people subject to the Act's prohibition are those engaged in the business of betting or wagering.[8] The types of payments governed by the Act include credit, electronic-funds transfers, checks, drafts, or other funds drawn on a financial institution.[9] In effect, it reaches the forms of payment that would commonly be used in a transaction over the Internet.

Taken together, these definitions imply that the Act criminalizes the receipt or transfer of payments to or from a website in the business of gambling from

6. 31 U.S.C. § 5363 (2006); *see also id.* § 5367 (prohibiting circumventions).
7. *See id.* § 5363.
8. *See id.*
9. *See id.*

players seeking to participate in the site's games.[10] For example, a proprietor of a website offering gambling would violate the Act by knowingly accepting a wire transfer from a person seeking to play a game which the transferee's state law deems gambling.[11] The player would not violate the Act because the UIGEA prohibits only the acceptance of funds rather than offering or sending funds. In addition, many players may not be deemed to be engaged in the business of betting or wagering, but it is possible that a professional player may fall into this category.

Crucial to the scope of the UIGEA's prohibition are the definitions of "bet or wager" and "unlawful Internet gambling." A bet or wager under the Act includes "risking . . . something of value upon . . . a contest of others, a sporting event, or a game subject to chance," with the understanding that value will be received for certain outcomes.[12] Unlawful internet gambling is the receipt or transmission of a bet or wager via the Internet when the bet or wager is illegal under federal law or under the law of the state in which the bet was made.[13] These definitions make clear that the UIGEA does not specify a set of prohibited games. Nor does it define a test or standard for determining which games constitute unlawful gambling. The UIGEA instead relies on determinations of the illegality of games made elsewhere in federal law and, more significantly, in state law. For example, in the April 2011 indictment of owners of several prominent poker websites, the government alleged that the games offered on those sites were unlawful gambling under New York state law.[14]

The incorporation of state criminal prohibitions into federal law is not an innovation of UIGEA. The Travel Act (which is an early organized-crime statute)[15] and the Racketeer Influenced and Corrupt Organizations Act (RICO),[16] among others, establish federal criminal liability for certain conduct involving violations of state law.[17] Nor is UIGEA unique in importing state law definitions of criminality into an antigambling statute. The federal prohibition on gambling businesses, which Congress enacted in 1970, defines a gambling business as,

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10. Violations of the UIGEA are punishable by up to five years in prison, fines, or both, and courts may place a permanent ban on making or assisting in the making of bets and wagers. *See id.* § 5366.

11. *Id.* § 5362(10)(A) (defining "unlawful Internet gambling" as transmission of a bet or wager "where such bet or wager is unlawful under any applicable . . . [s]tate law in the [s]tate . . . in which the bet or wager is initiated . . ."). The UIGEA also instructs the Federal Reserve and the Treasury Department to promulgate regulations requiring financial institutions to identify and block the prohibited transactions. *See id.* § 5364.

12. *See id.* § 5362(1)(A).

13. *See id.* § 5362(10)(A).

14. Superseding Indictment at ¶ 33, United States v. Scheinberg, No. 10CR00336 (S.D.N.Y. Mar. 10, 2011) 2011 WL 1449655 (citing N.Y. PENAL LAW §§ 225.00, 225.05 (McKinney 2008)).

15. Travel Act, 18 U.S.C. § 1952 (2006 & Supp. V 2011) (defining "unlawful activities" relevant to interstate travel).

16. Racketeer Influenced and Corrupt Organizations Act (RICO), 18 U.S.C. § 1961 (2006) (defining "racketeering activity" and "unlawful debt" as acts chargeable under state law).

17. *See, e.g.*, 18 U.S.C. § 1956 (2006) (defining "proceeds of . . . unlawful activity" in the context of money laundering).

among other things, "a violation of the law of [the] [s]tate . . . [where] it is conducted . . . ."[18] Yet, an implication of this statutory structure is that the scope of the federal prohibition can be understood only through study of the prohibitions in state law.

II. REGULATION OF GAMBLING UNDER STATE LAW

This Part describes how state courts have applied the dominant factor test and how their conceptual missteps have produced unduly restrictive interpretations of what is a game of skill. It proceeds in several steps. Section A begins with the sources of state gambling regulations and the origins of the dominant factor test. The plain language of state provisions differs in ways that suggest states should vary significantly in the degree of permissiveness toward gambling, but in practice, nearly all adhere to the dominant factor test. Sections B and C describe two common conceptual maneuvers that give the dominant factor test an exceedingly narrow interpretation. The first of these, explained in section B, is to characterize the test as qualitative rather than quantitative. By this, the courts mean that the test is not whether skill outweighs chance, but whether skill wholly controls the outcome of a game. The second, discussed in section C, is to confine the inquiry into the relative influence of skill and chance to a single round of play. This framing is at odds with the conventional understanding of "play" for many games, which is to participate in multiple rounds. Also, the fact that the influence of skill emerges only after multiple rounds of play is a source of the appeal of many games. Sections D and E respectively illustrate how these two conceptual maneuvers lead courts to discount evidence of skill in games. Defendants have often sought to introduce statistical evidence of skill in games, and courts have regularly set it aside by focusing on a single round of play and restricting the relevant notion of skill.

Section F returns to conceptual matters. It argues that the standard, narrow interpretation of the dominant factor test fails to give courts meaningful guidance as to which types of activities are gambling and which are not. In applying the test, some courts (and at least once, even the same court) have reached conflicting conclusions about the legality of particular games. Also, the test cannot distinguish activities commonly understood to be gambling from those that are not, including athletic competitions and widely accepted business practices such as insurance underwriting and derivatives contracting. Section G attempts to identify the underlying policy concern that animates state courts' restrictive interpretation of the dominant factor test. Our tentative conclusion is that courts are motivated by a concern for gambling addicts. We leave it to others to analyze whether the approach taken by state courts is increasingly at odds with the expansion of state-sanctioned casinos, state-sponsored lotteries,

18. *Id.* § 1955(b)(1) (2006).

and expanded access to those lotteries via the Internet.[19] Lastly, section H discusses a recent decision from a federal district court that applied the dominant factor test in a different way than these state courts have and accordingly reached a different conclusion about the legality of poker.

A. THE DOMINANT FACTOR TEST

Nearly all state courts employ the dominant factor test to determine whether a game constitutes gambling.[20] They have applied it to a profusion of games such as pinball, shuffleboard, slots, archery, raffles, tennis, roulette, checkers, and cockfighting.[21] The test is a judicial interpretation of state constitutions and statutes prohibiting gambling. The earliest cases involved constitutional prohibitions on "lotteries."[22] The state constitutions did not define the term *lottery*, and two competing interpretations, known as the "English" and "American" approaches, emerged from decisions in state courts. The English, or "pure chance" view, was that for a game to be a lottery, the "selection and award of the prize must be determined by pure chance in which man's choice or will has no part and which is undeterminable by human reason, foresight, sagacity, or design until the same has been accomplished."[23] By contrast, the American view was that

> in order to constitute a lottery within the meaning of the various statutes, it is not necessary for the distribution of prizes to be purely by chance, but only for such distribution to be by chance as the dominating element, even though affected to some extent by the exercise of skill or judgment.[24]

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19. Whether Proposals by Illinois and New York To Use the Internet and Out-Of-State Transaction Processors To Sell Lottery Tickets to In-State Adults Violate the Wire Act, Op. O.L.C. (2011), http://www.justice.gov/olc/2011/state-lotteries-opinion.pdf.

20. *See* Op. of the Justices, 795 So. 2d 630, 635–36 (Ala. 2001) (equating the "American Rule" to the "dominant factor" test, and citing additional cases demonstrating states' adoption of dominant factor test); Morrow v. State, 511 P.2d 127, 129 & n.5 (Alaska 1973) (citing additional cases supporting states' adoption of test); Roberts v. Commc'ns Inv. Club of Woonsocket, 431 A.2d 1206, 1211 & n.5 (R.I. 1981) (same).

21. D.A. Norris, Annotation, *What Are Games of Chance, Games of Skill, and Mixed Games of Chance and Skill*, 135 A.L.R. 104 (2010) (citing cases evaluating these games and other games).

22. *See Op. of the Justices*, 795 So. 2d at 633–34 (reciting the history of lotteries, beginning with their widespread popularity in the late eighteenth century and subsequent efforts to reform them in the wake of frauds and other social ills).

23. State v. Coats, 74 P.2d 1102, 1108 (Or. 1938) (Kelly, J., specially concurring).

24. *Id.* at 1109 (quoting 17 RULING CASE LAW 1225 (William M. McKinney & Burdett A. Rich eds., 1917) (internal quotation marks omitted). A prominent treatise, which many court opinions have quoted, explained the American approach as follows:

> A scheme is not a lottery if winning depends solely on skill or judgment. If elements both of skill and of chance are present in a [game], its character as a lottery generally depends on which is the dominant element. If the [game's winner] is to be determined solely by skill or judgment, the scheme is not a lottery, even though the result is uncertain or may be affected by things unforseen [sic] and accidental. Where elements both of skill and of chance enter into a contest, the determination of its character as a lottery or not is generally held to depend on which is the dominating element.

In view of this definition, many courts came to refer to the American test as the "dominant factor" test.

Implicit in the English and American approaches was the idea that there is a spectrum of games ranging from lotteries to contests of pure skill. The two approaches are in accord in their treatment of games at the poles of this spectrum: lotteries are prohibited, and games of pure skill are permitted. The set of games lying between these two poles—games of mixed skill and chance—distinguish the two approaches. Under the English view, games involving a mix of skill and chance are permitted because luck alone does not determine their outcomes. The English view prohibits only pure lotteries. By contrast, the American approach is more expansive. It sweeps into the category of gambling games in which chance dominates skill rather than just those in which chance alone determines the winner. Thus, games in which skill is a significant, although not dominant, element would be permitted under the English approach but forbidden under the American approach.[25]

In addition to state constitutions, some state gambling regulations are found in statutes. At times these statutes supplement and clarify state constitutional prohibitions, and at other times, they arise in the absence of constitutional provisions. The texts of these statutes have various formulations which seem to imply different degrees of permissiveness toward gambling. Some statutes appear to take a highly restrictive approach. For example, Georgia's statute defines a "bet" as "an agreement that, *dependent upon chance even though accompanied by some skill*, one stands to win or lose something of value."[26]

Other states employ slightly different language, but they have the same effect of prohibiting any game in which chance has some power over the outcome, even when skill's influence is considerable. For example, Utah bans games in which there is "an element of chance,"[27] and Virginia proscribes games in which the "the outcome . . . is uncertain or a matter of chance . . . ."[28] Arizona's statute defines gambling as the "act of risking or giving something of value for

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54 C.J.S. *Lotteries* § 4 (1987) (quoted in *Op. of the Justices*, 795 So. 2d at 641).

25. *Coats*, 74 P.2d at 1106 (determining that a pinball is a lottery). In general, the court held,

> [i]f any substantial degree of skill or judgment is involved, it is not a lottery. Of course, all forms of gambling involve prize, chance, and consideration, but not all forms of *gambling* are lotteries. A lottery is a scheme or plan, as distinguished from a game where some substantial element of skill or judgment is involved.

Id. (emphasis added).

26. GA. CODE ANN. § 16-12-20(1) (Supp. 2012) (emphasis added). Other states employing similar language in their statutes include Minnesota, New Mexico, Tennessee, and Wisconsin. *See* MINN. STAT. § 609.75 (2005) (defining "gambling device"); N.M. STAT. ANN. § 30-19-1(B) (2012) (defining "bet"); TENN. CODE ANN. § 39-17-501(1) (2010) (defining "gambling"); WIS. STAT. § 945.01(1) (2010) (defining "bet").

27. UTAH CODE ANN. § 76-10-1101(2)(a)(i) (LexisNexis 2011) (defining "gambling"); *see also* KY. REV. STAT. ANN. § 528.010(3)(a) (West 2006) (defining "gambling" similarly).

28. VA. CODE ANN. § 18.2-325(1) (2012) (defining "illegal gambling"). Similarly, Nebraska defines gambling as, among other things, betting "something of value upon the outcome of a future event,

the opportunity to obtain a benefit from a game or contest of *chance or skill* or a future contingent event . . . ."[29] In these states, the statutory language is both highly general and highly restrictive, leaving little room for judicial interpretation. A plain reading of these texts suggests that the presence of any degree of chance, no matter how minute, should classify the game as unlawful gambling under these statutes.

In other states, the statutory text suggests that the mere presence of some chance does not taint the game. Rather, it implies that the element of chance must reach a certain level of significance before it renders a game unlawful. For example, New York's statute defines a "contest of chance" as a game "the outcome [of which] depends in a *material degree* upon an element of chance, notwithstanding that skill of the contestants may also be a factor therein," and the statute proceeds to define "gambling" as placing a wager on "a contest of chance."[30] This type of statute seemingly reflects a more permissive approach. A "material" amount of chance is seemingly a greater quantity of chance than "any" amount of chance, implying that the statute sweeps fewer games into the prohibited category. Under a statute like New York's, the presence of a small and immaterial amount of chance would seemingly not run afoul of the gambling prohibition, but it would run afoul under a statute like Georgia's. In addition, a plausible interpretation of a "material degree of chance" is that chance dominates skill, and for this reason, courts construing statutes like New York's should be more likely to embrace the dominant factor test than courts faced with a statute like Georgia's.[31]

In a third group of states, the statute begins with a far-reaching prohibition but carves out an exception for games of skill. For example, Colorado's statute defines gambling as:

> [R]isking any money . . . or other thing of value for gain contingent in whole or in part upon lot, chance . . . or the happening or outcome of an event, including a sporting event, over which the person taking a risk has no control, but does not include: (a) *Bona fide contests of skill*, speed, strength, or

---

which outcome is determined by an element of chance . . . ." NEB. REV. STAT. § 28-1101(4) (2008). Montana defines gambling in part as "risking any money . . . or other thing of value for a gain that is contingent in whole or in part upon lot [or] chance . . . ." MONT. CODE ANN. § 23-5-112(13)(a) (2011).

29. ARIZ. REV. STAT. ANN. § 13-3301(4) (2010) (emphasis added). Similarly, Arkansas punishes anyone who bets "on any game of hazard or skill . . . ." ARK. CODE ANN. § 5-66-113(a) (2005). Louisiana defines gambling as "the intentional conducting, . . . as a business, of any game, contest, lottery, or contrivance whereby a person risks the loss of anything of value in order to realize a profit." LA. REV. STAT. ANN. § 14:90A(1)(a) (2009).

30. N.Y. PENAL LAW § 225.00(1)–(2) (McKinney Supp. 2012) (emphasis added). Other states have adopted nearly identical language. *See, e.g.*, ALASKA STAT. § 11.66.280 (2010); HAW. REV. STAT. § 712-1220(3) (Supp. 2009); MO. REV. STAT. § 572.010(3) (2011); N.J. STAT. ANN. § 2C:37–1(a) (West 2005); OR. REV. STAT. § 167.117(6) (2011); WASH. REV. CODE § 9.46.0225 (2010).

31. It is also plausible to interpret a material amount of chance as distinct from—and possibly less than—a dominant amount of chance. But we have not found any states that define material chance in this way.

> endurance in which awards are made only to entrants or the owners of entries . . . .[32]

This language is borrowed from an early model gambling statute.[33] A substantial number of states have statutes with identical or similar language.[34] Statutes with this formulation do not separately define "bona fide contest of skill," leaving it unclear whether the prohibition is as far-reaching as Georgia's or potentially more modest like New York's. The adjective "bona fide" typically means mere good faith, honesty, and an absence of deceit.[35] For example, under the Uniform Commercial Code, a "bona fide purchaser" is a person who pays valuable consideration, has no notice of the claims of others, and acts in good faith.[36] It is conceivable, but far from obvious, that an honest contest of skill could involve a material degree of chance. The difficulty of this question suggests that a legislature adopting this statutory language gives its courts a great degree of discretion to determine the state's policy toward gaming.

A sensible prediction is that the variance in judicial interpretations of gambling statutes should be smallest under a statute like Georgia's, greatest under a statute like Colorado's, and in between under a statute like New York's. The dominant factor test appears to be a most plausible interpretation for statutes, such as New York's, that refer to "material" degrees of chance. "Material" might be equated with "dominance." By contrast, statutes such as Georgia's that allude to "an element of chance" appear more restrictive than the dominant factor test. They suggest that any modicum of chance renders a game impermissible. The final category of statutes appears to leave courts the most leeway for interpretation, because these statutes require courts to construe the meaning of "bona fide."

