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Statistics Going to the Dogs

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Summary This article discusses a real life example of statistics in gambling

INTRODUCTION

The use of statistics is now so pervasive, that teachers should never be short of an example from the media to stimulate discussion and generate problems. By using such examples, students can be shown the relevance of statistics to everyday life, while learning the technical skills required by the syllabus. Gambling and sport are two areas of application that are of interest to students. Croucher (2000) discusses the attraction to students of a course concentrating on these two areas. With the growth of opportunities for betting on sport, this combination of sport and statistics is also providing increasing opportunities for employment of statisticians. For example, an advertisement from The Melbourne Age on the 12 October requires a Sports Analyst whose duties include 'research of current sporting statistics, risk management and forecasting'. A week later, a betting agency advertised for a Business Statistician ‘responsible for the mathematical analysis of all current and new games’. The use of examples from this area might not only motivate students, but also give them some idea of the interesting jobs that require statistics knowledge. In this case we examine a betting pool manipulation reported in the Australian press (Wilson, 2000).

THE STING

A group of punters based in Brisbane managed to manipulate the dividends to its advantage by staging a massive bet 18 seconds before race start at a Sydney greyhounds meeting. The $730,000 wager was made in what was reported as an ingenious sting, which exploited a loophole in the betting rules. The large bet netted the gambling syndicate a paper profit of $180,000, but payment has been withheld pending an investigation. What originally caught our attention was that the sting was reported as a sure thing - the syndicate couldn't lose. Students should always be taught to beware the sure thing, and an analysis shows things could have gone very differently. While the syndicate had the odds on their side, they could still have lost a considerable amount of money.

Like all real problems this can be tackled at several levels depending on the students’ statistical expertise. Here we first analyse what usually happens, then what actually happened due to an anomaly in the rules, then look at what could have happened, and finally suggest some further ideas for exploration.
THE TOTALISATOR

In Australia, there are currently two legal forms of betting on Greyhounds; the first is to use bookmakers, and the second is to bet on a totalisator system. A bookmaker offers fixed odds. For example, a punter who bets $1 on a greyhound at 6 to 1, will receive $6 plus his own $1 back if the selection wins. Thus he receives $7 in all, and this is usually referred to as paying a dividend of $7. The bookmaker is estimating that the true probability of the greyhound winning (or more correctly, the proportion of the punters who bet on that greyhound) is less than 1/7, so on average the bookmaker will return less than $1 and make a profit. Of course, on particular races, a loss may be made if more punters than the bookmaker expected bet on the winning greyhound. The totalisator system was devised to ensure the bookmaker always makes a profit, and is used by most government betting agencies. The system works in a manner similar to many lotteries where the prize money is divided between the winners, and so the size of the payout is not pre-determined, but depends on the number of winners. For example, if the total of all bets is $1000, the totalisator takes a fixed percentage (in this instance 14%), leaving $860 as a dividend pool to be returned to the winning punters. If 100 people bet on the winner, the dividend would be $860/100 = $8.60. If 200 people bet on the winner, the dividend would drop to $860/200 = $4.30. Note that a disadvantage of this system for the punter is that he is not sure until the start of the race, what the dividend will be. (A great way to teach how totalisators operate is to run a race meeting with a class, using sweets as money).

In this article, we are specifically interested in place (also known as show) betting, where a bet wins if the selected greyhound finishes either first, second or third. In this case the dividend pool is divided into three equal amounts, one for each placegetter. Table 1 shows the calculations for a hypothetical example.

<table>
<thead>
<tr>
<th>Runner position</th>
<th>Total Bet $</th>
<th>Dividend per $1 bet</th>
<th>Total Punters return $</th>
<th>Dividend with money back guarantee $</th>
<th>Total Punters return with money back guarantee $</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>1,984</td>
<td>1.15</td>
<td>2,282</td>
<td>1.15</td>
<td>2,282</td>
</tr>
<tr>
<td>2nd</td>
<td>2,535</td>
<td>0.90</td>
<td>2,282</td>
<td>1.00</td>
<td>2,535</td>
</tr>
<tr>
<td>3rd</td>
<td>507</td>
<td>4.50</td>
<td>2,282</td>
<td>4.50</td>
<td>2,282</td>
</tr>
<tr>
<td>4th</td>
<td>1,240</td>
<td>1.84</td>
<td>0</td>
<td>1.84</td>
<td>0</td>
</tr>
<tr>
<td>5th</td>
<td>600</td>
<td>3.80</td>
<td>0</td>
<td>3.80</td>
<td>0</td>
</tr>
<tr>
<td>6th</td>
<td>1,014</td>
<td>2.25</td>
<td>0</td>
<td>2.25</td>
<td>0</td>
</tr>
<tr>
<td>7th</td>
<td>51</td>
<td>44.75</td>
<td>0</td>
<td>44.75</td>
<td>0</td>
</tr>
<tr>
<td>8th</td>
<td>29</td>
<td>78.69</td>
<td>0</td>
<td>78.69</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>7,960</td>
<td>6,846</td>
<td>7,099</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Dividend and return to punters for bets totaling $7960.
Dividend pool = 86% * $7960 = $6846.

