Schnytzer, Adi; Luppi, Barbara

Working Paper
Painful regret and elation at the track

Working Paper, No. 2011-09

Provided in Cooperation with:
Department of Economics, Bar-Ilan University

Suggested Citation: Schnytzer, Adi; Luppi, Barbara (2008) : Painful regret and elation at the track, Working Paper, No. 2011-09, Bar-Ilan University, Department of Economics, Ramat-Gan

This Version is available at:
http://hdl.handle.net/10419/95991
Painful Regret and Elation at the Track

Adi Schnytzer¹
Barbara Luppi²

Abstract

We present an empirical study of loss aversion in the Hong Kong horse betting market. We provide evidence of the presence of loss aversion in a context of complete absence of the favourite-longshot bias. This would suggest that, since loss aversion is a psychological bias, the favourite-longshot bias may not necessarily be caused by psychological issues and may be due, for instance, to informational asymmetry. We investigate different types of bettors and their attitude towards loss aversion. Our data set enables us to distinguish approximately among insiders, unsophisticated outsiders and sophisticated outsiders. The results show clearly that even sophisticated bettors are beset by loss aversion, while even unsophisticated outsiders display no favourite-longshot bias. Thus, our paper provides evidence that loss aversion may be an attitude innate rather than learned, regardless of the level of sophistication in designing economic behaviour or the extent of information asymmetry. Chen et al (2006) show that capuchin monkeys display biases when faced with gambles, including loss aversion, and provide evidence that loss aversion extends beyond humans. The present work supports the idea that loss aversion may be a more universal bias, arising regardless of experience and culture and demonstrates that loss aversion is displayed even by those bettors regarded in the market as “smart money”. Further, we find that more sophisticated and experienced bettors display a higher level of loss aversion. This result is consistent with the findings of Haigh and List (2005), who show that professional traders in financial markets exhibit more loss aversion than do students.


21 October 2008

¹ Corresponding Address: Department of Economics, Bar Ilan University, Ramat Gan, Israel 52900. Email: schnyta@mail.biu.ac.il
² Corresponding Address: Department of Economics, University of Modena and Reggio Emilia, Viale Berengario, 22 44110 Modena. Email: barbara.luppi@unimore.it
1. Introduction

Is loss aversion acquired or innate in traders? Are expert traders more or less susceptible to loss aversion than amateurs? Is the favourite-longshot bias a psychological bias or is it, perhaps, a consequence of asymmetric information in the markets in which it is observed? These are among the important questions in contemporary behavioural finance. Our purpose in this paper is to shed some light on these questions by conducting an empirical study of the Hong Kong horse betting market. This market is characterized by very high turnovers and a parimutuel-only betting system. It is thus a market of sufficient size to proxy other types of financial market while, permitting the evaluation of some aspects of these questions via asset prices determined solely by demand.

Horse betting markets are very good natural experiment candidates to test theories of preferences under risk: they allow for the collection of large datasets, and the average amount of money at stake is significant. Racetrack studies may provide key insights for the analysis of risk-taking behaviour in other financial markets as well as in other contexts where risk is the key issue. Betting markets have the advantage of being short-run, lasting for one period only; this facilitates the calculation of the precise ex-post return on each bet. A win bet may be interpreted as an Arrow security, which provides revenue of (1+ R) dollars in the event the horse wins the race and 0 otherwise. R indicates the odds of the horse, defined as the net return contingent upon the backed horse winning the race.

In a parimutuel market, odds are endogenous, determined by the distribution of wagers over the horses: the odds of horse i are the ratio of total money B wagered on the race net of the track revenue (including the take, i.e. the percentage of bets collected by racetrack organizers and the taxes, and the breakage, equal to the return loss due to rounding the return to the nearest monetary unit) and total money B wagered on horse i.

We investigate the presence of loss aversion in the context of the Hong Kong horse betting market, for which we first show that there is no favourite-longshot bias. This constitutes one of the points of major interest of the paper since loss aversion – in one guise or another - has been used widely in the literature on betting markets in order to explain the presence of a favourite-longshot bias. This paper provides evidence of the presence of loss aversion in a context of complete absence of the favourite-longshot bias. This would suggest that, since loss aversion is a psychological bias, the favourite-longshot bias may not necessarily be caused by psychological issues and may be due, for instance, to informational asymmetry.

As distinct from Jullien and Salanie (2000), we do not perform a calibration exercise of the utility function type on the data. Rather, we implement a simple direct test for the presence of loss aversion on the betting price, based on the definition of loss aversion. Thus, in the presence of loss aversion, bettors would increase the winning price (reduce the winning odds) of a horse whose performance they expect to improve at its next start, by less that they would reduce its price if they expected a decrease in performance of equal measure. We show that bettors exhibit a degree of loss aversion which is consistent with the empirical findings of Kahneman and Tversky: bettors weigh a loss from 2 up to 3 times an equivalent expected gain.

---

3 In a parimutuel only market, the supplier (tote) is not an active goal oriented economic agent merely setting a take-out rate which guarantees it a profit. Prices are thus determined exclusively on the demand side.
4 This is particularly true in the case of Hong Kong. The annual revenue of the Hong Kong Jockey Club, which controls the betting market, was around $HK82 billion in 2000, roughly equal to that of the Tel Aviv Stock exchange at the time. Typically, there is over SUS 1 million in the win pool for every race.
5 In this paper, we are concerned exclusively with the win betting market.
6 See Schnytzer, Shilony and Thorne (2003) for an explanation along these lines.
As shown in Schnytzer and Shilony (1995), bettors with different levels of information have different betting strategies and are able to obtain different profit levels. Traditionally, economic theory has regarded bettors with higher levels of information as more rational. However, less attention has been devoted to investigate how widespread loss aversion, specifically, is. We investigate different types of bettors and their attitude towards loss aversion. In other words, we aim to understand whether bettors who can access different information sets and employ different levels of sophistication in their betting strategies, all display loss aversion and, if so, whether they do so to the same extent. Our data set permits us to distinguish approximately among insiders, unsophisticated outsiders and sophisticated outsiders, at least insofar as the information is imbued in the odds data at different times during the betting. Our results show clearly that even sophisticated bettors are beset by loss aversion. We thereby provide evidence that loss aversion may be an innate rather than a learned attitude, regardless of the level of sophistication in designing economic behaviour or the extent of information asymmetry. Chen et al (2006) show that capuchin monkeys display biases when faced with gambles, including loss aversion, and provide evidence that loss aversion extends beyond humans. The present work supports the idea that loss aversion may be a more universal bias, arising regardless of experience and culture and demonstrates that loss aversion is displayed even by those bettors regarded in the market as “smart money”.

