INSTITUTIONAL CHANGE AND PLACING A BET

What Do Bettors Want?

Determinants of Pari-Mutuel Betting Preference

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ABSTRACT. This paper is an analysis of the demand for thoroughbred racetrack wagers, examining evidence that would support the existence of two types of bettors: the risk-averse informed bettor versus the uninformed bettor. Looking at 12 major racetracks over the fall of 2002, we undertake an empirical examination of the determinants of bettors' preferences for particular wagers on specific races. The goal is to try to determine what individual aspects of a race (conditions, surface, participants, etc.) will encourage increased wagering dollars. With the advent of simulcasting, the competition for the wagering dollar is fierce, as the bettor can choose from more than 100 races daily, each race offering numerous betting options. We find for most wagers that higher quality participants, larger and more competitive fields, and turf races increase betting volume while higher pari-mutuel takeout, poor track conditions, and other races run concurrently reduce volume. However, more competitive fields reduce betting volume in the show and trifecta pools. Optimal field size is determined to be between 10 and 12 betting interests. Overall, we find support for the existence of a significant share of risk-averse informed bettors.

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I

Introduction

THOROUGHBRED RACING IS a unique spectator sport that allows fans to be active participants through wagering at the racetrack. Through pari-mutuel betting, the public collectively establishes a price on each betting interest. The track acts as an intermediary, extracting a certain amount (called the takeout, usually 15–30 percent) from the betting pool and then redistributing the remainder to the holders of the winning tickets. In recent years there have been dramatic changes in the dynamics of pari-mutuel betting markets. First, there has been the introduction of new "exotic" wagers, which require bettors to pick the winners in consecutive races (pick three, pick four, pick six) or to pick the top three or four finishers in a single race in the correct order (trifecta, superfecta). These bets require small investments and have the potential for enormous payouts.[1] The second significant change is the proliferation of simulcast wagering, which allows bettors to play a multitude of races at many tracks across the country from their home track, casino, off-track betting hub, by phone, or online, so that their bets are co-mingled into the same pool as those made at the host track. The increased availability of simulcast betting has resulted in an explosion in the dollar volume wagered on horse racing in the last decade. From 1985 to 2002, the total wagered on thoroughbred races in North America increased from $8.25 billion to $15.62 billion, despite the fact that the number of races dropped over 20 percent. Adjusting for inflation, total wagering increased by 21 percent, while per-race wagering increased by 53 percent. Much of this growth can be attributed to off-track betting, which accounted for 86 percent of all bets made in 2002. A third change affecting the industry has been increased competition as a result of the growth of other gambling opportunities such as lotteries, casino gambling, and slot machines at the track itself.

This paper is an analysis of the demand for racetrack wagers in this new context of increased opportunities and increased competition. Looking at 12 major racetracks over the fall of 2002, we undertake an empirical examination of the determinants of bettors' preferences for particular wagers on specific races. The goal is to try to determine what individual aspects of a race (conditions, surface, participants, etc.) will encourage increased wagering dollars. Specifically, we want to determine if lower returns or increased risk, due to reduced or noisier information about a betting interest or race, will deter bettors. In order to frame our question, we assume that there are two primary types of bettors on horse racing. The first type is the information-seeking, risk-averse individual (henceforth, "informed bettor") whose demand for racetrack wagers is dependent on both returns and the quantity and quality of information available about a race. The second type of gambler is risk-loving or risk-neutral with high costs of gathering information (henceforth, "uninformed bettor"). Demand for wagers by this second type would be unresponsive to increased noise or reduced information about a race.

With the advent of simulcasting, the competition for the wagering dollar is fierce, as the bettor can choose from more than 100 races daily, each offering numerous betting options, as described in Table 1. Each of these wagers has its own separate betting pool. We estimate demand for win, place, show, exacta, and trifecta wagers with five simultaneous equations using Zellner's seemingly unrelated regression (SUR) method. We use ordinary least squares (OLS) to estimate total race handle, determining the impact of quinella, superfecta, daily double, and pick-three wagers, as well as other race-specific characteristics. Inasmuch as we look for a response in wagering to various conditions that would impact information, we are implicitly testing whether or not the informed bettor makes up a significant proportion of the total bettors on horse racing.

Initial research on wagering demand focused on the effect of the change in the price of a wager (track takeout) using time series data where takeout rates change over time to calculate the price elasticity of demand. Most studies find that the takeout rate is elastic, indicating that lowering the takeout would increase revenue (Gruen 1976; Suits 1979; Pescatrice 1980; Morgan and Vasche 1982; Thalheimer and Ali 1992).[2] Thalheimer and Ali (1995) undertake a time series analysis to find determinants of demand using tracks in Kentucky and Ohio. Subsequent papers analyze the effect on wagering demand from subsidized purses for local breeders (DeGennaro 1989), intra-state intertrack wagering (Thalheimer and Ali 1995), transportation costs (Ali and Thalheimer 1997), alternative gaming (Thalheimer 1998), and

Table 1

Betting Options

Betting Options	Payout Criteria	Average Payout on a $2 Bet	Median Payout on a $2 Bet
Straight			
Win	1st	$12.98	$7.80
Place	1st or 2nd	$6.37	$4.60
Show	1st, 2nd, or 3rd	$4.27	$3.40
Single Race			
Exacta	Top two finishers in exact order	$86.66	$43.80
Quinella	Top two finishers in either order	$42.58	$23.00
Trifecta	Top three finishers in exact order	$683.85	$227.00
Superfecta	Top four finishers in exact order	$3,554.30	$1,363.60
Multi Race			
Daily Double	Winers of two consecutive races	$94.76	$44.80
Pick Three	Winners of three consecutive races	$641.48	$236.00

pari-mutuel racebook (Ali and Thalheimer 2002). Ray (2002a, 2002b, 2002c, 2002d) has multiple studies of simulcast wagering demand using a cross-section of races.

