The ‘Ostrich Effect’:
Selective Attention to Information about Investments

Niklas Karlsson, George Loewenstein and Duane Seppi

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Abstract:
We develop a model of selective attention to information and apply it to investors' decisions about whether to obtain information about the value of their portfolio. In our model investors receive information about the aggregate level of the market and then decide whether to look up the value of their personal portfolio. Doing so not only provides additional information, but also increases the psychological impact of information on utility – an *impact effect* – and increases the speed of a utility reference point adjustment – a *reference point updating effect*. The main prediction of the model is that investors will check the value of their portfolios more frequently in rising markets but will “put their heads in the sand” when markets are flat or falling. We test and find support for this prediction with three Scandinavian data sets.

Keywords: investor behavior, selective exposure, attention

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The observation that people derive utility not only from outcomes but also from beliefs, though once heretical in economics, is now commonplace and relatively uncontroversial. In the last few decades, economic models have been developed that incorporate utility from anticipation (Caplin and Leahy, 2001; Loewenstein, 1987) and from self-image or ego (Bodner and Prelec, 2001; Koscegi, 1999), as well as, based on work on "psychological games", utility that depends directly on beliefs about the beliefs of other players (Geanakoplos, Pearce and Stacccetti, 1989; Rabin, 1993). Research in psychology bolsters the work in economics by showing that people who hold optimistic beliefs about the future and positive views of themselves are both happier (Diener and Diener, 1995; Scheier, Carver and Bridges, 2001) and healthier (Baumeister, Campbell, Krueger and Vohs, 2003:28-32; Petersen and Bossio, 2001), if not necessarily wiser (Alloy and Abramson, 1979).

The insight that people derive utility from beliefs has also enriched the field of finance. Traditional finance theory assumes that investors only derive utility from their assets at the time when they liquidate and consume them – e.g., upon retirement – but people clearly derive pleasure and pain directly from shifts in the value of their portfolios prior to consuming the actual underlying cash flows. Barberis, Huang, and Santos (2001) show that a model in which investor utility depends directly on the value of their financial wealth provides an intuitive and parsimonious explanation for the equity premium puzzle as well as the low correlation between stock market returns and consumption growth (for earlier treatments, see Bernartzi & Thaler, 1995; Gneezy & Potter, 1997).

Incorporating beliefs directly into the utility function has diverse ramifications. Utility from anticipation can diminish or even reverse time discounting, resulting in patterns of behavior that resemble negative time discounting (Loewenstein, 1987), and can affect an individual's effective level of risk-aversion (Caplin and Leahy, 2000). Ego utility can cause people to take actions that they otherwise wouldn't be motivated to take in order to signal that they are of a particular type (Bodner and Prelec, 2001), and utility derived from beliefs about others can influence behavior in games in a variety of different ways (Geanakoplos, Pearce and Stacchetti, 1989; Rabin, 1993).

Perhaps the most novel, and potentially controversial, ramification of the idea that people derive utility from beliefs is, however, that they may have an incentive to control or regulate those beliefs. In the extreme, they may even deceive themselves about reality. There is ample evidence from psychology that desires exert a powerful influence on beliefs, a phenomenon that psychologists call "motivated reasoning" (Kruglanski, 1996; Kunda, 1990; Babad, 1995; Babad and Katz, 1991). Economists, too, have been interested in motivated formation of beliefs, but have focused more on modeling the phenomenon than on studying it empirically (Akerlof & Dickens, 1982; Benabou & Tirole, 2004, Brunnermeier & Parker, 2002).[1]

Somewhat milder than self-deception is the related idea that people have some capacity to either attend to or not attend to – i.e., ignore -- information. An extensive body of empirical research in psychology supports what is sometimes called the *selective exposure hypothesis*. Ehrilch, Guttman, Schonbach and Mills (1957), for example, found that new car owners paid more attention to advertisements for the model they purchased than for models they had considered but did not buy. Brock and Balloun (1967) demonstrated that smokers attended more to pro-smoking messages and that non-smokers attended more to anti-smoking messages. Although some studies have produced more equivocal findings (Cotton, 1985; Festinger, 1964; Freedman and Sears, 1965), the most recent research provides quite strong support for the selective exposure hypothesis (e.g., Jonas, Schulz-Hardt, Frey and Thelen, 2001; Frey and Stahlberg, 1986). Although attending to and exposing oneself to information may have different meanings, for the present purposes and in line with how it has been used in earlier research on selective exposure, we use the terms interchangeably.

The selective exposure hypothesis has also made its way into economics. Caplin (2003), building on earlier ideas proposed by Witte (1992), assumes that people have some ability to choose how much to *attend* to information. He develops a model in which people respond to health warnings either by adopting behaviors consistent with those beliefs, or, if the warnings are too threatening, by willfully ignoring them. We take Caplin's analysis a step further by examining the degree to which people expose themselves differentially to positive and negative information.

We develop a model of selective attention in which individuals receive information about the aggregate level of the stock market then decide whether to look up, and hence attend to, the value of their own personal portfolio. The intuition behind our model is that investors can regulate the impact of good and bad news on their utility by how intently they attend to the news. Knowing that information is bad is quite different from only suspecting that it may be bad (and vice versa). When, for example, the market is down, an investor might be able to forecast that her own portfolio is likely to have declined in value, but it is always possible that the specific stocks in the investor's personal portfolio may have risen even when the market declined. If knowing definitively that one has lost money is worse than simply suspecting that one has, then people may want to shield themselves from receiving definitive information when they suspect that the news may be adverse.

Under reasonable parameter values, our model predicts that people will exhibit what we call the *ostrich effect*.[2] Given bad, or, as it turns out by our model, ambiguous news, they optimally choose to avoid collecting additional information; they "put their heads in the sand" to shield themselves from further bad news. Given favorable news, in contrast, the model predicts that individuals will seek out definitive information about the value of their portfolio.

The paper is organized as follows. In section II we present a model of selective attention that predicts an asymmetry in the attention paid to bad or ambiguous news compared to good news. Section III validates this predicted asymmetry using three different Scandinavian data sets, each of which contains data on investors' decisions to check the value of their portfolios. Consistent with the predictions of our model, investors check their portfolio value more frequently in rising than in falling or flat markets. Section IV discusses alternative explanations of the observed ostrich effect. In Section V and VI we discuss additional implications of the ostrich effect and the rationality of selective attention. Section VII concludes.

II. A Model of Selective Attention

We develop predictions about interactions between attention and lagged stock market changes with a stylized decision-theoretic model applicable to a single investor. We posit that the investor has some degree of control over both the timing of information she receives about her wealth and about how this information affects her utility. In our model the investor decides whether or not to attend to information about her wealth conditional on prior market information.

Our definition of attention encompasses both external behavior and internal psychological processes. The most obvious external manifestation of attention is that investors actively seek out additional information when attending to their wealth. When inattentive, investors choose to be less informed about their portfolios. Thus, the attention decision affects how much the investor knows about her wealth over time. In our empirical work, the fact that information collection by investors is externally observable is important because investors' information collection activities provide an empirical window into their psychological states.

Attention also increases the psychological impact of information on utility. We refer to this as the *impact effect*. Prospect theory posits that utility depends on how outcomes deviate from a pre-specified reference point. Negative departures from the reference point are postulated to have a greater negative impact on utility than the positive impact of positive departures – a phenomenon known as *loss aversion*. The marginal utility of good and bad outcomes is not, however, fixed, but rather depends on a variety of factors. Previous research has found that people derive greater utility from positive outcomes, and greater disutility from negative outcomes, when they feel personally responsible for the outcomes (Kahneman and Tversky 1982; Shefrin and Statman 1984; Loewenstein and Issacharoff 1994), when the outcomes are unexpected (Kahneman and Miller 1986), and when the outcomes are not traded in markets, as is true of health (Horowitz and McConnell 2002). We add attention to the short list of factors that influence the steepness of the value function. We posit, hopefully uncontroversially, that paying attention magnifies the marginal impact for both gains and for losses.

Another psychological consequence of attention is on the dynamics of how reference points evolve over time. Specifically, we assume that paying attention to, and learning definitive information about, one's personal wealth accelerates the updating of one's reference point. Being inattentive, in contrast, causes the investor's benchmark to adjust more slowly in the absence of the investor-specific information that checking her personal brokerage account balance would provide. This *reference point updating effect* is consistent with empirical evidence that reference points are less responsive to probabilistic than to deterministic information. For instance, in a study of the endowment effect, Loewenstein and Adler (1995) endowed some subjects probabilistically with a coffee mug; they were told that there was a 50% chance that they would obtain a coffee mug. Other subjects were simply endowed with a mug or not endowed with one. Valuations of the mug for subjects who were endowed probabilistically were indistinguishable from valuations of those who were not endowed, and both were much lower than the valuations of those who were definitively endowed.

By linking together voluntary information collection, the utility impact of news, and the endogenous dynamics of investors' reference points we are assuming implicitly there are certain inherent constraints on investor psychology. For example, investors cannot distract themselves from bad news (or celebrate good news) independently of how much they pay attention to news. Given these linkages, selective attention is consistent with investor rationality in the sense that it maximizes utility.