Indeed, we find that more sophisticated and experienced bettors display a higher level of loss aversion than "amateurs". This result is consistent with the findings of Haigh and List (2005), who show that professional traders in financial markets exhibit more loss aversion than do students. This result is particularly interesting in light of the discussion as to whether loss aversion is limited to those agents who are inexperienced with markets. The evidence is not unambiguous on the topic: for example, Camerer et al. (1997) find that loss aversion in limited to less experienced subjects in a field study of New York taxi drivers.

Hong Kong has only two race tracks: Sha Tin and Happy Valley. Since our dataset includes nearly all the win bets at both tracks over a number of seasons, the empirical test on loss aversion is performed on the entire population of horse bettors in Hong Kong.

These tracks are, however, rather different. In particular, Happy Valley is a more difficult track than Sha Tin\(^7\). Both tracks are oval circuits and the track configuration suggests that those horses with barrier-positions on the inside of the track will be favoured, since, ceteris paribus, they will be required to run less distance. HV has a circumference of only 1454 meters whereas the circumference of ST is 1933 meters. The bends at HV are therefore tighter than those at ST; the tightest bend at HV having a radius of only 91 meters, whereas the equivalent bend at ST has a radius of 158 meters. Consequently, the configuration of these tracks suggests that horses with a low barrier-position will be favoured more at HV. This means that when measuring the extent of loss aversion, it is important to control for barrier positions of the horses (as well as, obviously, other control variables such as weight carried and so on). We find that loss aversion is present in different degrees at the two tracks: at Happy Valley - the more difficult track - there is less loss aversion for all kinds of bettors. The evidence indicates that even if loss aversion is innate in human beings, the type of economic context is relevant in determining its overall intensity.

The rest of this paper is organised as follows. In Section 2 we present an overview of the related literature, both in horse betting markets and in the alternative frameworks of standard expected utility. In Section 3 we provide the theoretical analysis underlying our empirical analysis. In section 4 the main empirical results are presented and discussed and Section 5 concludes.

\(^7\) There is a broad consensus among horse bettors in Hong Kong that Happy Valley is a far more difficult for both horses and bettors than Sha Tin.
2. Related literature

A major literature branch relevant to the present paper examines alternative frameworks to the expected utility model of behaviour under uncertainty. Experimental research into choice under uncertainty has revealed that people behave in ways that systematically violate the set of basic axioms formulated by Von Neumann and Morgenstern (1947) and Savage (1954), upon which the conventional expected utility theory is built. In particular, the empirical evidence presented by Kahneman and Tversky (1979) and others shows a number of patterns of choice that reveal behavioural regularities that systematically contradict the predictions of conventional expected utility theory. Following the discovery of the Allais and Ellsberg paradoxes, many attempts have been made to develop alternative frameworks for the analysis of choice under uncertainty, consistent with the observed behavioural regularities. A subset starts from an attempt at a psychological explanation of Allais Paradox phenomenon. One of the earliest was Prospect Theory (Kahneman and Tversky, 1979), later generalized to cumulative prospect theory (1992). A central feature of Prospect Theory is the incorporation of the idea that people care about changes in financial wealth – i.e. they utilize a reference point when evaluating an uncertain prospect - and they exhibit loss aversion over wealth changes, i.e. the decrease in utility associated with a loss is greater than the increase in utility level associated with a gain of equal size.

Two more intuitive and parsimonious psychologically based theories are regret theory (Sugden and Loomes, 1982, 1987) and disappointment theory (Sugden and Loomes, 1986); both of which incorporate *ex ante* considerations of *ex post* psychological feelings: of regret or rejoicing, in the former and of disappointment or elation, in the latter.

"The fundamental idea behind regret theory is that the psychological experience of "having x" can be influenced by comparison between x and y that one might have had, had one chosen differently. If, for example, I bet on a horse which fails to win, I may experience something more than a reduction in my wealth: I may also experience a painful sense of regret arising out of the comparison between my current state of wealth and the state that I would have enjoyed, had I not bet" (Sugden, 1991).

A number of empirical studies investigate the importance of non-expected utility theory and the role of loss aversion in different economic settings. In racetrack betting, Jullien and Salanié (2000) offer an alternative explanation of the *favourite-longshot bias* that affects pari-mutuel betting markets. They compare expected utility and prospect theory in pari-mutuel betting on horse races. Using a ten-year sample of flat races run in England, they assume that bettors value bets according to either expected-utility theory, rank-dependent utility theory or cumulative prospect theory and infer the parameters of bettor’s utility and probability weighting functions from the marginal bettor who is indifferent among bets on all horses at the odds established when the race is run. Jullien and Salanié show that cumulative prospect theory fits the data better than expected utility theory or rank-dependent theory. Further, they show that the weighting function for losses severely overweights low probability of loss, while the one for gains is roughly linear. These findings offer a different explanation for the favourite-longshot bias: bettors who like to gamble (u(x) is convex) are heavily afraid of losing in the case of bets on favourites with small loss probability, while this is not the case for longshots with a

---

9 The *favourite-longshot bias* identifies the phenomenon according to which bettors tend to over-bet “longshots” (i.e. horses with a relatively small probability of winning) and under-bet favourites. In other words, within the context of a parimutuel betting system, the percentage of money bet on longshots is much higher than the fraction of winning horses within the class formed according to the percentage of money bet on them. See, for example, Thaler and Ziemba (1988) and Hausch and Ziemba (1995) for analyses of this bias.
high probability of loss. Bradley (2002) assumes an agent maximising expected utility with a reference point (the case of no bet) and an asymmetric treatment for gains and losses incorporated under the hypothesis of a different constant relative risk aversion utility function for losses and gains. The author obtains a better fit of the data than Jullien and Salanié, enabling an alternative explanation the favourite-longshot bias.

3. The betting market

We present a concise model of a tote betting market where the bet price is characterised under a non-expected utility framework.

We assume that the agent’s preferences are described by the following utility function (Loomes and Sugden, 1986):

\[ U(x_i) = x_i + D(x_i - x) \]

where \( x_i \) denotes the payoff of betting on horse i in race j and \( x \) denotes the expected payoff of horse i.

According to this utility function, the economic agent receives not only the utility derived directly from the actual consequence of an uncertain prospect, but in addition feels some degree of disappointment or elation. When the agent evaluates a prospect, he forms an a priori expectation about any uncertain prospect and after the uncertainty is resolved, he compares the actual consequence of the prospect with the a priori expectation. If the actual consequence turns out to be worse than the expectation, he feels disappointment. On the other hand, the individual experiences some degree of elation if the actual consequence is better than the a priori expectation.

We assume the following functional form for the disappointment-elation component of the utility function, \( D(\cdot) \):

\[ D(y) = \begin{cases} \beta_g y & \text{if } y \geq 0 \\ \beta_l y & \text{if } y < 0 \end{cases} \]

and

\[ \beta_g < \beta_l \]

According to assumption (2), the utility function is defined on deviations from the reference point, i.e. the utility function is kinked at the origin. The parameter \( \beta_i, i = g, l \) captures the intensity of loss (= disappointment) aversion and we require the utility function to be steeper for losses than for gains, as given by assumption (3). This characteristic reflects a salient feature of attitudes to changes in welfare, that is, the disappointment associated with a loss with respect to the expected result appears to be greater than the pleasure associated with an equal-sized gain. This specification of the \( D(\cdot) \) function captures the attitude of loss aversion in the spirit of the Kahneman-Tversky descriptive theory of decision-making under uncertainty (Kahneman and Tversky, 1979).