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32. COLO. REV. STAT. ANN. § 18-10-102(2) (West 2006) (emphasis added).

33. MODEL ANTI-GAMBLING ACT § 2 (1952). The author of the draft statute, Rufus King, formerly an assistant general counsel of the Special Senate Committee on Organized Crime (the "Kefauver Committee"), viewed gambling as tightly linked to organized crime and highly lucrative:

> [T]he richest of all [criminal activities is] illegal gambling. When Capone's heirs and the Costello–Adonis–Lansky mob seized control of horse rooms, slot machines, and related gambling enterprises, they tapped a golden flow that defies comparison even with the zenith of their bootlegging careers. They, and lesser syndicates, have lately been sharing an income akin to that of our great corporations or the revenues of our wealthiest states.

Rufus G. King, *The Control of Organized Crime in America*, 4 STAN. L. REV. 52, 53 (1951).

34. *See, e.g.*, CONN. GEN. STAT. ANN. § 53-278a(2) (West 2007); IDAHO CODE ANN. § 18-3801 (2004); IND. CODE ANN. § 35-45-5-1 (West 1998); N.D. CENT. CODE § 12.1-28-01(1) (2011 Supp.); TEX. PENAL CODE ANN. § 47.01(1) (West 2009); WYO. STAT. ANN. § 6-7-101(a)(iii) (2011). Similarly, Illinois excludes from punishment gambling prizes and compensation given "to the actual contestants in any bona fide contest for the determination of skill, speed, strength or endurance or to the owners of animals or vehicles entered in such contest." 720 ILL. COMP. STAT. ANN. 5 / 28–1(b)(2) (West 2010).

35. BLACK'S LAW DICTIONARY 186 (8th ed. 2004).

36. U.C.C. § 8-302(1) (2012).

There is only partial support for this prediction. True, states with gambling statutes that make games dependent on a "material degree of chance" employ the dominant factor test. For example, the New York gambling statute defines a "contest of chance" as a game "in which the outcome depends in a material degree upon an element of chance, notwithstanding that skill of the contestants may also be a factor therein."[37] An influential and early decision from a New York court interpreted this statute in the following way: "The test of the character of the game is not whether it contains an element of chance or an element of skill, but which is the dominating element that determines the result of the game?"[38] This is consistent with the prediction: "dominance" is one plausible interpretation of "materiality."

But the states with restrictively worded statutes also follow the dominant factor test. For example, Arizona has a gambling statute like Georgia's, in that any element of chance renders a game unlawful. It defines gambling as the "act of risking or giving something of value for the opportunity to obtain a benefit from a game or contest of *chance or skill* or a future contingent event . . . ."[39] But, an Arizona court concluded that "[a] game of chance is a contest wherein chance predominates over skill."[40] Similarly, Wisconsin's constitution prohibits lotteries,[41] and a statute defines gambling as an agreement "that, dependent upon chance even though accompanied by some skill, one stands to win or lose something of value . . . ."[42] The state's intermediate appellate court held that for there to be a lottery, "[c]hance rather than skill must . . . be the dominant factor controlling the award in [the] lottery."[43] South Dakota has a constitutional prohibition and a statute nearly identical to Wisconsin's, and its top court similarly held that a "'game of chance' is a contest wherein chance predominates over skill."[44] The fact that courts faced with varying statutory language

37. N.Y. PENAL LAW § 225.00(1) (McKinney Supp. 2012).

38. People *ex rel.* Ellison v. Lavin, 71 N.E. 753, 755 (N.Y. 1904) (rejecting the view that to be a lottery, a game's "distribution must be . . . [exclusively] by chance"). New Jersey, which has a statute nearly identical to New York's, follows a similar approach. O'Brien v. Scott, 89 A.2d 280, 283 (N.J. Super. Ct. Ch. Div. 1952) (holding that "the character of a game, as to skill or chance, is determined by which of those two elements is the dominating factor in determining the result of the game"). In reaching this conclusion, the New Jersey court rejected two alternative tests for classifying games: (1) whether "the game is designed to and does appeal to, and induces, lures, and encourages, the gambling instinct"; and (2) whether amusement value itself constitutes a prize. *Id.* at 282 (quoting Hunter v. Mayor & Council, 24 A.2d 553, 555 (N.J. 1942)).

39. ARIZ. REV. STAT. ANN. § 13-3301(4) (2010) (emphasis added).

40. Boies v. Bartell, 310 P.2d 834, 837 (Ariz. 1957).

41. WIS. CONST. art. 4, § 24(1) ("Except as provided in this section, the legislature may not authorize gambling in any form.").

42. WIS. STAT. § 945.01(1) (2010).

43. State v. Dahlk, 330 N.W.2d 611, 617 (Wis. Ct. App. 1983).

44. Bayer v. Johnson, 349 N.W.2d 447, 449 (S.D. 1984) (citing *Boies*, 310 P.2d at 837); *see also* Baedaro v. Caldwell, 56 N.W.2d 706, 709 (Neb. 1953) ("The test of the character of the game is not whether it contains an element of chance or an element of skill, but which of these is the dominating element that determines the result of the game.").

have applied the same approach is puzzling, and it compels a closer look at how courts have applied the dominant factor test.

B. DOMINANCE IS QUALITATIVE, NOT QUANTITATIVE

For the courts that adhere to the dominant factor doctrine, what does it mean for chance to dominate skill, or vice versa? The extremes of the skill–chance spectrum are relatively easy to identify. "Throwing dice is purely a game of chance, and chess is purely a game of skill."[45] Courts have determined that games of skill include checkers, billiards, and bowling;[46] by contrast, raffle and roulette are games of pure chance.[47] The difficult cases involve games comprised of a mix of skill and chance. For those cases, the term "dominant factor" connotes an inquiry into the relative proportions of skill and chance. When only two factors determine a game's outcome, one factor's influence must necessarily be greater and the other lesser. The question of which influence dominates the other seems inherently quantitative. It implies the weighing of two quantities. When a game is more than fifty percent chance, or when the ratio of chance to skill exceeds unity, it should belong in the gambling category. Otherwise, courts should deem it a game of skill.

Yet, this intuition is incorrect. Despite the seemingly quantitative connotation of the test's name, courts have long held that "the rule that chance must be the dominant factor is to be taken in the qualitative or causative sense, rather than the quantitative sense."[48] As the Supreme Court of Washington explained, "The measure is a qualitative one; that is, the chance must be an integral part which influences the result. The measure is not the quantitative proportion of skill and chance in viewing the scheme as a whole."[49] Courts have explicitly rejected the idea that the dominant factor test is an inquiry into which of the two factors—skill and chance—is the greater and which is the lesser. As one court put it, "[T]he question was not to be determined on the basis of the mere proportions of skill and chance entering in the contest as a whole."[50]

Instead, some courts have seized on the language of the Washington Supreme Court: when the chance is "an integral part which influences the result," chance dominates the game.[51] Chance is not "integral" to the result where "skill

45. People *ex rel.* Ellison v. Lavin, 71 N.E. 753, 755 (N.Y. 1904).

46. *Id.*

47. *See* Commonwealth v. Plissner, 4 N.E.2d 241, 244 (Mass. 1936); *see also* Stearnes v. State, 21 Tex. 692, 692 (1858) (defining chess and billiards as games of pure skill, and raffles and "simple lotter[ies]" as games of pure chance).

48. Minges v. City of Birmingham, 36 So. 2d 93, 96 (Ala. 1948) (quoting 34 AM JUR. *Lotteries* § 6 (1941)); State *ex inf.* McKittrick v. Globe-Democrat Publ'g Co., 110 S.W.2d 705, 717 (Mo. 1937) (en banc).

49. Sherwood & Roberts-Yakima, Inc. v. Leach, 409 P.2d 160, 163 (Wash. 1965) (citing *McKittrick*, 110 S.W.2d at 717).

50. *McKittrick*, 110 S.W.2d at 717.

51. State *ex rel.* Tyson v. Ted's Game Enters., 893 So. 2d 355, 374 (Ala. Civ. App. 2002) (quoting *Sherwood & Roberts-Yakima*, 409 P.2d at 163).

override[s] the effect of the chance."[52] Although chance may be present in a game, its influence cannot be so great as to influence the outcome. For a court to consider skill dominant in a game, "[s]kill or the competitors' efforts must sufficiently govern the result. Skill must control the final result, not just one part of the larger scheme."[53]

A way of understanding chance as a qualitative concept is to envision a game with multiple rounds, where skill winnows the competitors as the rounds progress. If chance may nip in during the final round and influence which player wins, skill is not dominant in the game.[54] Of course, chance can exert a decisive influence even in single-shot games.[55] One court described the test by asking whether skill may "'destroy the existence or effect' of the chance? [If not], it can hardly be said that the skill predominates over the chance in the qualitative or causative sense contemplated."[56]

Other courts have described the relevant inquiry as whether chance controls the outcome of the game or whether it trumps the influence of skill. An early and much-cited opinion from the Supreme Judicial Court of Massachusetts stated that an "alternative test" to the dominant factor doctrine was that "if the element of chance is present in such a manner as to thwart the exercise of skill or judgment in a game, then there may be a lottery."[57] Subsequent courts have picked up the idea that where chance thwarts skill, chance dominates, and they have treated this conception as a test that is equivalent to the dominant factor test.[58] The state of Maine went so far as to incorporate this test expressly into its

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52. *Id.*

53. Morrow v. State, 511 P.2d 127, 129 (Alaska 1973) (citing Commonwealth v. Plissner, 4 N.E.2d 241 (Mass. 1936)); *see also Sherwood & Roberts-Yakima*, 409 P.2d at 163 (discussing "control").

54. *McKittrick*, 110 S.W.2d at 717 ("[W]here a contest is multiple or serial, and requires the solution of a number of problems to win the prize, the fact that skill alone will bring contestants to a correct solution of the greater part of the problems does not make the contest any the less a lottery if chance enters into the solution of another lesser part of the problems and thereby proximately influences the final result.").

55. Stevens v. Cincinnati Times-Star Co., 73 N.E. 1058, 1061 (Ohio 1905) ("It is easily within bounds to conclude that, if the dominating, determining element is one of chance, that element gives character to the whole scheme.").

56. *Tyson*, 893 So. 2d at 374 (quoting Horner v. United States, 147 U.S. 449, 459 (1893)).

57. *Plissner*, 4 N.E.2d at 245. "This test is in harmony with the rule that a result is determined by chance where it is determined 'by means making the result independent of the will of the manager of the game.'" *Id.* (quoting Commonwealth v. Sullivan, 15 N.E. 491, 494 (Mass. 1888)).

58. *See, e.g.*, United States v. Marder, 48 F.3d 564, 569 (1st Cir. 1995) (citing *Plissner*, 4 N.E.2d at 245). In another example, the North Carolina Supreme Court held that:

> [W]hether [a game] is a game of chance or a game of skill is not whether it contains an element of chance or an element of skill, but which of these is the dominating element that determines the result of the game . . . . Or, to speak alternatively, whether or not the element of chance is present in such a manner as to thwart the exercise of skill or judgment.

State v. Stroupe, 76 S.E.2d 313, 317 (N.C. 1953). The Supreme Court of Arizona defined a game of chance as "any sport or amusement . . . determined entirely, or in the main part, by mere luck, and in which judgment, skill or adroitness have no place or else are thwarted by chance." Engle v. State, 90 P.2d 988, 993 (Ariz. 1939). One court underscored that the very definition of chance is "a lack of control over events or the absence of 'controllable causation'—'the opposite of intention.'" Op. of the

gambling statute. Although it has since repealed it, Maine's definition of a game of chance required that, among other things, a person risk something of value on "an event the result of which is determined by chance, outside the control of the contestant or participant; and . . . [c]hance enters as an element that influences the outcome in a manner that can not be eliminated through the application of skill."[59]

C. FOCUS ON SINGLE ROUNDS OF PLAY

The focus on whether chance thwarts skill narrows a court's inquiry. It limits the scope of a court's review to an individual round of a game's play. When chance inheres in an individual round, courts have been quick to conclude that chance dominates the entire game. This logic is particularly apparent in courts' evaluations of card games. A player in a card game cannot control the cards that are dealt to him, and therefore, he faces nontrivial risk that he may lose any single round of play. For courts such as the North Carolina Supreme Court, this feature of the game compels the conclusion that chance is the dominant factor:

> It is a matter of universal knowledge that no game played with the ordinary playing cards is unattended with risk, whatever may be the skill, experience, or intelligence of the gamesters engaged in it. From the very nature of such games, where cards must be drawn by and dealt out to players, who cannot anticipate what ones may be received by each, the order in which they will be placed, or the effect of a given play or mode of playing, there must be unavoidable uncertainty as to the results.[60]

The North Carolina court's framing of the question as a single round of play is not an outlier. The earliest published opinion involving Texas Hold 'Em illustrates the importance of conceptualizing the inquiry as single or multiple rounds. In *People v. Mitchell*, an appellate court in Illinois heard the appeal of two defendants who participated in a game of Texas Hold 'Em at the home of one of the defendants.[61] Each participant in the game paid a $500 fee to enter the game, and each entrant received the same number of chips.[62] The proceeds of the entry fees were divided among the first- and second-place winners. Illinois state law prohibited playing a game of chance or skill for money or other thing of value, and it contained an exception for prizes given in "bona fide

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Justices, 795 So. 2d 630, 635 (Ala. 2001) (quoting BLACK'S LAW DICTIONARY 231 (6th ed. 1990)).

59. ME. REV. STAT. ANN. tit. 17, § 330(2) (2006) (repealed 2009).

60. State v. Taylor, 16 S.E. 168, 169 (N.C. 1892). In a recent case challenging the legality of a video poker machine, the imagery of the cards randomly dealt was presented to the jury: "There was testimony that the machine dealt the cards electronically, although a player could choose what cards to discard. There was testimony that winning depended on the cards dealt by the machine. A hand of video poker was played before the jury in the courtroom." *Marder*, 48 F.3d at 569.

61. People v. Mitchell, 444 N.E.2d 1153, 1154 (Ill. App. Ct. 1983).

62. *Id.*

contest[s] for the determination of skill."[63] At trial, the court instructed the jury that to convict, it must find that the government proved that the defendants participated in such a game and that the game was not a bona fide contest of skill. The jury convicted both defendants.[64]

On appeal, the defendants argued that the government had not proven beyond a reasonable doubt that Texas Hold 'Em poker was not a bona fide contest for the determination of skill.[65] The appellate court rejected this argument. It acknowledged that at trial, "[b]oth direct and circumstantial evidence was introduced to support the conclusion that the games, in fact, required a combination of skill and chance."[66] It nevertheless decided that "the jury's implicit conclusion that they were not 'bona fide contests for the determination of skill' [was not] so improbable as to warrant a reversal" of the defendants' convictions.[67] The court also opined that "the poker game played under the circumstances of the instant case is precisely the type of 'game of chance or skill' which falls squarely within the plain meaning of the activity proscribed" in the state statute.[68] The court, in affirming the defendants' convictions, thus indicated that it perceived chance dominating in each round of play.

Justice Heiple dissented because he saw the defendants' activity as a tournament in which the participants competed in a multiple-round contest of skill.[69] Justice Heiple observed that the game that the defendants played was not an individual round of Texas Hold 'Em. Rather, they played a tournament in which money was paid to the two most successful players. No money was exchanged after the play of individual hands, and participants could not buy additional chips. Anyone who left the game early could not receive a refund on his remaining chips. To obtain the prize money, a player had to exhibit the most skill at the game of Texas Hold 'Em—as well as, Justice Heiple noted, perhaps some endurance.[70]

The winners of the tournament were determined, in Justice Heiple's view, through repeated rounds of a predominantly skilled game. He saw the Texas Hold 'Em tournament as falling within the exception for bona fide contests for the determination of skill.[71] He denounced the government's conclusion that chance dominates Texas Hold 'Em as a "canard."[72] Crucial to his conclusion

63. *Id.* (citing ILL. REV. STAT. ch. 38, §§ 28–1(a)(1), (b)(2) (West Supp. 1979) (currently codified at 720 ILL. COMP. STAT. 5 / 28–1(a)(1), (b)(2) (West 2010))).

