Integrity Fees in Sports Betting Markets

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Abstract

Sports leagues have requested state legislatures to pass so-called integrity fees or taxes on the entire amount bet on their games, ostensibly to provide resources to protect against game fixing and other corrupt behavior. These fees might just augment league revenues. Integrity fees have different consequences if they are placed on a sports book's handle or hold. We model one possible consequence of an integrity fee placed on the handle, that sports books might be motivated to avoid pushes, after which they have no hold but face a tax liability. One approach moves to half-point lines which eliminate pushes but might be second best in terms of betting market efficiency. As a case study, we describe the characteristics of recent betting lines in four North American sports. Based on predicted pushes, actual pushes, half-point lines, and the intertemporal correlation between the annual number of pushes and the annual number of half-point lines, it appears that sports books already actively set lines that avoid pushes and could easily adjust to half-point lines motivated by integrity fees.

Keywords Sports gambling · Taxation · NCAA football · NCAA basketball · NFL · NBA

JEL Classification L83 · Z21 · H26

Introduction

In its 2018 decision in *Murphy v. NCAA*, the US Supreme Court invalidated the then federal law that made professional and amateur sports betting illegal in all states but Nevada, Montana, Delaware, and Oregon. In the months that followed the ruling,

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23 states legalized sports betting or were in the process of doing so. The estimated legal market for betting in the USA approaches \$5 billion per year and is predicted to reach \$8 billion by 2025 (Associated Press 2019). In anticipation and with an eye toward profiting from this newly legal market, professional and amateur sports leagues began lobbying for a so-called integrity fee to be placed on the handle, that is, the total amount bet, collected by legal sports books, and remitted to the league for the purpose of monitoring the behavior of players, referees, managers and trainers, fans, and others involved with the games, in the context of fixing game outcomes.

Although there is always an incentive to manipulate the outcome of games when wagering is involved, in a system where the vast majority of betting occurs in the underground economy there is no way for professional leagues to collect an integrity fee. Therefore, while an integrity fee might provide sufficient resources with which a league could reduce the possibility of successful game manipulation, it appears that one of the motivations for installing an integrity fee in the legal betting market is the ability to collect a tax in the licit economy.

This paper reviews the existing literature on integrity fees, models one possible ramification of an integrity fee on the efficiency of betting markets, and shows how this might motivate sports books to offer more half-point lines which eliminate the possibility of pushes. As a case study, we describe the characteristics of recent betting lines in four North American sports and how sports books and bettors might respond to integrity fees placed on the total amount bet rather than on the total amount retained by the sports book after paying out all winnings. The distinction is important for the efficiency of the betting markets but also the sustainability of the newly legalized sports gambling industry in the USA.

Integrity Fees and Taxation in Legalized Betting Markets

There are traditionally two ways of taxing gambling proceeds at the bookmaker level. Either there is an ad valorem tax on total dollars bet, called the handle, or there is an ad valorem tax on betting revenues less total winnings, called the hold. As shown by other authors, a tax on the hold does not alter the incentives of either the bookmaker or the bettors and therefore has no marginal impact on the odds offered nor on the amount bet in equilibrium, although it does alter the profitability of servicing bets and might push smaller bookmakers out of the market for certain bets, which, in turn, could alter the concentration of the (legitimate) betting market (see Smith 1971; Suits 1979; Paton et al. 2002; Vidal-Puga 2017). On the other hand, a tax on the handle alters the incentives for the bookmaker and therefore can lead to a change in the odds offered by the bookmakers, the amount won by bettors, and the amount of revenue available to be taxed by states and leagues (Paton et al. 2002; Vidal-Puga 2017; Montone 2020).

Previous studies estimate the price elasticity of horse betting to exceed unity (Suits 1979; Thalheimer and Mukhtar 2010; Gallet 2015). While there are few studies in fixed-odds betting markets, HM Revenue and Custom (2014) found that sports gambling might have price elasticities that fall well below unity. Unlike in

traditional commodity markets where the total tax is calculated as a product of price and quantity, both of which can respond to a change in an *ad valorem* tax, in betting markets the tax is only collected on dollars bet (as price is normalized to one). Thus, the consequences of a tax on gambling can be different than those expected in traditional commodity markets.

Why an Integrity Fee?

Most states with legalized gambling tax gross wagering revenues, also called the hold, which is the amount of money the casino or sports book retains after paying out all winnings. In Nevada, the state imposes a 6.75% tax on total hold (Nevada Gaming Commission 2019), whereas New Jersey taxes online hold at 13% (New Jersey 2018) and Pennsylvania passed a tax of 36% on sports gambling hold (Pennsylvania 2017). Integrity fees, as they are discussed by sports leagues, focus on the handle rather than the hold. As such, an integrity fee applies to a much broader base and is unique in that the tax is collected by the state and then directly remitted to leagues and private team owners. The integrity fees are ostensibly used to monitor those involved with the league's games so to ensure honesty in the game.