The choice of this utility function allows us to investigate the effect of a psychological attitude such as loss aversion in the betting market. Since we are investigating the betting market, we do not endow the agent with any legacy or other forms of wealth inherited from the past. The reference point is represented by the expected payoff from betting on a specific horse.

We develop a simple and intuitive model to explain the price of a horse in a given race in order to test the presence of loss aversion. Let \( R_{ij} \) be the odds of horse i in race j and \( p_{ij} \) be the horse’s subjective probability of winning of race j. Under the assumption of a linear utility function, the price of a horse i for an expected utility maximizer would be:
Price of horsei in race $j = p_j R_j - (1 - p_j)$

However, in our case, the price equation must be modified to take into account the anticipation of disappointment or elation. Thus, under assumptions (1) (2) (3) we derive the modified expected utility function as:

\[ (4) \quad \text{Price of horsei in race } j = p_j \left[ R_{ij} + \beta_g \left( R_{ij} - R_i \right) \right] - \left( 1 - p_j \right) \left[ 1 + \beta_i \left( 1 + R_j \right) \right] \]

We derive an appropriate econometric form of equation (4) in the next section.

4. Empirical tests

The data consist of 4258 Hong Kong races in which 54,335 horses took part between the 3rd of September 2000 and the 18th of October 2006. For each horse $i$ in race $j$, $i=1\ldots N_j$, $j=1\ldots 4258$, we observe the odds for horse $i$ in race $j$, which are the (net) return on HK$1 placed on that horse, if it wins. Further, we observe the final placing of all the horses in each race. We have these data for both tracks in Hong Kong: Happy Valley and Sha Tin.

The data set allows us to observe bet prices at three different time slices: overnight (indicated as _00), 5 minutes before race start (indicated as _05) and at the closure of bets (indicated as _fo). The prices at different time slices capture different types of bettors. Overnight bets are usually placed by people prepared to bet before the day of the race. This suggests that they are outsiders who are not expert, otherwise they would have not bet without knowing in what state the horse appears to be, the conditions of the track and the weather, etc. It cannot be ruled out that some insiders who wish to bet “unnoticed” place bets overnight, but this may be assumed to be a small percentage of the total pool. The bet price registered 5 minutes before race start adds to outsiders the bets placed by insiders, who have private information. Five minutes before the race most of money is in except for very late bettors, whose presence is captured in the closing price: usually they are professionals with very sophisticated analysis of public information and, of course, further bets by insiders and normal outsiders. The three bet prices indicate the role of a different type of bettor: the overnight price indicates non-expert bettors (outsiders) with public information, the price 5 minutes before race start capture the role of insiders with private information along with betting by outsiders, and the closing price adds to the pool the behaviour of insiders who bet late and professional syndicates with sophisticated analysis techniques.

Prior to testing for the presence of loss aversion in the Hong Kong betting market, it must be shown that the three set of prices contain different information and that there is no favourite-longshot bias implied at the three stages of the betting. That there is different information incorporated in the three sets of prices is shown in Table I, where we show the results of running a linear probability model, regressing a dummy which receives 1 for race winners and 0 otherwise, on the overnight odds, Odds open, the odds five minutes before the race, Odds_05 and final odds, Odds final, respectively, in the presence of interactions between all the horses and their jockeys in the sample. The regression in Table I shows clearly that the set of information contained by prices at different times during the betting period is different, since each of the implied probabilities is significant at 0.1% or better.

---

Note that the number of starters in a race runs from 7 through 14, with most races having 12 or 14 starters.
Table I

The role of different information sets

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Odds open</strong></td>
<td>-.0030464***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0002629)</td>
<td></td>
</tr>
<tr>
<td><strong>Odds_05</strong></td>
<td>.0020522***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0003918)</td>
<td></td>
</tr>
<tr>
<td><strong>Odds final</strong></td>
<td>-.0047497***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0003488)</td>
<td></td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>54,335</td>
<td></td>
</tr>
<tr>
<td><strong>Adjusted R^2</strong></td>
<td>3.54</td>
<td></td>
</tr>
</tbody>
</table>

Table I: Dependent variable: Win, a dummy which receives 1 for the winning horse in the race and zero otherwise. In addition to the explanatory variables shown in the table, the regression also contains horse-jockey interactions. Standard errors corrected for heteroskedasticity as required by the linear probability model are reported in parenthesis. *** The coefficient is significant at the 1% level.

The second step is to show that there is no favourite-longshot bias in Hong Kong. This is a key point since loss aversion is used often to explain why the favourite-longshot bias arises. We present results for the aggregate of both tracks, since the results do not differ significantly across tracks\(^\text{11}\). We divide the data set into 20 groups by each of the three sets of probability equivalents\(^\text{12}\) of the overnight odds, \(Prob_00\), odds five minutes before the race, \(Prob_05\) and final odds, \(Prob_fo\), respectively, and run weighted least squares regressions of winning frequencies on mean probability equivalents for each of the three sets of odds for each group. The weights are the numbers of horses in each group. The results were as follows:

---

\(^{11}\) Results by track are available upon request.

\(^{12}\) Since we do not have data on proportions of the pool bet on individual horses, we calculate probability equivalents as follows: Since the Hong Kong tote rounds all payouts down to the nearest 10 cents, we add 5 cents to all (odds+1), take the reciprocal and normalize the results over all races.
Table II
*The presence of Favourite-longshot Bias and different types of bettors*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Overnight bettors</th>
<th>Betting 5 minutes before race start</th>
<th>Betting at the close</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prob_00</td>
<td>1.024971***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0187403)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob_05</td>
<td></td>
<td>.9968372***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.0127564)</td>
<td></td>
</tr>
<tr>
<td>Prob_fo</td>
<td></td>
<td></td>
<td>1.000875***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(.0122404)</td>
</tr>
<tr>
<td>Constant</td>
<td>-.0017853</td>
<td>.0004127</td>
<td>.0000972</td>
</tr>
<tr>
<td></td>
<td>(.0019371)</td>
<td>(.0013713)</td>
<td>(.0013326)</td>
</tr>
<tr>
<td>Observations</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>99.37</td>
<td>99.69</td>
<td>99.72</td>
</tr>
</tbody>
</table>

Table II: Dependent variable: Win, a dummy which receives 1 for the winning horse in the race and zero otherwise. Standard errors corrected for heteroskedasticity as required by the linear probability model are reported in parenthesis.