We model the decision making process of an investor who experiences events at two points in time, t = 1 and 2. At date 1 there is an innovation to the investor's wealth. Let W_0 be the investor's incoming wealth and let $W_1 = W_0 + \varepsilon_1$ denote her new exact wealth at the end of date 1. The date 1 innovation consists of two components $\varepsilon_1 = c_a + c_d$. The investor learns the first component c_a automatically but can decide at date 1 whether to learn the second component c_d. For example, c_a might be a market index return that is widely reported in the public news media (e.g., the Dow) while the discretionary information c_d could be the idiosyncratic return due to the specific holdings in the investor's portfolio. We assume $c_a \in \{-e, 0, +e)$ so the publicly reported and automatically known innovation represents good, neutral, or bad news about the investor's wealth. For simplicity, the discretionary information is of the same magnitude as the automatic innovation, but can only take two states, $c_d \in \{-e, +e)$, which correspond to good or bad news relative to c_a. At date 2 there is one further wealth innovation so that the investor's final wealth is $W_2 = W_1 + \varepsilon_2$. Again for simplicity, the final innovation, $\varepsilon_2 \in \{-e, +e)$, is simply good or bad news relative to W_1. We assume that good and bad realizations for c_d and ε_2 are equally likely.

There is no direct cost to the investor if she chooses to learn c_d at date 1. Investors in our empirical data, for example, can log on to a web page and review their account balances at no cost except for a trivial amount of time. However, the investor does have the option of "burying her head in the sand" at date 1 – i.e., delaying learning about the additional component c_d of her wealth until date 2. This is our *ostrich effect*.

A key assumption is that the investor can condition her decision at date 1 about whether to pay attention to her expected wealth $W_1^* = W_0 + c_a$ after first learning the automatic component. Given her decision, her perceived wealth W_1^p at date 1 is either W_1 (if she chooses to be attentive and learns c_d) or W_1^* (if she does not). At date 2, the investor eventually learns all information. This is not a choice. She can only decide the timing of when she learns c_d; not her final knowledge about W_2. Consequently, her perceived wealth equals her actual wealth $W_2^p = W_2$. We hence assume that the investor is psychologically attentive at date 2.

We model the investor as having loss-averse preferences over information about her wealth. At each date t, her utility u_t is centered at the level of her previous realized utility u_{t-1}. Her utility is then perturbed by the deviation of her perceived wealth from a previously determined reference point b_{t-1}.

The investor's utility function and knowledge depend on whether she is attentive (denoted by "A") or inattentive (denoted by "IA"). When she is attentive, her utility per period is

$$
\begin{aligned}
u_t(A_t, W_t^p, b_{t-1}) = \; & u_{t-1} + \alpha(W_t^p - b_{t-1}) && \text{if } W_t^p > b_{t-1} \\
& u_{t-1} + \alpha(1 + \delta)(W_t^p - b_{t-1}) && \text{if } W_t^p < b_{t-1}
\end{aligned}
$$

and, when she is inattentive, her utility per period is:

$$
\begin{aligned}
u_t(IA_t, W_t^p, b_{t-1}) = \; & u_{t-1} + \alpha\lambda (W_t^p - b_{t-1}) && \text{if } W_t^p > b_{t-1} \\
& u_{t-1} + \alpha\lambda (1 + \delta)(W_t^p - b_{t-1}) && \text{if } W_t^p < b_{t-1}
\end{aligned}
$$

The parameter $\alpha > 0$ is the marginal utility wealth innovations relative to b_{t-1} when the investor is attentive. The parameter $\delta > 0$ captures the idea that the investor is loss-averse. Her marginal utility of wealth is greater when her perceived wealth W_t^p is lower than her reference point b_{t-1}. The parameter λ, with $0 < \lambda < 1$, represents the impact effect in that the utility impact of wealth when the investor is inattentive is muted relative to when she is actively paying attention.

The reference point changes over time. The dynamics of the reference point depend on the evolution of the investor's perceived wealth and on how attentive she is:

$$b_0 = W_0$$

$$b(W_1, A) = W_1$$

$$b(W_1^*, IA) = (1\text{-}\theta)\, W_0 + \theta\, W_1^* = W_0 + \theta\, [W_1^* - W_0] = W_0 + \theta\, c_a.$$

The parameter θ, where $0 < \theta < 1$, represents the reference point updating effect. It allows the reference point to respond more slowly to changes in wealth when the investor is inattentive.

The investor's decision is to choose whether to be attentive at date 1 so as to maximize her cumulative utility from the flow of information about her wealth over dates 1 and 2. In particular, this means choosing whether to learn the personal component c_d at time 1 (by being attentive) or to wait until time 2 (by being inattentive at time 1) and accepting the psychological consequences for her date 1 marginal utility and her reference point dynamics that accompany this decision. The investor conditions her decision on whatever she automatically learns at time 1 about the public component c_a of her wealth.

Good news case: First, consider the case in which the investor receives a positive signal $W_1^* = W_0+e$. If she decides to be psychologically attentive and learns c_d at time 1, then her cumulative expected utility is

$$\begin{aligned}
J(A,W_0+e, b_0) = {} & \tfrac{1}{2}\, u_1(A, W_0+2e, b_0) + \tfrac{1}{2}\, u_1(A, W_0, b_0) \\
& + \tfrac{1}{2}\, [\tfrac{1}{2}\, u_2(W_0+3e, b(A, W_0+2e)) + \tfrac{1}{2}\, u_2(W_0+e, b(A, W_0+2e))] \\
& + \tfrac{1}{2}\, [\tfrac{1}{2}\, u_2(W_0+e, b(A, W_0)) + \tfrac{1}{2}\, u_2(W_0-e, b(A,W_0))] \\
= {} & 2\, [u_0 + \tfrac{1}{2}\, \alpha\, 2e + \tfrac{1}{2}\, 0] \\
& + \tfrac{1}{4}\, [\alpha e] + \tfrac{1}{4}\, [-(1+\delta)\, \alpha e] + \tfrac{1}{4}\, [\alpha e] + \tfrac{1}{4}\, [-(1+\delta)\, \alpha e]
\end{aligned}$$

where $2\, [u_0 + \tfrac{1}{2}\, \alpha\, 2e + \tfrac{1}{2}\, 0]$ is the expected utility from information collection at date 1 plus the expected intercept of utility at date 2 and where the remaining terms give the expected utility perturbation at date 2 given that the reference point at 2 depends on what is learned about c_d at date 1.

If the investor instead decides to be inattentive and waits to learn c_d until time 2, then her cumulative expected utility is

$$\begin{aligned}
J(IA,W_0+e, b_0) = {} & u_1(IA, W_0+e, b_0) \\
& + \tfrac{1}{2}\, [\tfrac{1}{2}\, u_2(W_0+3e, b(IA, W_0+e)) + \tfrac{1}{2}\, u_2(W_0+e, b(IA, W_0+e))] \\
& + \tfrac{1}{2}\, [\tfrac{1}{2}\, u_2(W_0+e, b(IA, W_0+e)) + \tfrac{1}{2}\, u_2(W_0-e, b(IA, W_0+e))]
\end{aligned}$$

$$= 2\,[u_0 + \alpha\lambda\, e]$$
$$+ \tfrac{1}{4}\,[\alpha\,(3e - \theta\, e)] + \tfrac{1}{4}\,[\alpha\,(e - \theta\, e)]$$
$$+ \tfrac{1}{4}\,[\alpha\,(e - \theta\, e)] + \tfrac{1}{4}\,[\alpha\,(1 + \delta)\,(-e - \theta\, e)]$$

Comparing the alternatives of being attentive or inattentive, gives:

$$J(A,W_0{+}e,\, b_0) - J(IA,W_0{+}e,\, b_0) = 2\,(1 - \lambda)\,\alpha\, e - (1 - \theta)\,(1 + \tfrac{1}{4}\,\delta)\,\alpha\, e.$$

The optimal decision about whether to attend to her portfolio in period 1 depends on a trade-off between the advantages of enjoying the expected good news, $E(W_1|W_1^*) = W_1{+}e > b_0$, versus the advantages at date 2 of slow reference point updating. Clearly, actively enjoying good news increases the psychological utility derived from good news. However, if $\theta < 1$, this current active enjoyment comes at the cost of raising future anticipations (i.e., her reference point) for date 2. In contrast, being less attentive reduces the impact of the good news on next period's reference point. This makes disappointment from any bad news at date 2 both smaller and less likely. Given good news at date 1, the investors will choose to be attentive if:

- The initial impact effect is strong in that λ is sufficiently small
- The inattentive benchmark revision, θ, is sufficiently large.

In the absence of both the impact effect and delayed reference point updating, $\lambda = \theta = 1$, the investor is indifferent between learning c_d at date 1 or at date 2. If $\lambda = 1$ (i.e., no utility difference between being attentive or inattentive), then any lag in the reference point updating, $\theta < 1$, causes the investor to be inattentive and not look. Some impact effect is necessary to get active "looking" at c_d following good news. If $\theta = 1$, so the delayed reference point effect is absent, then any impact effect $\lambda < 1$ causes the investor to be attentive and look. A natural intermediate case is $\theta = \lambda$. This means that whatever portion of the date 1 wealth innovations is "enjoyed" at date 1 is also "booked" into the future reference point for date 2. In this case the attentive/inattentive comparison simplifies further to

$$J(A,W_0+e, b_0) - J(IA,W_0+e, b_0) = (1 - \lambda)\,(1 - \tfrac{1}{4}\delta)\,\alpha\, e.$$

Thus, given $\lambda = \theta < 1$, the investor optimally chooses to be psychologically attentive and collect additional information provided she is not too loss averse: $\delta < 4$.