Yet, it is not clear why leagues and teams have less incentive to ensure integrity of their game in the absence of legalized gambling. Some sports are popular despite the outcomes of the events being staged or highly scripted, e.g., professional wrestling in the USA. However, in general, it is commonly believed that honesty in competition represents an important component of demand for any sport. Chen et al. (2012) suggest that attendance to the Chinese Professional Baseball League declined over a 20-year period, in part, because of game-fixing scandals and Merkel (2007) points out that attendance to Germany's Bundesliga (top flight) soccer teams fell after a 1971 cheating scandal.

However, Preston and Szymanski (2003) find little evidence that cheating in soccer reduced fan interest, Van Reeth (2012) finds a slight decrease in short-run television audience for the Tour de France after a doping scandal, and Cisyk and Courty (2015) find little impact of performance enhancing drugs in Major League Baseball on attendance. However, with or without legalized gambling on a sport, team owners and league managers seem to have the same incentives to ensure transparent and honest competition is.

The net impact of legalized gambling on corruption is an empirical issue. On the one hand, it is possible that legalized gambling increases the potential for individuals to try to influence the outcomes of a game. Once gambling is legalized, an individual player, manager, or referee could place a bet or have others do so and could legally profit from their corruption. On the other hand, legalized gambling would ostensibly carry the force of law in the case of fraud and corruption. To avoid losses from insider information, legal and illegal sports books have strong incentives to monitor betting behavior. If corrupt betting were discovered in a legal betting market, the full force of the legal system could be used to prosecute and punish such offenses. Unfortunately, in an illegal gambling market, it is highly unlikely that a sports book would press charges in the formal justice system against corrupt betting.

Why Integrity Fees at the State Level?

The debate surrounding integrity fees focuses on two primary issues. First, that the sports (and to a lesser extent the state) should share in the revenues (rather than profits) generated from betting on the sport's events as a matter of principle. Thus, much like television contracts and other sources of revenues that center on a league's events, sports gambling appears to be viewed as something that would not exist without the league's events and therefore the league is entitled to some property rights over gambling revenue.

However, unlike in the case of television contracts, with integrity fees there is no private negotiation between the league and various sports books as the transaction costs involved with negotiating an integrity fee between the sports league and each legal sports book are viewed as being too large. This led the leagues to lobby individual states for state-mandated and state-collected integrity fees in the short-run. While no state has yet imposed an integrity fee, the leagues have approached the US Congress requesting a national-level integrity fee which would eliminate the need to negotiate with every state legislature that contemplates legalized sports gambling.

The second portion of the debate comes from the sports books themselves who point out that the integrity fee on the handle might be so large that it drives legal sports books into negative economic profits, thereby encouraging exit from the (legal) gambling market and promoting increased concentration, arguably in favor of the existing, larger casinos.

For example, consider a sports book operating in Nevada which generates \$1 million in betting revenue and retains approximately 5% of that in gross wagering profits or hold. Of the \$50,000 in hold, the sports book would pay 6.75% in state taxes or \$3375. A 1% integrity fee on the sports book's handle of \$10,000 would raise the effective average tax on operating income from 6.75 to 26.75% and would reduce the total operating income to \$36,625 for an effective profit margin of 3.66% rather than the industry average of approximately 5%. It is possible that some sports books would find larger economic profits in other industries.

While sports leagues can argue that they deserve a portion of the total gambling revenues generated by their sports, state governments can claim that tax revenues generated from gambling provide important public goods and provide resources to address problem gambling, and sports books can argue that integrity fees can artificially lower their profits sufficiently that exit might be encouraged, all three groups seem to ignore the fourth party in legalized sports gambling markets: bettors.

The Impact of Integrity Fees on Bettors

Other authors have derived the comparative statics for how increases in commissions, or other increases in the price of betting, influence equilibrium odds, unit bets on each possible outcome, total handle, and total hold (see Smith 1971, for example). Yet, the public discussion of integrity fees only briefly mentions that sports books might alter the odds offered to bettors to partially offset the integrity fee. Exactly how would sports books go about changing the odds offered to bettors?

