Update Automated Morning Line for Harness Racetracks
Spring - 2014

TrackMaster has developed an Automated Morning Line for use by U.S. Harness Tracks. A detailed "White Paper" from 2012 is attached which describes the history of this effort.

During late 2013 and early 2014, TrackMaster completed its internal, commercial level coding for the project and in March of 2014, the USTA completed its work on its eTrack system to communicate with the TrackMaster system which generates the odds.

In sum, the eTrack operator for each race track now has an option when s/he is about to enter the morning line to "engage" the TrackMaster system to compute the lines. The lines are then populated in 10-15 seconds. These lines are perfectly "balanced" and applied uniformly across all tracks. The operator has the option of accepting these lines or editing the lines as appropriate.

Yonkers Raceway was the first track to utilize the automated lines in April of 2014 and the operation has been smooth. TrackMaster has been tracking the initial operations as well as the results. Both have been very good.

The service is currently being offered at no fee to the tracks – simply as a "value add" to the eTrack system. The benefits of the TrackMaster lines are clear:

- More accurate than human created lines
- More timely than human created lines
- Lines are not influenced by any outside factors and therefore are above reproach
- Time and/or money savings
- Lines are created using the same algorithms across all tracks
- Lines are perfectly balanced

There is about 15 minutes of training from the USTA required to use this eTrack enhancement through a webinar.

Automated Morning Line for Harness Racetracks - August 15, 2012
A TrackMaster "White Paper"

Introduction

TrackMaster believed it could build a computer algorithm that, when presented with a race card absent morning line odds, could generate a morning line that was equal or superior to than current, human generated morning line odds. The goal of a morning line is to approximate, as accurately as possible, what the final odds of each horse in each field would be (subject to some ceilings and floors that race tracks might care to utilize). To this end, TrackMaster first developed and adopted a measurement system that could compare its morning line odds versus those produced at racetracks in North America. Then, it moved forward into building a program that would produce its own morning line. The process was iterative. Many different approaches were tried and ultimately, the one that is presented later in this paper, prevailed.

TrackMaster has been in the racing business working with large volumes of racing data since 1990. It began working with harness data in 1997. David Siegel, its president, has a mathematics undergraduate degree along with an MBA. The TrackMaster team is well-versed in the basic understanding of racing data, and valid statistical ways to manipulate such data. As such, it is qualified to take on such an analysis and present its findings.

TrackMaster achieved its goal. It has developed a process by which a morning line can be generated on an automated basis that is more accurate than that currently being produced by the racetracks.

This paper will go into detail about the steps taken as mentioned above and describe what next steps are required to take the work that has been done to date and make it into a commercially viable product. Some of this paper gets a little technical in terms of statistical analysis. It errs on the side of detail, so there is an accurate historical account of the methodology used and results obtained. The important conclusion though will be born out simply in some basic measures of accuracy, which are overwhelming in demonstrating the achievement of the TrackMaster methodology to compute morning lines more accurately, on average, than humans do. Furthermore, beyond the obvious benefit of greater accuracy, computer generated morning lines are by definition more consistent than humans can do, will be perfectly "balanced", are delivered without bias, would be delivered more timely, and would generally be delivered more reliably.

Basic Measurement System

The first thing that needed to be done was to set up a measurement system that would indicate the relative performance of the track-based morning line ("ML") and the TrackMaster-based morning line ("TL"). The best way to measure the effectiveness of the ML would involve the difference between the ML and the off odds. Similarly, the best way to measure the effectiveness of the TL would involve the difference between the TL and the off odds. The average difference could be one meaningful measure, but if the lines were balanced to start with, the average difference would be close to zero, assuming no scratches, so measuring the average difference would not be completely telling. What would be telling, would be measuring the spread of the differences - but the differences of what? Is a line that has a horse at 5/1 with off odds of 10/1 more or less accurate than one that has a line of 1/2 that goes off at 7/5?

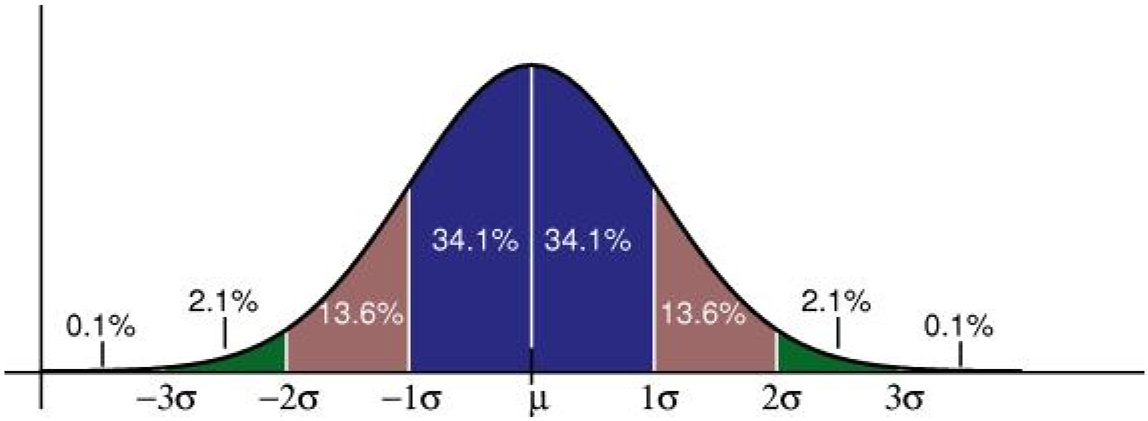
TrackMaster established a scale of "levels". Each level is one "step" up or down the table of industry-accepted standard odds levels as they appear on tote boards around the county. This table is attached as Exhibit One. In the above example, 5/1 is level 18 and 10/1 is level 23. So a 5/1 ML horse off at 10/1 would have a difference of 5 levels. 1/2 is level 3 and 7/5 is level 8. So a 1/2 ML horse off at 7/5 would have a difference of 5 levels as well. In these two cases, we would conclude that the ML maker did an equally proficient job in these two cases, each being "wrong" by 5 levels.

