AN ECONOMIC ANALYSIS OF
A PARIMUTUEL RACETRACK-RACEBOOK

for

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EXECUTIVE SUMMARY

The purpose of this study is to examine the determinants of wagering and related revenue and profitability at a parimutuel racetrack-racebook. Prior to 1983, racetrack patrons at all racetracks in the United States were presented with a single product, live racing. The only exception to this was the occasional opportunity (in some states) to wager on the simulcast of a single race of national importance. In 1983, wagering on entire days of races simulcast from other in-state racetrack locations (ITW) was permitted at racetracks in New Jersey. Since that time, the ability of a racetrack patron to wager on simulcast opportunities has been expanded greatly so that today, in all but one state which offer parimutuel horse racing, racetrack patrons are offered a wide variety of simulcast betting opportunities in addition to live racing. To recognize this transition from live race wagering to live and simulcast wagering at racetrack locations, a new term is introduced, the racetrack-racebook. A racetrack-racebook is a racetrack location which offers its patrons the opportunity to wager on a variety of parimutuel products including live (on-track) horse racing and a wide variety of races simulcast to that racetrack from both in-state and out-of-state racetracks. The portfolio of wagering opportunities offered to racetrack-racebook patrons is similar to that offered by a casino racebook in Las Vegas, Nevada or Atlantic City, New Jersey, to its patrons. The major difference is that live racing is not offered in the casino locations. One of the decisions that racetrack-racebook managers must make is to choose from that from a portfolio of live and simulcast races that combination of products which results in the greatest revenue and profit. As revenue and profit are directly related to wagering, understanding the determinants of wagering (handle) demand is crucial to the decision making process. In this study the factors which influence consumer choice among competing parimutuel horse race wagering products at a single location, a parimutuel racetrack-racebook, are examined

The subject of this study is the Garden State Park racetrack-racebook. During the 1995 sample period, Garden State Park, a New Jersey thoroughbred racetrack, offered its patrons the opportunity to wager on races from 53 racetracks (including its own live races) located in various states throughout the United States. In order to obtain sufficient variation to separate the effects of individual variables on wagering, these 53 racetracks were aggregated into 15 racetrack groups. Several distinct characteristics of the races being offered were considered in forming these groups. These factors included: (1) breed of racing, thoroughbred or harness, (2) type of racing, live or simulcast and (3) host track location. Accordingly, the 53 racetracks were first divided into two broad categories, one for those conducting thoroughbred and the other for those conducting harness racing. Within each of these categories, the racetracks were further classified into three sub-categories: (1) live races (conducted at Garden State Park racetrack), (2)

races simulcast from other host racetracks in New Jersey, (3) races simulcast from host racetracks located in states outside of New Jersey. Some of these sub-categories consisted of a single racetrack in a given state and others consisted of more than one racetrack located in a single state or in a group of contiguous states.

Demand characteristics for each race offered by each racetrack, for each day that its program was offered at Garden State Park, were obtained from two national data bases, one for thoroughbred (KIII Data Services, Inc.), and one for harness racing (United States Trotting Association Data Base). The size of the national data bases for the 53 racetracks used to construct the final 15 demand models is summarized in the following table:

Data Base Summary Statistics, Tracks Offered By Garden State Racetrack-Racebook 1995

	Thoroughbred	Harness	Total
Number Of Horses (Starters)	242,419	154,754	397,173
Number Of Races	29,522	19,185	48,707
Number Of Days	2,986	1,609	4,595
Number Of Tracks	38	15	53
Number Of States	15	8	23
Number Of Demand Models	9	6	15

Separate demand equations were estimated for 9 thoroughbred, and 6 harness, racetrack groups using standard regression analysis. All of the regression equations were statistically significant. For each subject racetrack group demand equation, both the own- (subject racetrack group) and cross- (competing racetrack group) effects of the included demand variables were estimated. Both the own- and cross-effects of: (1) number of races, (2) average field size, (3) average takeout rate, and (4) average purse size were, in most instances, found to be statistically significant and they exhibited the expected effect on wagering demand. In particular, signs of the own-effect coefficients imply that an increase in number of races, average field size or average purse size or a decrease in takeout rate for a subject racetrack group would increase wagering on races from this group. The signs of the cross-effect coefficients imply that an increase in number of races, average field size or purse size or decrease in takeout rate for competing racetrack groups would decrease wagering on races from the subject racetrack group. As expected, this indicates that competing racetrack groups act as substitutes for a subject racetrack group.

To better understand the strengths of wagering responses to changes in these variables, both the own- and cross-elasticities of wagering were computed for each variable. Wagering elasticity with respect to a variable can be interpreted as the percent change in wagering resulting from a one percent change in that

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variable. For example, a takeout rate elasticity of, say -1.50, would indicate that an increase of 1% in the takeout rate results in a 1.5% *decline* in wagering. In this case, the change in wagering is in the opposite direction of the change in the takeout rate indicated by the negative sign of the elasticity. As another example, a number-of-races elasticity of 0.50 indicates that an increase of 1% in the number of races results in a 0.5% *increase* in wagering. In this case, the change in wagering is in the same direction of the change in number of races as indicated by the positive sign of the elasticity. Estimated elasticities were found to vary considerably across racetrack group and among demand variables.

Median own-takeout rate elasticity was found to be -2.30 indicating that wagering is strongly responsive to takeout rate changes. This is consistent with prior findings in the literature. Median elasticities with respect to number of races and field size were found to be 0.64 and 0.58, respectively. There are no prior studies by which to gauge the magnitudes of these elasticities but it seems wagering is moderately responsive to changes in number of races and field size. Finally, median purse elasticity was found to be 0.06 which is considerably lower than elasticity with respect to takeout rate, number of races or field size. This elasticity is quite small and it suggests, for instance, that wagering at the racetrack-racebook would increase by a very small 6% if *average* purses were doubled. With the exception of the median cross-race elasticity of -0.41, the remaining cross-elasticities were, in general, statistically insignificant or small relative to their corresponding own-elasticities. This suggests that competing racetrack groups are moderate substitutes for the subject racetrack group.

The remaining estimation results pertain to two sets of control variables, (1) the presence of live racing at Garden State Park or the presence of intra-state (ITW) simulcast races in a competing racetrack group and (2) the presence of special stakes races such as the Kentucky Derby. In general, on days when live thoroughbred racing was conducted at Garden State Park, it was not found to have a significant effect on simulcast races taken from other racetracks. Similarly, on days when live harness racing was conducted at Garden State Park it was not, in general, found to have a significant effect on simulcast races taken from other racetracks.

In contrast to live racing, the presence of New Jersey ITW thoroughbred or harness racing was generally found to have a significant effect on wagering on races from a number of full-card subject thoroughbred and harness racetrack groups as shown in the following table.

Presence Of:	Median Impact On Full-Card Thoroughbred Handle	Median Impact On Full-Card Harness Handle
ITW-thoroughbred	-19%	47%
ITW-harness	14%	-16%

On days when ITW thoroughbred racing was available to Garden State Park patrons, *less* was wagered on full-card racing and *more* on full-card harness racing. A similar pattern was found for days when ITW harness racing was available. Thus, it seems ITW racing in New Jersey is a substitute for own-breed full-card racing and a complement for cross-breed full-card racing.

Special stakes races, such as the Kentucky Derby, were found to be highly significant determinants of wagering for every racetrack group. The own-effect of this variable is defined to be the effect that would result if the host racetrack of the event is a racetrack in the subject racetrack group and the cross-effect is defined as the effect that would result if the host racetrack of the event is present among the competing racetrack groups. All the own-effects and almost all of the cross-effects were found to be significant and positive. This is expected because these special stakes races carry not only high purse but also showcase "star quality" horses that attract higher than usual levels of patron attendance and wagering. These effects were found to have tremendous variation across the special events but, in general the effects were extraordinarily large. The minimum own-effect of offering a high quality stakes race was found to increase wagering on the subject racetrack group conducting the event by 31%. The maximum effect was found to be as large as 1,853% which was the case for wagering on Kentucky simulcast races (from Churchill Downs) when the Kentucky Derby was offered.

To illustrate the importance of our findings with respect to a racetrack-racebook manager's choice of a profit-maximizing portfolio of live and simulcast races, the effect of a one-race increase was estimated for each of the 15 racetrack groups. Also estimated was the concurrent offsetting effect of that additional race on handle and revenue of the fourteen other competing racetrack groups. Revenues were computed after subtraction of the percent of handle allocated to state parimutuel tax, purses and host track fees. *It was found that, for some racetrack groups the positive impact on handle and revenue from adding another race was not strong enough to offset the negative effects on competing racetrack groups.* For these cases, the result was negative net racetrack-racebook handle. This would imply that such racetracks should be considered for elimination from the racebook.

Racetrack groups which were characterized as having lower takeout rates generated positive revenues to the racetrack-racebook. Racetrack groups located in the same geographic region as the racetrack-racebook site also generated positive revenues. The latter effect can possibly be attributed to the racetrack-racebook patrons' greater familiarity with horses at nearby locations which positively affects their resulting wagers. One interesting point that can be made is that, while handle was found to be relatively insensitive to *changes* in average purse, those racetrack groups for which one additional day of racing generated positive revenues were characterized by higher *levels* of average purse than those which generated negative revenues.

To illustrate further the importance of the findings of this research, an additional simulation was performed which analyzed the impact on racetrack-racebook handle, revenue *and profit*, of an additional *day* of racing for live harness and thoroughbred racing at Garden State Park. A simulation was also performed for one of the full-card out-of-state simulcast racetrack group which had produced positive revenues for the addition of one race. For this simulation, the effect of introducing another day of racing for the subject racetrack on its own handle, and on the handle of the racetracks with which it competed, was evaluated at the average value of *all of its demand factors* (i.e. takeout rate, number of races, average field size and average purse). Profit computation for a day of racing requires cost data as well as handle data. Monthly cost data from Garden State Park over a three year period was used to estimate marginal costs of an additional day of racing. The resulting computation of profits are summarized in the following table using a simplified New Jersey revenue distribution system described in the report.

Additional Day Of Racing For:	Revenue From Subject Racetrack*	Revenue From Competing Racetracks*	Net Racetrack Racebook Revenue	Marginal Cost	Racetrack Racebook Profit
Live Thoroughbred Racing	$27,002	$1,252	$28,254	$32,490	-$4,003
Live Harness Racing	$23,785	-$4,657	$19,128	$32,490	-$13,362
One Simulcast Thoroughbred Group (KY)(2)	$2,776	-$1,439	$1,337	$80	$1,257
*Revenue after percent allocated to purses, parimutuel tax and host fee.					

An interesting observation can be made from the results reported in the table. Even though an additional day of live racing may produce substantially greater racebook revenue than an additional day of simulcast racing, on-site profit from the simulcast races may exceed that from the live races. This is because the marginal cost of live racing is considerably greater than that of simulcast racing. Thus, in addition to revenue considerations, the profit maximizing racetrack-racebook manager must consider the

cost of adding an additional race day from a racetrack before a decision is made to add that race day to the racetrack-racebook menu.

A second point to be noted in this decision is that profit from an additional live race day as reported in the table above is profit that is expected to be generated *only at the racetrack-racebook site*. In fact, the live race product is simulcast to other in-state and out-of-state locations which generates additional revenues to the racetrack-racebook. It is possible that these additional revenues may be sufficient to offset the on-site loss from live racing. For example, in 1995 simulcasts of Garden State Park live thoroughbred races to other in-state ITW sites, using the revenue distribution system outlined in the report, would have produced racebook revenue of $20,157 per day. In addition to its intra-state simulcasts, Garden State also simulcast its live races to out-of-state locations. In 1995 simulcasts to those locations would have resulted in an average daily revenue to the racetrack-racebook of $12,537. The sum of revenue generated from wagering on Garden State live races at off-site locations is computed to be $32,694 per racing day. Similarly, revenue from wagering on live harness races at off-site locations in 1995 was computed to be $40,043 per racing day. The marginal cost of sending the simulcasts out would be minimal relative to the revenues generated. When these additional off-site revenues are added to revenues generated at the racetrack site, it appears that an additional day of live racing would be profitable. It should be noted that this analysis does not consider fixed costs which determine, in the long run, whether or not a racetrack-racebook will be profitable.