Neutral news case: If the public news at date 1 is neutral, $W_1^* = W_0$, then the investor's cumulative expected utility from being psychologically attentive at date 1 is

$$\begin{aligned} J(A,W_0, b_0) = {} & \tfrac{1}{2} u_1(A, W_0+e, b_0) + \tfrac{1}{2} u_1(A, W_0-e, b_0) \\ & + \tfrac{1}{2} [\tfrac{1}{2} u_2(W_0+2e, b(A, W_0+e)) + \tfrac{1}{2} u_2(W_0, b(A, W_0+e))] \\ & + \tfrac{1}{2} [\tfrac{1}{2} u_2(W_0, b(A, W_0-e)) + \tfrac{1}{2} u_2(W_0-2e, b(A, W_0-e))] \end{aligned}$$

$$\begin{aligned} = {} & 2\,[u_0 + \tfrac{1}{2}\alpha e - \tfrac{1}{2}\alpha (1 + \delta) e] \\ & + \tfrac{1}{4} [\alpha e] + \tfrac{1}{4} [-\alpha (1 + \delta) e] + \tfrac{1}{4} [\alpha e] + \tfrac{1}{4} [-\alpha (1 + \delta) e]. \end{aligned}$$

If she is instead inattentive, then her value function is

$$\begin{aligned} J(IA,W_0, b_0) = {} & u_1(IA, W_0, b_0) + \tfrac{1}{2} [\tfrac{1}{2} u_2(W_0+2e, b(IA, W_0)) + \tfrac{1}{2} u_2(W_0, b(IA, W_0))] \\ & + \tfrac{1}{2} [\tfrac{1}{2} u_2(W_0, b(IA, W_0)) + \tfrac{1}{2} u_2(W_0-2e, b(IA, W_0))] \end{aligned}$$

$$= 2\, u_0 + \tfrac{1}{4} [\alpha\, 2e] + \tfrac{1}{4} [0] + \tfrac{1}{4} [0] + \tfrac{1}{4} [-\alpha (1 + \delta)\, 2e].$$

Comparing the two alternatives, the investor is strictly better off being inattentive at date 1 and waiting until date 2 to learn the non-public component c_d:

$$J(A,W_0, b_0) - J(IA,W_0, b_0) = -\,\alpha\delta e < 0$$

This is due to the impact of checking on date 1 utility given loss aversion. In particular, the expected utility perturbations at date 2 are identical irrespective of whether the investor is attentive or passive at date 1.

Bad news case: If the public news at date 1 is negative, $W_1^* = W_0\text{-}e$, then the investor's cumulative expected utility from being psychologically attentive at date 1 is

$$J(A,W_0\text{-}e, b_0) = \tfrac{1}{2}\, u_1(A, W_0, b_0) + \tfrac{1}{2}\, u_1(A, W_0\text{-}2e, b_0)$$
$$+ \tfrac{1}{2}\, [\tfrac{1}{2}\, u_2(W_0\text{+}e, b(A, W_0)) + \tfrac{1}{2}\, u_2(W_0\text{-}e, b(A, W_0))]$$
$$+ \tfrac{1}{2}\, [\tfrac{1}{2}\, u_2(W_0\text{-}e, b(A, W_0\text{-}2e)) + \tfrac{1}{2}\, u_2(W_0\text{-}3e, b(A,W_0\text{-}2e))]$$

$$= 2\, [u_0 + \tfrac{1}{2}\, 0 - \tfrac{1}{2}\, \alpha\, (1 + \delta)\, 2e]$$
$$+ \tfrac{1}{4}\, [\alpha\, e] + \tfrac{1}{4}\, [-\, \alpha\, (1 + \delta)\, e] + \tfrac{1}{4}\, [\alpha\, e] + \tfrac{1}{4}\, [-\, \alpha\, (1 + \delta)\, e].$$

The corresponding value function if the investor is inattentive is:

$$J(IA,W_0\text{-}e, b_0) = u_1(IA, W_0\text{-}e, b_0)$$
$$+ \tfrac{1}{2}\, [\tfrac{1}{2}\, u_2(W_0\text{+}e, b(IA, W_0\text{-}e)) + \tfrac{1}{2}\, u_2(W_0\text{-}e, b(IA, W_0\text{-}e))]$$
$$+ \tfrac{1}{2}\, [\tfrac{1}{2}\, u_2(W_0\text{-}e, b(IA, W_0\text{-}e)) + \tfrac{1}{2}\, u_2(W_0\text{-}3e, b(IA, W_0\text{-}e))]$$

$$= 2\, [u_0 - a(1 + \delta)\, e]$$
$$+ \tfrac{1}{4}\, [\alpha\, (e + \theta\, e)] + \tfrac{1}{4}\, [\alpha\, (1 + \delta)(\text{-}e + \theta\, e)]$$
$$+ \tfrac{1}{4}\, [\alpha\, (1 + \delta)(\text{-}e + \theta\, e)] + \tfrac{1}{4}\, [\alpha\, (1 + \delta)(\text{-}3e + \theta\, e)].$$

Comparing the two alternatives conditional on bad prior news gives:

$$J(A,W_0\text{-}e, b_0) - J(IA,W_0\text{-}e, b_0) = 2\, (\lambda - 1)\, (1 + \delta)\, \alpha\, e + (1\text{-}\theta)\, (1 + \tfrac{3}{4}\, \delta)\, \alpha\, e$$

With bad news, the impact effect favors being inattentive while the reference point updating effect favors being attentive (i.e., so as to have a lower benchmark at date 2). On balance, the investor is inattentive and does not collect additional information if:

- The initial impact effect is strong in that λ is sufficiently small
- The inattentive reference point updating is not too slow in that θ is sufficiently

large

The parameterizations favoring inattention after bad news are, therefore, qualitatively similar to those favoring attention after good news. As with good news, the absence of both the impact effect and reference point updating delays, $\lambda = \theta = 1$, makes the investor indifferent about when she learns c_d. If $\lambda = 1$ (no utility difference between being attentive or inattentive), then any updating lag $\theta < 1$ causes the investor to be attentive and collect additional information. Some impact effect is necessary to get "not looking" given bad news. If $\theta = 1$ (no delayed benchmark effect), then any inattention $\lambda < 1$ causes the investor to be attentive and look. In the intermediate case of $\theta = \lambda$, the comparison simplifies further to

$$J(A,W_0\text{-}e, b_0) - J(IA,W_0\text{-}e, b_0) = (\lambda - 1)(1 + \tfrac{1}{4}\delta)\,\alpha\, e < 0$$

In this case, given $\lambda = \theta < 1$ and bad news, the investor is optimally never attentive.

Comparing bad news to neutral news: Our intuition a priori is that investors are more likely to monitor their portfolios when the market is neutral than when it is sharply down. As will be evident in the following section, the data weakly support this prediction. The prior analysis may seem superficially at odds with this intuition since the model predicts that people will *never* monitor their portfolios when the market is flat and also predicts that, for some parameter values, investors *will* monitor when the market news is negative. Yet, we can show that there is a wide range of parameter values for which the disincentive for looking is greater when the market is down than when it is neutral in that:

$$J(A,W_0, b_0) - J(IA,W_0, b_0) > J(A,W_0\text{-}e, b_0) - J(IA,W_0\text{-}e, b_0)$$

Substituting terms from earlier derivations and simplifying gives:

$$\delta < 4(1 - \lambda)/(3 - \lambda)$$

Reasonable parameter values for λ lie between zero and one. Values greater than one would imply that information has a greater impact on utility when one doesn't pay attention than when one does. Values lower than zero would imply that bad news actually makes one feel *better* if one isn't paying attention. Thus, at one extreme, if $\lambda=1$, which means that investors cannot avoid the impact of information by not paying attention, investors will be more motivated to avoid bad news when the market is down rather than when it is flat only if δ is less than 0, which would contradict loss aversion. At the other extreme, when $\lambda=0$, then investors will be more motivated to avoid bad news when the market is down rather than when it is flat as long as δ is less than 4/3, which corresponds to loss aversion $1+\delta$ of 2.33. Thus, our model is ambiguous as to whether people will be more or less motivated to look when information is bad than when it is neutral.

The model is extremely stylized in its assumptions that there are only two periods, that there is no time discounting, and that the investor is forced to pay attention in the second period. In reality, most investors probably have some ability to defer attention from their portfolios for an extended period of time, and most investors care more about the present than about the future. In analyses not reported here, we find that relaxing either of these assumptions increases the relative benefit of not looking in the negative information case as compared with the neutral information case. Thus, the current model probably understates the strength of the desire to hide from information when the market is down relative to when it is neutral.

Allowing other motives for information: In the standard economic model, investors have an indirect demand for information simply as an input into their trading decisions. They need to know their current financial situation in order to trade. Our analysis can easily accommodate an indirect demand for information. Let $F(A, W_1^*) \geq 0$ denote the option value of potential trades that the investor may encounter at time 1 provided that she is actively attending to her portfolio. The investor then compares the combined direct and indirect expected utility from being informed, $J(A, W_1^*, b_0) + F(A, W_1^*)$, with the expected utility from being less informed and forgoing any potential trading opportunities, $J(IA, W_1^*, b_0)$ when deciding whether to attend to her portfolio at date 1.

If investors only have an indirect demand for information then, since $F(A, W_1^*) \geq 0$, they are just as likely to collect information in up markets as in down markets. For investors not to attend to their portfolios there must be some cost to attention. A direct disutility from information collection endogenously provides such a cost.

Empirical hypothesis: The empirical tests for the ostrich effect in Section III use data about information collection decisions for cross-sections of investors. In doing so, we interpret the ostrich effect to mean that investors are simply *less likely* to check their portfolios in down and flat markets than in up markets; not that *no* investor will check. The inclusion of an indirect trading demand for information justifies this interpretation. Whether investors attend to their financial situation in down and flat markets depends on the relative magnitude of the disutility of attending to bad and neutral news and the positive option value of trading. If investors are heterogeneous, then some may attend while others may not. In up markets, however, investors will have an incentive to attend both because of the direct utility from good news and also because of the option value of possible trades.

