INVESTOR PSYCHOLOGY: A BEHAVIOURAL EXPLANATION OF SIX FINANCE PUZZLES

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SUMMARY

This paper surveys the behavioural finance explanation of six puzzles of finance. These puzzles are: stock price under- and overreactions, excessive trading and the gender puzzle, financial hypes and panic, the equity premium puzzle, the winner/loser puzzle and the dividend puzzle. After an introduction of prospect theory and a description of heuristics and biases in the judgment of information, the paper applies behavioural insights to explain the puzzles.

Key words: psychology, behavioural finance
JEL codes: G1, D 80

SAMENVATTING

Dit paper verklaart, met behulp van de behavioural finance theorie, zes verschijnselen op financiële markten die te beschouwen zijn als anomalieën, of raadsels. Het paper geeft een beschrijving van prospect theorie en van psychologische vuistregels die een rol spelen bij de interpretatie van informatie. Vervolgens worden deze inzichten uit de behavioural finance toegepast ter verklaring van onder- en overreactie van aandelen, overmatig handelen en de verschillende performance van mannen en vrouwen, financiële hypes en paniek, de aandelenpremiepuzzel, de winnaar/verliezer puzzel en het dividendraadsel.

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1 INTRODUCTION

During the 1980s financial economists, confronted with phenomena in financial markets that were difficult to explain within the rational expectations and expected utility framework, started to consider the possibility that some market participants behave less than rationally, and to study whether this might affect markets as a whole.

Initially, they made no explicit use of insights from psychology. Although the literature by psychologist Daniel Kahneman and his co-author Amos Tversky on prospect theory had already been published in 1979, financial economists either were not aware either that this literature existed or that it might be relevant for finance. They introduced information asymmetries and shifts in preferences to explain the apparent anomalies, or simply assumed that people do not always behave rationally.

At a later stage, economists became aware that prospect theory and the psychological literature on heuristics and biases in judging information may provide a sophisticated model of why people make decisions for what seem to be non-rational reasons. Perhaps the 1987 crash provided an additional impulse to question the validity of the rational expectations framework. Anyway, during the 1990s, the finance literature that uses psychological concepts to explain the behaviour of market participants became a separate field of research. And it invented its own label: behavioural finance. The 2002 economics Nobel prize awarded to Kahneman was a further recognition of the contribution of psychology to the explanation of economic behaviour.

This study surveys the behavioural finance literature. It is set up as follows. In the next section, some financial puzzles, or anomalies, are briefly sketched. Section 3 introduces prospect theory. This is a theory of decision making under risk which takes actual decision making processes by people into account, rather than postulating rationality. Prospect theory is to be seen as an alternative to expected utility theory. Section 4 introduces the heuristics and biases used by people when judging information. Again, these heuristics and biases are found in actual behaviour, and are to be seen as an alternative to the rational expectations hypothesis. Section 5 describes how behavioural finance may help solving the six puzzles mentioned in section 2. In Section 5, the implications of behavioural finance for market (in)efficiency are discussed. Section 6 summarizes and concludes.

2 Six puzzles of finance

Puzz1e 1: Asset price over- and underreaction

Various empirical studies conclude that asset prices and exchange rates tend to under- and overreact to news. Cutler, Poterba and Simmons (1991) study various financial markets in the period 1960-88. They find autocorrelation of returns over a horizon varying from four months to one year. Bernard (1992) studies the returns on individual stocks in the periods following earnings announcements, measuring the surprise element in earnings and its effect on stock prices. His conclusion is, that the more surprising an earnings announcement is, the more a stock price will rise in the periods following the initial news release. Jegadeesh and Titman (1993) and De Bondt and Thaler (1985) find results that point to inefficient pricing in financial markets. Jegadeesh and Titman's research suggests a pattern of underreaction: over a given period (in the study under consideration: six months) the return on winning stocks exceeds that on losing stocks. De Bondt and Thaler show that in the longer run, the opposite holds.

Puzzle 2: Excessive trading and the gender puzzle

Barber and Odean (2000) study trading patterns and returns of over 66,000 accounts held by private investors with stockbrokers[1] in the period 1991-96. The average investor in their sample would have realised a higher return if he had traded less. Moreover, the difference in net return between the 20% investors that traded the least and the 20% that traded the most was about 7% percentage point. The average net return of the group fell short of that of Standard&Poor's 500 by 1.5 percentage point. On the basis of this empirical evidence, Barber and Odean conclude that the average individual (amateur) investor trades excessively. Barber and Odean (2001) study the difference in investment behaviour between men and women by analyzing the behaviour of more than 35,000 investors over a six-year period, distinguishing between investment accounts opened by women and by men. They study the frequency of transactions and the return on the individual accounts. Their study reveals that, on average, men trade 1.5 times more frequently than women, and earn a return that is one percentage point lower. The gender gap is even larger for singles. Single men trade 67% more often than single women, and earn a return that is 1,5 percentage points lower.

Puzzle 3: Hypes and panic

Kaminsky and Schmukler (1999) investigate investors' response to news in 1997-98, at the time of the Asian crisis. They conclude that the twenty largest daily price changes cannot be fully accounted for by economic and political news. Kaminsky and Schmukler also find that prices overreact more strongly as a crisis worsens, and that in such periods prices respond more strongly to bad news than to good news. In a similar analysis, Keijer and Prast (2001) analyse the response

[1] i.e. 'discount brokers', who, unlike 'retail brokers' do not advise their customers on purchases and sales.

to news of investors in ICT companies quoted on the Amsterdam Stock Exchange in the period 1 October 1999 – 1 March 2000, in the heydays of the ICT bubble. Classifying daily telecom news as good or bad, they study the difference in price development between the Amsterdam technology index (MIT index) and the general AEX index. They find that this difference turns out to respond significantly stronger to good news than to bad news.

