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SEARCHING FOR ANCHORING EFFECTS IN A NATURALISTIC ENVIRONMENT: EVIDENCE FROM THE HONG KONG HORSERACE BETTING MARKET

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This paper explores the extent to which decision makers in a naturalistic environment, the Hong Kong horserace betting market, anchor their probability judgments on highly visible information and make insufficient adjustments in the light of additional data. Linear regression and conditional logit models are employed to examine the extent to which certain types of information are over-represented in market odds. The results suggest that, in contrast to much of the research on anchoring conducted in laboratories, the Hong Kong betting public do not anchor their judgements on past performances of horses, jockeys or trainers.

I. INTRODUCTION

The rationality of human behaviour and the quality of human judgment have been explored by researchers within disciplines such as economics, management, and psychology. Neoclassical economic theories assume that individuals are able to gather all the information they need without time and cost constraints and that they have sufficient intellectual capacity to solve complicated decision tasks (Savage, 1954). However, in the real world, individuals are not fully rational. Under time and/or cost pressure and within the constraints of their limited knowledge and cognitive capacity, they employ simple 'heuristics' to undertake complex decision tasks (Simon, 1988). These rules of thumb are useful in making rapid decisions but they may result in systematic biases (Kahneman *et al.*, 1982; Kahneman and Tversky, 1972; Tversky and Kahneman, 1974). This paper explores the degree to which decision makers in a real world setting, the horserace betting market, employ one of the most common heuristics, *anchoring and adjustment*.

Laboratory research suggests that people make absolute estimates by starting from an initial value and make adjustments upwards or downwards from it. However, these adjustments are often insufficient (eg, Cohen, 1993b; Tversky and Kahneman, 1974). This phenomenon has become known as the anchoring and adjustment heuristic. It has been argued that although strong anchoring effects have been demonstrated in a number of laboratory-based studies, insufficient investigation of this phenomenon has been conducted in real world decision-making environments (Liu and Johnson, 2006). To emphasize this point we identify a number of features that distinguish

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naturalistic from laboratory environments and highlight the advantages of studying the impact of the anchoring heuristic in a real world setting. To fill the gap between laboratory and real world studies in this area we examine the extent to which horserace bettors in Hong Kong anchor their judgements.

The paper is organized as follows. A brief review of existing research on anchoring effects is provided in section II. In section III features which distinguish naturalistic from laboratory-based settings are identified and the advantages of exploring anchoring effects in naturalistic environments, and in horserace betting markets in particular, are discussed. The data and procedures used to analyse anchoring effects in the Hong Kong pari-mutuel betting market are described in section IV. The results are presented in section V and interpreted in section VI. Conclusions and suggestions for further research are developed in section VII.

II. ANCHORING AND ADJUSTMENT

When making judgments and decisions under time and/or cost pressure, individuals are often found to employ simple rules of thumb (*heuristics*) to make relatively quick and sound decisions (Kahneman *et al.*, 1982; Kahneman and Tversky, 1972; Simon, 1955, 1988; Tversky and Kahneman, 1974). One of these rules of thumb, the *anchoring and adjustment heuristic*, has received considerable attention in the literature. It has been demonstrated that adjustments from an initial starting point or 'anchor value' are often *insufficient* (eg, Kahneman *et al.*, 1982; Kahneman and Tversky, 1972; Mussweiler and Strack, 1999; Tversky and Kahneman, 1974).

Two types of anchoring effects have been identified: (i) traditional and (ii) basic. *Traditional* anchoring effects were first identified by Tversky and Kahneman (1974) and these are the main focus of the anchoring literature. It is thought these involve two judgmental steps: individuals first compare the target value with the anchor value and then make an absolute evaluation of the target to arrive at their final judgement (eg, Cervone and Peake, 1986; Joyce and Biddle, 1981; Mussweiler and Strack, 1999; Quattrone *et al.*, 1984; Russo and Schoemaker, 1989; Tversky and Kahneman, 1974). For example, subjects were asked to estimate the percentage of African countries in the United Nations. They were first required to estimate whether the answer was higher or lower than a randomly generated number, and then they were required to give their own estimates. Final judgements were highly influenced by the random number: low estimates being associated with low random numbers and *vice versa* (Tversky and Kahneman, 1974).