III. Empirical Investigation of the Ostrich Effect with Investments

The key prediction of our model is that investors are more likely to look up their portfolio's value when the stock market is up than when it is down. To test this hypothesis we examined three separate data sets, each containing information about different investors' decisions to check the value of their personal portfolios. Table 1 presents some basic information about these three data sets. The first data set gives the daily number of investor account look-ups at a large Norwegian financial services company. The second data set gives the daily number of times investors at a major Swedish bank logged in to a page displaying personal mutual fund value data. The third data set reports. the daily number of times investors looked up their personal pension fund value with the Swedish Premium Pension Authority.

Table 1 here

We follow the same estimation strategy for all three datasets: We regress the daily number of portfolio values look-ups on the value of the relevant index on that day, and the average value of the index during the prior 6 days (i.e., the remainder of the week).

Hypothesis: The ostrich effect predicts that the coefficient on the contemporaneous index coefficient should be positive and the coefficient on the lagged index should be negative.

Given that the ostrich effect is about price changes, the possibility of secular drifts in look-ups and market trends is not a problem. In addition to these basic regressions, we also run regressions with added controls for day of the week, and number of look-ups on the previous day. Finally, when the available data permits, we control for cases in which individuals logged on for the purpose of transaction. We do this in an attempt to distinguish the ostrich effect from alternative explanations based on the idea that people are more likely to transact when the market is up than when it is down – i.e., that people are more likely to look at their portfolios when the market is up only to gather information for the purpose of transacting.

Data set 1: Norwegian financial services company. Our first data set was obtained from a major Norwegian financial services company. It includes logins during the three and a half months period from October 2, 2003 to January 17, 2004.

Figure 1 displays for each day the standardized values of the Norwegian all-share stock exchange index (OSBEX) and the total number of logins (LOGIN_Z). The average number of logins on the web per day was 937. As may be seen the number of logins each day follows the national index quite closely.

Figure 1 here

We regress the daily number of lookups on current and lagged average values of the Norwegian stock index as well as on day-of-the-week dummy variable with and without the number of lagged lookups. In both specifications the stock price variables have the correct signs as predicted by the ostrich effect. In the first regression, an increase of one point of the current day OSBEX index raises the number of lookups with a bit more than 60, while an increase of one point in the lagged average index value results in close to 40 less lookups (the standardized values for these coefficients are 1.84 and -1.09, respectively). As may be seen, the magnitudes of the coefficients are somewhat lower in the second regression when controlling for the number of lagged transactions (the standardized coefficients for the current and lagged average value of the index are 1.02 and -0.64, respectively). The t-statistics are all significant except for the lagged index in column 2 which we attribute to the small sample size. Thus, this first set of regressions supports the ostrich effect.

Table 2 here

To link this empirical analysis more closely to the three cases discussed in the model section – where market news is positive, neutral or negative – we also calculated daily changes in the OSBEX and then divided the sample into three equal groups (triciles) consisting of the third of days following the biggest daily increases, the third of days following the biggest daily decreases and third of days lying in between these two extremes (i.e., with relatively small increases or decreases in the OSBEX). Figure 2 shows the average change in the daily number of fund-checks corresponding each of the triciles. As may be seen, the number of fund-checks goes up when the market goes up. However, the smallest number of fund-checks seems to be found in down markets rather than in flat markets. This is exactly the pattern predicted by our model given, as we argued in Section II, plausible parameter values.

Figure 2 here

Data set 2: Swedish mutual funds. Our second data set was provided by one of the major Swedish banks and mutual fund managers. The data include the number of logins each day during the 90-day period extending from June 30 to October 10, 2003. The logins recorded were to a page, personalized for each investor, which displayed information about the current value and performances of their mutual fund holdings. To reach this page, investors had to first enter their personal bank page, which included general account and transaction information.

Some investors may log in to their personal bank page specifically to check their mutual funds, while others may log in for other reasons – to pay bills, to transfer money between accounts, to check on a loan, etc. – and then afterwards check their mutual funds once they are there. Therefore we consider two dependent variables: The number of logins to the page displaying information about mutual funds and the proportion of logins to this page by people who had logged in to their personal bank page. Given the convenience of checking once investors logged in for whatever reason, this second proportional variable is a pure measure of voluntary information collection undistorted by the shoe leather cost of needing to go to the computer in the first place.

During the sample period there were an average of 57,513 logins into personal bank pages per day, and an average of 11,602 logins to the page displaying mutual fund information. Hence, on average, people checked the values of their mutual funds 20% of the times that they logged in to their personal bank pages.

Figure 3 displays standardized values of the Swedish all shares stock exchange index (SAX), the number of mutual fund checks (Fund check), and the proportional number of mutual fund checks relative to the total number of log ins (Fund check (prop)) for each day over the period. The overall pattern over the entire period and the short-term variations again suggest that the total fund-checks and the proportion of bank account logins that led to checking of mutual fund information are positively related to changes in the level of the SAX index.

Figure 3 here

We ran two sets of regressions to test the ostrich effect. The dependent variable in columns 1 and 2 is the raw number of fund-checks each day. The dependent variable in columns 3 and 4 is the proportion of website logins that led to fund-checks. All of the regressions include the contemporaneous daily level of the SAX, the average level of the SAX for the prior 6 days, weekday dummy variables to control for day-of-the-week effects, and a bill paying dummy that controls for the increase in website logins due to bill paying in the end of each month (days of the month from the 25^{th} to the 31^{st} were coded as 1, the other days were coded as 0). We also add in the lagged dependent variable, but we do not have data specifically on the number of trades from these logins. Table 3 presents the regression results. Only days when the stock exchange was open were included in the regression.

Table 3 here

The impact of the SAX index on portfolio lookups is consistently positive and significant in all four specifications. The coefficients on the lagged average SAX are significant and again consistently negative. Moreover, the magnitudes of the coefficients are roughly in the same ballpark as with the Norwegian data. The standardized coefficients for the current day value of the SAX index are 1.15, 0.65, 1.77, and 1.13 for specifications 1, 2, 3, and 4 respectively. The corresponding standardized coefficients for the lagged average of the SAX index are -0.73, -0.42, -1.45, and -1.05. Thus, these regressions clearly support an ostrich effect for log ins as well as for proportional log ins.

Figure 4a shows the average daily change in the number of portfolio look-ups, and figure 4b shows the average daily change in the ratio of lookups to logins broken down again by triciles of changes in the SAX. Both graphs show a substantially greater number of look-ups following the good news of large increases in the SAX. As displayed in Figure 4a, the changes in number of portfolio lookups are smaller after neutral news than after bad news. The changes in the ratio of lookups, however, are smaller after bad news than after neutral news.

Figures 4a and 4b here

Data set 1: Swedish Premium Pension Authority. Our last data set is from the Swedish Premium Pension Authority. It is the longest and broadest of our three samples. In the Swedish premium pension scheme, introduced in 2000, Swedish citizens choose how to invest 2.5% of their before-tax income in equity and interest bearing funds as part of their state pension savings. In 2004, 5.3 million of Sweden's 9 million citizens were included in this new premium pension system. The data we obtained included information about the total number of people who checked the value of their portfolio on each day between January 7, 2002 and October 13, 2004. In addition, the data set includes the number of changes (reallocations) made to portfolios (either on the web or through an automatic telephone service) for each day. The data on portfolio changes give us a clean look at when people check the value of their investments, since people only log in to check the value of their premium pension funds or to reallocate their portfolio. As a dependent measure we use number of logins minus the number of changes made each day (on the web or an automatic telephone service). For the entire period investigated, the average number of logins each day is 9,316. Of these, 994 also involved a change to investment allocation.

Figure 5 presents the standardized values of the Swedish all shares stock exchange index (SAX) and the number of logins to check the value of funds for each day of the period. As may be seen, the number of logins follows the SAX index reasonably closely. The number of logins is higher when the SAX index is higher, and vice versa.

Figure 5 here

To test whether people look up the value of their investments more frequently after the stock market has gone up than when it has fallen, we ran three regressions. The first column of Table 4 presents a regression of logins on the current value of the SAX, the average SAX price over the previous week, and various weekday dummy variables. The next two columns add the lagged number of logins and the lagged number of transactions as additional explanatory variables.

Table 4 here

In all three regressions, the number of fund-checks is increasing in the current SAX level and decreasing in lagged SAX values. The size of the negative coefficient on the lagged SAX average is close to the same magnitude as the positive coefficient on the current SAX. In the first regression, the standardized coefficient for the current SAX value is 1.62 and the lagged SAX average is -1.12. The corresponding numbers for the second regression are 0.34 and -0.32, and for the third regression 0.33 and -0.31. This is consistent with the prediction that the number of look-ups should be increasing in the change in the SAX (our proxy for public/automatic news) over some prior time window. Thus, this data set strongly supports the ostrich effect. This is true even after controlling for the positive autocorrelation in fund-checks and including the contemporaneous daily number of transactions as a control for the indirect trading demand for information. The R^2 are all good-sized.

Figure 6 displays the average daily changes in number of fund-checks by triciles of daily changes in the SAX index. Clearly the number of fund-checks increases dramatically following good news. However, unlike the two previous data sets on fund checks of mutual funds, the changes in fund look-ups for the premium pension portfolio tend to be fewer after bad news than after neutral news.