64. *Id.* at 1154–55.

65. *Id.* at 1155.

66. *Id.*

67. *Id.*

68. *Id.* (citing ILL. REV. STAT. ch. 38, § 28–1(a)(1) (West Supp. 1979) (currently codified at 720 ILL. COMP. STAT. 5 / 28–1(a)(1) (West 2010))).

69. *Id.* at 1157 (Heiple, J., dissenting).

70. *Id.*

71. *Id.*

72. *Id.*

that poker was a game of skill was his view that repeated rounds of play were the appropriate standard for evaluating the game:

> Anyone familiar with even the barest rudiments of the game knows better. Pure luck? Send a neophyte player to a Saturday night poker game with seasoned players and he will leave his clothes behind and walk home in a barrel. Pure luck? This is true of bingo or lottery. But it cannot be said of poker. The court should take judicial notice that poker is a game of skill. It cannot be gainsaid, of course, that there is an *element* of luck in poker. Of course there is. There is an element of luck in everything in life. Even the prosecution of a lawsuit contains an element of luck. But everything that contains an element of luck is not gambling.[73]

The focus on a single round of play misses that skill in many games becomes observable only after multiple rounds of play. Most card games, including poker, possess this feature. In playing a single hand, the most skilled player is not certain to win. But as more hands are played, the most skilled participant becomes more likely to enjoy success over his competitors. This feature is precisely why many games, including card games, are not commonly played for just a single round. Instead, a conventional understanding of playing a card game, like poker, is participating in an unbroken sequence of hands over a sustained period of time. This conception of a game implies that the focus on a single round has limited relevance and that courts have failed to analyze the game as most people define it. Rather, courts have analyzed a different game that is, in fact, not the one at issue in the case.

D. DISCOUNTING EVIDENCE FROM MULTIPLE ROUNDS

The focus on a single round of play is readily seen in the manner in which courts treat expert evidence. They regularly disregard evidence showing the emergence of skill over the course of repeated rounds of play. In some instances, courts set aside extensive expert evidence highlighting the importance of skill, favoring far weaker, even flimsy, evidence of chance's role. For example, in a Nebraska case, the owner of a "recreation center" sought a declaratory judgment that poker was a game of skill and that offering poker to the center's customers was not a violation of the state gambling law.[74] In its opinion, the court excerpted the testimony of the owner's expert witness. With the exception of three clarifying follow-up questions, the testimony that the court quoted consisted of responses to one question about the odds of "winning the next hand," four questions about the chances of receiving a particular hand "in any one deal" or the "initial deal" in different card games, and three questions about the odds of receiving particular cards when the "next card[s]"

73. *Id.* (emphasis in original).
74. Indoor Recreation Enters., Inc. v. Douglas, 235 N.W.2d 398, 400 (Neb. 1975).

are dealt.[75] Immediately after this excerpt, the court held that the "coll[o]quy demonstrates that there was sufficient factual basis in the record to support the . . . conclusion that the predominate purpose of the games in issue was chance."[76]

A North Carolina court recently employed similar reasoning in concluding that poker is dominated by chance and hence illegal under the state's antigambling statute.[77] A business owner who hoped to open a poker room sought a declaratory judgment that poker is a game of skill and an injunction against the local district attorney preventing enforcement of the state's antigambling statute.[78] A lower court denied the request, and on appeal, the intermediate court affirmed.[79] The government presented only one witness—a law enforcement officer who had played poker for more than thirty-nine years and who believed that, although poker involved skill, chance was dominant.[80] "He testified that he had seen a television poker tournament in which a hand with a 91% chance to win lost to a hand with only a 9% chance to win."[81] The business owner offered multiple expert witnesses. One of these was a professional poker player who testified that "while in a single hand of poker, chance may defeat a skilled and experienced player, the skilled player is likely to prevail when multiple hands are played."[82] The second expert witness for the business owner was a consultant to poker tournaments who testified that skill prevails over luck over long periods of play.[83] Another witness testified that he believed poker is a game of skill because he had improved his play by studying poker strategies.[84]

From this testimony, the court drew two conclusions. It concluded, first, that poker was a game involving both skill and chance and, second, that "in a single hand, chance may predominate over skill, but that over a long game, the most skilled players would likely amass the most chips."[85] These conclusions left the court with a choice of which framing of the inquiry—the single hand or a string of hands—was proper. The court held that poker was predominantly a game of chance and was thus illegal under the state statute.[86]

In the appellate court's view, chance dominated because "the instrumentality for victory is not entirely in the player's hand," and "novices may yet prevail

75. *Id.* at 401.
76. *Id.*
77. Joker Club, L.L.C. v. Hardin, 643 S.E.2d 626 (N.C. Ct. App. 2007). A caveat is that the court did not specify the type of poker, so the reach of this decision is a bit unclear.
78. *Id.* at 627.
79. *Id.*
80. *Id.* at 629.
81. *Id.* The witness apparently did not consider the possibility that he witnessed one of the 9% of hands rather than the 91%.
82. *Id.*
83. *Id.*
84. *Id.*
85. *Id.*
86. *Id.* at 631.

with a simple run of luck."[87] The court contrasted poker with bowling and billiards. In billiards, the player's skill determines whether a ball finds the pocket, and in bowling, skill fixes conclusively whether and how many pins a ball will topple.[88] In contrast to these games, poker "presents players with different hands, making the players unequal in the same game and subject to defeat at the turn of a card."[89] The court granted that "knowledge of human psychology, bluffing, and the ability to calculate and analyze odds" increase a player's chance of success, but "[n]o amount of skill can change a deuce into an ace."[90] The court also rejected the defendant's analogy to golf as "creative, [but] false."[91] "Although chance inevitably intervenes, it is not inherent in the game [of golf] and does not overcome skill, and the player maintains the opportunity to defeat chance with superior skill."[92] For the court, the "critical difference" was that in poker "a skilled player may give himself a statistical advantage but is always subject to defeat at the turn of a card, an instrumentality beyond his control."[93]

These courts are not alone in concluding that the player's inability to control the outcome of an individual round of play is the crucial consideration. The Washington Supreme Court took a similar approach in analyzing the legality of low-ball poker and several other card games.[94] A state statute prohibited the playing of games with cards in which money or property was "bet, wagered or hazarded upon any chance."[95] Two restaurant owners appealed an injunction requiring them to end gambling on their premises in violation of this provision.[96] One defendant testified "that skilled players have a definite advantage" and over time will "win consistently over those less skilled."[97] He also stated that "even the most skillful player would not have control over winning any individual hand, though he might naturally increase his chance of winning by playing young, inexperienced players."[98] The court's opinion excerpted passages of the defendant's testimony where he described differences between casual and professional players.[99] A difference he identified was that casual players often have only a limited time in which to play and are "fighting the clock."[100] The government's expert witness was a special agent from the

87. *Id.* at 630.
88. *Id.*
89. *Id.*
90. *Id.*
91. *Id.*
92. *Id.*
93. *Id.* at 630–31.
94. *See* State *ex rel*. Schillberg v. Barnett, 488 P.2d 255, 258 (Wash. 1971).
95. *Id.* at 255 (citing WASH. REV. CODE § 9.47.010 (repealed 1971)).
96. *Id.* at 255–56.
97. *Id.* at 256.
98. *Id.* at 258.
99. In his testimony, the defendant used the word "gambler" to describe players of the game, and the court italicized this word to emphasize the defendant's own characterization. *Id.*
100. *Id.*

Federal Bureau of Investigation, and the court stated briefly that his testimony was a mathematical explanation of how chance dominated the game.[101]

The trial court concluded that low-ball poker and the other games fell within the statute's prohibition because they involved a substantial element of chance.[102] The defendants appealed, arguing that the court's conclusion was inconsistent with its factual finding that the games were "predominantly games of skill and that one who is skilled will win consistently."[103] The appellate court rejected this argument. It understood the testimony as showing "from a mathematical standpoint . . . that chance was *a*, if not *the*, determinative element in the outcome of these games."[104] The court concluded that the evidence supported the trial court's finding that chance dominated this poker game, and it affirmed the trial court's injunction.[105]

In 2004, the governor of Rhode Island asked the state supreme court to give an advisory opinion on whether the games listed in casino legislation offended the state constitution's prohibition on lotteries.[106] Blackjack poker was one of the listed games, and the court applied the dominant factor test to determine whether the games were constitutionally prohibited lotteries.[107] The court reviewed several precedents from other states and concluded that blackjack poker was a game "in which one can exercise some level of skill to increase his or her likelihood of winning. . . . But even in these games, the outcome depends heavily on the luck of the draw."[108] The court concluded that chance dominated the outcomes in blackjack poker and other games included in the legislation and that such games consequently ran afoul of the state constitution's prohibition of lotteries.[109]

The Rhode Island Supreme Court reached this decision without any testimony or evidence regarding poker or the other games because it believed that "no special fact-finding process" was necessary "to determine whether the element of chance is the dominant factor" in blackjack poker and the other games mentioned in the legislation.[110] The court conceded that "a certain level of fact-finding would be helpful" in evaluating the precise influence of chance and skill.[111] The court was nevertheless confident that the elements of chance and skill were sufficiently clear that it could make the determinative assessment as a matter of law and unassisted by fact-finding.[112]

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101. *Id.* at 256.
102. *Id.* at 255–56.
103. *Id.* at 256.
104. *Id.* at 258.
105. *Id.* at 258–59.
106. *In re* Advisory Op., 856 A.2d 320, 323 (R.I. 2004).
107. *Id.* at 328.
108. *Id.*
109. *Id.* at 329–33.
110. *Id.* at 329.
111. *Id.*
112. *Id.*

A North Carolina court similarly rejected the relevance of expert testimony by narrowing the inquiry to a single round of play.[113] The court rejected the appeal of a defendant who was convicted by a jury of using and keeping a gaming table on which blackjack poker was played.[114] The defendant produced an expert witness who was a computer programmer and whose master's degree thesis attempted to show "in some detail" that skill was the dominant element in blackjack poker.[115] The expert sought to testify that although individuals vary in their skill, a person could, through study and practice, "beat the game of blackjack."[116] The appellate court held that the trial court's decision to exclude this testimony was not an abuse of discretion. In the appellate court's view, the decision whether blackjack poker was predominantly a game of skill or chance was for the jury to decide "and not a question for one who by extensive study and experience has evidently made a career of the game."[117] The appellate court also rejected the defendant's argument that the trial judge erred in failing to find as a matter of law that skill predominates in blackjack poker.[118] The appellate court recognized that both skill and chance were required to play blackjack poker, but it concluded that "the element of chance clearly dominates the elements of skill; certainly, 'the element of chance is present in such a manner as to thwart the exercise of skill or judgment.'"[119]

E. DISCOUNTING EVIDENCE OF SKILL

Another way in which courts commonly deemphasize the importance of skill is to disregard the relevance of any evidence of it at all and to discount the relevance of certain types of skill. Some courts believe that the importance of skill can be determined by examining the rules and structure of the game, without measuring how the individual players exercise skill: "It is the character of the game and not the skill or want of skill of the individual player which determines whether the game is one of chance or skill."[120] Other courts bluntly reject the relevance of a player's skill: "It is irrelevant that participants may exercise varying degrees of skill."[121] Some courts acknowledge that skill may have a role but insist that the game must be evaluated from the standpoint of the average or typical player.[122] These courts commonly look to the degree of skill

113. State v. Eisen, 192 S.E.2d 613, 616 (N.C. Ct. App. 1972).
114. *Id.*
115. *Id.* at 615.
116. *Id.* at 616.
117. *Id.*
118. *Id.*
119. *Id.* (quoting State v. Stroupe, 76 S.E.2d 313, 317 (N.C. 1953)).
120. Engle v. State, 90 P.2d 988, 993 (Ariz. 1939).
121. Morrow v. State, 511 P.2d 127, 129 (Alaska 1973).
122. *See, e.g.*, Boies v. Bartell, 310 P.2d 834, 839 (Ariz. 1957). Other courts have offered the same explanation: "While the evidence shows that by long practice a certain amount of skill may be developed, yet we must view the operation and result of the [game] as it is played by the mass of the patronizing public, with whom it is purely a game of chance." Baedaro v. Caldwell, 56 N.W.2d 706,

possessed by the pool of people to whom the game is offered and conclude that the game's potential participants lack the necessary skill. For instance, in evaluating the legality of two ball-pitching games, a New Jersey court reasoned:

> There is no denial of the factual premise that a player can develop an expertness in either of the games presently under examination sufficient to enable him to compete successfully in a contest with a novice. But plaintiffs' operations do not consist of the conduct of contests of that kind. . . . The average game they run is one in which a score or more of casual boardwalk passersby of various degrees of inexpertness try their hand in competition with others of the same ilk, and against the house.[123]

Nor does the fact that players may have an opportunity to develop skill, perhaps through repeat play, defeat the perception that skill plays little role in a game:

> We do not think that the great mass of the patronizing public has either the time, or inclination, to develop whatever latent talent they may have in this field of endeavor. It would appear therefore that as to the public in general this [game] . . . is still a game of chance.[124]

This sort of reasoning is distinctly unhelpful. The characteristics of the people to whom the game is offered may have nothing to do with whether skill improves or controls a player's odds of winning. Any game—whether a pure lottery or a keen test of skill—may be offered to people who lack the inclination to acquire any skills it may require.

Courts' reluctance to credit the importance of skill may be partly due to the fact that skill is commonly treated as a black box. Typically, neither the litigants nor the court articulate what the alleged skill required is in a given game, and when it is mentioned, it is often the ability to calculate probabilities. For many card games, a key skill is the ability to calculate the probability that a given hand will be sufficient to beat other players or the probability that the next card dealt will have a particular value.

Courts have rejected the idea that this kind of mathematical skill overrides chance for purposes of the dominant factor test. For example, an Alabama court concluded that a player's ability to manage the odds of success was effectively no skill at all.[125] "Simply put, a player's understanding of the rules or of the laws of probability relating to a game of chance does not change the fact that he is playing a game of chance. A player may be 'skilled' at 'playing the odds,' but

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709–10 (Neb. 1953) (quoting State *ex rel.* Dussault v. Kilburn, 109 P.2d 1113, 1115 (Mont. 1941)) (internal quotation marks omitted).

123. Ruben v. Keuper, 127 A.2d 906, 909–10 (N.J. Super. Ct. Ch. Div. 1956).

124. White v. State, 51 So. 2d 550, 554 (Ala. Ct. App. 1951). Similarly, the average player "plays a few times and moves on. He has neither the time nor the inclination to spend a couple of years studying the idiosyncrasies of the machine." Tooley v. United States, 134 F. Supp. 162, 167 (D. Nev. 1955).

125. State *ex rel.* Tyson v. Ted's Game Enters., 893 So.2d 355, 375 (Ala. Civ. App. 2002).

he is still 'playing the odds.'"[126] Were this statement not clear enough, the court also analogized the residual influence of skill to a hypothetical, "modified game of 'Russian roulette.'"[127] In the court's hypothetical game, the initial rounds consisted of games of skill, and a player prevailing there earned the opportunity to remove all but one bullet from the gun. The final round then consisted of a game of Russian roulette with the single bullet in the gun's chamber. The court observed that "one would still be hard-pressed to persuade a contestant who had done so that his [subsequent] 'winning' or 'losing' no longer depended upon chance."[128]

Another example of a court's inattention to the importance of skill is the recent Pennsylvania decision *Commonwealth v. Dent*.[129] In this case, the defendants were prosecuted for hosting games of Texas Hold 'Em in violation of the state gambling laws.[130] They filed a pretrial writ of habeas corpus, asking the court to dismiss the case, and they argued that the government could not make a prima facie showing that chance dominated skill.[131] A state trooper who had participated in the game as an undercover agent testified at a hearing about the importance of skill and luck, and the trial court decided that skill dominated chance in this type of poker and dismissed the charges.[132] The government appealed.[133]

The majority of the appellate court concluded that "skill can determine the outcome in a poker game, [but] players are still subject to defeat at the turn of the cards."[134] It reversed the district court's dismissal of the charges.[135] By contrast, the dissenting judge in *Dent* found the government's evidence wanting. He observed that the only evidence the government produced at the hearing was the testimony of the state trooper who made only a "passing reference to his views on the roles chance and skill played in these games."[136] He saw no evidence in the record that would prove that chance dominated skill in this type of poker.[137]

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126. *Id.*
127. *Id.* at 374 n.17.
128. *Id.*
129. 992 A.2d 190, 193–96 (Pa. Super. Ct. 2010).
130. *Id.* at 192 (citing 18 PA. CONS. STAT. ANN. §§ 5513(a)(2)–(4) (West Supp. 2012)).
131. *Id.* at 198 (Colville, J., dissenting).
132. *Id.* at 191–92 (majority opinion).
133. *Id.* at 192.
134. *Id.* at 196 (footnote omitted).
135. *Id.*
136. *Id.* at 198 (Colville, J., dissenting). In a footnote, the dissenting judge quoted the trooper's testimony on this point: "You don't have to know anything. You could go there as an idiot and you may get lucky but over the course of time it would be beneficial to know the game of poker[.]" *Id.* at 198 n.1 (alteration in original) (citation omitted).
137. The dissenting judge also argued that the question of whether chance dominated skill was not properly before the court. Instead, its task was to determine whether the government carried its burden to present evidence of the predominant influence of chance that, if accepted as true, would warrant submitting the case to the jury. *Id.* at 199.