Now that we have a scale to measure the difference between ML odds and off-odds, we can build a frequency distribution. Each "bin" represents the difference between the ML odds level and the off odds level. Since there are 29 odds levels (see Exhibit One), these bins could in theory range from –28 to +28. If the line maker established a horse's ML at 1/5 (level 1) and the horse went off at 50/1 (level 29), the difference would be -28. The overall distribution would tally how many races would fall into each "bin". On their own, scratches would account for some degree of the variance. One *could* only examine races where there were no scratches to eliminate this variance, but since we are comparing the ML to off odds differential (also referred to in this paper as "delta" or " Δ"), against the TL to off odds differential, the scratches will be similarly included in both, so there is no need to eliminate such races.

Once we build a frequency distribution, we can get to the key measurement that we seek. We need to measure the spread of this data as well as the average of the differences. The more the spread, the worse the ML's or TL's "fit" with the off odds. The less or narrower the spread, the better job the ML or TL did in predicting the off odds.

Statistically speaking, we measure this spread by a single number called the standard deviation. In probability and statistics, the standard deviation is the most common measure of statistical dispersion. Simply put, standard deviation measures how spread out the values in a data set are. More precisely, it is a measure of the *average difference* between the values of the data in the set. If the data points are all similar, then the standard deviation will be low (closer to zero). If the data points are highly variable, then the standard variation is high (further from zero).

Also, if the distribution is "normal" (a statistical term which basically means a normal bell shaped curve), then about 68% of the points will lie within 1 standard deviation of the mean, 95% will lie with 2 standard deviations of the mean and 99.7% will lie within 3 standard deviations of the mean. The following diagram depicts these key ranges (the Greek symbol sigma or "σ" means standard deviation and the Greek symbol mu or "μ" means average).



Simply stated, if the distribution of the difference between the TL and off odds deltas is more tightly distributed (smaller standard deviation) than the difference between the ML and off odds, then we have achieved a better morning line.

Morning Line Influence on Off Odds

This paper asserts that the ML has an influence on off odds. All one has to find is one person making one bet all year where the ML had some influence on this wagerer's decision to prove this statement correct. Since the author has personally experienced this, the statement is true. The question is: how much of an influence does it have?

This is important in the measurement system as if there is any influence at all, then the ML distribution would be tighter than the TM distribution if all other things were equal. Stated another way, whatever the TM distribution, it would have been tighter had it been the published line rather than the track-produced morning line.

There are three ways that TrackMaster could conceive of to even attempt to measure this effect.

1. Find a study that has been completed. Such a study could be one where a line maker for one year came up with his line, then say pushed all horses above 5/1 up one step from where his first line was, and then all below 5/1 down one step from where his first line was. Then, in the next year, he published his original, "true" morning line and measured the distributions of the differentials (standard deviations) between the two years. In this case, one could exactly measure, on average, how many "levels" the final odds were influenced by the morning line. TrackMaster searched for a study like this or any other kind of study that approached this subject. None existed that could be located.
2. Conduct a survey of industry experts. This is exactly what we did in the thoroughbred industry in 2006. There is no reason to believe the responses would be different today for harness racing. Four questions were asked which are included in Exhibit Two. Handicappers, chart callers and racing secretaries were included. The results are based on roughly 20 respondents. <u>The consensus was that off odds are influenced by the ML</u>. The degree varied and most agreed that

the influence was greater in certain kinds of races, generally races where there was less information available to the public (e.g., 2-year old maidens). On average, the experts said that the ML influenced the off odds by roughly one-half of one level. We will discuss later how this observation can be quantified and integrated into the overall analysis.

3. Use deductive reasoning combined with expectations relative to certain types of races. Using this method, one would formulate a simple hypothesis that one was reasonably certain was true. For example, a morning line maker will be more accurate in predicting the off odds of older horses in a non-maiden race than horses in a three-year old maiden race, due to the lack of information on the latter relative to the former. This is precisely what TrackMaster did when reviewing data for the Thoroughbred industry. In a review of over 214,000 dirt races for older horses run from June to December of 2005, the ML to off odds standard deviation ("SD") was almost the same for the 13,200 dirt races for three year olds run during that same period. Given the lack of data available, we accepted this result, along with others quite similar, to support the notions that the experts had as listed in the point above, namely that off odds are influenced by the ML

The quantification of this phenomenon is discussed later in this paper when we discuss overall results.

Basic Methodology - Overview

TrackMaster began by measuring the SD of the difference between the ML and the off odds for all races. This gave us a "target" to achieve. We felt if we could beat this SD directly, then whatever the ML influence on off odds really was, this influence would be "gravy". Data for the calendar year of 2011 was initially used in all parts of the project, and later, 2012 data was reviewed for any differences in outcomes (there were none).

The TL odds are simply derived from assessing the win probability of each horse in a race. By using a simple formula that includes the win probability and the take out, one can get directly to odds: Odds = (1 – Takeout – Win Probability)/Win Probability

So everything in the work was done to establish each horses (or entries) win probability, which was later converted to odds and then into the odds levels as discussed above for measurement.