Puzzle 4: The equity premium puzzle

Mehra and Prescott (1985) find that between 1926 and 1985, the premium between risky and risk-free assets was on average about 6% per year. In order to be able to explain this equity premium within a rational framework, an unrealistically high degree of risk aversion had to be assumed. Mehra and Prescott show that, in a model where individuals aim at smoothing consumption, the coefficient of relative risk aversion would need to exceed 30 to account for the equity premium. This is a puzzle, since both from a theoretical point of view and on the basis of earlier estimations this coefficient should be approximately 1.

Puzzle 5: The winner/loser puzzle

Investors sell winners more frequently than losers. Odean (2000) studies 163,000 individual accounts at a brokerage firm. For each trading day during a period of one year, Odean counts the fraction of winning stocks that were sold, and compares it to the fraction of losing stocks that were sold. He finds that from January through November, investors sold their winning stock 1.7 times more frequently than their losing loosing stocks. In other words, winners had a 70 percent higher chance of being sold. This is an anomaly, especially as for tax reasons it is for most investors more attractive to sell losers.

Puzzle 6: The dividend puzzle

Investors have a preference for cash dividends (Long, 1978; Loomis, 1968; Miller and Scholes 1982). This is an anomaly, as in the absence of taxes, dividends and capital gains should be perfect substitutes. Moreover, cash dividends often involve a tax disadvantage. Bhattacharya (1979) argues that dividends have a signalling function. However, signalling does not seem capable of explaining all evidence, hence many consider it to be a puzzle (Brealey and Myers, 1981).

3 Prospect theory

In 1979, Kahneman and Tversky launched their prospect theory in what in retrospect proved a seminal paper. On the basis of experiments conducted among colleagues and students, they concluded that the theory of expected utility maximisation does not hold in practice. Expected utility theory assumes that the individual maximises his expected return on the basis of the weighted sum of the various possible outcomes, with each weight being equal to the probability that the corresponding outcome will be realised. Furthermore, the theory assumes that the utility of a final state only depends on the final state; how this final state was reached is irrelevant. Finally, the theory usually assumes that the individual is risk averse. These assumptions imply, that:

(1) $U(x_1, p_1;\ldots..;x_n, p_n) = p_1u(x_1) + \ldots.+p_nu(x_n)$,

where U is the overall utility of a prospect, $(x_1, p_1;\ldots..;x_n, p_n)$ is a prospect (or gamble), which is defined as a contract that results in outcome x_i with probability p_i and where $p_1 + p_2 +\ldots.+p_n = 1$.

(2) $(x_1, p_1;\ldots..;x_n, p_n)$ is acceptable at asset position w if $U(w+ x_1, p_1;\ldots..;w+x_n, p_n) > u(w)$,

(3) $u'' < 0$

Condition (2) implies, that according to expected utility a prospect is acceptable to an individual if the utility resulting from integrating the prospect with the individual's assets exceeds the utility of those assets, u(w). Condition (3), the concavity of the utility function, is not necessary for expected utility theory, but it is generally assumed to describe the preferences of a representative individual and implies that the typical individual is risk averse (Kahneman and Tversky, 1979).

In the experiment set up by Kahneman and Tversky, subjects were asked to solve a range of choice problems. It turned out that in their choices they consistently deviated from expected utility maximisation. For example, they evaluate losses and gains in an asymmetric manner. In situations of winning they were risk averse, while in situations of losing they were risk-seeking. The experiments also showed that people are more sensitive to losses than to gains.[2] In fact, losses have a psychological impact that is about twice as large as the impact of gains. Moreover, further experiments show that people's risk attitude has more dimensions. Thus, a person's risk

[2] Loss aversion may explain money illusion. A nominal wage decrease at zero inflation is less easily accepted than exactly the same decrease in real wages in situations of inflation. For the macroeconomic effects of money illusion, see Fehr and Tyran (2001).

attitude depends on his recent history. After experiencing a financial loss people become less willing to take risks. After a series of gains, risk aversion decreases.

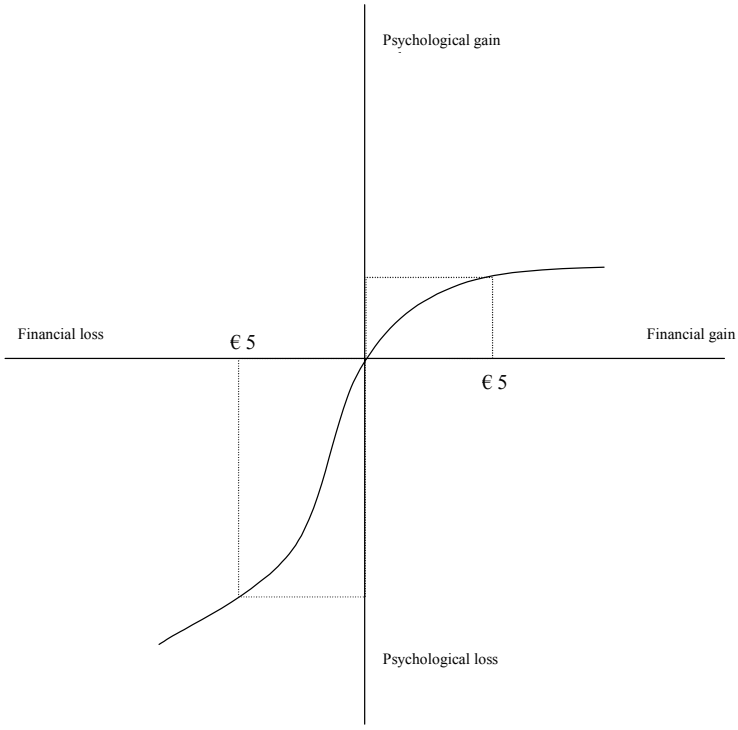
A simple value function according to prospect theory can be described by:

(4) $v(x) = x^a$ for $x \geq 0$; $v(x) = -\lambda(-x)^b$ for $x<0$

where v is the psychological value that the individual attaches to situation x. From experimental research it appears that the value of λ is approximately 2.25 and that a and b both equal 0.88 (Kahneman and Tversky, 1992).