For the Garden State racetrack-racebook, profit from an additional day of simulcast racing from a thoroughbred racetrack group like Kentucky was found to be positive but relatively small. It is important to remember, however, that simulcast racing, unlike live racing which is available for only part of the year, is available at the racetrack-racebook year-round. In addition, even though profit per simulcast racetrack group may be relatively small, the number of racetracks from which simulcasts can be taken in a given day may be very large, resulting in significant aggregate revenues and profits.

In summary, once selected for inclusion in his or her racetrack portfolio, the racetrack-racebook manager should expect the greatest increase in revenues from those racetracks which lower takeout rates from their currently high levels (but not below the profit maximizing takeout level). They should also expect a large increase in revenues on those days when high quality stakes races are added to a racetrack's program. Increases in number of own-races and own-field size will also yield an increase in revenues but the cross-effect of the increase in number of races will mitigate somewhat the revenue increase from additional races being offered by a subject racetrack. Changes in average daily purse by a racetrack

included in the portfolio will have the least relative impact on racetrack-racebook revenue. The decision to add or drop racetracks from the racetrack-racebook is influenced not only by the handle and revenue they generate but also by the effect that their inclusion has on wagering on other racetracks in the racetrack-racebook. It should be noted that those racetracks whose inclusion resulted in negative racetrack-racebook revenues, in general had lower average daily purse and higher takeout rates than those that had positive net revenues. Finally, an additional day of live racing at the Garden State Park racetrack-racebook was found to result in negative profits even though net revenue was found to be positive. While this would indicate that live racing should be dropped from the racetrack-racebook, there is an additional aspect of live racing that must be considered. This is the ability of the racetrack to export (simulcast) its live race product to other locations both in-state and out-of-state. When additional off-site revenues are considered, live racing was found to be profitable. The cost of an additional day of simulcast racing was found to be much less than an the cost of an additional day of live racing. The profit for an additional day of simulcast racing for a racetrack group which exhibited positive net revenues was found to be positive but small. However, compared to live racing, it must be remembered that simulcast racing occurs year-round and their can be numerous simulcast products offered on a single day leading to significant aggregate simulcast profits at the racetrack racebook.

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INTRODUCTION*

Wagering on races simulcast from other racetrack sites to a receiving racetrack location is a relatively new phenomenon in parimutuel horse race wagering. Simulcast wagering occurs when races are transmitted via satellite from a racetrack where live racing is being conducted (host track) to off-site (guest track) locations (racetracks and off-track betting sites) where patrons at the off-site locations may wager on races being conducted at the host track as they are being run. Until 1983, racetrack patrons in the United States were restricted to betting on live racing only, with (in some states) the occasional opportunity to wager on the simulcast of a single race of national importance from other racetrack locations. The earliest form of simulcast wagering on a full day of racing conducted by a host track in the United States was intra-state inter-track wagering (ITW). This form of wagering was first introduced in New Jersey in 1983.

A more recent variation of intra-state ITW is wagering on a full day of out-of-state (full-card) races simulcast to a racetrack-racebook location. This is essentially the same as intra-state ITW except that the host track is located at an out-of-state location. Full-card simulcast wagering was first introduced in South Dakota at greyhound racetracks in 1987 and currently (1997) is available in all states, except California, which have parimutuel wagering on live horse racing.

To recognize this transition from live race wagering to live and simulcast wagering at racetrack locations, a new term is introduced - the racetrack-racebook. A racetrack-racebook is a racetrack location which offers its patrons the opportunity to wager on a variety of parimutuel products including live on-site thoroughbred or harness racing and a wide variety of races simulcast to that site from both in-state and out-of-state locations. The portfolio of wagering opportunities offered to racetrack patrons is similar to that offered by a casino racebook in Las Vegas, Nevada or Atlantic City, New Jersey with the major exception that live racing is not offered at casinos in those locations. Profit maximizing racetrack-racebook managers must choose that combination of products from a menu of live and simulcast races which results in the

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greatest revenue and profit. To make such a decision it is necessary to understand the factors which influence consumer choice among competing parimutuel horse race wagering products at a single location, the racetrack-racebook. This study is an attempt to analyze such behavior. Standard consumer choice theory is used to specify the daily wagering (handle) demand equations for parimutuel racetrack wagering products. These individual demands are then combined into a portfolio and the impacts of individual demand factors on overall wagering and revenues are examined.

Model specification, discussion of the data, and variable definitions are given in Section II. Model estimation and implications are given in Section III. Summary and Conclusions are given in Section IV.

MODEL SPECIFICATION

Garden State Park, a racetrack which offers wagering on its own live thoroughbred and harness racing, and on simulcast racing from both in-state and out-of-state locations, was chosen as the subject of analysis for this study. The racetrack was selected because of the large number and variety of in-state and out-of-state simulcasts offered there and because of data availability. The year for which the analysis was performed was 1995, the most current year for which data were available at the time the analysis was undertaken. Table 1 gives the distribution of handle for live and simulcast wagering at Garden State Park in 1995.

TABLE 1: WAGERING BY SOURCE AT GARDEN STATE PARK RACETRACK, 1995

Wagering Source	Handle ($million)	Percent Of Total
Thoroughbred		
Live	$16	10.7%
Intra-State (ITW) Simulcast	$13	8.7%
Out-Of-State (Full-Card) Simulcast	$75	50.3%
Total	**$104**	**69.8%**
Harness		
Live	$10	6.7%
Intra-State (ITW) Simulcast	$23	15.4%
Out-Of-State (Full-Card) Simulcast	$12	8.0%
Total	**$45**	**30.2%**
Total		
Live	$26	17.4%
Intra-State (ITW) Simulcast	$36	24.2%
Out-Of-State (Full-Card) Simulcast	$87	58.4%
Grand Total	**$149**	**100.0%**

Patrons who frequented the Garden State racetrack-racebook were able to choose among a wide variety of parimutuel racetrack products in 1995. Individual racetracks whose products were offered to patrons in 1995 are listed in Table 2. In all, there were a total of 51 host racetracks whose simulcasts were offered by Garden State Park to its patrons at various times over the year. In addition, Garden State offered non-overlapping live thoroughbred and harness race meetings to its patrons. The data are daily over the year 1995. Different combinations of racetrack products could be available on any given day.

Separate wagering demands could not be estimated for each of the 53 racetracks due to data limitations. To overcome data and statistical limitations, these 53 racetracks were aggregated into a smaller number of racetrack groups. In forming these groups, several distinct demand characteristics of the races offered by these racetracks were considered. Among them were (1) race horse breed - thoroughbred or harness, and (2) type of racing - live at Garden State Park, in-state (within the state of New Jersey, the home state of Garden State Park) racing simulcast to Garden State Park, and out-of-state races simulcast to Garden State Park. Each racetrack was classified as to breed and type o/f racing. Some of these sub-categories consisted of a single racetrack while others consisted of more than one racetrack. The sub-categories consisting of a single racetrack constituted individual groups. The sub categories with multiple racetracks were further categorized into groups of racetracks within a single state and groups located in more than

TABLE 2: RACETRACKS OFFERED BY GARDEN STATE PARK, 1995

State	Track	Abbrev.	Days	Average Daily Handle
		Thoroughbred*		
AR	Oaklawn Park	OP	63	$28,002
CA	Bay Meadows	BM	84	$16,243
CA	Del Mar	DMR	43	$27,869
CA	Fairplex	FPX	19	$16,980
CA	Golden Gate	GG	100	$16,167
CA	Hollywood	HOL	96	$30,156
CA	Santa Anita	SA	120	$34,863
DE	Delaware Park	DE	128	$24,729
FL	Calder	CRC	168	$21,804
FL	Gulfstream	GP	63	$80,410
FL	Hialeah	HIA	60	$43,609
FL	Tampa Bay	TAM	27	$16,145
IA	Prairie Meadows	PRM	19	$2,780
IL	Arlington Park	AP	55	$18,671
IL	Fairmount Park	FP	34	$8,286
IL	Hawthorne	HAW-TH	91	$14,757
IL	Sportsman's Park	SPT-TH	24	$16,618
KY	Churchill Downs	CD	73	$38,348
KY	Ellis Park	ELP	52	$13,950
KY	Keeneland	KEE	30	$28,569
KY	Turfway Park	TP	77	$18,875
LA	Evangeline Downs	EVD	19	$12,561
LA	Fairgrounds	FG	54	$18,973
MA	Suffolk Downs	SUF	151	$17,593
MD	Laurel Park	LRL	156	$31,689
MD	Pimlico	PIM	91	$33,308
NH	Rockingham	RKM	93	$13,086
NJ-ITW	Atlantic City	ATL	57	$45,787
NJ-ITW	Meadowlands	MDLS-TH	65	$76,012
NJ-ITW	Monmouth	MTH	72	$70,830
NJ-LIVE	Garden State	GS-TH	75	$209,582
NY	Aqueduct	AQU	42	$35,234
NY	Belmont	BEL	106	$36,948
NY	Saratoga	SAR	34	$43,463
PA	Penn National	PEN	205	$23,409
PA	Philadelphia Park	PHA	209	$49,545
TX	Sam Houston	HOU	35	$18,418
TX	Retama	RET	96	$17,363
		Harness*		
FL	Pompano Park	PPK	70	$9,092
IL	Balmoral Park	BMLP	77	$5,540
IL	Hawthorne	HAW-HR	10	$8,672
IL	Maywood	MAY	60	$6,988
IL	Sportsman's Park	SPT-HR	41	$11,793
IL	Ill. State Fair-Springfield	SPR	2	$5,873
KY	Red Mile	LEX	9	$4,797
MA	Foxboro	FOX	86	$6,381
MD	Rosecroft	RCR	199	$8,408
NJITW	Freehold	FHLD	206	$30,937
NJITW	Meadowlands	MDLS-HR	181	$91,611
NJLIVE	Garden State Park	GS-HR	53	$182,103
NY	Yonkers	YR	273	$15,541
PA	Meadows	MEA	230	$12,878
PA	Pocono Downs	PCD	112	$7,797

*Actual abbreviations for Meadowlands thoroughbred and harness are MED and M, respectively.
  Actual abbreviations for Sportsmans Park thoroughbred and harness are SPT and SPK, respectively.
  Actual abbreviations for Garden State Park thoroughbred and harness are GS and GSP, respectively.

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one contiguous state. In all, there were 15 racetrack groups.[1] The groups with their abbreviated designations and associated racetracks are listed in Table 3. A system of 15 demand models was then estimated for daily wagering on thoroughbred, harness, live, simulcasts from in-state, and simulcasts from out-of-state at Garden State Park in 1995.

TABLE 3: RACETRACK GROUPS WITH ASSOCIATED RACTRACKS

Racetrack Groups*	Associated Racetracks	Number Of Racetracks
Thoroughbred(1)		
Arkansas-Louisiana-Texas (ARKLATX-TH)	OP, EVD, FG, HOU, RET	5
California (CA-TH)	BM, DMR, FPX, GG, HOL, SA	6
Florida (FL-TH)	CRC, GP, HIA, TAM	4
Illinois (IL-TH)	AP, FP, HAW-TH, SPT-TH	4
Kentucky (KY-TH)	CD, ELP, KEE, TP	4
Massachusetts-New Hampshire (MANH-TH)	RKM, SUF	2
Surrounding States and Maryland(SURR-TH)(2)	DE, AQU, BEL, SAR, PEN, PHA, LRL, PIM	8
New Jersey-ITW (NJITW-TH)	ATL, MDLS-TH, MTH	3
Garden State-Live (GSLIVE-TH)	GS-TH	1
Harness(3)		
Florida (FL-HR)	PPK	1
Illinois (IL-HR)	BMLP, HAW-HR, MAY, SPT-HR, SPR	5
Massachusetts (MA-HR)	FOX	1
Surrounding States and Maryland(SURR-HR)(4)	YR, MEA, PCD, RCR	4
New Jersey-ITW (NJITW-HR)	FHLD, MDLS-HR	2
Garden State-Live (GSLIVE-HR)	GS-HR	1
Note: -TH denotes thoroughbred and -HR denotes harness. *Iowa thoroughbred excluded due to lack of observations. **Kentucky harness excluded due to lack of observations. (1) Excludes Iowa (2) Includes DE, NY, PA and MD (which is in close proximity but not contiguous). (3) Excludes Kentucky (4) Includes NY, PA and MD (which is in close proximity but not contiguous).		