One way would be to alter the amount of money that is required for a unit bet. In most point-spread markets, a bet of \$110 will win \$100 regardless of the side of the point-spread outcome chosen. When betting the favorite, if the favorite wins by more than the closing line, the bettor receives \$100 plus the original \$110 bet for a total of \$210. On the other side of spread, a \$110 bet on the underdog lost \$110. Therefore, for each pair of standard bets on the favorite and the underdog, a total of \$220 is bet and a total of \$210 is paid out; the remaining \$10 is taken by the sports book as the vigorish or commission.

If an integrity fee alters the amount of commission the sports book can retain, it is possible that the sports book can alter the amount of money required to comprise a standard bet on the favorite, the underdog, or both. For instance, a sports book might require a standard bet to be \$120 rather than \$110 on the favorite. In the absence of integrity fees, sports books sometimes change the amount of money required to be bet on one or both sides of the line. However, we are unaware of any literature that investigates how such changes affect bettor behavior.

In money-line markets, bets are binary on either the favorite or the underdog winning and prices of standard bets are reflected in the lines. For example, if New England is favored in a NFL game, the team will most often show a negative line, e.g., -140 , which indicates that a bet of \$140 is required to win \$100 if New England wins (a win has a total payout of \$240). The underdog in the game will most often have a positive line, e.g., $+120$, which indicates that a bet of \$100 will win \$120 (for a total payout of \$220) if the underdog wins. In the case of a tie at the end of the game, no one wins, and all original bets are returned.

In money-line markets, the lines adjust to reflect the subjective probability of each team winning. Generally, the subjective probabilities sum to more than one, with the difference representing the commission or hold (in percentage terms) to the sports book (Berkowitz et al. 2018). If an integrity fee induces exogenous changes in the money lines themselves, this would induce an exogenous shift in the subjective probabilities of the favorite or the underdog winning. However, this shift would likely not coincide with the subjective probabilities ascertained by bettors, introducing a possible arbitrage opportunity.

Integrity Fees and Pushes

A second way that a sports book, in a point-spread betting market, could respond to an integrity fee on its handle would be to reduce the likelihood of a push, which occurs when the actual outcome does not match the outcome for the favorite or the underdog and entails the sports book returning all bets. If the line is four points and the favorite wins by exactly four points, the result is a push. If the combined points scored by the favorite and underdog exactly equal the total, the bet would be considered a push.

In the absence of any tax on the handle, sports books would theoretically be agnostic about pushes. On the one hand, a push entails some administrative costs as all bets must be recorded and eventually all bettors must be refunded (we have no data on what these costs are but we do not believe them to be zero). On the other

hand, refunding all bets after a push might generate a sense of good will between the sports book and the bettors which might result in all or more of the original money being bet on other events. Furthermore, a push might result in a form of seignorage if some bettors fail to reclaim their initial bets (this might happen if a tourist bet on the outcome of a future game but did not find it economically viable to bear the costs of refunding their bet from afar). Empirically testing these possibilities requires data that are not publicly available.

However, a tax on the sports book's handle changes this incentive. Now, if a push occurs and all bettors are refunded, the sports book is required to remit a tax on the amount bet while having no additional money in its hold to finance the tax. Perhaps a sports book would change the policy on remittance in the case of a push, i.e., return only $(1 - i)\%$ of the total handle, where i is the *ad valorem* integrity fee. Such a policy would put the sports book at a price disadvantage relative to other sports books (both legal and illegal) not subject to the tax on the handle and might reduce the sense of good will that the refunds from a push in the absence of the integrity fee might generate.

In the case of mega-events where the handle is expected to be very large, e.g., the NFL Super Bowl or the NCAA Basketball Final Four, sports books might be motivated to remove the possibility of a push by choosing half-point sides and total lines that eliminate pushes (in what follows, we focus on an end-of-game sides line, but the intuition can easily be adopted to other sides and totals lines).

Consider a market with a single game, a single bookmaker, and a state-collected integrity fee i that is placed on the book's handle and is collected after the game ends. Consider a line S_0 such that a bet of \$1.10 on the favorite returns $(\$1/1.1 = \$0.91)$ if the favorite wins the game by more than S_0 points and a bet of \$1.10 on the underdog returns $(\$1/1.1 = \$0.91)$ if the underdog loses by less than S_0 points or wins the game.¹ If the favorite wins the event by S_0 points, all bets are fully refunded. Define the handle $H_0 = X(S_0) + Y(S_0)$, where $X(S_0)$ is the number of unit bets on the favorite, $Y(S_0)$ is the number of unit bets on the underdog, $X' < 0$, $X'' > 0$, $Y' > 0$, and $Y'' > 0$.²

If the favorite wins by more than S_0 points, the sports book returns $X(S_0)$ plus $[(1/1.1) X(S_0)]$ in total winnings to the bets on the favorite. The sports book pays these winnings out of the bets on the underdog, $Y(S_0)$. In this case, the book retains a hold of $(Y(S_0) - [(1/1.1)X(S_0)])$, pays an integrity fee on the handle of $i(X(S_0) + Y(S_0))$, and yields a total commission of $((1 - i)Y(S_0) - [(1 + 1.1i)/1.1]X(S_0))$, which is decreasing in the integrity fee.