A second form of anchoring has also been identified: *basic* anchoring. This arises when individuals' final judgments are influenced by anchor values even though they are not required to make direct comparisons between initial values and final judgments; target values have been shown to be influenced by anchor values even if the anchor is completely irrelevant to the target (Brewer and Chapman, 2002; Wilson *et al.*, 1996). Wilson *et al.* (1996) argue that if individuals anchor on arbitrary anchors even without being asked to do so, the anchoring effect is probably more common in natural decision contexts than researchers had previously thought. However, experimental results also suggest that due to the lack of a comparison process between anchors and targets, basic anchoring effects are fragile and can easily disappear (Wilson *et al.*, 1996).

The majority of the literature focuses on traditional anchoring effects and a number of factors have been demonstrated to affect the degree of anchoring: for example, the sources of anchors (self-generated or externally provided), the relevance of anchors to targets, and the level of knowledge or experience of decision makers. Individuals anchor their judgments more on self-generated rather than externally provided anchors and the adjustments made from the former are less than those from the latter (eg, Cervon and Peake, 1986; Northcraft and Neale, 1987; Strack and Mussweiler, 1997). This arises because individuals are more likely to confirm internally generated knowledge (self-generated anchors) and view it as relevant to the targets. Consequently, adjustments from self-generated anchors are less than those from externally provided anchors (Davies, 1997; Hinsz *et al.*, 1997; Mussweiler and Neumann, 2000).

A number of studies suggest that anchoring effects occur even when the anchor value is unreasonable, implausibly extreme, or completely irrelevant to the target value (Cervone and Peake, 1986; Chapman and Johnson, 1994; Mussweiler and Strack, 1996b; Mussweiler and Strack, 2000b; Strack and Mussweiler, 1997). The accuracy of judgments based on relevant anchors is demonstrated to be higher than that based on irrelevant or randomly selected anchors (Bazerman, 1990) but anchors that are relevant to the targets cause higher degrees of anchoring than those which are irrelevant (Chapman and Johnson, 1994).

Research suggests that even those with relevant experience, knowledge or expertise[1] are subject to anchoring effects (eg, Diaz, III, 1997; Joyce and Biddle, 1981; Mussweiler and Strack, 2000b; Northcraft and Neale, 1987; Tversky and Kahneman, 1974) but to a lesser extent than those without these advantages (Bhattacharjee and Moreno, 2002; Mussweiler and Strack, 2000b).

The durability of anchoring effects has attracted the increasing interest of researchers (eg, Mussweiler, 2001; Srull and Wyer, 1979). It is suggested that the length of anchoring effects depends on the frequency with which relevant information is involved during the judgmental process and is highly related to the source of anchors (Mussweiler, 2001). In particular, the greater the amount of alternative information and the more often it is encountered in the judgmental process the more likely it is to be used as new priming events; thus reducing or eliminating the effect of anchoring on previous priming events (Srull and Wyer, 1979).

III. ANCHORING EFFECTS IN REAL WORLD ENVIRONMENTS

Laboratory-based v naturalistic studies

To date anchoring effects have largely been examined under controlled experimental conditions. Laboratory experiments offer a number of advantages over field-based studies but also lack some vital features contained in real world decision environments (Bruce and Johnson, 1997). In this section, the distinctions between laboratory-based and naturalistic studies are summarised and the benefits of exploring anchoring effects in real world environments, and in horserace betting markets in particular, are explored.

Two key aspects distinguish laboratory and real world decision settings: the nature of (i) decision tasks and (ii) decision makers. In terms of decision tasks, three distinguishing features can be identified. First, laboratory experiments enable researchers to investigate the effect and interaction of discrete factors under a set of manufactured and controlled conditions, with control groups to provide comparative results. Hence laboratory experiments enable the isolation of particular factors for separate analysis and comparison, whereas in natural settings all factors interact and it is difficult to separate the influence of individual factors. However, this also implies that experiments ''often omit vital elements which are present in a real-world decision environment'' (Bruce and Johnson, 1997; p.287). Second, laboratory experiments are usually conducted in low-stakes, stress free settings, whilst in the real world decision makers are often involved in high-stakes, stressful environments (Yates, 1992). Because the risks taken in laboratories and real world are different, individuals may behave differently in these contexts (Anderson and Brown, 1984). Third, laboratory experiments often use subjective evaluations such as the degree of perceived risk or degree of confidence in making a correct decision to measure the impact or performance of decision tasks (Bruce and Johnson, 1997) whereas in naturalistic environments, reliable objective measures are often available to evaluate decision quality.