Figure 1 gives a graphical presentation of a value function according to prospect theory.

Figure 1. Prospect theory. The psychological value of gains and losses



Source: Based on Kahneman and Tversky (1979)

Another important piece of prospect theory is the finding that people's decision weights do not correspond to objective probabilities. According to prospect theory, a decision process consists of two stages. The first is the editing stage. In this stage, people frame prospects in terms of losses and gains relative to a benchmark. In doing so, they apply rules of thumb, or heuristics, that

facilitate the interpretation of the various possibilities among which they have to choose. The second stage of the decision process is the evaluation stage. After the various prospects have been edited and framed as losses and gains, they are evaluated and the prospect with the highest value is chosen. The rules of thumb used when editing and evaluating are necessarily a simplification. For example, probabilities or outcomes are rounded, and extremely unlikely outcomes tend to be discarded. As a result, decision weights are a nonlinear function of probabilities. Thus, for small p, $\pi(p) > p$, where p is the probability of an outcome and $\pi(p)$ is the decision weight. Thus, after the individual has passed the two stages of editing and evaluation, he chooses the prospect that maximizes

(5) $\Sigma \pi (p_i)v(x_i)$.

Prospect theory shows that people use *mental accounting* when making financial decisions. Mental accounting is the tendency to classify different financial decision problems under separate mental accounts, while ignoring that it would be rational to integrate these choices into one portfolio decision. Prospect theory decision rules are then applied to each account separately, ignoring possible interaction. Mental accounting explains why people buy a lottery ticket, while at the same time taking out insurance, or, in other words, why people seek and hedge risk (Friedman and Savage, 1948). Investors mentally keep separate accounts, one for each investment, or one for covering downward risks – for which they use such instruments as bonds – and one for benefiting from the upward potential, for which they use stocks. Although portfolio theory predicts that it would be optimal to integrate these elements mentally, in practice people behave differently. One reason for this behaviour may be that the investor wishes to exert *self-control*. If he keeps separate accounts for different sorts of expenditure, he may be less easily tempted to use his nest egg for an impulse purchase (Thaler and Shefrin, 1981). When a new stock is purchased, a new mental account is opened (Thaler 1980; also, see Shefrin and Statman 1985).[3]

Mental accounting, combined with loss aversion and a multi-dimensional risk attitude, results in the *framing effect.* This is the phenomenon that decisions under risk are influenced by the way the decision problem is framed. If a decision is framed in terms of losses, people tend to choose a risky outcome, whereas they tend to avoid risk when the problem is presented in terms of winning. A frequently cited example to illustrate the framing effect is the following. ‘Imagine that you are an army official in a war, commanding six hundred soldiers. You have to choose between route A, where two hundred soldiers will be saved, or route B, where there is a one-third chance that all soldiers will be saved and a two-third chance that none will be saved. Which route do you

take?' Most people tend to choose route A when the decision problem is framed in this way. However, the decision problem can also be framed as follows. 'You have to choose between route A, where four hundred soldiers will die, or route B, where there is a one-third chance that no soldiers will die and a two-third chance that all will die.' When the decision problem is framed in this way, most people choose route B, although the objective characteristics are no different from the first problem (Belsky and Gilovich, 1999).

Another result of loss aversion and mental accounting is that in evaluating outcomes people tend to attach value to both changes and final states, rather than to final states only. An example, taken from Antonides (1999), may illustrate this. Students were asked to judge who was happier, mister A or mister B. Mister A bought a New York State lottery ticket and won $100, but he damaged the rug in his apartment and had to pay his landlord $80. Mister B bought a lottery ticket and won $20. About 70% of the students believed that mister B was happier, although their final states – a gain of $20 – is identical. This evaluation is the result of the fact that the payment, or loss, of $80 has a stronger psychological impact.

From the value function, the following mental rules can be derived for the combined value of outcomes or events. Examples are based on a situation with two outcomes, x and y (Antonides, 1999).

- *Both outcomes are positive*.
In this case (concavity of value function in region of gains), $v(x) + v(y) > v(x+y)$: segregation, that is experiencing these two events separately, is preferred. Moral: do not wrap all Christmas presents together.

- *Both outcomes are negative*
In this case (convexity of value function in region of losses), $v(-x) + v(-y) < v(-x -y)$, so integration of losses is preferred. Example: the psychological cost of suffering two losses on the same day, of say £100 and £50, exceeds the psychological cost of suffering one loss of £150.

- *Mixed outcomes, net result is positive*
This is the outcome (x, -y) with $x > y$, and so $v(x) + v(-y) < v(x-y)$. Hence in this case, integration is preferred. An example: withdrawal of income taxes from payments are less difficult to accept than having to pay taxes separately next year.