If the underdog loses by less than S_0 (or wins the event), the book returns $Y(S_0)$ plus $[(1/1.1) Y(S_0)]$ in total winnings to the bets on the underdog. The sports book pays these winnings out of the bets on the favorite or $X(S_0)$. In this case, the book retains a hold of $(X(S_0) - [(1/1.1)Y(S_0)])$, pays an integrity fee on the handle of

¹ At times, a sports book will require a different amount for a unit bet. If, for example, a sports book requires a bet of \$120 to win \$100 (on both the favorite and the underdog), then a unit bet on the favorite would return $(\$1/1.2 = \$0.83)$ and a unit bet on the underdog would return $(\$1/1.2 = \$0.83)$.

² This model follows closely that in Levitt (2004).

$i(X(S_0) + Y(S_0))$, and yields a total commission of $((1 - i)Y(S_0) - [((1 + 1.1i)/1.1)X(S_0)])$, which is decreasing in the integrity fee.

If the favorite wins by S_0 points, the hold is zero as all bets are refunded. The sports book pays an integrity fee of $i(X(S_0) + Y(S_0))$, and yields a total commission of $-i(X(S_0) + Y(S_0))$.

Assume the objective probability of the favorite winning by more than S_0 points is $f(S_0)$ and the objective probability of the underdog losing by less than S_0 points (or winning outright) is $u(S_0)$. The probability of a push is $p(S_0) = 1 - f(S_0) - u(S_0)$. In the case of a fee on the handle, rather than the hold, an even-point line leads to a total expected integrity fee liability of the book of $(f(S_0) + u(S_0) + p(S_0))i(X(S_0) + Y(S_0)) = i(X(S_0) + Y(S_0))$. The book can increase the line to $S_0 + 0.5$, in which case it is expected that fewer unit bets will be placed on the favorite and more unit bets will be placed on the underdog, but the net impact on the total handle is ambiguous. Likewise, the book can reduce the line to $S_0 - 0.5$, there will be more unit bets on the favorite and fewer unit bets on the underdog, but the net impact on the total handle is ambiguous.

Let $S_1 = S_0 + 0.5$ and $S_2 = S_0 - 0.5$, then handle $H_1 = X(S_1) + Y(S_1)$ and handle $H_2 = X(S_2) + Y(S_2)$, where $Y(S_1) > Y(S_0) > Y(S_2)$ and $X(S_1) < X(S_0) < X(S_2)$. The sports book can compare its expected integrity fee liability between iH_0 , iH_1 , and iH_2 , where $iH_0 = i(X(S_0) + Y(S_0))$, $iH_1 = i(f(S_1) + u(S_1))(X(S_1) + Y(S_1))$, and $iH_2 = i(f(S_2) + u(S_2))(X(S_2) + Y(S_2))$, where $f(S_1) < f(S_0) < f(S_2)$ and $u(S_1) > u(S_0) > u(S_2)$.

The sports book seeks to maximize its net hold while minimizing its expected tax burden. If the book chooses point spread S_0 , the handle will be $X(S_0) + Y(S_0)$, if it chooses point spread S_1 , the handle will be $X(S_1) + Y(S_1)$, and if it chooses point spread S_2 the handle will be $X(S_2) + Y(S_2)$. The net hold with point spread S_0 is $(f(S_0) - u(S_0))(Y(S_0) - [(1/1.1)X(S_0)])$, with point spread S_1 is $(f(S_1) - u(S_1))(Y(S_1) - [(1/1.1)X(S_1)])$, and with point spread S_2 is $(f(S_2) - u(S_2))(Y(S_2) - [(1/1.1)X(S_2)])$. The book would choose point spread S_1 relative to spread S_0 if

$$\frac{(f(S_0) - u(S_0))}{(f(S_1) - u(S_1))} < \frac{Y(S_1) - \left[\left(\frac{1}{1.1}\right)X(S_1)\right]}{Y(S_0) - \left[\left(\frac{1}{1.1}\right)X(S_0)\right]}.$$