A number of factors associated with decision makers also vary between laboratory and real world studies. First, in laboratory studies, participants are often aware that they are involved in a controlled experiment and this may affect their behaviour (Bruce and Johnson, 1997). Second, laboratory-based studies often use undergraduate students as subjects and they may be unfamiliar with the constructed decision tasks or may lack the experience of solving such problems. In the real world, decision makers are more likely to repeatedly face similar tasks so that they gain experience in the decision domain and decision judgments made by 'experts' are often more accurate than those made by 'novices' (Christensen-Szalanski *et al.*, 1983).

Taken together, features of laboratory-based and naturalistic studies differ in many ways and each offers certain advantages and disadvantages. However, the anchoring literature is largely based on laboratory studies and it is therefore appropriate to examine to what extent the observed anchoring effects translate to real world environments.

Horserace betting markets

The aim is to observe to what extent anchoring effects demonstrated in laboratory experiments feature in dynamic, naturalistic settings and horserace betting markets provide an ideal environment for a number of reasons. First, these markets meet all the criteria demanded by Orasanu and Connolly (1993) for a dynamic, naturalistic decision-making setting. For example, in this market, each element of the decision-making event (eg, participants, location, and conditions) is unique so that the performance of participants is uncertain. The market is also dynamic because the odds of each horse in a race are continuously changing and bettors must make decisions in a limited time period; and it has been shown that this period is sufficient for bettors to make good decisions (Johnson and Bruce, 2001). In addition, the horserace betting market involves action-feedback loops. Bettors make explicit or implicit subjective estimates of the horses' probability of winning based on a variety of information (eg, past performance of the horse, jockey and trainer) and once the race result is known the bettors are able to use the feedback to update their decision models. Such action-feedback loops are regarded as important for making dynamic decisions in naturalistic settings (Orasanu and Connolly, 1993).

Second, horserace betting markets offer a setting similar to that found in wider financial markets. For example, bettors have at their disposal a large quantity of relevant decision data, including professional analyses and advice, and the stakes at risk are meaningful to the participants (in contrast to the stakes in many laboratory experiments). In addition, the odds in betting markets are formed as a result of the judgments of a large number of different individuals; overcoming the potential sample size bias experienced in some laboratory experiments which involve a relatively small number of participants.

Third, analysis of betting market data allows for the investigation of behaviour without the individuals being aware that their decisions are being scrutinized. Therefore, the effects that are detected are more likely to reflect the individuals' genuine decision behaviour. The few anchoring studies which have been conducted in other real world contexts (eg, amongst auditors or real estate agents) employ questionnaires or observe behaviour associated with artificially constructed projects (Bhattacharjee and Moreno, 2002; Diaz III, 1997; Joyce and Biddle, 1981; Northcraft and Neale, 1987); decision makers are, consequently, still aware that they are being investigated and this may cause them to alter their behaviour.

The purpose of this study is to investigate whether anchoring effects occur in real, risky decision environments and, for the reasons outline above, the use of data from the horserace betting market offers a number of advantages.

IV. DATA AND METHODOLOGY

The study focuses on the degree of anchoring displayed in the horserace market as a whole rather than the behavioural biases displayed by individual bettors. Clearly, the market represents the aggregated decisions of individual bettors and will to some extent reflect individual decision making biases. However, market behaviour may differ from that of many individuals due to interactions between market participants and the uneven influences of particular individuals on the final market odds (Wallsten *et al.*, 1997). As such the study departs from the traditional approach to examining individual anchoring effects in the laboratory but represents one of the first attempts to examine the phenomenon in a market context.

The data and methodology for detecting anchoring effects in the horserace betting market are described in this section.