The standard theory of consumer behavior was followed in the specification of these demand models. According to this theory, the key determinants of demand for each of these wagering products are price and characteristics of the product and of the alternate products, and factors influencing the market environment and consumer preference. Here, the alternate products are the races from the competing racetrack groups which are all the racetrack groups other than the subject racetrack group that were offered on a given day. Following earlier studies, takeout rate served as the price of wagering variable. The three key variables, total number of races, average purse per race, and average field size per race represented the product characteristics. In addition to variables describing the price and product characteristics, a number

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[1] Two racetracks were not included in these groups due to insufficient observations and geographic distance from other groups. They were Iowa thoroughbred (PRM) and Kentucky harness (LEX).

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of dummy variables were used to control for distinctive racing characteristics in a racetrack group, special events, day of the week, live race meet week-end opening day for live racing and weather. Dummy variables were used to control for the presence of live racing and of in-state simulcast racing among the competing racetrack groups. A number of dummy variables were also used to control for the presence of special stakes races such as the Kentucky Derby, Belmont Stake, and Breeders Cup.

The system of 15 demand equations was estimated using daily wagering data for each of the 53 racetracks, 38 thoroughbred and 15 harness, at Garden State Park in 1995. Of the variables only the information on takeout rate was available from the daily data provided by Garden State Park. The remaining variables- total number of races, average daily purse, and average daily field size, were aggregated to a daily basis from race-by-race data for all tracks in the sample using national thoroughbred and harness racetrack data bases. The source for the thoroughbred race characteristics was a data base maintained by KIII Data Services, Inc. a subsidiary of Daily Racing Form, Inc. The source for harness race characteristics was a data base maintained by the United States Trotting Association (USTA). For a given day, the number of races, average purse per race, and average daily field size per race from the national data bases were matched to the daily handle data provided by Garden State Park using track ID and date. The size of the national data bases for the 53 tracks used to construct the final 15 demand models is given in Table 4. A more detailed definition and explanation of data construction of the demand determinants is given in Appendix 1. Summary statistics for each of the included variables are given in Appendix 2.

TABLE 4: DATA BASE SUMMARY STATISTICS, GARDEN STATE PARK RACEBOOK 1995

	Thoroughbred	Harness	Total
Horses (Starters)	242,419	154,754	397,173
Races	29,522	19,185	48,707
Days	2,986	1,609	4,595
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Demand Models	9	6	15

MODEL ESTIMATION AND IMPLICATIONS

The wagering demand equations for 9 thoroughbred and 6 harness racetrack groups were estimated using standard regression analysis. The thoroughbred and harness equations are reported, respectively in Table 1 and Table 2 of Appendix 3. All of the regression equations were statistically significant.

Demand Elasticities

Both the own- and cross-effects of the variables, (1) number of races, (2) average field size, (3) average takeout rate, and (4) average purse size were, in general, found to be statistically significant and when significant they were of the right sign. In particular, signs of own-effects imply that an increase in number of races, average field size or average purse size or a decrease in takeout rate for a subject racetrack group would result in an increase in wagering on races from this group. The signs of the cross-effects imply that an increase in number of races, average field size or purse size or decrease in takeout rate for competing racetrack groups would result in a decrease in the wagering on races from the subject racetrack group. As expected, this indicates that competing racetrack groups serve as substitutes for the subject racetrack group.

Both own- and cross-elasticities of wagering for these four variables were computed at the mean level of the independent variables in the equations. These elasticities for wagering on thoroughbred and harness wagering are reported in Table 5 and As can be seen, elasticities vary considerably across racetrack groups as well as across variables.

TABLE 5: ELASTICITIES

	Own-Races	Own-Field	Own-Purse	Own-Take	Cross-Races	Cross-Field	Cross-Purse	Cross-Take
ARKLATX-TH	0.41	*	0.07	-2.58	-0.70	-1.45	*	*
CA-TH	0.62	0.58	0.09	-1.60	-0.41	-0.84	*	*
FL-TH	0.94	0.62	*	-2.71	-0.55	-2.00	-0.17	*
IL-TH	0.95	1.20	0.23	-2.66	-0.64	*	-0.15	*
KY-TH	0.95	0.87	0.16	-1.85	-0.49	*	-0.25	3.35
MANH-TH	0.53	*	*	-3.00	-0.52	*	*	2.21
SURR-TH	0.64	0.37	0.08	*	-0.25	*	*	*
NJITW-TH	0.85	0.34	0.06	**	*	*	-0.08	*
GSLIVE-TH	1.45	0.38	0.11	**	*	*	*	*
FL-HR	*	2.46	*	**	*	*	*	*
IL-HR	0.54	*	0.25	-2.30	-0.66	-2.39	*	*
MA-HR	*	*	*	**	-1.86	*	*	*
SURR-HR	0.50	0.91	*	*	*	*	*	*
NJITW-HR	0.93	2.15	*	**	*	-1.67	*	*
GSLIVE-HR	0.87	1.02	*	**	*	*	*	*
*insignificant								
**Not able to be measured due to lack of variation over sample period.								

Examining the own-elasticities, it can be seen that of the four variables, wagering on a subject racetrack's races is most elastic with respect to its takeout rate, least elastic with respect to its average purse and comparably elastic with respect to number of races and average field size. The median takeout rate elasticity[2] was found to be –2.30 indicating that wagering is strongly responsive to takeout rate changes. This is consistent with prior findings in the literature (Gruen, 1976; Morgan and Vasche, 1979, 1980, 1982; Suits, 1979; Thalheimer and Ali, 1992, 1995a, 1995b; Ali and Thalheimer, 1997).

The takeout rate of -2.30 indicates that revenue will increase with a drop in takeout rate up to the optimum level where takeout rate elasticity is -1.00. If host fee cost is deducted from the takeout rate the optimum level will occur at an elasticity greater than -1.00.[3] It can be shown that for elasticities of the order of magnitude found in this study, the present level of takeout rate is such that it can be lowered *without changing the host track fee*, to increase net revenue to the racetrack-racebook (after host fee deduction). However, the racetrack-racebook will get a proportionally lower increase in net revenue than the host racetrack. For example, at a takeout rate level of 20% and a host fee of 3%, the net revenue maximizing elasticity is computed to be

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[2] The median was computed setting insignificant coefficients to zero.

[3] Assume TR=tH and TC=cH, where TR=total revenue, TC=total cost, t=takeout rate, H=handle, c=host fee cost. Then net revenue = R = tH-cH = (t-c)H. The net revenue maximizing takeout rate is such that dR/dt = (t-c)(dh/dt) + H = 0; i.e. +(dH/dt)(t/H) = +elasticity (e) = -t/(t-c). For c=0, elasticity at net revenue maximum = -1.

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-1.18 which is still less than the typical elasticity of -2.3 found in this study.[4] Of course, if the host track fee is lowered in proportion to the change in takeout rate, revenue for all parties (host track, racetrack-racebook, horsemen) will increase in the same proportion.

Median own-elasticities with respect to number of races and average field size were found to be 0.64 and 0.58, respectively. There is no prior study to gauge the magnitudes of these elasticities but it seems wagering is moderately responsive to changes in number of races or field size. Finally, median average purse elasticity was found to be 0.06 which is considerably smaller than elasticity with respect to takeout rate, number of races or field size. This average purse elasticity is quite small and it suggests, for example that wagering would increase by only 6% if purse were doubled. This is a surprising finding considering the importance that is attached to the purse variable in all major policy decisions to increase the wagering in this industry.

The cross-elasticities are, in most cases statistically insignificant and, with the exception of cross-race elasticity, when they are significant they are relatively small compared to their corresponding own-elasticities. The median cross-race elasticity of -0.41 is, however, relatively large. This suggests that competing racetrack groups are moderate substitutes for the subject racetrack group.

Impacts Of Special Factors - Live Racing, ITW Racing, Stakes Races

The remaining estimation results pertain to two sets of control variables, (1) live racing (Garden State Park) and intra-state (ITW) simulcast races among the competing racetrack groups and (2) special stakes (high purse) races such as the Kentucky Derby. The presence of live thoroughbred racing on a given day among the competing racetrack groups was found, in general, to have an insignificant effect on wagering on races of a subject racetrack group. This effect was found to be significant and positive for only two full-card subject racetrack groups both of which conducted simulcast harness racing. The presence of live harness racing in the competing racetrack group was found to be significant and negative for only three full-card subject racetrack groups, two harness and one thoroughbred.

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[4] Net revenue maximizing elasticity = $-t/(t-c)$.

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[4] Net revenue maximizing elasticity = $-t/(t-c)$.

In contrast to live racing, the presence of New Jersey ITW thoroughbred or harness racing was generally found to have a significant effect on wagering on races from a number of full-card subject thoroughbred and harness racetrack groups as shown in the following table.

Presence Of:	Median Impact On Full-Card Thoroughbred Handle	Median Impact On Full-Card Harness Handle
ITW-thoroughbred	-19%	47%
ITW-harness	14%	-16%

On days when ITW thoroughbred racing was available to Garden State Park patrons, they wagered less on full-card thoroughbred subject racetrack group racing and more on full-card harness subject group racing. A similar pattern was found for days when ITW harness racing was available. Thus, it seems ITW racing in New Jersey is a substitute for own-breed full-card subject racetrack groups and a complement for cross-breed subject racetrack groups.

While the effect of variations in average purse was found to be relatively small, special stakes races, which generally carry the highest purses, were found to be highly significant determinants of wagering for every racetrack group. The own-effect of this variable is defined to be the effect on subject racetrack group wagering when that group contains the host racetrack of the stakes race. The cross-effect is defined to be the effect on wagering on a subject racetrack group's races when that group does not contain the host racetrack offering the stakes race. All the own-effects and almost all of the cross-effects were found to be significant and positive. This is expected because these special stake races carry not only high purse but also showcase "star quality" horses that attract higher than usual levels of patron attendance and wagering. It seems, among all the demand variables, special stake races have the most dominating influence on wagering. The own-effects of these special stake races were computed and are reported in Table 6. As can be seen there is a tremendous variation of these effects across the special events but, in general, these effects are extraordinarily large. The minimum of these effects is to increase the wagering for subject racetrack group containing the host racetrack by 31% and the effects can be as large as 1,853%.

TABLE 6: SPECIAL STAKES RACES IMPACT ON GARDEN STATE RACETRACK-RACEBOOK WAGERING

Special Event Race	Purse	State	Host Racetrack	% Change In Handle For Host Racetrack Group
Arkansas Derby (ARKDERBY)	$500,000	AR	OP	128%
Oaklawn Handicap (OAKHCP)	$750,000	AR	OP	64%
Santa Anita Derby (SADERBY)	$700,000	CA	SA	117%
Florida Derby (FLDERBY)	$500,000	FL	GP	483%
Flamingo Stakes (FLAMINGO)	$200,000	FL	HIA	168%
Kentucky Derby (KYDERBY)	$957,400	KY	CD	1,853%
Jim Beam Stakes (JIMBEAM)	$600,000	KY	TP	102%
Blue Grass Stakes (BLUEGRASS)	$500,000	KY	KEE	140%
Pimlico Special (PIMSPCL)	$600,000	MD	PIM	55%
Preakness Stakes (PREAKNESS)	$687,400	MD	PIM	254%
Jersey Derby (JRSYDERBY)	$150,000	NJ	GS-TH	180%
Haskell Invitational (HASKELL)	$500,000	NJ	MTH	28%
Caesars International (CAESARS)	$500,000	NJ	AC	31%
Belmont Stakes (BELMONT)	$692,400	NY	BEL	102%
Breeders Cup (BRCUP)*	$10,000,000	NY	BEL	298%
Massachusetts Handicap (MASSHCP)	$750,000	MA	SUF	84%
Pennsylvania Derby (PADERBY)	$200,000	PA	PHA	45%
NJ Classic (NJCLASSIC)	$500,000	NJ	MDLS-HR	54%
Breeders Crown (BRCROWN)	$347,800	NJ	GS-HR	36%
Three Diamonds (THREEDIAM)	$437,900	NJ	GS-HR	42%

*The Breeders Cup rotates among racetracks on an annual basis. In 1995 it was held at Belmont Park. There are a total of 7 races offered on Breeders Cup Day with combined purses of $10,000,000 ranging from $1,000,000 to $3,000,000.

Summary-Elasticities And Special Factor Impacts

In summary, the major day-to-day determinants of wagering, in order of importance were found to be (1) takeout rate, (2) number of races, (3) field size and (4) purse. With the exception of cross-race elasticity, the cross-elasticities were, in most cases statistically insignificant and, when they were significant, were relatively small compared to the corresponding own-elasticities. Live racing at Garden State Park was neither a strong substitute nor a strong complement. However, New Jersey intra-state simulcast races were relatively strong substitutes for own-breed races simulcast from out-of-state and complements for cross-breed races from out-of-state. The presence of special stakes races was one of the strongest determinants of wagering. Both own- and cross-effects were found to be highly significant and positive.