II

Gamblers' Preferences

For decades, economists have viewed wagering markets as ideal grounds to match empiricism with theory. The sheer abundance of gambling data allows for extensive analysis on any scale, a trait shared with another commonly analyzed market—the financial market.

However, unlike financial markets, there exists a certain and fixed termination point at which a wager's value becomes known. Stock prices are a function of future cash flows and the price that someone may be willing to pay for the security; a racetrack wager can only pay a fixed amount of money at a predetermined point in time under well-defined conditions. Further, the structure of the wagering market—large-scale, immediate feedback, and repeated play, which leads to improved learning—has led economists to believe that wagering markets, as compared to other markets, have a better chance of becoming efficient (Thaler and Ziemba 1998).

Extensive research into a wide variety of markets has uncovered numerous inefficiencies. Stock market inefficiencies have been widely reported (DeBondt and Thaler 1989). The market for forecasting earnings seems to persist in inefficiency (DeBondt and Thaler 1990). Interestingly, economists' *own* economic forecasts also do not appear to self-correct over time (Ahlers and Lakonishok 1983). Strategies have been uncovered that produce greater returns to betting on long shots as opposed to favorites in National Football League (NFL) contests (Gandar, Zuber, O'Brien, and Russo 1988). Simple models exist that can take as few as three variables from any NFL game and generate better than break-even results (Kochman and Badarinathi 1992). Similar discrepancies have been found in major league baseball (MLB) and National Hockey League (NHL) betting markets (Woodland and Woodland 1994, 2001).

Inefficiencies also exist in racetrack betting markets despite their efficiency-enhancing characteristics. Discrepancies between win bets and both place and show bets have been shown to produce disturbances strong enough to violate weak-form market efficiency (Hausch, Ziemba, and Rubinstein 1981). The same violation can be found in exacta markets (Ziemba and Hausch 1985). The most researched anomaly, however, is the favorite-long shot bias, an irregularity in which the underbetting of favorites produces consistently greater returns as compared to long shots. Numerous studies have examined a wide range of pari-mutuel betting markets to show that the favorite-long shot bias exists (Ali 1977; Asch, Malkiel, and Quandt 1982), does not exist (Gandar, Zuber, and Johnson 2001), and exists in reverse form, where long shots are underbet and thus provide a greater expected return (Busche and Hall 1988; Swindler and Shaw 1995).

Despite a full spectrum of results concerning the favorite-long shot bias, models have emerged that can predict the movement of biases based upon predictable factors. By assuming heterogeneous pools of bettors, as opposed to the typical homogenous pool of identical "representative bettors," biases can be estimated due to race specifications that determine the characteristics of the bettors' pool (Sobel and Raines 2003). Biases are generated by uninformed bettors skewing the information gleaned from posted odds. A pool of perfectly knowledgeable bettors would lead to a pari-mutuel set of odds that would mirror the true odds of any participant winning. When casual, uninformed bettors enter this market, their bets produce biases in the odds and, ultimately, in the expected returns on wagers.

Gambling lies in an area of economics concerning risk preference and uncertainty. Theories that explain gambling can be segregated into two types: risk preference and information perception.

Risk-preference theories concern the inherent makeup of the gambler, or his or her preferences, and thus deal with utility curves. The typical utility curve traces the relationship between wealth level and utility and is a function that increases at a decreasing rate. As such, the common economic actor is risk-averse—that is, gambles that produce an expected level of wealth are not as highly regarded as simply holding the same level of wealth with certainty. A compensation would be needed in order to induce the typical risk-averse economic actor into taking a neutral gamble (i.e., in which the expected gain from the gamble were zero).

The idea of risk aversion, when considered in light of the existence of betting markets, creates a disconnect. Wagering establishments, be they casinos, sports books, or racetracks, will not knowingly foster a system containing any positive expected value bets. Further, gamblers often incur a cost to participate in these wagers instead of being compensated for them. A number of explanations have been put forth to explain this phenomenon. The simplest theory is that bettors are not risk-averse but risk-loving; instead of requiring compensation, bettors are willing to incur a cost to experience the utility gain from taking a gamble. Such a theory would describe a "globally risk-loving" economic actor, characterized by a utility curve that is increasing at an increasing rate over the entire span of possible wealth levels. Other theories have claimed that gamblers are globally risk-averse, yet locally risk-loving (Friedman and Savage 1948). The wealth levels of these gamblers hits a section of their utility curve that would classify them as risk-loving over small changes in wealth (locally risk-loving), yet risk-averse over large changes in wealth (globally risk-averse). Finally, starting with the assumption that a gambler will always take a larger expected value bet over a smaller one, the existence of a favorite-long shot bias proves the "representative bettor" to be risk-loving (Weitzman 1965; Quandt 1986).