Figure 6 here

IV. Alternative Explanations of the Observed Ostrich Effect

The results from the three data sets clearly support the predicted ostrich effect in line with what was suggested in the model of selective attention. There might, however, be alternative explanations for this effect. First, it may be sufficient to assume that investors consume the utility of good news to arrive with the same main prediction of an ostrich effect. One problem with this explanation is that there is ample evidence that experiencing outcomes that fall short of expectations results in disappointment (Gul, 1991; Bell, 1985; Loomes and Sugden, 1986; Zeelenberg et al., 2000). Hence, one would need to assume that people are able to consume good news about wealth that will be realized in the future without changing, and thus independently from, their expectations about the future value of their wealth. (Moreover, such an account would predict that investors always would be as reluctant to look up the value of their funds in flat markets as in down markets. Although not conclusive, our data suggest that investors may be somewhat more reluctant to check the value of their portfolios after neutral news than after bad news for their self initiated mutual fund investments, while they tend to be more reluctant to check the value of their premium pension investments after bad news than after neutral news. If assuming greater loss aversion for the mutual fund investments than for the premium pension investments, this is in line with our suggested model of selective attention.)

Second, another explanation could be that the media coverage is asymmetric in a way that makes investors pay more attention to their portfolios in bull markets. If the media talks more about the stock market when the market is up than when it is down this could increase attention to the value of one's own portfolio during up-markets. It seems unlikely, however, that differences in media cover can explain the presently observed changes in lookups due to market changes, which are the result of the changes in the current day value compared to the average value the latest week. Furthermore, even if differences in media cover could explain part of the results, one needs to explain why the media pays more attention during bull markets. One such reason could certainly be that the demand for media coverage is greater in bull markets, and accounting for the observed ostrich effect in terms of media coverage would thus suffer from some degree of circularity.

A third possible explanation for the obtained relationships between market variations and number of fund checks builds on an inverse reasoning about the causal relations. We may assume that due to some exogenous variable(s) investors want to transact. On days when investors want to transact, they will first look at their portfolios. Hence, if investors look at their portfolios to transact and this willingness to transact is an expression of a higher demand for stocks, market prices will go up when more investors log in to check the value of their funds. Although, we are able to control for the number of transactions in one of the data sets to rule out this possibility, since we do not know if a single investor logs in one or several times when transacting, this control may be insufficient. However, another indication that this inverse causal reasoning may be less valid emerges if we look at partial correlations in the Swedish premium pension sample in which we have the number of transactions registered. If lookups are driven by a willingness to transact, the partial correlation would be greater between transactions and the market index than between fund checks and the market index. When controlling for fund checks, the correlation between transactions and the SAX index is weak and non significant (r=.04, p= .34). On the other hand, when controlling for transactions, the partial correlation between fund checks and the SAX index is much greater and significant (r=.35, p<.001).

V. Additional Implications of the Ostrich Effect

Most readers, if they introspect about their personal behavior during the bull market of the late 1990s and the subsequent meltdown, or on the behavior of those around them, will not be surprised by these results. One attraction of our theoretical model, however, is that it allows us to link observable behavior (i.e., information collection decisions) with internal psychological covariates that, while not directly observable, are important for the dynamics of changing investor preferences in rising and falling markets. Thus, investors' decisions about whether to update information about their portfolio are, in our model, a proxy that can be used to identify unobservable investor preference parameters. This is important because earlier models that incorporate similar psychological considerations (e.g., Barberis, Huang and Santos, 2001; Routledge and Zin, 2004) have only been tested with price data. Beyond providing a new source of data for estimating parameters, our model also provides additional support for the psychological assumptions underlying such models – most notably that people derive utility directly from information about changes in their wealth.

Our model also provides new testable restrictions on prospect theory-based models of asset pricing. In particular, the ostrich effect implies that the loss aversion reference point should increase faster in bull markets than it falls in down markets. This is an endogenous consequence of investors' managing the impact of good and bad news on their utility. Since the "kink" in the utility function at the reference point induces first-order risk aversion locally, the asymmetric reference point updating dynamics will lead to asymmetric dynamics in the market risk premium.

The ostrich effect also has implications for trading volumes and market liquidity. For example, it may help explain the well-documented relationship between trading volume and market returns. Griffin, Nardari and Stulz (2004) examined market-wide trading activity and lagged returns in 46 markets and found that positive returns led to significant subsequent increases in volume ten weeks later in 24 of 46 countries. In no country was there a significant decrease. The authors explore a variety of possible explanations including liquidity effects, participation costs, over-confidence, and disposition effects. They conclude that no single theory is consistent with all of the patterns observed in the data. The ostrich effect may play at least a contributory role since positive lagged returns reduce the cost of attending to the market and, thereby, reduce the cost of being available for trading.

Turning to market liquidity, it is a commonplace that liquidity dries up during major market downturns such as the Asian crisis of 1997 and the Russian debt default in 1998. This is, again, consistent with investors temporarily ignoring the market in downturns – so as to avoid coming to terms mentally with painful losses – and, thus, being unavailable to respond to opportunities to provide liquidity. During market rallies the ostrich effect would improve liquidity as more investors begin actively following the market.

The ostrich effect also has social consequences for the transmission of information. As Robert Shiller documents in Irrational Exuberance, social factors play a critical role in financial market, pumping up values when rising markets create a "buzz." If people do not pay attention to the market when prices fall, this could easily suppress such social transmission, exacerbating downturns. If investors obsessively track the value of their portfolio when market values are rising, it is likely that this would facilitate interpersonal communication and positive feedback effects.

VI. Selective Attention and Rationality

Selective attention is fully rational given our assumption that investors are psychologically affected by information about the world around them. There is no self-deception in the sense of simultaneously knowing something and willfully not knowing it (see, e.g., Sartre 1953). In our model investors correctly interpret whatever information they have. Our argument that investors can regulate the impact of information on their utility instead relies on the idea that there are multiple ways to "experience" information. Recent work by psychologists (e.g., Sloman, 1996; Epstein et al., 1992) suggests that people may hold beliefs at different levels.[3] Prior research also shows that knowledge that is "fuzzy" – i.e., lacking in precision – is perceived as less salient or vivid and has greater leeway for self-manipulation of expectations in relation to knowledge (Schneider, 2001).

Whether the ostrich effect is rational ultimately comes down to the accuracy of people's assessments of how potential information will make them feel. Our model was exposited assuming these assessments are accurate, so our story does not require irrationality. It has been well documented, however, that ex ante utility forecasts are often erroneous (Loewenstein, O'Donoghue and Rabin, 2003). If investors' assessments of the utility of wealth are biased, then the ostrich effect may well cause investors to pay attention to the market too little or too much. In up markets, for example, people may check their portfolios more often than is justified on the basis of information required for decision making, much as a miser obsessively counting his gold. In down markets, investors could be so information-averse that they forgo optimal portfolio rebalancing and miss favorable opportunities to trade in the market.

Selective exposure may also play an evolutionary role in helping people live with risky investments, and by reducing immediate worries about these risks, thereby obtain the potential long-term benefits of such investments. Thus, the ostrich effect may lower, to some extent, the required market equity premium. Prior work in behavioral economics has also shown, consistent with the theory of second best, that the introduction of new biases can have beneficial effects when they counteract the negative effects of existing biases. For example, overconfidence can mitigate extreme risk aversion induced by loss aversion (Kahneman and Lovallo 1993), and the 'curse of knowledge' – the tendency to overestimate the degree to which one's personal knowledge is shared – can attenuate adverse selection if, for example, sellers of lemons overestimate the degree to which potential buyers will notice defects (Camerer, Loewenstein and Weber, 1989).

VII. Conclusions

This paper has presented a decision theoretic model in which information collection is linked to investor psychology. For a wide range of plausible parameter values, the model predicts that investors should collect additional information conditional on favorable news and avoid information following neutral or bad news. We call this the ostrich effect. Empirical evidence from three different Scandinavian datasets supports the existence of the ostrich effect in financial markets.

While we have examined the ostrich effect in the context of financial markets, its applications are much broader. If the assumptions of our model are correct, then we should observe ostrich-like behavior in any situation in which people care about information and have some ability to shield themselves from it. For example, parents of children with chronic problems, such as autism or mental retardation, might be prone to stick their heads in the sand and avoid reading the signs of the problem until after those problems are evident to surrounding people who are less emotionally involved. Our two period model could easily be applied to such a situation by assuming that in period 1 the parents receive public information (observations of the child's behavior) and must decide whether to obtain definitive medical tests, but that by period 2 it becomes clear whether the child has the condition regardless of whether they obtained the test results in period 1.

More generally, the core ideas in this paper – that people derive direct utility from information and that, as a result, they pay selective attention to information – join an expanding body of research that could be labeled the *new* new economics of information. Whereas the new economics of information adhered to standard economic assumptions about the individual but showed how market-level information asymmetries could produce suboptimalities, the *new* new economics of information focuses on characteristics of how emotionally invested and computationally bounded individuals process information. This work ranges from evidence that people do not use Bayes' Rule when updating expectations (e.g., Camerer 1987) to violations of the law of iterated expectations (Camerer, Loewenstein and Weber, 1989) to demonstrations that personal experience is weighted more heavily than vicarious experience, even when both have equal information value (Simonsohn et al. 2004). Our observation that people derive utility directly from information – and are, therefore, motivated to attend to it selectively as part of utility maximization – is just the latest in an ongoing effort to map out a more realistic account of how people mentally process and respond to information.

References

Akerlof, George A., and William T. Dickens. “The Economic Consequences of Cognitive Dissonance.” *American Economic Review*, 72 (1982), 307–319.

Alloy, Lauren B. and Lyn Y. Abramson. “Judgment of Contingency in Depressed and Nondepressed Students: Sadder but wiser?” Journal of Experimental Psychology: General, 108(4) (Dec 1979), 441-485.