The second column shows the total amount bet on each greyhound for a place by all the punters. In all a grand total of $7,960 was wagered. The totalisator operators take 14%
profit, leaving $6,846 as the dividend pool to return to punters. This pool is split into equal lots of $2282 for the first, second and third placegetters. The punters are actually waging against each other for this pool, and the dividend for each greyhound is simply calculated by dividing $2282 by the total bet on each greyhound. So for the above case, the dividend for the first placed greyhound is $2,282/1984 = $1.15 for each $1 bet. This is displayed in the third column. For completeness we have shown the dividend that would have applied for each of the other greyhounds. This column would normally be displayed electronically in betting shops, so punters know the approximate dividend each greyhound will pay. These dividends change as bets are placed. Of course, only the dividends on the three placegetters are actually paid, and the totals returned to punters are shown in column 4.

Note that so many punters bet on the second greyhound, the dividend is less than $1. Unlike a lottery, which has millions of possible outcomes, a greyhound race has only 8 runners. In some cases where there is a hot favourite and a high proportion of punters bet on the same outcome, a winning ticket may actually return less than the bet, as seen in Table 1. In the case above, the punters who bet on the second placegetter would lose $0.10 even though they had a winning bet. Punters tend to get upset when they pick the winner, but get back less than they invested. To avoid this some totalisator systems forgo some of their profit, and guarantee that winning bets will at least get their money back. In the event of a dividend being calculated by the totalisator to return a loss to the punter, the gaming authority will guarantee a $1 return, so that punters will at least get their money back. The last two columns in Table 1 reflect the outcomes of the totalisator with the guarantee in place. The agency still makes a profit of $861, $253 less than if the guarantee was not in place.

The syndicate’s scheme was devised to take advantage of this money back rule. In this case, it was the way the guarantee was implemented on the dividend pool by the Totalisator Agency Board (TAB) that provided the opportunity for the sting.

This is what happened. For a race to have three place returns requires a minimum of 8 runners, which is the maximum number racing at one time in Australian greyhound meetings. This was the case here, and the syndicate wagered with the TAB place bets (1st, 2nd or 3rd) of $350,000 on the first and second favourite in the race, and $5,000 on the remaining six runners. Their total outlay was $730,000, and with no rules in place to deter this type of betting pool manipulation, the bets, submitted via phone accounts, were taken 18 seconds before race time. This did not allow time for the other punters to react to the large changes in dividends the bets produced.

ANALYSIS

The amount bet by other punters was less than $2000, so we can effectively ignore the other punters in the analysis. After removing the gaming authority’s 14%, the dividend pool was approximately $630,000, giving $210,000 for each placegetter. The calculations are shown in Table 2.
Table 2. Dividend and return to the syndicate for a dividend pool of $630,000.

<table>
<thead>
<tr>
<th>Runner position</th>
<th>Syndicate bet $</th>
<th>Return per $1 without guarantee $</th>
<th>Syndicate return $</th>
<th>Return per $1 with guarantee $</th>
<th>Syndicate Return $</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>350,000</td>
<td>0.60</td>
<td>210,000</td>
<td>1.00</td>
<td>350,000</td>
</tr>
<tr>
<td>2nd</td>
<td>5,000</td>
<td>42.00</td>
<td>210,000</td>
<td>42.00</td>
<td>210,000</td>
</tr>
<tr>
<td>3rd</td>
<td>350,000</td>
<td>0.60</td>
<td>210,000</td>
<td>1.00</td>
<td>350,000</td>
</tr>
<tr>
<td>4th</td>
<td>5,000</td>
<td>42.00</td>
<td>210,000</td>
<td>42.00</td>
<td>210,000</td>
</tr>
<tr>
<td>5th</td>
<td>5,000</td>
<td>42.00</td>
<td>210,000</td>
<td>42.00</td>
<td>210,000</td>
</tr>
<tr>
<td>6th</td>
<td>5,000</td>
<td>42.00</td>
<td>210,000</td>
<td>42.00</td>
<td>210,000</td>
</tr>
<tr>
<td>7th</td>
<td>5,000</td>
<td>42.00</td>
<td>210,000</td>
<td>42.00</td>
<td>210,000</td>
</tr>
<tr>
<td>8th</td>
<td>5,000</td>
<td>42.00</td>
<td>210,000</td>
<td>42.00</td>
<td>210,000</td>
</tr>
<tr>
<td>Total</td>
<td>730,000</td>
<td>630,000</td>
<td>910,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Without accounting for the minimum $1 back guarantee, the dividend pool was equally divided amongst the first, second and third placegetters. This meant that the two favourites were paying approximately 60 cents for a $1 bet, whilst the other greyhounds were paying about $42.