A handful of papers deal explicitly with multiple types of representative bettors, including various forms of informed and uninformed participants. Busche and Walls (2000) show that there are gains to professional (informed) bettors in betting at tracks with larger volume. Coleman (2004), in combining past empirical studies, finds two groups, composed of informed risk-averse bettors and risk-loving bettors. Rhoda, Olson, and Rappaport (1999) show the information flows of three types of bettors, informed risk-averse, risk-loving, and risk-averse with utility from entertainment, and use this information to devise a strategy to earn ex post abnormal returns.

Information-perception theories are based on the idea that bettors do not perfectly absorb information. Cognitive psychologists have shown that people are consistently poor at discriminating between small probabilities (Snowberg and Wolfers 2004). As mentioned above, the skewing of posted race odds by casual, uninformed bettors—the information serious bettors utilize to equilibrate the market—allows the favorite-long shot bias to persist. As the incidence of uninformed bettors rises, so too does the degree to which information is skewed. Additionally, as bets become more complicated (trifecta or exacta bets versus win, place, or show bets), bettors become relatively more uninformed, and biases emerge accordingly.

For the purposes of predicting what bettors prefer, we treat each potential wager as the possible purchase of a risky asset. We ask if there exists a significant subset of bettors who are like investors, preferring to bet in pools and races for which there are higher expected rates of return and lower risks. In large part, perception of risk will relate to the amount of information versus noise available to the "investor" about the performance of a particular betting interest or the condition of a particular track. For the bettor with little or no interest in decreasing risk, gambling on horses would be akin to playing the slots, and poor information should have no bearing on whether the bettor places a bet. The return on the wager would be related to such variables as track take or high carryovers, discussed below, and both types of bettor would respond to increased returns such as these. Furthermore, we assume that bettors prefer more choices (of betting interests, wager types, races) *up to a point*, after which more choice may only result in more noise. Again, an uninformed bettor would be unconcerned with the increased noise.

After outlining the data available, we classify variables according to whether they are expected to increase or decrease the risk or return of a bet. In some cases, our prediction of the impact on wagering will be ambiguous, perhaps because the relationship may well be nonlinear. We will then test our hypotheses empirically and, furthermore, determine the relative importance of the determinants of wagering preferences.

III

Data

THE DATA USED in the study are comprised of thoroughbred races run at 12 racetracks in the United States during the months of October, November, and December 2002. Included are the major racing circuits of New York (Belmont and Aqueduct), Kentucky (Keeneland, Churchill Downs, Turfway Park), and California (Oak Tree at Santa Anita, Hollywood Park), as well as mid-major circuits in Maryland (Laurel), Louisiana (Fair Grounds, Louisiana Downs), Illinois (Arlington), and Florida (Calder). Table 2 summarizes the data, listing takeout, per race average purse size, and per race average mutuel pool size. The data include 2,957 races with an average of 8.49 betting interests per race.[3]

The track takeout, which represents the price of a wager, is the percentage extracted from the mutuel pool to pay for track expenses (purses, upkeep, etc.) and profits. At every track, the more complicated

Table 2

Racetracks (10/02–12/02)

Track	Take1	Take2	Take3	Horses	Races	Purse	Win	Place	Show	Exacta	Quinella	Trifecta	Super	Double	Pick 3
Arlington	17.0%	20.5%	25.0%	951	118	$27,381	$81,394	$28,595	$14,063	$100,930	$6,757	$85,622	$30,092	$36,437	$16,493
Aqueduct	14.0%	17.5%	25.0%	3,323	380	$44,182	$210,539	$65,965	$31,181	$303,169	$28,208	$207,657	$127,048	$180,962	$71,689
Belmont	14.0%	17.5%	25.0%	597	71	$49,493	$229,992	$74,972	$39,166	$332,442	$33,950	$241,265	$137,754	$181,795	$76,261
Churchill Downs	16.0%	19.0%	19.0%	2,269	240	$39,389	$147,047	$50,699	$27,667	$204,979	$0	$172,476	$53,603	$68,304	$31,012
Calder	18.0%	20.0%	27.0%	5,110	622	$23,892	$79,788	$25,368	$10,863	$123,181	$0	$94,903	$34,196	$44,930	$15,556
Fair Grounds	17.0%	20.5%	25.0%	1,366	157	$25,933	$97,074	$31,604	$18,455	$134,912	$13,910	$115,945	$33,370	$54,936	$17,706
Hollywood Park	15.43%	20.18%	20.18%	2,043	267	$41,846	$188,809	$64,394	$31,638	$189,803	$20,352	$197,616	$88,341	$38,470	$73,534
Keeneland	16.0%	19.0%	19.0%	556	61	$43,164	$144,874	$53,415	$30,369	$183,658	$10,518	$153,682	$44,484	$76,382	$29,982
Louisiana Downs	17.0%	20.5%	25.0%	1,466	176	$10,190	$36,863	$13,491	$7,518	$54,293	$6,978	$51,871	$15,272	$18,125	$4,633
Laurel Park	18.0%	21.0%	25.75%	3,960	493	$21,178	$47,580	$15,536	$6,608	$75,300	$0	$54,643	$14,422	$20,110	$8,306
Oak Tree	15.43%	20.18%	20.18%	1,348	159	$43,352	$192,054	$69,677	$32,906	$195,011	$21,595	$203,851	$91,048	$38,298	$76,315
Turfway Park	17.5%	22.5%	22.5%	2,122	213	$14,111	$49,428	$17,300	$7,950	$79,710	$0	$67,890	$21,814	$22,686	$9,416
	16.3%	19.9%	23.2%	25,111	2,957	$29,712	$113,750	$37,850	$18,393	$153,621	$16,523	$124,815	$41,306	$60,155	$33,910
Bet Availability											33.2%		57.6%	31.3%	63.6%