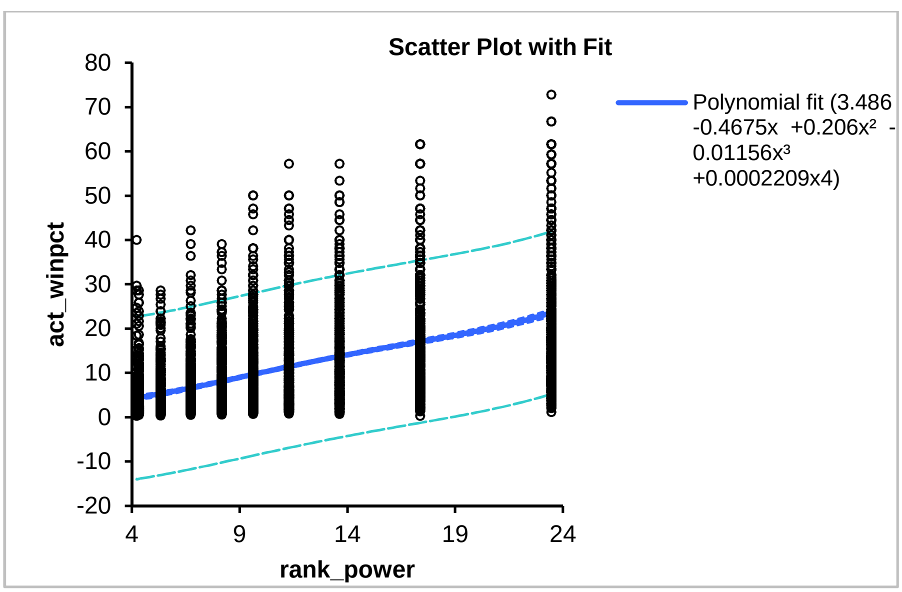
The fundamental method used to derive a formula to take pre-race horse data and derive from that a morning line was two-part regression analysis.

Two-Part Regression Analysis

Over the period of the project research phase, a total of about 75 variables were used as part of a two-part regression analysis. The first part took the off odds (converted to an equivalent implied win probability) as the dependent variable (the thing we are trying to predict) and regressed against each of the variables separately using a polynomial regression. The polynomial regression is a complicated notion, but essentially finds the best-fit curve (non-linear) for the one independent variable against the dependent variable. For those so inclined, polynomial regression is defined below (for those that don't have a head for statistics, read on as this understanding is not essential of the overall conclusion of this paper):

> *Used to predict values for a response variable (Y) based on a predictor variable (sometimes referred to as independent or X variable). The relationship between the X and Y variables must be curvilinear (curved line) with the number of inflexions (turns) in the curve indicated by the polynomial order.*
>
> *The curvilinear relation between the Y and X variables is expressed as: $y = a + bx + cx^2 + dx^3$ ... and so on up to the polynomial order. a is the y-intercept (where the regression line cuts the y-axis), and b, c, d (... and so on) are the partial regression coefficients.*

While graphical output is not needed (ultimately a formula is all that we need as output), this is what one such output would look like. The 4th order polynomial equation is what we used in this case to further our objective. In this example, we regress the horse's power rating ranking (x-axis labeled rank_power) against the off odds (converted to offWinPct on the y-axis labeled act_winpct). Another measure called the R-squared value tells how good the fit is (in this case, it is 0.28 which is just a fair fit). The r-squared value ranges from zero (no fit at all) to 1 (a perfect fit).



The first part of the two-part regression then was regressing separately each of the 75 variables against the off odds. This gave us the best independent fit polynomial formula for each of these variables. Each formula has constant and up to 4 coefficients that were put into a table for later computing.

The second part of the two-part regression was applying the polynomial formula to each of the 75 variables and then doing a linear regression on all 75 against the dependent variable of off odds. This essentially weights the relative importance of all variables against one another and comes up with coefficients for each variable that gives the best-fit final equation. The final equation would be of the form: Off Win Pct = constant + (coeff1 * PowerRatingRank) + (coeff2 * DriverROI) + ….. + (coeff75 * Variable75).

What I just described in the above two paragraphs took months to figure out and to run. When results were not satisfactory (the spread of the TL against the off odds was too great), we investigated more variables that might make sense to influence the off odds, and added them into the mix.

Furthermore, over time, the team understood that the relative importance of certain variables differed greatly with the conditions of particular races. For example, trainer's records might be much more of a factor in determining off odds in a 2-year old race than in an open claiming race for aged horses. So after many iterations, and balancing sample sizes (you need enough to make statistical sense) against the possible combinations of races, we landed on breaking the races up into nine distinct groups. Tracks were broken up into three sizes (small for 1/2 mile and below, medium for 5/8 and 3/4 mile tracks, and large for tracks larger than 3/4 miles (7/8ths, 1 mile and 1¼ mile tracks). Races were also broken up into three groups. These were two-year-old races (every horse in the race was two), "normal" raced races (every horse had at least 10 lifetime starts), and "lightly raced" races (where at least one horse had less than 10 lifetime starts). So between three track sizes and three race types, there were nine distinct sets of formulas that were derived.