As it turned out, the winner was Autobahn Lizzie, on which the syndicate had bet $350,000. The third placegetter was Ivory Dancer, on which the syndicate also had bet $350,000. The second placegetter was one of the six outsiders on which $5,000 was placed.

Thus under normal totalisator operational rules, the syndicate would have won $350,000 \times 0.60 + 350,000 \times 0.60 + 5,000 \times 42 = $630,000 for a loss of $100,000. However, because of the TAB guarantee that winning bets return at least $1, they won $350,000 \times 1 + 350,000 \times 1 + 5,000 \times 42 = $910,000 for a profit of $180,000. The profit to the syndicate and the shortfall to the TAB is some $180,000. As a consequence, the return was frozen and the system changed soon after to detect large pool manipulations, or indeed any large bets. One of the justifications given for moving against the syndicate was that their actions disadvantaged other punters. Students might like to investigate whether all punters are disadvantaged. On the face of it, injecting an additional $180,000 into the prize pool hardly seems a disadvantage to the punters.

All the publicity on the case indicated the syndicate was on a sure thing - they could not lose. However this is clearly not the case - the syndicate had their share of luck in that both the greyhounds on which they placed large stakes finished in the first three. What if one or both of these had missed a place? If only one manages to finish in a place the syndicate wins $350,000 \times 1 + 5,000 \times 42 + 5,000 \times 42 = $770,000 for a profit of $40,000. But if both miss a place the syndicate wins $5,000 \times 42 + 5,000 \times 42 + 5,000 \times 42 = $630,000 for a loss of $100,000.

The analysis at this stage involves little more than an understanding of how totalisators work, and simple arithmetic. It would form a useful exercise for early secondary classes.
INTRODUCING STOCHASTICITY

Probability can easily be introduced by investigating the chances of the syndicate making a profit. Would such a scheme be a good investment? To answer this we need to calculate the probability of the three possible outcomes – 0, 1 or 2 of the two favourites gaining a place. This requires assumptions about the probability for each particular greyhound running a place.

In the case of all greyhounds having an equal chance, we have a simple hypergeometric calculation. If \( X = \) the number of the two favourites running a place, then

\[
\begin{align*}
\text{Probability of both in placegetters:} \quad P(X = 2) &= \binom{2}{1} \binom{6}{1} \binom{8}{3} \binom{56}{2} = \frac{6}{56} \\
\text{Probability of one in placegetters:} \quad P(X = 1) &= \binom{2}{1} \binom{6}{2} \binom{8}{3} \binom{56}{1} = \frac{30}{56} \\
\text{Probability of none in placegetters:} \quad P(X = 0) &= \binom{2}{0} \binom{6}{3} \binom{8}{3} \binom{56}{0} = \frac{20}{56}
\end{align*}
\]

So the expected profit = \( \frac{6}{56} \times 180,000 \) + \( \frac{30}{56} \times 40,000 \) + \( \frac{20}{56} \times -100,000 \) = $5,000.

This is now hardly the windfall it first appeared. The expected profit is only $5,000, with a strong possibility of losing $100,000. While the syndicate has the odds on their side, there is a large element of risk. In addition, every $1 bet by non-syndicate members on a placed non-favourite greyhound reduces the syndicate’s take by about \( \frac{1}{5000} \times 210,000 = $42 \).

Like all real problems, this one can be tackled on various levels. One of the advantages of working with real problems, particularly if they relate to an area of which students have some knowledge, is that they will question the assumptions. In this case someone will complain that not all the greyhounds have an equal chance, and some students could consider incorporating varying chances in their model. For example, if the two favourites are twice as likely to place than the others, the chances of finishing in any position become 0.2, 0.2, 0.1, 0.1, 0.1, 0.1, and 0.1. A tree diagram and conditional probabilities can be used to show the above cases have chances of 11/42, 24/42 and 7/42 for an expected profit of $53,333. Students could also choose a particular race and use the actual odds to investigate how the scheme works. If the mathematics is too difficult, a simple simulation,
perhaps in Excel, could be used. Students might also investigate alternative schemes - betting large on only one greyhound, or three greyhounds. What are the effects if a larger pool is chosen, so we have to account for the other punters?

Students could also consider means of combating the scheme. In some states in Australia, the extra money to make up the bet would be taken from the other dividend pools. In the above case, this would have resulted in all winning bets receiving their money back, and the syndicate would have lost $25,000. Alternatively, a requirement that bets of a certain proportion of the pool be placed well before start time would allow market forces to balance the pool. If the above bets had been placed (say) 30 minutes prior to start, punters would have seen that an equal bet placed on each of the six non favourites would have to make a profit. This would have brought a flood of money onto those runners, and the scheme would have failed.

**CONCLUSION**

Probability first arose as a consequence of studying gambling problems, and the area continues to provide applications of statistics that may interest some students. It also gives students an example of the sort of problems statisticians may tackle when working in the gambling industry. With the growing range of gambling opportunities, it may also provide students with some useful skills and insights for some of life’s temptations.

**References**