Data

The data are drawn from a pari-mutuel betting market where the price of each bet (odds) is determined largely by the decisions of bettors, in contrast to bookmaker markets where odds are determined by the actions of both bettors and bookmakers. Consequently, the pari-mutuel market provides an ideal context for investigating bettors' subjective probability judgments and decision preferences without influences from the supply-side of the market (ie, bookmakers).

The data includes details of the total stakes on win bets in the pari-mutuel market on each of 33,304 horses in 2,579 races run at the Happy Valley and Sha Tin racetracks in Hong Kong over the period 1995–2000.[2] The number of the horses in each race varies from 7 to 14, with a mode of 14. The total stakes on each horse are collected at the close of the market. In addition, the database includes details of the past finishing positions of each horse, whether the previous race run at the meeting was won by a favourite, and whether the jockey or trainer of each horse won his/her last race.

Procedures

In a pari-mutuel market the odds on horse i in race j (O_{ij}) are determined by the proportion of money bet on horse i in race j, as follows:

$$(1) \qquad O_{ij} = \left(\frac{\sum_{i=1}^{n_j} V_{ij}}{V_{ij}}\right)(1-d) - 1$$

where $V_{ij} =$ amount bet on horse i, $d =$ pari-mutuel operator's deduction, $n_j =$ number of horses in race j. It is argued that bettors will continue to place money on a horse i in race j until the odds accurately reflects the market's best estimate of the horse's chance of winning the race (Asch *et al.*, 1984; Figlewski, 1979; Johnson and Bruce, 2001). The ratio, $p_{ij}^s = V_{ij}/\sum_{i=1}^{n_j} V_{ij}$, can therefore be regarded as the subjective probability judgment of the betting public concerning horse i's prospects of winning race j.

The aim is to assess to what extent the bettors' subjective assessment of horse i's chance of success in race j, p^s_{ij}, is a reflection of the horse's true or objective probability of success, p^o_{ij}, or whether bettors anchor their judgements on particular pieces of information. To achieve this objective two modelling procedures are adopted: conditional logit and linear regression.

Conditional logit

Under the competitive conditions of a horse race an efficient probability estimate of horse i's chance of winning race j is more likely to be obtained if its chance of winning is regarded as being *conditional* on the information available for the other runners in race j. To achieve this a 'winningness index' for horse i in race j is defined as: $w_{ij} = \alpha_k A_{ik} + \beta \ln(p^s_{ij}) + \xi_{ij}$, where A_{ik} is the value for horse i of the kth factor on which bettors may anchor their judgements (eg, a dummy variable indicating whether the horse won its last race), α_k and β measure the contribution of the kth anchoring factor and the bettors' aggregate subjective probability of horse i winning race j, respectively, and ξ_{ij} is the measurement error. The probability of horse i winning race j is therefore given by:

$$\begin{aligned} p^o_{ij} &= pr(w_{ij} > w_{lj}, l = 1, 2, \ \ldots \ n_j, l \neq i) \\ &= pr(\alpha_k A_{ik} + \beta \ln(p^s_{ij}) + \xi_{ij} > \alpha_k A_{lk} + \beta \ln(p^s_{lj}) + \xi_{lj}, l = 1, 2 \ldots n_j, l \neq i) \end{aligned}$$

The w_{ij} can not be observed directly, but whether horse i wins race j can be observed; so a win/lose variable t_{ij} is defined such that: $t_{ij} = 1$ if $w_{ij} = Max(w_{1j} w_{2j,} \ldots w_{n_j j})$; $t_{ij} = 0$ otherwise. Consequently, the probability of horse i winning race j can be represented as follows: $p_{ij} = \Pr\left(t_{ij} = 1 \middle| \ln\left(p^s_{ij}\right), A_{ik}\, i = 1, 2 \ldots, n_j\right)$. McFadden (1974) demonstrates that if it is assumed that the error terms ξ_{ij} are independent and distributed according to the double exponential distribution, the probability of horse i winning race j is given by a conditional logit function, as follows

$$(2) \qquad p^o_{ij} = \frac{\exp\left(\alpha_k A_{ik} + \beta \ln\left(p^s_{ij}\right)\right)}{\sum_{i=1}^{n_j} \exp\left(\alpha_k A_{ik} + \beta \ln\left(p^s_{ij}\right)\right)} \quad \text{for } \ i = 1, 2, \ \ldots \ n_j$$

The parameters α_k and β, are estimated by maximizing the joint probability of observing the results of all N races in the sample. Using equation (2), if bettors' subjective estimates of horses' chance of winning perfectly match their objective probabilities, α_k would equal 0 and β would equal 1 (ie, $p^o_{ij} = p^s_{ij}$). However, if α_k is significantly less than 0 this indicates that bettors' subjective probabilities are overly influenced by the kth factor (A_{ik}), suggesting that they have anchored unduly on this factor when forming their judgements.