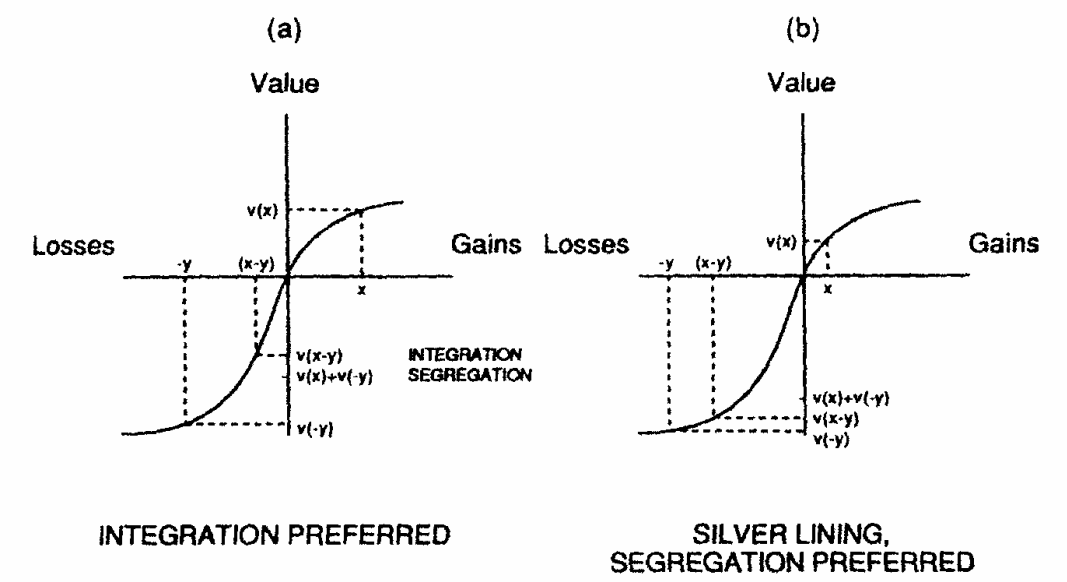
- *Mixed outcomes, net result is negative*

[3] People at auctions tend to bid a lot higher for the same product if they can pay with a credit card than if they were to pay in cash, even if they do not have to do so instantly. Also, foreign currency is more easily

In this event (x, -y) with x < y, integration is preferred if the positive event x is a little bit smaller than y, whereas segregation is preferred if x << y. This preference for segregation is called the 'silver lining' effect and is deliberately and frequently used by marketeers of financial products..

Figure 2 illustrates the mixed outcomes and silver lining effect.

Figure 2 Mental accounting: the silver lining effect



Source: Based on Antonides (1999), p. 257

4 Heuristics and biases in the use of information

Prospect theory deals with the evaluation of financial and non-monetary outcomes, or preferences, and is the first pillar of behavioural finance. The second pillar of behavioural finance concentrates on beliefs, or the way in which people use information. Cognitive psychology has found that people use heuristics and are biased in forming beliefs and in processing information. As a result of these heuristics and biases, information is not used in an objective manner. This section introduces a number of heuristics and biases that behavioural finance uses to account for irrational behaviour in financial markets. They are: cognitive dissonance, conservatism, overconfidence, biased self-attribution, availability heuristic, and representativeness heuristic.

Cognitive dissonance

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spent than home currency.

Cognitive dissonance is the phenomenon of two cognitive elements – an opinion, new information – conflicting with each other (Festinger, 1957). People want to reduce cognitive dissonance in order to avoid the psychological pain of a poor self-image. Therefore, they tend to ignore, reject or minimize information that suggests that they have made a wrong decision or hold on to an incorrect belief. The result is that people filter information in a biased manner. Filtering information is easier when the individual is part of a group whose members hold similar opinions or have taken similar decisions.[4] Therefore, herding may facilitate the reduction of cognitive dissonance and reinforce biased information filtering. The theory of cognitive dissonance may explain not only hypes, but also panic in financial markets. For it predicts that if much dissonant information is released, it becomes more difficult to ignore it. At a certain point the dissonance is equal to the resistance to revise the existing opinion, and the individual will switch to actively searching information that confirms that his earlier decision was wrong. If he was part of a group he will now break away from it. The group becomes smaller, and this increases the dissonance of the remaining group members. This may lead to a sudden change of direction of the herd.[5]

Conservatism

Conservatism is defined as the phenomenon that people only gradually adjust their beliefs to new information (Edwards, 1968). It therefore resembles the mechanism that plays a role in the theory of cognitive dissonance. Experimental research indicates that it takes two to five observations to bring about a change of information or opinion where in the case of Bayesian learning one observation would have sufficed. The more useful the new information, the stronger is the conservatism. This is because new information that is at variance with existing knowledge is harder to accept.

Overconfidence

Empirical research in cognitive psychology concludes that the average individual is overconfident. Overconfidence implies that an individual overestimates his ability. The degree of overconfidence varies among professions. It is strongest in professions that can easily shift the blame for mistakes on others or unforeseen circumstances (Odean, 1998b). An economist or financial market professional who in retrospect has failed to predict economic growth incorrectly may put this down to all sorts of unforeseeable political and economic events, or perhaps even to irrational behaviour of investors and consumers. On the other hand, in professions where no-one else is to blame, overconfidence is limited. Thus, a mathematician who cannot prove a theorem

[4] In religious sects people continue to believe in events that have been shown to be impossible. The most extreme response, of course, is that of killing the messenger of bad news. See Chancellor (1999).

[5] Akerlof and Dickens (1982) give several examples of the economic effects of cognitive dissonance, for example in the labour markets. They do not pay attention to financial markets.

has no one to blame but himself. There are also gender differences in overconfidence. Men have been found to be on average more overconfident than women (Barber and Odean, 2001).

Self-serving bias and biased self-attribution

The individual is inclined to interpret information in a way that is most favourable to himself even when he tries to be objective and impartial. People tend to discount the facts that contradict the conclusions they want to reach and embrace the facts that support their own viewpoints (Babcock and Loewenstein, 1997). This mechanism is called the self-serving bias. Also, people tend to blame failures on others and attribute successes to their own ability. This phenomenon is referred to as biased self-attribution (Zuckerman, 1979). The self-serving bias and biased self-attribution contribute to the dynamics of overconfidence. The asymmetry in dealing with successes and failures makes sure that people do not learn enough from their mistakes. In fact, biased self-attribution increases overconfidence.