the wager, as determined by the number of horses involved, the higher the takeout. The average takeout rates on straight wagers is 16.3 percent. There is a higher takeout on two horse wagers, exactas, and daily doubles, with the average being 19.9 percent, while the average take for wagers on three or more horses (trifecta, superfecta, pick three) is 23.2 percent. Multihorse exotic wagers are relatively new offerings on the menu of available wagers and can potentially provide monstrous payouts on small investments. Thalheimer and Ali (1995) provide a detailed analysis of exotic wagering and pricing.

The betting volume averages by racetrack of each of the nine wagers can also be found in Table 2. Every race had win, place, show, exacta, and trifecta wagering. Superfectas (58 percent of all races), quinellas (33 percent),[4] and the multirace wagers (doubles 31 percent, pick threes 64 percent) were available less frequently. The availability of multirace wagers depends on the race course. The California circuit offers rolling doubles (daily double on every race with the exception of the last race), while most tracks offer an early double (first two races) and a late double (last two races). Most tracks offer rolling pick threes. More extensive multirace wagers such as the pick four, pick six, and the place pick all are not included in this study.

Two different measures of race quality are utilitized in this study. The quality of the horses at a particular track can be measured either by the purse size for which horses compete or by the classification of the race. Belmont Park's prestigious fall meet offered an average of $51,542 per race, while racing at Louisiana Downs ($10,308) and Turfway Park ($14,240) only gave out a fraction of that. Since the Breeders' Cup was excluded,[5] the highest purses were offered on three Grade I (highest quality) stakes races at Hollywood Park, the Citation, the Matriarch, and the Hollywood Derby. Races are classified into five groups in descending order of quality and importance: stakes, allowance, maiden allowance, starter allowance, claiming, and maiden claiming. Stakes races offer large purses and attract the best horses on the grounds and possibly across the country. Allowance races are for horses that are not quite stakes caliber and are often run with conditions (e.g., nonwinners of three races other than maiden, claiming, or starter) so as to exclude the top horses stabled at a track and allow for the development of future stars. Claiming races are the core of most track's racing programs (56 percent of all races). In these races, any horse is for sale at the stated claiming price. Claiming races in this study range from starters priced between $4,000 and $80,000.[6] Starter allowance races are restricted to horses that have run for a claiming tag in the past.

The competitiveness of a race can be determined by examining the odds of all horses in a race. The more dispersed the odds are, the greater the range of predicted winning probabilities and thus the less competitive a race appears to be. The competitiveness of a race is measured by a modified Herfindahl Index as proposed by Ray (2002d). The competition index is calculated as $C = 100\left[\left(\sum_{i=1}^{n} X_i^2\right) - \frac{1}{m}\right]$, where X is the subjective probability of a possible outcome i and m is the total number of possible outcomes in a race. For a win wager, the total number of outcomes is simply the number of betting interests[7] in a race. Defining n as the number of betting interests in a race, the potential outcomes total $n(n-1)$ for exactas, $n(n-1)(n-2)$ for trifectas, $n(n-1)/2$ for place wagers, and $n(n-1)(n-2)/6$ for show wagers. Subjective probabilities for exacta, trifecta, place, and show wagers are calculated using Harville formulas (1973). For each race there are five competition indexes calculated corresponding to each betting pool. A perfectly competitive race, where each entrant has the same probability of winning, has an index of 0, and the smaller the index, the more competitive a race. Squaring the percentage wagered on each horse increases the weights of favorites, just as firms with greater market power are weighted more heavily in the Herfindahl Index. The most competitive race in the study was an allowance restricted to female horses at Calder with an evenly matched field of six (five of the six horses had odds between 5–2 and 5–1 with the long shot at 8–1) and a win index of 1.2. The least competitive race, with a win index of 46.0, was a race at Louisiana Downs with 11 horses with the favorite at odds of 1–10 and all other runners at odds of 10–1 or greater.

Various race conditions are also accounted for in the empirical model, including racing surface, track condition, distance, and age and sex restrictions. As for surface, only 14 percent of all races were over grass (turf) courses, as opposed to dirt courses, which is not surprising given that the study covered fall and winter months. Track condition is taken into account by noting when the race was on an "off track," which occurs when track conditions are not optimal (fast for dirt and firm for turf). Fall and winter racing can be plagued by bad weather racing days, as was the case at Belmont, where 65 percent of 84 races were on off tracks. Another race condition, distance, is accounted for by including whether or not the race was a "route race," which is contested at one mile or greater and is generally around two turns.[8] Route races require more stamina and are typically won by better-bred horses. More prestigious meets attract classier horses and, in turn, offer more route races.