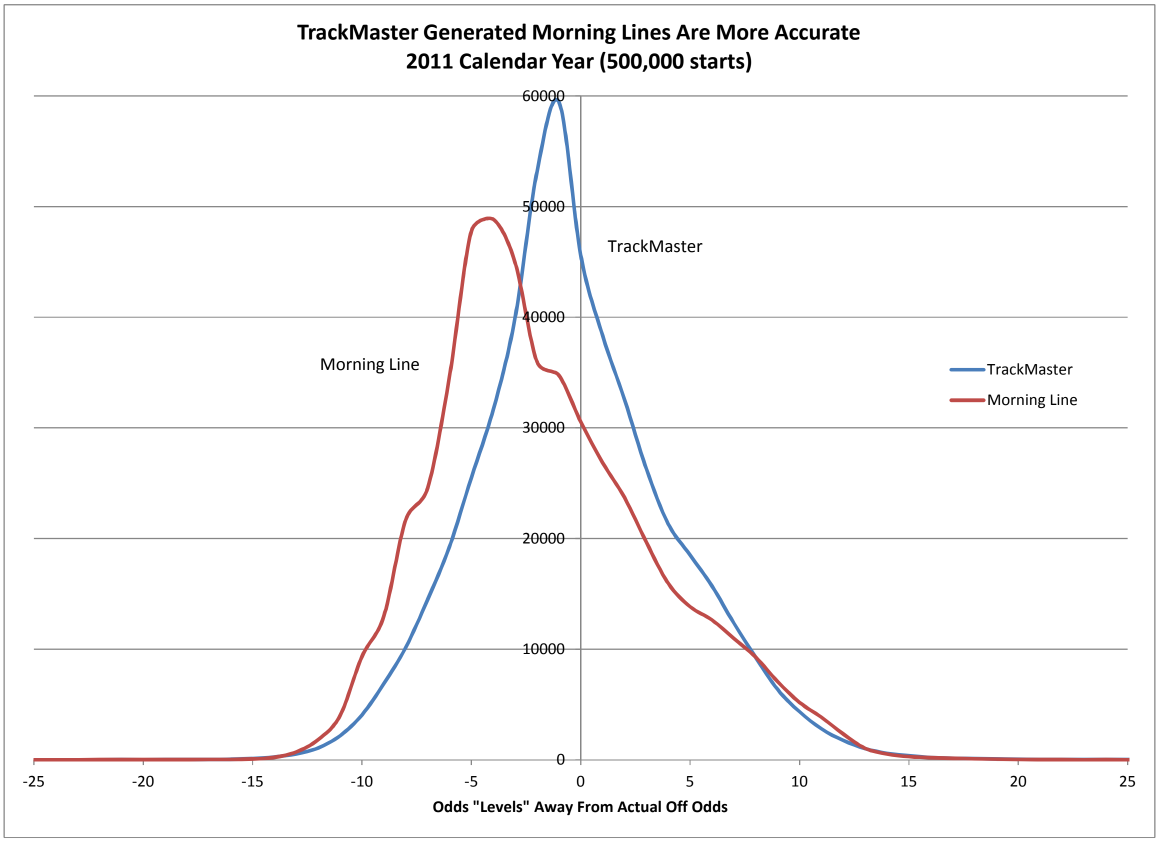
For each of these nine categories, polynomial regression was done on all 75 variables, and a linear regression done on the results of these. Needless to say a lot of numbers were crunched.

It is important to note that prior to the regressions being done, the data itself, all coming from TrackMaster "entry" (pre-race) files, had to be manipulated as results of the regressions were viewed. In many cases, ceilings and floor on the data were employed to keep results looking "reasonable". Moreover, data had to be altered to be meaningful for regressions on all starts as a single data set. For example, using Power Rating as a variable, one could not say a higher Power Rating should yield a lower morning line odds as any horse in a $50,000 claiming race would have a higher Power Rating than any horse in a $2,500 claiming race. In this example, we divided the Power Rating by the class rating of the race in question which then measures the relative strength of the horse to the field. Doing this then, all other things equal, the $50,000 claimer with a 100 Power Rating in a 100 class rated (1.00 ratio) race would be projected to have a lower morning line than a $2,500 claimer with a 70 Power Rating in a 60 class rated race (1.17 ratio). This type of technique is used throughout the modeling.

Results

Including about 500,000 races from January through December of 2011, the SD of the **ML was 5.04** (the SD once again is the Standard Deviation of the difference between the ML odds and the off odds). The SD of **TL was 4.53**. In a few words, this means we "beat" the morning line. And, this does not take into account the effect the ML has on the off odds. I will address that effect shortly. In addition, the ML was, on average, 1.60 "levels" off the off odds, where the TL was only 0.37 "levels" off

Visually, this is what that looks like. The line with the slight left tilt is the ML and the other the TL.



The graph's spread illustrates the "tighter" TM standard deviation calculated and referenced above. The x-axcis is the spread between the respective two lines against the off odds. The y-axcis measure how many races were in that spread category (the "bin" discussed earlier).

You will see by the results below that the TM calculated morning line is much close to the actual odds than the morning line is as that it a close to a "normal" distribution. In about 63% of the races, TrackMaster's line was within 4 levels of the off odds, there that occurred in only 46% of the races with the existing morning line.

	within 4 levels (~1 Standard Deviation)		within 9 levels (~2 Standard Deviations)	
	Races	Percent	Races	Percent
TL	316733	62.5%	479907	94.8%
ML	232379	45.9%	463642	91.6%
Total Races:		506410		

One could further wonder if there are certain types of races where TM is not as accurate as the morning line. As described earlier, we examined the data (and did related regression) on nine distinct groups of races: three track sizes and three levels of racing experience of the entrants. Reviewing the key measure of Standard Deviation, the following results are noteworthy. They show that the TM accuracy runs pretty consistently across all such groupings (as indicated by the TM "Edge" column which is simply the difference between the ML and TM standard deviations).