Availability heuristic

The availability heuristic is the tendency of people to estimate the frequency or probability of an event by the ease with which it can be brought to mind (Herring, 1999). The car driver who witnesses an accident immediately starts to drive more cautious, even though he knows that the probability of a car accident has not increased. It could be argued that seeing the accident has contributed to his insight into the hazards of driving and that his decision to drive more carefully is due to learning and therefore consistent with rationality. But in practice, in the course of time the driving style becomes more reckless again. In other words, the cautious driving style is not the result of learning, but of a temporary increase in the subjective probability of car accidents brought about by having recently witnessed one.

Representativeness heuristic

The representativeness heuristic is defined as the phenomenon that people look for a pattern in a series of random events (Tversky and Kahneman, 1974). The representativeness heuristic leads to stereotyping and serves to make the world look more organised than it really is. It may cause people to draw far-reaching conclusions on the basis of merely a few indications. The representativeness heuristic is often illustrated by the ‘Great Bear’ effect. People watching a starry sky are usually firmly resolved to detect a familiar pattern. The mechanism is also known as the law of small numbers. People tend to generalise and draw conclusions on the basis of too little statistical information.

5. APPLICATION TO FINANCIAL MARKETS

5.1 Introduction

Behavioural finance aims at explaining these puzzles using element from prospect theory to explain investor preferences, and assuming that investors use heuristics, or rules of thumb, when judging information and forming beliefs. Before turning to a behavioural finance explanation of the six puzzles of finance (Section 5), the next sections will introduce prospect theory (Section 3) and heuristics and biases in the judgement of information (Section 4).

This section shows how behavioural finance may explain the six financial puzzles introduced in section 2: over- and underreaction, excessive trading and the gender puzzle, the equity premium puzzle, the winner/loser puzzle and the dividend puzzle. Table 1 presents an overview of the puzzles and the behavioural concepts used to explain them. Puzzles 1, 2 and 3 are explained by heuristics and biases in the judgment of information and the formation of beliefs. Puzzles 4, 5 and 6 are explained with the help of prospect theory.

Table 1 Finance puzzles and their behavioural solutions

	Puzzle	**Solution**
1	Over- and underreaction	Conservatism; representativeness heuristic
2	Excessive trading and the gender puzzle	Overconfidence
3	Hypes and panic	Cognitive dissonance theory
4	Equity premium puzzle	Mental accounting and loss aversion
5	Winner/loser puzzle	Mental accounting and loss aversion
6	Dividend puzzle	Mental accounting, loss aversion and self-control

5.2 Over- and underreaction of stock prices

An underreaction of stock prices occurs if the stock market reacts to news not only in the period immediately after the news is released, but also in subsequent periods. Overreaction occurs in the opposite case: the news is immediately followed by a stock price reaction, which in the subsequent periods is partially compensated by one or more changes in the opposite direction.

Various behavioural finance models seek to explain these patterns of under- and overreactions. Barberis, Shleifer and Vishny (1998) use the concepts of conservatism and the representativeness heuristic; Daniel, Hirschleifer and Subrahmanyam (1998) concentrate on biased self-attribution and overconfidence.

Barberis, Shleifer and Vishny (1998) define underreaction as a situation in which the return in the period following the publication of good news (and after the very first reaction of stock prices) is on average higher than it would have been had the news been bad. In an efficient market, the news would be fully processed in the period following immediately upon the news release. Hence, in subsequent periods, the development of stock prices would be independent of the news released in the initial period. If, after a favourable news fact, prices continue to rise, there must have been an underreaction in the period immediately following the news. Indeed, if the reaction had been adequate, the rise would have been realised straightaway. An overreaction occurs if the price reacts too strongly. In that case, the stock price increase (decrease) will be followed by decreases (increases).

Barberis, Shleifer and Vishny account for the pattern of under- and overreactions by combining conservatism and the representativeness heuristic. They develop a model involving one investor and one asset. All profit is paid out as dividend. The equilibrium price of the asset equals the net present value of expected returns. Stock prices depend on news because investors use news to update their expectations about future earnings. However, conservatism causes news to be insufficiently reflected in prices in the short term. The average investor learns more slowly than would be optimal and prices take longer to reach the new equilibrium than would be the case with rational Bayesian learning. This explains the short-term underreaction. In the longer term, the representativeness heuristic induces the investor to attach too much value to a news fact if it is part of a series of a random series of similar messages in which the investor mistakenly perceives a pattern.[6] The investor believes that one of two regimes applies, i.e. either profits are 'mean-reverting', with a positive shock being followed by a negative one, or they are characterised by a trend. If the investor has observed a series of good earnings shocks, his belief that profits follow a trend grows. On the other hand, if he has observed a series of switches form positive to negative earnings shocks and vice versa, he may switch to the belief that earnings are mean-reverting. These updates of beliefs are meant to represent the mechanisms of the representativeness heuristic and conservatism. Simulating earnings with a random walk model, Barberis, Shleifer

[6] As an illustration and motivation of the basic assumptions of their approach, Barberis, Schleifer and Vishny show the results of an experiment in which the subjects were requested to toss a coin. The group was informed in advance that the probability of heads or tails was not fifty-fifty, but 70-30, but not whether the 70% probability applied to heads or tails. While learning too slowly in the beginning, it appears that, after a great many tosses, the subjects too hastily arrive at a conclusion about the probability of heads or tails showing up.

and Vishny show that, depending on the values chosen for the parameters, these basic assumptions may produce a pattern of underreactions, a pattern of overreactions or a pattern of underreactions alternated by overreactions.