*** The coefficient is significant at the 0.1% level.

In order to test the presence of favourite-longshot bias, we perform an F- test on the joint hypothesis:

\[
prob_i = 1 \quad i = 00, 05, fo \\
\text{Constant} = 0
\]
Table III
F-test results for the presence of Favourite -longshot Bias

<table>
<thead>
<tr>
<th>Variables</th>
<th>Overnight bettors</th>
<th>Betting 5 minutes before race start</th>
<th>Betting at the close</th>
</tr>
</thead>
<tbody>
<tr>
<td>(F)-test</td>
<td>0.90</td>
<td>0.05</td>
<td>0.02</td>
</tr>
<tr>
<td>((Prob&gt;F))</td>
<td>(0.4255)</td>
<td>(0.9550)</td>
<td>0.9817</td>
</tr>
</tbody>
</table>

It is clear from these results that bettors exhibit no favourite-longshot bias. Note that this result holds not only for closing prices, but even for those bettors who bet on the day before the races and five minutes before race start. The finding that prices before the close of betting display no statistically significant favourite-longshot bias is, to the best of our knowledge, entirely new in the literature on the favourite longshot bias.

Since Shin (1991, 1992) a number of papers have shown that insiders and outsiders have different betting strategies, reflecting the role of private information [see among others Schnytzer and Shilony (1995)]. However, none has ever investigated whether different types of agents reflect a different attitude towards risk. Here we investigate the loss aversion attitude for the three types of bettors.

According to the model described in the previous section, we design a simple empirical test, which consists in testing the hypotheses that \( \beta_g \) and \( \beta_l \) are significantly different and that \( \beta_g \) is lower than \( \beta_l \). However, in equation (4), the deviation, \( (R_{ij} - R_i) \), of the odds for horse i in race j from the expected odds is correlated with the price of horse i in race j, since the price of horse i in race j is calculated simply as the inverse of the odds plus one. Accordingly, we need to find an instrumental variable that will allow us to test our hypotheses on \( \beta_g \) and \( \beta_l \).

We define the normalized finishing position\(^{13} \) of horse i in race j \( NFP_{ij} \) as:

\[
NFP_{ij} = 1 - \frac{\text{Ordinal finishing position}}{\text{Number of runners}}
\]

for all horses but the winner and set \( NFP_{ij} = 1 \) for all winning horses.

\(^{13}\) Note that according to the definition used, the variable NFP takes values over the interval \([0,1]\), where the winner gets 1 and the last horse 0. The definition used differs from the one used by Brecher (1980), according to which NFP takes values over the interval \([-0.5, 0.5]\), and the winner gets 0.5 and the last horse -0.5.
We use a functional form of the difference between $NFP$ for horse $i$ in races $j$ and race $j-1$ (described below) as an instrumental variable for $(R_j - R_i)$: it is a measure of whether the bettor’s expectations over the winner of the race are satisfied or disappointed, but it is not directly correlated with the price of horse $i$ in race $j$. In order to perform the empirical test on the presence of loss aversion and test whether bettors react more to losses than gains, we need to distinguish between horses that improve their finishing positions and those that do not, in a sense that is meaningful in terms of win betting. We construct two separate variables, $Pla_{\text{up}}$ and $Pla_{\text{down}}$, that provide a quantitative measure of how much a horse $i$ has improved or worsened its finishing position with respect to the expectations. Analytically, we define the variables $Pla_{\text{up}}$ and $Pla_{\text{down}}$ as follows:

\[
pl_{ij} = NFP_{ij} \quad \text{if} \quad NFP_{ij} < 4 \\
pl_{ij} = 0 \quad \text{if} \quad NFP_{ij} \geq 4 \\
delpl_{ij} = pl_{ij} - pl_{ij-1} \\
Pla_{\text{up}}_{ij} = delpl_{ij} \quad \text{if} \quad pl_{ij} - pl_{ij-1} > 0 \\
Pla_{\text{down}}_{ij} = delpl_{ij} \quad \text{if} \quad pl_{ij} - pl_{ij-1} < 0
\]

The main idea behind these indicators is that only “meaningful” changes in expectations will affect betting prices. Thus, according to the definitions of $Pla_{\text{up}}$ and $Pla_{\text{down}}$, meaningful changes in performance relate to differences in finishing position in successive starts as between first, second, third and unplaced\(^{14}\). Therefore, a horse that run 8\(^{th}\) in one race and 6\(^{th}\) at its next start will register no change, even though it has improved its finishing position, but it will register a change if it finishes anywhere in the first three places. In other words, the shift from finishing in two different position neither of which is at least third is unlikely to impact meaningfully on a win bettor's regret or elation, where these changes were anticipated. On the other hand, a horse expected to win which runs second can be a source of considerable regret! While a horse that was considered only likely to run a place provides both profit and elation if it wins! Note that adaptive expectations are, by definition, implicitly assumed, since bettors compare $NFP_{ij}$ in this race with $NFP_{ij-1}$ in the previous race (in which horse $i$ took part). This assumption can be motivated in light of the typical behaviour of the bettor, who does not look too far into the past. In particular, in Hong Kong there are usually only two race meetings per week during the racing season (typically one for each track), and more importantly, the mean number of days between race starts for the horses in the data set is 36. This allows us to focus exclusively on comparison with a horse’s performance at its previous start.

We investigate the presence of an asymmetric impact on prices of a gain or a loss defined with respect to expected win, as measured by a change in horse’s final position as between the forthcoming race and the horse’s last start as defined above. We use ordinary least squares and control for a number of factors affecting race conditions, such as the barrier (a particularly important variable as between the two tracks, as noted above), distance of the race, turf (or dirt) track surface and the weight carried by the horse. We control for the specific track by inserting a dummy for the track Happy Valley and interacting the dummy with both $Pla_{\text{up}}$ and $Pla_{\text{down}}$. We run the regression on each of the three sets of prices available in order to detect the loss aversion attitude of different types of agent. We run the models twice: once without fixed effects and once with interaction dummies between the horses and the jockeys\(^{15}\).

\(^{14}\) Or "did not show" in American terminology.

\(^{15}\) Simple OLS with other fixed effects and interaction models were also run (not reported here) with similar results.
The results are reported in Table IVa for the case without fixed effects and in Table IVb for regressions including a dummy for each separate horse-jockey pair.