Babad, Elisha ”Can Accurate Knowledge Reduce Wishful Thinking in Voters' Predictions of Election Outcomes?” *Journal of Psychology: Interdisciplinary & Applied*,129(3) (May 1995), 285-300.

Babad, Elisha and Yosi Katz. ”Wishful Thinking--Against all Odds.” *Journal of Applied Social Psychology*, 21(23) (Dec 1991), 1921-1938.

Barberis, Nicholas, Ming Huang, and Tano Santos, “Prospect Theory and Asset Prices,” *Quarterly Journal of Economics*, 116, (2001), 1-53.

Baumeister, Roy F., J.D. Campbell, J.I. Krueger, and K.D. Vohs. “Does High Self-esteem Cause Better Performance, Interpersonal Success, Happiness, or Healthier Lifestyles?” *Psychological Science in the Public Interest*, 4(1) (2003), 1-44 (whole issue).

Bell, David E. “Disappointment in decision making under uncertainty.” *Operations Research*,33:1–27, 1985.

Benabou, Roland and Jean Tirole. “Self-confidence and Social Interactions,” NBER Working Paper 7585, 2000.

Benartzi, Shlomo and Richard Thaler. Myopic Loss Aversion and the Equity Premium Puzzle. Quarterly Journal of Economics 110(1) (1995), 73-92.

Bodner, Ronit, and Drazen Prelec. “Self-signaling and Diagnostic Utility in Everyday Decisionmaking,” in Collected Essays in Psychology and Economics, Isabelle Brocas and Juan D. Carrillo, editors (Oxford: Oxford University Press, 2001).

Brunnermeier, Markus K. and Jonathan A. Parker. “Optimal Expectations.” Princeton University, Working Paper, 2002.

Brock, Timothy C., and J. L. Balloun. “Behavioral Receptivity to Dissonant Information.” *Journal of Personality and Social Psychology, 6*, (1967), 413-428.

Camerer, Colin. Do biases in probability judgment matter in markets - experimental-evidence. *American Economic Review*. 77(5)(Dec 1987), 981-997.

Camerer, Colin, George Loewenstein and Martin Weber. The curse of knowledge in economic settings: An experimental analysis. *Journal of Political Economy*, 97 (1989), 1232-1254.

Caplin, Andrew, “Fear as a Policy Instrument,” in Time and decision, George Loewenstein, Daniel Read, and Roy Baumeister, editors (New York: Russell Sage, 2003).

Caplin, Andrew, and John Leahy Psychological expected utility theory and anticipatory feelings *Quarterly Journal of Economics*, 116, (2001), 51-80.

Cotton, John L. “Cognitive Dissonance in Selective Exposure.” in Selective Exposure to Communication, Dolf Zillmann and Jennings Bryant, editors (Hillsdale, N.J.: L. Erlbaum Associates, 1985)

Diener, E., and M. Diener, “Cross-cultureal Correlates of Life Satisfaction and Self-esteem. *Journal of Personality and Social Psychology*, 68 (1995), 653-663.

Ehrilch, D., I. Guttman, P. Schonbach & J. Mills. ”Postdecision exposure to relevant information.” *Journal of Abnormal and Social Psychology, 54* (1957), 98-102.

Epstein, S., Lipson, A., Holstein, C., & Huh, E. Irrational reactions to negative outcomes; Evidence for two conceptual systems. *Journal of Personality and Social Psychology*, 62 (1992), 328-339.

Festinger, Leon, *Conflict, Decision, and Dissonance* (Stanford, CA: Stanford University Press, 1964).

Freedman, Jonathan L. and David O. Sears. “Warning, Distraction, and Resistance to Influence. *Journal of Personality & Social Psychology*, 1(3) (1965), 262-266.

Frey, Dieter and Dagma Stahlberg. Selection of information after receiving more or less reliable self-threatening information. *Personality & Social Psychology Bulletin*. 12(4) (Dec 1986), 434-441.

Geanakoplos, John David Pearce, and Ennio Stacchetti. Psychological games and sequential rationality. *Games and Economic Behavior*, 1(1) (1989), 60–79.

Gneezy, Uri and Jan Potters. An Experiment on Risk Taking and Evaluation Periods," Quarterly Journal of Economics, 112, (1997), 631-645.

Griffin, John M., Nardari Federico and René M. Stulz. Stock market trading and market conditions. Working paper, McCombs School of Business, University of Texas at Austin.

Gul, Faruk. "A theory of disappointment aversion." *Econometrica*, 59(3):667–686, 1991.

Horowitz, John K. and Kenneth McConnell. A Review of WTA/WTP Studies. *Journal of Environmental Economics and Management* 44(3) (November 2002), 426-47.

Jonas , Eva, Stefan Schulz-Hardt, Dieter Frey, and Norman Thelen, "Confirmation Bias in Sequential Information Search after Preliminary Decisions: An Expansion of Dissonance Theoretical Research on Selective Exposure to Information." *Journal of Personality & Social Psychology* 80(4) (Apr 2001), 557-571.

Kahneman, Daniel and Dan Lovallo. Timid choices and bold forecasts: a cognitive perspective on risk taking. Management Science 39(1)(Jan 1993), 17 – 31.

Kahneman, Daniel and Dale T. Miller. Norm theory: Comparing reality to its alternatives. *Psychological Review*, 93(2)(1986), 136-153.

Kahneman, Daniel and Amos Tversky The psychology of preferences. *Scientific American*, 246 (1982), 160-173.

Karlsson, Niklas, George Loewenstein & John W. Patty. A dynamic model of optimism. Working paper, Department of Social and Decision Sciences.

Koszegi, Botond, "Self-image and Economic Behavior," Mimeo, Massachusetts Institute of Technology, 1999.

Kruglanski, Arie. "Motivated Social cognition: Principles of the Interface," in Edward Tory Higgins and Arie W. Kruglanski, editors, Social Psychology: Handbook of Basic Principles New York, NY, US, 1996).

Kunda, Ziva. "The Case for Motivated Reasoning." *Psychological Bulletin*, 108(3) (Nov 1990), 480-498.

Loewenstein, George , "Anticipation and the Valuation of Delayed Consumption." *Economic Journal*, 97 (1987), 666–684.

Loewenstein, George and Samuel Issacharoff. "Source-dependence in the valuation of objects." *Journal of Behavioral Decision Making*, 7 (1994), 157-168.

Loewenstein, George, Ted O'Donoghue and Matthew Rabin. "Projection bias in predicting future utility." *Quarterly Journal of Economics*, 118 (2003), 1209-1248.

Loomes, Graham, and Robert Sugden. "Disappointment and dynamic consistency in choice under uncertainty." *Review of Economic Studies*, 53(2):271–282, 1986.

Peterson, Christopher, and Lisa M. Bossio, "Optimism and Physical Well-being," in *Optimism & Pessimism: Implications for Theory, Research, and Practice*, Edward C. Change, editor (Washington, DC: American Psychological Association, 2001).

Rabin, Matthew, "Incorporating Fairness into Game Theory and Economics." *American Economic Review* 83 (1993), 1281-1302.

Rabin, Matthew, and Joel L. Schrag, "First Impressions Matter: A Model of Confirmatory Bias. *Quarterly Journal of Economics*, 114(1) (1999), 37–82.

Routledge, Bryan & Stanley Zin 2004, "Generalized Disappointment Aversion and Asset Prices," NBER working paper w8683.

Sartre, Jean-Paul, *The Existential Psychoanalysis (H.E. Barnes, trans.)* (New York: Philosophical Library, 1953).

Scheier, Michael F., Charles S. Carver, and Michael W. Bridges, "Optimism, Pessimism, and Psychological Well-being," in *Optimism & Pessimism: Implications for Theory, Research, and Practice*, Edward C. Chang, editor (Washington, DC: American Psychological Association, 2001).

Schneider, Sandra L. "In Search for Realistic Optimism: Meaning, Knowledge, and Warm Fuzziness." *American Psychologist*, 56 (2001), 250–263.

Shefrin, Hersh M. and Meyer Statman. Explaining investor preference for cash dividends. *Journal of Financial Economics*, 13(2) (1984), 253-282.

Simonson, Uri, Niklas Karlsson, George Loewenstein and Daniel Ariely. The Tree of Experience in the Forest of Information: Overweighing Personal Over Vicarious Experience. SSRN working paper. (2004).

Sloman. Steven A., "The Empirical Case for Two Systems of Reasoning." Psychological Bulletin, 119 (1996), 3–22.

Witte (1992). Putting the fear back into fear appeals: the extended parallel process model. Communication Monographs 59. Available at http://www.msu.edu/~wittek/fearback.htm

Zeelenberg, Marcel, Wilco W. van Dijk, Antony S. R. Manstead, and Joop van der Pligt. On bad decisions and disconfirmed expectancies: The psychology of regret and disappointment. *Cognition and Emotion*, 14:521–541, 2000.

Table 1: Descriptive statistics for the three data sets

	Norwegian bank data	Swedish bank data	Swedish Premium Pension Authority data
Sample period	October 2, 2003 – January 17, 2004	June 30, 2003 – October 7, 2003	January 7, 2002 – October 13, 2004
Average number of logins per day	937	11,602	9,316
Average number of transactions per day	97 (average data not available on a daily basis)	--	994

Table 2: Regressions with Norwegian bank data

The sample period is October 2, 2003 and January 17, 2004. Standard errors are in parentheses.