Daniel, Hirschleifer and Subrahmanyam (1998) develop a model of investor behaviour that takes account of overconfidence and biased self-attribution. They model these psychological mechanisms by assuming that investors tend to overestimate their amount of private information and their ability to interpret this information. Information is private if it has not (yet) been disclosed publicly. Because of his overconfidence, the investor believes that he is one of the few, if not the only one, to recognise the relevance of signals he receives. He believes he has discovered a hot tip which gives him an information advantage over others, who will not come into action until after the relevant information is public knowledge. If the private information is favourable, the investor will buy, convinced as he is that this information has not become incorporated yet into the prices. Daniel, Hirschleifer and Subrahmanyam show that the investor following this line of reasoning tends to purchase more (if the private information is favourable) than is warranted by the fundamental, which leads to an overreaction of stock prices. Besides overconfidence, biased self-attribution also comes into play in this model, for the investor interprets public information asymmetrically. If new public information corroborates what the investor has already assumed on the basis of his private information, this will increase investor confidence. If it does not, the investor blames others. Therefore, overconfidence will not diminish and is likely to increase.

5.3 Excessive trading and gender puzzle

Odean (1998b) develops a theoretical model which takes account of overconfidence. He models overconfidence by assuming that market participants overestimate their ability to interpret information. Every market participant believes that that he is better in picking up and interpreting information and that therefore the accuracy of the information he receives is above average. Thus, The model predicts that investors trade excessively. They assume that two types of asset are traded, one risk-free, with zero interest rate, and one risky asset. There are N price-taking investors ($N \rightarrow \infty$). Their *a priori* information is the same. All investors receive a signal about the probability distribution of the return on the risky asset. Each investor believes his signal to be more precise than the signals of others, but knows that there are some traders receiving the same signal. So each investor believes he belongs to the group of investors that is above average. Within this framework, overconfidence causes trading volume and stock price fluctuations to increase, and stock price efficiency to decrease. However, Odean (1998) shows that overconfidence not always stands in the way of market efficiency. In a market of noise traders –

traders who follow the market trend, despite being aware that share and bond prices are inconsistent with fundamental factors – including an insider overestimating himself, transaction volume and price fluctuations will increase, but pricing will be more efficient

Opinion polls suggest that the average amateur investor is, in fact, overconfident. Gallup conducted fifteen surveys in the period June-1998 – January 2000, each among thousand investors (Barber and Odean, 2001). One of the questions was what return the respondents expected to realise on their portfolio in the following year. The surveys also asked the investors' expectations of next year's average stock market return. On average, respondents thought they could beat the market, which is by definition impossible.[7]

As mentioned in Section 2, Barber and Odean (2000) indeed find that, first, the average investor trades too much and, second, that the investors in their survey who traded the least earned a return that was far above the return of the investors that traded the most. In order to investigate whether overconfidence might indeed be the explanation of the excessive trading, Barber and Odean (2001) study differences in investment behaviour between men and women. Psychological research has shown that, on average, men are more overconfident than women. If it could be shown that female investors trade less frequently than men, while realising a higher return, this would support the assumption that the excessive trading might be due to overconfidence, as predicted by Odean's theoretical model. Barber and Odean study the investment behaviour of more than 35,000 investors over a six-year period, distinguishing between accounts opened by women and by men. They analyze the investment pattern, the frequency of transactions, and the resulting returns. Their dual hypothesis was that men trade more frequently than women, and that they realise a lower return. The results prove them right. On average, men trade 1.5 times more frequently than women, and earn a return that is one percentage point lower. The superior performance by women cannot be ascribed to their being more experienced investors. Half of the women in the survey claimed to be experienced investors, against over 60% of men. Having found evidence for a possible relationship between overconfidence and excessive trading, Barber and Odean went further to study the subset of singles in their survey. It cannot be excluded that an investment account opened by a woman is managed by a man, and vice versa. But this is less likely for singles than for married couples. Therefore, one would expect the gender difference in trading frequency and return to be even larger in the singles subset. This is indeed what Barber and Odean find. The average male bachelor traded 67 percent more frequently than his female counterpart, and realised a return that was almost 1.5 percentage point lower.

[7] Irrational as it may seem, overconfidence may contribute to success. The individual who overestimates his abilities will be prepared to take more risks, will be more motivated and even be able to present himself more effectively (Taylor and Brown, 1988). Perhaps private entrepreneurship only exists because of

Barber and Odean consider an alternative explanation for excessive trading. It could be that the average investor considers trading to be a hobby. In that case, the lower return might be interpreted as the price the investor is willing to pay for this leisure activity. And the difference between men and women might be explained by assuming that investing is more of a hobby to men than it is to women. However, Barber and Odean reject this possibility. They calculate that the most active trader loses 3.9 per cent of his annual household income by trading excessively. This exceeds all expenditures on leisure activities of a typical family with an income similar to that of those in the sample.

5.4 Hypes and panic

Both empirical research by Kaminsky and Schmukler into the reaction of investors to news during the Asian crisis, and empirical research by Keijer and Prast into the reaction of ICT stock prices to news, finds that investors seem to filter information in a biased manner as predicted by the theory of cognitive dissonance. Kaminsky and Schmukler find that prices overreact more strongly as a crisis worsens, and that in such periods prices respond more strongly to bad news than to good news. Keijer and Prast (2001) analyse the response of investors in ICT companies quoted on the Amsterdam Stock Exchange in the period 1 October 1999 – 1 March 2000 to relevant news. Classifying daily telecom news as good or bad, they study the difference in price development between the Amsterdam technology index (MIT index) and the general AEX index. This difference turns out to respond significantly stronger to good news than to bad news. Thus, Keijer and Prast find that the reaction coefficient to good news is more than twice as large, in absolute value, than the reaction coefficient to bad news. These reaction patterns fit in with the theory of cognitive dissonance, which predicts that once people hold a fundamental opinion, they tend to ignore or minimize information which suggests they may be wrong, and tend to pay too much attention to information that confirms their opinion. The results by Kaminsky and Schmukler indicate panic, those by Keijer and Prast are suggestive of a hype. [8]

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overconfidence, judging by the finding that every starting entrepreneur thinks that their enterprise has a greater probability of succeeding than that of the average starter (Cooper, Woo and Dunkelberg, 1988).