2011 Data Summary By Race Type						
Race Type	**Starts**	**ML Average**	**TM Average**	**ML Std Dev**	**TM Std Dev**	**TM "Edge"**
2 Yr Old	18345	-1.85	-0.56	5.34	4.61	0.73
Light Race	109755	-1.68	-0.37	5.14	4.64	0.50
All Others	378310	-1.56	-0.36	5.00	4.49	0.51
** All **	506410	-1.60	-0.37	5.04	4.53	0.51

2011 Data Summary By Track Size						
Track Size	**Starts**	**ML Average**	**TM Average**	**ML Std Dev**	**TM Std Dev**	**TM "Edge"**
Small	232833	-1.64	-0.29	5.20	4.70	0.50
Medium	178881	-1.50	-0.40	5.04	4.41	0.63
Large	94696	-1.67	-0.49	4.63	4.30	0.33
** All **	506410	-1.60	-0.37	5.04	4.53	0.51

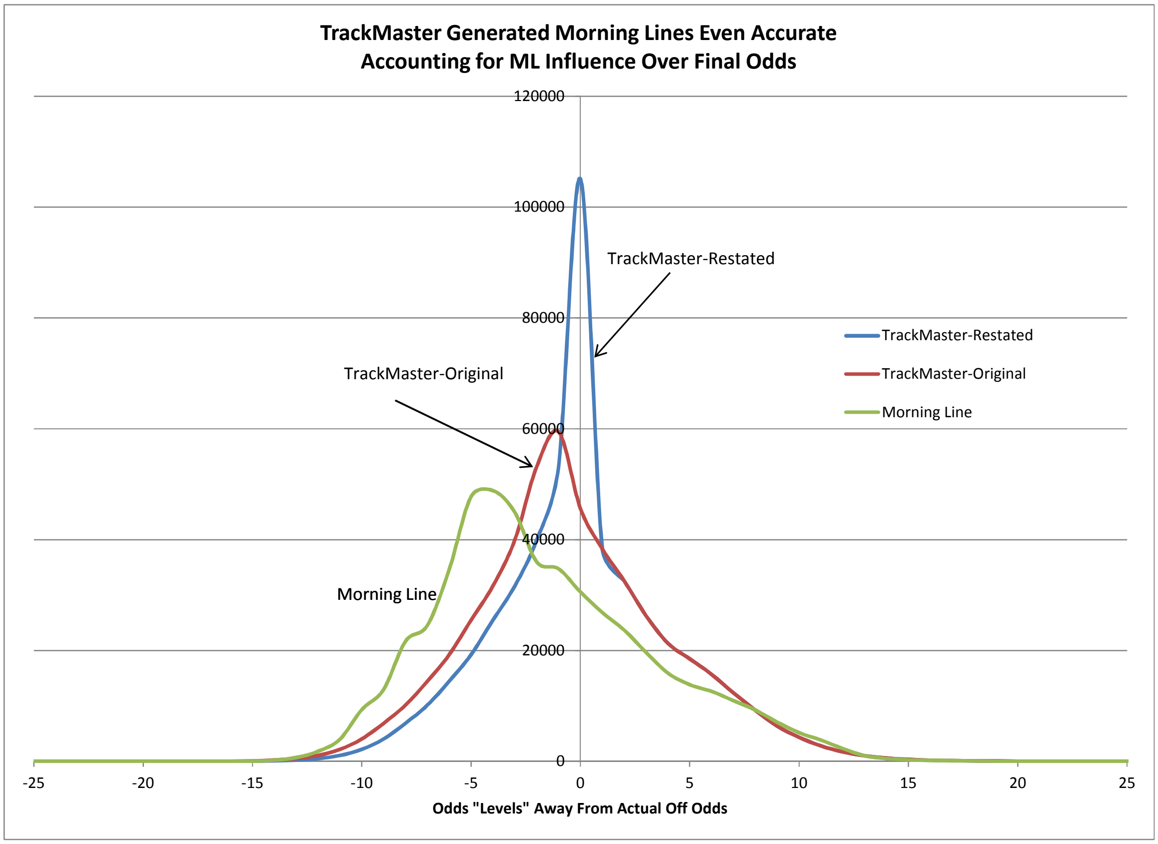
One could still wonder further if from track-to-track TM has an edge. With 83 tracks in our sample, it would be tough to show in all 83 cases we were superior. But the numbers show that more than 90% of the starts are associated with tracks where our numbers were superior as measured by standard deviation as well as average difference). This track data is included as Exhibit 3. Please be reminded that none of the track-to-track or other data discussed above accounts for the influence of the ML odds on the final odds. That subject is addressed now.

Results with ML influence

What is frankly amazing is that these clearly superior results were achieved without allowing for the influence the ML has on the off odds. As discussed earlier, both our survey and data-related evidence shows that it has some influence. The issue is how to properly quantify that influence so we would know what frequency distribution to have expected had the TL been the actual morning line. The survey indicated that the average effect was approximately one-half an odds level. We are certain that the real answer, on average, is between 1/10th level and 1 odds level. We can "re-state" the resulting TrackMaster-generated lines taking into account a 0.5 level "improvement" based on this influence. The already solid results look that much better:

	within 4 levels (~1 Standard Deviation)		within 9 levels (~2 Standard Deviations)	
	Races	Percent	Races	Percent
TL	316733	62.5%	479907	94.8%
TL-restated	348386	68.8%	486783	96.1%
ML	232379	45.9%	463642	91.6%
Total Races:		506410		