The preceding analysis identifies some of the important determinants of parimutuel wagering at a racetrack-racebook site and hence of racetrack-racebook revenue. The importance of our findings in relation to the racetrack-racebook manager's decision problem of choosing a portfolio of live and simulcast races can be understood by examining racebook handle and

revenues effects for a change in any one of these determinants. For example, the presence of special stakes races was found to increase handle and revenue. An obvious implication of this finding is that the revenue maximizing racetrack-racebook manager must increase the offerings of special stake races to its fullest extent.

Revenue Effect Of Change In Number Of Races For Each Racetrack Group

As a further illustration, the handle and revenue effects of increasing the number of races offered by a racetrack group by one were examined. The effects were computed for each of the 15 racetrack groups. The handle effects were estimated directly from the 15 demand equations. To estimate the revenue effects, we note that racetrack-racebook revenue is the sum of revenues from wagering (handle) on 15 separate wagering products (racetrack groups). By state statute, a fixed percentage (takeout rate) of each wager is taken out before distribution to winning bettors. This constitutes gross revenue to the racetrack-racebook. The takeout rate may vary from racetrack to racetrack. The appropriate takeout rate is the one applicable to the (host) racetrack conducting (originating) the races. The net revenue to the racetrack-racebook is realized after payment of state tax, host racetrack fee, and purses to New Jersey horsemen with horses at the racetrack-racebook site. The state tax is a percentage of the wager that is assessed as a tax by the state in which the business is operated. In this case, the state is New Jersey where the tax rate was 0% in 1995. The host racetrack fee is for use of races simulcast to the racetrack-racebook from the simulcast host racetrack which conducts the races. For live races which are conducted at the racetrack-racebook site, this charge is not applicable. The host racetrack fee is a percentage of the amount wagered on the host racetrack's races at the racetrack-racebook. The fee is negotiated between the host racetrack and the racetrack-racebook. There is a wide variation in these negotiated contracts. For this study, the fee schedule for Garden State Park in existence during the sample period is used. According to this schedule, the host racetrack fee was one-half of the after-tax host racetrack takeout rate for in-state (ITW) simulcast races and 3% of the wager for simulcast races from out-of-state racetracks.[5] Finally, purse expense in New Jersey is determined

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[5] Actual in-state ITW host track fee at Garden State Park was computed on the basis of a sliding scale up to a maximum of one-half of the host racetrack after-tax takeout rate. The formula used in this study is an

by negotiated contract between the horsemen and the racetrack. In 1995, purses at Garden State Park were negotiated to be (approximately) 33% of gross revenue after payment of state tax and host racetrack fee. Handle and revenue effects, after tax and host fee, were estimated for all 15 racetrack groups. The results are summarized in Table 7.

TABLE 7: HANDLE AND REVENUE EFFECTS OF INCREASING THE NUMBER OF RACES BY ONE
ORDERED BY NET REVENUE (AFTER HOST FEE AND STATE TAX)

Racetrack Group	Total Races Col.1	Base Handle Col.2	Change In Own Handle Col.3	Change In Cross Handles(1) Col.4	Net Change In Handle Col.5	Percent Change In Handle Col.6	Net Rev. After Tax & Host Fee(2) Col.7	Net Rev. To Race-book(3) Col.8	Percent Change In Rev. Col.9
GSLIVE-TH	9.8	$209,582	$31,081	($714)	$30,367	14.50%	$5,870	$3,933	14.50%
GSLIVE-HR	12.9	$182,103	$12,607	($1,286)	$11,321	6.20%	$2,217	$1,486	6.20%
FL-TH	11.3	$39,200	$3,247	($848)	$2,399	6.10%	$461	$309	6.20%
NJITW-TH	13.1	$83,731	$5,429	($971)	$4,459	5.30%	$341	$228	4.20%
NJITW-HR	16.1	$82,668	$4,764	($1,156)	$3,608	4.40%	$270	$181	3.30%
SURR-TH	26.2	$93,692	$2,295	($808)	$1,486	1.60%	$234	$157	1.50%
KY-TH	10.1	$25,264	$2,381	($930)	$1,451	5.70%	$217	$145	5.20%
CA-TH	15.2	$41,456	$1,695	($888)	$807	1.90%	$96	$64	1.50%
IL-TH	10.5	$16,313	$1,482	($939)	$543	3.30%	$75	$51	2.70%
MANH-TH	11.1	$15,845	$752	($957)	($205)	-1.30%	($20)	($14)	-0.60%
ARKLATX-TH	11.1	$22,815	$838	($899)	($61)	-0.30%	($22)	($14)	-0.50%
SURR-HR	31.2	$30,096	$482	($962)	($479)	-1.60%	($91)	($61)	-1.70%
MA-HR	10.9	$6,381	$282	($928)	($645)	-10.10%	($109)	($73)	-8.10%
IL-HR	12.4	$8,448	$366	($971)	($605)	-7.20%	($116)	($78)	-8.00%
FL-HR	11.5	$9,092	$277	($1,011)	($734)	-8.10%	($123)	($83)	-6.00%

(1) Computed using the sum of the impacts of a one race increase in cross-races for each of the 14 other tracks.
(2) Assume parimutuel tax is 0%. Host fee for full-card simulcasts assumed to be 3%. Host fee assumed to be 50% of takeout rate after parimutuel tax.
(3) 67% of revenue *after tax and host fee* (remaining 33% to purses and breeder awards).

Column 2 in Table 7 is base handle before the increase of one race offered by that group. Column 3 is the change in subject racetrack group handle which is the coefficient of own-races in the estimating equation. Column 4 is the total of the change in all of the other fourteen racetrack group handles as a result of the one race increase in the subject racetrack group's races. The subject racetrack is actually a competing racetrack in the other racetrack groups.[6] Column 7 is own-racetrack group revenue for each racetrack group[7] less the sum of cross-racetrack group

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approximation of this fee. In New Jersey the maximum host fee allowed by statute was 3% in 1995 with the exception that for certain stakes races of national significance, the host fee may be higher.

[6] The effect on the other racetrack groups is computed as the sum of the cross-racetrack group coefficients for own-race multiplied by 1 (race).

[7] Computed as own-takeout, after New Jersey tax and after host racetrack fee, times own racetrack group handle.

revenue for each of the fourteen other racetracks affected by the increase in own-races by one.[8] Column 8 shows the amount of revenue going to the racebook after purses are paid. In this case purses are 33% of the net revenue and the remaining 67% is distributed to the racebook as commissions.

As an example of interpreting the figures presented in Table 7, take ARKLATX-TH which is an out-of-state simulcast group sending its signals to the Garden State racetrack-racebook. This group produced a combined daily handle of $22,815. If the number of races were increased by one per day ARKLATX-TH handle would increase by $838 for the day while wagering on all the other fourteen racetrack groups would have decreased $899 for a net loss in handle of $61. After-tax revenue, after deduction of host track fee, decreased by $22. Assuming a 33% split of this revenue to purses, the remaining 67% or $14 was distributed to the racebook as its commission loss.

Assuming no changes in any of the other factors affecting handle, and given the revenue distribution assumptions above, the racebook manager would increase revenues by reducing the number of simulcasts from ARKLATX-TH, MANH-TH, FL-HR, IL-HR, MA-HR and SURR-HR to zero.

In the current example, the racebook manager would increase full-card simulcast revenues most by adding simulcasts from racetracks which are most similar to FL-TH and KY-TH. Revenues for in-state simulcasts, NJITW-TH and NJITW-HR, are also relatively large, especially considering that 50% of net revenues are remitted to the in-state host racetrack. Finally, by far the largest revenue at the racebook, in this case, is generated by adding more live thoroughbred races. Additional live harness races also generate revenues which, while less than those generated by live thoroughbred racing, are greater than those generated by additional simulcast races.

It is interesting to note the differential characteristics of racetracks generating positive revenue and those generating negative revenue in terms of purses, takeout rate and field size. Table 8 examines the association of the levels of average purse, takeout rate, and field size to change in revenue from adding an additional race. In general, it can be seen that racetracks

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[8] Computed as cross-takeout, after New Jersey tax and after host track fee, times cross-racetrack group handle for each of the fourteen other racetracks affected by the increase in own-races by one.

which generate positive revenues have about the same field size but larger average purses and lower takeout rates than those that generate negative revenues. It may also be noted that their appears to be a preference for racetracks located in the same geographic regional as the racetrack-racebook site.

TABLE 8: AVERAGE VALUE OF SELECTED DEMAND FACTORS ORDERED BY NET REVENUE
(AFTER HOST FEE AND STATE TAX)

Racetrack Group	Net Revenue Effect Of One More Race	Purse Per Race*	Average Takeout	Field Size
GSLIVE-TH	$5,870	$8,622	0.1930	7.2
GSLIVE-HR	$2,217	$18,429	0.1949	8.6
FL-TH	$461	$20,354	0.2198	8.1
NJITW-TH	$341	$21,572	0.1930	7.5
NJITW-HR	$270	$13,110	0.1978	8.5
SURR-TH	$234	$16,005	0.1983	8.0
KY-TH	$217	$36,365	0.1938	9.2
CA-TH	$96	$31,317	0.1852	7.9
IL-TH	$75	$16,699	0.1984	8.7
MANH-TH	($20)	$19,494	0.2356	8.3
ARKLATX-TH	($22)	$11,578	0.2034	9.1
SURR-HR	($91)	$5,437	0.2086	7.8
MA-HR	($109)	$1,981	0.2408	7.4
IL-HR	($116)	$5,850	0.2022	8.8
FL-HR	($123)	$2,644	0.2563	8.2
*Includes purses for simulcast races at host track.				

Revenue, Cost, and Profit Effect Of Change In Number Of Days For Selected Racetrack Groups

The preceding analysis of the revenue consequences of increasing the number of races by one per day for any racetrack group showed the usefulness of our findings in the racetrack-racebook manager's decision to include a racetrack in his or her portfolio. In addition to making such a portfolio decision, the racetrack-racebook manager is also confronted with a decision to increase or decrease the number of racing *days* for any racetrack group that is selected. In what follows, by way of an illustration, we show the usefulness of our findings in such a decision.

As can be seen, to a profit maximizing racetrack-racebook manger, an additional day of racing from a racetrack group would be desirable if and only if it adds to net profit. An addition to profit is defined as the additional (marginal) revenue generated by the additional day of racing less its additional (marginal) cost. For illustration, this additional day is taken to be a typical day characterized by setting the demand variables like number of races, field size, purse, takeout rate,

etc. to their average values. The handle effect for each subject racetrack group was estimated by substituting these typical values for the demand variables into its demand equation. At the same time, the effect of the additional day of subject racetrack racing on each of the remaining fourteen racetrack groups was estimated. The additional day of subject racetrack racing affected the 14 other racetrack demands through the computation of the value of the cross-variables in their demand equations due to the additional day of subject racetrack racing. These effects were estimated by evaluating the changes in demand, using the difference in handle estimated from their corresponding demand equations, with and without this additional day of racing.[9] We then followed the Garden State Park revenue schedule as described earlier to estimate the racetrack-racebook revenue effects from these 15 handle effects.

To estimate the marginal cost of a day of racing, we note that inputs required to produce a day of live racing are distinctly different from those required for a simulcast race. The cost of producing a live race performance over a day is much higher than the cost of an additional simulcast performance. This is due to the relatively large volume of wagering and attendance, with associated costs, when the live race product is being offered. In addition there is the considerable cost of maintaining the racing surface and surrounding area, and the stabling area for horses who race at the racetrack. Monthly aggregate expense data from Garden State Park racetrack for the thirty six month period 1994 through 1996 were used to determine the marginal cost of additional live racing. The following, rather simplistic, regression model was formulated to determine the marginal cost of live racing:

$$C = b_0 + b_1 TREND + b_2 LIVEDAYS$$

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[9] The cross-effect of additional races for each of the 14 racetrack groups affected by the increase in races at the subject racetrack group was computed as the coefficient of number of races in the competing racetrack group multiplied by the average number of own-races for an additional day. There were an average of 12 cross-racetrack groups competing with a given subject racetrack group. The cross-effect for average purse was computed as its associated cross-coefficient multiplied by [12 x average purse in cross-group + average purse in own-group]/13 - average purse in cross-group]. The same procedure was followed for the cross-effects of field size and takeout rate.

where, C = total race expenses (after parimutuel tax, purses and costs associated with sending simulcasts to off-site locations).[10] C averaged $1,926,000 per month or $64,200 per day in 1995.[11] TREND is a time trend variable beginning at 1 in January 1994 and ending at 36 in December 1996. LIVEDAYS is the number of live thoroughbred and harness race days over the month. The coefficient b_2 measures the marginal cost of an additional day of live racing. The estimated equation is:

$$C = 1753483 - 32490TREND + 35971LIVEDAYS$$

Both slope coefficients b_1 and b_2 were found to be significant at the 5% level with t-values of -5.2 and 11.8, respectively. The adjusted R^2 was 0.84 indicating a good fit to the data. From the equation, the marginal cost for an additional day of live racing at Garden State Park was estimated to be $35,971.