	Dependent variable: logins to mutual fund page	
	(1)	(2)
Intercept	-3224*** (395)	-1696** (519)
OSBEX index	62.9*** (15.3)	35.1* (15.1)
Ave($OSBEX_{t-1}$- $OSBEX_{t-7}$)	-37.5* (15.3)	-22.4 (14.2)
Lagged logins		0.51*** (0.12)
Number of observations R-square Durbin-Watson	70 0.69 1.18	69 0.75 2.33

*** p<.001; **p<.01; *p<.05

Table 3: Regressions with the Swedish bank data

The sample period is June 30, 2003 through October 7, 2003. Standard errors are in parentheses.

	Dependent variable: logins to mutual fund page		Dependent variable: logins to mutual fund page/logins to personal bank page	
	(1)	(2)	(3)	(4)
Intercept	-24024***	-14865**	-0.022	-0.0031
	(5799)	(5345)	(0.044)	(0.029)
SAX index	496***	288**	0.0058***	0.0037***
	(96.3)	(90.9)	(0.0007)	(0.0005)
Ave(SAX_{t-1}-SAX_{t-7})	-300**	-176*	-0.0045***	-0.0033***
	(91.8)	(81.4)	(0.0007)	(0.0005)
Lagged logins		0.44***		0.62***
		(0.09)		(0.06)
Number of observations	69	68	69	68
R-square	0.64	0.75	0.64	0.85
Durbin-Watson	0.71	1.36	0.67	1.80

*** p<.001; **p<.01; *p<.05

Table 4: Regressions with the Swedish Pension Authority data

The sample period is January 7, 2002 and October 13, 2004. Standard errors are in parentheses.

	Dependent variable: logins to mutual fund page – transactions		
	(1)	(2)	(3)
Intercept	-11937***	-1588***	-1542***
	(1396)	(394)	(390)
SAX index	358***	75.3***	73.7***
	(55.2)	(15.2)	(15.1)
Ave(SAX_{t-1}-SAX_{t-7})	-248***	-71.0***	-69.6***
	(55.1)	(15.0)	(14.8)
Lagged logins		0.96***	0.92***
		(0.01)	(0.01)
Transactions per day			0.37***
			(0.09)
Number of observations	691	690	690
R-square	0.29	0.95	0.95
Durbin-Watson	0.09	2.17	2.14

*** p<.001; **p<.01; *p<.05

Figure 1: OSBEX index and logins by investors at Norwegian bank

The sample period is October 2, 2003 to January 17, 2004

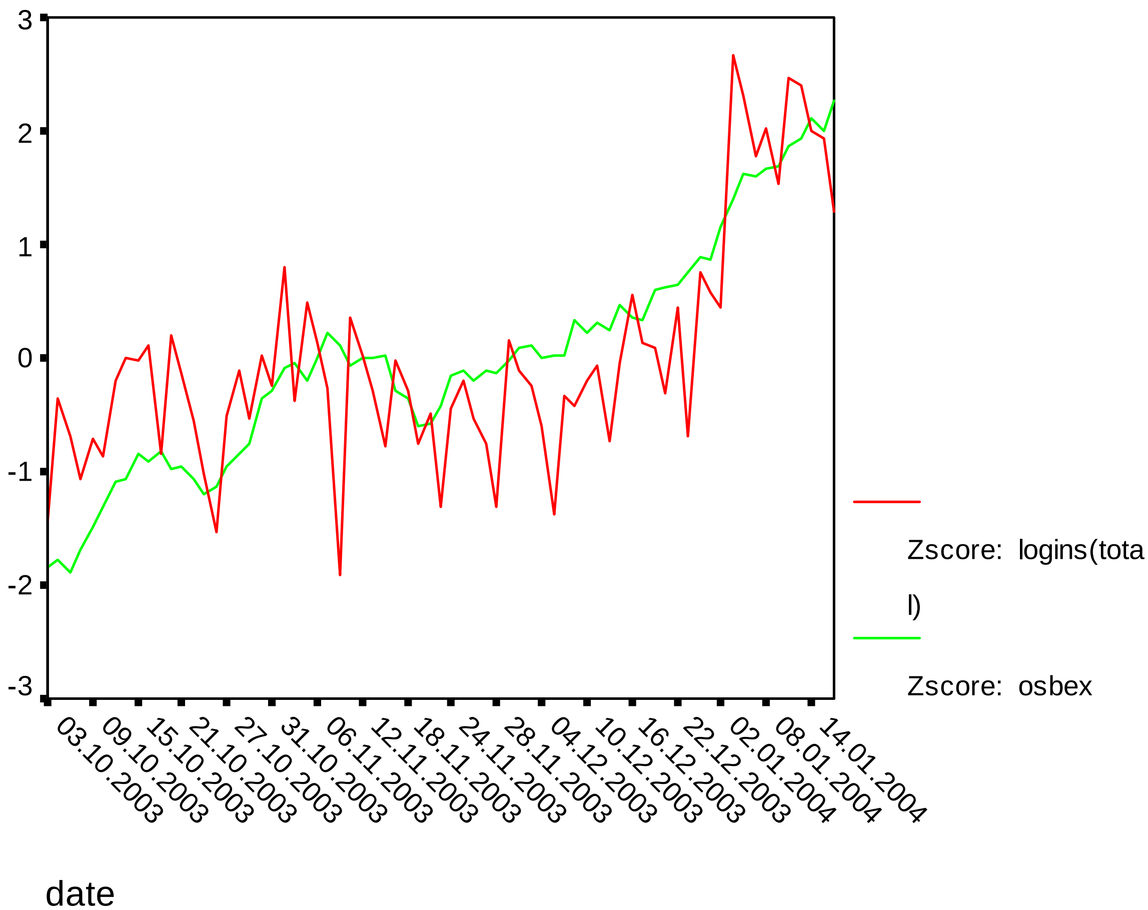


Figure 2: Changes in the OSBEX and fund look-ups by investors at Norwegian bank

The sample period is October 2, 2003 to January 17, 2004

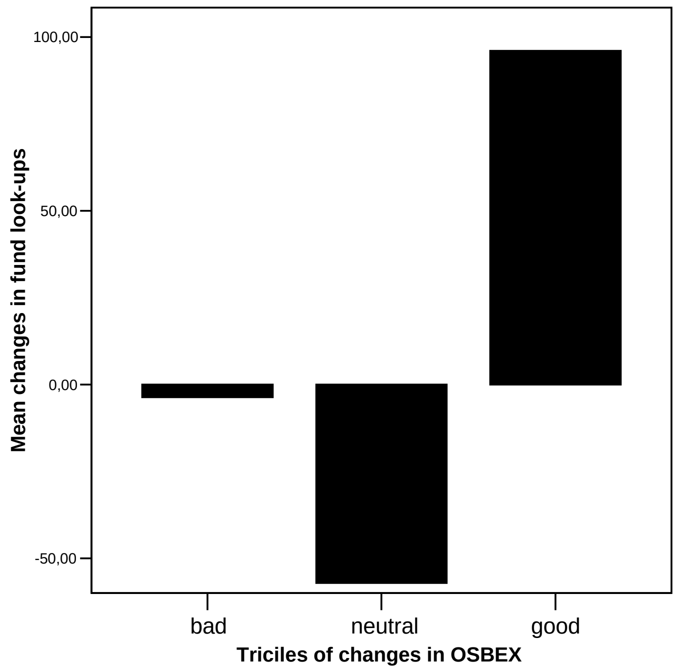


Figure 3: The SAX and fund look-ups by investors at a large Swedish Bank

The sample period is June 30, 2003 through October 7, 2003.

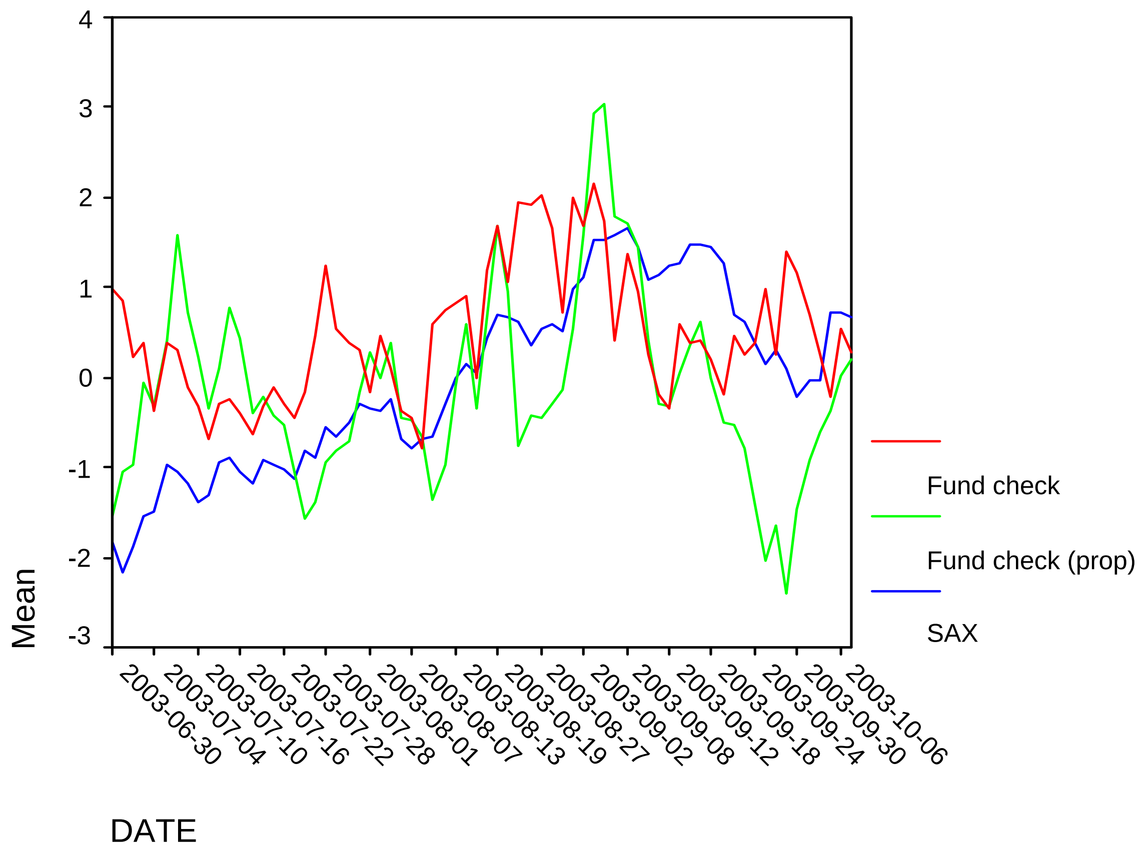


Figure 4a: Changes in the SAX and fund look-ups by investors at a large Swedish bank

The sample period is June 30, 2003 through October 7, 2003.