Graphically, one sees the revised TM line exhibiting far less spread then even before:

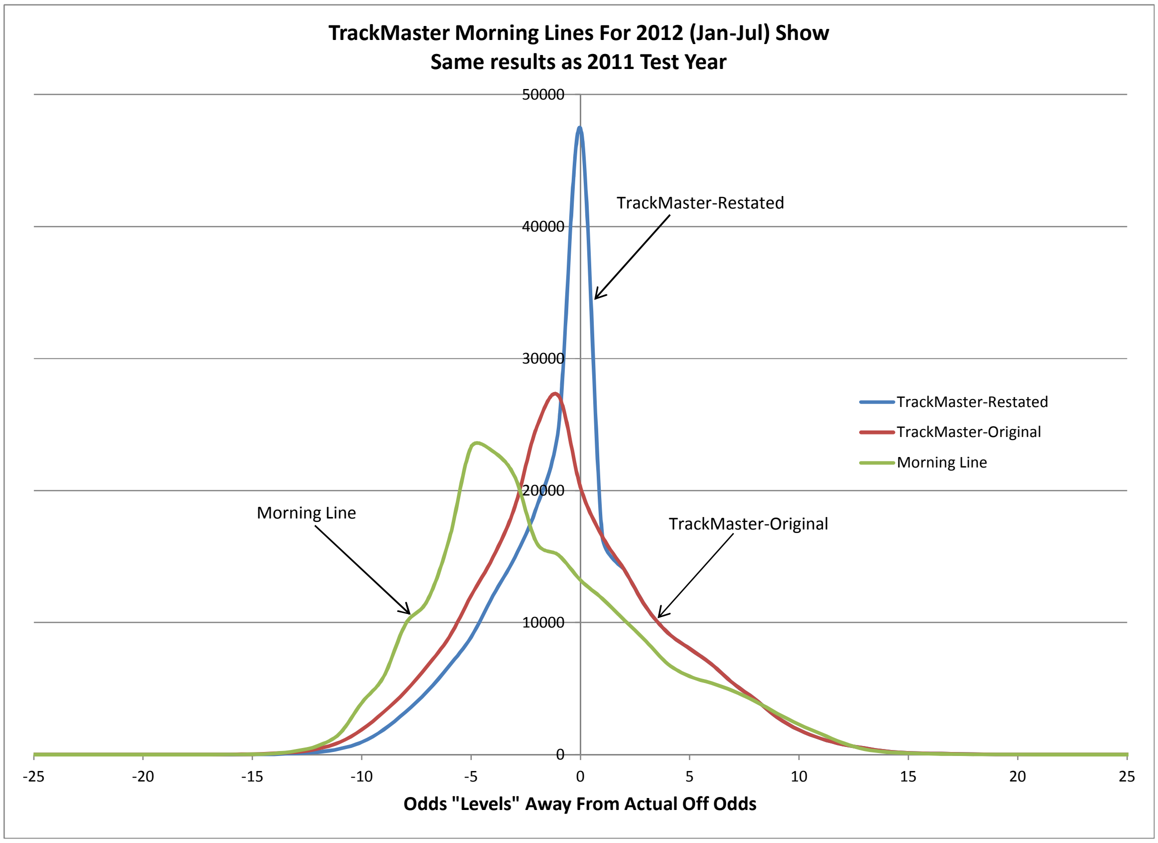


Results – Extension of Model into 2012

As mentioned, roughly 500,000 starts were used in the regression analysis for 2011. The question the arises that if we were to use the same model derived from 2011 data and applied it to 2012, would the results "hold up"? The answer is an emphatic "yes". As the chart below depcits, the results were almost identical. This tells us the model and technique works, and works exceptionally well.

	within 4 levels (~1 Standard Deviation)		within 9 levels (~2 Standard Deviations)	
	Races	Percent	Races	Percent
TL	141961	62.1%	216618	94.8%
TL-restated	156903	68.7%	219847	96.2%
ML	102877	45.0%	210340	92.1%
Total Races:		228457		

The frequency distribution graph visually depicts the 2012 results indicating TrackMaster's greater accuracy without and with the restatement of the morning line effect on off-odds.



Conclusions

- The TrackMaster-generated morning line odds currently can clearly outperform racetrack-generated morning line odds based on measurement systems established by TrackMaster.
- Taking into account the effect the ML odds has on off odds, this performance is likely much more significant than demonstrated through testing.
- TrackMaster reviewed the data track to-track. While more varied, the TM-created lines being by and large more accurate than human-created lines.

Next Steps

The data that was used for testing came 100% from the TrackMaster Plus data file, a file that is produced currently from the final program received from the USTA (and Standardbred Canada). Since the TrackMaster Plus files are generated well after morning lines are produced, obviously a TM-Plus-like file would have to be constructed in some way that fit into the real world timing of the race office and the USTA.

TrackMaster would imagine that the final “product” involve the real time transmission of an entry file like we receive today. TrackMaster would process the file and through some kind of web service, send the completed morning lines back to the track via the USTA. Tracks that would want to review or edit the lines, would then do so and submit the final files as they do today. There would be some delay (to be determined) from the time they submitted their “pre-ML file” to the time they received the lines back. Tracks that will accept the TM-created lines would not have to wait for any returned data.

The particulars of these actions to move implementation require serious discussion with the USTA and would require some investment on their part to update their systems to work with TrackMaster, which also would need to make an investment to get this process fully automated.