In addition to the host fee expense, computed in this case as 3% of average daily handle generated by the host track at the racetrack-racebook site, the cost of offering an additional simulcast race day to an existing racetrack-racebook is largely determined by telephone line and simulcast signal decoder charges. There are additional costs such as program and printing charges but these may be offset by revenues from program sales. To the extent that an additional simulcast race day increases wagering, there may be an increase in mutuel department (teller) expenses. However, with the advent of automated teller machines, this expenses is likely to be minimal. There is no standard cost for decoder and telephone line fees. For purposes of this analysis the decoder fee per racetrack is assumed to be $300 per month based on interviews with racetrack officials.[12] Assuming simulcasts from a racetrack are taken for 26 days per month, the daily cost would be $12. The phone line charge which links the host and receiving computers

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[10] These expenses, C, were computed as total after-tax expenses less purses, equipment rental-outside services for simulcast product, and telephone-simulcast lines. Live race expenses include equipment rental and other charges for simulcast of live races to off-site locations. Costs may vary by time of year, being higher in winter when extra charges such as snow removal and track maintenance may be higher.

[11] The average of all daily expenses, less purses, was $2,101,500 per month or $70,050 per day.

[12] Source: Garden State Park, New Jersey and Churchill Downs, Kentucky. This is a monthly charge for each simulcast racetrack and so the daily cost will increase as the number of days which a simulcast racetrack's signal is taken decreases. New Jersey allocates charges to various racetracks from its hub site which made it difficult to estimate individual racetrack costs.

and provides for general communications between them is estimated to be about $68 per day based on a six hour day per track.[13] The total of these two identifiable major costs is $80 per day.

As an illustration, racetrack-racebook handle, revenue and profit effects of adding a live thoroughbred (GSLIVE-TH) and harness (GSLIVE-HR) race day at Garden State Park, and a simulcast race day were estimated. One simulcast racetrack racegroup was selected for this illustration. The selected group was the Kentucky thoroughbred racetrack group (KY-TH) which was chosen from the group of simulcast racetrack groups which resulted in positive revenues for a one race increase in the prior analysis. Table 9 summarizes the findings.

TABLE 9: SUMMARY OF REVENUE AND PROFIT EFFECTS OF ONE MORE DAY OF RACING

Additional Day Of Racing For:	Revenue From Subject Racetrack*	Revenue From Competing Racetracks*	Net Racetrack Racebook Revenue	Marginal Cost	Racetrack Racebook Profit
Live Thoroughbred Racing	$27,002	$1,252	$28,254	$35,971	-$7,717
Live Harness Racing	$23,785	-$4,657	$19,128	$35,971	-$16,843
Full-Card Thoroughbred (KY)	*$2,776	-$1,439	$1,337	$80	$1,257
*Revenues are net of parimutuel tax, percent allocated to purses, and host track fee. **Host fee expense of $758 (3% x $25,264) allocated to commission of $508 (0.67 x $758) was subtracted.					

It is interesting to note from Table 9 that, even though an additional day of live racing may produce substantially greater revenue than an additional day of simulcast racing from a particular racetrack, profit from the simulcast racetrack may exceed that from live racing. This is because the marginal cost of live racing is considerably larger than that of simulcast racing. Thus, the profit maximizing racetrack-racebook manager must consider the *cost* of adding an additional day of racing, as well as the revenue generated by the additional wagering opportunity, before such a decision is made.

A second point worth noting is that profit given in Table 9 is computed from wagering on live or simulcast races at the racetrack-racebook site. In fact, the live race product is simulcast to other in-state and out-of-state locations which generates additional revenues to the racetrack-racebook. It is possible that these additional revenues may be sufficient to offset the on-track loss from live racing. For example, in 1995 simulcasts of Garden State Park thoroughbred races to other in-state ITW racetracks produced $23,382,245 in handle at those locations. Garden State

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[13] Source: Churchill Downs, Kentucky. Telephone charges are estimated to be about $0.19 per minute for six hours per day for a simulcast racetrack. Charges vary by track according to long-distance carrier and track location.

Park harness races produced in-state ITW handle of $20,735,319.[14] Using a takeout rate of 19.3%, state tax of 0%, and the assumed distribution schedule of 50% to host racetrack (Garden State Park) average daily revenue from wagering on Garden State Park thoroughbred races would be $30,085 per day over the 75 day meet. Assuming that 33% of revenue goes to purses, the racebook commission from in-state Thoroughbred ITW would be $20,157 per day. Similarly, at a takeout rate of 19.5%, average daily commission to the racebook would be $25,557 per day for harness racing over the 53 day meet.

In addition to its simulcasts to in-state locations, Garden State also simulcasts to out-of-state locations. In 1995 simulcast of its thoroughbred races to out-of-state locations resulted in out-of-state handle of $62,682,885. Garden State Park harness racing produced an out-of-state handle of $51,184,364. Assuming a Garden State host fee of 3%, with 50% of revenue from host fee going to purses and 50% to commissions, average daily commission to the racebook would be $12,537 for thoroughbred and $14,486 for harness racing.[15]

The sum of revenue generated from wagering on Garden State live races at off-site locations under the expense distribution schedule used in this illustration is computed to be $32,694 per day for live thoroughbred racing and $40,043 per day for live harness racing. The marginal costs of sending the simulcasts out are minimal relative to the revenues generated. When these additional off-site revenues are added to revenues generated at the racetrack-racebook site (i.e. on-track), it appears that an additional day of live racing is profitable. It should be noted that this analysis does not consider fixed costs which determine, in the long run, whether or not a racetrack-racebook is profitable.

Summary and Conclusions

A system of demand models was estimated for 15 racetrack groups offered by the Garden State Park racetrack-racebook in 1995. Included in these groups were live thoroughbred and

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[14] Source: New Jersey Racing Commission, Annual Report 1995.
[15] The "splits" to purses and racetrack commission are approximately 50% to purses and 50% to commission for host track fees paid to Garden State for simulcasts to out-of-state locations. The "splits" are approximately 33% purses and 67% commission for after-tax revenues from all other types of wagering (i.e. live, full-card, ITW).

harness racing at Garden State Park and thirteen simulcast racetrack groups whose signals were broadcast to Garden State Park from both in-state and out-of-state locations.

The major determinants of wagering were found to be, (1) takeout rate, (2) number of races, (3) field size, (4) average purse and (5) the presence of special high purse stakes races. The first four variables are available to the patron each day for each racetrack group. Of these variables, wagering is most responsive to the takeout rate and least responsive to average daily purse. Median purse elasticity was found to be 0.06 which is considerably smaller than the elasticity of -2.30 for takeout rate, 0.64 for number of races and 0.58 for field size. With the exception of the cross-elasticity of number of races, -0.41, the cross elasticities of field size, average purse and takeout rate were found to be either insignificant or relatively small. Competing racetrack groups were found to be moderate substitutes for subject racetrack group wagering.

The impacts of special high purse stakes races on racebook handle were found to be significant. Thus, unlike the relatively small own-handle response to changes in average daily purse, the introduction of a high quality purse on a special event days can have significant positive impacts on handle.

The own- and cross- effect on handle and revenue of increasing the number of races offered by one per day was estimated for each of the 15 racetrack groups in the Garden State racebook. It was found that, for some racetrack groups the positive impact on handle and revenue from adding another race was not strong enough to offset the negative effects on competing racetrack groups resulting in negative net handle and revenue to the racetrack-racebook. Such racetrack groups should be considered for elimination from the racetrack-racebook.

One interesting point that can be made is that, while handle was found to be relatively insensitive to *changes* in average purse, those racetrack groups for which one additional race generated positive revenues were characterized by higher levels of average purse than those which generated negative revenues. Relatively high average daily purses at a host track may attract larger fields as more horses are attracted from other locations to compete for the higher revenues. Since field size has a relatively large impact on subject racetrack handle at the racetrack-racebook site, larger average daily purses may indirectly lead to a larger handle through

increased field size. Finally, purses for live races are important to the extent that they are a factor in the ability of a racetrack to sell its simulcasts to off-site locations in order to generate revenues to supplement its own racebook revenues.

In addition to higher average purses, racetrack groups which generated positive revenues to the racetrack-racebook were also characterized as having lower takeout rates. Racetrack groups located in the same region as the racetrack-racebook site were also characterized by positive revenues. The latter effect can possibly be attributed to the racetrack-racebook patrons' greater familiarity with horses at nearby locations which positively affects their resulting wagers.

The decision to drop a racetrack which doesn't produce positive revenue would be a relatively easy one for a casino racebook manager. However, a *racetrack*-racebook manager has another consideration - one of reciprocity. In many cases, in order to send a live race signal to an out-of-state racetrack location, the out-of-state racetrack might insist on reciprocity for receiving its races even though its product might be a relatively weak one. The racebook manager might make the decision to take the weak signal to gain access to a lucrative out-of-state market. This paper does not address this consideration.

The effect on a racetrack-racebook's handle, revenue and profit, from an additional *day* of racing for the live harness and live thoroughbred race meets and for an out-of-state simulcast racetrack group were estimated. Monthly cost data from Garden State Park were used to estimate marginal costs of an additional day of racing. The cost of producing an additional day of live racing was far greater than the cost of an additional day of simulcast racing from off-site locations. Although racetrack-racebook revenue from both live thoroughbred and harness racing was larger than revenue from any of the simulcast racetrack groups in the racebook, it was not sufficient to cover the marginal cost associated with an additional day of live racing. Based on revenue generated at the racebook alone, live racing would be terminated. However, there is an important additional consideration for live race revenues which is revenue generated from simulcasting the live races to other in-state locations and to out-of-state locations. When revenues from these activities were added to revenues generated at the racetrack-racebook site, the addition of an additional day of live racing was seen to be profitable. Profit was computed for one of the better quality simulcast racetrack groups, as an example. In this case, profit was found to be relatively small but positive. It is important to remember that simulcast racing,

unlike live racing, is available at the racebook year-round. In addition, even though profit per track may be relatively small for any one track, the number of tracks taken per day may be very large.