Table IVa
Regression results: The presence of Loss Aversion and different types of bettors: simple ordinary least squares

<table>
<thead>
<tr>
<th>Variables</th>
<th>Overnight bettors</th>
<th>Betting 5 minutes before race start</th>
<th>Betting at the close</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pla_up</td>
<td>.0380452***</td>
<td>.0441875***</td>
<td>.0483988***</td>
</tr>
<tr>
<td></td>
<td>(.0014714)</td>
<td>(.0015542)</td>
<td>(.0016183)</td>
</tr>
<tr>
<td>Hypla_up</td>
<td>-.0052159**</td>
<td>-.0042817**</td>
<td>-.0040731</td>
</tr>
<tr>
<td></td>
<td>(.0024947)</td>
<td>(.0026351)</td>
<td>(.0027437)</td>
</tr>
<tr>
<td>Pla_down</td>
<td>-.0525902***</td>
<td>-.0653861***</td>
<td>-.0678672***</td>
</tr>
<tr>
<td></td>
<td>(.0014154)</td>
<td>(.001495)</td>
<td>(.0015567)</td>
</tr>
<tr>
<td>Hypla_down</td>
<td>-.0003724</td>
<td>-.0030016</td>
<td>-.0020635</td>
</tr>
<tr>
<td></td>
<td>(.0025351)</td>
<td>(.0026778)</td>
<td>(.0027881)</td>
</tr>
<tr>
<td>Happy Valley</td>
<td>.0097712***</td>
<td>.0094857***</td>
<td>.0096682 ***</td>
</tr>
<tr>
<td></td>
<td>(.0009851)</td>
<td>(.0010406)</td>
<td>(.0010835)</td>
</tr>
<tr>
<td>Turf</td>
<td>-.0054565***</td>
<td>-.0058753***</td>
<td>-.00623***</td>
</tr>
<tr>
<td></td>
<td>(.0012417)</td>
<td>(.0013116)</td>
<td>(.0013656)</td>
</tr>
<tr>
<td>Barrier</td>
<td>-.0030746***</td>
<td>-.003403***</td>
<td>-.0035826***</td>
</tr>
<tr>
<td></td>
<td>(.0000949)</td>
<td>(.0001002)</td>
<td>(.0001043)</td>
</tr>
<tr>
<td>Wt</td>
<td>.0027932***</td>
<td>.0035549***</td>
<td>.0032675***</td>
</tr>
<tr>
<td></td>
<td>(.0000612)</td>
<td>(.0000647)</td>
<td>(.0000674)</td>
</tr>
<tr>
<td>Constant</td>
<td>-.2308314***</td>
<td>-.3201571***</td>
<td>-.2885259 ***</td>
</tr>
<tr>
<td></td>
<td>(.0091615)</td>
<td>(.0096772)</td>
<td>(.0100761)</td>
</tr>
<tr>
<td>Observations</td>
<td>51,186</td>
<td>51,186</td>
<td>51,186</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>11.46</td>
<td>14.77</td>
<td>13.80</td>
</tr>
</tbody>
</table>

Table IVa: Dependent variable: The relevant prices. Robust standard deviations are reported in parenthesis.

***- The coefficient is significant at the 1% level
Table IVb
Regression results: The presence of Loss Aversion and different types of bettors: the fixed effect case

<table>
<thead>
<tr>
<th>Variables</th>
<th>Overnight bettors Horse-jockey interactions</th>
<th>Betting 5 minutes before race start Horse-jockey interactions</th>
<th>Betting at the close Horse-jockey interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pla_up</td>
<td>.0068856***</td>
<td>.0070963***</td>
<td>.0098***</td>
</tr>
<tr>
<td></td>
<td>(.0014973)</td>
<td>(.0015856)</td>
<td>(.0016061)</td>
</tr>
<tr>
<td>Hypla_up</td>
<td>.0048379***</td>
<td>.0083589***</td>
<td>.0088742 ***</td>
</tr>
<tr>
<td></td>
<td>(.0023462)</td>
<td>(.0024859)</td>
<td>(.002596)</td>
</tr>
<tr>
<td>Pla_down</td>
<td>-.0266834***</td>
<td>-.0341977***</td>
<td>-.035001 ***</td>
</tr>
<tr>
<td></td>
<td>(.0016741)</td>
<td>(.0017001)</td>
<td>(.0017366)</td>
</tr>
<tr>
<td>Hypla_down</td>
<td>-.0058686***</td>
<td>-.0088214***</td>
<td>-.0079 ***</td>
</tr>
<tr>
<td></td>
<td>(.0026555)</td>
<td>(.0027753)</td>
<td>(.0028241)</td>
</tr>
<tr>
<td>Happy Valley</td>
<td>.0132661***</td>
<td>.0141848***</td>
<td>.0147886 ***</td>
</tr>
<tr>
<td></td>
<td>(.0009293)</td>
<td>(.0009629)</td>
<td>(.0010042)</td>
</tr>
<tr>
<td>Turf</td>
<td>-.0121525***</td>
<td>-.0141276***</td>
<td>-.0147886 ***</td>
</tr>
<tr>
<td></td>
<td>(.0011645)</td>
<td>(.0011957)</td>
<td>(.0012392)</td>
</tr>
<tr>
<td>Barrier</td>
<td>-.0032932***</td>
<td>-.0036856***</td>
<td>-.0038916 ***</td>
</tr>
<tr>
<td></td>
<td>(.0000991)</td>
<td>(.0001041)</td>
<td>(.000109)</td>
</tr>
<tr>
<td>Wt</td>
<td>.0016021***</td>
<td>.0022956***</td>
<td>.0018781 ***</td>
</tr>
<tr>
<td></td>
<td>(.0000734)</td>
<td>(.0000776)</td>
<td>(.0000797)</td>
</tr>
<tr>
<td>Constant</td>
<td>-.0534271***</td>
<td>-.1422848***</td>
<td>-.0940949 ***</td>
</tr>
<tr>
<td></td>
<td>(.012239)</td>
<td>(.0128929)</td>
<td>(.0133648)</td>
</tr>
<tr>
<td>Observations</td>
<td>51,186</td>
<td>51,186</td>
<td>51,186</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>34.80</td>
<td>41.60</td>
<td>41.57</td>
</tr>
</tbody>
</table>

Table IVb: Dependent variable: The final prices on each run. Robust standard deviations are reported in parenthesis.

*** The coefficient is significant at the 1% level.
Loss Aversion (defined with respect to expectations of winning) appears to be present in bets in all set of regressions, at all three time slices, and at both tracks, Sha Tin and Happy Valley. In Tables IVa and IVb we measure loss aversion in the reaction of outsiders (overnight price), outsiders plus insiders (price 5 minutes before the race) and professional late bettors added to the other bettors (final price).

