Projection Bias: An Initial Survey

People tend to misjudge the degree to which their current situation and excitement affect their future taste. The result is that people might over- or underestimate the value of their actions (such as purchasing a durable good[1]) and end up making choices which are suboptimal to choices made by a rational agent unaffected by projection bias. In this survey I introduce the reader to several examples of projection bias and review some of the theoretical and empirical research on the main mechanisms of projection bias. A large part of the existing literature is written within the fields of medicine and psychology, but most of the interpretations can be transferred to economic problems as well.

The main object of this survey is to provide the reader with a compact reference tool. Hence, the survey has as far as possible been divided into a theoretical/suggestive part and an empirical part.

1 Introduction

Every day people face situations where they have to predict future tastes which may differ significantly from current tastes. If the prediction of future tastes is affected by the decision maker's current state, he misgauges the future utility received from a good and may therefore act different compared to the situation, where he assesses the future correctly. For instance, when making summer vacation plans during a 0^oF winter an agent maybe can not get it too hot. But with the coming of the 100^oF summer, he may wish he planned the vacation to a more tempered location.

There are several other situations in which projection bias may lead to suboptimal choices. If a person fails to apprehend that he will get used to be a great looker, he may overvalue the utility gained from a cosmetic operation, because he think it will improve his well-being for ever. In the other direction, a over weighted person may fail to realize that being fit would increase his well-being.

It is important to notice that the existence of projection bias does not rule out that the agent can take actions in order to mitigate it. A well known example of this is the folk

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[1] Throughout this paper I will use the term 'good' and 'durable good' synonymously, as projection bias does only make sense when talking about durable goods.

wisdom that shopping on an empty stomach makes you buy too much. By eating before shopping a person can change his current state from hungry to satisfied, and, hence, change his own predicted future valuation of food.

The rest of the paper is organized as follows. In section 2 I introduce a simple model to illustrate projection bias. Section 3 pays special attention to the formation of the state factor, and suggests a wide range of effects which possible influence a person's state. In section 4 I present a wide range of empirical evidence for each effect, suggesting the existence of projection bias. Finally, section 5 discusses the implications and interpretations of the projection bias.

2 The Theoretical Framework

One of the most intuitive models explaining projection bias is the simple projection bias model formalized by Loewenstein et al. 2003. Suppose an agent's utility in period t is given by $u(c_t,s_t)$, where c_t is the period t consumption. The variable s_t is the agent's state at time t and may be both endogenous affected through e.g. past consumption, and/or exogenous affected by e.g. the economical environment.[2] Consider an agent with state s', who tries to predict his future utility from consuming c in state s. A rational agent[3] who does not suffer from projection bias will assess his future utility correctly, i.e. he predicts $\hat{u}_r(c_t,s_t/s') = u(c_t,s_t)$, where $\hat{u}_r(c_t,s_t/s')$ is the agents prediction. As suggested by the evidence in section 1, a biased agent[4] tends to incorporate the true qualitative effect of projection bias but fails to assess the whole quantitative effect. That is, his predicted utility is in between the true future utility and the utility given his current state so that $\hat{u}_b(c_t,s_t/s')$ is a weighted average of $u(c_t,s_t)$ and $u(c_t,s')$, where the weight reflects the extent of projection bias. Formally, $\hat{u}_b(c_t,s_t/s') = (1-a)u(c_t,s_t) + au(c_t,s')$, where $0 = a = 1$ such that $a = 0$ reflects no projection bias.

The model predicts that agents may make choices which do not maximize their life time utility.[5] Consider a person who has to decide whether to buy a television. For simplicity, assume the person lives in two periods, and his utility is $u = s_t - p$ if he buys

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[2] In section 3 the ways the state variable can be formed are considered further.
[3] Here and in the rest of the paper I use the term *rational agent* to denote an agent, who makes optimal choices. That is, the rational agent does not suffer from projection bias.
[4] Here and in the rest of the paper the term *biased agent* refers to an agent *with* projection bias.
[5] The model described above is a simplification of the model presented by Loewenstein et al. (2003). However, it gives the same primarily results, and yields sufficient intuition for this survey.

the television, and $u = 0$ else. The person pays the price, p, only once, but the television provides utility in both periods. Hence, the person will either buy it in period 1 or never. Assume the state factor, s_t, is higher in period 1 e.g. because the person is excited about the purchase. It is easy to see that a rational agent would buy the television if and only if $s_1 + s_2 = p$. An agent with simple projection bias will buy the television if $s_1 + [as_1 + (1-a)s_2] = p$. Hence, as $as_1 + (1-a)s_2 = s_2$ the biased agent will be ready to pay more for the television.[6]

The model also explains dynamic inconsistency in agent's choices. Instead of buying the television assume the agent leased it for $\frac{1}{2} p$ per period. If $s_1 + [as_1 + (1-a)s_2] = p$, i.e. $s_1 > \frac{1}{2}p$ and $s_2 < \frac{1}{2}p$, the biased agent would lease the television and plan to keep it for both periods. However, when s_2 is realized in period 2 the agent would want to return the television to the distributor if possible. Hence, the biased agent may act different than planned.