Compared to the original point spread S_0 , the difference between $f(S_1) - u(S_1)$ drops relative to $f(S_0) - u(S_0)$ as does the difference $Y(S_1) - [(1/1.1)X(S_1)]$ relative to $Y(S_0) - [(1/1.1)X(S_0)]$, and therefore, this condition is less likely to be met. Likewise, the book would choose point spread S_2 relative to point spread S_0 if

$$\frac{f(S_0) - u(S_0)}{f(S_2) - u(S_2)} < \frac{Y(S_2) - \left[\left(\frac{1}{1.1}\right)X(S_2)\right]}{Y(S_0) - \left[\left(\frac{1}{1.1}\right)X(S_0)\right]}.$$

Compared to the original point spread S_0 , the difference between $f(S_2) - u(S_2)$ increases relative to $f(S_0) - u(S_0)$ and $Y(S_2) - [(1/1.1)X(S_2)]$ increases relative to

$Y(S_0) - [(1/1.1)X(S_0)]$, and therefore, this condition is more likely to be met as the handle increases.

If the book chooses a half-point spread, it removes the possibility of a push, which reduces the book's expected integrity fee liability. Yet, there are possible non-pecuniary consequences to removing the possibility of the push, which might include reduced good will among bettors, and perhaps decreased betting over time as bettors realize that the push is no longer an option. Therefore, while a half-point line might maximize expected profits in the presence of an integrity fee, it might cause the overall market to result in a second best outcome.

Recent History of Pushes in Four North American Sports

Whether an integrity fee on the handle provides sufficient incentives to avoid pushes so that sports books offer more half-point lines is an empirical question. Unfortunately, there are no publicly available data on total handles. This section provides a case study of how many times various betting lines in four North American sports resulted in a predicted push, an actual push, how many times sports books offered half-point lines, and the intertemporal correlation between the number of actual pushes and half-point lines.

We collected archived end-of-game sides, end-of-game totals, second-half sides, and second-half totals from NCAA Division I basketball, NCAA FBS football, the National Football League, and the National Basketball Association from the 2015/2016 season through the 2019/2020 season from www.sportsbookreviewsonline.com.³ An end-of-game side is a bet that the underdog will lose by more than the sides line. An end-of-game total is a bet that the combined points scored by the underdog and the favorite will not be less than or equal the totals line. A second-half sides or totals line pertains only to the second half of the game (regardless of how many periods comprise the second half).

For each end-of-game and second-half sides, we determine whether the line was a "pickem," which occurs when the line equals zero. This can occur when the combined wisdom of the bettors truly cannot decide which team is favored or when the combined betting on the home team and the away team are equal when the closing sides line is zero.⁴ While end-of-game ties are not possible in college and

³ The 2020 NCAA basketball season was ended after the regular season was completed but before most conference tournaments and the three national post-season tournaments had been held and the NBA season was suspended on March 11, 2020, and had not been resumed by the time of this writing. The 2019/2020 NFL and NCAA FBS seasons were completed before the 2020 SARS-COV-2 pandemic led to the suspension of other leagues.

⁴ Here, we assume that the sports book aims to have equal amounts bet on each team so that their vigorish (commission) is risk free. This assumption is not without controversy [see Levitt (2004)] but is common without strong evidence to the contrary. It is likely the case that for certain games the handle is too small or the sides so lopsided in quality that it is not possible to have the amount bet on both sides exactly equal. This potential for systematic bias in lines is not possible to test without data on the handles for both sides of many bets. However, a sports book balances or does not balance their bets, a pickem reflects there is no favorite in the bet.

Table 1 Annual number of “pickem” closing sides lines

	2015	2016	2017	2018	2019	Total pickems
NCAA Div-I basketball	56	51	57	92	79	335 (1.45%)
NCAA FBS football	9	2	11	10	9	41 (0.81%)
NFL	6	7	4	5	3	25 (1.87%)
NBA	15	22	12	17	18	84 (1.35%)

Of the 485 predicted ties reflected in pickem sides lines, none ended in an actual tie. During the sample period, ties are not possible in NCAA basketball, NCAA football, and the NBA. During the sample period, there were five actual ties in the NFL, but none of them were predicted. Thus, of the 485 predicted end-of-game ties, none resulted in an actual tie

professional basketball or college football and rarely occur in professional football, in all four sports a second-half tie is possible in all four sports, which would result in a push on a pickem line. During the 2015/2016–2019/2020 seasons in the four sports only 63 pickem second-half sides lines resulted in a push.⁵ In the case of end-of-game pickem’s none resulted in a push because of the inability or rarity of end-of-game ties in these four sports.