Consider the presence of loss aversion in the regression on final prices (reported in summary form from Table IVb in the third row of Table V): \( \hat{\beta}_g > 0 \) is significantly higher in absolute value than \( \hat{\beta}_r \) at both tracks, Happy Valley and Sha Tin: in both sets of regressions a positive “surprise” in a horse’s final position increases the price by a lower amount than the price reduction caused by a same-sized loss measured in terms of worsening final position of the horse with respect to previous race. The set of coefficients \( \hat{\beta}_r \) and \( \hat{\beta}_g \) is significantly different at both tracks (as can be seen through an F-test on the equivalence restriction \( \hat{\beta}_g = \hat{\beta}_r \)). Loss aversion affects final prices at both tracks Happy Valley and Sha Tin. Moreover, at Happy Valley – where it is more difficult to predict the winner of the race - bettors show a lower level of loss aversion, since \( \hat{\beta}_r (0.0429) \) is about 2 times the value of \( \hat{\beta}_g (0.019) \), while at Sha Tin, \( \hat{\beta}_r (0.035) \) is about 3.5 times \( \hat{\beta}_g (0.0098) \). Therefore, the intensity of loss aversion is lower at the more difficult track with respect to the (by consensus) “easier” track. This latter result may suggest the role of learning effects on shaping the loss aversion bias: in a more difficult environment – as at Happy Valley - the degree of loss aversion tends to be lower since it is more difficult to learn – because there are fewer possibilities to improve the capacity to forecast the race winner, the bettor cannot be disappointed by her own mistakes. By contrast, at Sha Tin, the presence of a learning effect may increase the intensity of loss aversion, since each bettor can more readily improve his ability to bet on the winning horse. As shown in Table V, bettors at Sha Tin display a higher level of loss aversion than at Happy Valley, confirming the presence of learning effects.

Further, these results allow us to focus on the behaviour of “smart money”, represented by insiders (whose major impact is seen in the prices 5 minutes before the race start) and professional bettors (who are known to bet right before the close). The main result is that even insiders and professional bettors, like outsiders who are not trained to bet and have no informational advantage, exhibit loss aversion. This provides new evidence of the presence of loss aversion in a particular context: supporting the idea that loss aversion is a basic behavioural bias affecting trained and untrained bettors. This result is consistent with the empirical evidence presented in Chen et al (2007) – which shows that loss aversion is present in the trading behaviour of capuchin monkeys as an innate attitude.

However, the intensity of loss aversion is not homogenous across types of bettors: both at Sha Tin and Happy Valley professional traders (with late bets) exhibit a lower level of loss aversion, while in case of insiders we can observe different patterns: at Happy Valley (in absence of a learning effect) trained bettors exhibit a lower level of loss aversion, while insiders at Sha Tin (with its learning effect) display an increased the level of LA, which becomes 4 times the coefficient in the case of gain. Note that since the extent of loss aversion does not fall monotonically between the overnight odds and the final odds, we cannot argue that insiders have less loss aversion than outsiders.

\(^{16}\) \( \hat{\beta}_r \) is negative since \( \text{pla}_{down} \) is a dummy variable that takes on the value 1 when a horse worsens its \( NFP \). Therefore the effect of a negative surprise in final race placement is to reduce the bet price of the losing horse.
Table V: Loss Aversion in the three time slices at Sha Tin and Happy Valley.

Summary of results of Table IV

<table>
<thead>
<tr>
<th></th>
<th>SHA TIN</th>
<th></th>
<th></th>
<th>HAPPY VALLEY</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\hat{\beta}_1$</td>
<td>$\hat{\beta}_g$</td>
<td>$\hat{\beta}_1$</td>
<td>$\hat{\beta}_g$</td>
<td>$\hat{\beta}_1$</td>
</tr>
<tr>
<td>OVERNIGHT</td>
<td>.027</td>
<td>.0069</td>
<td>3.9</td>
<td>.033</td>
<td>.124</td>
</tr>
<tr>
<td>MIN BEFORE5</td>
<td>.034</td>
<td>.0071</td>
<td>4.8</td>
<td>.042</td>
<td>.153</td>
</tr>
<tr>
<td>FINAL PRICE</td>
<td>.035</td>
<td>.0098</td>
<td>3.57</td>
<td>.043</td>
<td>.019</td>
</tr>
</tbody>
</table>

5. Conclusions

In this paper we have presented a simple theoretical model of regret and elation in a betting market. We have shown that our Hong Kong horse betting market data set may be divided into three sets of prices which incorporate significantly different kinds of information. We used this finding to show that neither amateur outsiders, who bet on the day before the race, nor insiders or sophisticated outsiders, bet with a statistically significant favourite-longshot basis. We then used our theoretical model to perform a direct test for the presence of loss aversion in this market and found that, indeed, every type of bettor appeared to be beset by loss aversion. The absence of a favourite-longshot bias not only in final prices, as in the standard literature on the favourite-longshot bias, but also for overnight prices and prices five minutes before the start of the race, in the presence of loss aversion at each stage, suggests that the favourite-longshot bias may not be psychologically based. Moreover, the results provide additional evidence supporting the idea that loss aversion is innate, as in Chen et al. (2006). Finally, we have investigated how widespread loss aversion is across different types of bettors and have shown that more sophisticated and experienced bettors display a higher level of loss aversion than amateurs, as in the Haigh and List (2005) study of professional traders.

References


Bar-Ilan University
Department of Economics
WORKING PAPERS

1-01 The Optimal Size for a Minority

2-01 An Application of a Switching Regimes Regression to the Study of Urban Structure

3-01 The Kuznets Curve and the Impact of Various Income Sources on the Link Between Inequality and Development

4-01 International Asset Allocation: A New Perspective

5-01 מודל המועדים והקשיים המרובים

6-01 Multi-Generation Model of Immigrant Earnings: Theory and Application

7-01 Shattered Rails, Ruined Credit: Financial Fragility and Railroad Operations in the Great Depression

8-01 Cooperation and Competition in a Duopoly R&D Market

9-01 A Theory of Immigration Amnesties

10-01 Dynamic Asset Pricing With Non-Redundant Forwards

11-01 Macroeconomic and Labor Market Impact of Russian Immigration in Israel

Electronic versions of the papers are available at http://www.biu.ac.il/soc/ec/wp/working_papers.html
12-01 **Network Topology and the Efficiency of Equilibrium**

13-01 **General Equilibrium Pricing of Trading Strategy Risk**

14-01 **Social Conformity and Child Labor**

15-01 **Determinants of Railroad Capital Structure, 1830–1885**

16-01 **Political-Legal Institutions and the Railroad Financing Mix, 1885–1929**

17-01 **Macroeconomic Instability, Migration, and the Option Value of Education**

18-01 **Property Rights, Theft, and Efficiency: The Biblical Waiver of Fines in the Case of Confessed Theft**
   Eliakim Katz and Jacob Rosenberg, November 2001.

19-01 **Ethnic Discrimination and the Migration of Skilled Labor**
   Frédéric Docquier and Hillel Rapoport, December 2001.

1-02 **Can Vocational Education Improve the Wages of Minorities and Disadvantaged Groups? The Case of Israel**
   Shoshana Neuman and Adrian Ziderman, February 2002.

2-02 **What Can the Price Gap between Branded and Private Label Products Tell Us about Markups?**

3-02 **Holiday Price Rigidity and Cost of Price Adjustment**

4-02 **Computation of Completely Mixed Equilibrium Payoffs**
   Igal Milchtaich, March 2002.