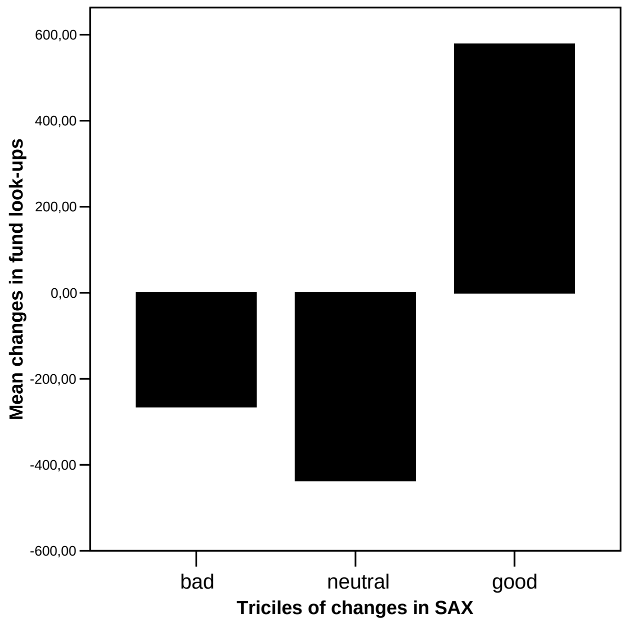


Figure 4b: Changes in the SAX and ratio of fund look-ups to logins to personal banking page by investors at a large Swedish bank

The sample period is June 30, 2003 through October 7, 2003.

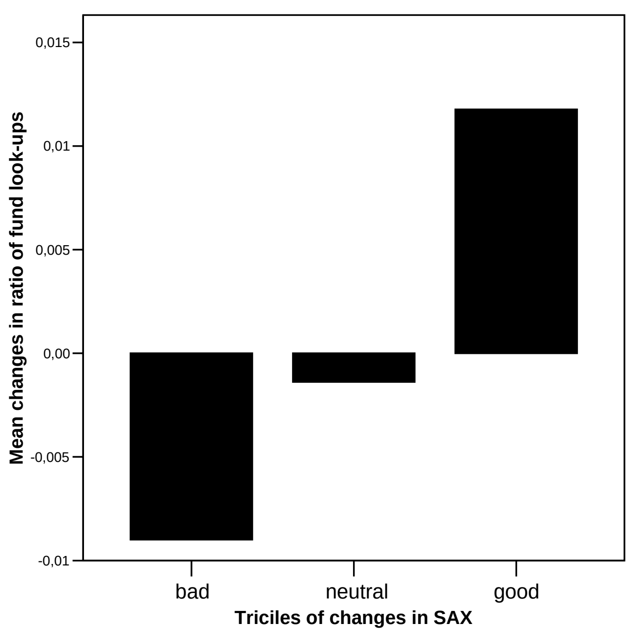


Figure 5: **: SAX index and portfolio checks for Swedish pension data**

The sample period is January 7, 2002 and October 13, 2004

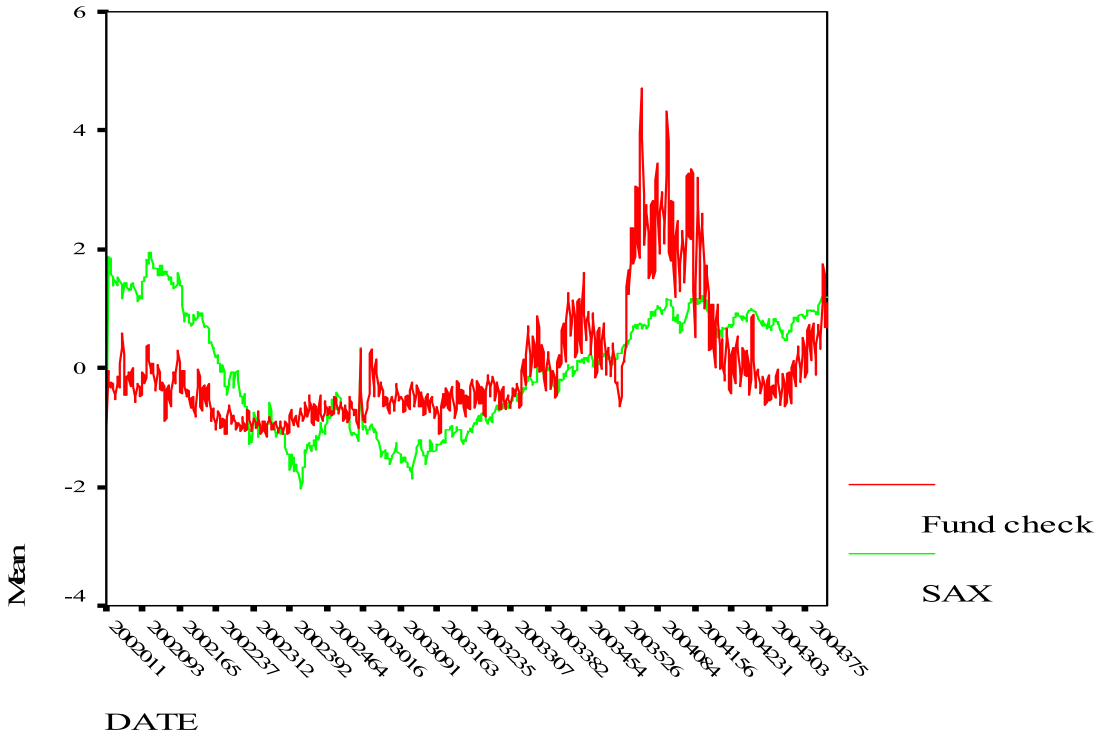
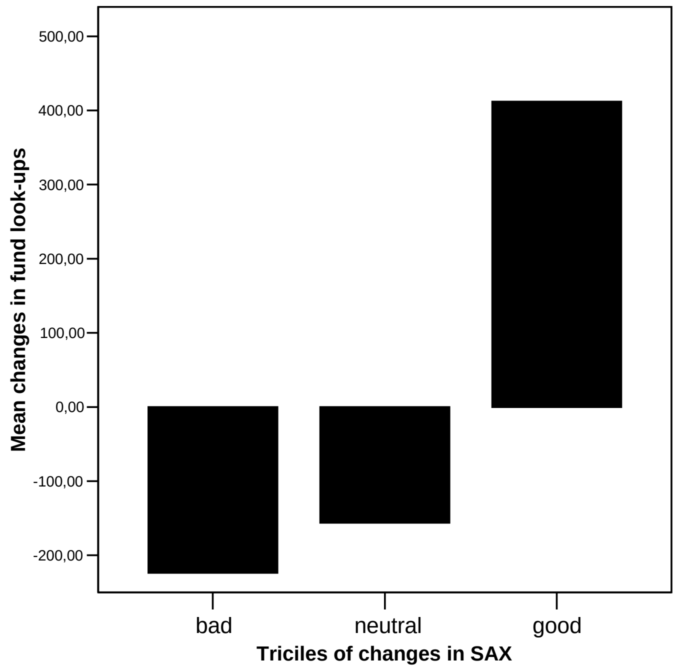


Figure 6: Changes in the SAX and fund look-ups for Swedish pension data

The sample period is January 7, 2002 and October 13, 2004



[1] In Akerlof and Dicken's (1982) model, workers in dangerous work environments downplay the severity of unavoidable risks they face. In Koszegi (1999), Bodner and Prelec (2001), and Benabou and Tirole (2004) people take actions to persuade themselves (and others) that they have desirable personal characteristics that they may not have. In Benabou and Tirole's (2000) model, people exaggerate their own likelihood of succeeding at a task so as to counteract the inertia-inducing effects of hyperbolic time discounting. In models proposed by Brunnermeier and Parker (2002) and by Karlsson, Loewenstein and Patty (2003), agents maximize total well-being over time by balancing the benefits of holding optimistic beliefs and the costs of basing actions on distorted expectations. Rabin and Shrag (1999) propose a model in which people interpret evidence in a biased fashion that responds more strongly to information consistent with what they are motivated to believe.

[2] The idea that ostriches hide their head in the sand is in fact a myth. As reported on the website of the Candadian Museum of Nature (http://www.nature.ca/notebooks/english/ostrich.htm), "If threatened while sitting on the nest, which is simply a cavity scooped in the earth, the hen presses her long neck flat along the ground, blending with the background. Ostriches, contrary to popular belief, do not bury their heads in the sand."

[3] When presented with two jars, one containing one blue and nine red beans, and the other containing ten blue and ninety red beans, most people state that the probability of drawing blue is the same with either jar; yet most people prefer to bet on the jar with the larger number of blue beans (and many are willing to pay a premium to do so).