Perhaps the most significant misstep of the *Dent* court was its reliance on an earlier decision of the Supreme Court of Pennsylvania, *Commonwealth v. Two Electronic Poker Game Machines*,[138] and, specifically, that case's articulation of the dominant factor test.[139] But an important factual distinction was that the earlier decision involved video poker machines rather than, as in *Dent*, poker games between live persons. In the earlier case, the defendant offered the testimony of a statistics professor from Carnegie Mellon University. This expert claimed that knowledge of statistics could raise the rate at which a player won hands by four times over playing a "dumb" strategy of standing pat on the hand initially dealt.[140] This testimony did not persuade the Pennsylvania Supreme Court that the ability to play a mathematically informed strategy was a relevant skill.

> While skill, in the form of knowledge of probabilities, can improve a player's chances of winning and can maximize the size of the winnings, chance ultimately determines . . . the cards dealt and the cards from which one can draw—in short, a large random element is always present.[141]

The high court also noted that several skills that are relevant to poker played between individuals, such as "holding, folding, bluffing and raising," are absent in the electronic form of play.[142] The court concluded that the game involves some skill but that the element of chance dominated.[143] The *Dent* court did not acknowledge this distinction and the wider set of skills involved in live poker.

The distinction between video and live poker—and its implications for the relative influence of skill—has also escaped other courts. In a Montana case, a county attorney sought a declaratory judgment that the state's prohibition on slot machines applied to video poker machines and that such devices were not covered by the antigambling statute's poker exception.[144] The trial court found as a matter of fact that electronic poker was identical to poker between persons or what the court called "poker as that term is anciently and commonly understood."[145] However, when the government appealed, the majority of the

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138. 465 A.2d 973 (Pa. 1983).

139. *Dent*, 992 A.2d at 196 (relying upon "the 'predominate-factor test' as enunciated by the Pennsylvania Supreme Court in *Two Electronic Poker Machines* [sic]").

140. *Two Elec. Machs.*, 465 A.2d at 978; *see also* Commonwealth v. One Electro-Sport Draw Poker Mach., 443 A.2d 295, 298 (Pa. Super. Ct. 1981).

141. *Two Elec. Machs.*, 465 A.2d at 978.

142. *Id.* By contrast, the intermediate court did not even mention the interactions between persons and perhaps the psychological aspects of bluffing and discerning its presence as important. "The fact that the game is played here with a computer rather than a deck of cards is not meaningful." *Electro-Sport Draw Poker Machs.*, 443 A.2d at 298.

143. *Two Elec. Machs.*, 465 A.2d at 978.

144. Gallatin Cnty. v. D & R Music & Vending, Inc., 676 P.2d 779, 780 (Mont. 1984), *superseded by statute*, Video Draw Poker Machine Control Law, ch. 720, § 1, 1985 Mont. Laws 1649, *as recognized in* MPH Co. v. Imagineering, Inc., 792 P.2d 1081, 1085 (Mont. 1990).

145. *Id.* at 783 (Morrison, J., dissenting) (quoting trial court) (internal quotation marks omitted).

Montana Supreme Court ignored that finding and concluded that electronic poker and live poker were different games and that electronic poker was indistinguishable from a slot machine.[146] The dissenting judge argued that the high court should be bound by the trial court's finding that the winner was determined not only by "'luck of the draw' . . . but also on the knowledge of those odds by the player, and his skill in applying those odds to the particular hand with which he is confronted."[147] The dissenter also objected to the majority's overlooking of the defendant's evidence that skillful play had a three-to-one chance of winning over random play.[148]

The discounting of mathematical skill is connected to the framing of the inquiry as a single round of play. For instance, a New York court made an allusion to poker while explaining the dominant factor test.[149] The court conceded that poker or blackjack may "require considerable skill in calculating the probability of drawing particular cards. Nonetheless, [they] are as much games of chance as [a pure lottery], since the outcome depends to a material degree upon the random distribution of cards."[150] Another court dismissed the importance of mathematical skill in managing the influence of chance: "Mathematicians, engineers, physical scientists, or others familiar with scientific calculations might be considered more 'skilled' at using the 'laws of probability' to predict a particular outcome. A guess by someone educated in any discipline still, in its essence, remains a guess."[151]

In both of these passages, the courts gave exclusive attention to a single round of play: a discrete deal of cards or one guess. Yet, when a player receives a poor deal of the cards, the smart play, according to the dictates of probability, is often to fold immediately. But a player who demonstrates his skill by following the recommendation of probability loses the round. In this instance, a player's exercise of skill ironically implies that another player wins the hand. Yet, for the typical player, whose horizon is many rounds or hours of play, it is often the best strategy. If other participants realize a player applies his knowledge of probability to a game, they will infer a strong hand whenever he fails to fold. This creates an opportunity for the player to bluff. When bluffing occurs with regularity in face-to-face games, the ability to detect the telltale signs of an emotional reaction (or "tells") becomes a valuable skill. Similarly, the capacity

146. *Id.* at 781–82 (majority opinion).

147. *Id.* at 783 (Morrison, J., dissenting) (quoting trial court) (internal quotation marks omitted).

148. *Id.* at 782–83 (arguing also that the majority's conclusion was "judicial legislation" and was inconsistent with an earlier decision on keno). An instance in which a court treated poker as a game of skill was a Missouri case involving whether the playing of "twenty-one" poker and other games in riverboats complied with the state constitution's prohibition on lotteries. Harris v. Mo. Gaming Comm'n, 869 S.W.2d 58 (Mo. 1994) (en banc). The parties agreed that poker was a game of skill, and thus, the application of the dominant factor test to poker was not an issue. *Id.* at 64.

149. People v. Turner, 629 N.Y.S.2d 661, 662 (Crim. Ct. 1995).

150. *Id.*

151. Op. of the Justices, 795 So. 2d 630, 641 (Ala. 2001).

to suppress reactions and maintain an impassive demeanor (the eponymous "poker face") is an advantage in the game.

Nearly all of these skills require the acquisition of information about other players and the construction of a reputation about oneself. A player has an opportunity to deploy these skills only when players have observed each other's behavior over repeated hands. By narrowing the inquiry to a single hand of play, the courts deny defendants the opportunity to demonstrate the dominance—and perhaps even the presence—of these skills.

F. INDETERMINACIES IN APPLICATIONS OF THE DOMINANT FACTOR TEST

The consequences of these conceptual missteps are that the dominant factor test has regularly yielded inconsistent results and that it cannot distinguish gambling from sports and even the activity of many large financial markets. One court openly acknowledged that the test has produced a profusion of conflicting opinions across jurisdictions. According to the court, "It is impossible to harmonize all the cases."[152] A telling example of the incoherence of the dominant factor test is the New York courts' experience in evaluating three-card monte. This game, often known as the "shell game," involves a dealer designating one of three items, typically a playing card, as the target. The dealer then rearranges the items or shuffles the cards, and the player guesses which of the three is the target item. A judge on a New York criminal court concluded that this was a game of skill. In the court's view, "the contest pits the skill level of the dealer in manipulating the cards against that of the player in visually tracking the card."[153] The next year, a different judge on the same court held that the dominant factor test led to the opposite conclusion. According to that judge, the "effect of the dealer's skill is merely to influence the odds. The outcome is still determined by the player's selection at random."[154] The second judge did not believe that the ability to alter the chance of success was a skill recognized for purposes of the dominant factor test. This judge also rejected the idea that the player employed any skill because the player could always ignore the dealer's repositioning of the objects and make a random guess.[155] The fact that two judges on the same court could reach diametrically opposed conclusions within a year about the same legal question on identical facts illustrates the indeterminacy of the dominant factor test.

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152. State *ex inf.* McKittrick v. Globe-Democrat Publ'g Co., 110 S.W.2d 705, 717 (Mo. 1937) (en banc); *cf.* State v. Coats, 74 P.2d 1102, 1110 (Or. 1938) (Kelly, J., specially concurring) ("It is apparent that then [when the state constitution was written, about ninety years before], as now, lotteries were included in the all-embracive terms of the general antigambling statutes. It is equally apparent that the chance or pure chance doctrine could not then, as it cannot now, correctly distinguish a lottery from an ordinary form of gambling."). The *McKittrick* court also observed that "[w]hether the chance factor is dominant or subordinate is often a troublesome question." *McKittrick*, 110 S.W.2d at 713.

153. People v. Hunt, 616 N.Y.S.2d 168, 170 (Crim. Ct. 1994).

154. *Turner*, 629 N.Y.S.2d at 663.

155. *Id.* Of course, skilled players can always guess, too, or intentionally decline to use their skills.

Another weakness of the dominant factor test is its inability to distinguish activities that are commonly understood to be gambling from those that are not. For example, are athletic competitions, like golf, games of skill or of chance? The Supreme Court of North Carolina grappled with this question in 1848 when it considered whether ten pins was a game of chance or skill.[156] The court recognized that even in games requiring a high degree of skill,

> [the] superiority of skill is not always successful—the race is not necessarily to the swift. Sometimes an oversight, to which the most skilful [sic] is subject, gives an adversary the advantage; or an unexpected puff of wind, or an unseen gravel in the way, may turn aside a quoit or a ball and make it come short of the aim.[157]

The court saw that if these small variations and interventions were considered chance, then the distinction between games of chance and those of skill would collapse.[158] It rejected the idea that small variations in wind, gravel, or inattention rendered athletic events gambling. The court did so by looking to the statutory text. It read the statute's reference to the phrase "game of chance," rather than just "games," as indicating the legislature's intention to prohibit only certain games and not all games.[159] In the court's view, the legislature sought to maintain a distinction between athletic games and gambling. It distinguished the two by asserting that it was "not inherent in the nature" of sports and games of skill for the less skilled to lose.[160] It brushed off oversight or inattention as "the party's fault, and not his luck," and it discounted "the other obstacles" as "occurrences in the course of nature and not chances."[161]

Perhaps a more forthright description of the court's view is that whenever chance enters explicitly into a game, it is prohibited gambling, but implicit chance is permissible. In games such as tennis or golf, there is no formal randomization, but chance enters implicitly in the form of gusts of wind and other unexpected distractions and obstacles. These random influences might prevent the most skilled player from winning. Arguably, the ability of a player to continue to perform at a high level in the presence of wind, gravel, and other

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156. State v. Gupton, 30 N.C. (8 Ired.) 271 (1848).

157. *Id.* at 274.

158. *Id.* (foreseeing that "there would be none other but games of that character").

159. *Id.* at 273–74. Subsequent courts have picked up on the fear that too great an emphasis on the role of chance in athletic events would cause the distinctions between categories of games to collapse. For example, the North Carolina high court wrote that

> [i]t is true an unseen gravel in the way may deflect a ball in tenpins or bowls or a sudden gust of wind a bullet, but if these incidents are sufficient to make tenpins and bowls or shooting at beef a game of chance, there would be no other games but those of chance.

State v. Stroupe, 76 S.E.2d 313, 316 (N.C. 1953) (citing *Gupton*, 30 N.C. at 274).

160. *Gupton*, 30 N.C. at 274.

161. *Id.*

variations in playing conditions itself constitutes a dimension of skill. The North Carolina court was comfortable with these aspects of chance, seemingly because they were implicit. To call these random forces "occurrences in the course of nature"[162] merely attaches a different label to what is, in essence, chance. The court was willing to assign responsibility for the player's reaction to these varying conditions to the player himself (and hence the importance of "fault"). But when chance or randomization was a formal part of the game, such as through a deal of the cards, the court was troubled.

This distinction between implicit and explicit chance is not workable. The element of chance introduced through variations in conditions such as wind and gravel is as much a formal part of some games as the deal of cards or the roll of dice is in other games. The rules of the game or the locale of play could be altered to eliminate these "natural occurrences," but instead they are permitted. In addition, the very skill tested in many games is the player's ability to manage and respond to risks and changing conditions.

Another crucial weakness of the dominant factor test is its inability to distinguish gambling from widely accepted business practices, such as insurance and derivative contracts. The business of insurance—contracts in which one party pays a fee in exchange for a larger payment if a specified contingency arises—requires the insurer and the insured to estimate the probability that the contingency will occur. For example, in a life-insurance contract, the insured is betting that his life is not so long that the present value of his insurance premiums exceeds that of his eventual payout. The insurer is making the opposite bet. In effect, it is a gamble about the insured's performance relative to the mortality tables. An annuity contract is similar, except the parties' hopes for the insured's longevity are reversed. The parties to an insurance or annuity contract are "playing the odds," the very activity so many court decisions have condemned under the dominant factor test.

The argument that insurance is dominated by skill rather than chance is not fanciful. As previously described, many states have express exceptions in their gambling statutes for "bona fide business transactions."[163] The UIGEA replicates this problem because it follows the state law definitions of gambling. To overcome it, the UIGEA expressly excludes from the definition of a bet or wager activities governed by the securities laws and transactions governed by or exempt under the Commodity Exchange Act.[164] It also excludes over-the-counter derivatives and contracts of indemnity, guarantee, or insurance, among other things.[165] The exemption for bona fide business transactions under state law was necessary because a line of court decisions spanning several states held

162. *See id.*
163. *See supra* notes 32–36 and accompanying text.
164. 31 U.S.C. § 5362(1)(E) (2006).
165. *Id.*

that arrangements which today would be known as derivatives contracts were illegal gambling.[166] Early precedents forbade contracts that had the form of promises of future delivery of personal property but that, in actuality, were promises to pay and receive the difference between an agreed price and the market price at a future day. Such a contract was a "wager" on the future market price and thus void. The test of whether a contract was an impermissible wager of this form was whether actual delivery of the property was intended.[167] These prohibitions covered commodities in which there are now established futures markets as well as financial instruments.[168] The need for an exception for bona fide business transactions (to ensure that derivatives are not treated as gambling) illustrates the over-reach of the dominant factor test.

For other courts, the test's reach is insufficiently far. In some cases, courts have redefined the test in ways that broaden its reach but also stretch its judicial credibility. These interpretations occur most often when a court considers a game in which skill is so crucial that it is likely to survive the highly restrictive dominant factor test. For example, the New Jersey Supreme Court, in deciding the legality of a type of pinball machine, declined to use the most common definition of the test—whether chance may thwart skill in a single round of play.[169] Instead, the court stated, "we think a fair test would be whether a player possessing average skill would be successful more often than not in the venture."[170] The court readily acknowledged the bizarre implication of this test—that for a game to be deemed a contest of skill, the payouts in prizes would have to exceed the inflow of revenues.[171] The court viewed the apparent profit motive of the game's sponsor as a reason to affirm the lower court's condemnation of the game:

> In view of the fact that there is not even a suggestion that the appellant was conducting his business as a philanthropy with an intent to donate his money to the public, we fully agree with the finding of the trial judge that chance and not skill is the predominant factor in the play of these machines.[172]

Another court was less self-aware in relying on the same idea.[173] It saw the profit that an owner garnered from his video poker machine, and it saw that more

166. Lynn A. Stout, *Why the Law Hates Speculators: Regulation and Private Ordering in the Market for OTC Derivatives*, 48 DUKE L.J. 701, 713–20 (1999).