Finally, the race conditions may specify which horses are allowed to compete in a particular race. Juvenile races are restricted to two-year-olds. F&M are races restricted to female thoroughbreds, fillies (up to four years old), and mares (five years old and above). Some states provide incentives to local breeders by restricting races to horses bred in their home state. New York (especially in the winter) and Louisiana offer a large proportion of state-bred races. Kentucky has no state-bred program, and Maryland and Florida only offer state-bred stakes races.

IV

Variable Classification

A. Variables Affecting Quantity of Information

Races with higher quality horses, as measured by either purse size or race classification, should attract more informed bettors because of greater information available on high-quality horses. More expert/press analysis is likely to be focused on the better horses, in addition to more past performance statistics on the horses running in similar races with similar competition. However, it may be the case that uninformed bettors bet more in the highest quality races (stakes) as well, since these races are the most advertised and therefore likely to attract the interest of even the most uninformed individual.

Races restricted to particular groups, such as maiden, juvenile, or state-bred, are likely to attract lower quality horses and, especially in the cases of maiden or juvenile races, horses with fewer past performance statistics. As a result of the reduced information on these horses, we expect less to be bet in races targeted to specific categories if the informed bettor composes a significant proportion of the total.

In addition to the fact that turf races represent a small share of the races in this data set, they are generally less common. As bettors are less familiar with turf racing, and since there is a difference in how turf versus dirt races are handicapped, the lack of familiarity should translate into fewer bets by informed bettors.

B. Variables Affecting Quality of Information

Risk associated with betting on a particular race is also influenced by five variables that affect either the quality of the information about the horse/track or the bettor's ability to use information to predict the race's outcome. These five variables are: large field size, race quality, competitiveness, an off track, and race length (route). The public will generally bet more overall given more options, which is the case when field size grows. However, each additional horse adds more opportunity for random events affecting the outcome of the race. We expect that the information-seeking bettor will respond to increased noise once the field size becomes too large.

One sign of a higher quality horse is consistency in performance, making it easier to predict current performance. On the other hand, lower quality horses tend to be less consistent, leading to increased noise. The quality of the race participants, determined by purse size and race classification, also influences the quantity of information. State-bred restricted races tend to be of inferior quality, but offer decent purses to reward local breeders.

The more competitive a race, measured by a lower competition index, the bigger the handicapping challenge, and whether the public prefers many evenly matched horses to a few standouts is unclear, but may be dependent on the type of wager.

Races on an off track are less predictable, since the poor conditions of the track, and often the poor weather associated with track condition, may have uncertain impact on individual horses or on their performance as a group. We expect that for the informed/risk-averse bettor the "noise" introduced by poor track conditions will reduce the amount bet.

Finally, longer-distance races introduce more uncertainty. Longer races attract higher quality horses, possibly increasing the amount bet. However, with longer races there is more time for random events to occur, while strategy, jockey quality, pace, and luck become more important, making handicapping increasingly difficult as more noise is introduced. It could also be argued that a longer race allows more time for superior horses to dominate. Therefore, the length of the race will have an uncertain impact on the amount bet for a risk-averse bettor.

C. Variables Affecting Return

Two of the available variables directly affect the return on a bet: the takeout and the carryover. Increased cost of a wager, measured by the track's takeout from the mutuel pool, is predicted to reduce betting volume by reducing the return on any bet. A dummy variable for a big pick-six[9] carryover (>$100,000) is predicted to be positive, since the higher returns due to carryovers are likely to attract interest in a track's races and increase wagering in all pools. It is not possible to distinguish between informed and uninformed bettors using these two variables.

D. Availability of Competing Wagers

A variable with the number of competing races offered in an hour accounts for the number of different race choices a bettor faces. The more race choices the bettor has, the less will be wagered on any particular race due to both budget and time (for handicapping) constraints. While the informed bettor will be responding to both time and budget constraints, the uninformed bettor will respond only to the budget constraint.

There is some question over the impact of availability in the same race of very similar types of wagers, such as the quinella and the exacta. There may be an argument for increased wagering, since bettors are attracted by a greater variety of types of wagers available. On the other hand, it is likely the case that bettors see these types of wagers as substitutes for one another. This question will be determined empirically.

V

Empirical Model

SINCE STRAIGHT WAGERS, exactas, and trifectas are offered on nearly every race, five simultaneous equations are estimated using Zellner's seemingly unrelated regression (SUR) method.[10] The log of the total amount wagered into the win, place, show, exacta, and trifecta pools are the five dependent variables for the SUR regressions. While all equations included 32 independent variables, each of the place, show, exacta, and trifecta equations included additional variables as well, which are discussed below. Variable definitions are listed in Table 3.