Exhibit 1
Odds Levels

Level	Decimal Odds Range	Tote Odds
1	Decimal Odds > 0 and Decimal Odds < 0.3	1/5
2	Decimal Odds >= 0.3 and Decimal Odds < 0.45	2/5
3	Decimal Odds >= 0.45 and Decimal Odds < 0.55	1/2
4	Decimal Odds >= 0.55 and Decimal Odds < 0.7	3/5
5	Decimal Odds >= 0.7 and Decimal Odds < 0.9	4/5
6	Decimal Odds >= 0.9 and Decimal Odds < 1.1	1/1
7	Decimal Odds >= 1.1 and Decimal Odds < 1.3	6/5
8	Decimal Odds >= 1.3 and Decimal Odds < 1.45	7/5
9	Decimal Odds >= 1.45 and Decimal Odds < 1.55	3/2
10	Decimal Odds >= 1.55 and Decimal Odds < 1.7	8/5
11	Decimal Odds >= 1.7 and Decimal Odds < 1.9	9/5
12	Decimal Odds >= 1.9 and Decimal Odds < 2.25	2/1
13	Decimal Odds >= 2.25 and Decimal Odds < 2.75	5/2
14	Decimal Odds >= 2.75 and Decimal Odds < 3.25	3/1
15	Decimal Odds >= 3.25 and Decimal Odds < 3.75	7/2
16	Decimal Odds >= 3.75 and Decimal Odds < 4.25	4/1
17	Decimal Odds >= 4.25 and Decimal Odds < 4.75	9/2
18	Decimal Odds >= 4.75 and Decimal Odds < 5.5	5/1
19	Decimal Odds >= 5.5 and Decimal Odds < 6.5	6/1
20	Decimal Odds >= 6.5 and Decimal Odds < 7.5	7/1
21	Decimal Odds >= 7.5 and Decimal Odds < 8.5	8/1
22	Decimal Odds >= 8.5 and Decimal Odds < 9.5	9/1
23	Decimal Odds >= 9.5 and Decimal Odds < 10.5	10/1
24	Decimal Odds >= 10.5 and Decimal Odds < 13.5	12/1
25	Decimal Odds >= 13.5 and Decimal Odds < 17.5	15/1
26	Decimal Odds >= 17.5 and Decimal Odds < 22.5	20/1
27	Decimal Odds >= 22.5 and Decimal Odds < 27.5	25/1
28	Decimal Odds >= 27.5 and Decimal Odds < 40.0	30/1
29	Decimal Odds >= 40.0 and Decimal Odds < 900	50/1

Exhibit 2a
Morning Line Influence on Off Odds
Survey Questions

QUESTION ONE

Assume that a morning line odds maker lists all of the choices that he believes will go off at 3/1 as 3/1 and on average, they end up going off at 3.0 to 1. If the same line maker lists those 3/1 horses as 6/1 in the morning line, what do you believe the average odds will now be for the same horses? Will they still be 3.0 to 1, or will the morning line odds have some influence on the off odds? (Answer can't be a range, must be exact, for example 3.2 to 1 or 3.5 to 1, etc.)

QUESTION TWO

The morning line odds maker lists a horse at 3/1 and the horse goes off at odds of 20/1. How much higher, if any amount, do you believe that on average, the odds would have been had the horse been listed at 20/1. Please give your answer in an odds format as in the first question. If you believe it makes no difference, then answer 20.0 to 1. (Answer can't be a range, must be exact, for example 21.2 to 1 or 25.0 to 1, etc.)

QUESTION THREE

Do you think the morning line has more relative influence on off odds in maiden races with mostly first-time starters than in non-maiden races? This can be answered yes or no and feel free to add any commentary.

QUESTION FOUR

Do you think the morning line has any influence on any horse's off odds in any kind of race? This can be answered yes or no and feel free to add any commentary letting us know what kind of influence, what kind of races or what kind of horses or situations.

Exhibit 2b
Morning Line Influence on Off Odds
Survey Participants

Name	Title
Phil O'Hara	President/CEO of Equibase
Jack Kelly	Equibase Eastern Region Field Supervisor
David Haydon	President Incompass
David O'Neill	Equibase Product Development Manager
Chuck Scaravilli	Equibase Vice President of Track & Field Operations
Doug Bredar	Racing Secretary
Eric Johnston	Racing Secretary
Jim Ralph	Racing Secretary
Jim Quinn	Handicapper
Rick Needham	Handicapper
Ellis Starr	Handicapper
Steve Mancine	Handicapper
Dave Johnson	Handicapper
Jeff Taylor	Equibase Chart Caller
Arnie Metz	Equibase Chart Caller
Rich McCarthy	Equibase Chart Caller
Charles Streva	Equibase Chart Caller
Michael Schneider	Equibase Chart Caller
Darryl Hove	Equibase Chart Caller
David Basler	Equibase Chart Caller
Lewis Zagnit	Equibase Chart Caller
Gary Norton	Equibase Chart Caller

Exhibit 3
Track by Track Results
(without regard to influence of Morning Line on off-odds)