Table 1 reports the number of pickem closing lines for all four sports during the five seasons and how many of these predicted pushes were actual pushes. As can be seen, it is very rare for there to be an end-of-game pickem in any of the four sports. The lowest number of end-of-game pickems was 41 (0.81%) in college football and the most was 335 in college basketball. Because end-of-game ties are not possible in NCAA basketball, NCAA football, or the NBA, and are rare in the NFL (there was an average of one tie a year from 2015 to 2020), the only pickems that can lead to a push are the second-half sides and totals lines.

The discussion above suggests that larger handles or larger odds of a push would increase the likelihood that a book would move to a half-point line. Second-half betting markets only last as long as the halftime of the sport: 20 min for college football, are rather short: 15 min in college and professional basketball, 20 min in college football, and 12 min in professional football (in most cases). While it is possible for the handle on second-half sides or second-half totals lines to be greater than the handles on the end-of-game sides and totals lines, it is unlikely as the halftime markets have fewer bettors and are of abbreviated time. Therefore, pickem-related pushes seem insufficiently common and not of large enough handles to motivate more half-point lines after the imposition of an integrity fee.

Yet, pickem sides are not the only source for pushes. Indeed, every nonzero even-point sides and total carries a nonzero probability of a push. For example, if the sides had the home team favored by eight and the home team won by eight or if the closing sides line had the visiting team favored by three and it won by three,

⁵ During the 2015/2016–2019/2020 seasons, there were 295, 282, 156, and 295 pickem second-half sides lines in college basketball, college football, professional football, and professional basketball, respectively. Of these pickems, 13, 28, 9, and 13 resulted in a push, respectively.

Table 2 Percent of lines in various North American sports that result in a push

Sport	Year	Total games	Sides line (%)	Totals line (%)	Second-half sides line (%)	Second-half totals line (%)
NCAA Div-I basketball	2015	4017	2.04	1.09	2.36	1.86
	2016	4023	1.78	1.19	2.16	1.66
	2017	4077	1.83	1.34	2.35	2.06
	2018	5599	1.57	1.35	2.30	1.57
	2019	5329	1.83	1.42	2.19	2.19
	Total	23,045	1.80	1.29	2.27	1.87
NCAA FBS football	2015	866	1.96	1.38	1.73	2.88
	2016	876	1.71	1.14	2.73	2.96
	2017	883	2.03	1.01	2.71	2.26
	2018	901	1.55	0.99	2.77	2.77
	2019	1550	1.87	1.03	3.09	1.67
	Total	5076	1.83	1.10	2.67	2.40
NFL	2015	267	4.49	0.74	2.99	3.37
	2016	267	2.62	0.74	1.49	4.86
	2017	267	4.49	0.74	1.87	2.62
	2018	267	3.37	1.12	3.37	2.62
	2019	267	3.74	0.74	3.37	2.24
	Total	1335	3.74	0.82	2.62	3.14
NBA	2015	1316	1.36	1.59	2.50	2.27
	2016	1309	0.99	0.22	1.83	1.75
	2017	1312	2.59	1.37	1.44	1.75
	2018	1312	0.60	0.38	1.75	1.44
	2019 ^a	971	1.54	0.30	1.64	2.57
	Total	6220	1.41	0.80	1.84	1.92

^aSeason suspended in March 2020

this is a push. If the closing totals line was 135 and the combined final score of the home team and visiting team was 135 points, this is also a push. If the second-half totals line was 60 and the combined second-half scoring by the home and visiting team was 60, this is a push. Finally, if the second-half sides line was the home team favored by three points in the second half and the home team “won” the second half by three points this is a push.

Table 2 reports the percentage of end-of-game and second-half sides and totals lines that resulted in a push for each season and the total over the five-season period in each sport. Looking at the aggregated annual data, the end-of-game sides line in the NFL resulted in the highest percentage of pushes (2.74%) and the closing totals line in the NBA resulted in the fewest pushes (0.80%). Overall, in the presence of integrity fees on the entire handle, the total number of bets that resulted in pushes might be sufficient for sports books to implement more