Two sets of SUR regressions are estimated to account for different measures of the quality of horses entered in a race. Regression Q1 uses the race's purse size as a measure of quality to determine the purse elasticity (the effect of a 1 percent increase in purse size on betting volume). Regression Q2 uses the five major race classifications and assigns dummy variables. The top level at any track is stake races followed by allowance, starter allowance, high claimers, middle claimers, and low claimers. For either measure of quality, we predict that higher quality is associated with more betting. Specifically, the purse elasticity is predicted to be positive for the first set of regressions, and the coefficients on race classifications should increase with the quality of the race in the second set of regressions. Note that the control race type is allowance races and it is predicted that more is bet on stakes races and less is bet on claimers.

Also among the independent variables is the number of betting interests in a race, as well as the square of the number of betting interests to pick up any diminishing effects. This information can be used to determine the optimal field size to maximize betting volume for a particular wager. The competition index is included to determine the impact of competitiveness of race on betting, with no a priori

Table 3

Race Factor Variables

Definition	
Log of the Race Purse	Avg $29,712
Stakes Dummy	6.6% of all races
Starter Allowance Dummy	1.5% of all races
High-Claiming Dummy (claim price >$25 k)	13.9% of all races
Mid-Claiming Dummy (claim price 10 k–25 k)	24.9% of all races
Low-Claiming Dummy (claim price ≤10 k)	15.7% of all races
Takeout on One-Horse Wagers	Range of 14%–18%
Takeout on Two-Horse Wagers	Range of 17.5%–22.5%
Takeout on Three- or More Horse Wagers	Range of 19%–25.75%
Daily Double Dummy	31.3% of all races
Pick Three Dummy	63.6% of all races
Quinella Dummy	33.2% of all races
Superfecta Dummy	57.6% of all races
Competition Index: Lower value indicates a more competitive race	Range of win 1.2–46.0 Place 0.7–26.8, show 0.4–35.6 Exacta 0.4–16.1, trifecta 0.1–7.7
Number of Betting Interests	Avg 8.49 per race
Squared Number of Betting Interests	
Big Carryover Dummy (≥$100 k for pick six)	3.5% of all races
Maiden Race Dummy (restricted to nonwinners)	34.3% of all races
Juvenile Dummy (restricted to 2 yos)	30.7% of all races
Grass Race Dummy	13.9% of all races
Filly & Mare Dummy (restricted to female horses)	43.4% of all races

Table 3 *Continued*

Definition	
State-Bred Dummy (restricted to in-state bred horses)	10.0% of all races
Off Track Conditions Dummy	21.2% of all races
Route Race Dummy (race ≥ 1 mile in distance)	41.8% of all races
Number of Races in the Same Hour	Avg 6.3, SD 3.1
Minus Pool Dummy	1 races place, 81 races show
Handle on Quinella	
Handle on Superfecta	
Days of the Week Dummy Variables	
Holiday Dummy Variables	
Race Order Dummy Variables	

prediction of the direction of impact. Dummy variables are included for track conditions (turf, off track), race participants (juvenile, female), and distance (route), all of which are expected to reduce betting. Variables for track take and a dummy for big (>$100,000) carryovers are included to determine the importance of increased returns. The variable for the number of other races concurrently available for the bettor to handicap is included, as are dummy variables for the order of races at a track, the day of the week, and holidays.

Additional variables were added for place, show, exacta, and trifecta wagers. For place and show wagers, an additional dummy variable for a minus pool was included. Tracks are required by states to pay a minimum of 5 percent (and in some cases 10 percent) on any wagers. Minus pools occur when very heavily bet horses finish in the top three (top two) and the track loses money on show (place) wagers. This occurs occasionally in the show pool and rarely in the place pool. In both cases, the coefficient should be large and positive.

For exactas and trifectas, the cross-wager elasticities are determined by including the log of quinella volume and superfecta volume in the respective regressions. The quinella is very similar to the exacta and is offered on about one-third of all races, while the superfecta is most closely associated with the trifecta and is offered on more than half of all races. The elasticities are predicted to be negative, since these pairs of wagers are probably substitutes.

To evaluate overall race handle, ordinary least squares with heteroskedasticity robust standard errors is used, with the log of overall race handle as the dependent variable. Thirty-eight independent variables cover race competitiveness, track conditions, track takeout, surface, race participants, race restrictions, day of the week, holiday, and race number. Once again, two different regression models were used to account for different measures of race quality (purse size and race classifications). Also included were dummy variables for availability of daily double, pick three, quinella, and superfecta wagers. For the double and pick three, wagers on these exotics contribute to the handle on the first race in the wagering sequence. It is estimated that additional wagering options increase the amount bet on a specific race.

VI

Empirical Results

A. SUR Regressions by Wager

The SUR regressions summary results can be found in Table 4. The matrix of residuals indicate that they are highly correlated, which is verified by the Breusch-Pagan test for independence of equations ($\chi^2 > 15{,}000$ in each case). There were 2,957 usable observations (races with all five wagers and values for each of the independent variables).