3 The State Factor

As seen above the projection bias model only predicts irrational behavior by the biased agent when the state factor is changing over time. In the following I present several circumstances in which the state factor is likely to be inconsistent, making the agent either buy too much or too little.

3.1 Fluctuations in Valuation

The utility a person derives from a good often fluctuates from day to day and even from second to second. If the person suffers from projection bias, he may overvalue the good's impact on future consumption on high-value days and undervalue it on low-value days (Read & Leeuwen 1998). In a one-opportunity game where the agent only has only one chance to buy a good, the risk that the agent overvalue the good is equal to the risk of undervaluing it.[7] However, in the real world consumers have several chances to buy a durable good. Hence, only one single day, where the consumer value the utility derived from the good (sufficiently) high, is needed, before the he buys the good. When e.g. a salesperson or TV Shop works up a customer's excitement during a sales talk, it might be

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[6] Or equivalent; he will buy too many televisions.
[7] Given that the chance of a high-value day is equal to the chance of a low-value day.

in order to take advantage of the customer's projection bias. The result of the fluctuations in the agent's valuation of the good is that the biased agent ends up consuming more (and working more) than the rational agent. (Loewenstein & Schkade 1997b)

3.2 Adaption

The utility a person obtains from a good is likely to decrease over time as the person adapts to possessing the good (Loewenstein et al. 2003) or simply adapt to his current material standard of living (Stutzer 2004, Easterlin 1973).[8] The adaption effect is different from the fluctuations mentioned above, as it exists even though the valuation of the good is unaffected by the agents currents state on the day of purchase. As an agent suffering from projection bias fails to take account of the adaption effect, he overstates the utility he will derive from the good in the future. Likewise, he overestimates the suffered loss from loosing an object. In addition, the adaption effect implies that the utility a person will reap from future consumption is negatively correlated to current consumption, as higher current consumption accustom the agent to a higher level of consumption in the future. If a biased agent fails to take this fully into account, he ends up consuming too much too early compared to the rational agent.

The adaption effect can be asymmetric if an agent is averse to losses. The literature on loss aversion suggests that agents' losses loom larger than corresponding gains (Kahneman & Tversky 1991). Hence, the adaption effect may be most prominent when the agent must decide whether to keep or divest an object.[9]

3.3 Relative Dilution

Another effect which may cause the agent to overestimate the future utility is the relative dilution effect (Stark & Wang 2000, Luttmer 2003). People make social comparisons and judge their own material standings against the surrounding society. Hence, it is not only the absolute level of consumption that matters, but the level compared to the agent's peer group. If the agent's absolute consumption is constant while his acquaintances'

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[8] One exemption is noise. In a paper from 1982 Weinstein study the long-term reactions to noise, and find that people overestimate their ability to adapt to noisy environments.
[9] With some introspection, most readers might acknowledge that the disposal of old stuff kept in the garage is a hard and unpleasant job. But the day after a major garage cleaning, the losses are more or less forgotten.

consumption are rising, the agent's utility will decrease due to a lower relative consumption position. Hence, as the biased agent fails to perceive the dilution effect

The dilution effect may be especially strong when buying technological durables such as computers and digital cameras. It is likely that a person compares his own computer to the new computers in the same price range as his own was at the time of purchase. As the technological development is rapid in the computer market the person's computer will quickly be outdated and, likewise, the person's valuation of it will decrease.

3.4 The Endowment Effect

People tend to value an object more when they own it (Boven et al. 2003, Kahneman et al. 1991). This means that a biased agent may underestimate the utility he will reap from a good in the future, and, hence, may choose not to buy it even though it would increase his lifetime utility.