167. *Id.* at 713–17.

168. *See, e.g.*, McKeon v. Wolf, 77 Ill. App. 325 (App. Ct. 1898) (discussing market for bonds); *In re* Peterson's Estate, 281 N.W. 877 (Minn. 1938) (discussing market for cattle); Becher-Barrett-Lockerby Co. v. Hilbert, 267 N.W. 727 (Minn. 1936) (discussing market for grain).

169. State v. Ricciardi, 114 A.2d 257, 259 (N.J. 1955).

170. *Id.*

171. *Id.*

172. *Id.*

173. United States v. Marder, 48 F.3d 564 (1st Cir. 1995).

players of the machine lost than won, as evidence that chance dominated skill.[174]

G. THE UNDERLYING POLICY CONCERN

Courts' confused use of the dominant factor test and their consistently restrictive applications of it suggest that another concern motivates their decisions. The Supreme Court of Oregon took the unusual step of articulating its actual concerns in a decision on the permissibility of keno.[175] The court began with a sophisticated evaluation of poker, even though its legality was not at issue in the case.[176] The court perceived that a player's skill becomes evident only with repeat play:

> In all card games there is more or less an element of skill. Take, for instance, the great American game of poker; we have no doubt, if a couple of gamblers sat down to play this game against a couple of ministers, who presumably do not indulge in it, that the ministers would soon be destitute of "chips" and the gamblers' pile augment accordingly. It is true there is an element of chance in poker, and a very large element at that, and there is an element of chance in faro or any other game played with cards, but in any of these there is also some element of skill.[177]

The court ultimately concluded that keno was "under every essential element as much a game of chance as faro, poker, or any other game played with cards . . . ."[178] Although the court gave this detailed analysis of the mix of skill and chance, the court did not rest its decision on that reasoning. Instead, the court identified the policy concern that it believed was behind the legislature's prohibition of gambling. The court saw that keno was "a game calculated to stimulate in the minds of young people, especially, a desire to take chances in the hope of obtaining an article of considerable value by risking a very small sum of money."[179] In the court's view, this was a social problem that the legislature sought to address by prohibiting gambling, and it should be the basis of the court's decision.

Early precedents tend to express this concern more directly. For example, the Supreme Court of Ohio in 1905 wrote, "All highly civilized peoples recognize the evils to society arising from the encouragement of the gambling spirit, and it is for the purpose of discouraging this vice and preventing the spread of it that laws are passed . . . to punish and prohibit [it]."[180] What is this "gambling

174. *Id.* at 569.
175. State v. Randall, 256 P. 393 (Or. 1927).
176. *Id.* at 394.
177. *Id.*
178. *Id.*
179. *Id.*
180. Stevens v. Cincinnati-Times Star Co., 73 N.E. 1058, 1062 (Ohio 1905).

spirit" and why must it be discouraged? A 1915 decision from North Carolina explained:

> It is the one playing at the game who is influenced by the hope enticingly held out, which is often false or disappointing, that he will, perhaps and by good luck, get something for nothing, or a great deal for a very little outlay[.] This is the lure that draws the credulous and unsuspecting into the deceptive scheme, and it is what the law denounces as wrong and demoralizing.[181]

These passages identify the policy issue behind the consistently restrictive interpretations of the dominant factor test. Despite courts' assurances that the test probes the nature of the game, the primary concern is the identity of the players and the effect that participation in the game has on them. This view assumes that the members of the audience suffer two kinds of vulnerabilities. The first is a lack of information about the risks potential players face in playing certain games. In this sense, they are "unsuspecting," and to the extent that the purveyors of the games intentionally withhold this information, the games are "deceptive." Second, the players do not have sufficient self-control to resist the temptation of the game. The prospect of "something for nothing, or a great deal for a very little outlay" is so great an inducement it overthrows the will. Other courts have echoed both of these themes.[182]

The concern for vulnerable players explains courts' insistence that the standard for evaluating the role of skill in a game is that of the average player, and it also explains why courts commonly assume that the average player is utterly without skill. In applying the dominant factor test, courts are unwilling to entertain the possibility that a player may be skilled because they do not perceive skilled players to be the class of persons the statute is intended to protect. Seen from this perspective, the reason why courts do not apply the dominant factor test as a quantitative balancing of influences of chance and skill emerges.

These decisions are characteristic of the Progressive Era's belief in moral weakness as the source of vice and its faith in law's potential to protect the vulnerable.[183] During the past century, courts have shied away from this sort of moral rhetoric and have hewed closely to the language of skill and chance. But

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181. State v. Lipkin, 84 S.E. 340, 343 (N.C. 1915).

182. *See, e.g.*, Morrow v. State, 511 P.2d 127, 129 (Alaska 1973) ("In many instances the gambling aspect of a lottery could be cleverly concealed so that ignorant and unwary persons would be enticed into participation before they became aware of the true nature of the scheme."); Ruben v. Keuper, 127 A.2d 906, 910 (N.J. Super. Ct. Ch. Div. 1956) ("These are games in which comparative novices can win an occasional prize and thus titillate themselves and others into continued participation. To them the lure is chance and not an opportunity to match skills.").

183. David A. Skeel Jr. & William Stuntz, *The Criminal Law of Gambling: A Puzzling History*, *in* GAMBLING: MAPPING THE AMERICAN MORAL LANDSCAPE 257, 265 (Alan Wolfe & Erik C. Owens eds., 2009) (quoting William Jennings Bryan's advocacy of a ban on gambling in the Nebraska constitution: "Chance should not be allowed to be substituted for honest industry . . .").

occasionally, the Progressive Era concerns have explicitly come to the surface. In *Baedaro v. Caldwell*, the Supreme Court of Nebraska evaluated whether a type of pinball machine was a "gambling device" for purposes of the state's gambling statute.[184] The court first analyzed the machine under the dominant factor test and concluded that the game played was one of chance.[185] It also observed that the only prize offered by the machine—the additional rounds of play—was "the inducement to play the machine, and players are allured or enticed to play it for that reason."[186] The court concluded that the game fell under the purview of the gambling statute because the prospect of additional rounds of play was a sufficient reward to constitute "money or property."[187] The court went beyond this analysis and announced that "[a]nything affording necessary lure to indulge the gambling instinct and appeal to the gambling propensities of man is a gambling device."[188] This statement of law was wholly unnecessary for the resolution of the case, but it now stands as a legal principle on which subsequent courts have relied.

In *State v. Prevo*, the Supreme Court of Hawaii examined whether the state's gambling prohibition encompassed a ball-tossing game.[189] The state's statute prohibited winning money or a thing of value by playing certain "prohibited games" or "any other game in which money or anything of value is lost or won,"[190] and the legal question for the court was whether this prohibition against winning money at "any other game" covered the ball-tossing game.[191] The court acknowledged that the plain text of the statute seemed to sweep even athletic games into its prohibition, a possibility that the court saw as a "patent absurdity . . . clearly not intended by our legislature."[192] The court also perceived the limitations of the dominant factor test in distinguishing the ball-tossing game from athletic events. Ultimately, the court did not rest its decision on the dominant factor test. Instead, it held that the game fell squarely within the statute's ban because it was designed and operated

> to induce customers to play and keep playing with the expectation of getting more than their money's worth. . . . [T]hese machines are designed to play one part of the public against another part for the purpose of inducing the whole public to take the chance of gain. The vice consists not alone in the amount of money risked in playing, but also in the encouragement of the gambling instinct latent in most people.[193]

184. 56 N.W.2d 706 (Neb. 1953).
185. *Id.* at 711.
186. *Id.* at 710.
187. *Id.*
188. *Id.*
189. 361 P.2d 1044 (Haw. 1961).
190. *Id.* at 1046–47 (quoting HAW. REV. STAT. § 288-4 (1955)).
191. *Id.*
192. *Id.* at 1049.
193. *Id.* at 1051.

These decisions reveal that the courts perceive the "gambling spirit," or in modern terms, "gambling addiction," to be the legislature's true concern. Gambling addiction is a serious social problem, and it is sensible for government to regulate activities that may contribute to it. A relevant question, then, is which regulations are optimal and whether the dominant factor test is the best tool for calibrating these policies. It seems doubtful that the dominant factor test accurately identifies the activities that produce a high incidence of gambling addiction. Courts developed the test nearly a century before the concept of gambling addiction emerged. The test is not enlightened by modern psychiatric science on the causes of gambling addiction.[194] Moreover, the development of many tribal casinos and the enlargement of state-sponsored lotteries during the past thirty years have greatly expanded the availability of activities that may tempt the addict.[195] At the same time, the legal doctrine has become reflexively restrictive and disconnected from the social reality of gambling. The courts' interpretations of the test have even become unmoored from common intuitions about gambling, encompassing a far wider range of activities. As currently applied, the test introduces arbitrary and unhelpful distinctions and excludes the sort of evidence that might reveal when skill is crucial. At the broadest level, the test does not make the relevant social comparison, which would be the benefits enjoyed by players and the harms suffered by addicts.

H. A DIFFERENT APPROACH BY ONE COURT

A rare exception to this pattern is a recent federal decision, *United States v. Dicristina*, written by Judge Jack Weinstein.[196] The defendant operated a club for the playing of Texas Hold 'Em out of a warehouse, and the government alleged that this conduct violated the Illegal Gambling Business Act (IGBA).[197] Before trial, the defendant moved to dismiss the indictment, arguing that poker did not constitute illegal gambling.[198] The court allowed the testimony of the defendant's expert that poker was a game dominated by skill not chance, but then excluded this evidence as "irrelevant."[199] It reserved a decision on the motion to dismiss, but ruled that the question of whether poker was gambling was a matter of law for the court to decide.[200] The court instructed the jury that poker was gambling under the IGBA, and after the jury convicted, the defendant renewed the motion to dismiss, offering a different argument.[201]

The defendant then argued that to constitute gambling under the IGBA, a

194. Henry R. Lesieur & Robert L. Custer, *Pathological Gambling: Roots, Phases, and Treatment*, 474 ANNALS AM. ACAD. POL. & SOC. SCI. 146, 147–48 (1984).

195. James I. Schapp, *The Growth of the Native American Gaming Industry: What Has the Past Provided, and What Does the Future Hold?*, 34 AM. INDIAN Q. 365, 368–70 (2010).

196. United States v. Dicristina, No. 11-CR-414, 2012 WL 3573895 (E.D.N.Y. Aug. 21, 2012).

197. *Id.* at *1, *23 (citing 18 U.S.C. § 1955 (2006)).

198. *Id.*

199. *Id.* at *3.

200. *Id.*

201. *Id.* at *1.

game must be sufficiently similar to nine games enumerated in the statute, and that to constitute a "gambling business," the game must be "house-banked" and dominated by chance.[202] Poker, in the defendant's view, was neither. The government responded that the text of the statute does not imply such limitations. It argued the statute should be read in light of its purpose, which was to assist states in combating organized crime by cutting off revenues from illegal gambling.[203] The court concluded that both interpretations were plausible and, faced with an ambiguous statute, the court applied the rule of lenity and dismissed the conviction.[204]

The *Dicristina* decision is remarkable for several reasons. First, rather than relying on state interpretations to fill in the meaning of gambling within the federal statute, the court determined that the IGBA itself has a definition of gambling different from that of state law. In so doing, it joined a small set of courts that require the government to prove that a game constitutes gambling under the federal statute rather than under state law.[205] By imposing this requirement, the *Dicristina* decision created a tension between state and federal law as to whether specific games are prohibited. Judge Weinstein left no doubt that if the definition of gambling were to be decided under New York state law, the defendant would lose; under New York precedent, poker is clearly gambling.[206] But the question before the court was whether poker was gambling as a matter of federal law, specifically the IGBA.[207] In resolving this question, Judge Weinstein concluded that the game of poker did not fall within the prohibition of the federal statute.[208]

Judge Weinstein reconciled these conflicting interpretations by noting that the New York statute prohibits games that depend to a "*material degree upon an element of chance*" while interpreting the federal statute as reaching games in which chance was the *predominant* factor.[209] Judge Weinstein's reliance on this subtle difference in the statutory language is unconvincing. New York courts have effectively disregarded this nuance in the statutory text and have inter-

202. *Id.* at *2 ("The federal statute defines gambling as 'includ[ing] but . . . not limited to pool-selling, bookmaking, maintaining slot machines, roulette wheels or dice tables, and conducting lotteries, policy, bolita or numbers games, or selling chances therein.'" (quoting 18 U.S.C. § 1955(b)(2) (2006))).

203. *Id.*

204. *Id.*

205. *Id.* at *26.

206. *Id.* at *1 ("The argument . . . . has no merit. New York courts have long considered that poker contains a sufficient element of chance to constitute gambling under that state's laws.")

207. *Id.* at *1 ("This series of New York decisions do [sic] not decide the issue now posed: whether a business involving illegal poker games violates the federal IGBA.").

208. *Id.* at *2 ("His acts did not constitute a federal crime."); *id.* at *60 ("[Poker] is not gambling as defined by IGBA.").

209. *Id.* at *60 (emphasis in original) (quoting N.Y. PENAL LAW § 225.00(1) (McKinney 2008)).

preted its statute using the dominant factor test.[210] More plausibly, the *Discristina* decision simply represents the possibility that state and federal courts will weigh the balance of chance and skill in any given game differently.

The second noteworthy feature of *Dicristina* is that it creates the possibility of conflicts between and within federal laws as to whether particular games constitute gambling. The so-called "Black Friday" indictments of the operators of online poker websites (and transfer agents) in March 2011, and the subsequent guilty pleas, suggest that the Department of Justice believes (or at least believed before *Dicristina*) that poker is prohibited under the UIGEA.[211] Because *Dicristina* concludes that poker is not prohibited under the IGBA, the Department must change its view, or the same game may be treated as illegal gambling under one federal statute but permissible under another. It is also possible that different federal courts contemplating the same statute will reach different conclusions about the permissibility of the game. Whether this is a salutary development is unclear. In the long term, it might provide greater clarity about which statutes govern which games and might even narrow the number of games that are reached by federal law. But in the near term, different federal courts ruling at different times may produce multiple, conflicting precedents and create a continuously shifting patchwork of case law.[212] Absent clarification from Congress or policy guidance on enforcement from the Department of Justice, only time will tell which route the courts will take. In any event, this lack of clarity is particularly disturbing in the context of criminal law.

Perhaps the most remarkable feature of *Dicristina* was its announcement that poker was not illegal gambling under the IGBA, even though the court did not need to decide this question.[213] The main legal question before the court was whether poker fell within the purview of the IGBA's definition of gambling.[214] The court conceded that the statutory text was ambiguous and relied on the rule of lenity to resolve the question. The court needed to go no further, but it decided whether poker is gambling under the IGBA anyway. Moreover, the manner in which it considered the question contrasts sharply with the mode of analysis that state courts regularly employ. The *Dicristina* court (implicitly) treated the dominant factor test as quantitative, it gave considerable weight to

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210. Bennett Liebman, *Chance v. Skill in New York's Law of Gambling: Has the Game Changed?*, 13 GAMING L. REV. & ECON. 461, 463 (2009) (arguing that the "material degree" test is the same as the "dominating factor" test); *see also supra* section II.A.

211. Superseding Indictment, United States v. Scheinberg, No. 10CR00336 (S.D.N.Y. Mar. 10, 2011), 2011 WL 1449655.

212. *See, e.g.*, United States v. Elie, No. S3 10 Crim. 0336(LAK), 2012 WL 383403, at *3 (S.D.N.Y. Feb. 7, 2012) (denying a motion to dismiss and reserving the question whether poker is gambling as a matter of law under the IGBA); *see also Dicristina*, 2012 WL 3573895 at *51–52 (collecting cases in which IGBA convictions for running poker games were upheld on other grounds).

213. *Dicristina*, 2012 WL 3573895 at *60 ("Because the poker played on the defendant's premises is not predominately a game of chance, it is not gambling as defined by the IGBA.").

214. *Id.* at *4.

the statistical evidence of experts, it considered multiple rounds of play to be the relevant frame of inquiry, and it thoughtfully examined the idea of player skill.