Increased race quality does have a positive impact on wager dollars across racing pools. The estimated purse elasticity is inelastic for all wagers (between 0.41–0.48). When measured by race classification, the racetrack hierarchy, from low-level claimers up to stakes races, is strongly related to predicted betting volume. Bettors prefer higher quality races. With allowance races as the control group, stakes races attracted an estimated 15–35 percent increase in

Table 4

SUR Results

	Win		Place		Show		Exacta		Trifecta	
	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2
Purse Elasticity	0.483		0.458		0.458		0.417		0.476	
Stakes		24%		24%		35%		16%		15%
Starter Allowance		*		*		*		*		*
High-Claiming		*		*		*		*		9%
Mid-Claiming		−26%		−24%		−22%		−25%		−26%
Low-Claiming		−44%		−40%		−37%		−41%		−48%
Optimal Field Size	10.9	11.0	11.0	11.1	11.9	12.1	12.2	13.0	10.4	10.4
Take Elasticity	−2.42	−3.14	−2.52	−3.21	−2.70	−3.48	−2.98	−3.64	−0.53	−0.72
Competition Index	−0.8%	−0.8%	−1.3%	−1.3%	*	*	−0.7%	−0.6%	2.2%	3.1%
Big Carryover	25%	33%	27%	35%	28%	35%	25%	34%	32%	43%
Maiden	*	−11%	*	−10%	*	−10%	−4%	−14%	*	−11%
Juvenile	*	4%	*	*	*	*	*	*	*	*
Turf Race	5%	15%	9%	19%	10%	20%	−5%	*	*	9%
Female	−3%	*	−2%	*	*	*	−3%	*	*	*
State-Bred	−10%	*	−8%	*	−5%	*	−6%	*	*	14%
Off Track	−12%	−16%	−13%	−16%	−14%	−18%	−6%	−8%	−10%	−14%
Route	−5%	*	−5%	*	−3%	*	−3%	*	*	*
Other Races	−3%	−3%	−3%	−3%	−4%	−4%	−4%	−4%	−4%	−4%
Quinella Elasticity							−0.006	−0.004		
Superfecta Elasticity									−0.012	−0.016
R squared	0.740	0.683	0.744	0.692	0.748	0.707	0.698	0.646	0.573	0.469
Observations	2,957		2,957		2,957		2,957		2,957	

*Not significant.

betting volume, with the greatest effect on the show pool and the slightest effect on exactas and trifectas. Starter allowance and high-level claiming races do not have a significantly different effect from allowance races. Mid-level (22–26 percent less) and low-level claimers (37–48 percent less) are less attractive to bettors. The fact that stakes races are much more popular among bettors than all other races is not necessarily evidence of increased presence of informed bettors only, inasmuch as stakes races are heavily advertised and attract interest from all bettors. We would argue, however, that those who are *not* betting in claiming races are more likely to be the informed bettors.

Races restricted to fillies and mares are found to slightly reduce volume for win, place, and exacta wagers in the purse size regressions only. Maiden races are shown to reduce betting volume for all wagers in the race classification regressions, and for exactas in the purse size regressions. This evidence supports the idea that less information leads to less betting.

For each wager, the number of betting interests is found to have a positive but diminishing effect on betting volume. Optimal field size, the point at which increasing the number of competitors in the race would actually begin to decrease betting volume, is found to range from 10 on trifectas, to 11 on win and place wagers and 12 on show wagers and exactas. The estimates are not significantly different from one another, but the results indicate that the optimal field size from a betting perspective is between 10–12 horses. Since for each pool there is evidence of an optimal number of betting interests, there is support for the hypothesis that after some point, informed bettors reduce betting volume in response to increased noise.

A divergence in the betting volume by wager is found in estimates of the competitiveness of a particular race. A race is considered more competitive when the probabilities of outcomes are similar. The competition index is small in a more competitive race; therefore, an increase in the competition index indicates a less competitive race and a negative coefficient establishes that a more competitive race increases betting volume. A less competitive race is found to attract less money in the win, place, and exacta pools and more money into the trifecta pool. It is of interest that the highest probability wager, the show wager, and the lowest probability wager, the trifecta, both seem to attract more money (relative to other wagers) for less competitive fields. Perhaps this is because the informed bettors will play these races with more confidence when there are a few “sure things” that will finish in the money. If a race is contentious, informed bettors will stick to win, place, or exacta wagers. Some bettors may focus on trying to make a big score, which in a wide-open race can be done by betting to win or exactas, but for a less competitive race requires trifectas (unless favorites run off the board).

As for the estimated impact of track take, the elasticity of demand for a wager across tracks is estimated to be price elastic for straight wagers and exactas and price inelastic for trifectas. The other variable reflecting rate of return, a large pick-six carryover, has a significant impact on all betting pools, increasing betting volume by a predicted 25–43 percent. Building up large progressive carryovers helps build handle on all wagers. Of course, high rates of return should attract both informed and uninformed bettors.

Contrary to our initial predictions, turf races attract additional volume for straight wagers (5–15 percent win, 9–19 percent place, 10–20 percent show) but there are no significant differences in trifectas and possibly a negative effect for exactas (−5 percent for regression Q1 while regression Q2 was insignificant). This is consistent with the findings of Ray (2002b, 2002c), who speculates that these races are “unique and often high quality.” It may be the case that, like stakes races, advertising/high interest in turf races may attract all bettors.

Suboptimal track conditions reduce the amount wagered across all pools. The distance of the race reduces volume for win, place, and exacta wagers in regression Q1. Again, these reductions in volume support the hypothesis that bettors bet less when information is noisy.

As for competing races or similar wagers, quinellas and exacta are substitutes, as are trifectas and superfectas, though the effect is small in each case. Each additional competing race run in the same hour reduces betting volume 3–5 percent for each wager.