The factors, A_{ik}, which are selected as possible anchors, include those frequently discussed by bettors, namely factors related to the previous performances of horses, jockeys and trainers. In particular, we examine the degree to which bettors anchor on the following aspects of the past performance of horses: (i) the average finishing position of a horse over its career (with more recent results being more heavily weighted than earlier results: RNF); (ii) whether the horse won its last race (HWL takes the value 1 if the horse won its last race and 0 otherwise) and (iii) whether the favourite won the last race at the race meeting (ie, does this encourage bettors to over-bet the favourite in the next race): FWL is defined such that the favourite of the current race is assigned a value of 1 if the favourite won the last race at the meeting, 0 otherwise. Anchoring effects related to jockeys and trainers are assessed by examining the extent to which over-betting occurs on horses ridden by jockeys and/or from a trainer's stable whose previous mount or runner, respectively, have won their last race (JWL is given the value 1 if a jockey won on the last horse he/she rode and TWL is assigned a value of 1 if the trainer's last runner won its race).

Linear regression

The conditional logit function represented by equation (2) enables the type of information bettors use to assess the chances of a horse winning to be discerned. However, it is only estimated on the basis of data concerning *winning* horses. Consequently, it overlooks the ability of bettors to discriminate between horses which finish further down the field (eg, in 2nd, 3rd etc). In order to incorporate data concerning the finishing position of all horses in a race when assessing the degree of anchoring in bettors' judgements, parameters of equations of the following form are estimated using OLS regression:

$$(3) \qquad NFP_{ij} = \chi_k A_{ik} + \delta \ln p^s_{ij} + \xi_{ij}$$

where NFP_{ij} represents the normalized finishing position of horse i in race j and is given by $0.5 - (\textit{ordinal finishing position} - 0.5)/\textit{number of runners}$ (Brecher, 1980). A horse finishing 5th in a 5-horse field has not beaten any horses, whereas a horse finishing 5th in a 30-horse field has beaten the other 25 horses. Therefore, in order to ensure that the finishing position is comparable between races normalisation is undertaken. Since NFP ranges from -0.5 to 0.5 in all races, whatever the number of runners, it provides a consistent measure for determining how well (in relation to other horses in the race) a particular horse ran. If the coefficient χ_k in equation (3) is significantly less than 0, this would imply that bettors anchor their subjective probability judgements on the variable A_{ik}, when assessing the likely finishing position of all runners.

V. RESULTS

Horses' past performances

The results of estimating the conditional logit and the linear regression models associated with the degree to which bettors employ information concerning horses' previous performances in their subjective probability judgements are given in Tables 1 and 2 respectively.

From the results of the first four models displayed in Tables 1 and 2 it is clear that the bettors' subjective probability judgements ($\ln(p_{ij}^s)$), the recency weighted normalised finishing position of a horse over all its career starts

TABLE 1

RESULTS OF ESTIMATING CONDITIONAL LOGIT MODELS INCORPORATING HORSES' PAST PERFORMANCES AND BETTORS' SUBJECTIVE PROBABILITY JUDGMENTS

	Coefficient(s) in model						
Variable	1	2	3	4	5	6	7
$\ln p_{ij}^s$	0.994*				0.932*	0.992*	0.993*
	0.025				*0.032*	*0.026*	*0.027*
RNF[a]		4.213*			0.589*		
		0.144			*0.182*		
HWL[b]			0.786*			0.021	
			0.060			*0.066*	
FWL[c]				1.461*			0.016
				0.088			*0.095*
R^2	0.147	0.074	0.011	0.016	0.148	0.147	0.147

[a] RNF: represents the recency weighted normalised finishing position of a horse over all its career starts.
[b] HWL: is a dummy variable representing whether the horse won its last race (1 won, 0 otherwise).
[c] FWL: the favourite of current race is assigned a value of 1 if the favourite won the last race at the meeting, 0 otherwise.
Standard errors are in italics.
* Significant at the 5 percent level.