2011Data Summary By Track						
Track	Starts	ML Average	TM Average	ML Std Dev	TM Std Dev	TM "Edge"
ACES	2918	-1.76	-0.56	5.22	4.46	0.76
AD	5626	-2.76	0.58	5.26	4.56	0.70
BANG	3687	-1.71	-0.70	5.62	4.81	0.81
BGD	854	-0.28	-0.09	5.79	5.70	0.09
BMLP	14179	-1.28	-0.57	4.77	4.14	0.63
BR	8961	-1.44	-0.54	4.68	4.22	0.46
BTVA	6674	-1.27	-0.50	4.67	4.45	0.22
CALX	10986	-1.51	-0.56	3.85	4.05	-0.20
CHRTN	7492	-1.15	0.52	5.20	4.92	0.28
CHST	15957	-1.07	-0.96	5.81	4.63	1.18
CLNTN	1764	-0.98	0.66	4.82	5.08	-0.26
CNL	2624	-1.21	-0.38	5.34	4.29	1.05
CUM	518	-2.12	-0.06	5.40	4.55	0.85
DD	15485	-1.69	-0.82	4.73	4.47	0.26
DELA	580	-1.25	-0.76	5.26	4.57	0.69
DRES	1819	-0.25	0.74	5.37	5.61	-0.24
DUQ	236	-0.45	-0.61	5.33	4.25	1.08
EPR	1604	1.44	2.29	7.02	6.80	0.22
FARM	489	-2.03	-0.07	5.52	5.39	0.13
FHLD	9155	-1.86	-0.92	5.61	4.59	1.02
FLMD	18798	-2.27	0.29	5.08	4.44	0.64
FRD	6097	-1.65	-0.68	4.32	4.21	0.11
FRDTN	1287	0.31	1.52	5.64	5.31	0.33
FRYBG	438	-2.07	0.13	4.63	4.34	0.29
GEOD	9374	-2.05	0.29	5.25	4.60	0.65
GRVR	6912	-0.79	0.12	4.71	4.76	-0.05
HAR	11305	-2.18	-0.81	5.33	4.55	0.78
HNVR	2703	-3.07	0.58	5.24	4.85	0.39
HOP	9354	-2.14	-0.24	4.34	3.95	0.39
HP	5145	-1.49	-0.47	4.71	4.01	0.70
INDY	9104	-1.97	-0.36	4.67	4.06	0.61
INVRN	1764	-1.18	1.42	5.21	5.32	-0.11
KD	8482	-3.30	0.09	5.19	4.61	0.58
LEB	4967	-1.25	-0.57	4.71	4.43	0.28
LEX	2738	-1.65	-0.90	4.71	4.84	-0.13
LON	10901	-1.25	-0.06	4.55	4.63	-0.08
M	8202	-1.47	-0.75	4.40	4.37	0.03
MARI	63	0.19	-0.97	5.03	5.20	-0.17
MAY	9890	-1.12	-0.72	4.81	4.37	0.44
MCCNL	35	0.86	-1.17	5.65	5.43	0.22
MEA	25089	-1.35	-0.62	5.02	4.23	0.79
MOH	9629	-1.70	-0.78	4.51	4.42	0.09

MR	19615	-2.49	-0.43	5.46	4.40	1.06
NFLD	23445	-1.98	-0.74	5.23	4.59	0.64
NOR	5863	-2.82	-0.50	5.01	4.34	0.67
NP	2589	-1.19	-0.62	3.83	4.05	-0.22
NTSD	2696	-2.06	1.44	5.70	5.51	0.19
OD	3066	-1.30	-0.54	5.24	4.64	0.60
OWASH	63	1.46	-0.27	5.56	4.55	1.01
OXFD	376	-2.05	-0.26	5.40	5.51	-0.11
PCD	16525	-1.54	-0.42	4.83	4.28	0.55
PPK	13336	-1.44	-0.50	4.76	4.42	0.34
PRC	5708	-1.32	-0.49	5.08	4.51	0.57
PRES	232	-0.69	-0.31	5.09	4.78	0.31
PRM	747	-1.25	-0.89	5.08	5.31	-0.23
QUE	1513	-3.31	-0.70	6.60	5.22	1.38
RCR	1443	-1.63	-0.42	5.59	5.15	0.44
RIDC	18607	-0.91	0.18	5.24	4.36	0.88
RP	3965	-1.49	-0.33	5.07	4.15	0.92
SAR	4103	-0.86	0.67	4.77	4.83	-0.06
SCAR	8579	-2.74	-0.70	5.87	4.76	1.11
SCD	5207	-1.84	-0.54	4.93	4.21	0.72
SKOW	519	-2.39	-0.71	5.64	4.82	0.82
SPCK	3865	-2.21	-0.26	5.22	4.07	1.15
SPR	392	-0.35	-0.44	5.27	4.14	1.13
STGA	16968	-1.82	-0.78	4.72	4.56	0.16
STJNS	514	1.47	2.83	6.13	6.28	-0.15
SUDBY	4474	-1.80	0.23	4.53	4.61	-0.08
SUMM	2818	-1.08	0.55	5.13	4.87	0.26
TGDN	5223	-1.55	-0.90	4.73	4.26	0.47
TOPS	319	-1.73	-0.46	5.76	5.27	0.49
TRR	488	4.24	4.00	7.98	8.25	-0.27
TRURO	2978	-0.51	1.37	5.99	5.75	0.24
UNION	260	-1.84	-0.45	5.77	4.76	1.01
VD	7876	-1.01	-0.32	5.03	4.46	0.57
WDB	13003	-1.77	-0.69	4.49	4.43	0.06
WIND	622	-2.17	-0.36	5.60	4.35	1.25
WMR	224	-0.09	1.60	6.02	5.31	0.71
WODSK	1792	-0.08	0.85	5.50	5.33	0.17
WODST	194	0.93	1.61	5.80	4.76	1.04
WR	8909	-1.14	-0.10	4.54	4.35	0.19
YR	22560	-0.77	-0.75	4.68	4.47	0.21
YRKTN	849	-0.72	-0.65	4.76	4.54	0.22
* All*	506410	-1.60	-0.37	5.04	4.53	0.51