The *Dicristina* court discussed at length three pieces of evidence presented by the defendant's expert witness.[215] The expert's evidence was an analysis of millions of hands of Texas Hold 'Em played on the website PokerStars.com between April 2010 and March 2011, even though the facts of *Dicristina* involved poker played face to face.[216] The first piece of evidence was simply variation in player returns over the year. In terms of dollars won, the ten most "proficient" players earned substantially more than the least proficient players over the year. The government's expert noted that a series of coin flips, an activity involving no skill, could produce the same pattern, a point which the defendant's expert conceded.[217]

The expert's second piece of evidence was to examine whether a player's success at the game generally predicted his success when dealt specific pairs of hole cards. Take as an example the pair King–Nine.[218] The expert calculated each player's average success rate on all other possible pairs (other than King–Nine) and grouped the players according to whether their averages fell above or below the sample median. He then compared whether players above this median had a higher win rate when dealt a King–Nine than players below this median. This comparison was meant to test whether more skillful players perform better when dealt the same cards as less skillful players. The comparisons confirmed this prediction, showing that when dealt the same hand, the players thought to be more highly skilled won more (or lost less) than those thought to be less skilled.[219]

The last piece of evidence was an analysis of an index of skill to determine whether it correlated with a player's win rate. The expert divided the data randomly into halves, and using the first half, he created an index of skill that related 240 statistics about a participant's play to his win rate. Then he applied this index to players in the second half of the data and measured its correlation with a player's win rate. He predicted that to the extent that the index reflected a player's skill, his win rate should rise with the index. The results supported this prediction.[220] The expert also calculated that 900 hands of poker were needed for the higher skill group to dominate the lower skill group with 90% confidence and 1,400 hands for 95% confidence.[221]

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215. *Id.* at *6. The expert was both a Ph.D. economist and a poker player "in national poker tournaments." *Id.*

216. *Id.* at *10–11.

217. *Id.* at *9.

218. *Id.* at *11.

219. *Id.*

220. *Id.* at *11–12.

221. *Id.* at *12.

The manner in which the *Dicristina* court applied the dominant factor test was markedly different than the usual approach taken by state courts. It described at length the defense expert's statistical evidence and his exchange with the government's expert, and it even included nine figures in the opinion.[222] It reviewed earlier academic studies presenting statistical evidence on the importance of skill in poker.[223] In so doing, the court implicitly accepted the dominant factor test as inherently quantitative and recognized that the inquiry into the importance of skill properly considers multiple rounds of play. Also, the court perceived that poker implicates a broad range of skills.[224] The court even distinguished the types of skill involved in poker between individuals and in video poker.[225] It concluded that the degree of skill in poker was comparable to that in bridge and golf, games which no one would think constitute gambling.[226] Whether the *Dicristina* decision presages a new judicial approach to the dominant factor test remains to be seen. But it inspires confidence that courts could readily embrace the version of the dominant factor test that we propose and apply in Parts III and IV.

III. AN EMPIRICAL FRAMEWORK FOR DISTINGUISHING BETWEEN SKILL AND LUCK IN GAMES

For the distinction between skill and luck to operate successfully as a legal standard, there must be ways to observe differences between skill and luck in data from actual games played. In this Part, we propose a variety of tests that have the potential to isolate the relative importance of skill and luck in a general setting; in Part IV we apply these tests to a large data set of poker hands played online.

A. THE STATISTICAL PROPERTIES OF GAMES OF PURE LUCK

Consider the following scenario. A number of individuals have been assembled and are positioned around a table. Each player is required to put an equal, predetermined amount of money into the center of the table. A deck of cards is then shuffled, and two cards are dealt facedown to each of the players. Five cards are then dealt faceup on the table. The players each turn over the two cards that they have been dealt. Using the same hierarchy of hand values used in poker, it is determined which player can make the best poker hand by combining the five cards at the center of the table with their own two cards. The player with the best hand wins the money put into the pot at the start of the game. At that point, the game concludes.

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222. *Id.* at *6–12.
223. *Id.* at *18–19.
224. *Id.* at *55 ("Expert poker players draw on an array of talents, including facility with numbers, knowledge of human psychology, and powers of observation and deception.").
225. *Id.* at *22.
226. *Id.* at *57.

The game described above, under any reasonable definition, would be classified as a game of pure luck. There are no plausible means through which the identity, actions, or decisions of the player can impact the outcome of the game. The payoff the player receives depends only upon the luck of whether the cards that happen to be dealt to the player are good. An appropriate name for such a game would be "Lucker," because it has some superficial resemblance to poker, but it is a game of pure luck.

The statistical properties of games of pure luck are well understood, and indeed, deriving the statistical properties of such games was one of the first rigorous applications of probability and statistics.[227] Theory generates a number of strong hypotheses regarding the distribution of payoffs across players and over time for games of pure luck:

> (1) The expected payoff when playing this game will be identical across players;
> (2) No observable characteristics of the player will systematically be correlated with the payoffs they receive in the game;
> (3) No action that the player takes will be correlated with her payoff; and
> (4) Payoffs from the game will not be serially correlated. For example, the success rate over the first 100 repetitions of the game for a particular player will not help in predicting the success rate for that player in the next 100 repetitions.

The intuition underlying these hypotheses is straightforward. Because the player's identity and actions have no impact on the outcome of the game, nothing about the player (for example, observable characteristics, actions, or past results) should be predictive of the game's outcome. Note that these predictions are not specific to the particular game of pure luck described above; the theory applies to any and all games of pure luck.

These four predictions are, of course, probabilistic in nature. Only with an infinite amount of data will they be exactly satisfied, based on what statisticians call the "law of large numbers."[228] In finite samples, deviations will occur. Because the distribution of the outcomes is known (for example, this simple game will be drawn from the binomial distribution), the tools of statistical hypothesis testing can be used to compute confidence intervals, allowing the statistician to estimate with what probability the null hypotheses enumerated above can be rejected by any particular sample of the data.

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227. Indeed, many of the earliest formal statistical treatises were devoted to understanding the probabilities associated with the various outcomes in the popular gambling games of the time. *See, e.g.*, PETER L. BERNSTEIN, AGAINST THE GODS: THE REMARKABLE STORY OF RISK 11–22 (1996).

228. ARTHUR S. GOLDBERGER, A COURSE IN ECONOMETRICS 99, 109 (1991).

B. IDENTIFYING WHETHER SKILL IS PRESENT IN A GAME

In principle, determining empirically whether a particular game has an element of skill is straightforward: if one can reject with a great enough level of certainty any of the four null hypotheses presented above concerning the outcomes of games of luck, then the data suggest that there is an element of skill to the game, where skill is broadly defined as the ability of a given player to influence her outcomes in the game.[229] The greater the deviation of a game from the statistical regularities of a game of pure luck, the greater the evidence for skill in the game.

The tests we propose follow in a straightforward manner from the null hypotheses presented above:

> *Test of skill #1: Can one reject the null hypothesis that all players have the same expected payoff when playing the game?*
> *Test of skill #2: Do there exist predetermined observable characteristics about players that help one to predict payoffs across players?*
> *Test of skill #3: Do actions that a player takes in the game have statistically significant impacts on the payoffs that are achieved?*
> *Test of skill #4: Are player returns correlated over time, implying persistence in skill?*

It is important to note that the power of these four tests will depend on the time horizon examined. In the presence of persistent skill, the more hands considered, the greater the role is for skill. Luck evens out over time, but consistent skill does not.

A second consideration when implementing these tests of skill is the population upon which the test is carried out. One could, for instance, invite novices into a laboratory environment, teach them the rules of poker, and then have them play the game as part of a laboratory experiment. While having the virtue of providing the researcher control over certain aspects of the setting,[230] the results that emerge from such a setting are not likely to be easily generalized to naturally occurring settings such as online poker sites, which are of more interest to the courts.[231] Unlike lab volunteers, online poker players are a self-selected, experienced group of players, many of whom play for extremely

229. Note that these statistical tests do not require that the researcher understand the precise causal pathway through which skill operates. Drawing a parallel from sports, if two teams play one another twenty times, and the same team wins all twenty games, it is quite clear statistically that one team is likely better than the other, but understanding what makes one team better (for example, better coaching, more raw talent, biased officiating) may be a much more difficult task.

230. For example, the researcher could control which cards are dealt to which players, making sure each subject in the experiment had the exact same series of hands, thereby eliminating any influence of the "luck of the draw."

231. *See* Steven D. Levitt & John A. List, *What Do Laboratory Experiments Measuring Social Preferences Reveal About the Real World?*, J. ECON. PERSP., Spring 2007, at 153, 168–69 (describing the features of laboratory experiments that must be scrutinized before generalizing results to broader settings).

large stakes. Thus, in the empirical work that follows, we focus on real-world data generated by real-money poker games played online.

IV. AN EMPIRICAL ANALYSIS OF THE ROLES OF SKILL VERSUS LUCK IN ONLINE POKER

Using the theoretical framework described in the previous section, we now turn to testing the various hypotheses proposed. A large online poker site provided the data for the purpose of carrying out academic analysis.[232] The data set represents the entire history of play in real-money, no-limit Texas Hold 'Em ring games for a randomly selected subset of all players who played for real money on the website between May 2006 and May 2007.[233] We have information for every player at the table for each of those hands. Notably, the data set we have is unusual, in that it includes the "hole" cards for all players. The hole cards are the two cards dealt to each player facedown. Typically, only when a player goes to "showdown" are these cards revealed to the other players. Consequently, in most other large-hand databases that have been assembled, the identity of the hole cards of opposing players is not available. The presence of hole cards for all players is critical for testing many of the hypotheses of interest.

The raw data contain the full history of play for a total of 4,765 players. Another 297,755 players appear in at least one hand in the data because they played at least one hand against one of the players for whom we have the full history. For most of our analysis, we restrict the sample to those players (a) for whom we have the entire history of play, and (b) who have played at least 250 hands on the website, because statistically, there is little that can be said about a player when we observe only a few hands.[234] These data restrictions leave us with 2,775 players with more than twelve million hands of no-limit Texas Hold 'Em—or an average of nearly 4,500 hands per player. Summary statistics for

232. We approached the poker site requesting data we could use to ferret out fraud and collusion among online poker players, along the lines of earlier work by one of the co-authors on cheating. *See* Mark Duggan & Steven D. Levitt, *Winning Isn't Everything: Corruption in Sumo Wrestling*, 92 AM. ECON. REV. 1594 (2002); Brian A. Jacob & Steven D. Levitt, *Rotten Apples: An Investigation of the Prevalence and Predictors of Teacher Cheating*, 118 Q.J. ECON. 843 (2003). Only later did we appreciate the value of the data for answering the question addressed in this Article.

233. The poker site also provided data for real-money, pot-limit, and limit Texas Hold 'Em as well, but the prevalence of these variants of the game was much lower, leading us to focus exclusively on no-limit Texas Hold 'Em. There is every reason to believe that the types of patterns we observe would persist across game variants.

234. Although it takes less than five hours to play 250 hands online, 42% of the sample does not make that threshold. Empirically, it appears that it is common for players to deposit money on the website, lose that money in a few hands, and then never return to the website. Presumably, the least skilled players are overrepresented in this group of fast initial losers. By excluding them, our results will tend to underestimate the magnitude of skill differences across players. The statistical gains afforded by observing more hands per player, however, more than offset this bias in our opinion. Where appropriate, for instance, when computing relative rankings of which hole cards are most desirable, we use all hands in the data, not the subsample.

Table 1. Summary Statistics

	Summary Statistics for the Full Sample				
	Mean	**Std. Dev.**	**Median**	**Minimum**	**Maximum**
Player–Hand Level Data					
Amount Won per Hand (in $)	6.42	98.95	0.00	0.00	58,101.80
Amount Wagered per Hand (in $)	6.51	77.89	0.20	0.00	38,304.80
Net per Hand (in $)	−0.09	55.11	0.00	−23,442.40	19,797.00
Dollar Value of Big Blind	1.69	6.68	0.50	0.10	400.00
Big Blinds Won per Hand	3.53	15.28	0.00	0.00	1,719.80
Big Blinds Wagered per Hand	3.64	11.74	0.50	0.00	1,819.55
Net Big Blinds per Hand	−0.11	8.77	0.00	−346.50	557.68
Number of Players	2,775				
Number of Observations (Player–Hands)	12,363,802				
Player Level Aggregate Data					
Net per Hand (in $)	−0.27	0.76	−0.10	−20.38	2.29
Net Big Blinds per Hand	−0.31	0.41	−0.21	−3.16	1.08
Total Player Profit or Loss (in $)	−399.50	5,665.70	−138.30	−207,703.30	166,823.00
Number of Hands Played	4,455.42	13,228.54	1,284	251	287,882

this data set are presented in Table 1. In the top panel of the table, a player–hand is the unit of observation.

The top three rows of the table describe the outcomes of hands, measured in dollars. On average, players collect $6.42 per hand in winnings after betting $6.51, resulting in a net loss of $0.09 a hand. That $0.09 represents the poker site's "rake," which is the fee the site charges for hosting the games. Underlying these averages is an enormous dispersion of results; the standard deviation on the net return per hand is $55.11. There are cases of single pots worth more than $50,000 in our data.

To facilitate comparisons across players who play for widely varying stakes, we also express player returns in terms of big blinds won or lost per hand played. The size of the big blind dictates the amount of money put into the pot prior to any cards being dealt, which in turn determines how large the subsequent bets are. The average big blind observed in our data is $1.69, with games ranging from $0.10 big blinds to $400 big blinds. It should be noted that the poker site collects a larger percentage rake (although a smaller absolute-dollar-value rake) in the low-stakes games.[235] Consequently, players lose an average of $0.11 big blinds per hand.

Overall player results, which are more central to our four tests than the outcomes of individual hands, are presented in the bottom panel of Table 1. In this panel, each player represents one observation—that is, the same weight is given to a player with 251 hands and a player with 251,000 hands. The average player loses about $400 in our sample, but there is enormous variation around that number—the standard deviation is over $5,000. We observe some players who win or lose hundreds of thousands of dollars.

Before turning to formal tests of the four hypotheses associated with the presence of skill in a game, we briefly return our attention to the pure luck game, "Lucker," that we described above. Because the card structure of Lucker mirrors that of real Texas Hold 'Em, we are able to construct what outcomes would have occurred for each poker hand in our data if instead the players had been playing Lucker.[236] Since we know that Lucker is pure luck, deviations in outcomes between Lucker and true poker are suggestive of a role of skill in poker.

Table 2 presents a comparison of the outcomes in Lucker versus poker. We start by ordering each player's hand in Lucker, from best (top row of the table) to worst (bottom row). In other words, if every player stayed in to the end of the hand, then the player denoted "Lucker Rank 3" would be the player who had the third-best hand. The columns of the table report the percentage of the time that the actual winner of the poker hand corresponds with a player's Lucker hand rank. For instance, in Column 1 ("Overall"), which includes all hands with nine players, the player who would have won the fictional game of Lucker only wins the hand in Texas Hold 'Em 31% of the time. The second-best Lucker hand wins 22% of the time. Even the worst Lucker hand manages to win 2% of the time.

235. In this analysis, we do not make any adjustments for rake; in other words, the data we show are the actual returns of the players that they would see in their accounts. A case could be made for conducting our analysis taking "pre-rake"—that is, redistributing the poker site's cut back to the players. The findings excluding rake from the analysis are little changed, however, except that player returns are increased in proportion to the site's rake.

236. In Texas Hold 'Em, the hand often ends before all five of the cards are dealt faceup on the table. In those cases, we randomly generate values for any undealt cards, taking into the account the fact that we observe the identities of all the cards that have been dealt on a given hand.