TABLE 2

RESULTS OF ESTIMATING LINEAR REGRESSION EQUATIONS WITH NORMALISED FINISHING POSITION REGRESSED ON FACTORS RELATED TO HORSES' PAST PERFORMANCES AND BETTORS' SUBJECTIVE PROBABILITY JUDGEMENTS

	Coefficient(s) in model						
Variable	1	2	3	4	5	6	7
$\ln p_{ij}^s$	0.139*				0.122*	0.138*	0.138*
	0.001				*0.002*	*0.002*	*0.002*
RNF[a]		0.576*			0.160*		
		0.009			*0.011*		
HWL[b]			0.119*			0.007	
			0.006			*0.006*	
FWL[c]				0.248*			0.016
				0.012			*0.011*
R^2	0.208	0.109	0.011	0.012	0.213	0.208	0.208

[a] RNF: represents the recency weighted normalised finish position of a horse over all its career starts.
[b] HWL: is a dummy variable representing whether the horse won its last race (1 won, 0 otherwise).
[c] FWL: the favourite of current race is assigned a value of 1 if the favourite won the last race at the meeting, 0 otherwise.
Standard errors are in italics.
* Significant at the 5 percent level.

(RNF), whether the horse won its last race(HWL) and if a horse is favourite in the current race when a favourite won the last race at the meeting (FWL), all provide valuable information in terms of assessing the likely finishing position of a horse in its current race, and the probability of each horse winning. This conclusion can be drawn since the coefficients of all four variables in the linear regression equations with normalised finishing position as dependent variable and in the equivalent conditional logit models are positive and significant at the 5 percent level. However, it is evident from the R^2 values for the first four linear regression and conditional logit models that bettors' subjective judgements, revealed as odds, contain far more valuable information concerning a horse's finishing position than the other variables (RNF, HWL or FWL). Results for model 5, reported in Tables 1 and 2, suggest that bettors do not fully account for the previous finishing position of horses over their whole career when assessing the likely finishing order of horses and when assessing the probability of each horse winning the race, since the coefficient of RNF is positive and significantly different from zero at the 5 percent level when combined in a model with the bettors' subjective probability judgements (in both the linear regression and conditional logit models). Models 6 and 7 suggest that bettors fully discount, in the odds, information regarding whether a horse won its last race (HWL) and whether the horse is favourite in the current race when a favourite won the last race (FWL). This conclusion can be drawn since the coefficients of these variables in both the linear regression and conditional logit models are not significantly different to zero at the 5 percent level when these variables are combined in a model with the subjective probabilities derived from market odds.

Taken together the results of estimating models 1–7 suggest that information concerning whether a horse won its previous race, whether a horse is favourite in the current race when a favourite won the previous race at the meeting and the normalised finishing position of a horse throughout its career all provide valuable information for discriminating between the likely finishing position of horses in a race and in assessing each horse's probability of winning. However, bettors do not appear to unduly anchor their judgements on this information.

Past performances of jockeys and trainers

The conditional logit model results exploring anchoring effects based on the past performances of jockeys and trainers are reported in Table 3 and equivalent linear regression results are presented in Table 4. Once again the two modelling approaches produce consistent findings. The results demonstrate that the likely finishing position of a horse and its probability of winning are both enhanced if the horse's jockey won his/her last race (JWL = 1) and if the last horse to run from a trainer's stable won (TWL = 1). This conclusion can be drawn since coefficients of JWL and TWL in the conditional logit and linear regression models are both positive

TABLE 3

RESULTS OF ESTIMATING CONDITIONAL LOGIT MODELS INCORPORATING JOCKEYS' AND TRAINERS' PREVIOUS RACE PERFORMANCES AND BETTORS' SUBJECTIVE PROBABILITY JUDGMENTS

	Coefficient(s) in model				
Variable	1	2	3	4	5
$\ln p_{ij}^{s}$	0.994*			0.995*	0.994*
	0.025			*0.025*	*0.025*
JWL[a]		0.181*		− 0.019	
		0.070		*0.072*	
TWL[b]			0.164*		0.030
			0.070		*0.073*
R^2	0.147	0.001	0.001	0.147	0.147

[a] JWL: assigned a value of 1 if the horse's jockey won on his/her last ride, 0 otherwise.
[b] TWL: assigned a value of 1 if the previous horse to run from the trainer's stable won, 0 otherwise.
Standard errors are in italics.
* Significant at the 5 percent level.