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APPENDICES

TABLE 1: VARIABLE CONSTRUCTION

Variable	Construction	Source
RACES	Total number of races for a racetrack group on a given day.	KIII Data Base-Thoro. USTA Data Base-Harn.
PURSE	Average daily purse per race for a racetrack group on a given day.	KIII Data Base-Thoro. USTA Data Base-Harn.
FIELD	Average daily field per race for a racetrack group on a given day.	KIII Data Base-Thoro. USTA Data Base-Harn.
TAKE	Average daily takeout rate for a racetrack group on a given day. In some cases, TAKE was unchanged over the sample period for a particular racetrack group and so was omitted from further analysis. Competing racetrack group takeout is taken to be 1if no racing is offered from that group on a given day.	Garden State Park.
LIVE-TH LIVE-HR	Binary (0,1) variable denoting presence (=1) of live thoroughbred racing (LIVE-TH) or live harness racing (LIVE-HR) in the competing racetrack groups, and 0, otherwise.	Garden State Park
ITWAC-TH ITWMDLS-TH ITWMTH-TH ITW-TH ITWFHLD-HR ITWMDLS-HR	Binary (0,1) variable denoting presence (=1) of New Jersey ITW thoroughbred racing from Atlantic City Racecourse (ITWAC-TH), Meadowlands (ITWMDLS-TH) or Monmouth (ITWMTH-TH) in competing racetrack groups, and 0. otherwise. Variable denoting number of New Jersey ITW thoroughbred racetracks in the competing racetrack group and 0, otherwise. Binary (0,1) variables denoting presence (=1) of New Jersey ITW harness racing from Freehold (ITWFHLD-HR) or the Meadowlands (ITWMDLS-HR) in the competing racetrack group, and 0 otherwise.	Garden State Park
MON, TUE, THU, FRI, SAT, SUN	Binary (0,1) day of the week variables which take the value 1 on Monday, Tuesday, Thursday, Friday, Saturday and Sunday, respectively, and 0. otherwise.	Calendar
HOL	Binary (0,1) holiday variable which take the value 1 on holidays and 0, otherwise.	Calendar
PRECIP	Total precipitation at Garden State Park. Weather is measured at the weather station nearest to Garden State Park (Philadelphia).	U.S. Department Of Commerce, National Oceanic and Atmospheric Admin.
TEMP	Average daily temperature at Garden State Park measured at the weather station nearest to Garden State Park (Philadelphia).	U.S. Department Of Commerce, National Oceanic and Atmospheric Admin.
Special Stakes (App. 1, Table 2)	Binary (0,1) variables which take the value 1 on a day when a special high quality event stakes race is offered and 0 on all other days.	KIII Data Base-Thoro. USTA Data Base-Harn.
OPENFRI OPENSAT	Binary (0,1) variables which denote opening Friday and Saturday weekend days for the live race meetings at Garden State Park. The variables take the value 1 on opening Friday (OPENFRI) or opening Saturday (OPENSAT) and 0 on all other days.	Garden State Park
Specific Group In Subject Racetrack Group	Variable which denotes presence of a racetrack(s) in the subject racetrack group which have characteristics that distinguishes them from the remaining racetracks in the group. The variable takes the value of number of distinguishing racetracks in the group.	Garden State Park
Specific Group In Competing Racetrack Group	Variable which denotes presence of racetrack(s) among the competing racetrack groups which has characteristics that distinguish it from the other racetracks in the groups. The variable takes the value of number of racetracks in the group.	Garden State Park

TABLE 2: SPECIAL EVENT RACES

Special Event Race (Variable Designation)	Purse	State	Track
Arkansas Derby (ARKDERBY)	$500,000	AR	OP
Oaklawn Handicap (OAKHCP)	$750,000	AR	OP
Santa Anita Derby (SADERBY)	$700,000	CA	SA
Florida Derby (FLDERBY)	$500,000	FL	GP
Flamingo Stakes (FLAMINGO)	$200,000	FL	HIA
Kentucky Derby (KYDERBY)	$957,400	KY	CD
Jim Beam Stakes (JIMBEAM)	$600,000	KY	TP
Blue Grass Stakes (BLUEGRASS)	$500,000	KY	KEE
Pimlico Special (PIMSPCL)	$600,000	MD	PIM
Preakness Stakes (PREAKNESS)	$687,400	MD	PIM
Jersey Derby (JRSYDERBY)	$150,000	NJ	GS-TH
Haskell Invitational (HASKELL)	$500,000	NJ	MTH
Caesars International (CAESARS)	$500,000	NJ	AC
Belmont Stakes (BELMONT)	$692,400	NY	BEL
Breeders Cup (BRCUP)*	$10,000,000	NY	BEL
Massachusetts Handicap (MASSHCP)	$750,000	MA	SUF
Pennsylvania Derby (PADERBY)	$200,000	PA	PHA
NJ Classic (NJCLASSIC)	$500,000	NJ	MDLS-HR
Breeders Crown (BRCROWN)	$347,800	NJ	GS-HR
Three Diamonds (THREEDIAM)	$437,900	NJ	GS-HR
*The Breeders Cup rotates among racetracks on an annual basis. In 1995 it was held at Belmont Park. There are a total of 7 races offered on Breeders Cup Day with combined purses of $10,000,000 ranging from $1,000,000 to $3,000,000.			

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TABLE 1: SUMMARY STATISTICS-THOROUGHBRED
[Racetrack Group (Number of Racetracks, Number of Observations)]

Variable	ARKLATX-TH (5 Tracks, 234 Obs.)			CA-TH (6 Tracks, 281 Obs.)			FL-TH (4 Tracks, 301 Obs.)		
	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
HAND	22815.3	76878	4422	41455.6	113020	11383	39200.2	276700	8425
GENERAL ENVIRONMENTAL CONDITIONS									
MON	0.1581	1	0	0.0854	1	0	0.1628	1	0
TUE	0.0171	1	0	0.0142	1	0	0.0897	1	0
WED	0.0684	1	0	0.1637	1	0	0.0764	1	0
THU	0.1923	1	0	0.1815	1	0	0.1528	1	0
FRI	0.1966	1	0	0.1851	1	0	0.1728	1	0
SAT	0.1966	1	0	0.1851	1	0	0.1728	1	0
SUN	0.1709	1	0	0.1851	1	0	0.1728	1	0
HOL	0.0085	1	0	0.0107	1	0	0.0033	1	0
PRECIP	0.0791	1.4	0	0.0933	1.6	0	0.0932	1.6	0
TEMP	55.84	92.0	12.5	57.7	92.00	18.50	54.94	92.0	12.5
SUBJECT RACETRACK GROUP									
RACES	11.1	21	4	15.2	25	7	11.3	23	3
PURSE	11577.7	115454.5	3287.5	31316.7	169400.0	11562.5	20354.4	126416.7	3880.0
TAKE	0.2034	0.2168	0.1884	0.1852	0.2023	0.1780	0.2198	0.2677	0.189
FIELD	9.1	11.3	6.6	7.9	9.9	6.0	8.1	10.3	6.1
COMPETING RACETRACK GROUPS									
RACES	133.6	208	30	129.8	206	10	127.0	206	19
PURSE	16411.3	54490.4	5034.2	15268.3	176547.1	6292.4	15387.8	167598.8	54334.0
TAKE	0.2041	0.2266	0.1875	0.2053	0.2246	0.1940	0.2032	0.2224	0.18613
FIELD	8.1	9.0	7.4	8.2	10.0	7.5	8.2	9.2	7.1
LIVE-TH	0.3077	1	0	0.2633	1	0	0.2259	1	0
LIVE-HR	0.0940	1	0	0.1886	1	0	0.1329	1	0
ITWMTH-TH	0.1923	1	0	0.1993	1	0	0.1528	1	0
ITWAC-TH	0.1880	1	0	0.1922	1	0	0.1495	1	0
TIWMDLS-TH	0.0983	1	0	0.1993	1	0	0.1495	1	0
ITWMDLS-HR	0.5641	1	0	0.5089	1	0	0.4983	1	0
ITWFHLD-TH	0.5427	1	0	0.5907	1	0	0.5615	1	0
SPECIAL EVENTS									
SPECIAL STAKES									
KYDERBY	0.0043	1	0	0.0036	1	0	0.0033	1	0
BRCUP				0.0036	1	0	0.0033	1	0
ARKDERBY	0.0043	1	0						
OAKHCP	0.0043	1	0						
SADERBY				0.0036	1	0			
FLDERBY							0.0033	1	0
FLAMINGO							0.0033	1	0
SPECIFIC RACETRACK (GROUP) WITHIN SUBJECT RACETRACK GROUP									
TX-TH	0.5598	1	0						
ARKANSAS-TH	0.2692	1	0						
SOUTHERN CAL TRACKS				0.9253	1	0			
TAMPA BAY(FL)							0.0897	1	0
CALDER RACE COURSE(FL)							0.5615	1	0

TABLE 1: SUMMARY STATISTICS-THOROUGHBRED (CONTINUED)
[Racetrack Group (Number of Racetracks, Number of Observations)]

Variable	IL-TH (4 Tracks, 188 Obs.)			KY-TH (4 Tracks, 233 Obs.)			MANH-TH (2 Tracks, 245 Obs.)		
	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
HAND	16312.9	42594	1756	25263.6	484400	7023	15845.1	32440	1791
GENERAL ENVIRONMENTAL CONDITIONS									
MON	0.2234	1	0	0.0215	1	0	0.1959	1	0
TUE	0.0266	1	0	0.0644	1	0	0.0041	1	0
WED	0.0957	1	0	0.1588	1	0	0.2000	1	0
THU	0.1809	1	0	0.1717	1	0	0.0000	0	0
FRI	0.1489	1	0	0.1674	1	0	0.2041	1	0
SAT	0.1383	1	0	0.2103	1	0	0.2000	1	0
SUN	0.1862	1	0	0.2060	1	0	0.1959	1	0
HOL	0.0106	1	0	0.0129	1	0	0.0082	1	0
PRECIP	0.0869	1.6	0	0.0918	1.6	0	0.0870	1.4	0
TEMP	61.7	92.0	19.0	60.7	92.0	18.5	58.2	92.0	19.5
SUBJECT RACETRACK GROUP									
RACES	10.5	22	1	10.1	14	8	11.1	16	2
PURSE	16242.9	73665.0	4100.0	36365.2	731821.4	8740.0	19494.8	719714.3	4950.0
TAKE	0.1984	0.2061	0.1899	0.1938	0.2103	0.1758	0.2356	0.2421	0.2254
FIELD	8.7	12.0	6.8	9.2	11.1	6.9	8.3	10.3	6.0
COMPETING RACETRACK GROUPS									
RACES	131.6	208	17	140.3	207	64	132.6	205	65
PURSE	16699.3	167773.3	5219.8	16508.2	122958.1	6097.3	16815.3	154963.3	5731.2
TAKE	0.2054	0.2293	0.1831	0.2034	0.2215	0.1940	0.2026	0.2243	0.1912
FIELD	8.1	9.0	7.0	8.1	8.9	7.4	8.2	9.1	7.5
LIVE-TH	0.0160	1	0	0.1674	1	0	0.2245	1	0
LIVE-HR	0.2713	1	0	0.2275	1	0	0.1592	1	0
ITWMTH-TH	0.2128	1	0	0.2790	1	0	0.2367	1	0
ITWAC-TH	0.2074	1	0	0.2403	1	0	0.1755	1	0
ITWMDLS-TH	0.3032	1	0	0.2446	1	0	0.1633	1	0
ITWMDLS-HR	0.2021	1	0	0.4807	1	0	0.4694	1	0
ITW HARN-FHLD	0.4468	1	0	0.5708	1	0	0.4939	1	0
SPECIAL EVENTS									
SPECIAL STAKES									
KYDERBY				0.0043	1	0			
BRCUP	0.0053	1	0	0.0043	1	0	0.0041	1	0
BLUEGRASS				0.0043	1	0	0.0041	1	0
JIMBEAM				0.0043	1	0			
MASSHCP							0.0041	1	0
SPECIFIC RACETRACK (GROUP) WITHIN SUBJECT RACETRACK GROUP									
HAWTHORNE-TH	0.4894	1	0						
CHURCHILL-TH				0.3133	1	0			

Variable	SURR-TH (8 Tracks, 360 Obs.)			NJITW-TH (2 Tracks, 152 Obs.)			GSLIVE-TH (1 Track, 75 Obs.)		
	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
HAND	93691.9	561522	20534	83731.3	155505	31386	209582.0	680268	113570
GENERAL ENVIRONMENTAL CONDITIONS									
MON	0.1389	1	0	0.0197	1	0	0	0	0
TUE	0.1417	1	0	0.1711	1	0	0	0	0
WED	0.1417	1	0	0.1776	1	0	0.2297	1	0
THU	0.1444	1	0	0.1776	1	0	0.2568	1	0
FRI	0.1444	1	0	0.1776	1	0	0.2703	1	0
SAT	0.1417	1	0	0.1776	1	0	0.2432	1	0
SUN	0.1472	1	0	0.0987	1	0	0	0	0
HOL	0.0083	1	0	0.0197	1	0	0	0	0
PRECIP	0.0829	1.6	0	0.0780	1.1	0	0.0847	1.3	0
TEMP	57.1	92.0	18.5	68.9	92.0	31.0	49.2	74.0	19.5
SUBJECT RACETRACK GROUP									
RACES	26.2	56	9	13.1	23	9	9.8	12	9
PURSE	16005.0	216187.9	4100.0	21572.7	138833.3	4688.9	8622.5	21427.3	6033.3
TAKE	0.1983	0.2183	0.1815	0.1930	-	-	0.1930	-	-
FIELD	8.0	10.1	5.4	7.5	9.1	6.0	7.2	8.8	6.0
COMPETING RACETRACK GROUPS									
RACES	109.1	176	21	138.6	196	71	132.0	192	80
PURSE	14888.5	134851.0	4314.3	16722.5	167378.2	5006.1	15484.9	47116.0	10025.9
TAKE	0.2060	0.2275	0.1922	0.2036	0.2112	0.1943	0.2022	0.2154	0.1937
FIELD	8.2	9.2	7.5	8.2	8.8	7.7	8.2	8.7	7.8
LIVE-TH	0.2083	1	0	0	0	0	1	1	1
LIVE-HR	0.1472	1	0	0.3355	1	0	0	0	0
ITWMTH-TH	0.2000	1	0	0.4737	1	0	0	0	0
ITWAC-TH	0.1583	1	0	0.3750	1	0	0	0	0
ITWMDLS-TH	0.1833	1	0	0.4342	1	0	0	0	0
ITWMDLS-HR	0.5028	1	0	0.3618	1	0	1	1	1
ITWFHLD-HR	0.5722	1	0	0.5263	1	0	1	1	1
SPECIAL EVENTS									
OPENFRI							0.0135	1	0
OPENSAT							0.0135	1	0
SPECIAL STAKES									
KYDERBY	0.0028	1	0				0.0135	1	0
BRCUP	0.0028	1	0	0.0066	1	0			
BELMONT	0.0028	1	0	0.0066	1	0			
PIMSPCL	0.0028	1	0						
PREAKNESS	0.0028	1	0						
PADERBY	0.0028	1	0						
HASKELL				0.0066	1	0			
CAESARS				0.0066	1	0			
JRSYDERBY							0.0135	1	0
SPECIFIC RACETRACK (GROUP) WITHIN SUBJECT RACETRACK GROUP									
PA-TH	1.1556	2	0						
NY-TH	0.5083	1	0						
SPECIFIC RACETRACK (GROUP) WITHIN COMPETING RACETRACK GROUP									
SOUTH FL-TH	0.8056	1	0						