Table 2. Lucker Winners

		Community Cards				Stakes		
	Overall	**0**	**3**	**4**	**5**	**Low**	**Medium**	**High**
Lucker Rank 1	31%	20%	25%	32%	42%	32%	31%	29%
Lucker Rank 2	22%	19%	22%	22%	24%	22%	22%	21%
Lucker Rank 3	15%	15%	16%	15%	14%	15%	15%	15%
Lucker Rank 4	10%	12%	12%	10%	8%	10%	10%	10%
Lucker Rank 5	7%	10%	9%	7%	5%	7%	8%	8%
Lucker Rank 6	6%	9%	6%	5%	3%	5%	6%	6%
Lucker Rank 7	4%	7%	5%	4%	2%	4%	4%	4%
Lucker Rank 8	3%	5%	3%	3%	1%	3%	3%	3%
Lucker Rank 9	2%	3%	2%	3%	1%	2%	2%	2%

How is it that the outcomes in poker and Lucker are so different? Given the way that betting works in poker, only rarely does a hand proceed all the way to "showdown," when the remaining players turn their cards faceup. Even when a showdown does occur, it typically involves only two of the players; the other players fold their cards earlier in the hand. There is a substantial role for skill in the betting component of poker: knowing when to bet and when to fold, as well as how much to bet to maximize returns. Columns 2–5 ("Community Cards") confirm this point. The more community cards (the five cards dealt faceup) that have been dealt when a hand ends, the closer the correspondence between Lucker and poker. Even when all the cards are dealt, however, the best Lucker hand wins only 42% of the time; in the remaining cases, the best hand has folded at earlier rounds of betting.

In the final columns of Table 2 ("Stakes"), we divide games by the stakes level. We see that the correspondence between Lucker and poker is weaker the higher the stakes of the game. This finding is consistent with skill playing a role in poker. Presumably, the high-stakes games attract more skilled players on average. The greater the skill level, the less the real poker game resembles Lucker.

A. FOUR TESTS OF THE PRESENCE OF SKILL IN POKER

We now address the four proposed tests of skill in turn.

1. Test of Skill #1: Can One Reject the Null Hypothesis That All Players Have the Same Expected Payoff When Playing the Game?

Figure 1 presents a histogram of player returns, measured in big blinds per hand.[237] We divide the sample into four pieces, depending on how many hands a player has. Three patterns are clear in the data. First, players with fewer hands do worse. Measured in big blinds, players with 250–1,000 hands have a median loss of 0.39, compared to 0.05 for players with over 10,000 hands. Second, the amount of dispersion shrinks as more hands are played, as predicted by the law of large numbers. Third, there is substantial variation in returns across players. One in six players makes a profit, in spite of the rake.

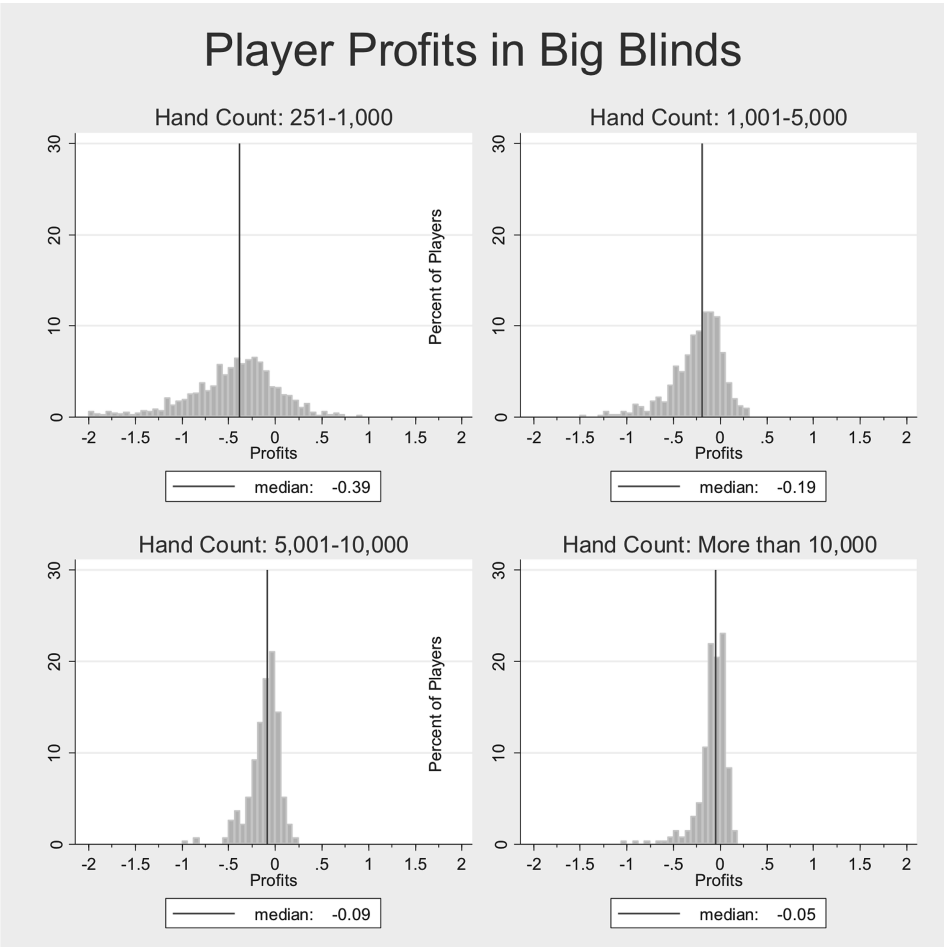

Figure 1.
Distributions of Player Profits by Number of Hands Played

237. *See infra* Figure 1.

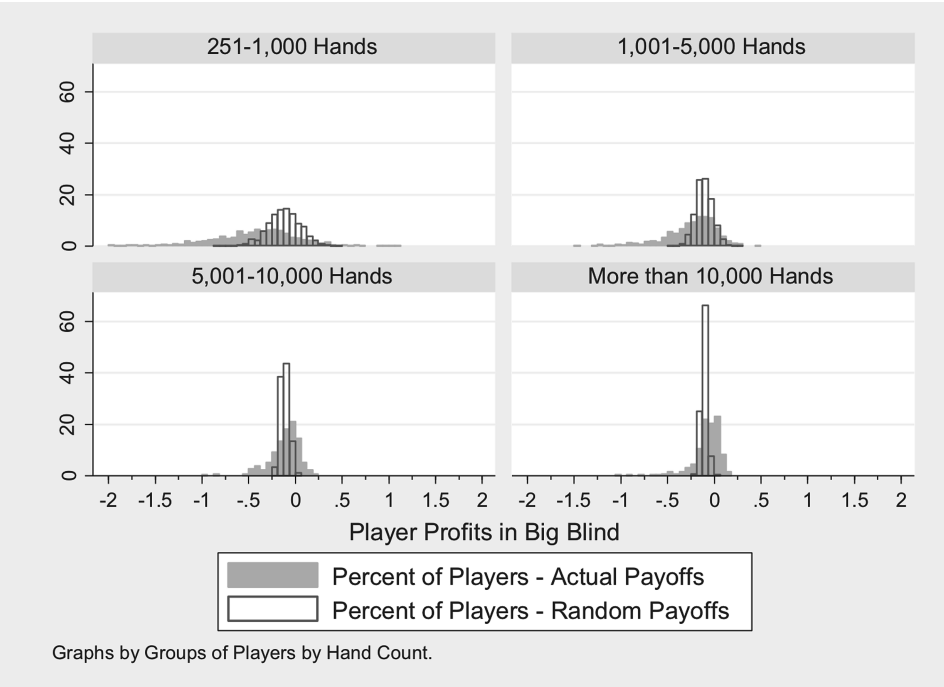

Figure 2.
Player Profits in Big Blinds by Hand Count Group

In finite samples, variation in returns across players will always be present—variation by itself is not sufficient to reject the null hypothesis. What is of interest in this setting is the presence of *excess* variance—that is, the degree to which the distribution of player returns is more variable than would be predicted by chance. To provide a visual sense of the extent of excess variance in our data, Figure 2 superimposes on top of the actual distribution of player payoffs the simulated distribution of player payoffs under the null hypothesis that every player has the same expected payoff.[238] We construct this distribution using Monte Carlo techniques, which are standard in the field of economics.[239] Under the null hypothesis, the simulated and actual distributions should look similar. In practice, however, they look quite different. In all cases, the simulated distributions are more concentrated, as evidenced by taller bars in the center of the simulated distribution than in the actual distribution. There is excess variation in the actual distribution. Also, for players with less than 1,000 hands, the actual returns are well below what would be expected under the null

238. *See supra* Figure 2.

239. To construct the Monte Carlo simulation, for each player–hand we sample with replacement using the actual distribution of payoffs across all players, constructing a fictional payoff profile for a player with this many hands. We repeat this procedure five times for each player in order to create a smoother distribution, with the results of the exercise plotted in the figure. *See supra* Figure 2.

hypothesis because these players systematically underperform. The opposite is true for the players with more than 10,000 hands.

To test this notion more formally, we carry out an F-test of the null hypothesis that all players have the same expected payoff.[240] The test statistic is 2.995, rejecting the null hypothesis at the 0.01 level. Thus, the data show that players do not have the same expected payoff from no-limit Texas Hold 'Em, and therefore, the data resoundingly reject the first test of whether skill is absent in poker.

2. Test of Skill #2: Do There Exist Predetermined Observable Characteristics About Players That Help One To Predict Payoffs Across Players?

In a pure game of luck, nothing that can be observed prior to playing the game is helpful in predicting the game's outcome. So if there are predetermined characteristics that correlate with performance, this is evidence of a role for skill. Due to the nature of our data, many of the most natural variables for predicting outcomes—for example, the amount of poker experience a player has, a player's mathematical prowess, whether a player is drunk—are unavailable. Instead, we focus on two more subtle determinants. The first of these is whether the player is playing at multiple tables concurrently.[241] In contrast to live poker, where a player can be at only one table at a time, online poker is set up so that a player can participate in many tables at once. Simple theory would suggest that performance at any one table would decline as a player plays more games at once because less attention is devoted to each table.[242] If this is indeed observed in the data, then it is evidence of skill in poker; in a game of pure luck, devoting greater attention will not affect outcomes.

The second observable characteristic that we examine is the table stakes—that is, how much money is at risk. Conventional wisdom among poker players is that the quality of play increases with the stakes of the game. If that is true, then players should see worse outcomes—measured in units that are independent of the stakes of the game, such as big blinds won or lost per hand—as they move up in stakes. As stakes rise, the average quality of a player's opponents should increase. In contrast, with games of pure luck, the quality of opponent is irrelevant, so performance, properly measured, would be unrelated to stakes.

To investigate the impact of multitabling and the stakes level, we run regression analysis of the form:

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240. To carry out this F-test, we run ordinary least squares where the unit of observation is a player, the dependent variable is the player's average win or loss rate in big blinds per hand, and the only regressors are an exhaustive set of player fixed effects. The F-test is a test of whether the coefficients on all of those fixed effects are identical. *See supra* Figure 2.

241. Playing multiple tables is common in our data. Roughly 74% of the players engage in multitabling at some point in time.

242. Although the returns at each table might worsen when multiple tables are played, for a player earning positive returns, the overall money earned may nonetheless rise. From the perspective of maximizing utility, as opposed to financial returns, playing multiple tables may be more enjoyable for the players.

$$BigBlindsPerHand_{it} = \beta MultiTable_{it} + \delta_1 HighStakes_{it} + \delta_2 LowStakes_{it} + \theta_i + \varepsilon_{it},$$

where i indexes players and t corresponds to a particular session of poker. A session begins when a player sits down at a table and starts to play and ends when the player stands up from the table. $BigBlindsPerHand_{it}$ is our measure of the win or loss rate of the player, and $MultiTable_{it}$ is an indicator variable that takes on the value of one if a player is at multiple tables concurrently, and is zero otherwise. $HighStakes_{it}$ and $LowStakes_{it}$ are also indicator variables corresponding to whether the stakes at this table are above or below the player's usual stakes. The omitted category of stakes is the player's typical stakes level. Consequently, the correct interpretation of the coefficients on the stakes variable is the performance relative to the player's usual stakes. These regressions include player or player–day fixed effects (the θ_i ("theta") term), so identification of the parameters is based on differences over time for a given player (that is, whether the player does better or worse when multitabling), not on comparisons across players (that is, whether players who multitable do better on average than those who play a single table).

The estimation results are presented in Table 3.[243] The odd-numbered columns include player fixed effects; the even-numbered columns include player–day fixed effects. Other than that, the only difference across columns is the specificity with which the multitabling variable is defined. The first two columns include a single dummy for whether a player is multitabling. In column (1), the coefficient on multitabling is negative and significant, carrying a coefficient of −0.048. This implies that relative to hands where the player is sitting at only a single table, returns are 0.048 big blinds worse when playing multiple tables. Playing at unusually high stakes is also associated with bad outcomes: a highly significant 0.089 per hand big-blind reduction. Interestingly, players also do worse when playing at lower-than-usual stakes. This is partly attributable to the fact that the poker site takes a bigger percentage rake at lower stakes. It is also the case that players tend to play low stakes when they first join the site, eventually moving up as they improve their play.

To control for a player's ability changing over time, column (2) controls for player and day, so that identification of the parameters comes only from a comparison of player outcomes relative to the other hands that player plays on that very day. The coefficient on multitabling jumps sharply in this specification to more than −0.13 big blinds. The difference in the multitabling coefficient between columns (1) and (2) suggests that the specification in column (1) is masking the true loss that players suffer when multitabling, presumably because as players improve, they are more likely to multitable. The coefficient on low

243. *See infra* Table 3.

Table 3: Regression Estimates of Factors Influencing Player Returns

	(1)	(2)	(3)	(4)	(5)	(6)
Multitable	−0.0484***	−0.1306***				
	(0.0084)	(0.0112)				
2 Tables Played at Once			−0.0490***	−0.1257***	−0.0489***	−0.1254***
			(0.0088)	(0.0115)	(0.0088)	(0.0115)
3 or More Tables Played at Once			−0.0468***	−0.1531***		
			(0.0111)	(0.0160)		
3 Tables Played at Once					−0.0389**	−0.1448***
					(0.0122)	(0.0168)
4 Tables Played at Once					−0.0553***	−0.1655***
					(0.0137)	(0.0196)
5 or More Tables Played at Once					−0.0621***	−0.1837***
					(0.0174)	(0.0262)
Low Stakes	−0.0205*	−0.0044	−0.0205*	−0.0039	−0.0205*	−0.0034
	(0.0081)	(0.0141)	(0.0081)	(0.0141)	(0.0081)	(0.0141)
High Stakes	−0.0888***	−0.0542**	−0.0888***	−0.0550**	−0.0892***	−0.0553**
	(0.0105)	(0.0172)	(0.0105)	(0.0172)	(0.0105)	(0.0172)
Fixed Effects	Player	Player–Day	Player	Player–Day	Player	Player–Day
R-squared	0.0007	0.0080	0.0007	0.0080	0.0007	0.0080
Adjusted R-squared	0.0005	0.0024	0.0005	0.0024	0.0005	0.0024

Note: Dependent variable is profits in terms of big blinds. The unit of observation is a hand played by a player. The number of observations is equal to 12,363,802 in all columns. Standard errors are in parentheses.

* $p<0.05$, ** $p<0.01$, *** $p<0.001$.

stakes becomes statistically insignificant in column (2); the coefficient on high stakes shrinks, but it remains statistically significant.

Columns (3) and (4) separate the effects of concurrently playing a second table from the effects of "sitting" in three or more tables at the same time. Finally, the last two columns add dummy variables for each number of tables played at the same time from two to four, plus a dummy for five or more tables. Once again, the multitabling and high-stakes estimates are highly statistically significant. The results in these columns reinforce the argument that participating in multiple tables tends to damage outcomes. Overall, the rate of success in a given hand decreases as the number of tables played simultaneously goes up. In sum, the results in Table 3 show that two characteristics of players—the number of tables played simultaneously and the stakes of the game—correlate with a player's expected payoffs. These results reject the second test of the null hypothesis of the absence of skill in poker.

3. Test of Skill #3: Do Actions That a Player Takes in the Game Have Statistically Significant Impacts on the Payoffs That Are Achieved?

If skill is part of a game, then evidence of the role of skill should manifest itself in the choices that players make. For instance, in baseball one might expect a correlation between how hard a pitcher throws the ball and a measure of his success, such as the fraction of his pitches that result in strikes.

We present two pieces of evidence with regard to the impact of a player's actions in poker. The first choice we evaluate is the share of hands that a player is involved in. In each hand, a player is dealt two cards facedown and then faces a choice of whether to play those cards or whether to fold them. Expert poker players frequently argue that players have a tendency to be involved in too many hands.[244] To analyze the relationship between returns and the share of hands played, we compute for each player in our sample the share of hands in which they voluntarily put money into the pot—that is, they put money into the pot other than the blinds, which are mandatory.[245] We then divide players into four equal-sized groups based on this variable, or quartiles, and we compute the average win or loss rate in big blinds for each of these groups.