TABLE 4

RESULTS OF ESTIMATING LINEAR REGRESSION EQUATIONS WITH NORMALISED FINISH POSITION REGRESSED ON FACTORS RELATED TO JOCKEYS' AND TRAINERS' PREVIOUS RACE PERFORMANCE AND BETTORS' SUBJECTIVE PROBABILITY JUDGEMENTS

	Coefficient(s) in model				
Variable	1	2	3	4	5
$\ln p_{ij}^{s}$	0.139*			0.139*	0.139*
	0.001			*0.001*	*0.001*
JWL[a]		0.043*		0.004	
		0.003		*0.006*	
TWL[b]			0.028*		0.004
			0.006		*0.006*
R^2	0.208	0.001	0.001	0.208	0.208

[a] JWL: assigned a value of 1 if the horse's jockey won on his/her last ride, 0 otherwise.
[b] TWL: assigned a value of 1 if the previous horse to run from the trainer's stable won, 0 otherwise.
Standard errors are in italics.
* Significant at the 5 percent level.

and significant. However, when these variables are incorporated in linear regression and conditional logit models together with log of winning probability derived from pari-mutuel market odds, their coefficients do not make a significant difference to the expected normalised finish position nor to the probability of winning, respectively.

The results relating to the previous performances of trainers and jockeys suggest that this information is useful in trying to assess a horse's likely finishing position and its probability of winning but that this information is fully discounted in pari-mutuel market odds; and bettors do not appear to anchor on this information.

VI. DISCUSSION

Overall the results suggest that bettors do not anchor their judgements on a variety of variables associated with the previous performances of horses, trainers or jockeys. In fact they appear to effectively discount the majority of this information in their subjective probability judgements which are revealed as pari-mutuel odds (other than the recency weighted normalised finish position of horses throughout their career). This is a surprising result given the wealth of laboratory based studies which demonstrate the powerful anchoring effect of data presented prior to judgements being made. There are a number of possible reasons for the contrasting findings of the current study and previous work exploring anchoring. These are related to the decision environment in which the judgements are made, the nature of the decision task and the decision makers.

There is a clear distinction between the real world environment faced by pari-mutuel bettors and the sterile, artificial environment faced by subjects in many laboratory experiments. Bettors operate in an environment which contains a number of action-feedback loops, where decisions are dynamic and can be adjusted in the light of past successes and mistakes; this is rarely the case in previous laboratory based anchoring studies. Feedback has been shown to have a positive influence on the accuracy of judgements (eg, McClelland and Bolger, 1994). In addition, the betting task is a fairly uniform one, with regular *immediate* feedback and both these factors have been shown to improve calibration (Lock, 1987).

The pari-mutuel betting market is a 'high stakes' environment; where bettors have a clear incentive to make good decisions, since they are risking their own money; and they are likely to bet in such a way that the potential returns are meaningful to them. In addition, previous literature has suggested that the existence of multiple self-interested participants may enhance the effects of the incentives in the market (Waller *et al.*, 1999). This is precisely the situation in the pari-mutuel market, where a bettor's potential returns are directly determined by the actions of other bettors. Consequently, individual bettors adjust their betting decisions by watching other bettors' actions, revealed via the odds (Johnson and Bruce, 2001). It is difficult for experiments in the laboratory to recreate such an incentive-rich, competitive environment and it is unlikely that subjects taking part in laboratory studies are as highly motivated to make accurate judgements as the majority of horserace bettors.