5-02 **Coordination and Critical Mass in a Network Market – An Experimental Evaluation**
6-02  Inviting Competition to Achieve Critical Mass  
Amir Etziony and Avi Weiss, April 2002.

7-02  Credibility, Pre-Production and Inviting Competition in a Network Market  
Amir Etziony and Avi Weiss, April 2002.

8-02  Brain Drain and LDCs’ Growth: Winners and Losers  
Michel Beine, Fréderic Docquier, and Hillel Rapoport, April 2002.

9-02  Heterogeneity in Price Rigidity: Evidence from a Case Study Using Micro-Level Data  

10-02  Price Flexibility in Channels of Distribution: Evidence from Scanner Data  

11-02  Acquired Cooperation in Finite-Horizon Dynamic Games  
Igal Milchtaich and Avi Weiss, April 2002.

12-02  Cointegration in Frequency Domain  

13-02  Which Voting Rules Elicit Informative Voting?  
Ruth Ben-Yashar and Igal Milchtaich, May 2002.

14-02  Fertility, Non-Altruism and Economic Growth: Industrialization in the Nineteenth Century  
Elise S. Brezis, October 2002.

15-02  Changes in the Recruitment and Education of the Power Elites in Twentieth Century Western Democracies  
Elise S. Brezis and François Crouzet, November 2002.

16-02  On the Typical Spectral Shape of an Economic Variable  

17-02  International Evidence on Output Fluctuation and Shock Persistence  

1-03  Topological Conditions for Uniqueness of Equilibrium in Networks  
Igal Milchtaich, March 2003.

2-03  Is the Feldstein-Horioka Puzzle Really a Puzzle?  
3-03  **Growth and Convergence across the US: Evidence from County-Level Data**  
Matthew Higgins, Daniel Levy, and Andrew Young, June 2003.

4-03  **Economic Growth and Endogenous Intergenerational Altruism**  
Hillel Rapoport and Jean-Pierre Vidal, June 2003.

5-03  **Remittances and Inequality: A Dynamic Migration Model**  
Frédéric Docquier and Hillel Rapoport, June 2003.

6-03  **Sigma Convergence Versus Beta Convergence: Evidence from U.S. County-Level Data**  

7-03  **Managerial and Customer Costs of Price Adjustment: Direct Evidence from Industrial Markets**  

8-03  **First and Second Best Voting Rules in Committees**  
Ruth Ben-Yashar and Igal Milchtaich, October 2003.

9-03  **Shattering the Myth of Costless Price Changes: Emerging Perspectives on Dynamic Pricing**  

1-04  **Heterogeneity in Convergence Rates and Income Determination across U.S. States: Evidence from County-Level Data**  

2-04  **“The Real Thing:” Nominal Price Rigidity of the Nickel Coke, 1886-1959**  

3-04  **Network Effects and the Dynamics of Migration and Inequality: Theory and Evidence from Mexico**  
David Mckenzie and Hillel Rapoport, March 2004.

4-04  **Migration Selectivity and the Evolution of Spatial Inequality**  

5-04  **Many Types of Human Capital and Many Roles in U.S. Growth: Evidence from County-Level Educational Attainment Data**  
6-04  **When Little Things Mean a Lot: On the Inefficiency of Item Pricing Laws**  

7-04  **Comparative Statics of Altruism and Spite**  
Igal Milchtaich, June 2004.

8-04  **Asymmetric Price Adjustment in the Small: An Implication of Rational Inattention**  

1-05  **Private Label Price Rigidity during Holiday Periods**  

2-05  **Asymmetric Wholesale Pricing: Theory and Evidence**  

3-05  **Beyond the Cost of Price Adjustment: Investments in Pricing Capital**  

4-05  **Explicit Evidence on an Implicit Contract**  
Andrew T. Young and Daniel Levy, June 2005.

5-05  **Popular Perceptions and Political Economy in the Contrived World of Harry Potter**  

6-05  **Growth and Convergence across the US: Evidence from County-Level Data (revised version)**  

1-06  **Sigma Convergence Versus Beta Convergence: Evidence from U.S. County-Level Data (revised version)**  
Andrew T. Young, Matthew J. Higgins, and Daniel Levy, June 2006.

2-06  **Price Rigidity and Flexibility: Recent Theoretical Developments**  

3-06  **The Anatomy of a Price Cut: Discovering Organizational Sources of the Costs of Price Adjustment**  
4-06  **Holiday Non-Price Rigidity and Cost of Adjustment**  
Georg Müller, Mark Bergen, Shantanu Dutta, and Daniel Levy.  
September 2006.

2008-01  **Weighted Congestion Games With Separable Preferences**  
Igal Milchtaich, October 2008.

2008-02  **Federal, State, and Local Governments: Evaluating their Separate Roles in US Growth**  

2008-03  **Political Profit and the Invention of Modern Currency**  
Dror Goldberg, December 2008.

2008-04  **Static Stability in Games**  
Igal Milchtaich, December 2008.

2008-05  **Comparative Statics of Altruism and Spite**  
Igal Milchtaich, December 2008.

2008-06  **Abortion and Human Capital Accumulation: A Contribution to the Understanding of the Gender Gap in Education**  

2008-07  **Involuntary Integration in Public Education, Fertility and Human Capital**  

2009-01  **Inter-Ethnic Redistribution and Human Capital Investments**  
Leonid V. Azarnert, January 2009.

2009-02  **Group Specific Public Goods, Orchestration of Interest Groups and Free Riding**  
Gil S. Epstein and Yosef Mealem, January 2009.

2009-03  **Holiday Price Rigidity and Cost of Price Adjustment**  

2009-04  **Legal Tender**  
Dror Goldberg, April 2009.

2009-05  **The Tax-Foundation Theory of Fiat Money**  
Dror Goldberg, April 2009.
2009-06 The Inventions and Diffusion of Hyperinflatable Currency
Dror Goldberg, April 2009.

2009-07 The Rise and Fall of America’s First Bank
Dror Goldberg, April 2009.

2009-08 Judicial Independence and the Validity of Controverted Elections
Raphaël Franck, April 2009.

2009-09 A General Index of Inherent Risk
Adi Schnytzer and Sara Westreich, April 2009.

2009-10 Measuring the Extent of Inside Trading in Horse Betting Markets
Adi Schnytzer, Martien Lamers and Vasiliki Makropoulou, April 2009.

2009-11 The Impact of Insider Trading on Forecasting in a Bookmakers’ Horse Betting Market
Adi Schnytzer, Martien Lamers and Vasiliki Makropoulou, April 2009.

2009-12 Foreign Aid, Fertility and Population Growth: Evidence from Africa
Leonid V. Azarnert, April 2009.

2009-13 A Reevaluation of the Role of Family in Immigrants’ Labor Market Activity: Evidence from a Comparison of Single and Married Immigrants

2009-14 The Efficient and Fair Approval of “Multiple-Cost–Single-Benefit” Projects Under Unilateral Information
Nava Kahanaa, Yosef Mealem and Shmuel Nitzan, May 2009.