The results are reported in Table 4.[246] Each row in the table represents the outcomes for a different quartile; the top row corresponds to the players who participate in the lowest percentage of pots, and the subsequent rows capture players who play increasingly larger fractions of hands. The differences in

244. This is especially true in "ring games," which are the basis of our data. In a ring game, the stakes of the table remain fixed over time, and wins and losses are based on the money won or lost in each hand. Another variant of poker is a tournament, where the blinds increase over time and payoffs depend on the order in which players lose all their chips. In tournaments, a higher variance strategy may prove more profitable.

245. For this analysis, we restrict the sample to nine-person tables and players with more than 100 hands at these tables.

246. *See infra* Table 4.

Table 4: Player Profit by Tendency To Volunteer Money Preflop

	Player's Probability of Volunteering Money Preflop			Player Profits					
	Mean	**Minimum**	**Maximum**	**Mean**	**Std. Dev.**	**Median**	**Minimum**	**Maximum**	**N**
Quartile 1	0.199	0.069	0.254	−0.077	0.200	−0.045	−1.144	0.560	347
Quartile 2	0.291	0.254	0.325	−0.158	0.242	−0.114	−1.053	0.605	347
Quartile 3	0.367	0.325	0.414	−0.241	0.273	−0.208	−1.406	0.710	347
Quartile 4	0.515	0.415	0.881	−0.531	0.468	−0.439	−2.472	0.879	347
Total	0.343	0.069	0.881	−0.252	0.357	−0.162	−2.472	0.879	1,388

Note: Profits measured as average profits in terms of big blinds for the hands played by a player. Quartiles are generated from the player's probability of voluntarily putting money into the pot. The sample is restricted to nine-person tables and players with more than 100 hands at these tables. The number of players is 1,388 and the number of observations is 8,360,169.

strategy are substantial. Players in the top row voluntarily put money into the pot 20% of the time versus 51% for the fourth quartile. These differences in strategy correlate strongly with outcomes, measured in wins and losses in big-blind units. Just as the player's probability of voluntarily putting money into the pot rises with the number of hands played, losses grow consistently as the number of hands played rises. Average losses are 0.08 big blinds in the top row compared to 0.53 for the fourth quartile.

These are large differences in dollar terms. The average big blind in the sample is between $1.00 and $2.00, so these differences in play translate into $0.60 or $0.70 per hand at the average stakes, or $30–40 per hour of poker played. These results indicate that players who fail to follow conventional poker advice to play fewer hands bet more often and lose greater amounts. This evidence rejects the third hypothesis for the absence of skill in poker—that a player's choices do not correlate with outcomes.

4. Test of Skill #4: Are Player Returns Correlated over Time, Implying Persistence in Skill?

Absent skill, success in one period should be uncorrelated with success in other periods. Both Croson et al. and Levitt and Miles exploit this simple insight to test for skill in poker.[247] Levitt and Miles, for instance, identify a set of poker players who have had poker success in the past (for example, those who appear in listings of top-ranked players) and compare how that set of poker players performs relative to all others in that year's World Series of Poker. Those players identified ex ante as being highly skilled in the Levitt and Miles analysis generate average returns on investment (ROIs) of 30.5%, compared to a −15.6% return for all other players. This result is consistent with serial correlation in returns.[248]

We are able to perform a parallel analysis in the current data set. Specifically, we divide our sample, which runs from May 31, 2006, to May 31, 2007, in half at the midpoint to create two mutually exclusive time windows. For each player who has at least 100 hands in each half of the sample, we compute the returns in big blinds per hand in the first and second halves of the sample. The correlation between returns in the two halves of the sample is 0.33. Thus, we can reject the null hypothesis of no serial correlation at the 0.01 level. When we restrict the sample to players with at least 250 hands in each half of the sample, the correlation rises to 0.37. To put that number in perspective, the correlation in wins from year to year for Major League baseball teams is roughly 0.5.[249]

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247. Rachel Croson, Peter Fishman & Devin G. Pope, *Poker Superstars: Skill or Luck?*, CHANCE, Dec. 2008, at 25; Steven D. Levitt & Thomas J. Miles, *The Role of Skill Versus Luck in Poker: Evidence from the World Series of Poker*, 14 J. SPORTS ECON. (forthcoming 2013), *available at* http://jse.sagepub.com/content/early/2012/06/20/1527002512449471.

248. Levitt & Miles, *supra* note 247 (manuscript at 11–12).

249. *Id.* (manuscript at 11) and authors' calculations.

Table 5. Distribution of Players by Returns in the Two Halves

		Second-Half Skill Groups					
		1	2	3	4	5	Total
First-Half Skill Groups	1	68	37	30	17	16	168
		(40.48%)	(22.02%)	(17.86%)	(10.12%)	(9.52%)	(100%)
	2	38	41	29	29	30	167
		(22.75%)	(24.55%)	(17.37%)	(17.37%)	(17.96%)	(100%)
	3	21	33	46	38	29	167
		(12.57%)	(19.76%)	(27.54%)	(22.75%)	(17.37%)	(100%)
	4	26	30	36	41	34	167
		(15.57%)	(17.96%)	(21.56%)	(24.55%)	(20.36%)	(100%)
	5	15	26	26	42	58	167
		(8.98%)	(15.57%)	(15.57%)	(25.15%)	(34.73%)	(100%)
	Total	168	167	167	167	167	836
		(20.1%)	(19.98%)	(19.98%)	(19.98%)	(19.98%)	(100%)

Note: This table shows the frequency of players in each combination of skill groups for the two halves of the sample, with row percentage in parentheses. The sample is restricted to players with at least 100 hands in each half of the sample. The number of players is 836. The skill groups are calculated controlling for the number of players at the table, big blinds, and the number of tables played at once.

Table 5 provides an alternative, more visual means of capturing the serial correlation.[250] We once again divide the sample period in half and restrict the sample to players with at least 100 hands in each half of the sample.[251] For each of the two periods, we rank players by their returns per hand during that half of the sample, and then we divide the players into five equally sized groups (or quintiles). For example, someone who does extremely well in the first half of the sample but just average in the second half would be in quintile one in the first half and quintile three in the second half. The rows of Table 5 reflect the quintile in the first part of the sample; the columns capture the quintile in the second half of the sample.

The sum of the entries in each row and each column add to one, so in the absence of serial correlation, we would expect to observe equal weights—or a value of 20%—in each cell. In the presence of positive serial correlation, weight will be concentrated on the diagonal—players will tend to perform similarly in the two parts of the sample. Consistent with serial correlation, 35% of players in the top (or fifth) quintile in period one remain there in period two; only 9% of

250. *See supra* Table 5.
251. Restricting the sample to players with at least 250 hands in each half yields similar results.

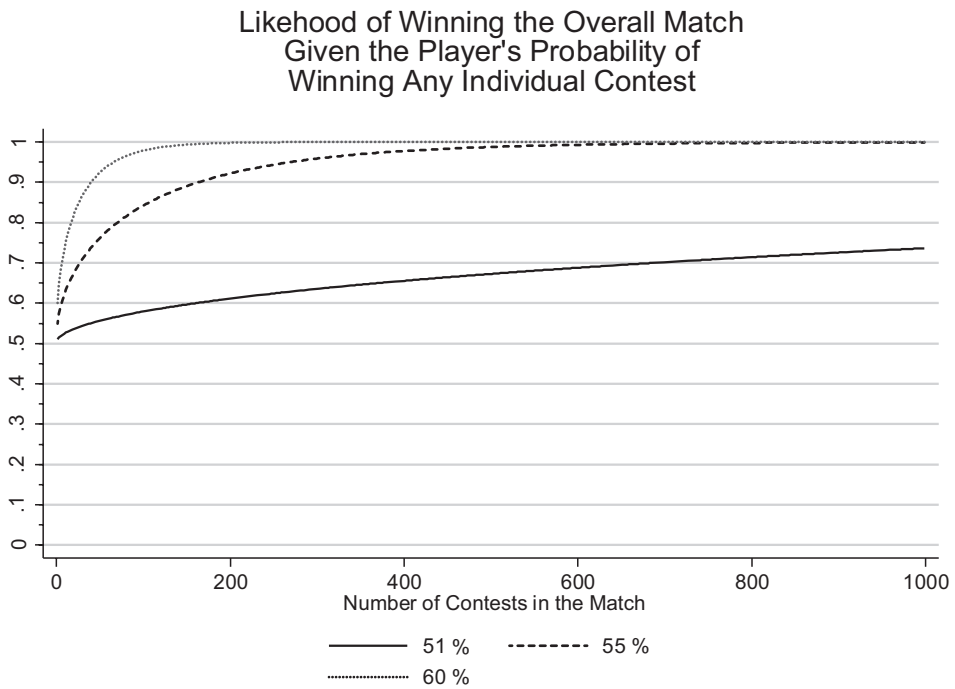

Figure 3.
The Importance of Skill Versus Luck Depends Critically on the Time Horizon Examined

the players move from the top (or fifth) quintile to the bottom (or first) quintile. The patterns are even stronger going the other direction: if a player starts in the lowest quintile, he will remain there in the second period 40% of the time—or twice as often as would be expected by chance. The results in Table 5 show persistence in player success and thus reject the fourth test for the absence of skill in poker.

B. QUANTIFYING THE RELATIVE ROLES OF SKILL AND LUCK IN POKER

In the preceding section, we presented four tests looking for evidence of skill in poker, and all four tests were consistent with a role for skill in poker. These tests, however, do not directly address the relative importance of luck and skill; they simply reveal that there is some influence of skill. In this section, we attempt to quantify the relative importance of those two factors.

The importance of skill versus luck depends critically on the time horizon examined. Imagine that two players compete in some activity (for example, a closest-to-the-pin contest in golf, forecasting the high temperature on a given day, etc.). The player that wins an individual contest earns one point. The activity is repeated a number of times, with the winner of the match determined by the player with the most points overall. Figure 3 plots the likelihood of each

player winning the overall match.[252] The number of rounds of contests making up a game is shown along the horizontal axis, and the three curves trace out the likelihood of winning the overall game for different probabilities of winning each round: 51%, 55%, and 60%. The top line in the figure corresponds to a player who has a 60% chance of winning any individual contest, and the middle line corresponds to a player who has a 55% chance. By definition, if a match is composed of a single contest, that player will win 55% of the time, as seen on the far left part of the figure. As the number of contests in a match rises, the likelihood that player wins the match continually rises. In a match lasting 200 or more tries, the player with a 60–40 advantage will triumph virtually every time. With a 55–45 edge, it takes roughly 1,000 tries before victory is all but certain. Even when a player has a much smaller advantage, such as 51–49, as captured by the bottom line in the figure, after 1,000 tries the win rate is already over 70%.

Even tiny differences in skill manifest themselves in near certain victory if the time horizon is long enough. The average number of hands played per person in our sample is between 4,000 and 5,000. If one player has even a 50.1% to 49.9% advantage on a single hand, over the average number of hands in our sample, the first player will win more than half the hands 55% of the time. Judged from this perspective, it is almost inconceivable that luck could be the predominant determinant of outcomes if there are even small differences in skill. Consequently, it seems nonsensical for courts to rely on the role of skill versus luck in a single hand as a legal standard.

To investigate further the relative importance of skill and luck in our data, we analyze the contribution of one important facet of luck—which hole cards the player is dealt—to outcomes. On any given hand, the hole cards one receives are perhaps the greatest determinant of whether the hand is won. In our data, a player dealt two aces has an expected profit rate on the hand of over three big blinds; in contrast, a player dealt a poor hand will expect to lose about 0.2 big blinds. To assess how important luck in hole cards is to the overall distribution of player outcomes, we make calculations for each set of hole cards. We first compute the average return across all players when dealt a particular set of hole cards. Then, using the actual hole cards a player received, we assign that player the average return for those hole cards. We then compute a hypothetical distribution of player outcomes based on those average returns. This hypothetical distribution isolates differences in luck across players in terms of whether they received good or bad hole cards, but it purges out all skill by assigning each player the average outcome for those two cards.

We also do the opposite computation: using a player's actual returns for each set of hole cards but assigning that player the exact distribution of hole cards that would be expected by the laws of probability. So the first exercise shows

252. *See supra* Figure 3.

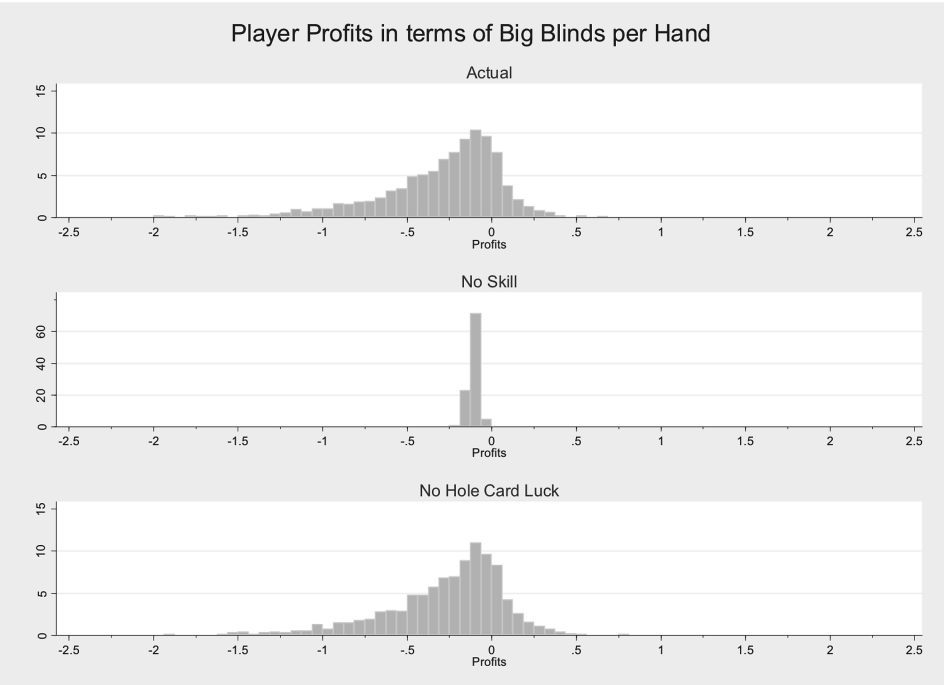

Figure 4.
The Minimal Role of Hole-Card Luck in Determining Player's Outcome

the impact of luck alone, with skill purged, and the second exercise shows what is leftover when the luck associated with hole cards is purged.

Figure 4 presents the results.[253] For purposes of comparison, the top panel of the figure presents the actual distribution of player outcomes per hand in the data—these actual returns are driven by a combination of skill and luck. The second panel of the figure shows the distribution of returns when we isolate the luck associated with which hole cards were received. As is immediately apparent, almost none of the dispersion in returns is due to differences in the mix of hole cards a player receives.

Differences in the returns players obtain after being dealt the same hole cards account for almost all of the variation in total returns, as shown in the bottom panel of the figure. The distribution of returns in panel three is almost the same as in panel one. Luck in hole cards is not an important factor in determining player outcomes at the time horizon of our sample; if it were, it would account for more of the observed deviations in player returns.[254]

253. *See infra* Figure 4.

254. This is not to say that luck plays no role at all in outcomes at this time horizon. There is also luck associated with the five community cards, for instance. Because players typically fold most hands preflop, the asymptotic forces pushing the luck contribution towards zero operate more quickly on hole cards than community cards.

CONCLUSION

This Article develops a series of tests for quantifying the influence of skill in a game and applies them to data from the online play of Texas Hold 'Em. The results strongly suggest that skill is a highly important factor in poker and that it is simply wrong to consider poker a "game of chance," if that phrase is meant to indicate anything more than the fact that an element of chance is present in any single round of play. Beyond the specific application to poker, the tests developed here may provide a useful tool to courts. A significant virtue of the tests is that courts can implement them given a reasonably sized data set of repeated plays. The quantitative approach we suggest operationalizes the notion of a "dominant factor" inquiry in a way that the qualitative approach that courts have favored does not. Our tests lead to a sharply different conclusion about poker than the one that courts following the qualitative approach have reached, and this divergence highlights the importance of courts employing the correct analytical framework.