[8] It should be noted that this type of analysis is not without pitfalls. In the first place, reporters publish news facts that they have selected at their discretion. Secondly, the researcher cannot always objectify why a given news fact is relevant, or why a news fact should be rated as good or bad, as the case may be. Thirdly, news facts are always assigned the same weight. No distinction is made between news that is rather good, quite good, or just bad.

5.5 Equity premium puzzle

Benartzi and Thaler (1995) show that the equity premium puzzle is solved if it is assumed that individuals behave in accordance with prospect theory. They model the behaviour of investors who have a long planning horizon and whose aim of investing is not to realise speculative profits, but rather to have a high return on a long-term investment. In their model, the investor must choose between a portfolio only consisting of stocks and one containing just bonds. These investors evaluate their portfolios on a regular basis, say a year, not with the aim of changing it, but for example because they need to state their income to tax officials or to a compliance officer. The evaluation of their portfolio does have a psychological effect. Losses, even if they are not realised, have a larger psychological impact than gains. This implies that a portfolio consisting of risky assets should earn an expected return that compensates for the emotional cost of these 'paper losses". Assuming a plausible degree of loss aversion, namely a coefficient of 2.25, Benartzi and Thaler show that an investor who has a 30-year planning horizon and evaluates his portfolio annually, requires an equity premium of about 6.5 percentage points to be indifferent between stocks and bonds. At evaluation frequencies of two, five and ten times per year, the equity premiums should be 4.65, 3.0 and 2.0 percentage points, respectively.[9] Benartzi and Thaler note that it is conceivable that the psychological involvement of individual investors regarding the value of their portfolios is stronger than that of institutional investors. As the latter are major players in financial markets, they may be expected to be less hampered by loss aversion. Still, the psychological impact of a regular portfolio evaluation by their clients may be relevant to the position of fund managers and other institutional investors. Loss aversion may also explain why pension funds, whose horizon is basically infinitely long, invest relatively little in stocks.[10] Recent research has shown that the equity premium is declining, though (Jagannathan, McGrattan and Scherbina (2001)). According to Benartzi and Thaler's model this would signify that the average evaluation period has grown longer. This phenomenon is not accounted for by the theory.

5.6 Winner/loser asymmetry

Investors are predisposed to hold their losing stocks for too long, and sell their winning stocks too early (Shefrin and Statman, 1985). This is an anomaly, especially as in many countries selling losers offers a tax advantage. Shefrin and Statman (1985) use prospect theory to explain the

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[9] According to Jagannathan, McGrattan and Scherbina (2001), in the United States the premium was about 7 percentage points in the period 1926-70, and less than 1 percentage point since 1970. Based on stocks from the S&P 500, on the one hand, and long-term bonds on the other hand, the premium was 0.7 percentage point in the seventies, -0.6 percentage point in the 80s and 1 percentage point in the 90s.

[10] Pension funds are also subject to regulatory constraints.

asymmetry in the sale of losers and winners. Take the case where an investor needs cash. He may choose between selling share A, which gained twenty per cent since he bought it, and share B, which fell twenty percent since he added it to his portfolio. The investor applies prospect theory rules separately to the accounts of A and B. In doing so, he evaluates the selling prices in terms of gains or losses relative to the price he paid for each stock. Thus, the price paid is the reference point for the investor. Selling share B would imply that the investor would have to close his mental account of share B with a loss. When selling share A, the investor can close the mental account of share A with a profit. Thus, mental accounting and loss aversion make the investor prefer selling winners rather than losers.

The prediction of the model by Shefrin and Statman is confirmed by the results of empirical work by Odean (1998a, Shefrin 2002). Odean studies 163,000 individual accounts at a brokerage firm. For each trading day during a period of one year, Odean counts the fraction of winning stocks that were sold, and compares it to the fraction of losing stocks that were sold. He finds that from January through November, investors sold their winning stock 1.7 times more frequently than their losing loosing stocks. In other words, winners had a 70 percent higher chance of being sold. In December, these investors sold their losers more quickly, though only by 2 percent.

5.7 Dividend puzzle

The preference for cash dividends can be explained by mental accounting. Two different explanations can be distinguished. The first explanation focuses on the need for self-control. The investor puts capital gains and cash dividends into separate mental accounts. This is one way of keeping control of spending. The investor worries that, once he decides to finance consumption from spending part of his portfolio, he may spend his savings too quickly. As Shefrin puts it: *'Don't dip into capital' is akin to 'don'tt kill the goose that lays the golden eggs'* (Shefrin, 2002, p. 30). . When stock prices fall, dividends serve as a 'silver lining'. Statman (1999) formulates its as follows: *"'Not one drop' is a good rule for people whose self-control problems center on alcohol. 'Consume from dividends but don't dip into capital' is a good rule for investors whose self-control problems center on spending."* The second explanation concentrates on loss aversion, mental accounting and framing. According to this explanation, when stock prices fall, dividends serve as a 'silver lining'. This is the mixed outcome example with x<<y of Section 3 above. On the other hand, when stock prices rise, the investor likes dividends because they are regarded as a separate gain. This is the 'don't wrap all Christmas presents together' example of Section 3. Here dividend and capital are two positive outcomes.