4 Empirical Evidence

4.1 Fluctuations in valuation

A wide range of literature gives empirical support to the projection bias theory. In an experiment carried out by Read & Leeuwen (1998) 200 persons were asked to choose between healthy and unhealthy snacks to be consumed at a specific time one week later.[10] The persons were divided into four groups depending on their expected current and future hunger.[11] One week later the test persons were allowed to choose again, so their final choice only depended on their current hunger.[12] The authors found prove for what they call an empathy gap. Given their future hunger people were significantly more likely to choose the unhealthy snack if their current state were 'hungry'. Moreover, they find that the empathy gap is incomplete (i.e. $0 < a < 1$ in the theoretical model), as the persons did make some considerations of their future state.[13] While people understood qualitatively

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[10] The idea is that hungry people are more likely to choose unhealthy high calories snacks compared to satisfied people.

[11] The persons made the choice either shortly after lunch (satisfied) or in the late afternoon (hungry).

[12] Read and Leeuween make much of securing that the test persons do not feel they are part of an experiment and that they do not feel committed to their earlier choices.

[13] The authors prove this by looking at the difference in choices between persons with same current hunger but different future hunger.

the direction in which tastes change, they systematically underestimated the magnitude of these changes.[14]

In a similar setup Loewenstein et al. (1997a) shows that sexual arousal increases people's expectations of their own sexual aggressiveness.[15] The authors show that the impact is not a result of changes in perceptions about costs and benefits of sexual aggressiveness. Hence, they conclude that people's preferences change when they are excited, and that people are not fully aware of this effect.

Both Loewenstein et al. (1997a) and Read & Leeuwen (1998) make use of experiments to prove that people exhibit systematic bias when predicting future tastes. One could dispute these evidences, as they do not come from real-world decisions. Using data on catalog orders[16] Colin et al. (2004) find evidence that people do suffer from projection bias. They find that the current weather affects people's expectation of future tastes, leading them to order more cold-weather clothes on colder days and to be more likely to return these clothes on warmer days. Interestingly they estimate that people's predictions for future tastes are roughly halfway in between their actual future tastes and their current tastes, equivalent to $a = 0.5$ in the model presented in section 2.

4.2 Adaption

The inbuilt long term development in preferences has made it difficult to set up experiments to measure the importance of the adaption effect. In addition, it is nearly impossible to identify people who later will undergo changes in life, without simply measuring their current excited state. As a logical consequence most researches have compared people's predicted well-being if something in their life changed, with the self-reported well-being of people who actually did undergo such changes.

Based on interviews of assistant professors awaiting tenure decision or who earlier awaited a tenure decision, Gilbert et al. (1997) find that people are relatively accurate in predicting the immediate impact of changes in life, but extrapolate the immediate feeling to far into the future. In a study of lottery winners Brickman et al.

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[14] Read & Leeuwen (1998) also find prove of dynamic inconsistency. People in general planned to eat healthier than they actually ended up doing.

[15] Loewenstein et al. (1997a) expose half of their test persons for adult pictures, where after they let all test persons answer questions about how they would react in certain dating situations.

[16] Colin et al. (2004) uses data of in total 12 million items shipped from a U.S. company that sells outdoor apparel. Using zip codes they combine the data with weather data, giving them a rather unique data set.

(1978) found no difference in self-reported happiness between the lottery-winners and a control group.[17] Several similar studies have been made in the medical domain, where people in general underestimate their ability to adapt to major changes in life such as chronic dialysis (Sackett & Torrance 1978) and kidney transplantations (Jepson et al. 2001).

In a more economic framework Kapteyn et al. (1997) find that people adapt to their current level of income. He finds that additional income increases utility initially, but as times goes by the effect wears off, as people get used to the new income level. Same effect is found by Stutzer (2004), who finds that the total effect from relative dilution and adaption erodes the positive effect from an increase in income completely.

One might still be concerned that the above mentioned results uses self-reported well-being as a proxy for the person's utility. A vast number of studies confirm that self-reported satisfaction is indeed correlated with the underlying 'true' happiness. For instance, people who report to be happy tend to smile more often and show fewer signs of stress (Blanchflower & Oswald 2004). Clark & Oswald (1996) list a number of studies that reports strong correlations between satisfaction and observable events such as length of life, poor mental health, and absenteeism. Another problem is that people might answer the satisfaction question in relative rather than absolute terms, i.e. people may rate their current well-being as "given their current state". Luttmer (2003) investigates this issue by using proxies for utility with a more objective definition such as the frequency of financial worries or the frequency of marital disagreements, and concludes that this concern is not driving his results. However, using self-reported well-being is still considered a severe flaw (Lowenstein et al. 2003).