Table 3 Percent of lines in various North American sports that have half-point

Sport	Year	Total games	Sides line	Totals line	Second-half sides line	Second-half totals line
NCAA basketball	2015	4017	48.89	48.84	47.87	47.82
	2016	4023	51.78	53.32	48.55	50.43
	2017	4077	49.99	50.99	50.50	47.76
	2018	5599	49.83	50.88	48.26	46.95
	2019	5329	49.03	50.80	48.70	48.08
	Total	23,045	49.85	50.97	48.74	48.11
NCAA football	2015	866	45.49	44.91	48.03	51.38
	2016	876	50.34	47.71	52.73	52.39
	2017	883	44.62	47.45	49.49	46.20
	2018	901	43.50	43.72	45.06	41.17
	2019	1550	43.35	47.54	54.06	56.00
	Total	5076	45.17	46.43	50.41	50.25
NFL	2015	267	35.20	42.69	57.30	55.05
	2016	267	43.07	52.81	56.17	47.56
	2017	267	36.32	54.68	47.94	58.05
	2018	267	43.82	49.43	42.32	42.69
	2019	267	41.57	51.68	56.17	50.93
	Total	1335	40.00	50.26	51.98	50.86
NBA	2015	1316	48.55	48.93	47.64	49.08
	2016	1309	51.26	51.26	51.18	48.05
	2017	1312	50.22	50.61	49.61	48.84
	2018	1312	51.44	51.44	48.85	50.00
	2019 ^a	971	50.05	50.05	51.59	52.00
	Total	6220	50.32	50.48	49.69	49.61

^aSeason suspended in March 2020

half-point lines to avoid the potential tax liability of the pushes, especially for games that are expected to generate large handles.

While the data on handle amounts are not available, we can investigate how many sides and totals lines are already offered with half-points without integrity fees. Table 3 reports the annual and overall percentage of half-point lines among the four lines in each of the four sports. The greatest percentage of half-point lines is the second-half sides line in the NFL (56.17%) and the lowest percentage of half-point lines is the closing sides line in the NFL (40.0%). Even without integrity fees, five of the sixteen sides and total lines have majority half-point lines. If sports books can (reasonably) predict those games most likely to end in a push, they could target those games to have half-point lines and reduce their exposure to the increased tax liability while only increasing the prevalence of half-point lines by just a few percentage points.

Table 4 Correlation between annual number of pushes and number of half-point lines in various North American sports from 2015 to 2020

Sport	Years	Sides line	Totals line	Second-half sides line	Second-half totals line
NCAA Div-I basketball	2015–2019	0.68	0.95	0.97	0.71
NCAA FBS football	2015–2019	0.94	0.88	0.95	0.40
NFL	2015–2019	−0.89	−0.09	−0.16	−0.17
NBA	2015–2019	0.07	0.32	0.47	−0.21

Table 5 Probability of half-point line when game is characterized by a high sides line or total line

Sport	Obs	High sides line	High totals line
NCAA Div-I basketball	23045	−0.048*	−0.069*
NCAA FBS football	5076	−0.206*	−0.277*
NFL	1335	0.051	0.082
NBA	6220	0.016	0.020

Results from probits which estimate the probability of having a half-point sides (total) line when the sides (total) line is 1.5 standard deviations or more away from the season's mean sides (total) line. Effects reported are dF/dX for a discrete change in the right-hand side dummy variable from zero to one. * $p < 0.05$

What is the relationship between half-point betting lines and the number of pushes over time? On the one hand, if sports books are more concerned about the administrative costs of pushes relative to the good-will pushes can generate, we expect the intertemporal correlation between pushes and half-point lines is positive. On the other hand, if good will is more important, then we would expect a negative correlation between pushes and half-point lines over time.

Using the number of pushes and half-point lines, we calculate the correlation between the two variables across the five seasons; the correlations are reported in Table 4. In the two collegiate sports, the correlation is positive, and there is negative, albeit low, correlation in the two professional sports. This difference, even in the absence of integrity fees, might indicate a segmented betting market where those who bet on college sports are less price elastic to half-point lines compared to those who bet on professional sports. These differences would feed back into the conditions described in the previous section by which sports books are more inclined to offer half-point lines.

An alternative explanation could be the difference between casual bettors and financially motivated bettors as described by Feddersen et al. (2020). In these four sports, those bettors who are less price elastic may be less concerned about the availability of a push when the line is relatively large. In each sport year we calculated the mean and standard deviation of the line and totals. We then categorized each line and total as being relatively high if it was more than 1.5 standard deviations above the mean. We then estimated probit models that relate an indicator variable for the line being a half line against the line being relatively high.

The marginal effects at the mean are reported in Table 5. In both college sports, a relatively high sides or total corresponds with a lower probability of a half line, suggesting that when one team is a heavy favorite or there is an expectation of a large number of points scored that bettors might be more casual and appreciate a possible push, especially in college football. In the two professional sports, there is no statistically significant relationship between having a relatively high line and having a half-point line. This might suggest that bettors in these sports are more financially motivated and do not require a possible push when the lines are relatively high.