6 EVALUATION. BEHAVIOURAL FINANCE AND MARKET EFFICIENCY

Fama states that, while the existence of cognitive-psychological mechanisms may explain why the average individual investor does not behave rationally, this need not imply that markets are inefficient. Even if many market participants behave irrationally, arbitrage by a few rational investors, he and others argue, is a sufficient condition for market efficiency.

Barberis and Thaler (2002) challenge this view, using two mottos to this end, i.e. Keynes's well-known statement *"Markets can remain irrational longer than you can remain solvent"*, and *"When the rest of the world is mad, we must imitate them in some measure*." Barberis and Thaler give a number of reasons for their proposition that it is unlikely that arbitrage always leads to efficient pricing in financial markets. Their main argument is that there are risks and costs involved in arbitrage. Thus, the irrationality of the participants in financial markets may increase. The rational arbitrageur who buys undervalued stocks will incur a loss if market participants grow even more pessimistic, no matter how right he may be about fundamentals.

Therefore, in view of the arbitrage risk, traders may wish to go along with the market, even if they know that asset prices do not reflect economic fundamentals (Black, 1986; De Long, Shleifer, Summers and Waldmann, 1990). This risk is even more important because of the principal-agent problem in financial markets resulting from, as Shleifer and Vishny (1997) formulate it, a 'separation of brains and capital'. Professionals do not manage their own money, but that of customers who on average do suffer from cognitive-psychological mechanisms. If a professional incurs short-term losses by trading against the irrational market, this may harm his reputation and induce customers to withdraw. The professional who anticipates this response will adjust his behaviour accordingly. The professional who does not, and trades on the basis of fundamentals, will lose customers, be increasingly restricted in arbitraging, and eventually be forced to quit the market. From this perspective, it may be rational for a professional to be myopic.

Barberis and Thaler (2002) mention several reasons why there is no full arbitrage. Contrary to what theory suggests, there are costs involved in arbitrage, such as commission fees. Besides, arbitrage often requires going short. This not only carries additional costs, but also meets with regulatory constraints. Some, often major, market participants, e.g. pension funds, are simply prohibited from taking short-positions. Moreover, the identification of price efficiencies is costly. Tracking market inefficiencies in order to conduct arbitrage is only rational if the expected benefits exceed the costs, including those of gathering information (Merton 1987). One final reason, not given by Barberis and Thaler, for assuming that the market as a whole may be inefficient is the fact that in practice well-informed individuals, too, appear to be suffering from a

subconscious tendency of biased judgement. Experimental studies of the *self-serving bias* reveals that subjects, even after having been informed of the existence of a bias, thought that not they themselves but others were liable to this bias (Babcock and Loewenstein, 1997). For this reason it seems implausible that market participants are free from any biases in searching and interpreting information.

The assumption that, given fundamentals, prices can be inefficient for a long period is empirically supported by Froot and Deborah (1999). On the basis of the price movements of Royal Dutch/ Shell stocks, Froot and Deborah show that prices may deviate from their equilibrium for a long time. In 1907, Royal Dutch and Shell decided to merge. This was realised on a sixty-forty basis. Henceforth, Royal Dutch stocks would represent sixty percent of the two companies' cash flows, and Shell stocks forty. In other words, the price of a share in Royal Dutch should be 1.5 times that of a share in Shell. Froot and Debora establish that, irrespective of the fundamental value of the Royal Dutch Shell share, there are structural deviations from the equilibrium price ratio, which may amount to as high as 35%.

Fama also criticises behavioural finance because the models that make use of cognitive-psychological concepts only account for one anomaly at a time. In his opinion, this is an ad hoc approach which sometimes leads to inconsistency between behavioural models. Fama does have a point, in that a new paradigm may be expected to provide a consistent framework. Behavioural finance appears to be on its way to doing just that. Its practitioners systematically employ empirically established psychological mechanisms of human behaviour in addition to, or instead of, the conventional assumption of rationality. Actual decision-making under risk appears to be less simple than would be consistent with the assumptions of expected utility theory and efficient markets theory.

7 SUMMARY AND CONCLUSIONS

Behavioural finance has made two valuable innovative contributions to finance theory and to empirical research. In the first place, it shows that market participants evaluate financial outcomes in accordance with prospect theory rather than expected utility theory. Many anomalies in preferences result from rules of thumb that are applied when editing prospects to facilitate decision making. Moreover, a greater sensitivity to losses than to gains implies that decisions differ according to how a choice problem is framed. In the second place, behavioural finance uses insights from cognitive psychology to take into account that people, when judging information and forming beliefs, use heuristics and biases that are difficult, if not impossible, to overcome.

As Statman (1999) puts it: *'Standard finance people are modelled as "rational", whereas behavioural finance people are modelled as "normal"'*. Behavioural finance explains financial markets anomalies by taking actual behaviour as a starting point, rather than postulating rationality both as a norm and as a positive description of actual behaviour. One particularly important question to be answered within this context is, of course, whether irrational behaviour of individual market participants may also lead to inefficiency of the market as a whole. Indeed, it is conceivable that even if the average investor behaves according to the psychological mechanisms mentioned, the market as a whole will generate efficient outcomes anyway. However, this is not the case, behavioural finance argues, for example because the arbitrage required to compensate for price inefficiencies is costly and risky.

What does this imply for the future of finance Statman (1999) raises the question of market efficiency in a fundamental manner. According to Statman, it is important that a distinction be made between two definitions of efficient markets. One reads that investors cannot beat the market systematically, the other says that stock prices are always and fully determined by economic fundamentals. Statman makes a pleas to agree on two things, namely (1) that investors cannot systematically beat the market, and (2) that prices may reflect both fundamental and emotional factors. This would pave the way for a further analysis of financial markets, allowing room for both economic fundamentals and systematic psychological factors.

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