4.3 Relative Dilution

The relative dilution effect has been proved in several papers the last decade (among others, see Ferrer-i-Carbonell 2004, Herby & Jørgensen 2003, Luttmer 2004, McBride 2001, and Stutzer 2004), who all find that a persons well-being is negatively correlated

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[17] Contrary to most other researches the control group was not asked to predict their well-being if they won.

with his peer group's[18] income. Common for these papers is that they use self-reported well-being as the dependent variable leading to the same concerns as mentioned in section 4.2.

A few studies use the concept of revealed preferences to prove the existence of relative income concerns. Using this approach Neumark & Postlewaite (1998) find that women's decision to seek paid employment partly depend on the incomes of their sisters and sisters-in-law. Similarly, Stark & Taylor (1991) show that relative deprived households in Mexico are more likely to engage in migration to the United States.

4.4 The Endowment Effect and Loss Aversion

Research on the endowment effect has shown that people tend to value an object more when it is endowed to them. In an often quoted experiment, Boven et al. (2000) show that people tend to underestimate the endowment effect. The authors endowed one group with coffee mugs and asked them to state the minimum price, for which they would be willing to sell the mug (s). Likewise they asked a group who had a 50% chance of being endowed with a mug to state the minimum price at which they would be willing to sell the mug (s'). Finally they asked a group with no change of being endowed with a mug about the minimum price for which they would be indifferent between buying a mug or receiving the money (c).[19] The potential owners stated much lower sales prices than actual owners ($s' < s$), suggesting that the subjects did not fully take account of the endowment effect. Also, consistent with the endowment theory the last group of non-endowed stated a significantly lower price than the endowed group ($c < s$).

In a very similar experiment Kahneman et al. (1990) asked a group of persons to state the minimum price they would require to sell a decorated mug, which would later be given to them. Also, the authors asked a group initially endowed with a mug to state the maximum price they would be willing to pay for the mug, which would later be taken from them. Even though the two groups faced a similar decision, the initially endowed

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[18] The actual definition of a persons peer group varies from paper to paper, but in general the theoretical peer group is the group a person compare his income to, i.e. neighbors, colleagues, and people with same level of education.
[19] In order to secure that the subjects stated their true reservation price, a price was later drawn randomly where after all subjects with a minimum/maximum price below/above the drawn price had to sell/buy the mug.

group stated a significantly higher price. Kahneman et al. interpret this as loss aversion, as the endowed group faces a loss contrary to the other group who faces a gain.

The existence of loss aversion suggests that negotiations about how a loss should be divided between parties may be significantly more difficult than if the parties were dividing a gain.

5 Discussion

The strong empirical evidences presented above substantiate the existence of a projection bias, which leads people so make suboptimal decisions when their decision has long term consequences. The cost of projection bias to the single agent may be significant. In the extreme case a depressed person may commit suicide because he weighs his current depressive mood too much, when evaluating whether his life is going to be better in the future. In a less grave framework the costs may still be significant, if the agent can not undo his choice. Loosing a fortune in Las Vegas when excited, drinking too much early in life without thoughts on future health, or simply buying a new (too) expensive computer may all partly be a result of projection bias.

Several legal steps can be seen as a way to mitigate the costs of projection bias. In Denmark a person can withdraw a maximum of DKK 3000 (approximately \$500) on a casino forcing a person to plan any loss above DKK 3000 before he enters the casino. Moreover, laws requiring stores to have a post purchase return period give the consumer a change to cool off, and, if the transaction is costly, reduces the store's incentive to engage in sales talks in order to hype up the customer.

In some cases the effect may be double. When buying snacks for future consumption, a person may both be affected by his current desire and in addition fail to realize the long term impact on his health. Furthermore, when smoking at parties and the like, a person may overestimate his capability of fighting addiction, and later underestimate the long term impacts on the loss in utility following a bad health.

Not surprisingly, the available literature in general agrees that projection bias exists and that the effect is not irrelevant. However, relatively little research has been devoted on resolving or mitigating the problem. A negligible exception is Ubel et al. (2003), who show that projection bias can be mitigated by inducing people to think more

carefully about the adaption effect, suggesting that people can be raised to recognize projection bias.

Another open question is how costly the projection bias is for the single agent. As mentioned above, the ability to return a purchase to the store may protect the customer from impulse buying when excited at a relatively low cost. If other kinds of projection bias are severely costly to the agent, other political installments could be beneficial. For instance, the tendency to over-consume early in life when the adaption effect is important could justify a forced saving plan for younger people.

To conclude, the research on projection bias so far has been concentrated on proving its existence empirically. In this short survey I have reviewed a theoretical model and a wide range of empirical literature. The next step is to find a measure of the costs of projection bias and suggest and motivate initiatives to mitigate the bias.

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