2009-15 Après nous le Déluge: Fertility and the Intensity of Struggle against Immigration
Leonid V. Azarnert, June 2009.

2009-16 Is Specialization Desirable in Committee Decision Making?

2009-17 Framing-Based Choice: A Model of Decision-Making Under Risk
Kobi Kriesler and Shmuel Nitzan, June 2009.

2009-18 Demystifying the ‘Metric Approach to Social Compromise with the Unanimity Criterion’
Shmuel Nitzan, June 2009.
2009-19  On the Robustness of Brain Gain Estimates
Michel Beine, Frédéric Docquier and Hillel Rapoport, July 2009.

2009-20  Wage Mobility in Israel: The Effect of Sectoral Concentration
Ana Rute Cardoso, Shoshana Neuman and Adrian Ziderman, July 2009.

Shoshana Neuman and Adrian Ziderman, July 2009.

2009-22  National Aggregates and Individual Disaffiliation: An International Study

2009-23  The Big Carrot: High-Stakes Incentives Revisited

2009-24  The Why, When and How of Immigration Amnesties
Gil S. Epstein and Avi Weiss, September 2009.

2009-25  Documenting the Brain Drain of «la Crème de la Crème»: Three Case-Studies on International Migration at the Upper Tail of the Education Distribution
Frédéric Docquier and Hillel Rapoport, October 2009.

2009-26  Remittances and the Brain Drain Revisited: The Microdata Show That More Educated Migrants Remit More
Albert Bollard, David McKenzie, Melanie Morten and Hillel Rapoport, October 2009.

2009-27  Implementability of Correlated and Communication Equilibrium Outcomes in Incomplete Information Games
Igal Milchtaich, November 2009.

2010-01  The Ultimatum Game and Expected Utility Maximization – In View of Attachment Theory
Shaul Almakias and Avi Weiss, January 2010.

2010-02  A Model of Fault Allocation in Contract Law – Moving From Dividing Liability to Dividing Costs
Osnat Jacobi and Avi Weiss, January 2010.
2010-03  Coordination and Critical Mass in a Network Market: An Experimental Investigation

2010-04  Immigration, fertility and human capital: A model of economic decline of the West
Leonid V. Azarnert, April 2010.

2010-05  Is Skilled Immigration Always Good for Growth in the Receiving Economy?
Leonid V. Azarnert, April 2010.

2010-06  The Effect of Limited Search Ability on the Quality of Competitive Rent-Seeking Clubs

2010-07  Condorcet vs. Borda in Light of a Dual Majoritarian Approach
Eyal Baharad and Shmuel Nitzan, April 2010.

2010-08  Prize Sharing in Collective Contests
Shmuel Nitzan and Kaoru Ueda, April 2010.

2010-09  Network Topology and Equilibrium Existence in Weighted Network Congestion Games
Igal Milchtaich, May 2010.

2010-10  The Evolution of Secularization: Cultural Transmission, Religion and Fertility Theory, Simulations and Evidence

2010-11  The Economics of Collective Brands

2010-12  Interactions Between Local and Migrant Workers at the Workplace
Gil S. Epstein and Yosef Mealem, August 2010.

2010-13  A Political Economy of the Immigrant Assimilation: Internal Dynamics
Gil S. Epstein and Ira N. Gang, August 2010.

2010-14  Attitudes to Risk and Roulette
Adi Schnytzer and Sara Westreich, August 2010.
2010-15  Life Satisfaction and Income Inequality  
Paolo Verme, August 2010.

2010-16  The Poverty Reduction Capacity of Private and Public Transfers in Transition  
Paolo Verme, August 2010.

2010-17  Migration and Culture  
Gil S. Epstein and Ira N. Gang, August 2010.

2010-18  Political Culture and Discrimination in Contests  
Gil S. Epstein, Yosef Mealem and Shmuel Nitzan, October 2010.

2010-19  Governing Interest Groups and Rent Dissipation  
Gil S. Epstein and Yosef Mealem, November 2010.

2010-20  Beyond Condorcet: Optimal Aggregation Rules Using Voting Records  
Eyal Baharad, Jacob Goldberger, Moshe Koppel and Shmuel Nitzan, December 2010.

2010-21  Price Points and Price Rigidity  

2010-22  Price Setting and Price Adjustment in Some European Union Countries: Introduction to the Special Issue  

2011-01  Business as Usual: A Consumer Search Theory of Sticky Prices and Asymmetric Price Adjustment  
Luís Cabral and Arthur Fishman, January 2011.

2011-02  Emigration and democracy  
Frédéric Docquier, Elisabetta Lodigiani, Hillel Rapoport and Maurice Schiff, January 2011.

2011-03  Shrinking Goods and Sticky Prices: Theory and Evidence  
Avichai Snir and Daniel Levy, March 2011.

2011-04  Search Costs and Risky Investment in Quality  
2011-05  
To What Extent do Investors in a Financial Market Anchor Their Judgments? Evidence from the Hong Kong Horserace Betting Market

Johnnie E.V. Johnson, Shuang Liu and Adi Schnytzer, March 2011.

2011-06  
Attitudes to Risk and Roulette

Adi Schnytzer and Sara Westreich, March 2011.

2011-07  
False Consciousness in Financial Markets: Or is it in Ivory Towers?

Adi Schnytzer and Sara Westreich, March 2011.

2011-08  
Herding in Imperfect Betting Markets with Inside Traders

Adi Schnytzer and Avichai Snir, March 2011.

2011-09  
Painful Regret and Elation at the Track

Adi Schnytzer and Barbara Luppi, March 2011.

2011-10  
The Regression Tournament: A Novel Approach to Prediction Model Assessment

Adi Schnytzer and Janez Šušteršič, March 2011.

2011-11  
Shorting the Bear: A test of anecdotal evidence of insider trading in early stages of the sub-prime market crisis

Les Coleman and Adi Schnytzer, March 2011.

2011-12  
SP Betting as a Self-Enforcing Implicit Cartel

Adi Schnytzer and Avichai Snir, March 2011.

2011-13  
Testing for Home Team and Favorite Biases in the Australian Rules Football Fixed Odds and Point Spread Betting Markets

Adi Schnytzer and Guy Weinberg, March 2011.

2011-14  
The Impact of Insider Trading on Forecasting in a Bookmakers' Horse Betting Market

Adi Schnytzer, Martien Lamers and Vasiliki Makropoulou, March 2011.

2011-15  
The Prediction Market for the Australian Football League

Adi Schnytzer, March 2011.
2011-16  Information and Attitudes to Risk at the Track
Adi Schnytzer and Sara Westreich, March 2011.

2011-17  Explicit Evidence on an Implicit Contract
Andrew T. Young and Daniel Levy, March 2011.

2011-18  Globalization, Brain Drain and Development
Frédéric Docquier and Hillel Rapoport, March 2011.