It should also be noted that the current study explores the anchoring effects of a *market* made up of a variety of individuals. It has been shown that the interaction between individuals in markets can significantly reduce errors (Wallsten *et al.*, 1997). This results from a variety of causes, not least the fact that different individuals use different decision-making procedures and have diverse information gathering skills. As a result their reaction to the same information may vary. It is possible that ''certain biases present in an individual bettor's decisions are being counterbalanced by opposite biases in other bettors' decisions'' (Johnson and Bruce, 2001; p. 280). Consequently, it is possible that the anchoring of some individuals is offset by the underweighting of the same piece of information by others. This is made more likely in a betting market context (cf the laboratory) because of the low possibility of collusive behaviour between individual bettors (Johnson and Bruce, 2001). Individuals who believe they hold privileged information or skills in predicting outcomes have a strong incentive not to divulge this information to others; who, through a bandwagon effect, could substantially reduce the odds on the intended target horse.

In addition to the factors in the betting environment which reduce the likelihood of bettors anchoring their judgements, there are also distinct differences between bettors and the subjects of most laboratory experiments. These differences might also help explain the contrasting results of the current study and most anchoring studies conducted in the laboratory. The majority of pari-mutuel bettors are familiar with the betting task, unlike many of the subjects in laboratory experiments who face tasks for which they have no relevant experience. In fact, those laboratory experiments which do compare the performances of those with more and less experience of the decision task identify less anchoring for the former group (eg, Bhattacharjee and Moreno, 2002; Diaz, III, 1997; Mussweiler and Strack, 2000; Northcraft and Neale, 1987). In addition, it has been suggested that due to the very large betting volumes on Hong Kong races these markets attract a number of professional betting organisations since they can bet with high stakes without damaging their returns. As a result they can recoup the large expenses associated with collecting/analysing data for modelling the likely results of horseraces (Benter, 1994). In fact, it is clear from presentations given at a number of conferences that a number of betting syndicates do operate in the Hong Kong horseracing betting market.

In summary, the results suggest that horserace bettors in Hong Kong do not anchor their judgements on the most obvious pieces of information concerning previous performances of horses, jockeys or trainers. This may indicate that anchoring effects observed in the laboratory are not as common in real world decision settings, particularly amongst decision-makers who are familiar with their decision domain.

VII. CONCLUSION

This paper has suggested an effective method of exploring anchoring effects in a real world setting, the pari-mutuel horserace betting market. New evidence is presented which questions the degree to which anchoring effects observed in the laboratory influence the subjective judgements of decision makers in naturalistic environments. A number of factors are identified as the potential reason for this, including features of real world environments which distinguish them from laboratory settings, and, in particular, aspects of the horserace betting market which facilitate good calibration.

Naturalistic environments differ from experimental settings in a number of ways, including: (i) their higher level of complexity; (ii) the greater stress and personal stakes facing real world decision makers (implying that individuals may take their real world (cf laboratory-based) decision making more seriously); and (iii) the fact that individuals in laboratory experiments are aware that their decisions are being scrutinised, which may result in a change in their behaviour. In addition, a number of features of horserace betting markets are identified as being likely to reduce anchoring effects, including: (i) the prevalence of decision makers who are familiar with the betting task; (ii) an environment characterised by action-feedback loops in which bettors can quickly learn to adjust their future decisions in the light of past successes and failures; and (iii) a market context in which the interaction of individuals and the offsetting of biases can result in subjective judgements which are well calibrated.

The results presented here represent a preliminary study of anchoring effects in the horserace betting market. Only a limited number of potential anchoring factors have been examined and these need to be expanded in future studies before it can be concluded that anchoring does not exist in the horserace betting market. In addition, it is possible that sophisticated mathematical models employed by some professional syndicates help eliminate any anchoring effects demonstrated by the rest of the betting public. Consequently, further analysis is currently being undertaken to examine the extent to which anchoring effects differ between casual and professional/ expert bettors.

In summary, the results reported here challenge the consensus to emerge from laboratory based studies, and suggest that anchoring effects may not be as widespread in real world decision making environments as previously thought.

NOTES

1. The terms “experience”, “knowledge”, and “expertise” are highly related but different concepts. Experience is the participation in or observation of an event and it is argued that, in general, the more experience people have in a specific field, the more knowledge they gain about this field. Knowledge is the understanding or awareness of a subject gained through experience or study. Expertise refers to professional knowledge and/or skills in a particular field, which can either be gained from experience or from other sources.
2. We would like to thank Mr. William Benter for providing these data.

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