The days of the week and the order of races did impact wagering. Saturdays are the most popular (and are the control group), followed by Fridays and Wednesdays. Wagering increases throughout the day.

Table 5

Race Handle

	Q1	Q2
Purse Elasticity	0.212	
Stakes		20%
Starter Allowance		*
High-Claiming		–4%
Mid-Claiming		–8%
Low-Claiming		–14%
Optimal Field Size	11.6	11.7
1 Horse Take Elasticity	–2.68	–2.96
2 Horse Take Elasticity	–3.48	–3.93
3+ Horse Take Elasticity	–0.58	–0.82
Double	22%	25%
Pick Three	24%	24%
Quinella	*	–6%
Superfecta	24%	25%
Competition Index	*	*
Big Carryover	10%	11%
Maiden	–3%	–6%
Juvenile	*	4%
Turf Race	6%	11%
Female	–2%	–2%
State-Bred	–5%	*
Off Track	–10%	–12%
Route	–3%	*
Other Races	–3%	–3%
R squared	0.833	0.818
Observations	2,957	

*Not significant.

B. OLS Regression of Total Race Handle

The total race handle models, whose results are listed in Table 5, explains 82–83 percent of the variation in wagering handle. The multirace wagers increase betting volume by a predicted 22–25 percent for doubles and 24 percent for pick threes. Superfectas increase betting volume by 24–25 percent, which supports the idea that bettors prefer more choice in wagers. A surprising finding was that quinellas actually reduce wagering volume by 6 percent in regression Q2 (though is not significant in regression Q1). This is difficult to explain, given that quinellas were offered at eight tracks and on one-third of the races in the sample. Quinella wagering makes up on average less than 3 percent of total betting on a race. An additional betting interest increases wagers at a decreasing rate, with the optimal field size at 11.6–11.7 horses. Bettors prefer quality racing, betting more on races with larger purses (purse elasticity of 0.212), and stakes races. Race competitiveness does not impact total race handle, despite affecting specific wagers. Off track conditions and races restricted to maiden and fillies and mares reduce total race handle. Grass races are found to be more popular among bettors, increasing volume between 6–11 percent. Similar to the results of the individual wagers, the elasticity of demand across tracks is estimated to be price elastic for straight wagers and exactas and price inelastic for trifectas. Each additional competing race run in the same hour reduces total race handle by 3 percent.

VII

Conclusions

THIS PAPER IS AN EXAMINATION of the demand for racetrack betting in the simulcast era, and looks for evidence of risk-averse informed bettors versus uninformed bettors. The determinants of wagering demand are discovered through an empirical analysis of 2,957 races at major racetracks in the fall of 2002. With simulcasting, bettors have access to numerous races and betting options daily. Bettors prefer higher quality races, larger fields (with an optimal size of between 10–12 betting interests depending on the wager), and grass races. Bettors wager less on tracks with higher takeout rates, with poor track conditions, and when other races run concurrently. There is some evidence that races restricted to maidens, fillies and mares, and state-bred horses reduce volume. The competitiveness of a race yields ambiguous results. With the exception of the quinella wager (which could decrease handle), additional exotic wagers increase overall race handle. Overall, we find support for the existence of informed bettors who choose to place bets according to both risk and return.

Notes

1. In 2005, an $8 wager on the pick six at the Breeders' Cup returned $2.7 million for one bettor in South Dakota.

2. Pescatrice (1980) estimates an inelastic demand for wagers, but his study is refuted by Morgan and Vasche (1982), who point out specification problems in the Pescatrice study resulting in an underestimation of elasticity.

3. Ray's (2002a) previous cross-sectional study of wagering demand consisted of less than 200 races.

4. The similarity between the quinella and the exacta make it an odd offering, and the amount wagered on the quinella averaged only 0.3 percent of the total handle on a particular race. Quinella wagering was 10.8 percent of the similar exacta when offered. Four tracks—Churchill Downs, Calder, Laurel, and Turfway—do not offer quinella wagering.

5. Arlington Park hosted the 2002 Breeders' Cup World Thoroughbred Championships, eight races with $13 million in purses. This series rotates to different tracks yearly and was not included in this study. Including these eight races inflates Arlington's average purse sizes from $28,258 to $122,000. (These races also would skew the betting handle numbers for Arlington and were removed because they do not represent a typical day of racing at Arlington.)

6. In order to increase field sizes, tracks have been mixing highest price claimers with conditioned allowance horses. These races, Optional Claimers, were included as allowance races since the quality of competition is comparable and, furthermore, few entrants race with a claiming tag.

7. Generally, each horse in a race is a separate betting interest. However, in some cases when horses have the same owner or trainer, they are grouped together as one betting interest and are effectively treated as one horse in wagering.

8. The exceptions being the flat one-turn mile at Aqueduct and Churchill Downs and most races at the cavernous one and one-half mile Belmont oval.

9. The pick six requires bettors to pick the winners of six consecutive races. If there are no winning tickets, then a majority of the pool is carried over to the next racing day. The pot progressively builds until the wager is hit.

10. Zellner's SUR is a form of simultaneous equation estimation that accounts for the correlation of each equation's error term and yields more efficient estimates.

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