Conclusions

After the 2018 Supreme Court decision in *Murphy* versus *NCAA* legalized sports betting in the USA, many sports leagues have asked for a so-called integrity fee that would tax the entire amount bet, or handle, involving the league's games. The distinction is not trivial for any party involved in the betting markets. A handle on a single game could run in the millions of dollars, whereas the hold to the sports book might be less than five percent of the handle. Obviously, sports leagues would prefer an integrity fee on the greater amount and sports books on the lower amount. A 1% tax on the handle would represent close to a 20% tax on the net revenue (hold) of a sports book with a 5% hold. This might be sufficient to eliminate any economic profit to the sports book which might cause some to go out of business. If this were to happen, illicit gambling markets would become more viable reintroducing extra-legal activity, the inability of government and leagues to collect taxes and integrity fees, eliminating redress in the formal legal system for bettors and sports books, and introducing the potential for problematic gambling to persist longer than it would otherwise.

Moreover, an integrity fee on the handle opens sports books to potential tax liability when a push occurs, after which all bets are returned (the book has no net revenue from the event but must pay the integrity fee on the total bet). One defense to this possibility is to lobby the legislature to exempt pushes from taxation (as was done in West Virginia in 2018). Another possible defense is for sports books to introduce half-point sides and totals lines which eliminate the possibility of a push.

Raising the line against the favorite would lower the handle bet on the favorite and raise the handle bet on the underdog, *ceteris paribus*, while lowering the line against the underdog would have the opposite effect. Whether a sports book finds it profitable to offer a half-point sides or totals line depends on how sensitive the changes in the handle are and how likely a push is to occur.

We derive the conditions under which a sports book will find itself with a lower potential tax liability and higher expected profit in the presence of an integrity fee on the handle by offering a half-point line.

In the absence of detailed data on the actual amount bet before and after lines change, we describe the pattern of pushes, half-point lines, and their correlation for four different lines in college basketball, college football, professional basketball, and professional football. Sports books offer end-of-game sides lines, end-of-game totals lines, second-half sides lines, and second-half totals lines for the vast majority

of the games in these four sports.⁶ We look at the difference between the closing lines and the end-of-game and second-half outcomes and categorize bets as being pickems, i.e., a sides-line that is zero because there is no favorite and lines that result in a push (all four types of lines can result in a push). We also document how many of the four lines are half-point lines in which pushes are not possible.

Over a five-year period from 2015 to 2020, there was a total of 335 pickem closing sides lines in college basketball (1.45% of all games with lines), 41 in college football (0.81% of all games with lines), 25 in the National Football League (1.87% of all games with lines), and 84 in the National Basketball Association (1.35% of all games with lines). The pattern suggests it is relatively rare for the pre-game sentiment of the betting market to “shrug” about who is expected to win. Regardless of whether sports books balance the betting on each side or take an explicit position on which team will win, the low number of organically predicted pushes reflected in sides lines suggests that pushes are not often expected.

Yet, actual pushes occur much more often than predicted pushes. For example, in the National Football League 3.74% of all games result in a push in the closing sides line, almost double the predicted number of pushes as reflected in pickem sides lines. This suggests that sports books face considerable possible tax liability from an integrity fee implemented on the handle rather than the hold. If the empirical conditions hold such that the sports book finds it more profitable to introduce a half-point line, what is the expected sensitivity of the handle?

In the absence of detailed data on how handles change before and after line changes or across games with different lines, we document the number and percentage of half-point lines that were offered in the absence of integrity fees. In most of the four lines across the four sports, there is at least a plurality, and in five cases, a majority of lines are already half-point lines. We interpret this pattern as suggesting that if all the pushes were accurately predictable and the lines became half-point lines, there would not be a dramatic response to the half-point line, per se. That is, there are already enough half-point lines offered that the betting market would not react in shock to the existence of the half-point line. The extent that the handle changes in response to the half-point line is an empirical question that would be solved by the sports book because it has the private information on handles across lines and games.

While leagues have softened their original demands from a 1% integrity fee on the handle, included in H.B. 1835 (Indiana 2018), to as low as 0.02% in H.B. 191 (Missouri 2019), it is not clear how well the distinction between taxing the handle or the hold is understood by sports leagues in their lobbying either individual states or the federal government. States tend to tax the hold rather than the handle indicating that state legislatures understand better the distinction or more readily respond to lobbying by the gambling industry. As of May 2020, no state has explicitly included an integrity fee in their legalization legislation, yet West Virginia (2018) did exempt pushes from its taxes

⁶ In college basketball there are many games in which one or more lines are not offered. This is most common when the game is between two very lopsided teams or when there is considerable uncertainty surrounding the game, e.g., a star player is hurt. In the case of college football, lines are generally not offered on inter-divisional games, e.g., when an FBS school is playing an FCS school.

and any future integrity fees. If other states implement integrity fees in the future, the implications of taxing the handle rather than the hold should be remembered.

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