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TABLE 2: SUMMARY STATISTICS-HARNESS
[Racetrack Group (Number of Racetracks, Number of Observations)]

Variable	FL-HR (1 Track, 70 Obs.)			IL-HR (5 Tracks, 169 Obs.)			MA-HR (1 Track, 86 Obs.)		
	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
HAND	9092.2	17439	3323	8448.4	24914	2592	6380.7	15031	782
GENERAL ENVIRONMENTAL CONDITIONS									
MON	0.6143	1	0	0.2899	1	0	0.3605	1	0
TUE	0	0	0	0.1657	1	0	0.1628	1	0
WED	0.3429	1	0	0.1479	1	0	0.0116	1	0
THU	0.0286	1	0	0.0473	1	0	0.0930	1	0
FRI	0	0	0	0.0355	1	0	0.0000	0	0
SAT	0.0143	1	0	0.0355	1	0	0.1744	1	0
SUN	0	0	0	0.2781	1	0	0.1977	1	0
HOL	0.0143	1	0	0.0059	1	0	0	0	0
PRECIP	0.0571	1.2	0	0.0614	1.4	0	0.0630	0.8	0
TEMP	52.5	84.5	12.5	59.1	88.0	12.5	65.2	92.0	36
SUBJECT RACETRACK GROUP									
RACES	11.5	13	10	12.4	23	10	10.9	14	7
PURSE	2644.3	5850.0	1980.0	6140.0	33838.5	3290.0	1980.6	4975.0	1171.4
TAKE	0.2563	-	-	0.2022	0.2195	0.1900	0.2408	-	-
FIELD	8.2	8.8	7.1	8.4	10.0	6.8	7.4	8.6	5.3
COMPETING RACETRACK GROUPS									
RACES	93.0	177	52	115.6	204	44	130.3	207	65
PURSE	11879.9	27105.7	6908.3	14606.2	54506.7	5929.2	16039.2	54626.2	6107.5
TAKE	0.2054	0.2214	0.1939	0.2071	0.2293	0.1945	0.2057	0.2237	0.1923
FIELD	8.2	8.9	7.4	8.1	9.0	7.5	8.1	8.7	7.6
LIVE-TH	0.1857	1	0	0	0	0	0.0465	1	0
LIVE-HR	0	0	0	0.9941	1	0	0.5581	2	0
ITW-TH	0.1571	2	0	0.5503	2	0	0.2907	1	0
ITWMDLS-HR	0.3857	1	0	0.2249	1	0	0.3372	1	0
ITWFHLD-HR	0.3714	1	0	0.3491	1	0	0.4939	1	1
SPECIAL EVENTS									
SPECIFIC RACETRACK (GROUP) WITHIN SUBJECT RACETRACK GROUP									
HAWTHORNE-HR				0.0592	1	0			
MAYWOOD-HR				0.3550	1	0			
SPRINGFIELD FAIR-HR				0.0118	1	0			
SPECIFIC RACETRACK (GROUP) WITHIN COMPETING RACETRACK GROUP									
IL-HR	0.6429	1	0						
SURR-HR	0.9143	3	0	1.8402	4	0	2.2442	4	1

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TABLE 2: SUMMARY STATISTICS-HARNESS (CONTINUED)
[Racetrack Group (Number of Racetracks, Number of Observations)]

Variable	SURR-HR (4 Tracks, 324 Obs.)			NJITW-HR (2 Tracks, 277 Obs.)			GSLIVE-HR (1 Track, 53 Obs.)		
	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
HAND	30096.0	84897	5759	82868.2	267134	14227	182103.4	324960	96141
GENERAL ENVIRONMENTAL CONDITIONS									
MON	0.1574	1	0	0.0253	1	0	0	0	0
TUE	0.1543	1	0	0.1805	1	0	0	0	0
WED	0.0710	1	0	0.1805	1	0	0.2453	1	0
THU	0.1574	1	0	0.1841	1	0	0.2264	1	0
FRI	0.1605	1	0	0.1877	1	0	0.2642	1	0
SAT	0.1574	1	0	0.1841	1	0	0.2642	1	0
SUN	0.1420	1	0	0.0578	1	0	0	0	0
HOL	0.0062	1	0	0.0108	1	0	0	0	0
PRECIP	0.0812	1.6	0	0.0895	1.6	0	0.1777	1.6	0
TEMP	57.3	92.0	12.5	56.9	92.0	19.5	56.0	81.0	31
SUBJECT RACETRACK GROUP									
RACES	31.2	64	9	16.1	27	10	12.9	15	10
PURSE	5436.6	54831.7	1937.5	13109.8	147500.0	3263.6	18429.6	151382.1	3536.4
TAKE	0.2086	0.2496	0.1851	0.1978	-	-	0.1949	-	-
FIELD	7.8	8.7	7.0	8.5	10.1	7.4	8.6	10.3	6.9
COMPETING RACETRACK GROUPS									
RACES	81.0	125	22	124.2	203	46	138.6	188	87
PURSE	17639.1	175849.3	3901.894	15183.3	168019.1	4355.667	19853.7	167705.3	11036
TAKE	0.2053	0.2342	0.1913	0.2037	0.2262	0.1927	0.2004	0.2062	0.1944
FIELD	8.3	9.4	7.5	8.1	8.9	7.2	8.2	8.7	7.6
LIVE-TH	0.1883	1	0	0.2708	1	0	0	0	0
LIVE-HR	0.1327	1	0	0.1913	1	0	1	1	1
ITW-TH	0.5494	2	0	0.6282	2	0	0.9623	1	0
ITWMDLS-HR	0.4969	1	0	0.6534	1	0	0	0	0
ITWFHLD-HR	0.5617	1	0	0.7437	1	0	1	1	1
SPECIAL EVENTS									
SPECIAL STAKES									
NJCLASSIC				0.0036	1	0			
BREEDERSROWN							0.0189	1	0
THREEDIAM							0.0189	1	0

APPENDIX 3: ESTIMATED DEMAND EQUATIONS

TABLE 1: THOROUGHBRED EQUATIONS

Variable	ARKLATX-TH (5 TRACKS) Coefficien	t	CA-TH (6 TRACKS) Coefficient	t	FL-TH (4 TRACKS) Coefficient	t	IL-TH (4 TRACKS) Coefficient	t	KY-TH (4 TRACKS) Coefficien	t
C	94429.0	2.28	103610.8	1.70	271621.4	4.05	26261.5	0.80	-30054.8	-0.66
GENERAL ENVIRONMENTAL CONDITIONS										
MON	8065.4	2.63	4284.0	1.29	3179.3	0.62	-4625.5	-1.66	-4574.6	-0.98
TUE	-460.1	-0.13	9808.3	1.96	-7857.5	-1.41	-2870.4	-0.95	-2392.2	-0.80
THU	7206.9	3.49	1236.8	0.63	7767.8	1.71	2200.4	1.43	3945.9	1.88
FRI	13173.9	6.39	10689.1	4.68	15270.6	3.89	4776.8	2.70	6387.3	2.83
SAT	11277.3	4.41	16016.5	5.86	32278.6	6.84	3929.7	1.67	9283.1	3.01
SUN	304.7	0.09	10047.0	2.93	8940.8	1.86	-1925.3	-0.71	44.5	0.01
HOLIDAY	-8981.2	-1.76	-2662.3	-0.47	5539.3	0.38	7578.7	1.98	2918.8	0.51
PRECIP.	-1385.8	-0.74	-1420.1	-0.65	-4620.4	-1.30	-564.5	-0.34	487.3	0.19
TEMP	-76.5	-2.32	-90.6	-1.99	-113.6	-1.69	-50.4	-1.65	-4.3	-0.09
SUBJECT RACETRACK GROUP										
RACES	837.5	6.00	1694.9	10.28	3247.4	6.25	1482.1	8.51	2380.9	2.23
PURSE	0.1283	3.09	0.1192	3.02	0.0072	0.10	0.2296	4.33	0.1138	2.99
TAKE	-289313.3	-2.03	-358812.1	-1.81	-483360.5	-10.88	-219033.3	-1.87	-241104.6	-2.60
FIELD	366.9	0.78	3029.2	3.88	3020.4	2.27	2256.0	4.68	2379.2	3.45
COMPETING RACETRACK GROUPS										
RACES	-120.4	-3.80	-130.9	-4.39	-170.9	-3.75	-79.7	-3.86	-89.0	-2.68
PURSE	0.0691	0.82	-0.1233	-1.22	-0.4215	-1.84	-0.1512	-1.92	-0.3862	-2.59
TAKE	26366.3	0.23	-92753.9	-0.61	-334583.7	-1.17	116774.9	1.26	415517.8	2.33
FIELD	-4076.8	-2.33	-4246.1	-1.81	-9584.1	-2.79	-1406.6	-0.92	-3114.0	-1.22
LIVE-TH	-2523.7	-1.30	-1021.4	-0.44	-6121.3	-1.59	-758.9	-0.23	1615.9	0.62
LIVE-HR	*		3104.2	0.87	-12820.3	-2.14	2524.1	1.10	5101.3	1.59
ITWMTH-TH	406.3	0.23	-2113.2	-0.94	-6045.6	-1.69	-1634.0	-1.11	-298.2	-0.15
ITWAC-TH	-4896.6	-2.03	-193.3	-0.07	-8633.9	-1.87	2665.3	1.35	-3017.1	-1.10
ITWMDLS-TH	-4420.3	-2.10	625.9	0.17	5032.3	0.90	-4225.8	-1.75	-3977.0	-1.24
ITWMDLS-HR	7151.6	4.62	9175.3	5.01	*		-800.3	-0.46	1334.3	0.76
ITWFHLD-HR	2618.3	1.52	6734.3	3.00	10795.0	3.50	1838.4	1.08	6130.8	2.57
SPECIAL EVENTS										
SPECIFIC RACETRACK (GROUP) WITHIN SUBJECT RACETRACK GROUP										
TX TRACKS-TH	12773.7	5.83								
AR TRACKS-TH	6886.8	3.41								
SOUTHERN CA TRACKS-TH			13710.1	5.30						
TAMPA BAY DOWNS-TH					-31052.1	-5.87				
CALDER-TH					-29037.7	-8.60				
HAWTHORNE-TH							-5161.6	-4.16		
CHURCHILL DOWNS-TH									7863.0	4.15
SPECIAL STAKES RACES										
KYDERBY	5005.9	0.89	8296.7	1.05	-1765.0	-0.13	-		433542.4	55.51
BRCUP			37272.4	2.14	60561.8	1.70	31812.0	2.62	-26198.0	-1.26
ARKDERBY	28980.4	5.03								
OAKHCP	14620.9	2.45								
SADERBY			48302.8	6.04						
FLDERBY					184420.8	13.27				
FLAMINGO					64662.5	4.84				
JIMBEAM									35043.5	4.29
BLUEGRASS									25742.2	3.41
SUMMARY STATISTICS										
Observations	234		281		301		188		233	
Adjusted R-squared	0.796		0.738		0.832		0.504		0.953	
F-statistic	33.5		29.2		52.2		8.3		164.4	
Prob(F-statistic)	0.000		0.000		0.000		0.000		0.000	

* Excluded due to collinearity.

TABLE 1: THOROUGHBRED EQUATIONS (CONTINUED)

Variable	MANH-TH (2 TRACKS) Coefficient	t	SURR-TH (8 TRACKS) Coefficient	t	NJITW-TH (2 TRACKS) Coefficient	t	GSLIVE-TH (1 TRACK) Coefficient	t
C	48115.5	1.47	63247.5	0.97	75602.6	0.74	-384625.5	-1.63
GENERAL ENVIRONMENTAL CONDITIONS								
MON	-4209.6	-2.10	24946.4	4.15	2129.2	0.18	-	
TUE	-14179.6	-2.11	13799.6	3.03	-22655.1	-2.51	-	
THU	-		18310.5	4.32	2192.1	0.49	16828.6	2.01
FRI	-3489.4	-2.70	28168.6	7.38	32422.3	6.20	59590.2	3.95
SAT	-2778.5	-1.61	46662.2	9.32	24022.2	3.17	82306.4	4.37
SUN	-9473.6	-4.58	407.6	0.07	-15554.4	-1.15	-	
HOLIDAY	-2757.3	-0.53	-17152.2	-1.50	8417.5	0.71	-	
PRECIP	-3178.9	-2.44	-5138.5	-1.45	-20631.4	-3.25	-18731.2	-2.02
TEMP	-42.9	-1.72	30.1	0.46	216.7	2.04	178.1	0.77
SUBJECT RACETRACK GROUP								
RACES	751.6	2.53	2294.7	12.63	5429.5	11.94	31081.2	7.01
PURSE	-0.0083	-0.28	0.4391	2.60	0.2912	2.85	2.6	2.26
TAKE	-201522.3	-2.00	-323823.5	-1.40	-		-	
FIELD	255.2	0.62	4275.2	3.31	3782.9	2.11	11167.3	2.57
COMPETING RACETRACK GROUPS								
RACES	-62.2	-3.14	-210.6	-3.53	-48.1	-0.61	-305.2	-1.23
PURSE	0.0910	0.96	0.1714	1.07	-0.4883	-1.64	0.3	0.48
TAKE	172450.4	2.23	-58693.3	-0.27	-366426.1	-0.79	150838.9	0.19
FIELD	-2032.2	-1.50	-1179.6	-0.33	-1922.9	-0.32	16638.2	1.32
LIVE-TH	-13.0	-0.01	-2249.5	-0.59			-	
LIVE-HR	1188.7	0.43	967.2	0.19	2014.6	0.25	-	
ITWMTH-TH	1657.4	0.99	-8116.3	-2.44	-		-	
ITWAC-TH	-4315.5	-2.13	1675.3	0.38			-	
ITWMDLS-TH	-4004.6	-1.46	5407.1	1.12	-		-	
ITWMDLS-HR	1061.2	0.95	5402.1	1.86	-655.3	-0.10	*	
ITWFHLD-HR	673.6	0.51	7611.2	2.24	-3841.6	-0.54	*	
SPECIAL EVENTS								
OPENFRI	-		-		-		161023.2	7.74
OPENSAT							26650.1	1.36
SPECIFIC RACETRACK (GROUP) WITHIN SUBJECT RACETRACK GROUP								
PA TRACKS-TH			15547.4	4.48				
NY TRACKS-TH			-5874.1	-1.81				
ITWAC-TH					-26897.7	-3.06		
SPECIFIC RACETRACK (GROUP) WITHIN COMPETING RACETRACK GROUP								
SOUTH FL-TH			-9642.1	-3.65				
SPECIAL STAKES RACES								
KYDERBY	12187.1	2.78	65129.0	4.71	-		16200.4	0.87
BRCUP	-8848.7	-0.64	279374.3	8.12	77343.4	1.78	-	
MASSHCP	13166.9	3.04						
PIMSPCL			52081.2	3.69				
PREAKNESS			238251.9	17.16				
PADERBY			42222.3	2.45				
BELMONT			96161.4	6.97				
HASKELL					23251.4	1.84		
CAESARS					26131.9	1.72		
JRSYDERBY							367281.4	15.30
SUMMARY STATISTICS								
Observations	245		360		152		74	
Adjusted R-squared	0.513		0.938		0.873		0.957	
F-statistic	10.8		165.3		46.3		103.0	
Prob(F-statistic)	0.000		0.000		0.000		0.000	

*Meadowlands and Freehold Harness Ran Every Day During Live Race Meet (perfectly collinear with constant).

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TABLE 2: HARNESS EQUATIONS

Variable	FL-HR (1 TRACK) Coefficient	t	IL-HR (5 TRACKS) Coefficient	t	MA-HR (2 TRACKS) Coefficient	t
C	-28298.5	-1.11	72870.2	3.94	9269.5	0.58
GENERAL ENVIRONMENTAL CONDITIONS						
MON	1502.0	0.54	-884.3	-0.68	-5850.0	-1.61
TUE	-		3567.0	1.63	-2969.2	-1.25
THU	-721.8	-0.35	4861.6	2.72	-2606.4	-1.00
FRI	-		7140.5	3.70	-	
SAT	6495.1	2.04	7849.5	3.76	-1557.4	-0.59
SUN	-		-39.0	-0.03	-4956.6	-1.42
HOLIDAY	216.4	0.04	-1590.4	-0.50	-	
PRECIP	1579.8	0.92	-432.8	-0.35	1843.8	1.47
TEMP	-59.8	-1.86	-59.3	-2.63	-56.4	-3.10
SUBJECT RACETRACK GROUP						
RACES	276.5	0.50	365.9	3.90	282.3	1.09
PURSE	0.1453	0.33	0.3503	4.56	-0.4237	-1.14
TAKE	-		-96208.7	-1.65	-	
FIELD	2723.6	2.49	-121.6	-0.23	334.0	0.83
COMPETING RACETRACK GROUPS						
RACES	-8.3	-0.24	-48.1	-2.86	-91.3	-4.35
PURSE	0.2749	1.18	-0.0098	-0.20	-0.0367	-1.04
TAKE	70858.3	0.78	-47921.4	-0.83	43486.9	0.83
FIELD	346.3	0.31	-2490.1	-2.75	700.8	0.71
LIVE-TH	515.8	0.26	-		-	
LIVE-HR	-		-8664.2	-2.85	-1682.6	-0.90
ITW-TH	-111.1	-0.10	2421.5	3.76	3249.7	3.21
ITWMDLS-HR	-2872.1	-0.94	-1171.6	-1.81	-349.1	-0.40
ITWFHLD-HR	-1068.8	-0.54	*		-1472.5	-1.66
SPECIAL EVENTS						
SPECIFIC RACETRACK (GROUP) WITHIN SUBJECT RACETRACK GROUP						
HAWTHORNE-HR			-3809.5	-3.03		
MAYWOOD-HR			-3875.1	-3.98		
SPRINGFIELD FAIR-HR			-3335.8	-1.41		
SPECIFIC RACETRACK (GROUP) WITHIN COMPETING RACETRACK GROUP						
IL-HR	-4265.5	-2.27				
SURR-HR	-2352.2	-2.32	-1679.7	-2.53	-1449.0	-1.46
SUMMARY STATISTICS						
Observations	70		169		86	
Adjusted R-squared	0.442		0.633		0.780	
F-statistic	3.9		13.1		16.9	
Prob(F-statistic)	0.000		0.000		0.000	
*Excluded due to collinearity.						

TABLE 2: HARNESS EQUATIONS (CONTINUED)

Variable	SURR-HR (4 TRACKS) Coefficient	t	NJITW-HR (2 TRACKS) Coefficient	t	GSLIVE-HR (1 TRACK) Coefficient	t
C	-18792.0	-0.51	40476.3	0.36	-584474.1	-1.25
GENERAL ENVIRONMENTAL CONDITIONS						
MON	-972.5	-0.25	4696.4	0.43	-	
TUE	9098.4	2.76	-735.0	-0.13	-	
THU	6726.8	2.62	3207.8	0.62	3374.1	0.35
FRI	12069.0	4.01	35768.8	5.91	71863.9	4.80
SAT	17159.5	5.04	45301.0	5.66	83965.9	4.66
SUN	1140.0	0.31	8078.7	0.81	-	
HOLIDAY	3515.8	0.45	-8985.2	-0.60	-	
PRECIP	1849.5	0.82	-14213.4	-2.29	-3453.7	-0.22
AVG TEMP	-30.0	-0.82	124.8	1.10	-397.2	-1.05
SUBJECT RACETRACK GROUP						
RACES	482.0	5.69	4764.0	8.31	12606.6	4.33
PURSE	0.0324	0.24	0.0146	0.14	-0.1	-0.75
TAKE	-1189.6	-0.01	-		-	
FIELD	3499.6	1.64	20874.0	6.27	21075.4	3.15
Competing Racetrack Groups						
RACES	-57.5	-1.24	136.6	1.54	266.7	1.01
PURSE	-0.0452	-0.97	-0.0748	-0.51	-0.1	-0.54
TAKE	17451.0	0.18	-580232.9	-1.42	1833754.0	0.98
FIELD	633.2	0.36	-17075.4	-2.65	595.0	0.03
LIVE-TH	4336.6	2.02	38675.8	6.30	-	
LIVE-HR	-1022.2	-0.50	-16457.3	-3.31	-	
ITW-TH	-1652.4	-1.09	-1906.5	-0.44	-5687.1	-0.25
ITWMDLS-HR	-5092.1	-2.97			-	
ITWFHLD-HR	854.0	0.39			-	
SPECIAL EVENTS						
OPENFRI	-		-		15478.0	0.66
OPENSAT					48224.2	1.92
SPECIAL STAKES RACES						
NJCLASSIC			44370.4	2.01		
BRCROWN					65320.8	2.37
THREEDIAM					75904.9	2.81
SUMMARY STATISTICS						
Observations	324		277		53	
Adjusted R-squared	0.662		0.867		0.896	
F-statistic	29.7		90.7		27.4	
Prob(F-statistic)	0.00		0.000		0.000	

TABLE 1: NEW JERSEY LIVE AND ITW RACING IMPACT ON THOROUGHBRED WAGERING

	ARKLATX-TH	CA-TH	FL-TH	IL-TH	MANH-TH	SURR-TH	NJITW-TH	GSLIVE-TH
LIVE IMPACT								
LIVE-TH	*	*	*	*	*	*	na	na
LIVE-HR	**	*	-31.7%	*	*	*	*	*
ITW THOROUGHBRED IMPACT								
MTHITW-TH	*	*	-15.2%	*	*	-8.4%	na	na
ACITW-TH	*	*	-21.5%	*	-26.1%	-28.6%	na	na
MDLSITW-TH	-19.0%	*	*	-24.0%	*	*	na	na
ITW HARNESS IMPACT								
MDLSITW-HR	38.1%	24.8%	32.3%	*	*	5.9%	*	**
FHLDITW-HR	*	17.9%	**	*	*	8.4%	*	**
*Insignificant **Not able to be measured due to multicollinearity.								

TABLE 2: LIVE AND ITW IMPACT ON HARNESS WAGERING

	FL-HR	IL-HR	MA-HR	SURR-HR	NJITW-HR	GSLIVE-HR
LIVE IMPACT						
LIVE-TH	*	na	na	14.9%	53.9%	na
LIVE-HR	na	-57.2%	*	*	-19.3%	na
ITW THOROUGHBRED IMPACT						
ITW-TH	*	46.7%	71.6%	*	*	*
ITW HARNESS IMPACT						
MDLSITW-HR	*	-17.3%	*	-15.6%	na	na
FHLDITW-HR	*	**	-21.5%	*	na	**
*Insignificant. **Not able to be measured due to multicollinearity.						

TABLE 3: SUMMARY TABLE FOR ITW IMPACT ON FULL-CARD RACETRACK GROUPS

Presence Of:	Median Impact On Full-Card Thoroughbred	Median Impact On Full-Card Harness
ITW-TH	-19%	47%
ITW-HR	14%	-16%
Note: If one ITW racetrack had a significant impact on a full-card group, that impact was used to compute the median. In cases where more than one thoroughbred ITW racetrack had a significant impact on a full-card racetrack group, the average impact was used to compute the median.		